



# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

## MATHEMATICS

### EXAMINATION GUIDELINES

**GRADE 12**

**2021**

**These guidelines consist of 16 pages.**





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## 1. INTRODUCTION

The *Curriculum and Assessment Policy Statement (CAPS)* for Mathematics outlines the nature and purpose of the subject Mathematics. This guides the philosophy underlying the teaching and assessment of the subject in Grade 12.

The purpose of these Examination Guidelines is to:

- Provide clarity on the depth and scope of the content to be assessed in the Grade 12 National Senior Certificate Examination in Mathematics
- Assist teachers to adequately prepare learners for the examinations

This document deals with the final Grade 12 external examinations. It does not deal in any depth with the school-based assessment (SBA), performance assessment tasks (PATs) or final external practical examinations as these are clarified in a separate PAT document which is updated annually.

These guidelines should be read in conjunction with:

- The *National Curriculum Statement (NCS) Curriculum and Assessment Policy Statement (CAPS): Mathematics*
- The National Protocol of Assessment: *An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), regarding the National Protocol for Assessment (Grades R–12)*
- National policy pertaining to the programme and promotion requirements of the *National Curriculum Statement, Grades R to 12*

Included in this document is a list of Euclidean Geometry reasons, both in English and Afrikaans, which should be used as a guideline when teaching learners Euclidean Geometry.

The Information Sheet for Paper 1 and 2 is included in this document.





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## 2. ASSESSMENT IN GRADE 12

All candidates will write two external papers as prescribed.

### 2.1 Format of Question Papers for Grade 12

Paper	Topics	Duration	Total	Date	Marking
1	Patterns and sequences Finance, growth and decay Functions and graphs Algebra, equations and inequalities Differential Calculus Probability	3 hours	150	October/November	Externally
2	Euclidean Geometry Analytical Geometry Statistics and regression Trigonometry	3 hours	150	October/November	Externally

Questions in both Papers 1 and 2 will assess performance at different cognitive levels with an emphasis on process skills, critical thinking, scientific reasoning and strategies to investigate and solve problems in a variety of contexts.

**An Information Sheet is included on p. 15.**

### 2.2 Weighting of Topics per Paper for Grade 12

PAPER 1	MARKS	PAPER 2	MARKS
Algebra, Equations and Inequalities	25	Statistics and Regression	20
Number Patterns	25	Analytical Geometry	40
Functions and Graphs	35	Trigonometry	50
Finance, Growth and Decay	15	Euclidean Geometry	40
Differential Calculus	35		
Counting Principle and Probability	15		
<b>TOTAL</b>	<b>150</b>	<b>TOTAL</b>	<b>150</b>





### 2.3 Weighting of Cognitive Levels

Papers 1 and 2 will include questions across four cognitive levels. The distribution of cognitive levels in the papers is given below.

Cognitive Level	Description of Skills to be Demonstrated	Weighting	Approximate Number of Marks in a 150-mark Paper
<b>Knowledge</b>	<ul style="list-style-type: none"> <li>Recall</li> <li>Identification of correct formula on the information sheet (no changing of the subject)</li> <li>Use of mathematical facts</li> <li>Appropriate use of mathematical vocabulary</li> <li>Algorithms</li> <li>Estimation and appropriate rounding of numbers</li> </ul>	20%	30 marks
<b>Routine Procedures</b>	<ul style="list-style-type: none"> <li>Proofs of prescribed theorems and derivation of formulae</li> <li>Perform well-known procedures</li> <li>Simple applications and calculations which might involve few steps</li> <li>Derivation from given information may be involved</li> <li>Identification and use (after changing the subject) of correct formula</li> <li>Generally similar to those encountered in class</li> </ul>	35%	52–53 marks
<b>Complex Procedures</b>	<ul style="list-style-type: none"> <li>Problems involve complex calculations and/or higher-order reasoning</li> <li>There is often not an obvious route to the solution</li> <li>Problems need not be based on a real-world context</li> <li>Could involve making significant connections between different representations</li> <li>Require conceptual understanding</li> <li>Learners are expected to solve problems by integrating different topics.</li> </ul>	30%	45 marks
<b>Problem Solving</b>	<ul style="list-style-type: none"> <li>Non-routine problems (which are not necessarily difficult)</li> <li>Problems are mainly unfamiliar</li> <li>Higher-order reasoning and processes are involved</li> <li>Might require the ability to break the problem down into its constituent parts</li> <li>Interpreting and extrapolating from solutions obtained by solving problems based in unfamiliar contexts.</li> </ul>	15%	22–23 marks





### 3. ELABORATION OF CONTENT/TOPICS

The purpose of the clarification of the topics is to give guidance to the teacher in terms of depth of content necessary for examination purposes. Integration of topics is encouraged as learners should understand Mathematics as a holistic discipline. Thus questions integrating various topics can be asked.

#### FUNCTIONS

1. Candidates must be able to use and interpret functional notation. In the teaching process learners must be able to understand how  $f(x)$  has been transformed to generate  $f(-x)$ ,  $-f(x)$ ,  $f(x+a)$ ,  $f(x)+a$ ,  $af(x)$  and  $x=f(y)$  where  $a \in R$ .
2. Trigonometric functions will ONLY be examined in PAPER 2.

#### NUMBER PATTERNS, SEQUENCES AND SERIES

1. The sequence of first differences of a quadratic number pattern is linear. Therefore, knowledge of linear patterns can be tested in the context of quadratic number patterns.
2. Recursive patterns will not be examined explicitly.
3. Links must be clearly established between patterns done in earlier grades.

#### FINANCE, GROWTH AND DECAY

1. Understand the difference between nominal and effective interest rates and convert fluently between them for the following compounding periods: monthly, quarterly and half-yearly or semi-annually.
2. With the exception of calculating  $i$  in the  $F_v$  and  $P_v$  formulae, candidates are expected to calculate the value of any of the other variables.
3. Pyramid schemes will NOT be examined in the examination.

#### ALGEBRA

1. Solving quadratic equations by completing the square will NOT be examined.
2. Solving quadratic equations using the substitution method ( $k$ -method) is examinable.
3. Equations involving surds that lead to a quadratic equation are examinable.
4. Solution of non-quadratic inequalities should be seen in the context of functions.
5. Nature of the roots will be tested intuitively with the solution of quadratic equations and in all the prescribed functions.





## DIFFERENTIAL CALCULUS

- The following notations for differentiation can be used:  $f'(x)$ ,  $D_x$ ,  $\frac{dy}{dx}$  or  $y'$ .
- In respect of cubic functions, candidates are expected to be able to:
  - Determine the equation of a cubic function from a given graph.
  - Discuss the nature of stationary points including local maximum, local minimum and points of inflection.
  - Apply knowledge of transformations on a given function to obtain its image.
- Candidates are expected to be able to draw and interpret the graph of the derivative of a function.
- Surface area and volume will be examined in the context of optimisation.
- Candidates must know the formulae for the surface area and volume of the right prisms. These formulae will NOT be provided on the formula sheet
- If the optimisation question is based on the surface area and/or volume of the cone, sphere and/or pyramid, a list of the relevant formulae will be provided in that question. Candidates will be expected to select the correct formula from this list.

## PROBABILITY

- Dependent events are examinable but conditional probabilities are not part of the syllabus.
- Dependent events in which an object is not replaced are examinable.
- Questions that require the learner to count the different number of ways that objects may be arranged in a circle and/or the use of combinations are not in the spirit of the curriculum.
- In respect of word arrangements, letters that are repeated in the word can be treated as the same (indistinguishable) or different (distinguishable). The question will be specific in this regard.

## EUCLIDEAN GEOMETRY AND MEASUREMENT

- Measurement can be tested in the context of optimisation in calculus and two- and three-dimensional trigonometry.
- Composite shapes could be formed by combining a maximum of TWO of the stated shapes.
- The following proofs of theorems are examinable:
  - The line drawn from the centre of a circle perpendicular to a chord bisects the chord;
  - The line drawn from the centre of a circle that bisects a chord is perpendicular to the chord;
  - The angle subtended by an arc at the centre of a circle is double the size of the angle subtended by the same arc at the circle (on the same side of the chord as the centre);
  - The opposite angles of a cyclic quadrilateral are supplementary;
  - The angle between the tangent to a circle and the chord drawn from the point of contact is equal to the angle in the alternate segment;
  - A line drawn parallel to one side of a triangle divides the other two sides proportionally;
  - Equiangular triangles are similar.





4. Corollaries derived from the theorems and axioms are necessary in solving riders:
  - Angles in a semi-circle
  - Equal chords subtend equal angles at the circumference
  - Equal chords subtend equal angles at the centre
  - In equal circles, equal chords subtend equal angles at the circumference
  - In equal circles, equal chords subtend equal angles at the centre.
  - The exterior angle of a cyclic quadrilateral is equal to the interior opposite angle of the quadrilateral.
  - If the exterior angle of a quadrilateral is equal to the interior opposite angle of the quadrilateral, then the quadrilateral is cyclic.
  - Tangents drawn from a common point outside the circle are equal in length.
5. The theory of quadrilaterals will be integrated into questions in the examination.
6. Concurrency theory is excluded.

### TRIGONOMETRY

1. The reciprocal ratios  $\operatorname{cosec} \theta$ ,  $\sec \theta$  and  $\cot \theta$  can be used by candidates in the answering of problems but will not be explicitly tested.
2. The focus of trigonometric graphs is on the relationships, simplification and determining points of intersection by solving equations, although characteristics of the graphs should not be excluded.

### ANALYTICAL GEOMETRY

1. Prove the properties of polygons by using analytical methods.
2. The concept of collinearity must be understood.
3. Candidates are expected to be able to integrate Euclidean Geometry axioms and theorems into Analytical Geometry problems.
4. The length of a tangent from a point outside the circle should be calculated.
5. Concepts involved with concurrency will not be examined.

### STATISTICS

1. Candidates should be encouraged to use the calculator to calculate standard deviation, variance and the equation of the least squares regression line.
2. The interpretation of standard deviation in terms of normal distribution is not examinable.
3. Candidates are expected to identify outliers intuitively in both the scatter plot as well as the box and whisker diagram.

In the case of the box and whisker diagram, observations that lie outside the interval (lower quartile  $- 1,5$  IQR; upper quartile  $+ 1,5$  IQR) are considered to be outliers. However, candidates will not be penalised if they did not make use of this formula in identifying outliers.





#### 4. ACCEPTABLE REASONS: EUCLIDEAN GEOMETRY

In order to have some kind of uniformity, the use of the following shortened versions of the theorem statements is encouraged.

##### 4.1 ACCEPTABLE REASONS: EUCLIDEAN GEOMETRY (ENGLISH)

THEOREM STATEMENT	ACCEPTABLE REASON(S)
<b>LINES</b>	
The adjacent angles on a straight line are supplementary.	$\angle$ s on a str line
If the adjacent angles are supplementary, the outer arms of these angles form a straight line.	adj $\angle$ s supp
The adjacent angles in a revolution add up to $360^\circ$ .	$\angle$ s round a pt <b>OR</b> $\angle$ s in a rev
Vertically opposite angles are equal.	vert opp $\angle$ s =
If $AB \parallel CD$ , then the alternate angles are equal.	alt $\angle$ s; $AB \parallel CD$
If $AB \parallel CD$ , then the corresponding angles are equal.	corresp $\angle$ s; $AB \parallel CD$
If $AB \parallel CD$ , then the co-interior angles are supplementary.	co-int $\angle$ s; $AB \parallel CD$
If the alternate angles between two lines are equal, then the lines are parallel.	alt $\angle$ s =
If the corresponding angles between two lines are equal, then the lines are parallel.	corresp $\angle$ s =
If the co-interior angles between two lines are supplementary, then the lines are parallel.	coint $\angle$ s supp
<b>TRIANGLES</b>	
The interior angles of a triangle are supplementary.	$\angle$ sum in $\Delta$ <b>OR</b> sum of $\angle$ s in $\Delta$ <b>OR</b> Int $\angle$ s $\Delta$
The exterior angle of a triangle is equal to the sum of the interior opposite angles.	ext $\angle$ of $\Delta$
The angles opposite the equal sides in an isosceles triangle are equal.	$\angle$ s opp equal sides
The sides opposite the equal angles in an isosceles triangle are equal.	sides opp equal $\angle$ s
In a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.	Pythagoras <b>OR</b> Theorem of Pythagoras
If the square of the longest side in a triangle is equal to the sum of the squares of the other two sides then the triangle is right-angled.	Converse Pythagoras <b>OR</b> Converse Theorem of Pythagoras
If three sides of one triangle are respectively equal to three sides of another triangle, the triangles are congruent.	SSS
If two sides and an included angle of one triangle are respectively equal to two sides and an included angle of another triangle, the triangles are congruent.	SAS <b>OR</b> S $\angle$ S
If two angles and one side of one triangle are respectively equal to two angles and the corresponding side in another triangle, the triangles are congruent.	AAS <b>OR</b> $\angle$ $\angle$ S
If two right-angled triangles, the hypotenuse and one side of one triangle are respectively equal to the hypotenuse and one side of the other, the triangles are congruent	RHS <b>OR</b> $90^\circ$ HS





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THEOREM STATEMENT	ACCEPTABLE REASON(S)
The line segment joining the midpoints of two sides of a triangle is parallel to the third side and equal to half the length of the third side	Midpt Theorem
The line drawn from the midpoint of one side of a triangle, parallel to another side, bisects the third side.	line through midpt $\parallel$ to 2 <sup>nd</sup> side
A line drawn parallel to one side of a triangle divides the other two sides proportionally.	line $\parallel$ one side of $\Delta$ <b>OR</b> prop theorem; name $\parallel$ lines
If a line divides two sides of a triangle in the same proportion, then the line is parallel to the third side.	line divides two sides of $\Delta$ in prop
If two triangles are equiangular, then the corresponding sides are in proportion (and consequently the triangles are similar).	$\parallel \Delta$ s <b>OR</b> equiangular $\Delta$ s
If the corresponding sides of two triangles are proportional, then the triangles are equiangular (and consequently the triangles are similar).	Sides of $\Delta$ in prop
If triangles (or parallelograms) are on the same base (or on bases of equal length) and between the same parallel lines, then the triangles (or parallelograms) have equal areas.	same base; same height <b>OR</b> equal bases; equal height
CIRCLES	
The tangent to a circle is perpendicular to the radius/diameter of the circle at the point of contact.	tan $\perp$ radius tan $\perp$ diameter
If a line is drawn perpendicular to a radius/diameter at the point where the radius/diameter meets the circle, then the line is a tangent to the circle.	line $\perp$ radius <b>OR</b> converse tan $\perp$ radius <b>OR</b> converse tan $\perp$ diameter
The line drawn from the centre of a circle to the midpoint of a chord is perpendicular to the chord.	line from centre to midpt of chord
The line drawn from the centre of a circle perpendicular to a chord bisects the chord.	line from centre $\perp$ to chord
The perpendicular bisector of a chord passes through the centre of the circle;	perp bisector of chord
The angle subtended by an arc at the centre of a circle is double the size of the angle subtended by the same arc at the circle (on the same side of the chord as the centre)	$\angle$ at centre = $2 \times \angle$ at circumference
The angle subtended by the diameter at the circumference of the circle is $90^\circ$ .	$\angle$ s in semi-circle <b>OR</b> diameter subtends right angle <b>OR</b> $\angle$ in $\frac{1}{2} \odot$
If the angle subtended by a chord at the circumference of the circle is $90^\circ$ , then the chord is a diameter.	chord subtends $90^\circ$ <b>OR</b> converse $\angle$ s in semi-circle
Angles subtended by a chord of the circle, on the same side of the chord, are equal	$\angle$ s in the same seg
If a line segment joining two points subtends equal angles at two points on the same side of the line segment, then the four points are concyclic.	line subtends equal $\angle$ s <b>OR</b> converse $\angle$ s in the same seg
Equal chords subtend equal angles at the circumference of the circle.	equal chords; equal $\angle$ s
Equal chords subtend equal angles at the centre of the circle.	equal chords; equal $\angle$ s
Equal chords in equal circles subtend equal angles at the circumference of the circles.	equal circles; equal chords; equal $\angle$ s

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THEOREM STATEMENT	ACCEPTABLE REASON(S)
Equal chords in equal circles subtend equal angles at the centre of the circles.	equal circles; equal chords; equal $\angle$ s
The opposite angles of a cyclic quadrilateral are supplementary	opp $\angle$ s of cyclic quad
If the opposite angles of a quadrilateral are supplementary then the quadrilateral is cyclic.	opp $\angle$ s quad supp <b>OR</b> converse opp $\angle$ s of cyclic quad
The exterior angle of a cyclic quadrilateral is equal to the interior opposite angle.	ext $\angle$ of cyclic quad
If the exterior angle of a quadrilateral is equal to the interior opposite angle of the quadrilateral, then the quadrilateral is cyclic.	ext $\angle$ = int opp $\angle$ <b>OR</b> converse ext $\angle$ of cyclic quad
Two tangents drawn to a circle from the same point outside the circle are equal in length	Tans from common pt <b>OR</b> Tans from same pt
The angle between the tangent to a circle and the chord drawn from the point of contact is equal to the angle in the alternate segment.	tan chord theorem
If a line is drawn through the end-point of a chord, making with the chord an angle equal to an angle in the alternate segment, then the line is a tangent to the circle.	converse tan chord theorem <b>OR</b> $\angle$ between line and chord
QUADRILATERALS	
The interior angles of a quadrilateral add up to $360^\circ$ .	sum of $\angle$ s in quad
The opposite sides of a parallelogram are parallel.	opp sides of $\parallel$ m
If the opposite sides of a quadrilateral are parallel, then the quadrilateral is a parallelogram.	opp sides of quad are $\parallel$
The opposite sides of a parallelogram are equal in length.	opp sides of $\parallel$ m
If the opposite sides of a quadrilateral are equal, then the quadrilateral is a parallelogram.	opp sides of quad are = <b>OR</b> converse opp sides of a parm
The opposite angles of a parallelogram are equal.	opp $\angle$ s of $\parallel$ m
If the opposite angles of a quadrilateral are equal then the quadrilateral is a parallelogram.	opp $\angle$ s of quad are = <b>OR</b> converse opp angles of a parm
The diagonals of a parallelogram bisect each other.	diag of $\parallel$ m
If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.	diags of quad bisect each other <b>OR</b> converse diags of a parm
If one pair of opposite sides of a quadrilateral are equal and parallel, then the quadrilateral is a parallelogram.	pair of opp sides = and $\parallel$
The diagonals of a parallelogram bisect its area.	diag bisect area of $\parallel$ m
The diagonals of a rhombus bisect at right angles.	diags of rhombus
The diagonals of a rhombus bisect the interior angles.	diags of rhombus
All four sides of a rhombus are equal in length.	sides of rhombus
All four sides of a square are equal in length.	sides of square
The diagonals of a rectangle are equal in length.	diags of rect
The diagonals of a kite intersect at right-angles.	diags of kite
A diagonal of a kite bisects the other diagonal.	diag of kite
A diagonal of a kite bisects the opposite angles	diag of kite

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**4.2 ACCEPTABLE REASONS: EUCLIDEAN GEOMETRY (AFRIKAANS)**

STELLING	AANVAARBARE REDE
<b>LYNE</b>	
Aangrensende hoeke op 'n reguitlyn is supplementêr.	$\angle^e$ op reguit lyn
As aangrensende hoeke supplementêr is, lê die buitenste bene van die hoeke in 'n reguitlyn.	aangr. $\angle^e$ suppl.
Die som van die aangrensende hoeke om 'n punt is $360^\circ$ .	$\angle^e$ om 'n punt <b>OF</b> $\angle^e$ in 'n omw
Regoorstaande hoeke is gelyk.	regoorst. $\angle^e$
As $AB \parallel CD$ , dan is die verwissellende hoeke gelyk	verw. $\angle^e$ ; $AB \parallel CD$
As $AB \parallel CD$ , dan is die ooreenkomstige hoeke gelyk.	ooreenk. $\angle^e$ ; $AB \parallel CD$
As $AB \parallel CD$ , dan is die ko-binnehoeke supplementêr.	ko-binne $\angle^e$ ; $AB \parallel CD$
As die verwissellende hoeke tussen twee lyne gelyk is, dan is die lyne ewewydig.	verw. $\angle^e =$
As die ooreenkomstige hoeke tussen twee lyne gelyk is, dan is die lyne ewewydig.	ooreenk. $\angle^e =$
As die ko-binnehoeke tussen twee lyne supplementêr is, dan is die lyne ewewydig.	ko-binne $\angle^e$ suppl.
<b>DRIEHOEKE</b>	
Die binnehoeke van 'n driehoek is supplementêr.	$\angle$ som van $\Delta$ <b>OF</b> som van $\angle^e$ in $\Delta$ <b>OF</b> binne $\angle^e \Delta$
Die buitehoek van 'n driehoek is gelyk aan die som van die twee teenoorstaande binnehoeke.	buite $\angle$ van $\Delta$
Die hoeke teenoor die gelyke sye van 'n gelykbenige driehoek, is gelyk.	$\angle^e$ teenoor gelyke sye
Die sye teenoor die gelyke sye van 'n gelykbenige driehoek, is gelyk.	sye teenoor gelyke $\angle^e$
In 'n reghoekige driehoek is die vierkant op die skuinssy gelyk aan die som van die vierkante op die ander twee sye.	Pythagoras <b>OF</b> Stelling van Pythagoras
As die vierkant op een sy van 'n driehoek gelyk is aan die som van die vierkante op die ander twee sye, dan is die driehoek reghoekig.	Omgekeerde Pythagoras <b>OF</b> Omgekeerde stelling: Pythagoras
As drie sye van een driehoek onderskeidelik gelyk is aan drie sye van 'n ander driehoek, dan is die driehoeke kongruent.	SSS
As twee sye en 'n ingeslote hoek van een driehoek onderskeidelik gelyk is aan twee sye en 'n ingeslote hoek van 'n ander driehoek, dan is die twee driehoeke kongruent.	SHS <b>OF</b> S $\angle$ S
As twee hoeke en 'n sy van een driehoek onderskeidelik gelyk is aan twee hoeke en 'n ooreenstemmende sy van 'n ander driehoek, dan is die twee driehoeke kongruent.	HHS <b>OF</b> $\angle\angle$ S
As die skuinssy en 'n reghoeksy van 'n reghoekige driehoek onderskeidelik gelyk is aan die skuinssy en 'n reghoeksy van 'n ander reghoekige driehoek, dan is die twee driehoeke kongruent.	RHS <b>OF</b> $90^\circ$ HS
Die lynstuk wat die middelpunte van twee sye van 'n driehoek verbind, is ewewydig aan en gelyk aan die helfte van die derde sy.	Midpt.-stelling
Die lynstuk wat van die middelpunt van een sy van 'n driehoek ewewydig aan die tweede sy getrek word, halveer die derde sy.	lyn deur midpt $\parallel$ 2de sy
Die lyn ewewydig aan een sy van 'n driehoek verdeel die ander twee sye in eweredige dele.	lyn $\parallel$ een sy van $\Delta$ <b>OF</b> eweredige stelling; noem $\parallel$ lyne

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STELLING	AANVAARBARE REDE
As 'n lyn twee sye van 'n driehoek in eweredige dele verdeel, is die lyn ewewydig aan die derde sy.	lyn verdeel twee sye van $\Delta$ eweredig
As twee driehoeke gelykhoekig is, is hulle ooreenstemmende sye eweredig (en is driehoeke dus gelykvormig).	$\parallel \Delta^e$ <b>OF</b> gelykhoekige $\Delta^e$
As die ooreenstemmende sye van twee driehoeke eweredig is, is die driehoeke gelykhoekig (en is driehoeke dus gelykvormig).	Sye van $\Delta^e$ eweredig
Driehoeke (of parallelogramme) op dieselfde basis en tussen dieselfde ewewydige lyne is gelyk in oppervlakte.	dieselfde basis ; dieselfde hoogte <b>OF</b> gelyke basis ; gelyke hoogte
SIRKELS	
'n Raaklyn aan 'n sirkel is loodreg op die radius/middellyn van die sirkel by die raakpunt.	raaklyn $\perp$ radius raaklyn $\perp$ middellyn
As 'n lyn loodreg getrek word na die radius/middellyn by die punt waar die radius/middellyn die sirkel ontmoet, dan is die lyn 'n raaklyn aan die sirkel.	Lyn $\perp$ Radius <b>OF</b> omgekeerde raaklyn $\perp$ radius <b>OF</b> omgekeerde raaklyn $\perp$ middellyn
Die lynstuk wat die middelpunt van 'n sirkel met die middelpunt van 'n koord verbind, is loodreg op die koord.	lyn vanuit midpt na midpt van koord
Die loodlyn uit die middelpunt van 'n sirkel na 'n koord, halveer die koord.	lyn vanuit midpt $\perp$ op koord
Die middelloodlyn van 'n koord gaan deur die middelpunt van die sirkel.	middelloodlyn van koord
Die hoek wat 'n koord by die middelpunt van 'n sirkel onderspan, is dubbel die hoek wat dit by enige punt op die omtrek onderspan (aan dieselfde kant van die koord as die midpt).	Midpts $\angle = 2 \times$ Omtreks $\angle$
Die omtrekshoek wat deur die middellyn onderspan word, is $90^\circ$ .	$\angle$ in halwe sirkel <b>OF</b> middellyn onderspan regte hoek <b>OF</b> $\angle$ in $\frac{1}{2}\odot$
As 'n koord van 'n sirkel 'n regte hoek by die omtrek onderspan, dan is die koord 'n middellyn.	Koord onderspan $90^\circ$ <b>OF</b> omgekeerde $\angle$ in halwe sirkel
Hoek onderspan deur 'n koord van 'n sirkel, aan dieselfde kant van die koord, is gelyk.	$\angle^e$ in dieselfde segment
As 'n lynstuk wat twee punte verbind, gelyke hoeke by twee ander punte aan dieselfde kant van die lynstuk onderspan, dan is die vier punte konsiklies (d.w.s. hulle lê op die omtrek van 'n sirkel).	Lynstuk onderspan gelyke $\angle^e$ <b>OF</b> omgekeerde $\angle^e$ in dieselfde segment
Gelyke koorde onderspan gelyke omtrekshoeke.	gelyke koorde; gelyke $\angle^e$
Gelyke koorde onderspan gelyke middelpuntshoeke.	gelyke koorde; gelyke $\angle^e$
Gelyke koorde in gelyke sirkels onderspan gelyke omtrekshoeke.	gelyke sirkels; gelyke koorde ; gelyke $\angle^e$
Gelyke koorde in gelyke sirkels onderspan gelyke middelpuntshoeke.	gelyke sirkels; gelyke koorde ; gelyke $\angle^e$
Die teenoorstaande hoeke van 'n koordvierhoek is supplementêr.	teenoorst. $\angle^e$ van kvh
As die teenoorstaande hoeke van 'n vierhoek supplementêr is, dan is die vierhoek 'n koordevierhoek.	teenoorst. $\angle^e$ van vierhoek is supp <b>OF</b> omgekeerde teenoorst $\angle^e$ koordevierhoek
Die buitehoek van 'n koordevierhoek is gelyk aan die teenoorstaande binnehoek.	buite $\angle$ van kvh

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Mathematics

14  
Examination Guidelines

DBE/2021

STELLING	AANVAARBARE REDE
As die buitehoek van 'n vierhoek gelyk is aan die teenoorstaande binnehoek, dan is die vierhoek 'n koordevierhoek.	buite $\angle$ van vierhoek = teenoorst. binne $\angle$ <b>OF</b> omgekeerde buite $\angle$ koordevierhoek
Twee raaklyne wat vanaf dieselfde punt buite 'n sirkel na 'n sirkel getrek word, is ewe lank.	Raaklyne vanuit gemeensk. Punt <b>OF</b> raaklyne vanaf dieselfde punt
Die hoek wat gevorm word tussen 'n raaklyn aan 'n sirkel en 'n koord wat vanuit die raakpunt getrek word, is gelyk aan die hoek in die oorsaande segment.	raaklyn koord stelling
As 'n lyn deur die eindpunt van 'n koord 'n hoek met die koord vorm wat gelyk is aan die hoek in die oorsaande segment, dan is die lyn 'n raaklyn aan die sirkel.	$\angle$ tussen lyn en koord <b>OF</b> omgekeerde raaklyn koord stelling
VIERHOEKE	
Die som van die binnehoeke van 'n vierhoek is $360^\circ$ .	som van $\angle^e$ in vierhoek
Die teenoorstaande sye van 'n parallelogram is ewewydig.	teenoorst. sye van $\parallel m$
As die teenoorstaande sye van 'n vierhoek ewewydig is, dan is die vierhoek 'n parallelogram.	teenoorst sye van vierh is $\parallel$
Die teenoorstaande sye van 'n parallelogram is gelyk in lengte.	teenoorst. sye van $\parallel m$
As die teenoorstaande sye van 'n vierhoek gelyk is, dan is die vierhoek 'n parallelogram.	teenoorst sye van vierh = <b>OF</b> omgekeerde teenoorst sye van $\parallel m$
Die teenoorstaande hoeke van 'n parallelogram is gelyk.	teenoorst. $\angle^e$ van $\parallel m$
As die teenoorstaande hoeke van 'n vierhoek gelyk is, dan is die vierhoek 'n parallelogram.	teenoorst. $\angle^e$ van vierh = <b>OF</b> omgekeerde teenoorst. $\angle^e$ van $\parallel m$
Die hoeklyne van 'n parallelogram halveer mekaar.	hoeklyne van $\parallel m$
As die hoeklyne van 'n vierhoek mekaar halveer, dan is die vierhoek 'n parallelogram.	hoeklyne van vierh halveer mekaar <b>OF</b> omgekeerde hoeklyne van $\parallel m$
As een paar teenoorstaande sye van 'n vierhoek gelyk en ewewydig is, dan is die vierhoek 'n parallelogram.	teenoorst. sye = en $\parallel$
Die hoeklyne van 'n parallelogram halveer die oppervlakte van die parallelogram.	hoeklyn van $\parallel m$ halveer opp
Die hoeklyne van 'n ruit halveer mekaar reghoekig.	hoeklyne van ruit
Die hoeklyne van 'n ruit halveer die teenoorstaande binnehoeke.	hoeklyne van ruit
Al vier sye van 'n ruit is gelyk.	sye van ruit
Al vier sye van 'n vierkant is gelyk.	sye van vierkant
Die hoeklyne van 'n reghoek is ewe lank.	hoeklyne van reghoek
Die hoeklyne van 'n vlieër sny mekaar reghoekig.	hoeklyne van vlieër
Die een hoeklyn van 'n vlieër halveer die ander hoeklyn.	hoeklyne van vlieër
Een hoeklyn van 'n vlieër halveer die teenoorstaande binnehoeke	hoeklyne van vlieër

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## 6. GENERAL GUIDELINES FOR MARKING

- If a learner makes more than one attempt at answering a question and does not cancel any of them out, only the first attempt will be marked irrespective of which of the attempt(s) may be the correct answer.
- Consistent Accuracy marking regarding calculations will be followed in the following cases:
  - **Subquestion to subquestion:** When a certain variable is incorrectly calculated in one subquestion and needs to be substituted into another subquestion, **full marks can be** awarded for the subsequent subquestions provided the methods used are correct and the calculations are correct.
  - Assuming values/answers in order to solve a problem is unacceptable.

## 7. CONCLUSION

This Examination Guidelines document is meant to articulate the assessment aspirations espoused in the *CAPS* document. It is therefore not a substitute for the *CAPS* document which teachers should teach to.

Qualitative curriculum coverage as enunciated in the *CAPS* cannot be over-emphasised.





# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**FEBRUARY/MARCH 2015**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 11 pages and 1 information sheet.**





Mathematics/P1

3  
NSC

DBE/Feb.–Mar. 2015

**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 - x - 20 = 0$  (2)

1.1.2  $2x^2 - 11x + 7 = 0$  (correct to TWO decimal places) (3)

1.1.3  $5x^2 + 4 > 21x$  (5)

1.1.4  $2^{2x} - 6.2^x = 16$  (4)

1.2 Solve for  $x$  and  $y$  simultaneously:

$$\begin{aligned} y + 1 &= 2x \\ x^2 - xy + y^2 &= 7 \end{aligned} \quad (6)$$

1.3 The roots of a quadratic equation are given by  $x = \frac{-5 \pm \sqrt{20 + 8k}}{6}$ , where  $k \in \{-3; -2; -1; 0; 1; 2; 3\}$ .

1.3.1 Write down TWO values of  $k$  for which the roots will be rational. (2)1.3.2 Write down ONE value of  $k$  for which the roots will be non-real. (1)

1.4 Calculate  $a$  and  $b$  if  $\sqrt{\frac{7^{2014} - 7^{2012}}{12}} = a(7^b)$  and  $a$  is not a multiple of 7. (4)  
[27]





Mathematics/P1

4  
NSC

DBE/Feb.–Mar. 2015

**QUESTION 2**

2.1 Prove that in any arithmetic series in which the first term is  $a$  and whose constant difference is  $d$ , the sum of the first  $n$  terms is  $S_n = \frac{n}{2}[2a + (n-1)d]$ . (4)

2.2 Calculate the value of  $\sum_{k=1}^{50} (100 - 3k)$ . (4)

2.3 A quadratic sequence is defined with the following properties:

$$T_2 - T_1 = 7$$

$$T_3 - T_2 = 13$$

$$T_4 - T_3 = 19$$

2.3.1 Write down the value of:

(a)  $T_5 - T_4$  (1)

(b)  $T_{70} - T_{69}$  (3)

2.3.2 Calculate the value of  $T_{69}$  if  $T_{89} = 23\,594$ . (5)  
[17]

**QUESTION 3**

Consider the infinite geometric series:  $45 + 40,5 + 36,45 + \dots$

3.1 Calculate the value of the TWELFTH term of the series (correct to TWO decimal places). (3)

3.2 Explain why this series converges. (1)

3.3 Calculate the sum to infinity of the series. (2)

3.4 What is the smallest value of  $n$  for which  $S_\infty - S_n < 1$ ? (5)  
[11]





Mathematics/P1

5  
NSC

DBE/Feb.–Mar. 2015

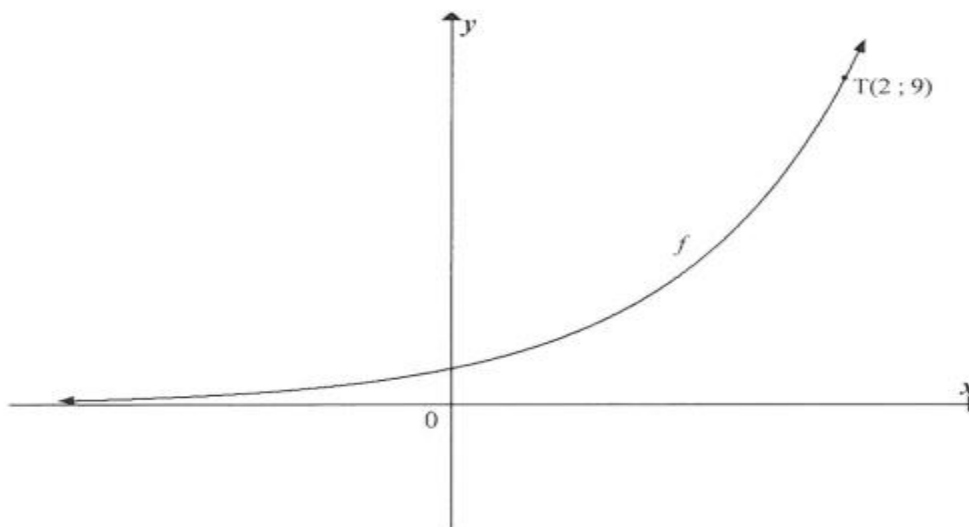
**QUESTION 4**

Given:  $g(x) = \frac{6}{x+2} - 1$

- 4.1 Write down the equations of the asymptotes of  $g$ . (2)
- 4.2 Calculate:
- 4.2.1 The  $y$ -intercept of  $g$  (1)
- 4.2.2 The  $x$ -intercept of  $g$  (2)
- 4.3 Draw the graph of  $g$ , showing clearly the asymptotes and the intercepts with the axes. (3)
- 4.4 Determine the equation of the line of symmetry that has a negative gradient, in the form  $y = \dots$  (3)
- 4.5 Determine the value(s) of  $x$  for which  $\frac{6}{x+2} - 1 \geq -x - 3$ . (2)
- [13]**

**QUESTION 5**

The graph of  $f(x) = a^x$ ,  $a > 1$  is shown below.  $T(2; 9)$  lies on  $f$ .



- 5.1 Calculate the value of  $a$ . (2)
- 5.2 Determine the equation of  $g(x)$  if  $g(x) = f(-x)$ . (1)
- 5.3 Determine the value(s) of  $x$  for which  $f^{-1}(x) \geq 2$ . (2)
- 5.4 Is the inverse of  $f$  a function? Explain your answer. (2)
- [7]**

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Mathematics/P1

6  
NSC

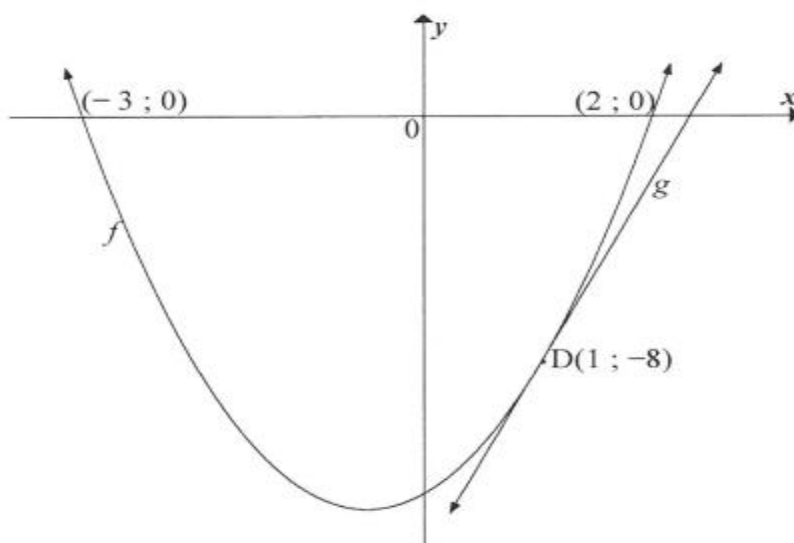
DBE/Feb.–Mar. 2015

**QUESTION 6**

The graphs of  $f(x) = ax^2 + bx + c$  ;  $a \neq 0$  and  $g(x) = mx + k$  are drawn below.

$D(1 ; -8)$  is a common point on  $f$  and  $g$ .

- $f$  intersects the  $x$ -axis at  $(-3 ; 0)$  and  $(2 ; 0)$ .
- $g$  is the tangent to  $f$  at  $D$ .



- 6.1 For which value(s) of  $x$  is  $f(x) \leq 0$ ? (2)
- 6.2 Determine the values of  $a$ ,  $b$  and  $c$ . (5)
- 6.3 Determine the coordinates of the turning point of  $f$ . (3)
- 6.4 Write down the equation of the axis of symmetry of  $h$  if  $h(x) = f(x - 7) + 2$ . (2)
- 6.5 Calculate the gradient of  $g$ . (3)
- [15]**





Mathematics/P1

7  
NSC

DBE/Feb.–Mar. 2015

**QUESTION 7**

- 7.1 Nomsa started working on 1 January 1970. At the end of January 1970 and at the end of each month thereafter, she deposited R400 into an annuity fund. She continued doing this until she retired on 31 December 2013.
- 7.1.1 Determine the total amount of money that she paid into the fund. (2)
- 7.1.2 The interest rate on this fund was 8% p.a., compounded monthly. Calculate the value of the fund at the time that she retired. (5)
- 7.1.3 On 1 January 2014 Nomsa invested R2 million in an account paying interest at 10% p.a. compounded monthly. Nomsa withdraws a fixed amount from this account at the end of each month, starting on 31 January 2014. If Nomsa wishes to make monthly withdrawals from this account for 25 years, calculate the maximum amount she could withdraw at the end of each month. (4)
- 7.2 For each of the three years from 2010 to 2012 the population of town X decreased by 8% per year and the population of town Y increased by 12% per year.
- At the end of 2012 the populations of these two towns were equal.
- Determine the ratio of the population of town X (call it  $P_X$ ) to the population of town Y (call it  $P_Y$ ) at the beginning of 2010. (4)

**[15]**



Mathematics/P1

8  
NSC

DBE/Feb.–Mar. 2015

**QUESTION 8**

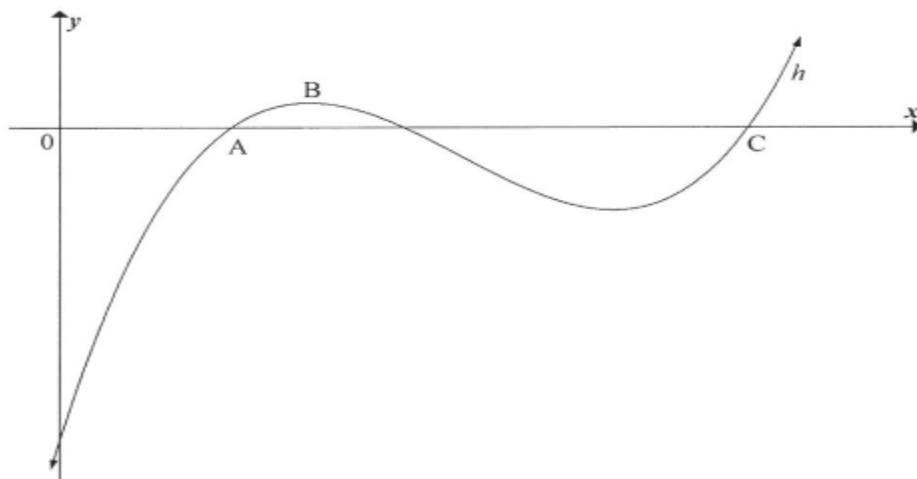
8.1 Determine the derivative of  $f(x) = 2x^2 + 4$  from first principles. (4)

8.2 Differentiate:

8.2.1  $f(x) = -3x^2 + 5\sqrt{x}$  (3)

8.2.2  $p(x) = \left(\frac{1}{x^3} + 4x\right)^2$  (4)

8.3 The sketch below shows the graph of  $h(x) = x^3 - 7x^2 + 14x - 8$ . The  $x$ -coordinate of point A is 1. C is another  $x$ -intercept of  $h$ .



8.3.1 Determine  $h'(x)$ . (1)

8.3.2 Determine the  $x$ -coordinate of the turning point B. (3)

8.3.3 Calculate the coordinates of C. (4)

8.3.4 The graph of  $h$  is concave down for  $x < k$ . Calculate the value of  $k$ . (3)  
[22]



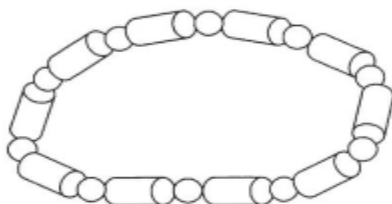
Mathematics/P1

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NSC

DBE/Feb.–Mar. 2015

**QUESTION 9**

A necklace is made by using 10 wooden spheres and 10 wooden cylinders. The radii,  $r$ , of the spheres and the cylinders are exactly the same. The height of each cylinder is  $h$ . The wooden spheres and cylinders are to be painted. (Ignore the holes in the spheres and cylinders.)



$V = \pi r^2 h$	$S = 2\pi r^2 + 2\pi r h$
$V = \frac{4}{3}\pi r^3$	$S = 4\pi r^2$

- 9.1 If the volume of a cylinder is  $6 \text{ cm}^3$ , write  $h$  in terms of  $r$ . (1)
- 9.2 Show that the total surface area ( $S$ ) of all the painted surfaces of the necklace is equal to  $S = 60\pi r^2 + \frac{120}{r}$  (4)
- 9.3 Determine the value of  $r$  so that the least amount of paint will be used. (4)
- [9]**



Mathematics/P1

10  
NSC

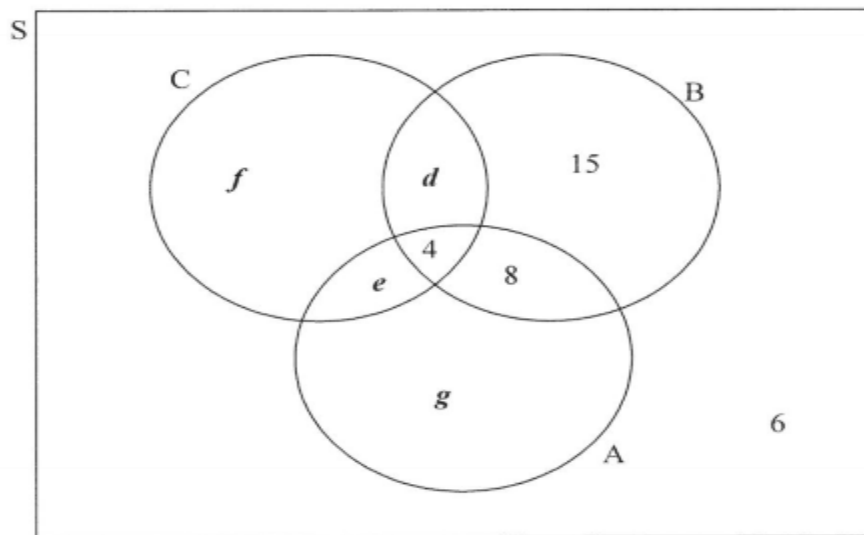
DBE/Feb.–Mar. 2015

**QUESTION 10**

10.1 Research was conducted about driving under the influence of alcohol. Information obtained from traffic authorities in 54 countries on the methods that are used to measure alcohol levels in a person, are summarised below:

- 4 countries use all three methods (A, B and C).
- 12 countries use the alcohol content of breath (A) and blood-alcohol concentration (B).
- 9 countries use blood-alcohol concentration (B) and certificates issued by doctors (C).
- 8 countries use the alcohol content of breath (A) and certificates issued by doctors (C).
- 21 countries use the alcohol content of breath (A).
- 32 countries use blood-alcohol concentration (B).
- 20 countries use certificates issued by doctors (C).
- 6 countries use none of these methods.

Below is a partially completed Venn diagram representing the above information.



- 10.1.1 Use the given information and the Venn diagram to determine the values of  $d$ ,  $e$ ,  $f$  and  $g$ . (4)
- 10.1.2 For a randomly selected country, calculate:
- $P(A \text{ and } B \text{ and } C)$  (1)
  - $P(A \text{ or } B \text{ or } C)$  (1)
  - $P(\text{only } C)$  (1)
  - $P(\text{that a country uses exactly two methods})$  (1)





Mathematics/P1

11  
NSC

DBE/Feb.–Mar. 2015

10.2 Nametso may choose DVDs from three categories as listed in the table below:

Drama	Romance	Comedy
<ul style="list-style-type: none"> <li>• <i>Last Hero</i></li> <li>• <i>Midnight</i></li> <li>• <i>Stranger Calls</i></li> <li>• <i>Missing in Action</i></li> <li>• <i>Only 40 Seconds Left</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>One Heart</i></li> <li>• <i>You and Me</i></li> <li>• <i>Love Song</i></li> <li>• <i>Bird's First Nest</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Laughing Dragon</i></li> <li>• <i>Falling Down</i></li> <li>• <i>Sitting on the Stairs</i></li> </ul>

- 10.2.1 Nametso must choose ONE DVD from the Drama category. What is the probability that she will choose *Midnight*? (2)
- 10.2.2 How many different selections are possible if her selection must include ONE drama, ONE romance and ONE comedy? (2)
- 10.2.3 Calculate the probability that she will have *Last Hero* and *Laughing Dragon* as part of her selection in QUESTION 10.2.2. (2)
- [14]**
- TOTAL: 150**





# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

## NATIONAL SENIOR CERTIFICATE

GRADE/*GRAAD* 12

MATHEMATICS P1/*WISKUNDE V1*

FEBRUARY/MARCH/*FEBRUARIE/MAART* 2015

MEMORANDUM

MARKS: 150  
*PUNTE: 150*

This memorandum consists of 18 pages.  
*Hierdie memorandum bestaan uit 18 bladsye.*





Mathematics P1/Wiskunde V1

2  
NSC/NSS – Memorandum

DBE/Feb.–Mar./Feb.–Mrt. 2015

**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in all aspects of the marking memorandum.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$(x + 4)(x - 5) = 0$ $\therefore x = -4$ or $x = 5$	✓ factors/faktore ✓ answers/antwoorde (2)
1.1.2	$2x^2 - 11x + 7 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-11) \pm \sqrt{(-11)^2 - 4(2)(7)}}{2(2)}$ $= 4,77$ or $0,73$  <b>OR/OF</b> $2x^2 - 11x + 7 = 0$ $x^2 - \frac{11}{2}x + \frac{7}{2} = 0$ $x^2 - \frac{11}{2}x + \left(\frac{1}{2} \cdot \frac{11}{2}\right)^2 + \frac{7}{2} - \left(\frac{1}{2} \cdot \frac{11}{2}\right)^2 = 0$ $\left(x - \frac{11}{4}\right)^2 + \frac{7}{2} - \frac{121}{16} = 0$ $\left(x - \frac{11}{4}\right)^2 = \frac{121 - 56}{16}$ $x - \frac{11}{4} = \pm \sqrt{\frac{65}{16}}$ $\therefore x = \frac{11}{4} + \frac{\sqrt{65}}{4}$ or $x = \frac{11}{4} - \frac{\sqrt{65}}{4}$ $x = 4,77$ or $x = 0,73$	✓ substitution into correct formula/substitusie in korrekte formule ✓ 4,77 ✓ 0,73 (3)  ✓ correct completion of the square/korrekte voltooiing van die vierkant  ✓ 4,77 ✓ 0,73 (3)

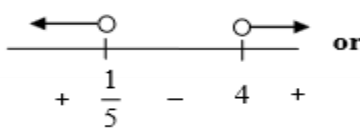
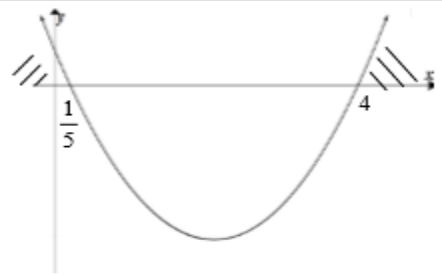




Mathematics P1/Wiskunde V1

3  
NSC/NSS – Memorandum

DBE/Feb.–Mar./Feb.–Mrt. 2015

1.1.3	$5x^2 - 21x + 4 > 0$ $(5x - 1)(x - 4) > 0$ $x < \frac{1}{5} \text{ or/of } x > 4$ 		<ul style="list-style-type: none"> <li>✓ standard form/ standaardvorm</li> <li>✓ factors/faktore</li> <li>✓ <math>x &lt; \frac{1}{5}</math></li> <li>✓ <math>x &gt; 4</math></li> <li>✓ of</li> </ul>
1.1.4	$2^{2x} - 6 \cdot 2^x = 16$ $2^{2x} - 6 \cdot 2^x - 16 = 0$ $(2^x - 8)(2^x + 2) = 0$ $2^x = 2^3 \text{ or/of } 2^x = -2$ $x = 3 \text{ or/of No Solution or } 2^x \neq -2$		<ul style="list-style-type: none"> <li>✓ factors/faktore</li> <li>✓ no solution to/ geen oplossing</li> <li><math>2^x = -2</math></li> <li>✓ <math>2^x = 2^3</math></li> <li>✓ answer/antw.</li> </ul>





Mathematics P1/Wiskunde V1

4  
NSC/NSS – Memorandum

DBE/Feb.–Mar./Feb.–Mrt. 2015

1.2	$y = 2x - 1$ $x^2 - x(2x - 1) + (2x - 1)^2 = 7$ $x^2 - 2x^2 + x + 4x^2 - 4x + 1 = 7$ $3x^2 - 3x - 6 = 0$ $x^2 - x - 2 = 0$ $(x - 2)(x + 1) = 0$ $x = 2 \text{ or/of } x = -1$ $y = 3 \text{ or/of } y = -3$ <p><b>OR/OF</b></p> $x = \frac{y}{2} + \frac{1}{2}$ $\left(\frac{y}{2} + \frac{1}{2}\right)^2 - \left(\frac{y}{2} + \frac{1}{2}\right)y + y^2 = 7$ $\frac{y^2}{4} + \frac{y}{2} + \frac{1}{4} - \frac{y^2}{2} - \frac{y}{2} + y^2 = 7$ $\times 4: y^2 + 2y + 1 - 2y^2 - 2y + 4y^2 - 28 = 0$ $3y^2 - 27 = 0$ $y^2 - 9 = 0$ $(y - 3)(y + 3) = 0$ $\therefore y = 3 \quad \text{or} \quad y = -3$ $\therefore x = \frac{3}{2} + \frac{1}{2} \quad x = \frac{-3}{2} + \frac{1}{2}$ $x = 2 \quad x = -1$	<p>✓ <i>y</i> the subject/ <i>die onderwerp</i></p> <p>✓ substitution/substitusie ✓ simplification/vereenv.</p> <p>✓ factors/faktore ✓ <i>x</i>-values/waardes ✓ <i>y</i>-values/waardes (6)</p> <p>✓ <i>x</i> the subject/ <i>die onderwerp</i> ✓ substitution/substitusie</p> <p>✓ simplification/vereenv.</p> <p>✓ factors/faktore ✓ <i>y</i>-values/waardes ✓ <i>x</i>-values/waardes (6)</p>
1.3.1	$k = -2 \text{ or/of } k = 2$	<p>✓✓ answer/antw. (2)</p>
1.3.2	$k = -3$	<p>✓ -3 (1)</p>





Mathematics P1/Wiskunde V1

5  
NSC/NSS – Memorandum

DBE/Feb.–Mar./Feb.–Mrt. 2015

1.4	$\sqrt{\frac{7^{2014} - 7^{2012}}{12}}$ $= \sqrt{\frac{7^{2012}(7^2 - 1)}{12}}$ $= \sqrt{\frac{7^{2012} \cdot 48}{12}}$ $= \sqrt{7^{2012} \cdot 4}$ $= 2 \cdot 7^{1006}$ $a = 2; b = 1006$	$\checkmark \frac{7^{2012}(7^2 - 1)}{12}$ $\checkmark \sqrt{7^{2012} \cdot 4}$ $\checkmark 2 \cdot 7^{1006} \checkmark$ <p><b>OR/OF</b></p> $\checkmark a = 2$ $\checkmark b = 1006$ <p style="text-align: right;">(4) [27]</p>
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**QUESTION/VRAAG 2**

2.1	$S_n = a + (a + d) + (a + 2d) + \dots + a + (n - 1)d$ $S_n = a + (n - 1)d + a + (n - 2)d + a + (n - 3)d + \dots + a$ $2S_n = n(2a + (n - 1)d)$ $S_n = \frac{n}{2}[2a + (n - 1)d]$	$\checkmark$ first series/eerste reeks $\checkmark$ series reversed/reeks omgekeer $\checkmark$ sum/som $\checkmark$ division/deling <p style="text-align: right;">(4)</p>
2.2	$\sum_{k=1}^{50} (100 - 3k) = 97 + 94 + 91 + \dots$ $T_1 = a = 97$ $d = -3$ $n = 50 - 1 + 1 = 50$ $S_n = \frac{n}{2}[2a + (n - 1)d]$ $= \frac{50}{2}[2(97) + 49(-3)]$ $= 1175$ <p><b>OR/OF</b></p> $T_1 = a = 97$ $l = 100 - 3(50) = -50$ $n = 50 - 1 + 1 = 50$ $S_n = \frac{n}{2}[a + l]$ $= \frac{50}{2}[97 - 50]$ $= 1175$	$\checkmark a = 97$ $\checkmark d = -3$ $\checkmark n = 50$ $\checkmark$ answer/antwoord <p style="text-align: right;">(4)</p> $\checkmark a = 97$ $\checkmark l = -50$ $\checkmark n = 50$ $\checkmark$ answer/antwoord <p style="text-align: right;">(4)</p>

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2.3.1 (a)	$T_5 - T_4 = 25$	✓ answer/antwoord (1)
2.3.1 (b)	$T_{70} - T_{69} = 7 + (69 - 1)(6)$ $= 415$	✓ $n = 69$ ✓ $7 + (69 - 1)(6)$ ✓ answer/antw. (3)
2.3.2	$T_{89} - T_{69} = (T_{70} - T_{69}) + (T_{71} - T_{70}) + \dots + (T_{89} - T_{88})$ $= 415 + 421 + \dots \text{to 20 terms}$ $= \frac{20}{2} [2(415) + 19(6)]$ $= 9440$ $T_{69} = T_{89} - (\text{sum of the differences from/som van die verskille van } T_{69} \text{ to } T_{89})$ $T_{69} = 23594 - 9440$ $= 14154$  <b>OR/OF</b> $\begin{array}{ccc} 7 & 13 & 19 & 25 \\ \swarrow & \swarrow & \swarrow & \\ 6 & 6 & 6 & \end{array}$  $\therefore 2a = 6$ $a = 3$ $3a + b = 7$ $b = -2$ $T_{89} = 3(89)^2 - 2(89) + c = 23594$ $\therefore c = 9$ $\therefore T_n = 3n^2 - 2n + 9$ $\therefore T_{69} = 3(69)^2 - 2(69) + 9$ $\therefore T_{69} = 14154$	✓ expansion/uitbreiding ✓ $n = 20$ ✓ method/metode ✓ $a = 415$  ✓ answer/antwoord (5)  ✓ $a$ and/en $b$ ✓ $T_{89}$ (subst $n = 89$ ) ✓ $T_n$ ✓ substitution/substitusie ✓ answer/antwoord (5)





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	<p><b>OR/OF</b></p> $\begin{array}{ccc} 7 & 13 & 19 & 25 \\ \swarrow & \swarrow & \swarrow & \\ 6 & 6 & 6 & \end{array}$ <p> <math>\therefore 2a = 6</math>  <math>a = 3</math>  <math>7 - 6 = 1</math>  <math>T_1 - T_0 = 1</math>  <math>a + b + c - c = 1</math>  <math>3 + b = 1</math>  <math>b = -2</math>  <math>T_{89} = 3(89)^2 - 2(89) + c = 23594</math>  <math>\therefore c = 9</math>  <math>\therefore T_n = 3n^2 - 2n + 9</math>  <math>\therefore T_{69} = 3(69)^2 - 2(69) + 9</math>  <math>\therefore T_{69} = 14154</math> </p>	<p> <math>\checkmark a</math> and/en <math>b</math>  <math>\checkmark T_{89}</math> (subst <math>n = 89</math>)  <math>\checkmark T_n</math>  <math>\checkmark</math> substitution/substitusie  <math>\checkmark</math> answer/antwoord            (5)  <b>[17]</b> </p>
	<p><b>OR/OF</b></p> $T_{n+1} - T_n = 7 + 6(n-1)$ $\therefore T_{89} - T_1 = \sum_{n=1}^{88} (T_{n+1} - T_n)$ $= \frac{n}{2} [2a + (n-1)d]$ $= \frac{88}{2} [14 + 87 \times 6]$ $= 23584$ $\therefore T_1 = 23594 - 23584 = 10$ $\therefore T_{69} - 10 = \sum_{n=1}^{68} (T_{n+1} - T_n)$ $= 34(15 + 67 \times 6) = 14144$ $\therefore T_{69} = 14154$	<p> <math>\checkmark</math> formula/formule  <math>\checkmark</math> value of/waarde van <math>S_{88}</math>  <math>\checkmark</math> first term value/            eerste term waarde  <math>\checkmark</math> substitution/substitusie  <math>\checkmark</math> answer/antwoord            (5)  <b>[17]</b> </p>





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**QUESTION 3**

3.1	$r = \frac{40,5}{45} = 0,9$ $T_{12} = 45(0,9)^{12-1}$ $= 14,12147682\dots$ $= 14,12$	<p>✓ <math>r = 0,9</math></p> <p>✓ substitution into correct formula/substitusie in korrekte formule</p> <p>✓ answer/antwoord</p> <p style="text-align: right;">(3)</p>
3.2	$r = 0,9$ $-1 < 0,9 < 1$	<p>✓ answer/antwoord</p> <p style="text-align: right;">(1)</p>
3.3	$S_{\infty} = \frac{45}{1-0,9}$ $S_{\infty} = 450$	<p>✓ substitution/substitusie</p> <p>✓ 450</p> <p style="text-align: right;">(2)</p>
3.4	$S_{\infty} - S_n < 1$ $S_{\infty} - S_n = 450 - \frac{45(1 - (0,9)^n)}{1 - 0,9}$ $S_{\infty} - S_n = 450 - 450(1 - (0,9)^n)$ $450(0,9)^n < 1$ $(0,9)^n < \frac{1}{450}$ $\log(0,9)^n < \log \frac{1}{450}$ $n \cdot \log(0,9) < \log \frac{1}{450}$ $n > \frac{\log \frac{1}{450}}{\log(0,9)}$ $n > 57,98\dots$ <p>Smallest value/Kleinste waarde: <math>n = 58</math></p>	<p>✓ <math>450 - \frac{45(1 - (0,9)^n)}{1 - 0,9}</math></p> <p>✓ <math>(0,9)^n = \frac{1}{450}</math></p> <p>✓ introducing/gebruik logs</p> <p>✓ making <math>n</math> the subject/maak <math>n</math> die onderwerp</p> <p>✓ <math>n = 58</math> <span style="float: right;">(5)</span></p> <p style="text-align: right;"><b>[11]</b></p>

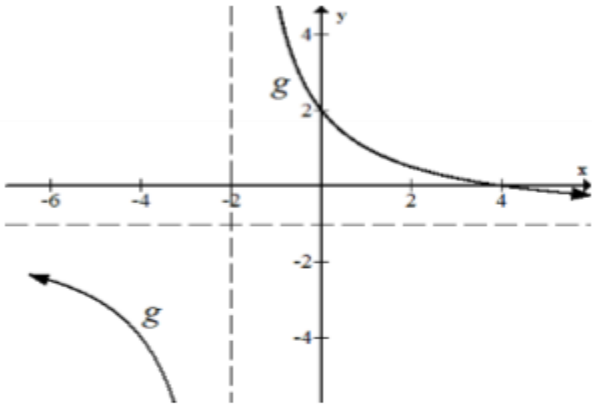


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**QUESTION/VRAAG 4**

4.1	$x = -2$ $y = -1$	✓ $x = -2$ ✓ $y = -1$ (2)
4.2.1	$g(0) = \frac{6}{0+2} - 1$ $= 2$ <i>y</i> -intercept/afsnit (0 ; 2)	✓ answer/antwoord (1)
4.2.2	$0 = \frac{6}{x+2} - 1$ $1 = \frac{6}{x+2}$ $x+2 = 6$ $x = 4$ <i>x</i> -intercept/afsnit (4 ; 0)	✓ equating to/stel gelyk aan 0  ✓ answer/antwoord (2)
4.3		✓ asymptotes/asimptote ✓ intercepts/afsnitte ✓ shape/vorm (3)
4.4	$y + 1 = -(x + 2)$ $y = -x - 3$  <b>OR/OF</b>  Using general formula/ <i>Gebruik algemene formule:</i> $y = -(x + p) + q$ $y = -(x + 2) - 1$ $y = -x - 3$	✓ $m = -1$ ✓ substitution of (-2 ; -1) ✓ answer (3)  ✓ formula/formule ✓ substitution of $p$ and $q$ values/ <i>substitusie van p- en q-waardes</i> ✓ answer/antwoord (3)
4.5	$x > -2$	✓✓ answer (2)

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## QUESTION/VRAAG 5

5.1	$9 = a^2$ $a = 3$  <b>OR/OF</b>  $f^{-1}(x) = \log_a x$ $2 = \log_a 9$ $a^2 = 9 = 3^2$ $\therefore a = 3$	$\checkmark 9 = a^2$ $\checkmark a = 3$ (2)  $\checkmark 9 = a^2$ $\checkmark a = 3$ (2)
5.2	$g(x) = 3^{-x}$  <b>OR/OF</b> $g(x) = \left(\frac{1}{3}\right)^x$	$\checkmark$ answer/antwoord (1)  $\checkmark$ answer/antwoord (1)
5.3	$x \geq 9$  <b>OR/OF</b>  $f^{-1}(x) = \log_3 x$ $\log_3 x = 2$ $x = 3^2 = 9$ $\therefore x \geq 9$  <b>OR/OF</b>  $\log_3 x \geq 2$ $x \geq 3^2$ $\therefore x \geq 9$	$\checkmark\checkmark$ answer/antwoord (2)  $\checkmark\checkmark$ answer/antwoord (2)  $\checkmark\checkmark$ answer/antwoord (2)
5.4	<p>Yes/Ja. For every <math>y</math>-value there is only one <math>x</math> such that/Vir elke <math>y</math>-waarde is daar slegs een <math>x</math> sodanig dat <math>y = f(x)</math>.</p> <p><b>OR/OF</b></p> <p>Yes/Ja. <math>f</math> is a one-to-one relation/is 'n een-tot-een-relasie.</p>	$\checkmark$ Yes/Ja $\checkmark$ Reason/Rede (2)  $\checkmark$ Yes/Ja $\checkmark$ Reason/Rede (2) <b>[7]</b>





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**QUESTION/VRAAG 6**

6.1	$-3 \leq x \leq 2$	✓ critical values/ kritiese waardes ✓ notation/notasie (2)
6.2	$f: y = a(x - x_1)(x - x_2)$ $y = a(x + 3)(x - 2)$ $-8 = a(1 + 3)(1 - 2)$ $-8 = -4a$ $2 = a$ $y = 2(x + 3)(x - 2)$ $y = 2x^2 + 2x - 12$ $b = 2$ and/en $c = -12$  <b>OR/OF</b>  $y = a\left(x + \frac{1}{2}\right)^2 + q$ $0 = a\left(2 + \frac{1}{2}\right)^2 + q \rightarrow 0 = \frac{25}{4}a + q \dots(1)$ $-8 = a\left(1 + \frac{1}{2}\right)^2 + q \rightarrow -8 = \frac{9}{4}a + q \dots(2)$ $(1) - (2) : 8 = 4a$ $a = 2$  $q = 0 - \frac{25}{4}(2) = -\frac{25}{2} = -12,5$  $y = 2\left(x + \frac{1}{2}\right)^2 - 12\frac{1}{2}$ $y = 2\left(x^2 + x + \frac{1}{4}\right) - 12\frac{1}{2}$ $y = 2x^2 + 2x + \frac{1}{2} - 12\frac{1}{2}$ $y = 2x^2 + 2x - 12$  $\therefore b = 2$ and $c = -12$  <b>OR/OF</b>	✓ $y = a(x + 3)(x - 2)$ ✓ substitute/vervang $(1; -8)$  ✓ $a = 2$  ✓ $b = 2$ and/en ✓ $c = -12$ (5)  ✓ equation/vergeljing 1 ✓ equation/vergeljing 2  ✓ $a = 2$  ✓ substitution/substitusie  ✓ $b = 2$ and/en ✓ $c = -12$ (5)



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	$f'(x) = 2ax + b$ $f'\left(-\frac{1}{2}\right) = 2a\left(-\frac{1}{2}\right) + b = 0$ $\therefore a = b$ $(-3; 0): 9a - 3b + c = 0$ $\therefore 6a + c = 0 \dots \dots \dots (1)$ $(1; -8): a + b + c = -8$ $\therefore 2a + c = -8 \dots \dots \dots (2)$ $(1) - (2): 4a = 8$ $\therefore a = 2$ $\Rightarrow b = 2$ $\therefore c = -12$	<p>✓ equation/vergeliking 1</p> <p>✓ equation/vergeliking 2</p> <p>✓ <math>a = 2</math></p> <p>✓ <math>b = 2</math></p> <p>✓ <math>c = -12</math></p> <p>(5)</p>
6.3	$x = -\frac{b}{2a}$ $x = -\frac{2}{2(2)} = -\frac{1}{2}$ $y = \frac{1}{2} - 1 - 12$ $y = -12\frac{1}{2}$ $\text{TP}\left(-\frac{1}{2}; -12\frac{1}{2}\right)$ <b>OR/OF</b>	<p>✓ <math>x = -\frac{1}{2}</math></p> <p>✓ substitution/substitusie</p> <p>✓ y-value/waarde</p> <p>(3)</p>



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	$y = 2[x^2 + x - 6]$ $y = 2\left[x^2 + x + \left(\frac{1}{2} \cdot 1\right)^2 - 6 - \left(\frac{1}{2} \cdot 1\right)^2\right]$ $= 2\left[\left(x + \frac{1}{2}\right)^2 - 6,25\right]$ $= 2\left(x + \frac{1}{2}\right)^2 - 12,5$ $\text{TP}\left(-\frac{1}{2}; -12,5\right)$ <p><b>OR/OF</b></p> $x = \frac{-3 + 2}{2} = -\frac{1}{2}$ $y = 2\left(-\frac{1}{2}\right) + 2\left(-\frac{1}{2}\right) - 12$ $y = -12\frac{1}{2}$ $\text{TP}\left(-\frac{1}{2}; -12,5\right)$ <p><b>OR/OF</b></p> $f(x) = y = 2x^2 + 2x - 12$ $f'(x) = 4x + 2$ $4x + 2 = 0$ $4x = -2$ $x = -\frac{1}{2}$ $\therefore y = 2\left(-\frac{1}{2}\right)^2 + 2\left(-\frac{1}{2}\right) - 12 = -\frac{25}{2}$ $\text{TP}\left(-\frac{1}{2}; -\frac{25}{2}\right)$	<p>✓ method/metode</p> <p>✓ x-value/waarde ✓ y-value/waarde</p> <p>(3)</p> <p>✓ method/metode ✓ x-value/waarde</p> <p>✓ y-value/waarde</p> <p>(3)</p> <p>✓ method/metode</p> <p>✓ x-value/waarde ✓ y-value/waarde</p> <p>(3)</p>
6.4	$x = \frac{13}{2}$	<p>✓✓ answer/i</p> <p>(2)</p>
6.5	$f'(x) = 4x + 2$ $m = f'(1) = 4(1) + 2$ $m = 6$	<p>✓ <math>y' = 4x + 2</math> ✓ subst. <math>x = 1</math> ✓ answer/antwoord</p> <p>(3)</p> <p><b>[15]</b></p>



**QUESTION/VRAAG 7**

7.1.1	$R400 \times (44 \times 12)$ $= R211200$	$\checkmark R400 \times (44 \times 12)$ $\checkmark R211200$ <p style="text-align: right;">(2)</p>
7.1.2	$F = \frac{x[(1+i)^n - 1]}{i}$ $= \frac{400 \left[ \left(1 + \frac{0,08}{12}\right)^{528} - 1 \right]}{\frac{0,08}{12}}$ $= R1\,943\,524,42$	$\checkmark x = 400$ $\checkmark n = 528$ $\checkmark i = \frac{0,08}{12}$ $\checkmark \text{substitution into correct formula/substitusie in korrekte formule}$ $\checkmark \text{answer/antwoord}$ <p style="text-align: right;">(5)</p>
7.1.3	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $2000000 = \frac{x \left[ 1 - \left(1 + \frac{0,1}{12}\right)^{-300} \right]}{\frac{0,1}{12}}$ $x = R18\,174,01$ <p><b>OR/OF</b></p> $2000000 \left(1 + \frac{0,1}{12}\right)^{300} = \frac{x \left[ \left(1 + \frac{0,1}{12}\right)^{300} - 1 \right]}{\frac{0,1}{12}}$ $x = R18174,01$	$\checkmark P = 2000000$ $\checkmark n = 300 \text{ and/en } i = \frac{0,1}{12}$ $\checkmark \text{substituting into correct formula/substitusie in korrekte formule}$ $\checkmark \text{answer/antwoord}$ <p style="text-align: right;">(4)</p> $\checkmark P = 2000000$ $\checkmark n = 300 \text{ and/en } i = \frac{0,1}{12}$ $\checkmark \text{equating/stel gelyk}$ $\checkmark \text{answer/antwoord}$ <p style="text-align: right;">(4)</p>
7.2	<p>Let <math>P_X</math> and <math>P_Y</math> be the populations of the two towns at the beginning of 2010./Laat <math>P_X</math> en <math>P_Y</math> die bevolkings wees van die twee dorpe aan die begin van 2010.</p> $A_X = A_Y$ $P_X(1 - 0,08)^3 = P_Y(1 + 0,12)^3$ $\frac{P_X}{P_Y} = \frac{(1 + 0,12)^3}{(1 - 0,08)^3}$ $= \frac{1,404\dots}{0,778\dots}$ $= 1,8:1$	$\checkmark \text{equating/stel gelyk}$ $\checkmark A_X = P_X(1 - 0,08)^3$ $\checkmark A_Y = P_Y(1 + 0,12)^3$ $\checkmark \text{answer/antwoord}$ <p style="text-align: right;">(4) <b>[15]</b></p>



**QUESTION/VRAAG 8**

8.1	$f(x+h) = 2(x+h)^2 + 4$ $= 2x^2 + 4xh + 2h^2 + 4$ $f(x+h) - f(x) = 2x^2 + 4xh + 2h^2 + 4 - 2x^2 - 4$ $= 4xh + 2h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{4xh + 2h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(4x + 2h)}{h}$ $= \lim_{h \rightarrow 0} (4x + 2h)$ $= 4x$	$\checkmark 2x^2 + 4xh + 2h^2 + 4$ $\checkmark 4xh + 2h^2$ $\checkmark \lim_{h \rightarrow 0} \frac{h(4x + 2h)}{h}$ $\checkmark 4x \quad (4)$
8.2.1	$f(x) = -3x^2 + 5\sqrt{x}$ $f(x) = -3x^2 + 5x^{\frac{1}{2}}$ $f'(x) = -6x + \frac{5}{2}x^{-\frac{1}{2}}$	$\checkmark 5x^{\frac{1}{2}}$ $\checkmark -6x$ $\checkmark \frac{5}{2}x^{-\frac{1}{2}}$ <p style="text-align: right;">(3)</p>
8.2.2	$p(x) = \left(\frac{1}{x^3} + 4x\right)^2$ $= \frac{1}{x^6} + \frac{8}{x^2} + 16x^2$ $= x^{-6} + 8x^{-2} + 16x^2$ $p'(x) = -6x^{-7} - 16x^{-3} + 32x$ <p><b>OR/OF</b></p> $p(x) = (x^{-3} + 4x)^2$ <p>by making use of the chain rule:</p> $p'(x) = 2(x^{-3} + 4x)(-3x^{-4} + 4)$ $p'(x) = -6x^{-7} - 16x^{-3} + 32x$	$\checkmark \frac{1}{x^6} + \frac{8}{x^2} + 16x^2$ $\checkmark x^{-6} + 8x^{-2} + 16x^2$ $\checkmark \checkmark \text{ answer/antwoord} \quad (4)$ $\checkmark \checkmark 2(x^{-3} + 4x)$ $\checkmark \checkmark (-3x^{-4} + 4)$ <p style="text-align: right;">(4)</p>
8.3.1	$h'(x) = 3x^2 - 14x + 14$	$\checkmark \text{ finding/kry } h'(x) \quad (1)$
8.3.2	<p>At/By B: <math>h'(x) = 0</math></p> $3x^2 - 14x + 14 = 0$ $x = \frac{14 \pm \sqrt{(-14)^2 - 4(3)(14)}}{2(3)}$ $= 1,45 \text{ or } 3,22$ <p style="text-align: center;"><math>n/a</math></p>	$\checkmark \text{ derivative equal to/afgeleide gelyk aan } 0$ $\checkmark \text{ substitution into correct formula/substitusie in korrekte formule}$ $\checkmark x\text{-value of/x-waarde van } 1,45 \quad (3)$





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8.3.3	$x^3 - 7x^2 + 14x - 8 = (x-1)(x^2 - 6x + 8)$ $= (x-1)(x-2)(x-4)$ <p>C(4;0)</p> <p><b>OR/OF</b></p> $x_c > 3,22$ $h(4) = (4)^3 - 7(4)^2 + 14(4) - 8 = 0$ $\therefore x_c = 4$	$\checkmark (x-1)$ $\checkmark x^2 - 6x + 8$ $\checkmark (x-2)(x-4)$ $\checkmark$ coordinates of/ <i>koördinate</i> <i>van C</i> (4)  $\checkmark x_c > 3,22$ $\checkmark$ substitution of/ <i>substitusie van 4</i> $\checkmark h(4) = 0$ $\checkmark x_c$ (4)
8.3.4	$h'(x) = 3x^2 - 14x + 14$ $h''(x) = 6x - 14$ $6x - 14 < 0$ $6x < 14$ $\therefore x < \frac{7}{3}$ $\therefore k = \frac{7}{3}$	$\checkmark h''(x) = 6x - 14$ $\checkmark 6x - 14 < 0$  $\checkmark k = \frac{7}{3}$  (3) <b>[22]</b>





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**QUESTION/VRAAG 9**

9.1	$\pi r^2 h = 6$ $h = \frac{6}{\pi r^2}$	$\checkmark h = \frac{6}{\pi r^2} \quad (1)$
9.2	$S = 10(2\pi r^2 + 2\pi r h + 4\pi r^2)$ $= 10[2\pi r h + 6\pi r^2]$ $= 20\pi r h + 60\pi r^2$ $= 20\pi r \left( \frac{6}{\pi r^2} \right) + 60\pi r^2$ $= 60\pi r^2 + \frac{120}{r}$ <p><b>OR/OF</b></p> <p>Area of/van 10 spheres/sfere = <math>10 \times 4 \times \pi \times r^2 = 40\pi r^2</math>            Area of/van 10 cylinders/silinders = <math>10(2\pi r^2 + 2\pi r h)</math>  <math display="block">= 10(2\pi r^2 + 2\pi r \frac{6}{\pi r^2})</math>  <math display="block">= 20\pi r^2 + \frac{120}{r}</math></p> <p>Total area/Totale area = <math>40\pi r^2 + 20\pi r^2 + \frac{120}{r}</math>  <math display="block">= 60\pi r^2 + \frac{120}{r}</math></p>	$\checkmark \checkmark 10(2\pi r^2 + 2\pi r h + 4\pi r^2)$ $\checkmark 20\pi r h + 60\pi r^2$ $\checkmark \text{substitution/substitusie}$  $\checkmark \text{area of 10 spheres/}$ $\text{area van 10 sfere}$ $\checkmark \text{area of 10 cylinders/}$ $\text{area van 10 silinders}$ $\checkmark \text{substitution/substitusie}$  $\checkmark \text{simplification/vereen-}$ $\text{voudiging}$  $(4)$  $(4)$
9.3	$S' = 120\pi r - 120r^{-2} = 0$ $120\pi r - \frac{120}{r^2} = 0$ $120\pi r^3 - 120 = 0$ $r^3 = \frac{120}{120\pi}$ $\therefore r = \frac{1}{\pi^{\frac{1}{3}}} = 0,68 \text{ cm}$	$\checkmark 120\pi r - 120r^{-2}$ $\checkmark = 0$  $\checkmark r^3 = \frac{120}{120\pi}$  $\checkmark \text{answer/antwoord}$  $(4)$

**[9]**



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**QUESTION/VRAAG 10**

10.1.1	$d = 5$ $e = 4$ $f = 7$ $g = 5$	✓ $d = 5$ ✓ $e = 4$ ✓ $f = 7$ ✓ $g = 5$	(4)
10.1.2a	$P(\text{A and/en B and/en C}) = \frac{4}{54} = \frac{2}{27}$	✓ $\frac{4}{54} = \frac{2}{27}$	(1)
10.1.2b	$P(\text{A or/of B or/of C}) = \frac{48}{54} = \frac{8}{9}$	✓ $\frac{48}{54} = \frac{8}{9}$	(1)
10.1.2c	$P(\text{only/slegs C}) = \frac{7}{54}$	✓ $\frac{7}{54}$	(1)
10.1.2d	$P(\text{that a country uses exactly two methods/dat 'n land presies twee metodes gebruik}) = \frac{5 + 4 + 8}{54} = \frac{17}{54}$	✓ $\frac{17}{54}$	(1)
10.2.1	$P(\text{selects Midnight as drama/kies Midnight as drama}) = \frac{1}{5}$	✓ ✓ answer/antwoord	(2)
10.2.2	Number of different selections of drama, romance and comedy/Aantal verskillende keuses van drama, liefdesverhale en komedie = $5 \times 4 \times 3 = 60$	✓ product/produk ✓ answer/antwoord	(2)
10.2.3	$P(\text{select Last Hero and Laughing Dragon/kies Last Hero en Laughing Dragon}) = \frac{1}{5} \times \frac{1}{3} = \frac{1}{15}$ <b>OR/OF</b> $P(\text{select Last Hero and Laughing Dragon/kies Last Hero en Laughing Dragon}) = \frac{1 \times 4 \times 1}{60} = \frac{1}{15}$	✓ product/produk ✓ answer/antwoord  ✓ product/produk ✓ answer/antwoord	(2)  (2)
<b>TOTAL/TOTAAL:</b>			<b>[14]</b> <b>150</b>





# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**FEBRUARY/MARCH 2016**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 8 pages and 1 information sheet.**





Mathematics/P1

3  
NSC

DBE/Feb.–Mar. 2016

**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 - x - 12 = 0$  (3)

1.1.2  $x(x+3) - 1 = 0$  (Leave your answer in simplest surd form.) (3)

1.1.3  $x(4 - x) < 0$  (3)

1.1.4  $x = \frac{a^2 + a - 2}{a - 1}$  if  $a = 888\ 888\ 888\ 888$  (2)

1.2 Solve the following equations simultaneously:

$y + 7 = 2x$  and  $x^2 - xy + 3y^2 = 15$  (6)

1.3 Determine the range of the function  $y = x + \frac{1}{x}$ ,  $x \neq 0$  and  $x$  is real. (6)**[23]****QUESTION 2**2.1 Given the following quadratic sequence:  $-2 ; 0 ; 3 ; 7 ; \dots$ 

2.1.1 Write down the value of the next term of this sequence. (1)

2.1.2 Determine an expression for the  $n^{\text{th}}$  term of this sequence. (5)

2.1.3 Which term of the sequence will be equal to 322? (4)

2.2 Consider an arithmetic sequence which has the second term equal to 8 and the fifth term equal to 10.

2.2.1 Determine the common difference of this sequence. (3)

2.2.2 Write down the sum of the first 50 terms of this sequence, using sigma notation. (2)

2.2.3 Determine the sum of the first 50 terms of this sequence. (3)

**[18]**



Mathematics/P1

4  
NSC

DBE/Feb.–Mar. 2016

**QUESTION 3**

Chris bought a bonsai (miniature tree) at a nursery. When he bought the tree, its height was 130 mm. Thereafter the height of the tree increased, as shown below.

INCREASE IN HEIGHT OF THE TREE PER YEAR		
During the first year	During the second year	During the third year
100 mm	70 mm	49 mm

- 3.1 Chris noted that the sequence of height increases, namely 100 ; 70 ; 49 ..., was geometric. During which year will the height of the tree increase by approximately 11,76 mm? (4)
- 3.2 Chris plots a graph to represent the height  $h(n)$  of the tree (in mm)  $n$  years after he bought it. Determine a formula for  $h(n)$ . (3)
- 3.3 What height will the tree eventually reach? (3)
- [10]**

**QUESTION 4**

Given:  $f(x) = 2^{-x} + 1$

- 4.1 Determine the coordinates of the  $y$ -intercept of  $f$ . (1)
- 4.2 Sketch the graph of  $f$ , clearly indicating ALL intercepts with the axes as well as any asymptotes. (3)
- 4.3 Calculate the average gradient of  $f$  between the points on the graph where  $x = -2$  and  $x = 1$ . (3)
- 4.4 If  $h(x) = 3f(x)$ , write down an equation of the asymptote of  $h$ . (1)
- [8]**





Mathematics/P1

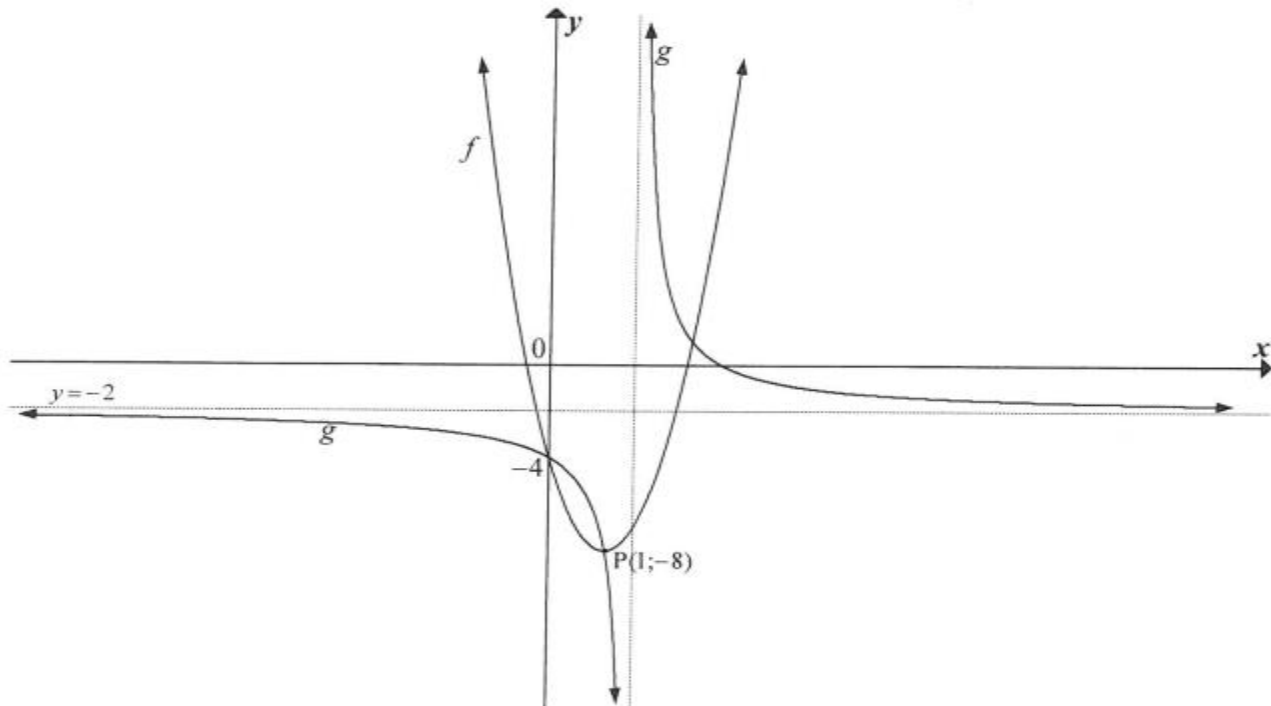
5  
NSC

DBE/Feb.–Mar. 2016

**QUESTION 5**

The graphs of the functions  $f(x) = a(x+p)^2 + q$  and  $g(x) = \frac{k}{x+r} + d$  are sketched below.

Both graphs cut the  $y$ -axis at  $-4$ . One of the points of intersection of the graphs is  $P(1; -8)$ , which is also the turning point of  $f$ . The horizontal asymptote of  $g$  is  $y = -2$ .



- 5.1 Calculate the values of  $a$ ,  $p$  and  $q$ . (4)
- 5.2 Calculate the values of  $k$ ,  $r$  and  $d$ . (6)
- 5.3 Determine the value(s) of  $x$  in the interval  $x \leq 1$  for which  $g(x) \geq f(x)$ . (2)
- 5.4 Determine the value(s) of  $k$  for which  $f(x) = k$  has two, unequal positive roots. (2)
- 5.5 Write down an equation for the axis of symmetry of  $g$  that has a negative gradient. (3)
- 5.6 The point  $P$  is reflected in the line determined in QUESTION 5.5 to give the point  $Q$ . Write down the coordinates of  $Q$ . (2)

**[19]**

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Mathematics/P1

6  
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**QUESTION 6**

Given:  $f(x) = \frac{1}{4}x^2, x \leq 0$

- 6.1 Determine the equation of  $f^{-1}$  in the form  $f^{-1}(x) = \dots$  (3)
- 6.2 On the same system of axes, sketch the graphs of  $f$  and  $f^{-1}$ . Indicate clearly the intercepts with the axes, as well as another point on the graph of each of  $f$  and  $f^{-1}$ . (3)
- 6.3 Is  $f^{-1}$  a function? Give a reason for your answer. (2)
- [8]**

**QUESTION 7**

- 7.1 Diane invests a lump sum of R5 000 in a savings account for exactly 2 years. The investment earns interest at 10% p.a., compounded quarterly.
- 7.1.1 What is the quarterly interest rate for Diane's investment? (1)
- 7.1.2 Calculate the amount in Diane's savings account at the end of the 2 years. (3)
- 7.2 Motloi inherits R800 000. He invests all of his inheritance in a fund which earns interest at a rate of 14% p.a., compounded monthly. At the end of each month he withdraws R10 000 from the fund. His first withdrawal is exactly one month after his initial investment.
- 7.2.1 How many withdrawals of R10 000 will Motloi be able to make from this fund? (5)
- 7.2.2 Exactly four years after his initial investment Motloi decides to withdraw all the remaining money in his account and to use it as a deposit towards a house.
- (a) What is the value of Motloi's deposit, to the nearest rand? (4)
- (b) Motloi's deposit is exactly 30% of the purchase price of the house. What is the purchase price of the house, to the nearest rand? (1)
- [14]**





Mathematics/P1

7  
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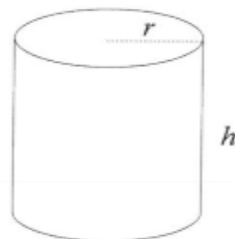
DBE/Feb.–Mar. 2016

**QUESTION 8**

- 8.1 Determine  $f'(x)$  from first principles if  $f(x) = -x^2 + 4$ . (5)
- 8.2 Determine the derivative of:
- 8.2.1  $y = 3x^2 + 10x$  (2)
- 8.2.2  $f(x) = \left(x - \frac{3}{x}\right)^2$  (3)
- 8.3 Given:  $f(x) = 2x^3 - 23x^2 + 80x - 84$
- 8.3.1 Prove that  $(x - 2)$  is a factor of  $f$ . (2)
- 8.3.2 Hence, or otherwise, factorise  $f(x)$  fully. (2)
- 8.3.3 Determine the  $x$ -coordinates of the turning points of  $f$ . (4)
- 8.3.4 Sketch the graph of  $f$ , clearly labelling ALL turning points and intercepts with the axes. (3)
- 8.3.5 Determine the coordinates of the  $y$ -intercept of the tangent to  $f$  that has a slope of 40 and touches  $f$  at a point where the  $x$ -coordinate is an integer. (6)
- [27]**

**QUESTION 9**

A soft drink can has a volume of  $340 \text{ cm}^3$ , a height of  $h \text{ cm}$  and a radius of  $r \text{ cm}$ .



- 9.1 Express  $h$  in terms of  $r$ . (2)
- 9.2 Show that the surface area of the can is given by  $A(r) = 2\pi r^2 + 680r^{-1}$ . (2)
- 9.3 Determine the radius of the can that will ensure that the surface area is a minimum. (4)
- [8]**





Mathematics/P1

8  
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DBE/Feb.–Mar. 2016

**QUESTION 10**

- 10.1 Each passenger on a certain Banana Airways flight chose exactly one beverage from tea, coffee or fruit juice. The results are shown in the table below.

	MALE	FEMALE	TOTAL
Tea	20	40	60
Coffee	$b$	$c$	80
Fruit juice	$d$	$e$	20
TOTAL	60	100	$a$

- 10.1.1 Write down the value of  $a$ . (1)
- 10.1.2 What is the probability that a randomly selected passenger is male? (2)
- 10.1.3 Given that the event of a passenger choosing coffee is independent of being a male, calculate the value of  $b$ . (4)
- 10.2 A Banana Airways aeroplane has 6 seats in each row.
- 10.2.1 How many possible arrangements are there for 6 people to sit in a row of 6 seats? (2)
- 10.2.2 Xoliswa, Anees and 4 other passengers sit in a certain row on a Banana Airways flight. In how many different ways can these 6 passengers be seated if Xoliswa and Anees must sit next to each other? (2)
- 10.2.3 Mary and 5 other passengers are to be seated in a certain row. If seats are allocated at random, what is the probability that Mary will sit at the end of the row? (4)
- TOTAL: 150**





# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12/*GRAAD 12***

**MATHEMATICS P1/*WISKUNDE V1***

**FEBRUARY/MARCH/*FEBRUARIE/MAART* 2016**

**MEMORANDUM**

**MARKS: 150**

***PUNTE: 150***

**This memorandum consists of 18 pages.  
*Hierdie memorandum bestaan uit 18 bladsye.***



Mathematics/P1/Wiskunde V1

2

DBE/Feb.–Mar./Feb.–Mrt. 2016

NSC/NSS – Memorandum

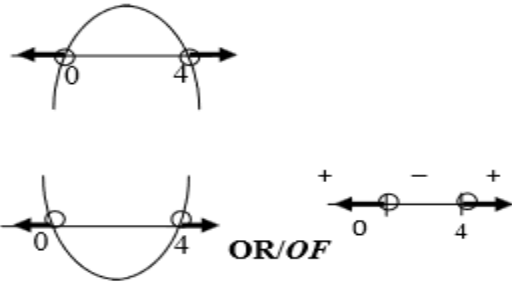
**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking memorandum.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.
- Volgehoue akkuraatheid is op ALLE aspekte van die memorandum van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$x^2 - x - 12 = 0$ $(x - 4)(x + 3) = 0$ $x = 4 \text{ or } x = -3$ <p><b>OR/OF</b></p> $x^2 - x - 12 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-12)}}{2(1)}$ $= 4 \text{ or } -3$	✓ factors ✓✓ answers (3)
1.1.2	$x(x + 3) - 1 = 0$ $x^2 + 3x - 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-3 \pm \sqrt{3^2 - 4(1)(-1)}}{2(1)}$ $= \frac{-3 \pm \sqrt{13}}{2}$	✓ standard form  ✓ substitution into correct formula ✓ answer (3)
1.1.3	$x(4 - x) < 0$ $x < 0 \text{ or } x > 4$ <p><b>OR/OF</b></p> $x(4 - x) < 0$ $x(x - 4) > 0$ $x < 0 \text{ or } x > 4$ 	✓ $x < 0$ ✓ $x > 4$ ✓ or (3)



Mathematics/P1/Wiskunde V1

3  
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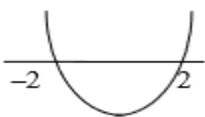
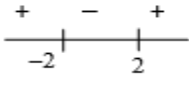
1.1.4	$x = \frac{a^2 + a - 2}{a - 1}$ $= \frac{(a+2)(a-1)}{a-1}$ $= a + 2$ $= 888\ 888\ 888\ 890$	$\checkmark (a+2)(a-1)$ $\checkmark$ answer (check ten eights written)/tien agtstes geskryf (2)
1.2	$y + 7 = 2x$ $y = 2x - 7 \dots\dots\dots(1)$ $x^2 - xy + 3y^2 = 15$ <p>substitute (1) in (2) :</p> $x^2 - x(2x - 7) + 3(2x - 7)^2 = 15$ $x^2 - 2x^2 + 7x + 3(4x^2 - 28x + 49) = 15$ $x^2 - 2x^2 + 7x + 12x^2 - 84x + 147 - 15 = 0$ $11x^2 - 77x + 132 = 0$ $x^2 - 7x + 12 = 0$ $(x - 3)(x - 4) = 0$ $x = 3 \quad \text{or} \quad x = 4$ $y = 2(3) - 7 \quad y = 2(4) - 7$ $y = -1 \quad \quad \quad y = 1$ <p><b>OR/OF</b></p> $y + 7 = 2x$ $x = \frac{y+7}{2} \dots\dots\dots(1)$ $x^2 - xy + 3y^2 = 15 \quad \dots\dots\dots(2)$ <p>substitute (1) in (2) :</p> $\left(\frac{y+7}{2}\right)^2 - \left(\frac{y+7}{2}\right)y + 3y^2 = 15$ $\frac{y^2 + 14y + 49}{4} - \frac{y^2 + 7y}{2} + 3y^2 = 15$ $y^2 + 14y + 49 - 2y^2 - 14y + 12y^2 - 60 = 0$ $11y^2 - 11 = 0$ $y^2 - 1 = 0$ $(y - 1)(y + 1) = 0$ $y = -1 \quad \quad \quad y = 1$ $x = \frac{-1+7}{2} \quad \quad \quad x = \frac{1+7}{2}$ $x = 3 \quad \quad \quad x = 4$	$\checkmark y = 2x - 7$ $\checkmark$ substitution $\checkmark$ standard form $\checkmark$ factorisation $\checkmark$ x-values $\checkmark$ y-values  $\checkmark x = \frac{y+7}{2}$ $\checkmark$ substitution  $\checkmark$ standard form $\checkmark$ factorisation $\checkmark$ y-values $\checkmark$ x-values (6)

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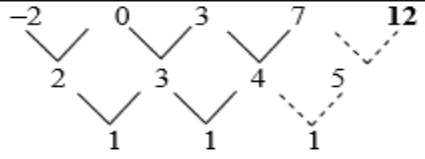
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<p>1.3</p>	$y = x + \frac{1}{x}$ $xy = x^2 + 1$ $x^2 - xy + 1 = 0$ <p>Since <math>x</math> is real, this equation has real roots./Omdat <math>x</math> reëel is, het die vergelyking reële wortels.</p> $\Delta \geq 0$ $y^2 - 4 \geq 0$ $(y - 2)(y + 2) \geq 0$ <div style="display: flex; align-items: center; justify-content: center;">  <span style="margin: 0 10px;"><b>OR/</b></span> <span style="margin: 0 10px;"><b>OF</b></span>  </div> $y \leq -2 \text{ or } y \geq 2$	<ul style="list-style-type: none"> <li>✓ <math>x^2 - xy + 1 = 0</math></li> <li>✓ <math>\Delta \geq 0</math></li> <li>✓ <math>y^2 - 4</math></li> <li>✓ factors</li>   <li>✓ <math>y \leq -2</math></li> <li>✓ <math>y \geq 2</math></li> </ul> <p style="text-align: right;">(6) <b>[23]</b></p>
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**QUESTION/VRAAG 2**

<p>2.1.1</p>	 <p>The next term of the sequence is 12./Die volgende term in die ry is 12.</p>	<ul style="list-style-type: none"> <li>✓ answer</li> </ul> <p style="text-align: right;">(1)</p>
<p>2.1.2</p>	$2a = 1$ $a = \frac{1}{2}$ $3a + b = T_2 - T_1$ $3\left(\frac{1}{2}\right) + b = 2$ $b = \frac{1}{2}$ $a + b + c = T_1$ $\frac{1}{2} + \frac{1}{2} + c = -2$ $c = -3$ $\therefore T_n = \frac{1}{2}n^2 + \frac{1}{2}n - 3$ <p><b>OR/OF</b></p>	<ul style="list-style-type: none"> <li>✓ value of <math>a</math></li> <li>✓ <math>3\left(\frac{1}{2}\right) + b = 2</math></li> <li>✓ value of <math>b</math></li> <li>✓ <math>\frac{1}{2} + \frac{1}{2} + c = -2</math></li> <li>✓ value of <math>c</math></li> </ul> <p style="text-align: right;">(5)</p>







	<p>Since <math>T_2 = 0</math>, <math>(n-2)</math> is a factor of <math>T_n</math></p> $T_n = an^2 + bn + c$ $= a(n-2)(n-k)$ $T_1 = -2 = a(1-2)(1-k)$ $-2 = -a(1-k)$ $a = \frac{2}{1-k}$ $T_3 = 3 = a(3-2)(3-k)$ $3 = a(3-k)$ $a = \frac{3}{3-k}$ $\frac{2}{1-k} = \frac{3}{3-k}$ $2(3-k) = 3(1-k)$ $6-2k = 3-3k$ $k = -3$ $a = \frac{1}{2}$ $T_n = \frac{1}{2}(n-2)(n+3)$ $= \frac{1}{2}n^2 + \frac{1}{2}n - 3$	<p>✓ <math>T_n = a(n-2)(n-k)</math></p> <p>✓ <math>-2 = a(1-2)(1-k)</math></p> <p>✓ <math>3 = a(3-2)(3-k)</math></p> <p>✓ value of <math>k</math></p> <p>✓ value of <math>a</math></p> <p>(5)</p>
2.1.3	$\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322$ $n^2 + n - 6 = 644$ $n^2 + n - 650 = 0$ $n = \frac{-1 \pm \sqrt{1^2 - 4(1)(-650)}}{2}$ $n = 25 \text{ or } n = -26$ <p>The 25<sup>th</sup> term has a value of 322./Die 25<sup>ste</sup> term se waarde is 322.</p> <p><b>OR/OF</b></p> $\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322$ $n^2 + n - 6 = 644$ $n^2 + n - 650 = 0$ $(n-25)(n+26) = 0$ $n = 25 \text{ or } n = -26$ <p>The 25<sup>th</sup> term has a value of 322./Die 25<sup>ste</sup> term se waarde is 322.</p> <p><b>OR/OF</b></p>	<p>✓ <math>\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322</math></p> <p>✓ standard form</p> <p>✓ substitution into quadratic formula</p> <p>✓ answer</p> <p>(4)</p> <p>✓ <math>\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322</math></p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ answer</p> <p>(4)</p>





	$\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322$ $n^2 + n - 6 = 644$ $(n+3)(n-2) = 23 \times 28$ $n-2 = 23$ $n = 25$	$\checkmark \frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322$ $\checkmark (n+3)(n-2)$ $\checkmark 23 \times 28$ $\checkmark \text{answer}$ <p style="text-align: right;">(4)</p>
2.2.1	$T_2 : a + d = 8$ $T_5 : a + 4d = 10$ $T_5 - T_2 : 3d = 2$ $d = \frac{2}{3}$	$\checkmark a + d = 8$ $\checkmark a + 4d = 10$ $\checkmark \text{answer}$ <p style="text-align: right;">(3)</p>
2.2.2	$T_1 = T_2 - d$ $= 8 - \frac{2}{3}$ $= \frac{22}{3}$ $T_n = a + (n-1)d$ $= \frac{22}{3} + (n-1)\frac{2}{3}$ $= \frac{2n+20}{3}$ $S_{50} = \sum_{n=1}^{50} \left( \frac{22}{3} + (n-1)\frac{2}{3} \right)$ <b>OR/OF</b> $S_{50} = \sum_{n=1}^{50} \left( \frac{2n+20}{3} \right)$	$\checkmark T_1 = \frac{22}{3}$ $\checkmark \text{answer}$ <p style="text-align: right;">(2)</p> <p style="text-align: right;">(2)</p>
2.2.3	$S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{50} = \frac{50}{2} \left[ 2 \left( \frac{22}{3} \right) + (50-1) \left( \frac{2}{3} \right) \right]$ $= \frac{3550}{3}$	$\checkmark \text{correct substitution into correct formula}$ $\checkmark \checkmark \text{answer}$ <p style="text-align: right;">(3)</p> <p style="text-align: right;"><b>[18]</b></p>





## QUESTION/VRAAG 3

3.1	$r = \frac{70}{100}$ $= \frac{7}{10}$ $T_n = ar^{n-1}$ $11,76 = 100\left(\frac{7}{10}\right)^{n-1}$ $\left(\frac{7}{10}\right)^{n-1} = \frac{11,76}{100}$ $n-1 = \log_{\frac{7}{10}}\left(\frac{11,76}{100}\right)$ $n-1 = 6$ $n = 7$ <p>During the 7<sup>th</sup> year/<i>In die 7<sup>de</sup> jaar</i></p> <p><b>OR/OF</b></p> $r = \frac{70}{100}$ $= \frac{7}{10}$ $T_n = ar^{n-1}$ $11,76 = 100(0,7)^{n-1}$ $0,7^{n-1} = \frac{11,76}{100}$ $= 0,1176$ $(n-1)\log 0,7 = \log 0,1176$ $n-1 = \frac{\log 0,1176}{\log 0,7}$ $n-1 = 6$ $n = 7$ <p>During the 7<sup>th</sup> year/<i>In die 7<sup>de</sup> jaar</i></p>	<p>✓ value of <math>r</math></p> <p>✓ substitution in formula for <math>T_n</math></p> <p>✓ use of logarithms</p> <p>✓ answer (4)</p> <p>✓ value of <math>r</math></p> <p>✓ substitution in formula for <math>T_n</math></p> <p>✓ use of logarithms</p> <p>✓ answer (4)</p>
3.2	$h(n) = 130 + (100 + 70 + 49 + \dots \text{to } n \text{ terms})$ $= 130 + \frac{100(1 - (0,7)^n)}{1 - 0,7}$ $= 130 + \frac{100(1 - (0,7)^n)}{0,3}$	<p>✓ 130</p> <p>✓</p> <p>100 + 70 + 49 + ... to <math>n</math> terms</p> <p>✓ answer (3)</p>



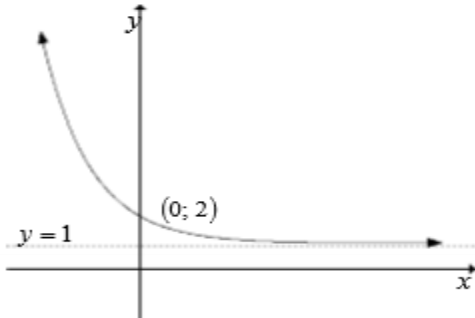
Mathematics/P1/Wiskunde V1

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3.3	<p>Eventual height of the tree/<i>Uiteindelijke hoogte van die boom</i></p> $= 130 + \frac{100}{1 - 0,7}$ $= 463,33 \text{ mm} \quad \text{OR} \quad \frac{1390}{3} \text{ mm}$	<p>✓✓ <math>130 + \frac{100}{1 - 0,7}</math></p> <p>✓ answer</p> <p>(3) [10]</p>
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## QUESTION/VRAAG 4

4.1	(0 ; 2)	✓ answer (1)
4.2		<p>✓ shape</p> <p>✓ (0; 2)</p> <p>✓ asymptote</p> <p>(3)</p>
4.3	$f(-2) = 5$ $f(1) = 2^{-1} + 1 = \frac{3}{2}$ Average gradient = $\frac{f(1) - f(-2)}{1 - (-2)}$ $= \frac{\frac{3}{2} - 5}{3}$ $= -\frac{7}{6}$	<p>✓ <math>f(-2) = 5</math></p> <p>✓ <math>f(1) = \frac{3}{2}</math></p> <p>✓ answer</p> <p>(3)</p>
4.4	<p>Since the asymptote of <math>f</math> is <math>y = 1</math>, the asymptote of <math>h(x) = 3f(x)</math> will be <math>y = 3</math>.</p> <p><i>Omdat die asimptoot van <math>f</math> <math>y = 1</math> is, sal die asimptoot van <math>h(x) = 3f(x)</math> <math>y = 3</math> wees.</i></p>	<p>✓ answer</p> <p>(1) [8]</p>



## QUESTION/VRAAG 5

5.1	$y = a(x + p)^2 + q$ Turning point (1 ; -8): $y = a(x - 1)^2 - 8$ Substitute (0 ; -4): $-4 = a(0 - 1)^2 - 8$ $-4 = a - 8$ $a = 4 \quad p = -1 \quad q = -8$ $y = 4(x - 1)^2 - 8$	$\checkmark y = a(x - 1)^2 - 8$ $\checkmark$ substitute (0; -4) $\checkmark a = 4$ $\checkmark p$ and $q$ values (4)
5.2	Asymptote is $y = -2 \Rightarrow d = -2$ Substitute (1; -8): $-8 = \frac{k}{1+r} - 2$ $k = -6(1+r)$ $k = -6 - 6r \dots \dots \dots \text{line 1}$ Substitute (0; -4): $-4 = \frac{k}{r} - 2$ $\frac{k}{r} = -2$ $k = -2r \dots \dots \dots \text{line 2}$ Equating lines 1 and 2: $-6 - 6r = -2r$ $-4r = 6$ $r = -\frac{3}{2}$ Substituting into line 2                      or    line 1: $k = (-2)\left(-\frac{3}{2}\right) = 3$ $k = -6 - 6\left(-\frac{3}{2}\right) = 3$	$\checkmark d = -2$ $\checkmark k = -6 - 6r$ $\checkmark k = -2r$ $\checkmark -6 - 6r = -2r$ $\checkmark$ value of $r$ $\checkmark$ value of $k$ (6)
5.3	$g(x) \geq f(x)$ $\therefore 0 \leq x \leq 1$	$\checkmark 0 \leq x$ $\checkmark x \leq 1$ (2)
5.4	The line $y = k$ must pass through $f$ twice on the positive side of the $x$ -axis. / Die lyn $y = k$ moet twee keer deur $f$ aan die positiewe kant van die $x$ -as sny. $-8 < k < -4$	$\checkmark -8 < k$ $\checkmark k < -4$ (2)





5.5	$y = -x + c$ Substitute the intersection point of the asymptotes, i.e. $\left(\frac{3}{2}; -2\right)$ : <i>Vervang die snypunt van die asimptote, m.a.w. <math>\left(\frac{3}{2}; -2\right)</math>:</i> $-2 = -\frac{3}{2} + c$ $c = -\frac{1}{2}$ $y = -x - \frac{1}{2}$ <b>OR/OF</b> $y = -x$ is translated $\frac{3}{2}$ units right and 2 units down/ $y = -x$ transleer $\frac{3}{2}$ eenhede na regs en 2 eenhede na onder $\Rightarrow$ $y = -\left(x - \frac{3}{2}\right) - 2$ $y = -x - \frac{1}{2}$	$\checkmark y = -x + c$ $\checkmark -2 = -\frac{3}{2} + c$ $\checkmark$ answer (3)
5.6	By symmetry, $Q = \left(\frac{3}{2} + 8 - 2; -2 + \frac{3}{2} - 1\right)$ $= \left(\frac{15}{2}; -\frac{3}{2}\right)$	$\checkmark x = \frac{15}{2}$ $\checkmark y = -\frac{3}{2}$ (2) <b>[19]</b>





## QUESTION/VRAAG 6

6.1	$f: y = \frac{1}{4}x^2$ $f^{-1}: x = \frac{1}{4}y^2$ $y^2 = 4x$ $y = \pm\sqrt{4x}$ $f^{-1}(x) = -\sqrt{4x} \quad \text{OR/OF} \quad f^{-1}(x) = -2\sqrt{x}$	✓interchanging $x$ and $y$ ✓ $y^2 = 4x$  ✓ answer (3)
6.2		✓both graphs pass through $(0; 0)$  ✓shape for both  ✓one additional point on both graphs (3)
6.3	<p>Yes. No value of <math>x</math> in the domain of <math>f^{-1}</math> maps onto more than one <math>y</math>-value.  <i>Ja. Geen waarde van <math>x</math> in die definisieversameling van <math>f^{-1}</math> assosieer met meer as een <math>y</math>-waarde nie.</i></p> <p><b>OR/OF</b></p> <p>Yes. One to one function./<i>Ja. Een-tot-een-funksie.</i></p> <p><b>OR/OF</b></p> <p>Yes. Vertical line test holds./<i>Ja. Die vertikale lyntoets werk.</i></p>	✓yes ✓reason (2)  ✓yes ✓reason (2)  ✓yes ✓reason (2) <b>[8]</b>



**QUESTION/VRAAG 7**

7.1.1	<p>Quarterly interest rate/<i>Kwartaallikse rentekoers</i></p> $= \frac{10\%}{4}$ $= 2,5\%$	<p>✓ answer</p> <p>(1)</p>
7.1.2	$A = P(1+i)^n$ $= 5000 \left(1 + \frac{2,5}{100}\right)^{2 \times 4}$ $= R6092,01$	<p>✓ <math>n = 8</math></p> <p>✓ <math>5000 \left(1 + \frac{2,5}{100}\right)^{2 \times 4}</math></p> <p>✓ answer</p> <p>(3)</p>
7.2.1	$P_v = \frac{x[1 - (1+i)^{-n}]}{i}$ $800\,000 = \frac{10\,000 \left[1 - \left(1 + \frac{0,14}{12}\right)^{-n}\right]}{\frac{0,14}{12}}$ $\frac{800\,000}{10\,000} \times \frac{0,14}{12} = 1 - \left(1 + \frac{0,14}{12}\right)^{-n}$ $\left(1 + \frac{0,14}{12}\right)^{-n} = 1 - \frac{800\,000}{10\,000} \times \frac{0,14}{12}$ $-n = \frac{\log \left[1 - \frac{800\,000 \times 0,14}{10\,000}\right]}{\log \left(1 + \frac{0,14}{12}\right)}$ $n = 233,4699962$ <p>Motloi can make 233 withdrawals of R10 000./<i>Motloi kan 233 onttrekkings van R10 000 maak.</i></p>	<p>✓ <math>i = \frac{0,14}{12}</math></p> <p>✓ substitute into present value formula</p> <p>✓</p> $\left(1 + \frac{0,14}{12}\right)^{-n} = 1 - \frac{800\,000}{10\,000} \times \frac{0,14}{12}$ <p>✓ use of logs</p> <p>✓ 233</p> <p>(5)</p>
7.2.2 (a)	$A - F_v = 800\,000 \left(1 + \frac{0,14}{12}\right)^{48} - \frac{10\,000 \left[\left(1 + \frac{0,14}{12}\right)^{48} - 1\right]}{\frac{0,14}{12}}$ $= 1\,396\,005,54 - 638\,577,36$ $= R757\,428$ <p><b>OR/OF</b></p>	<p>✓ <math>n = 48</math> in both formulae</p> <p>✓ <math>i = \frac{0,14}{12}</math> in both formulae</p> <p>✓ substitution into both formulae</p> <p>✓ answer</p> <p>(4)</p>



	$P_v = \frac{x[1-(1+i)^{-n}]}{i}$ $= \frac{10000 \left[ 1 - \left( 1 + \frac{0,14}{12} \right)^{-185,4699962...} \right]}{\frac{0,14}{12}}$ $= R757\,428$	$\checkmark n = -185,46996...$ $\checkmark i = \frac{0,14}{12}$ $\checkmark$ $\frac{10000 \left[ 1 - \left( 1 + \frac{0,14}{12} \right)^{-185,4699962...} \right]}{\frac{0,14}{12}}$ $\checkmark$ answer (4)
7.2.2 (b)	<p>Let the purchase price of the house be <math>y</math>. / <i>Laat die koopprys van die huis <math>y</math> wees.</i></p> $\frac{757\,428}{y} = 30\%$ $757\,428 = 0,3y$ $y = \frac{757\,428}{0,3}$ $= R2\,524\,760$ <p><b>OR/OF</b></p> <p>Let the purchase price of the house be <math>y</math>. / <i>Laat die koopprys van die huis <math>y</math> wees.</i></p> $y = \frac{757\,428}{30} \times 100$ $= R2\,524\,760$	$\checkmark$ answer (1)  $\checkmark$ answer (1) <b>[14]</b>





## QUESTION/VRAAG 8

8.1	$f(x+h) = -(x+h)^2 + 4 = -(x^2 + 2xh + h^2) + 4$ $= -x^2 - 2xh - h^2 + 4$ $f(x+h) - f(x) = -2xh - h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \rightarrow 0} (-2x - h)$ $= -2x$ <b>OR/OF</b> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-(x+h)^2 + 4 - (-x^2 + 4)}{h}$ $= \lim_{h \rightarrow 0} \frac{-x^2 - 2xh - h^2 + 4 + x^2 - 4}{h}$ $= \lim_{h \rightarrow 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \rightarrow 0} (-2x - h)$ $= -2x$	<ul style="list-style-type: none"> <li>✓ finding <math>f(x+h)</math></li> <li>✓ <math>-2xh - h^2</math></li>   <li>✓ formula</li>   <li>✓ factorisation</li>   <li>✓ answer (5)</li>   <li>✓ formula</li>   <li>✓ finding <math>f(x+h)</math></li> <li>✓ <math>-2xh - h^2</math></li>   <li>✓ factorisation</li>   <li>✓ answer (5)</li> </ul>
8.2.1	$y = 3x^2 + 10x$ $\frac{dy}{dx} = 6x + 10$	<ul style="list-style-type: none"> <li>✓ <math>6x</math></li> <li>✓ <math>10</math></li> </ul> <p style="text-align: right;">(2)</p>
8.2.2	$f(x) = \left(x - \frac{3}{x}\right)^2$ $= x^2 - 6 + \frac{9}{x^2}$ $= x^2 - 6 + 9x^{-2}$ $f'(x) = 2x - 18x^{-3}$	<ul style="list-style-type: none"> <li>✓ <math>x^2 - 6 + \frac{9}{x^2}</math></li> <li>✓ <math>9x^{-2}</math></li> <li>✓ <math>2x - 18x^{-3}</math></li> </ul> <p style="text-align: right;">(3)</p>





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8.3.1	$f(2) = 2(2)^3 - 23(2)^2 + 80(2) - 84$ $= 0$ $\therefore (x - 2) \text{ is a factor}$	✓ substitution of 2 into $f$ ✓ value of 0 (2)
8.3.2	$f(x) = 2x^3 - 23x^2 + 80x - 84$ $= (x - 2)(2x^2 - 19x + 42)$ $= (x - 2)(2x - 7)(x - 6)$	✓ $2x^2 - 19x + 42$ ✓ $(x - 2)(2x - 7)(x - 6)$ (2)
8.3.3	$f'(x) = 6x^2 - 46x + 80$ $6x^2 - 46x + 80 = 0$ $3x^2 - 23x + 40 = 0$ $(3x - 8)(x - 5) = 0$ $x = \frac{8}{3} \text{ or } x = 5$	✓ $f'(x) = 6x^2 - 46x + 80$ ✓ $f'(x) = 0$  ✓ factors  ✓ $x$ -values (4)
8.3.4		✓ $x$ -intercepts ✓ $y$ -intercept ✓ shape (3)
8.3.5	$6x^2 - 46x + 80 = 40$ $6x^2 - 46x + 40 = 0$ $3x^2 - 23x + 20 = 0$ $(3x - 20)(x - 1) = 0$ $x = \frac{20}{3} \text{ or } x = 1$ <p>But <math>x</math> must be an integer, so <math>x = 1</math> at the point where tangent touches <math>f/x</math> moet heelgetal wees so <math>x = 1</math> by punt waar die raaklyn <math>f</math> raak:</p> $y = f(1) = 2(1)^3 - 23(1)^2 + 80(1) - 84 = -25$ $y = mx + c$ $-25 = 40(1) + c$ $-65 = c$ $(0; -65)$	✓ $6x^2 - 46x + 80 = 40$  ✓ factors  ✓ $x = 1$  ✓ $y$ -value  ✓ $-25 = 40(1) + c$ ✓ answer (6) <b>[27]</b>





Mathematics/P1/Wiskunde V1

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**QUESTION/VRAAG 9**

9.1	$340 = \pi r^2 h$ $\therefore h = \frac{340}{\pi r^2}$	✓ substitution into volume formula ✓ answer (2)
9.2	$A = 2\pi r^2 + 2\pi r h$ $= 2\pi r^2 + 2\pi r \left( \frac{340}{\pi r^2} \right)$ $= 2\pi r^2 + 680r^{-1}$	✓ formula ✓ substitution of $h$ (2)
9.3	$A(r) = 2\pi r^2 + 680r^{-1}$ $A'(r) = 4\pi r - 680r^{-2}$ $4\pi r - 680r^{-2} = 0$ $4\pi r = \frac{680}{r^2}$ $r^3 = \frac{680}{4\pi}$ $r = \sqrt[3]{\frac{680}{4\pi}} \text{ cm or } 3,78 \text{ cm}$	✓ $4\pi r$ ✓ $-680r^{-2}$  ✓ $r^3 = \frac{680}{4\pi}$  ✓ answer (4) <b>[8]</b>

**QUESTION/VRAAG 10**

10.1.1	160	✓ answer (1)
10.1.2	$P(M) = \frac{60}{160}$ $= \frac{3}{8}$ $= 0,375$	✓ 60  ✓ answer (2)
10.1.3	$P(\text{Male}) \times P(\text{Coffee}) = P(\text{Male and Coffee})$ $P(\text{Manlik}) \times P(\text{Koffie}) = P(\text{Manlik en Koffie})$ $\frac{3}{8} \times \frac{80}{160} = \frac{b}{160}$ $\frac{3}{16} = \frac{b}{160}$ $16b = 480$ $b = 30$	✓ formula  ✓ $\frac{80}{160}$  ✓ $\frac{b}{160}$  ✓ answer (4)





10.2.1	$6!$ $= 6 \times 5 \times 4 \times 3 \times 2 \times 1$ $= 720$	$\checkmark 6!$  $\checkmark$ answer (2)
10.2.2	<p>number of ways Xoliswa sits next to Anees/  <i>getal maniere waarop Xoliswa langs Anees sit</i></p> $= 5! \times 2$ $= 240$	$\checkmark 5! \times 2$ $\checkmark$ answer (2)
	<p><b>OR/OF</b></p> <p>Regard Xoliswa and Anees as a single entity/<i>Beskou Xoliswa en Anees as een</i></p> <p>Number of ways in which 5 passengers can be arranged = <math>5!</math>  <i>Getal maniere waarop 5 passasiers gerangskik kan word = <math>5!</math></i></p> <p>So <math>5!</math> different arrangements for XA and <math>5!</math> different arrangements for AX  <i>So <math>5!</math> verskillende rangskikkings vir XA en <math>5!</math> verskillende rangskikkings vir AX</i></p> <p>number of ways Xoliswa sits next to Anees  <i>getal maniere waarop Xoliswa langs Anees sit</i></p> $= 5! \times 2$ $= 240$	$\checkmark 5! + 5!$  $\checkmark$ answer  (2)
10.2.3	<p>number of ways Mary is at an end of the row on the left = <math>1 \times 5!</math>            number of ways Mary is at an end of the row on the right = <math>5! \times 1</math>            total number of arrangements = <math>6!</math></p> $P(\text{Mary is at an end of the row}) = \frac{5! \times 1 + 1 \times 5!}{6!}$ $= \frac{1}{3}$ <p><i>getal maniere waarop Mary aan die einde van die ry links is = <math>1 \times 5!</math></i>  <i>getal maniere waarop Mary aan die einde van die ry regs is = <math>5! \times 1</math></i>  <i>totale getal rangskikkings = <math>6!</math></i></p> $P(\text{Mary is aan einde van die ry}) = \frac{5! \times 1 + 1 \times 5!}{6!}$ $= \frac{1}{3}$	$\checkmark$ both LHS and RHS ways $\checkmark 6!$ $\checkmark$ setting up probability  $\checkmark$ answer  (4)
	<b>TOTAL/TOTAAL:</b>	<b>150</b>





# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**FEBRUARY/MARCH 2017**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages and 1 information sheet.**





Mathematics/P1

3  
NSC

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**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $(x-3)(x+1) = 0$  (2)

1.1.2  $\sqrt{x^3} = 512$  (3)

1.1.3  $x(x-4) < 0$  (2)

1.2 Given:  $f(x) = x^2 - 5x + 2$ 

1.2.1 Solve for  $x$  if  $f(x) = 0$  (3)

1.2.2 For which values of  $c$  will  $f(x) = c$  have no real roots? (4)

1.3 Solve for  $x$  and  $y$ :

$$\begin{aligned} x &= 2y + 2 \\ x^2 - 2xy + 3y^2 &= 4 \end{aligned}$$
 (6)

1.4 Calculate the maximum value of  $S$  if  $S = \frac{6}{x^2 + 2}$ . (2)  
[22]

**QUESTION 2**Given the geometric sequence:  $-\frac{1}{4}; b; -1; \dots$ 2.1 Calculate the possible values of  $b$ . (3)2.2 If  $b = \frac{1}{2}$ , calculate the 19<sup>th</sup> term ( $T_{19}$ ) of the sequence. (3)2.3 If  $b = \frac{1}{2}$ , write the sum of the first 20 positive terms of the sequence in sigma notation. (4)2.4 Is the geometric series formed in QUESTION 2.3 convergent? Give reasons for your answer. (2)  
[12]



Mathematics/P1

4  
NSC

DBE/Feb.–Mar. 2017

**QUESTION 3**

- 3.1     6 ; 6 ; 9 ; 15 ; ... are the first four terms of a quadratic number pattern.
- 3.1.1     Write down the value of the fifth term ( $T_5$ ) of the pattern. (1)
- 3.1.2     Determine a formula to represent the general term of the pattern. (4)
- 3.1.3     Which term of the pattern has a value of 3 249? (4)
- 3.2     Determine the value(s) of  $x$  in the interval  $x \in [0^\circ ; 90^\circ]$  for which the sequence  $-1 ; 2\sin 3x ; 5 ; \dots$  will be arithmetic. (4)
- [13]**



Mathematics/P1

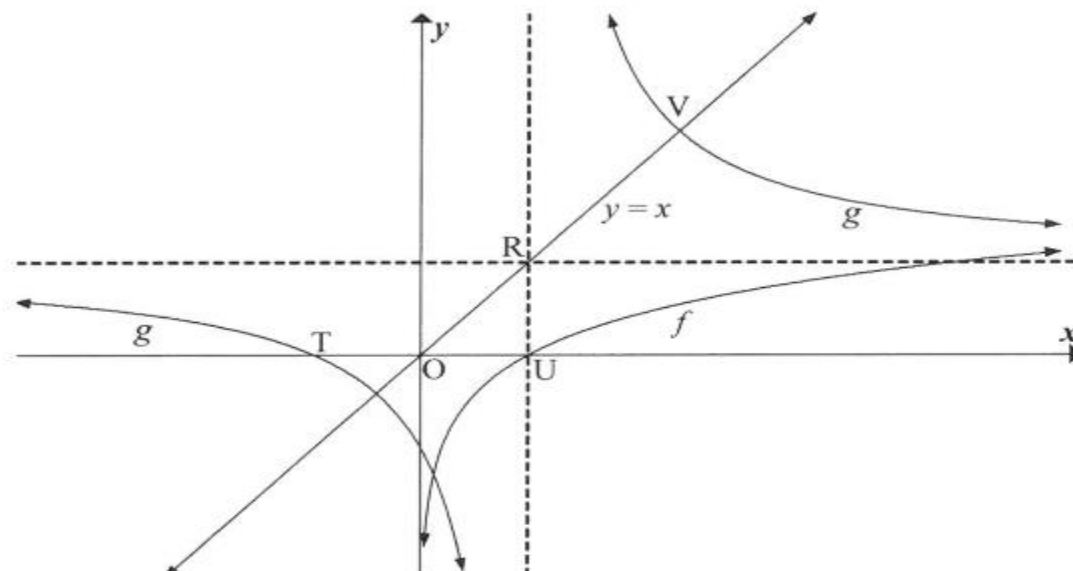
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**QUESTION 4**

The sketch below shows the graphs of  $f(x) = \log_5 x$  and  $g(x) = \frac{2}{x-1} + 1$ .

- T and U are the  $x$ -intercepts of  $g$  and  $f$  respectively.
- The line  $y = x$  intersects the asymptotes of  $g$  at R, and the graph of  $g$  at V.



- 4.1 Write down the coordinates of U. (1)
- 4.2 Write down the equations of the asymptotes of  $g$ . (2)
- 4.3 Determine the coordinates of T. (2)
- 4.4 Write down the equation of  $h$ , the reflection of  $f$  in the line  $y = x$ , in the form  $y = \dots$  (2)
- 4.5 Write down the equation of the asymptote of  $h(x-3)$ . (1)
- 4.6 Calculate the coordinates of V. (4)
- 4.7 Determine the coordinates of  $T'$  the point which is symmetrical to T about the point R. (2)

**[14]**

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Mathematics/P1

6  
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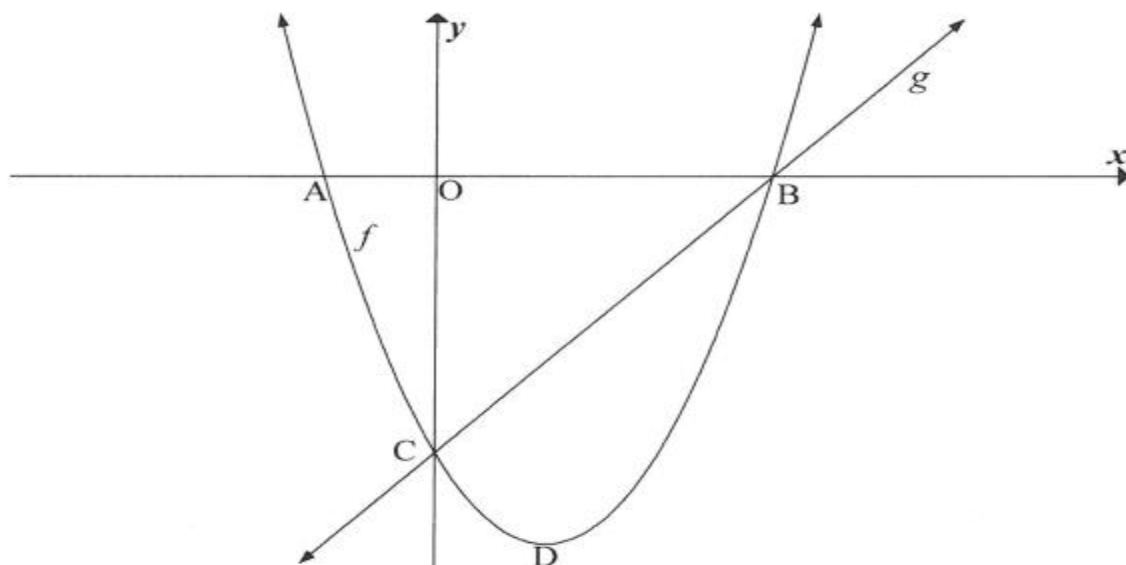
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**QUESTION 5**

5.1 The sketch below shows the graphs of  $f(x) = x^2 - 2x - 3$  and  $g(x) = x - 3$ .

- A and B are the  $x$ -intercepts of  $f$ .
- The graphs of  $f$  and  $g$  intersect at C and B.

D is the turning point of  $f$ .



- 5.1.1 Determine the coordinates of C. (1)
- 5.1.2 Calculate the length of AB. (4)
- 5.1.3 Determine the coordinates of D. (2)
- 5.1.4 Calculate the average gradient of  $f$  between C and D. (2)
- 5.1.5 Calculate the size of  $\hat{O}CB$ . (2)
- 5.1.6 Determine the values of  $k$  for which  $f(x) = k$  will have two unequal positive real roots. (3)
- 5.1.7 For which values of  $x$  will  $f'(x) \cdot f''(x) > 0$ ? (3)

- 5.2 The graph of a parabola  $f$  has  $x$ -intercepts at  $x = 1$  and  $x = 5$ .  $g(x) = 4$  is a tangent to  $f$  at P, the turning point of  $f$ . Sketch the graph of  $f$ , clearly showing the intercepts with the axes and the coordinates of the turning point. (5)
- [22]

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Mathematics/P1

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**QUESTION 6**

- 6.1 On the 2<sup>nd</sup> day of January 2015 a company bought a new printer for R150 000.
- The value of the printer decreases by 20% annually on the reducing-balance method.
  - When the book value of the printer is R49 152, the company will replace the printer.
- 6.1.1 Calculate the book value of the printer on the 2<sup>nd</sup> day of January 2017. (3)
- 6.1.2 At the beginning of which year will the company have to replace the printer? Show ALL calculations. (4)
- 6.1.3 The cost of a similar printer will be R280 000 at the beginning of 2020. The company will use the R49 152 that it will receive from the sale of the old printer to cover some of the costs of replacing the printer. The company set up a sinking fund to cover the balance. The fund pays interest at 8,5% per annum, compounded quarterly. The first deposit was made on 2 April 2015 and every three months thereafter until 2 January 2020. Calculate the amount that should be deposited every three months to have enough money to replace the printer on 2 January 2020. (4)
- 6.2 Lerato wishes to apply for a home loan. The bank charges interest at 11% per annum, compounded monthly. She can afford a monthly instalment of R9 000 and wants to repay the loan over a period of 15 years. She will make the first monthly repayment one month after the loan is granted. Calculate, to the nearest thousand rand, the maximum amount that Lerato can borrow from the bank. (5)

[16]

**QUESTION 7**

- 7.1 Determine  $f'(x)$  from first principles if  $f(x) = x^2 - 5$ . (5)
- 7.2 Determine the derivative of:  $g(x) = 5x^2 - \frac{2x}{x^3}$  (3)
- 7.3 Given:  $h(x) = ax^2$ ,  $x > 0$ .  
Determine the value of  $a$  if it is given that  $h^{-1}(8) = h'(4)$ . (6)

[14]





Mathematics/P1

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NSC

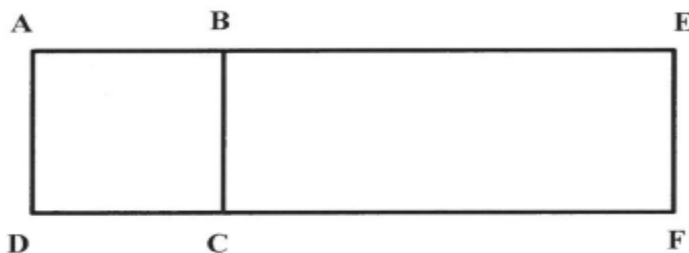
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**QUESTION 8**Given:  $f(x) = 2x^3 - 5x^2 + 4x$ 

- 8.1 Calculate the coordinates of the turning points of the graph of  $f$ . (5)
- 8.2 Prove that the equation  $2x^3 - 5x^2 + 4x = 0$  has only one real root. (3)
- 8.3 Sketch the graph of  $f$ , clearly indicating the intercepts with the axes and the turning points. (3)
- 8.4 For which values of  $x$  will the graph of  $f$  be concave up? (3)
- [14]**

**QUESTION 9**

A piece of wire 6 metres long is cut into two pieces. One piece,  $x$  metres long, is bent to form a square ABCD. The other piece is bent into a U-shape so that it forms a rectangle BEFC when placed next to the square, as shown in the diagram below.



Calculate the value of  $x$  for which the sum of the areas enclosed by the wire will be a maximum. [7]





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**QUESTION 10**

10.1 The events S and T are independent.

- $P(S \text{ and } T) = \frac{1}{6}$
- $P(S) = \frac{1}{4}$

10.1.1 Calculate  $P(T)$ . (2)10.1.2 Hence, calculate  $P(S \text{ or } T)$ . (2)

10.2 A FIVE-digit code is created from the digits 2 ; 3 ; 5 ; 7 ; 9.

How many different codes can be created if:

10.2.1 Repetition of digits is NOT allowed in the code (2)

10.2.2 Repetition of digits IS allowed in the code (1)

10.3 A group of 3 South Africans, 2 Australians and 2 Englishmen are staying at the same hotel while on holiday. Each person has his/her own room and the rooms are next to each other in a straight corridor.

If the rooms are allocated at random, determine the probability that the 2 Australians will have adjacent rooms and the 2 Englishmen will also have adjacent rooms. (4)

**[11]****QUESTION 11**

The success rate of the Fana soccer team depends on a number of factors. The fitness of the players is one of the factors that influence the outcome of a match.

- The probability that all the players are fit for the next match is 70%
- If all the players are fit to play the next match, the probability of winning the next match is 85%
- If there are players that are not fit to play the next match, the probability of winning the match is 55%

Based on fitness alone, calculate the probability that the Fana soccer team will win the next match. [5]

**TOTAL: 150**



# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12/GRAAD 12**

**MATHEMATICS P1/WISKUNDE V1**

**MARCH 2017**

**MEMORANDUM**

**MARKS: 150**

**PUNTE: 150**

**This memorandum consists of 18 pages.  
*Hierdie memorandum bestaan uit 18 bladsye.***



1.2.1	$x^2 - 5x + 2 = 0$ $x = \frac{5 \pm \sqrt{(-5)^2 - 4(1)(2)}}{2(1)}$ $x = \frac{5 \pm \sqrt{17}}{2}$ $x = 0,44 \text{ or } x = 4,56$ <p><b>OR</b></p> $x^2 - 5x + 2 = 0$ $x^2 - 5x = -2$ $x^2 - 5x + \left(-\frac{5}{2}\right)^2 = -2 + \left(-\frac{5}{2}\right)^2$ $\left(x - \frac{5}{2}\right)^2 = \frac{17}{4}$ $x = \frac{5 + \sqrt{17}}{2} \text{ or } x = \frac{5 - \sqrt{17}}{2}$ $x = 0,44 \text{ or } x = 4,56$	<p>✓ subst correct formula</p> <p>✓ answer</p> <p>✓ answer</p> <p>(3)</p> <p>✓ <math>\left(x - \frac{5}{2}\right)^2 = \frac{17}{4}</math></p> <p>✓ answer</p> <p>✓ answer</p> <p>(3)</p>
1.2.2	$f(x) = x^2 - 5x + 2$ $x^2 - 5x + 2 = c$ $x^2 - 5x + 2 - c = 0$ $b^2 - 4ac < 0$ $(-5)^2 - 4(1)(2 - c) < 0$ $25 - 8 + 4c < 0$ $4c < -17$ $c < -\frac{17}{4}$	<p>✓ standard form</p> <p>✓ <math>b^2 - 4ac &lt; 0</math></p> <p>✓ substitution</p> <p>✓ answer</p> <p>(4)</p>
1.3	$x = 2y + 2$ $x^2 - 2xy + 3y^2 = 4$ $(2y + 2)^2 - 2y(2y + 2) + 3y^2 = 4$ $4y^2 + 8y + 4 - 4y^2 - 4y + 3y^2 = 4$ $3y^2 + 4y = 0$ $y(3y + 4) = 0$ $y = 0 \text{ or } y = -\frac{4}{3}$ $x = 2 \quad x = -\frac{2}{3}$	<p>✓ substitution</p> <p>✓ simplification</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ <math>y = 0; y = -\frac{4}{3}</math></p> <p>✓ x-values (ca on both x-values)</p> <p>(6)</p>



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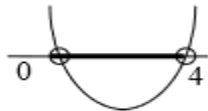
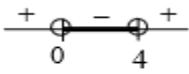
**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking memorandum.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$(x-3)(x+1) = 0$ $x = 3$ or $x = -1$	✓ answer ✓ answer (2)
1.1.2	$\sqrt{x^3} = 512$ $x^{\frac{3}{2}} = 512$ $\left(x^{\frac{3}{2}}\right)^{\frac{2}{3}} = (512)^{\frac{2}{3}}$ $x = 64$ <b>OR</b> $\sqrt{x^3} = 512$ $x^3 = 262144$ $x^3 = 2^{18}$ $x = 2^6$ $x = 64$	✓ $x^{\frac{3}{2}}$ ✓ $(8^3)^{\frac{2}{3}}$ ✓ answer (3)  ✓ squaring both sides ✓ $x^3 = 2^{18}$  ✓ answer (3)
1.1.3	$x(x-4) < 0$  <b>OR / OF</b>  $0 < x < 4$ <b>OR / OF</b> $x \in (0; 4)$	✓ critical values ✓ inequality or interval (2)





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	<p><b>OR / OF</b></p> $x = 2y + 2$ $y = \frac{1}{2}x - 1$ $x^2 - 2xy + 3y^2 = 4$ $x^2 - 2x\left(\frac{1}{2}x - 1\right) + 3\left(\frac{1}{2}x - 1\right)^2 = 4$ $x^2 - x^2 + 2x + 3\left(\frac{1}{4}x^2 - x + 1\right) = 4$ $2x + \frac{3}{4}x^2 - 3x + 3 = 4$ $3x^2 - 4x - 4 = 0$ $(3x + 2)(x - 2) = 0$ $x = 2 \quad \text{or} \quad x = -\frac{2}{3}$ $y = 0 \quad \quad y = -\frac{4}{3}$	<p>✓ substitution</p> <p>✓ simplification</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ <math>x = 2</math> ; <math>x = -\frac{2}{3}</math></p> <p>✓ y-values (ca on both y-values)</p> <p>(6)</p>
1.4	$S = \frac{6}{x^2 + 2}$ <p>For S to be a maximum the denominator needs to be at a minimum.</p> <p><i>Vir S om 'n maksimum waarde te hê, moet die deler 'n minimum waarde h</i></p> <p>Minimum of <math>x^2 + 2</math> is 2</p> $\text{Maximum of } S = \frac{6}{x^2 + 2}$ $= \frac{6}{2}$ $= 3$	<p>✓ Minimum of <math>x^2 + 2</math> is 2</p> <p>✓ 3</p> <p>(2)</p>
		[22]





## QUESTION/VRAAG 2

2.1	<p>For geometric:</p> $-\frac{1}{4}; b; -1; \dots$ $\frac{b}{-\frac{1}{4}} = -\frac{1}{b}$ $b^2 = \frac{1}{4}$ $b = \pm \frac{1}{2}$ <p><b>OR</b></p> $b = \pm \sqrt{\left(-\frac{1}{4}\right)(-1)}$ $b = \pm \frac{1}{2}$	$\checkmark \frac{b}{-\frac{1}{4}} = -\frac{1}{b}$ $\checkmark b = \frac{1}{2}$ $\checkmark b = -\frac{1}{2}$ <p>(3)</p> $\checkmark b = \pm \sqrt{\left(-\frac{1}{4}\right)(-1)}$ $\checkmark b = \frac{1}{2}$ $\checkmark b = -\frac{1}{2}$ <p>(3)</p>
2.2	$-\frac{1}{4}; \frac{1}{2}; -1; \dots$ $r = -2$ $T_{19} = ar^{18}$ $= \left(-\frac{1}{4}\right)(-2)^{18}$ $= \left(-\frac{2^{18}}{2^2}\right)$ $= -2^{16}$ $= -65536$ <p><b>OR / OF</b></p> $T_{19} = ar^{18}$ $= \left(-\frac{1}{4}\right)(-2)^{18}$ $= (-2^{-2})(2^{18})$ $= -2^{16}$ $= -65536$	$\checkmark r = -2$ <p><math>\checkmark</math> subst. into correct formula</p> $\checkmark -65536 / -2^{16}$ <p>(3)</p> $\checkmark r = -2$ <p><math>\checkmark</math> subst. into correct formula</p> $\checkmark -65536 / -2^{16}$ <p>(3)</p>





Mathematics P1/ Wiskunde V1

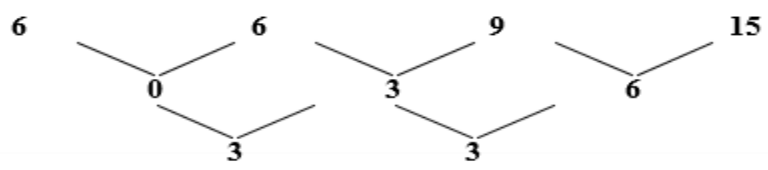
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2.3	<p>The series is: <math>-\frac{1}{4}; \frac{1}{2}; -1; 2; -4; 8; \dots</math></p> <p>The new positive term series: <math>\frac{1}{2}; 2; 8; 32; 128; \dots</math></p> <p>.....</p> <p><math>a = \frac{1}{2} \quad r = 4</math></p> <p><math>\sum_{n=1}^{20} \left(\frac{1}{2}\right)(4)^{n-1}</math></p> <p><b>OR/OF</b></p> <p><math>\sum_{p=0}^{19} \left(\frac{1}{2}\right)(4)^p</math> etc.</p>	<p>✓ <math>a = \frac{1}{2}</math></p> <p>✓ <math>r = 4</math></p> <p>✓ <math>\sum_{n=1}^{20}</math> or <math>\sum_{p=0}^{19}</math></p> <p>✓ correct formula (4)</p>
2.4	<p>No, the series is not convergent / <i>Nee, die reeks konvergeer nie</i></p> <p><math>r = 4</math> and for convergence <math>-1 &lt; r &lt; 1</math></p> <p><math>r = 4</math> en vir konvergering <math>-1 &lt; r &lt; 1</math></p>	<p>✓ no</p> <p>✓ reason (2)</p>
		<b>[12]</b>



## QUESTION/VRAAG 3

3.1.1	24	✓ 24 (1)
3.1.2	<p style="text-align: center;">  </p> $2a = 3 \qquad 3a + b = 0 \qquad a + b + c = 6$ $a = \frac{3}{2} \qquad b = -\frac{9}{2} \qquad c = 9$ $T_n = \frac{3}{2}n^2 - \frac{9}{2}n + 9$ <p><b>OR/OF</b></p> $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)d_2}{2}$ $= 6 + (n-1)(0) + \frac{(n-1)(n-2)(3)}{2}$ $= 6 + \frac{n^2 - 3n + 2}{1} \left(\frac{3}{2}\right)$ $= 6 + \frac{3}{2}n^2 - \frac{9}{2}n + 3$ $= \frac{3}{2}n^2 - \frac{9}{2}n + 9$	<p>✓ <math>a = \frac{3}{2}</math></p> <p>✓ <math>b = -\frac{9}{2}</math></p> <p>✓ <math>c = 9</math></p> <p>✓ <math>T_n = \frac{3}{2}n^2 - \frac{9}{2}n + 9</math> (4)</p> <p>✓ formula</p> <p>✓ substitution</p> <p>✓ simplifying</p> <p>✓ <math>T_n = \frac{3}{2}n^2 - \frac{9}{2}n + 9</math> (4)</p>
3.1.3	$\frac{3}{2}n^2 - \frac{9}{2}n + 9 = 3249$ $3n^2 - 9n + 18 = 6498$ $3n^2 - 9n - 6480 = 0$ $n^2 - 3n - 2160 = 0$ $(n + 45)(n - 48) = 0$ $n \neq -45 \quad \text{or} \quad n = 48$	<p>✓ equating general term to 3249</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ <math>n \neq -45</math> or <math>n = 48</math> (4)</p>
3.2	<p style="text-align: center;">-1 ; 2 sin 3x ; 5 ; .....</p> $2 \sin 3x + 1 = 5 - 2 \sin 3x$ $4 \sin 3x = 4$ $\sin 3x = 1$ $3x = 90^\circ$ $x = 30^\circ$	<p>✓ <math>2 \sin 3x + 1 = 5 - 2 \sin 3x</math></p> <p>✓ <math>\sin 3x = 1</math></p> <p>✓ <math>3x = 90^\circ</math></p> <p>✓ <math>x = 30^\circ</math> (4)</p> <p style="text-align: right;"><b>[13]</b></p>



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## QUESTION/VRAAG 4

4.1	$U(1; 0)$	✓ (1; 0) (1)
4.2	$x = 1$ $y = 1$	✓ $x = 1$ ✓ $y = 1$ (2)
4.3	$\frac{2}{x-1} + 1 = 0$ $2 = -x + 1$ $x = -1$ $T(-1; 0)$	✓ $y = 0$  ✓ $x = -1$ (2)
4.4	$f(x) = \log_5 x$ $h: x = \log_5 y$ $y = 5^x$	✓ change $x$ and $y$  ✓ $y = 5^x$ (2)
4.5	$y = 0$	✓ answer (1)
4.6	$V(\sqrt{2} + 1; \sqrt{2} + 1)$ $V(2,41; 2,41)$  <b>OR / OF</b> $x = \frac{2}{x-1} + 1$ $x^2 - x = 2 + x - 1$ $x^2 - 2x - 1 = 0$ $x = \frac{2 \pm \sqrt{4 - 4(1)(-1)}}{2}$ $= \frac{2 \pm \sqrt{8}}{2}$ $= \frac{2 \pm 2\sqrt{2}}{2}$ $= 1 \pm \sqrt{2}$ $V(1 + \sqrt{2}; 1 + \sqrt{2})$  <b>OR / OF</b> $x - 1 = \frac{2}{x-1}$ $(x-1)^2 = 2$ $x = 1 \pm \sqrt{2}$ $V(1 + \sqrt{2}; 1 + \sqrt{2})$	✓✓ $\sqrt{2} + 1$ ✓✓ $\sqrt{2} + 1$ (4)  ✓ $x = \frac{2}{x-1} + 1$  ✓ subs into correct formula  ✓ $x = \sqrt{2} + 1$ ✓ $y = \sqrt{2} + 1$ (4)  ✓ $x - 1 = \frac{2}{x-1}$ ✓ $(x-1)^2 = 2$ ✓ $x = \sqrt{2} + 1$ ✓ $y = \sqrt{2} + 1$ (4)
4.7	$T'(3; 2)$	✓ $x = 3$ ✓ $y = 2$ (2) <b>[14]</b>

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## QUESTION 5

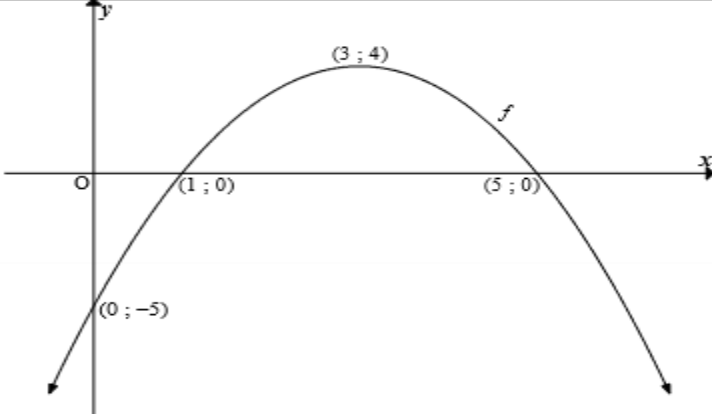
5.1.1	$C(0 ; -3)$	✓ $C(0 ; -3)$ (1)
5.1.2	$f(x) = x^2 - 2x - 3$ $(x-3)(x+1) = 0$ $x = -1$ or $x = 3$ $AB = 3 - (-1)$ $AB = 4$ units	✓ factors ✓ $x$ -value ✓ other $x$ -value  ✓ answer (4)
5.1.3	$x = \frac{2}{2(1)}$ or $2x - 2 = 0$ or $x = \frac{-1+3}{2}$ $= 1$ $y = (1)^2 - 2(1) - 3$ $= -4$ $D(1 ; -4)$	✓ $x = 1$  ✓ $y$ value (2)
5.1.4	$C(0 ; -3)$ $D(1 ; -4)$  Average gradient / Gemiddelde gradiënt $= \frac{-4+3}{1-0}$ or $\frac{-3+4}{0-1}$ $= -1$	✓ $\frac{-4+3}{1-0}$ or $\frac{-3+4}{0-1}$ ✓ $-1$ (2)
5.1.5	$OC = OB = 3$ $\hat{OCB} = 45^\circ$ isosceles right angled triangle <i>Gelykbenige reghoekige driehoek</i> <b>OR / OF</b> $\tan \beta = m_g$ $\tan \beta = 1$ $\beta = 45^\circ$ $\hat{OBC} = 45^\circ$ $\hat{OCB} = 45^\circ$	✓ equal lengths ✓ $45^\circ$ (2)  ✓ $\tan \beta = 1$ ✓ $45^\circ$ (2)
5.1.6	$-4 < k < -3$ <b>OR</b> $(-4 ; -3)$	✓ $-4$ ✓ $-3$ ✓ notation (3)
5.1.7	$f'(x) \cdot f''(x) > 0$ $(2x-2) \cdot 2 > 0$ $2x-2 > 0$ $x > 1$	✓ $2x-2$ ✓ $2$  ✓ $x > 1$ (3)



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5.2	 <p> <math>f(x) = a(x-1)(x-5)</math>  <math>4 = a(3-1)(3-5)</math>  <math>4 = -4a</math>  <math>a = -1</math>  <math>f(x) = -x^2 + 6x - 5</math> </p>	<p>TP</p> <ul style="list-style-type: none"> <li>✓ <math>x = 3</math></li> <li>✓ <math>y = 4</math></li> <li>✓ <math>x</math>-intercepts</li> <li>✓ <math>y</math>-intercept</li> <li>✓ shape</li> </ul> <p>(5)</p>
<b>[22]</b>		

**QUESTION/VRAAG 6**

6.1.1	$A = 150\,000(1 - 0,2)^2$ $= R96\,000$	<ul style="list-style-type: none"> <li>✓ <math>n = 2</math></li> <li>✓ 150 000 in correct formula</li> <li>✓ 96 000 (3)</li> </ul>
6.1.2	$150\,000(1 - 0,2)^n = 49\,152$ $(0,8)^n = \frac{1024}{3125}$ $n \log(0,8) = \log \frac{1024}{3125}$ $n = 5$ <p>The machine will need to be replaced at the beginning of 2020 / <i>Masjien moet aan die begin van 2020 vervang word</i></p> <p><b>OR / OF</b></p> $150\,000(1 - 0,2)^n = 49\,152$ $(0,8)^n = \frac{1024}{3125}$ $n = \log_{0,8} \frac{1024}{3125}$ $n = 5$ <p>The machine will need to be replaced at the beginning of 2020 / <i>Masjien moet aan die begin van 2020 vervang word</i></p>	<ul style="list-style-type: none"> <li>✓ <math>150\,000(1 - 0,2)^n = 49\,152</math></li> <li>✓ <math>n \log(0,8) = \log \frac{1024}{3125}</math></li> <li>✓ <math>n = 5</math></li> <li>✓ 2020 (4)</li> <li>✓ <math>150\,000(1 - 0,2)^n = 49\,152</math></li> <li>✓ <math>n = \log_{0,8} \frac{1024}{3125}</math></li> <li>✓ <math>n = 5</math></li> <li>✓ 2020 (4)</li> </ul>



6.1.3	$\begin{aligned} & \text{R280 000} - \text{R49 152} \\ & = \text{R230 848} \\ & 230\,848 = \frac{x \left[ \left( 1 + \frac{0,085}{4} \right)^{20} - 1 \right]}{\frac{0,085}{4}} \\ & x = \text{R9 383,26} \end{aligned}$	<p>✓ R230 848</p> <p>✓ <math>i = \frac{0,085}{4} = 0,02125</math> and <math>n = 20</math></p> <p>✓ subs into correct formula</p> <p>✓ R 9 383,26</p> <p style="text-align: right;">(4)</p>
6.2	$\begin{aligned} P_v &= \frac{x[1 - (1+i)^{-n}]}{i} \\ &= \frac{9\,000 \left[ 1 - \left( 1 + \frac{0,11}{12} \right)^{-180} \right]}{\frac{0,11}{12}} \\ &= \text{R791 837,43} \end{aligned}$ <p>Lerato qualifies for a loan of R 791 000 under the given conditions / Lerato kwalifiseer vir 'n lening van R 791 000 gegewe die kondisies</p>	<p>✓ <math>i = \frac{0,11}{12}</math></p> <p>✓ <math>n = 180</math></p> <p>✓ substitution correct formula</p> <p>✓ R791 837,43</p> <p>✓ R791 000</p> <p style="text-align: right;">(5) <b>[16]</b></p>



Mathematics P1/ *Wiskunde V1*12  
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7.1	$f(x+h) = (x+h)^2 - 5 = (x^2 + 2xh + h^2) - 5$ $= x^2 + 2xh + h^2 - 5$ $f(x+h) - f(x) = x^2 + 2xh + h^2 - 5 - (x^2 - 5)$ $= 2xh + h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h)}{h}$ $= \lim_{h \rightarrow 0} (2x + h)$ $= 2x$ <p><b>OR/OF</b></p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - 5 - (x^2 - 5)}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h)}{h}$ $= \lim_{h \rightarrow 0} (2x + h)$ $= 2x$	<ul style="list-style-type: none"> <li>✓ simplifying</li> <li>✓ formula</li> <li>✓ subst. into formula</li> <li>✓ factorisation</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(5)</p> <ul style="list-style-type: none"> <li>✓ formula</li> <li>✓ subst. into formula</li> <li>✓ simplifying</li> <li>✓ factorisation</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(5)</p>
7.2	$g(x) = 5x^2 - \frac{2x}{x^3}$ $= 5x^2 - 2x^{-2}$ $g'(x) = 10x + 4x^{-3}$ $= 10x + \frac{4}{x^3}$	<ul style="list-style-type: none"> <li>✓ <math>5x^2 - 2x^{-2}</math></li> <li>✓ <math>10x</math></li> <li>✓ <math>4x^{-3}</math> or <math>\frac{4}{x^3}</math></li> </ul> <p style="text-align: right;">(3)</p>



7.3	$h(x) = ax^2, x > 0$ $h^{-1}: x = ay^2 \quad y > 0$ $y = \sqrt{\frac{x}{a}}$ $h^{-1}(8) = \sqrt{\frac{8}{a}}$ $h'(x) = 2ax$ $h'(4) = 2a(4)$ $= 8a$ $\sqrt{\frac{8}{a}} = 8a$ $64a^2 = \frac{8}{a}$ $a^3 = \frac{1}{8}$ $a = \frac{1}{2}$	$\checkmark y = \sqrt{\frac{x}{a}}$ $\checkmark \sqrt{\frac{8}{a}}$ $\checkmark h'(4) = 8a$ $\checkmark \sqrt{\frac{8}{a}} = 8a$ $\checkmark a^3 = \frac{1}{8}$ $\checkmark a = \frac{1}{2}$ <p style="text-align: right;">(6)</p>
<b>[14]</b>		

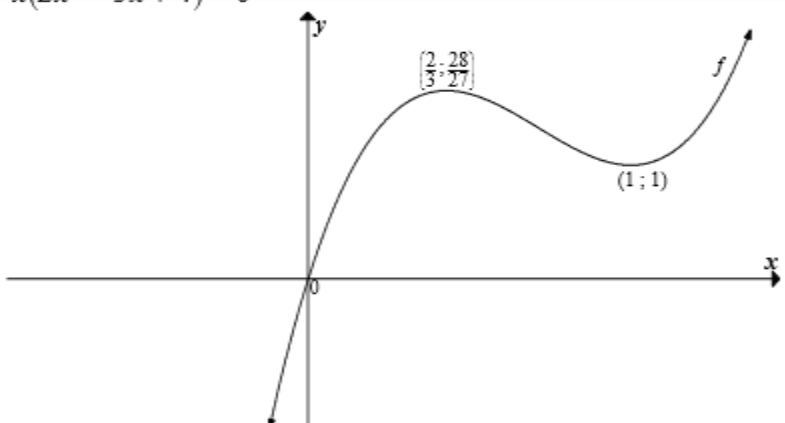
**QUESTION/VRAAG 8**

8.1	$f'(x) = 0$ $6x^2 - 10x + 4 = 0$ $3x^2 - 5x + 2 = 0$ $(3x - 2)(x - 1) = 0$ $x = \frac{2}{3} \quad \text{or} \quad x = 1$ $y = 2\left(\frac{2}{3}\right)^3 - 5\left(\frac{2}{3}\right)^2 + 4\left(\frac{2}{3}\right) \quad y = 2(1)^3 - 5(1)^2 + 4(1)$ $y = \frac{28}{27} \quad \text{or} \quad y = 1$ <p>Turning points are <math>\left(\frac{2}{3}; \frac{28}{27}\right)</math> and <math>(1; 1)</math></p>	$\checkmark \text{ derivative}$ $\checkmark \text{ derivative} = 0$ $\checkmark \text{ factors}$ $\checkmark \text{ x-values}$ $\checkmark \text{ y-values}$ <p style="text-align: right;">(5)</p>
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Mathematics P1/ Wiskunde V1

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8.2	$2x^3 - 5x^2 + 4x = 0$ $x(2x^2 - 5x + 4) = 0$ $x = 0 \quad \text{or} \quad x = \frac{5 \pm \sqrt{25 - 4(2)(4)}}{4}$ $= \frac{5 \pm \sqrt{-7}}{4}$ <p>No real roots / <i>Geen reële wortels</i></p> <p><b>OR / OF</b></p> $2x^3 - 5x^2 + 4x = 0$ $x(2x^2 - 5x + 4) = 0$ $x = 0 \quad \text{or} \quad b^2 - 4ac = 25 - 4(2)(4)$ $= -7 < 0$ <p>No real roots / <i>Geen reële wortels</i></p>	$\checkmark x(2x^2 - 5x + 4) = 0$ $\checkmark x = 0$ $\checkmark \frac{5 \pm \sqrt{-7}}{4}$ <p>(3)</p> $\checkmark x(2x^2 - 5x + 4) = 0$ $\checkmark x = 0$ $\checkmark b^2 - 4ac < 0$ <p>(3)</p>
8.3	$f(x) = 2x^3 - 5x^2 + 4x$ $x(2x^2 - 5x + 4) = 0$ 	$\checkmark (0; 0)$ $\checkmark \text{turning points}$ $\checkmark \text{shape}$ <p>(3)</p>

Mathematics P1/ *Wiskunde VI*15  
NSC/NSS – MemorandumDBE/Feb.–Mar./*Feb.–Mrt.* 2017

8.4	$f(x) = 2x^3 - 5x^2 + 4x$ $f'(x) = 6x^2 - 10x + 4$ $f''(x) = 12x - 10$ $f''(x) > 0$ $12x - 10 > 0$ $x > \frac{5}{6}$ <p><b>OR</b></p> <p>Point of inflection: <math>x = -\frac{b}{3a}</math></p> $x = -\frac{(-5)}{3(2)}$ $x = \frac{5}{6}$ <p>The function is concave up for <math>x &gt; \frac{5}{6}</math> since <math>a &gt; 0</math></p> <p><b>OR</b></p> <p>Point of inflection: <math>x = \frac{\frac{2}{3} + 1}{2}</math></p> $x = \frac{5}{6}$ <p>The function is concave up for <math>x &gt; \frac{5}{6}</math> since <math>a &gt; 0</math></p>	$\checkmark 12x - 10$ $\checkmark f''(x) > 0$ $\checkmark \text{answer}$ <p style="text-align: right;">(3)</p> $\checkmark x = -\frac{(-5)}{3(2)}$ $\checkmark x = \frac{5}{6}$ $\checkmark f''(x) > 0$ <p style="text-align: right;">(3)</p> $\checkmark x = \frac{\frac{2}{3} + 1}{2}$ $\checkmark x = \frac{5}{6}$ $\checkmark f''(x) > 0$ <p style="text-align: right;">(3)</p> <p style="text-align: right;"><b>[14]</b></p>
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## QUESTION/VRAAG 9

9.	<p>Length of one side of the square / <i>lengte van sy van vierkant</i></p> $= \frac{x}{4}$ <p>Length of the rectangle / <i>lengte van die reghoek</i> :</p> $2l + x + \frac{x}{4} = 6$ $l = \frac{6 - \frac{5x}{4}}{2}$ $= \frac{24 - 5x}{8}$ $A = \left(\frac{x}{4}\right)^2 + \frac{x}{4} \left(\frac{24 - 5x}{8}\right)$ $= \frac{x^2}{16} + \frac{24x - 5x^2}{32}$ $= \frac{24x - 3x^2}{32}$ $A = \frac{24x - 3x^2}{32}$ <p>For minimum area / <i>Vir minimum oppervlakte</i> <math>\frac{dA}{dx} = 0</math></p> $\frac{dA}{dx} = \frac{24 - 6x}{32}$ $6x = 24$ $x = 4$	$\checkmark \frac{x}{4}$ $\checkmark \frac{6 - \frac{5x}{4}}{2} \quad \text{or} \quad \frac{24 - 5x}{8}$ $\checkmark \left(\frac{x}{4}\right)^2$ $\checkmark \frac{x}{4} \left(\frac{24 - 5x}{8}\right)$ $\checkmark \frac{dA}{dx} = 0$ $\checkmark \frac{24 - 6x}{32}$ $\checkmark x = 4$ <p style="text-align: right;">(7)</p>
		[7]



**QUESTION/VRAAG 10**

10.1.1	$P(S \text{ and } T) = P(S) \times P(T)$ $\frac{1}{6} = \left(\frac{1}{4}\right) \times P(T)$ $P(T) = \frac{2}{3}$	$\checkmark P(S \text{ and } T) = P(S) \times P(T)$ $\checkmark P(T) = \frac{2}{3}$ <p style="text-align: right;">(2)</p>
10.1.2	$P(S \text{ or } T) = P(S) + P(T) - P(S \text{ and } T)$ $= \left(\frac{1}{4}\right) + \left(\frac{2}{3}\right) - \frac{1}{6}$ $= \frac{3}{4}$	$\checkmark \left(\frac{1}{4}\right) + \left(\frac{2}{3}\right) - \frac{1}{6}$ $\checkmark \frac{3}{4}$ <p style="text-align: right;">(2)</p>
10.2.1	$5!$ $= 120$	$\checkmark 5$ $\checkmark 5! \text{ or } 120$ <p style="text-align: right;">(2)</p>
10.2.2	$5^5$ $= 3125$	$\checkmark 5^5 \text{ or } 3125$ <p style="text-align: right;">(1)</p>
10.3	$n(E) = 5! \times 2! \times 2!$ $n(S) = 7!$ $P(E) = \frac{5! \times 2! \times 2!}{7!}$ $= \frac{2}{21}$	$\checkmark 5!$ $\checkmark 2! \times 2!$ $\checkmark \frac{5! \times 2! \times 2!}{7!}$ $\checkmark \frac{2}{21}$ <p style="text-align: right;">(4)</p>
		<b>[11]</b>



Mathematics P1/ *Wiskunde V1*18  
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11	<p> <math>P(\text{Win}) = P(\text{F and W}) + P(\text{not F and W})</math>  <math>= 0,7 \times 0,85 + 0,3 \times 0,45</math>  <math>= 0,595 + 0,165</math>  <math>= 0,76</math>  <math>= 76\%</math>  <math>= \frac{19}{25}</math> </p>	<p> <math>P(\text{F and W}) = 0,595</math>  <math>P(\text{F and L}) = 0,105</math>  <math>P(\text{not F and W}) = 0,165</math>  <math>P(\text{not F and L}) = 0,135</math> </p> <p>✓ 0,3</p> <p>✓ <math>P(\text{F and W}) = 0,7 \times 0,85 = 0,595</math></p> <p>✓ <math>P(\text{not F and W}) = 0,3 \times 0,45 = 0,165</math></p> <p>✓ <math>0,595 + 0,165</math></p> <p>✓ <math>0,76 / 76\% / \frac{19}{25}</math></p> <p style="text-align: right;">(5)</p>
		[5]

**TOTAL/TOTAAL: 150**



# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1  
FEBRUARY/MARCH 2018**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages and 1 information sheet.**

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Mathematics/P1

3  
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**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 - 6x - 16 = 0$  (3)

1.1.2  $2x^2 + 7x - 1 = 0$  (correct to TWO decimal places) (4)

1.2 List all the integers that are solutions to  $x^2 - 25 < 0$ . (4)1.3 Solve for  $x$  and  $y$ :

$$-2y + x = -1 \quad \text{and} \quad x^2 - 7 - y^2 = -y$$
 (6)

1.4 Evaluate:  $\frac{3^{2018} + 3^{2016}}{3^{2017}}$  (2)1.5 Given:  $f(x) = \frac{\sqrt{3x-5}}{x-3}$ 1.5.1 For which values of  $x$  will  $\frac{\sqrt{3x-5}}{x-3}$  be real? (3)1.5.2 Solve for  $x$  if  $f(x) = 1$ . (4)**[26]****QUESTION 2**2.1 Given the following geometric sequence:  $30 ; 10 ; \frac{10}{3} ; \dots$ 2.1.1 Determine  $n$  if the  $n^{\text{th}}$  term of the sequence is equal to  $\frac{10}{729}$ . (4)2.1.2 Calculate:  $30 + 10 + \frac{10}{3} + \dots$  (2)2.2 Derive a formula for the sum of the first  $n$  terms of an arithmetic sequence if the first term of the sequence is  $a$  and the common difference is  $d$ . (4)**[10]**

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Mathematics/P1

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**QUESTION 3**

The first three terms of an arithmetic sequence are  $-1$  ;  $2$  and  $5$ .

3.1 Determine the  $n^{\text{th}}$  term,  $T_n$ , of the sequence. (2)

3.2 Calculate  $T_{43}$ . (2)

3.3 Evaluate  $\sum_{k=1}^n T_k$  in terms of  $n$ . (3)

3.4 A quadratic sequence, with general term  $T_n$ , has the following properties:

- $T_{11} = 125$
- $T_n - T_{n-1} = 3n - 4$

Determine the first term of the sequence. (6)  
**[13]**



Mathematics/P1

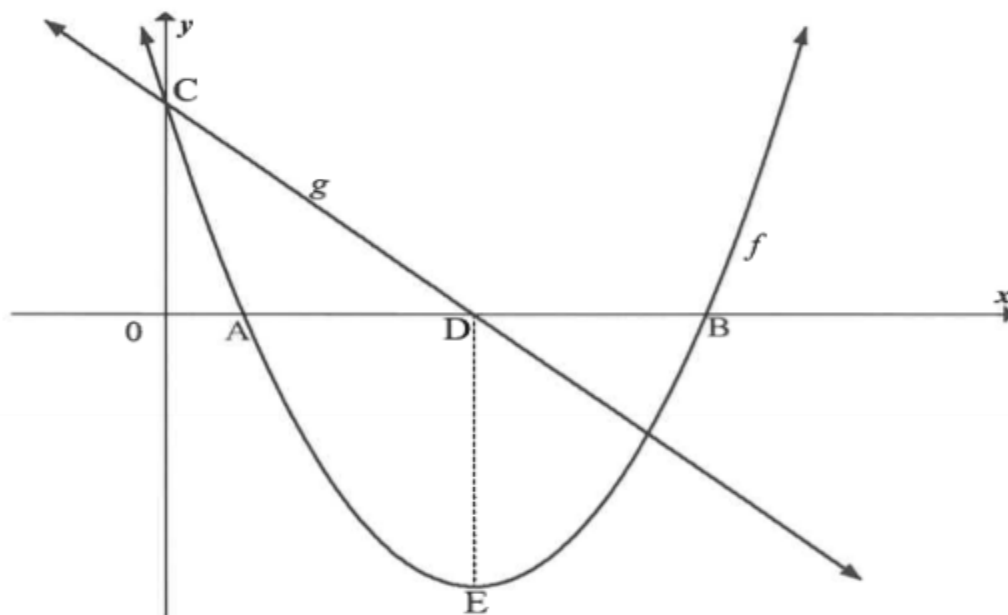
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**QUESTION 4**

Below are the graphs of  $f(x) = (x - 4)^2 - 9$  and a straight line  $g$ .

- A and B are the  $x$ -intercepts of  $f$  and E is the turning point of  $f$ .
- C is the  $y$ -intercept of both  $f$  and  $g$ .
- The  $x$ -intercept of  $g$  is D. DE is parallel to the  $y$ -axis.



- 4.1 Write down the coordinates of E. (2)
- 4.2 Calculate the coordinates of A. (3)
- 4.3 M is the reflection of C in the axis of symmetry of  $f$ . Write down the coordinates of M. (3)
- 4.4 Determine the equation of  $g$  in the form  $y = mx + c$ . (3)
- 4.5 Write down the equation of  $g^{-1}$  in the form  $y = \dots$  (3)
- 4.6 For which values of  $x$  will  $x(f(x)) \leq 0$ ? (4)
- [18]**

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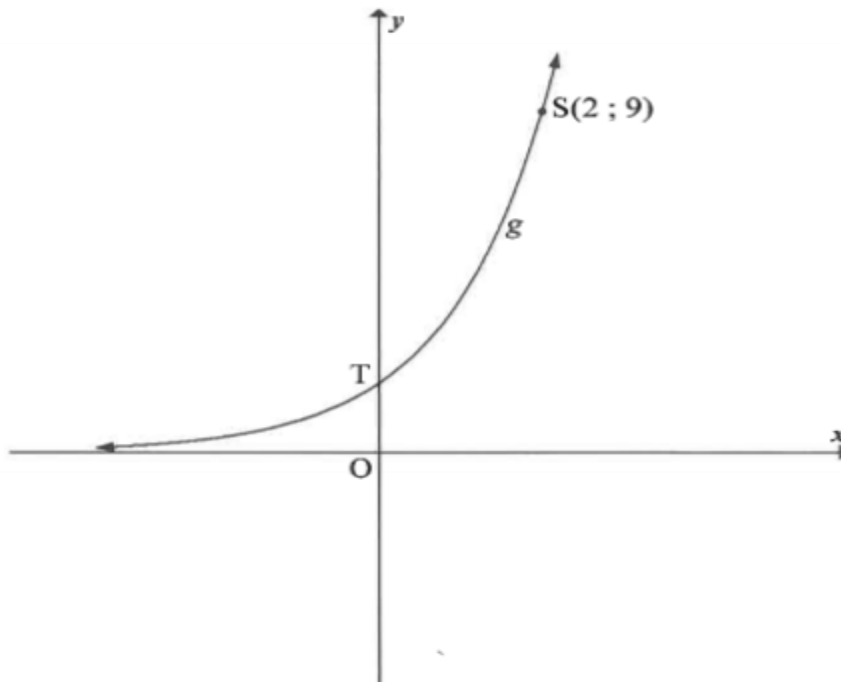
Mathematics/P1

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**QUESTION 5**

The graph of  $g(x) = a^x$  is drawn in the sketch below. The point  $S(2 ; 9)$  lies on  $g$ .  $T$  is the  $y$ -intercept of  $g$ .



- 5.1 Write down the coordinates of  $T$ . (2)
- 5.2 Calculate the value of  $a$ . (2)
- 5.3 The graph  $h$  is obtained by reflecting  $g$  in the  $y$ -axis. Write down the equation of  $h$ . (2)
- 5.4 Write down the values of  $x$  for which  $0 < \log_3 x < 1$ . (2)
- [8]**

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**QUESTION 6**

The function  $f$ , defined by  $f(x) = \frac{a}{x+p} + q$ , has the following properties:

- The range of  $f$  is  $y \in R, y \neq 1$ .
- The graph  $f$  passes through the origin.
- $P(\sqrt{2} + 2; \sqrt{2} + 1)$  lies on the graph  $f$ .

- 6.1 Write down the value of  $q$ . (1)
- 6.2 Calculate the values of  $a$  and  $p$ . (5)
- 6.3 Sketch a neat graph of this function. Your graph must include the asymptotes, if any. (4)
- [10]**

**QUESTION 7**

- 7.1 On 30 June 2013 and at the end of each month thereafter, Asif deposited R2 500 into a bank account that pays interest at 6% per annum, compounded monthly. He wants to continue to deposit this amount until 31 May 2018.

Calculate how much money Asif will have in this account immediately after depositing R2 500 on 31 May 2018. (3)

- 7.2 On 1 February 2018, Genevieve took a loan of R82 000 from the bank to pay for her studies. She will make her first repayment of R3 200 on 1 February 2019 and continue to make payments of R3 200 on the first of each month thereafter until she settles the loan. The bank charges interest at 15% per annum, compounded monthly.

7.2.1 Calculate how much Genevieve will owe the bank on 1 January 2019. (3)

7.2.2 How many instalments of R3 200 must she pay? (5)

7.2.3 Calculate the final payment, to the nearest rand, Genevieve has to pay to settle the loan. (5)

**[16]**





Mathematics/P1

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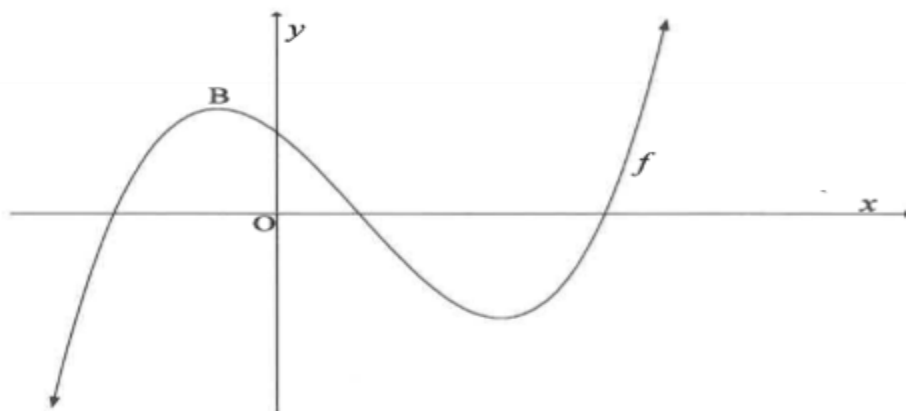
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**QUESTION 8**8.1 Determine  $f'(x)$  from first principles if  $f(x) = 4x^2$ . (5)

8.2 Determine:

8.2.1  $D_x \left[ \frac{x^2 - 2x - 3}{x + 1} \right]$  (3)8.2.2  $f''(x)$  if  $f(x) = \sqrt{x}$  (3)  
[11]**QUESTION 9**

The sketch below represents the curve of  $f(x) = x^3 + bx^2 + cx + d$ . The solutions of the equation  $f(x) = 0$  are  $-2$ ;  $1$  and  $4$ .

9.1 Calculate the values of  $b$ ,  $c$  and  $d$ . (4)9.2 Calculate the  $x$ -coordinate of B, the maximum turning point of  $f$ . (4)9.3 Determine an equation for the tangent to the graph of  $f$  at  $x = -1$ . (4)9.4 In the ANSWER BOOK, sketch the graph of  $f''(x)$ . Clearly indicate the  $x$ - and  $y$ -intercepts on your sketch. (3)9.5 For which value(s) of  $x$  is  $f(x)$  concave upwards? (2)  
[17]

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**QUESTION 10**Given:  $f(x) = -3x^3 + x$ .Calculate the value of  $q$  for which  $f(x) + q$  will have a maximum value of  $\frac{8}{9}$ . [6]**QUESTION 11**

11.1 Veli and Bongki are learners at the same school. Some days they arrive late at school. The probability that neither Veli nor Bongki will arrive late on any day is 0,7.

11.1.1 Calculate the probability that at least one of the two learners will arrive late on a randomly selected day. (1)

11.1.2 The probability that Veli arrives late for school on a randomly selected day is 0,25, while the probability that both of them arrive late for school on that day is 0,15. Calculate the probability that Bongki will arrive late for school on that day. (3)

11.1.3 The principal suspects that the latecoming of the two learners is linked. The principal asks you to determine whether the events of Veli arriving late for school and Bongki arriving late for school are statistically independent or not. What will be your response to him? Show ALL calculations. (3)

11.2 The cards below are placed from left to right in a row.



11.2.1 In how many different ways can these 6 cards be randomly arranged in a row? (2)

11.2.2 In how many different ways can these cards be arranged in a row if the diamonds and hearts are placed in alternating positions? (3)

11.2.3 If these cards are randomly arranged in a row, calculate the probability that ALL the hearts will be next to one another. (3)  
[15]**TOTAL: 150**

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# basic education

Department:  
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**NATIONAL  
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**GRADE 12/GRAAD 12**

**MATHEMATICS P1/WISKUNDE V1**

**FEBRUARY/MARCH/FEBRUARIE/MAART 2018**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS/PUNTE: 150**

**These marking guidelines consist of 17 pages./  
Hierdie nasienriglyne bestaan uit 17 bladsye.**





Mathematics/P1

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**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking guidelines.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$x^2 - 6x - 16 = 0$ $(x - 8)(x + 2) = 0$ $x = -2 \text{ or } x = 8$	✓ factors ✓ $x = -2$ ✓ $x = 8$ (3)
1.1.2	$2x^2 + 7x - 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(7) \pm \sqrt{(7)^2 - 4(2)(-1)}}{2(2)}$ $= \frac{-7 \pm \sqrt{57}}{4}$ $x = 0,14 \text{ or } x = -3,64$ <p><b>OR/OF</b></p> $x^2 + \frac{7}{2}x + \frac{49}{16} = \frac{1}{2} + \frac{49}{16}$ $\left(x + \frac{7}{4}\right)^2 = \frac{57}{16}$ $x + \frac{7}{4} = \pm \frac{\sqrt{57}}{4}$ $x = \frac{-7 \pm \sqrt{57}}{4}$ $x = 0,14 \text{ or } x = -3,64$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>NOTE: Penalise 1 mark if the rounding to TWO decimal places is incorrect.</p> </div>	✓ subs into correct formula $\checkmark \frac{-7 \pm \sqrt{57}}{4}$ $\checkmark x = 0,14$ $\checkmark x = -3,64$ <p><b>OR/OF</b></p> $\checkmark \text{for adding } \frac{49}{16} \text{ on both sides}$ $\checkmark \frac{-7 \pm \sqrt{57}}{4}$ $\checkmark x = 0,14$ $\checkmark x = -3,64$ (4)
1.2	$x^2 - 25 < 0$ $(x - 5)(x + 5) < 0$ <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><math>-5 &lt; x &lt; 5</math></p> </div> <div style="text-align: center;"> </div> </div> $x = \{-4; -3; -2; -1; 0; 1; 2; 3; 4\}$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>NOTE: Final answer only 2/2</p> </div>	✓ factors  ✓ ✓ inequality  ✓ answer (4)



1.3	$x = 2y - 1$ $(2y - 1)^2 - 7 - y^2 = -y$ $4y^2 - 4y + 1 - 7 - y^2 = -y$ $3y^2 - 3y - 6 = 0$ $y^2 - y - 2 = 0$ $(y - 2)(y + 1) = 0$ $y = 2 \text{ or } y = -1$ $x = 2(2) - 1 \text{ or } x = 2(-1) - 1$ $x = 3 \text{ or } x = -3$ <p><b>OR/OF</b></p> $y = \frac{x+1}{2}$ $x^2 - 7 - y^2 = -y$ $x^2 - 7 - \left(\frac{x+1}{2}\right)^2 = -\left(\frac{x+1}{2}\right)$ $x^2 - 7 - \left(\frac{x^2 + 2x + 1}{4}\right) = \frac{-x-1}{2}$ $4x^2 - 28 - x^2 - 2x - 1 = -2x - 2$ $3x^2 - 27 = 0$ $x^2 - 9 = 0$ $(x - 3)(x + 3) = 0$ $x = -3 \text{ or } x = 3$ $y = \frac{-3+1}{2} \text{ or } y = \frac{3+1}{2}$ $y = -1 \text{ or } y = 2$	<p>✓ <math>x = 2y - 1</math>          ✓ substitution</p> <p>✓ correct standard form</p> <p>✓ factors          ✓ <math>y</math>-values</p> <p>✓ <math>x</math>-values</p> <p><b>OR/OF</b></p> <p>✓ <math>y = \frac{x+1}{2}</math></p> <p>✓ substitution</p> <p>✓ correct standard form</p> <p>✓ factors          ✓ <math>x</math>-values</p> <p>✓ <math>y</math>-values (6)</p>
1.4	$\frac{3^{2018} + 3^{2016}}{3^{2017}}$ $= \frac{3^{2017}(3^1 + 3^{-1})}{3^{2017}}$ $= 3 + \frac{1}{3}$ $= 3\frac{1}{3} \text{ or } \frac{10}{3}$ <p><b>OR/OF</b></p>	<p>✓ common factor <math>3^{2017}</math></p> <p>✓ answer</p> <p><b>OR/OF</b></p>

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	$\frac{3^{2018} + 3^{2016}}{3^{2017}}$ $= \frac{3^{2016}(3^2 + 1)}{3^{2017}}$ $= \frac{10}{3}$ <p><b>OR/OF</b></p> $\frac{3^{2018} + 3^{2016}}{3^{2017}}$ $= \frac{3^{2018}}{3^{2017}} + \frac{3^{2016}}{3^{2017}}$ $= 3 + \frac{1}{3}$ $= 3\frac{1}{3} \text{ or } \frac{10}{3}$	<p>✓ common factor <math>3^{2016}</math></p> <p>✓ answer</p> <p><b>OR/OF</b></p> <p>✓ dividing by <math>3^{2017}</math></p> <p>✓ answer</p> <p>(2)</p>
1.5.1	$3x - 5 \geq 0 \text{ and } x \neq 3$ $x \geq \frac{5}{3} \text{ and } x \neq 3$	<p>✓ <math>3x - 5 \geq 0</math></p> <p>✓ <math>x \geq \frac{5}{3}</math></p> <p>✓ <math>x \neq 3</math></p> <p>(3)</p>
1.5.2	$\frac{\sqrt{3x-5}}{x-3} = 1$ $\sqrt{3x-5} = x-3$ $3x-5 = (x-3)^2$ $3x-5 = x^2 - 6x + 9$ $x^2 - 9x + 14 = 0$ $(x-7)(x-2) = 0$ $x \neq 2 \text{ or } x = 7$ <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p>NOTE: If <math>x = 2</math> is not rejected, then maximum 3 / 4 marks</p> </div>	<p>✓ <math>\sqrt{3x-5} = x-3</math></p> <p>✓ <math>3x-5 = (x-3)^2</math></p> <p>✓ factors</p> <p>✓ <math>x = 7</math></p> <p>(4) [26]</p>

Mathematics/P1

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## QUESTION/VRAAG 2

2.1.1	$30 ; 10 ; \frac{10}{3} \dots\dots$ $a = 30 \quad r = \frac{1}{3}$ $T_n = ar^{n-1}$ $\frac{10}{729} = 30\left(\frac{1}{3}\right)^{n-1}$ $\frac{1}{2187} = 3^{1-n}$ $3^{-7} = 3^{1-n}$ $-7 = 1-n$ $n = 8$ <p style="text-align: center;"><b>OR/OF</b></p> $\frac{1}{2187} = \left(\frac{1}{3}\right)^{n-1}$ $\left(\frac{1}{3}\right)^7 = \left(\frac{1}{3}\right)^{n-1}$ $7 = n-1$ $n = 8$	$\checkmark r = \frac{1}{3}$ $\checkmark \text{substitution into correct formula}$ $\checkmark 3^{-7} = 3^{1-n} \text{ or}$ $\left(\frac{1}{3}\right)^7 = \left(\frac{1}{3}\right)^{n-1} \text{ or}$ $\text{use of logs}$ $\checkmark n = 8$ <p style="text-align: right;">(4)</p>
2.1.2	$S_\infty = \frac{a}{1-r}$ $= \frac{30}{1-\frac{1}{3}}$ $= 45$	$\checkmark \text{substitution into correct formula}$ $\checkmark \text{answer}$ <p style="text-align: right;">(2)</p>
2.2	$S_n = a + (a+d) + \dots + (a+(n-2)d) + (a+(n-1)d) \quad (1)$ $S_n = (a+(n-1)d) + (a+(n-2)d) + \dots + (a+d) + a \quad (2)$ <p>Adding both equations/Tel die twee vergelykings bymekaar:</p> $2S_n = 2a + (n-1)d + 2a + (n-1)d + 2a + (n-1)d + \dots$ $= n[2a + (n-1)d]$ $S_n = \frac{n}{2}[2a + (n-1)d]$ <p><b>OR/OF</b></p> $S_n = a + (a+d) + \dots + (a+(n-2)d) + T_n \quad (1)$ $S_n = T_n + (T_n - d) + (T_n - 2d) + \dots + a \quad (2)$ <p>Adding both equations/Tel die twee vergelykings bymekaar:</p> $2S_n = (a+T_n) + (a+T_n) + (a+T_n) + \dots + (a+T_n)$ $S_n = \frac{n}{2}(a+T_n)$ <p>but <math>T_n = a + (n-1)d</math></p> $S_n = \frac{n}{2}[2a + (n-1)d]$	$\checkmark \text{expanding } S_n$ $\checkmark \text{reverse writing}$ $\checkmark 2S_n = n[2a + (n-1)d]$ $\checkmark S_n = \frac{n}{2}[2a + (n-1)d]$ <p style="text-align: right;">(4)</p> $\checkmark \text{expanding } S_n$ $\checkmark \text{reverse writing}$ $\checkmark 2S_n = n(a+T_n)$ $\checkmark S_n = \frac{n}{2}[2a + (n-1)d]$ <p style="text-align: right;">(4)</p> <p style="text-align: right;"><b>[10]</b></p>



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**QUESTION/VRAAG 3**

3.1	$-1; 2; 5$ $T_n = -1 + (n-1)(3)$ $= 3n - 4$	$\checkmark 3n$ $\checkmark -4$ (2)
3.2	$T_{43} = 3(43) - 4$ $= 125$ <b>OR/OF</b> $T_{43} = -1 + (43-1)(3)$ $= 125$	$\checkmark$ subs of 43 $\checkmark$ answer (2)
3.3	$T_n = 3n - 4$ $S_n = \sum_{k=1}^n T_k = -1 + 2 + 5 + \dots + 3n - 4$ $S_n = \frac{n}{2}[-1 + 3n - 4]$ or $S_n = \frac{n}{2}[-2 + (n-1)3]$ $= \frac{n}{2}[3n - 5]$ $= \frac{3n^2 - 5n}{2}$ <b>OR/OF</b> $T_n = 3n - 4$ $\sum_{k=1}^n T_k = 3(1) - 4 + 3(2) - 4 + 3(3) - 4 + \dots + 3n - 4$ $= 3(1 + 2 + 3 + \dots + n) - 4n$ $= \frac{3n(n+1)}{2} - 4n$ $= \frac{3n^2 - 5n}{2}$	$\checkmark S_n = \sum_{k=1}^n T_k$ $\checkmark$ substitution into correct formula $\checkmark \frac{n}{2}[3n - 5]$ or $\frac{3n^2 - 5n}{2}$ <b>OR/OF</b> $\checkmark (1) - 4 + 3(2) - 4 + 3(3) - 4 + \dots + 3n - 4$ $\checkmark 3(1 + 2 + 3 + \dots + n) - 4n$ $\checkmark \frac{3n^2 - 5n}{2}$ (3)





<p>3.4</p>	$T_{11} = (T_{11} - T_{10}) + (T_{10} - T_9) + (T_9 - T_8) + \dots + (T_3 - T_2) + (T_2 - T_1) + T_1$ $125 = 29 + 26 + 23 + \dots + 2 + T_1$ $= \frac{10}{2}(29 + 2) + T_1$ $= 155 + T_1$ $T_1 = -30$ <p><b>OR/OF</b></p> $T_n = an^2 + bn + c$ $\therefore T_{11} = 121a + 11b + c = 125$ $T_n - T_{n-1} = an^2 + bn + c - [a(n-1)^2 + b(n-1) + c]$ $= an^2 + bn + c - an^2 + 2an - a - bn + b - c$ $= 2an + b - a$ $T_n - T_{n-1} = 3n - 4$ $2a = 3 \quad \text{and} \quad b - a = -4$ $a = \frac{3}{2} \quad \text{and} \quad b = -\frac{5}{2}$ $121a + 11b + c = 125$ $121\left(\frac{3}{2}\right) + 11\left(-\frac{5}{2}\right) + c = 125$ $c = -29$ $T_n = \frac{3}{2}n^2 - \frac{5}{2}n - 29$ $T_1 = \frac{3}{2}(1)^2 - \frac{5}{2}(1) - 29$ $= -30$	<p>✓✓ generating sum          ✓ 29 + 26 + 23 + ... + 2          ✓ <math>\frac{10}{2}(29 + 2)</math>          ✓ 155          ✓ -30</p> <p><b>OR/OF</b></p> <p>✓ <math>121a + 11b + c = 125</math></p> <p>✓ calculating <math>T_n - T_{n-1}</math> in terms of <math>a</math>, <math>b</math> and <math>c</math></p> <p>✓ <math>a = \frac{3}{2}</math>          ✓ <math>b = -\frac{5}{2}</math></p> <p>✓ <math>c = -29</math></p> <p>✓ -30</p> <p>(6) [13]</p>
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**QUESTION/VRAAG 4**

4.1	E(4 ; -9)	$\checkmark x = 4$ $\checkmark y = -9$	(2)	
4.2	$f(x) = (x-4)^2 - 9$ $(x-4)^2 - 9 = 0$ $(x-4)^2 = 9$ $x-4 = \pm 3$ $x = 7$ or $x = 1$ A(1 ; 0) <b>OR/OF</b> $f(x) = (x-4)^2 - 9$ $0 = x^2 - 8x + 16 - 9$ $0 = x^2 - 8x + 7$ $(x-7)(x-1) = 0$ $x = 7$ or $x = 1$ A(1 ; 0)	$\checkmark y = 0$ $\checkmark x - 4 = \pm 3$ $\checkmark A(1 ; 0)$ <b>OR/OF</b> $\checkmark y = 0$ $\checkmark (x-7)(x-1)$ $\checkmark A(1 ; 0)$	(3)	
4.3	C(0 ; 7) M(8 ; 7)	NOTE: Answer only 3 / 3	$\checkmark C(0 ; 7)$ $\checkmark x = 8$ $\checkmark y = 7$	(3)
4.4	C(0 ; 7) D(4 ; 0) $m = \frac{7-0}{0-4}$ or $m = \frac{0-7}{4-0}$ or $0 = 4m + 7$ $m = -\frac{7}{4}$ $m = -\frac{7}{4}$ $m = -\frac{7}{4}$ $y - 0 = -\frac{7}{4}(x - 4)$ $y = -\frac{7}{4}x + 7$	$\checkmark D(4 ; 0)$ $\checkmark m = -\frac{7}{4}$ $\checkmark y = -\frac{7}{4}x + 7$	(3)	
4.5	$g : y = -\frac{7}{4}x + 7$ $g^{-1} : x = -\frac{7}{4}y + 7$ $4x = -7y + 28$ $7y = -4x + 28$ $y = -\frac{4}{7}x + 4$ <b>OR/OF</b>	$\checkmark$ interchange $x$ and $y$ $\checkmark$ simplification $\checkmark y = -\frac{4}{7}x + 4$ <b>OR/OF</b>		

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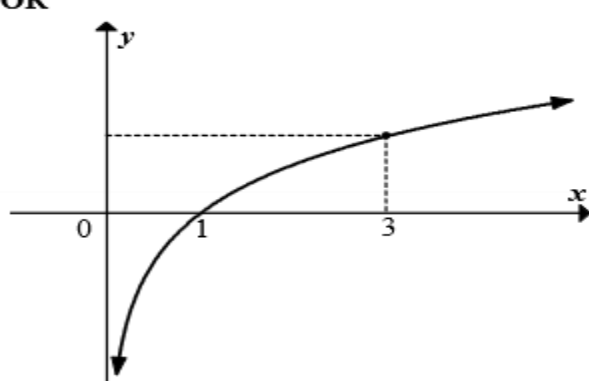
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	$g^{-1}$ is the straight line through (0 ; 4) and ( 7 ; 0) $y = mx + 4$ $0 = 7m + 4$ $y = -\frac{4}{7}x + 4$	✓ straight line through (0 ; 4) and ( 7 ; 0) ✓ substitution ✓ $y = -\frac{4}{7}x + 4$	(3)
4.6	$x \cdot f(x) \leq 0$ $\therefore x \leq 0$ or $1 \leq x \leq 7$	✓✓ $x \leq 0$ ✓✓ $1 \leq x \leq 7$	(4)
			<b>[18]</b>

## QUESTION/VRAAG 5

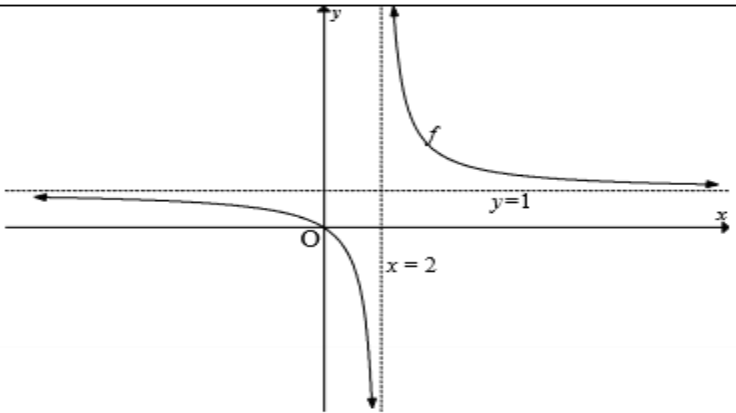
5.1	$a^0 = 1$ $T(0 ; 1)$	✓ $x = 0$ ✓ $y = 1$	(2)
5.2	$g(x) = a^x$ $9 = a^2$ $a = 3$ $a > 0$	✓ substitution ✓ $a = 3$	(2)
5.3	$y = \left(\frac{1}{3}\right)^x$ or $y = 3^{-x}$	✓✓ $y = \left(\frac{1}{3}\right)^x$	(2)
5.4	$3^0 < 3^{\log_3 x} < 3^1$ $1 < x < 3$ <b>OR</b>  $1 < x < 3$	✓ $1 < x$ ✓ $x < 3$  ✓ $1 < x$ ✓ $x < 3$	(2)
			<b>[8]</b>

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## QUESTION/VRAAG 6

6.1	$q = 1$	$\checkmark q = 1$  $(1)$
6.2	<p>Subs (0;0) <math>0 = \frac{a}{0+p} + 1</math></p> $\frac{a}{p} = -1$ $a = -p$ <p>Subs P:</p> $\sqrt{2} + 1 = \frac{a}{\sqrt{2} + 2 + p} + 1$ $\sqrt{2} = \frac{a}{\sqrt{2} + 2 + p}$ $2 + 2\sqrt{2} + \sqrt{2}p = a$ $2 + 2\sqrt{2} = a - p\sqrt{2} = a + a\sqrt{2}$ $2(1 + \sqrt{2}) = a(1 + \sqrt{2})$ $a = 2 ; p = -2$	$\checkmark 0 = \frac{a}{0+p} + 1$  $\checkmark a = -p$  $\checkmark$ substitution  $\checkmark a = 2$ $\checkmark p = -2$  $(5)$
6.3		$\checkmark y = 1$ $\checkmark x = 2$ $\checkmark$ shape $\checkmark (0 ; 0)$  $(4)$ <b>[10]</b>

**QUESTION/VRAAG 7**

7.1	$F = \frac{x[(1+i)^n - 1]}{i}$ $= \frac{2500 \left[ \left(1 + \frac{0,06}{12}\right)^{60} - 1 \right]}{\frac{0,06}{12}}$ $= R174\,425,08$	<ul style="list-style-type: none"> <li>✓ <math>n = 60</math> and <math>i = \frac{0,06}{12} / 0,005</math></li> <li>✓ correct substitution into correct formula</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(3)</p>
7.2.1	<p>After eleven months, Genevieve will owe/ <i>Na elf maande skuld Genevieve</i></p> $A = 82\,000 \left(1 + \frac{0,15}{12}\right)^{11}$ $= R\,94\,006,79$	<ul style="list-style-type: none"> <li>✓ <math>n = 11</math></li> <li>✓ correct substitution into correct formula</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(3)</p>
7.2.2	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $94\,006,79 = \frac{3\,200 \left[ 1 - \left(1 + \frac{0,15}{12}\right)^{-n} \right]}{\frac{0,15}{12}}$ $\frac{94\,006,79}{3\,200} \times \frac{0,15}{12} = 1 - \left(1 + \frac{0,15}{12}\right)^{-n}$ $\left(1 + \frac{0,15}{12}\right)^{-n} = 1 - 0,3672147\dots$ $-n \log \left(1 + \frac{0,15}{12}\right) = \log 0,6327852\dots$ $-n = -36,8382\dots$ $n = 36,84$ <p>Genevieve will have to pay 36 installments of R3 200</p>	<ul style="list-style-type: none"> <li>✓ 94006,79</li> <li>✓ substitute into correct formula</li> <li>✓ correct use of logs (logs to be defined)</li> <li>✓ <math>n = 36,84</math></li> <li>✓ 36 installments</li> </ul> <p style="text-align: right;">(5)</p>





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<p>7.2.3</p> $P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $= \frac{3200 \left[ 1 - \left( 1 + \frac{0,15}{12} \right)^{-0,83826912} \right]}{\frac{0,15}{12}}$ <p><math>P = 2652</math></p> <p>Outstanding balance after 36 installments is R2 652 Final payment will be:</p> $A = 2652,00 \left( 1 + \frac{0,15}{12} \right)^1$ <p>= R 2685,00</p> <p><b>OR/OF</b></p> $\text{Balance : } 94006,79 \left( 1 + \frac{0,15}{12} \right)^{36} - \frac{3200 \left[ \left( 1 + \frac{0,15}{12} \right)^{36} - 1 \right]}{\frac{0,15}{12}}$ <p>= R2 651,72</p> <p>Final payment will be:</p> $A = 2651,72 \left( 1 + \frac{0,15}{12} \right)^1$ <p>= R 2 685,00</p>	<p>✓ <math>n = -0,83826912</math></p> <p>✓ substitute into correct formula</p> <p>✓ answer</p> <p>✓ <math>2652,00 \left( 1 + \frac{0,15}{12} \right)^1</math></p> <p>✓ answer</p> <p><b>OR/OF</b></p> <p>✓ <math>94006,79 \left( 1 + \frac{0,15}{12} \right)^{36}</math></p> <p>✓ <math>\frac{3200 \left[ \left( 1 + \frac{0,15}{12} \right)^{36} - 1 \right]}{\frac{0,15}{12}}</math></p> <p>✓ 2 651,72</p> <p>✓ <math>2651,72 \left( 1 + \frac{0,15}{12} \right)^1</math></p> <p>✓ answer</p> <p style="text-align: right;">(5) <b>[16]</b></p>
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## QUESTION/VRAAG 8

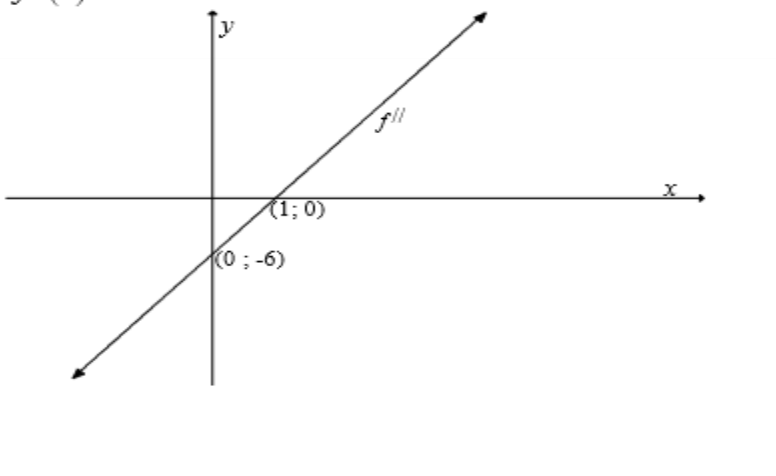
8.1	$f(x+h) = 4x^2$ $f(x+h) - f(x) = 4(x+h)^2 - 4x^2$ $= 4(x^2 + 2xh + h^2) - 4x^2$ $= 4x^2 + 8xh + 4h^2 - 4x^2$ $= 8xh + 4h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \left[ \frac{8xh + 4h^2}{h} \right]$ $= \lim_{h \rightarrow 0} \left[ \frac{h(8x + 4h)}{h} \right]$ $= 8x$ <p><b>OR/OF</b></p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \left[ \frac{4(x+h)^2 - 4x^2}{h} \right]$ $= \lim_{h \rightarrow 0} \left[ \frac{4x^2 + 8xh + 4h^2 - 4x^2}{h} \right]$ $= \lim_{h \rightarrow 0} \left[ \frac{8xh + 4h^2}{h} \right]$ $= \lim_{h \rightarrow 0} \left[ \frac{h(8x + 4h)}{h} \right]$ $= 8x$	$\checkmark 4(x+h)^2$ $\checkmark 8xh + 4h^2$ $\checkmark \frac{f(x+h) - f(x)}{h}$ $\checkmark \frac{h(8x + 4h)}{h}$ $\checkmark 8x$ <p><b>OR/OF</b></p> $\checkmark \frac{f(x+h) - f(x)}{h}$ $\checkmark 4(x+h)^2$ $\checkmark 8xh + 4h^2$ $\checkmark \frac{h(8x + 4h)}{h}$ $\checkmark 8x$ <p style="text-align: right;">(5)</p>
8.2.1	$D_x \left[ \frac{x^2 - 2x - 3}{x - 1} \right]$ $= D_x \left[ \frac{(x-3)(x+1)}{x+1} \right]$ $= D_x(x-3)$ $= 1$	$\checkmark \frac{(x-3)(x+1)}{x+1}$ $\checkmark (x-3)$ $\checkmark 1$ <p style="text-align: right;">(3)</p>
8.2.2	$f(x) = \sqrt{x} = x^{\frac{1}{2}}$ $f'(x) = \frac{1}{2} x^{-\frac{1}{2}}$ $f''(x) = -\frac{1}{4} x^{-\frac{3}{2}}$	$\checkmark x^{\frac{1}{2}}$ $\checkmark \frac{1}{2} x^{-\frac{1}{2}}$ $\checkmark -\frac{1}{4} x^{-\frac{3}{2}}$ <p style="text-align: right;">(3) <b>[11]</b></p>

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## QUESTION/VRAAG 9

9.1	$f(x) = (x+2)(x-1)(x-4)$ $= (x^2 + x - 2)(x - 4)$ $= x^3 + x^2 - 2x - 4x^2 - 4x + 8$ $= x^3 - 3x^2 - 6x + 8$ $b = -3 ; c = -6 ; d = 8$	$\checkmark\checkmark f(x) = (x+2)(x-1)(x-4)$ $\checkmark \text{ expansion}$ $\checkmark x^3 - 3x^2 - 6x + 8$ <p style="text-align: right;">(4)</p>
9.2	$f(x) = x^3 - 3x^2 - 6x + 8$ $f'(x) = 0$ $3x^2 - 6x - 6 = 0$ $x^2 - 2x - 2 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{2 \pm \sqrt{(2)^2 - 4(1)(-2)}}{2(1)}$ $= \frac{2 \pm \sqrt{12}}{2}$ $x = -0,73$	$\checkmark f'(x) = 0$ $\checkmark 3x^2 - 6x - 6$ $\checkmark \text{ substitution into correct formula}$ $\checkmark x = -0,73$ <p style="text-align: right;">(4)</p>
9.3	$f(x) = x^3 - 3x^2 - 6x + 8$ $f(-1) = (-1)^3 - 3(-1)^2 - 6(-1) + 8 \quad \text{or} \quad f(-1) = (1)(-2)(-5)$ $= 10 \qquad \qquad \qquad = 10$ $f'(-1) = 3(-1)^2 - 6(-1) - 6$ $= 3$ $y - 10 = 3(x + 1)$ $y = 3x + 13$	$\checkmark f(-1) = 10$ $\checkmark f'(-1) = 3$ $\checkmark \text{ substitution}$ $\checkmark y = 3x + 13$ <p style="text-align: right;">(4)</p>
9.4	$f''(x) = 6x - 6$ 	$\checkmark f''(x) = 6x - 6$ $\checkmark \text{ x- intercept}$ $\checkmark \text{ y- intercept}$ <p style="text-align: right;">(3)</p>



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9.5	$f$ concave upwards $f''(x) > 0$ $6x - 6 > 0$ $x > 1$	<b>NOTE:</b> <b>Answer only 2 / 2</b>	$\checkmark f''(x) > 0$ $\checkmark x > 1$
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(2)  
[17]**QUESTION/VRAAG 10**

$f(x) = -3x^3 + x$ $-9x^2 + 1 = 0$ $x = \frac{1}{3} \quad \text{or} \quad x = -\frac{1}{3}$ <p>Maximum of <math>f</math> will be at <math>x = \frac{1}{3}</math></p> $f\left(\frac{1}{3}\right) = -3\left(\frac{1}{3}\right)^3 + \left(\frac{1}{3}\right)$ $= \frac{2}{9}$ <p>Maximum of <math>f(x) + q</math> will also be at <math>x = \frac{1}{3}</math></p> $f\left(\frac{1}{3}\right) + q = \frac{8}{9}$ $\frac{2}{9} + q = \frac{8}{9}$ $q = \frac{6}{9}$ $= \frac{2}{3}$ <p>For <math>f(x) + q</math> to have a maximum of <math>\frac{8}{9}</math> the value of <math>q</math> has to be <math>\frac{2}{3}</math>.</p>	$\checkmark -9x^2 + 1 = 0$ $\checkmark x = \frac{1}{3} \quad \text{or} \quad x = -\frac{1}{3}$ $\checkmark$ Maximum at $x = \frac{1}{3}$ $\checkmark f\left(\frac{1}{3}\right) = \frac{2}{9}$ $\checkmark \frac{2}{9} + q = \frac{8}{9}$ $\checkmark q = \frac{2}{3}$
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[6]





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**QUESTION/VRAAG 11**

11.1.1	Let the event Veli arrive late for school be V. Let the event Bongsi arrive late for school be B. / <i>Laat V die gebeurtenis wees dat Veli Laat B die gebeurtenis wees dat Bongsi laatkom</i> $P(V \text{ or } B) = 1 - 0,7$ $= 0,3$	✓ answer (1)
11.1.2	$P(V \text{ or } B) = P(V) + P(B) - P(V \text{ and } B)$ $0,3 = 0,25 + P(B) - 0,15$ $P(B) = 0,2$	✓ $P(V \text{ or } B) = P(V) + P(B) - P(V \text{ and } B)$ ✓ substitution ✓ 0,2 (3)
11.1.3	$P(V) \times P(B) = 0,25 \times 0,2$ $= 0,05$ $P(V) \times P(B) \neq P(V \text{ and } B)$ V and B are NOT independent/ <i>V en B is NIE onafhanklik nie.</i>	✓ $P(V) \times P(B) = 0,05$ ✓ $P(V) \times P(B) \neq P(V \text{ and } B)$ ✓ NOT independent (3)
11.2.1	$6! = 720$	✓ 6! or 720 (2)
11.2.2	Number of arrangements $= 3! \times 3! \times 2$ $= 72$	✓ $3! \times 3!$ ✓ $\times 2$ ✓ answer (3)
11.2.3	$P(\text{hearts next to each other}) = \frac{3! \times 4!}{6!}$ $= \frac{144}{720}$ $= \frac{1}{5}$ or 0,2 or 20%  <b>OR/OF</b> $P(\text{hearts next to each other}) = \frac{4 \times 3! \times 3!}{6!}$ $= \frac{144}{720}$ $= \frac{1}{5}$ or 0,2 or 20%	✓ ✓ $3! \times 4!$  ✓ $\frac{1}{5}$ or 0,2 or 20%  <b>OR/OF</b> ✓ ✓  ✓ $\frac{1}{5}$ or 0,2 or 20%  (3) [15]

**TOTAL/TOTAAL: 150**

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# basic education

Department:  
Basic Education  
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## SENIOR CERTIFICATE EXAMINATIONS

MATHEMATICS P1

2016

MARKS: 150

TIME: 3 hours

**This question paper consists of 9 pages and 1 information sheet.**

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Mathematics/P1

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**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $4x^2 - 25 = 0$  (3)

1.1.2  $x^2 - 5x - 2 = 0$  (correct to TWO decimal places) (3)

1.1.3  $(2 - x)(x + 4) \geq 0$  (3)

1.1.4  $x - 3x^{\frac{1}{2}} = 4$  (5)

1.2 Solve for  $x$  and  $y$ :

$2x - y + 1 = 0$  and  $x^2 - 3x - 4 - y = y^2$  (6)

1.3 Given:  $f(x) = \sqrt{2x+1}$ 1.3.1 Write down the domain of  $f$ . (1)1.3.2 Solve for  $x$  if  $f(x) = 2x - 1$ . (5)  
[26]**QUESTION 2**2.1 Given the arithmetic series:  $a + 13 + b + 27 + \dots$ 2.1.1 Show that  $a = 6$  and  $b = 20$  (2)

2.1.2 Calculate the sum of the first 20 terms of the series. (3)

2.1.3 Write the series in QUESTION 2.1.2 in sigma notation. (2)

2.2 Given the geometric series:  $(x - 2) + (x^2 - 4) + (x^3 + 2x^2 - 4x - 8) + \dots$ 2.2.1 Determine the values of  $x$  for which the series converges. (4)2.2.2 If  $x = -\frac{3}{2}$ , calculate the sum to infinity of the given series. (3)  
[14]



Mathematics/P1

4  
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DBE/2016

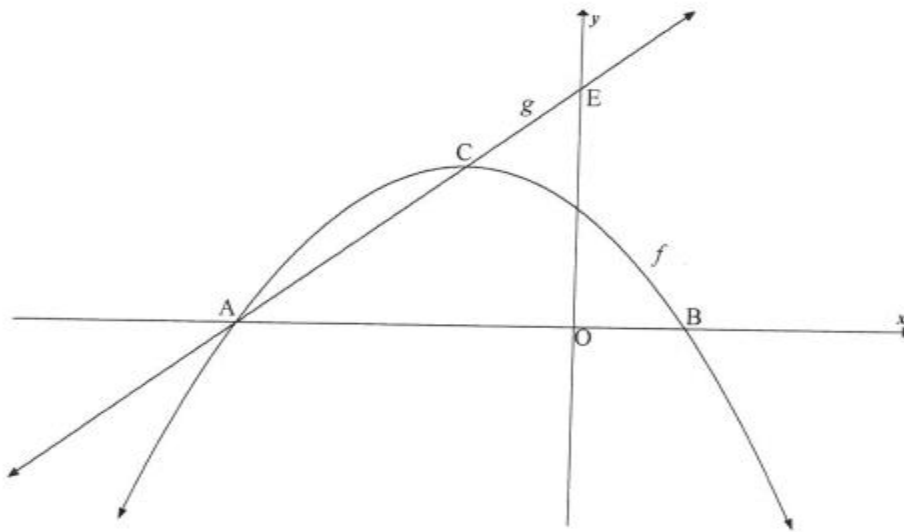
**QUESTION 3**

The first four terms of a quadratic number pattern are  $-1 ; 2 ; 9 ; 20$ .

- 3.1 Determine the general term of the quadratic number pattern. (4)
- 3.2 Calculate the value of the 48<sup>th</sup> term of the quadratic number pattern. (2)
- 3.3 Show that the sum of the first differences of this quadratic number pattern can be given by  $S_n = 2n^2 + n$  (3)
- 3.4 If the sum of the first 69 first differences in QUESTION 3.3 equals 9 591 (that is,  $S_{69} = 9 591$ ), which term of the quadratic number pattern has a value of 9 590? (2)

**[11]****QUESTION 4**

The sketch below shows the graphs of  $f(x) = -x^2 - 2x + 3$  and  $g(x) = mx + q$ . Graph  $f$  has  $x$ -intercepts at  $A$  and  $B(1 ; 0)$  and a turning point at  $C$ . The straight line  $g$ , passing through  $A$  and  $C$ , cuts the  $y$ -axis at  $E$ .



- 4.1 Write down the coordinates of the  $y$ -intercept of  $f$ . (1)
- 4.2 Show that the coordinates of  $C$  are  $(-1 ; 4)$ . (3)
- 4.3 Write down the coordinates of  $A$ . (1)
- 4.4 Calculate the length of  $CE$ . (6)
- 4.5 Determine the value of  $k$  if  $h(x) = 2x + k$  is a tangent to the graph of  $f$ . (5)
- 4.6 Determine the equation of  $g^{-1}$ , the inverse of  $g$ , in the form  $y = \dots$  (2)
- 4.7 For which value(s) of  $x$  is  $g(x) \geq g^{-1}(x)$ ? (3)

**[21]**

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Mathematics/P1

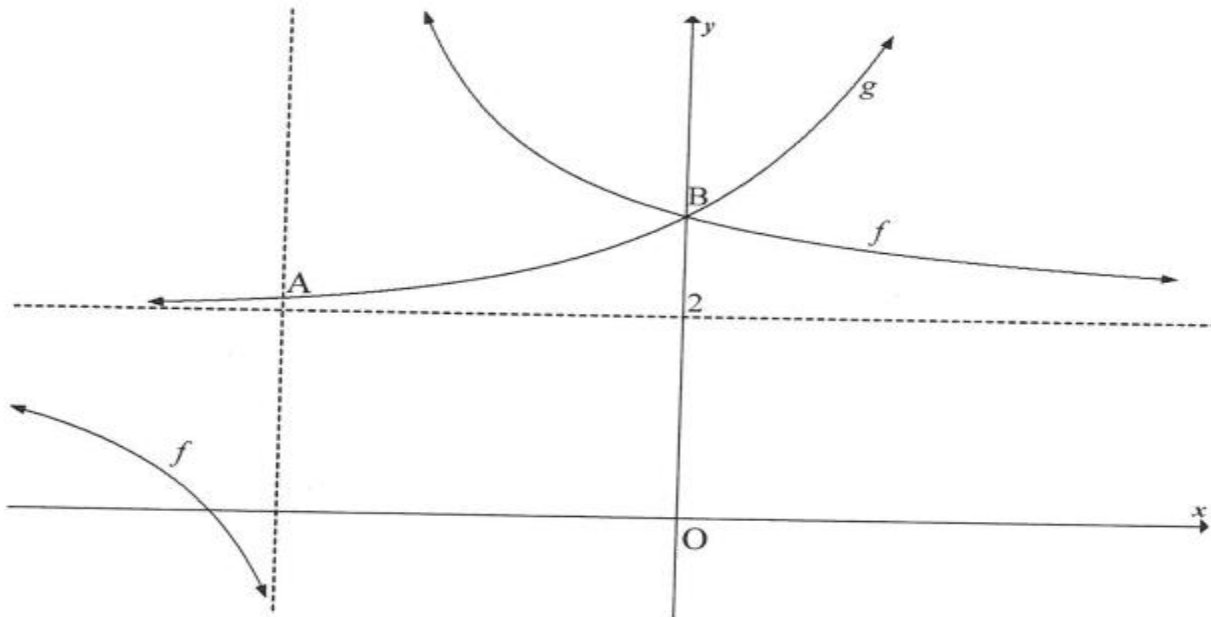
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**QUESTION 5**

The sketch below shows the graphs of  $f(x) = \frac{3}{x-p} + q$  and  $g(x) = 2^x + r$

- $g$  intersects the vertical asymptote of  $f$  at A.
- B is the common  $y$ -intercept of  $f$  and  $g$ .
- $y = 2$  is the common horizontal asymptote of  $f$  and  $g$ .



- 5.1 Write down the value of  $r$ . (1)
- 5.2 Determine the value of  $p$ . (4)
- 5.3 Determine the coordinates of A. (3)
- 5.4 For which value(s) of  $x$  is  $f(x) - g(x) \geq 0$ ? (2)
- 5.5 If  $h(x) = f(x-2)$ , write down the equation of  $h$ . (2)
- [12]**





Mathematics/P1

6  
SCE

DBE/2016

**QUESTION 6**

- 6.1 How long would the price of an asset take to reduce by a third of its original value if it depreciates on a reducing balance at a rate of 4,7% p.a.? (4)
- 6.2 Lebogo bought a tractor for  $Rx$  on 1 April 2016.
- She will trade in this tractor when she replaces it with a similar one in 5 years' time on 1 April 2021.
  - The tractor depreciates by 20% p.a. according to the reducing-balance method.
  - The price of a similar tractor increases by 18% annually.
  - Lebogo calculated that if she deposited R8 000 per month into a sinking fund, which paid interest at 10% p.a. compounded monthly, she would have enough money to cover the replacement cost of the tractor. She made the first deposit in this fund on 30 April 2016 and will continue to do so at the end of every month until 31 March 2021.
- 6.2.1 Determine, in terms of  $x$ , what the book value of the current tractor will be on 1 April 2021 (that is, 5 years after it was bought). Give your answer correct to FIVE decimal places. (2)
- 6.2.2 Determine, in terms of  $x$ , what the price of a similar new tractor will be on 1 April 2021. Give your answer correct to FIVE decimal places. (2)
- 6.2.3 Calculate the amount accumulated in the sinking fund on 1 April 2021. (4)
- 6.2.4 Calculate the value of  $x$ , the price of the current tractor. Round off your answer to the nearest thousand. (4)
- [16]**

**QUESTION 7**

- 7.1 Determine  $f'(x)$  from first principles if  $f(x) = 3x^2 - 5$  (5)
- 7.2 Determine  $\frac{dy}{dx}$  if:
- 7.2.1  $y = 2x^5 + \frac{4}{x^3}$  (3)
- 7.2.2  $y = (\sqrt{x} - x^2)^2$  (4)
- [12]**

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Mathematics/P1

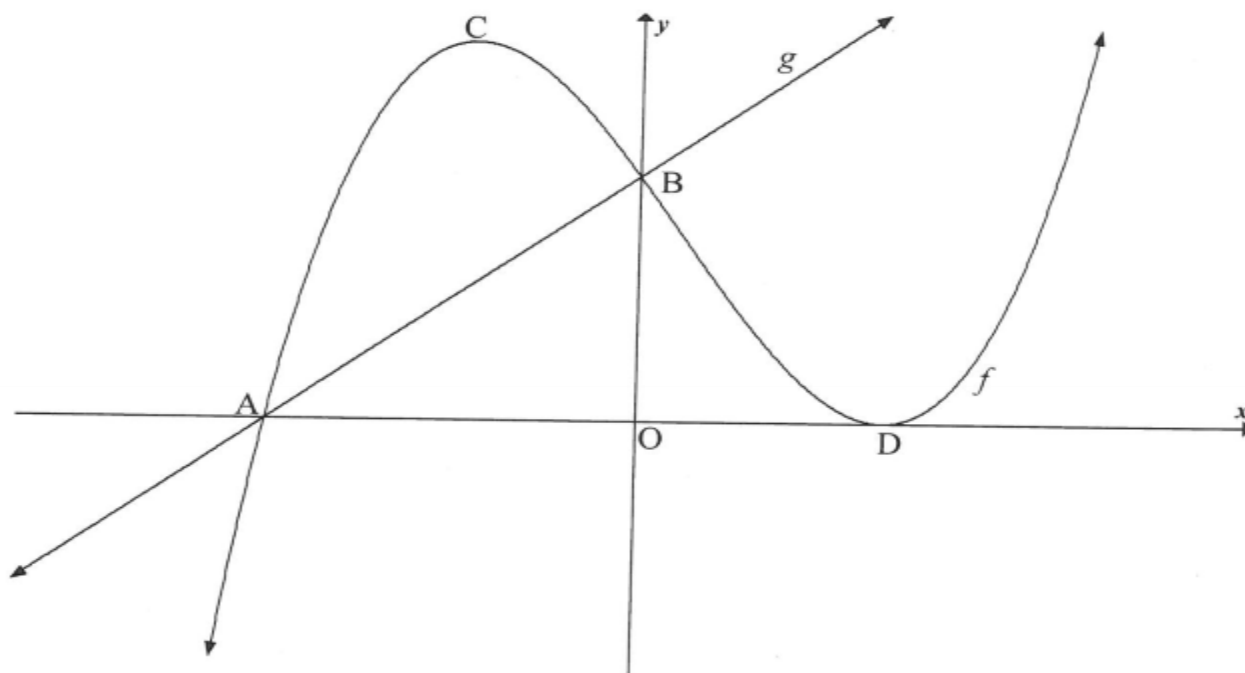
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**QUESTION 8**

Sketched below are the graphs of  $f(x) = (x-2)^2(x-k)$  and  $g(x) = mx+12$

- A and D are the  $x$ -intercepts of  $f$ .
- B is the common  $y$ -intercept of  $f$  and  $g$ .
- C and D are turning points of  $f$ .
- The straight line  $g$  passes through A.



- 8.1 Write down the  $y$ -coordinate of B. (1)
- 8.2 Calculate the  $x$ -coordinate of A. (3)
- 8.3 If  $k = -3$ , calculate the coordinates of C. (6)
- 8.4 For which values of  $x$  will  $f$  be concave down? (3)
- [13]

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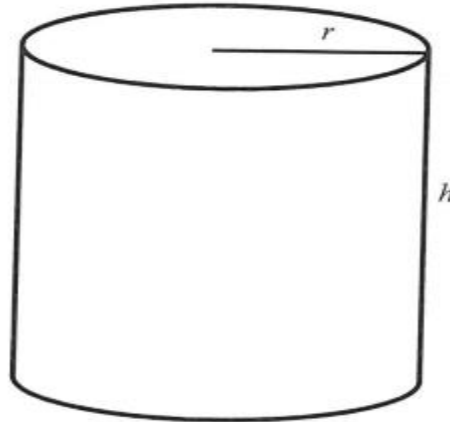
Mathematics/P1

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DBE/2016

**QUESTION 9**

A 340 ml can with height  $h$  cm and radius  $r$  cm is shown below.



$$1 \text{ ml} = 1 \text{ cm}^3$$

- 9.1 Determine the height of the can in terms of the radius  $r$ . (3)
- 9.2 Calculate the length of the radius of the can, in cm, if the surface area is to be a minimum. (6)
- [9]

**QUESTION 10**

- 10.1 A tournament organiser conducted a survey among 150 members at a local sports club to find out whether they play tennis or not. The results are shown in the table below.

	PLAYING TENNIS	NOT PLAYING TENNIS
Male	50	30
Female	20	50

- 10.1.1 What is the probability that a member selected at random is:
- (a) Female (2)
- (b) Female and plays tennis (1)
- 10.1.2 Is playing tennis independent of gender? Motivate your answer with the necessary calculations. (3)

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Mathematics/P1

9  
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10.2 The probability of events A and B occurring are denoted by  $P(A)$  and  $P(B)$  respectively.

For any two events A and B it is given that:

- $P(B') = 0,28$
- $P(B) = 3P(A)$
- $P(A \text{ or } B) = 0,96$

Are events A and B mutually exclusive? Justify your answer.

(4)  
[10]

### QUESTION 11

Five boys and four girls go to the movies. They are all seated next to each other in the same row.

11.1 One boy and girl are a couple and want to sit next to each other at any end of the row of friends. In how many different ways can the entire group be seated?

(3)

11.2 If all the friends are seated randomly, calculate the probability that all the girls are seated next to each other.

(3)  
[6]

**TOTAL: 150**

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# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

## SENIOR CERTIFICATE EXAMINATIONS/ *SENIORSERTIFIKAAT-EKSAMEN*

**MATHEMATICS P1/WISKUNDE VI**

**2016**

**MEMORANDUM**

**MARKS/PUNTE: 150**

**This memorandum consists of 20 pages and an addendum of 7 pages**  
*Hierdie memorandum bestaan uit 20 bladsye en 'n addendum uit 7 bladsye.*



**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking memorandum.

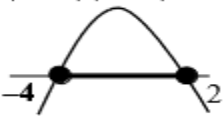


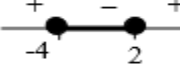
**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.
- Volgehoue akkuraatheid is op ALLE aspekte van die memorandum van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$4x^2 - 25 = 0$ $(2x - 5)(2x + 5) = 0$ $x = \frac{5}{2} \quad \text{or/of} \quad x = -\frac{5}{2}$ <p><b>OR/OF</b></p> $4x^2 = 25$ $x^2 = \frac{25}{4}$ $x = \pm\sqrt{\frac{25}{4}}$ $x = \frac{5}{2} \quad \text{or/of} \quad x = -\frac{5}{2}$	<p>✓✓ factors</p> <p>✓ answers (3)</p> <p>✓ <math>x^2 = \frac{25}{4}</math></p> <p>✓ <math>x = \pm\sqrt{\frac{25}{4}}</math></p> <p>✓ answer (3)</p>
1.1.2	$x^2 - 5x - 2 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-2)}}{2(1)}$ $= \frac{5 \pm \sqrt{33}}{2}$ $x = 5,37 \quad \text{or/of} \quad x = -0,37$ <p><b>OR/OF</b></p> $x^2 - 5x + \frac{25}{4} = 2 + \frac{25}{4}$ $\left(x - \frac{5}{2}\right)^2 = \frac{33}{4}$ $x - \frac{5}{2} = \pm\frac{\sqrt{33}}{2}$ $x = \frac{5 \pm \sqrt{33}}{2}$ $x = -0,37 \quad \text{or} \quad x = 5,37$	<p>✓ correct substitution into correct formula</p> <p>✓ answer</p> <p>✓ answer (3)</p> <p>✓ for adding <math>\frac{25}{4}</math> on both sides</p> <p>✓ answer</p> <p>✓ answer (3)</p>



1.1.3	$(2-x)(x+4) \geq 0$  <p>OR / OF</p>  $-4 \leq x \leq 2 \quad \text{OR / OF} \quad x \in [-4; 2]$ <p>OR / OF</p> $(2-x)(x+4) \geq 0$ $(x-2)(x+4) \leq 0$  <p>OR / OF</p>  $-4 \leq x \leq 2 \quad \text{OR / OF} \quad x \in [-4; 2]$	<ul style="list-style-type: none"> <li>✓ method</li> <li>✓ critical values in context of inequality</li> <li>✓ inequality or interval</li> </ul> <p style="text-align: right;">(3)</p> <ul style="list-style-type: none"> <li>✓ change of inequality</li> <li>✓ critical values in context of inequality</li> <li>✓ inequality or interval</li> </ul> <p style="text-align: right;">(3)</p>
1.1.4	$x - 3x^{\frac{1}{2}} - 4 = 0$ $\left(x^{\frac{1}{2}} - 4\right)\left(x^{\frac{1}{2}} + 1\right) = 0$ $x^{\frac{1}{2}} = 4 \quad \text{or} \quad x^{\frac{1}{2}} = -1$ $x = 16 \quad \text{N/A}$ <p>OR/OF</p> $x - 3x^{\frac{1}{2}} - 4 = 0$ <p>Let <math>x^{\frac{1}{2}} = k</math></p> $k^2 - 3k - 4 = 0$ $(k-4)(k+1) = 0$ $x^{\frac{1}{2}} = 4 \quad \text{or} \quad x^{\frac{1}{2}} = -1$ $x = 16 \quad \text{N/A}$ <p>OR/OF</p> $x - 3x^{\frac{1}{2}} = 4$ $x - 4 = 3\sqrt{x} \quad \text{Restrictions/Bepoerings: } x \geq 4 \quad \text{and} \quad x \geq 0$ $9x = x^2 - 8x + 16$ $x^2 - 17x + 16 = 0$ $(x-1)(x-16) = 0$ $x = 1 \quad \text{or} \quad x = 16$ <p>N/A</p>	<ul style="list-style-type: none"> <li>✓ standard form</li> <li>✓ factors</li> <li>✓ <math>x^{\frac{1}{2}} = 4</math></li> <li>✓ <math>x^{\frac{1}{2}} = -1</math></li> <li>✓ answer</li> </ul> <p style="text-align: right;">(5)</p> <ul style="list-style-type: none"> <li>✓ standard form</li> <li>✓ factors</li> <li>✓ <math>x^{\frac{1}{2}} = 4</math></li> <li>✓ <math>x^{\frac{1}{2}} = -1</math></li> <li>✓ answer</li> </ul> <p style="text-align: right;">(5)</p> <ul style="list-style-type: none"> <li>✓ isolating <math>3\sqrt{x}</math> or <math>3x^{\frac{1}{2}}</math></li> <li>✓ standard form</li> <li>✓ factors</li> <li>✓ answers</li> <li>✓ selection</li> </ul> <p style="text-align: right;">(5)</p>



1.2	$y = 2x + 1$ $x^2 - 3x - 4 - (2x + 1) = (2x + 1)^2$ $x^2 - 3x - 4 - 2x - 1 = 4x^2 + 4x + 1$ $3x^2 + 9x + 6 = 0$ $x^2 + 3x + 2 = 0$ $(x + 2)(x + 1) = 0$ $x = -2 \quad \text{or} \quad x = -1$ <p>If <math>x = -2</math>, then <math>y = -3</math>            If <math>x = -1</math>, then <math>y = -1</math></p> <p><b>OR/OF</b></p> $x = \frac{y-1}{2}$ $\left(\frac{y-1}{2}\right)^2 - 3\left(\frac{y-1}{2}\right) - 4 - y = y^2$ $\frac{y^2 - 2y + 1}{4} - 3\left(\frac{y-1}{2}\right) - 4 - y = y^2$ $y^2 - 2y + 1 - 6y + 6 - 16 - 4y = 4y^2$ $3y^2 + 12y + 9 = 0$ $y^2 + 4y + 3 = 0$ $(y + 3)(y + 1) = 0$ $y = -3 \quad \text{or} \quad y = -1$ <p>If <math>y = -3</math>, then <math>x = -2</math>            If <math>y = -1</math>, then <math>x = -1</math></p>	<ul style="list-style-type: none"> <li>✓ <math>y</math> subject of formula</li> <li>✓ substitution</li> <li>✓ standard form</li> <li>✓ factors</li> <li>✓ values of <math>x</math></li> <li>✓ values of <math>y</math></li> </ul> <p style="text-align: right;">(6)</p> <ul style="list-style-type: none"> <li>✓ <math>x</math> subject of formula</li> <li>✓ substitution</li> <li>✓ standard form</li> <li>✓ factors</li> <li>✓ values of <math>y</math></li> <li>✓ values of <math>x</math></li> </ul> <p style="text-align: right;">(6)</p>
1.3.1	$2x + 1 \geq 0$ $x \geq -\frac{1}{2}$ <p><b>OR/OF</b></p> $\left[-\frac{1}{2}; \infty\right)$	<ul style="list-style-type: none"> <li>✓ answer</li> </ul> <p style="text-align: right;">(1)</p> <ul style="list-style-type: none"> <li>✓ answer</li> </ul> <p style="text-align: right;">(1)</p>





1.3.2	$f(x) = 2x - 1$ $\sqrt{2x+1} = 2x - 1$ <p style="text-align: center;">Restrictions/Bepenkings :</p> $2x + 1 = 4x^2 - 4x + 1 \quad x \geq -\frac{1}{2} \text{ and } x \geq \frac{1}{2}$ $4x^2 - 6x = 0$ $x(4x - 6) = 0$ $x = \frac{3}{2} \text{ or } x = 0$ $\therefore x = \frac{3}{2}$	<ul style="list-style-type: none"> <li>✓ <math>\sqrt{2x+1} = 2x - 1</math></li> <li>✓ standard form</li> <li>✓ factors</li> <li>✓ answers</li> <li>✓ correct selection</li> </ul> <p style="text-align: right;">(5) [26]</p>
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**QUESTION/VRAAG 2**

2.1.1	$27 - b = b - 13$ $b = \frac{27 + 13}{2}$ $b = 20$ $27 - 20 = 13 - a$ $a = 6$ <p style="text-align: center;"><b>OR/OF</b></p> $27 - 13 = 2d$ $d = 7$ $b = 13 + 7 = 20$ $a = 13 - 7 = 6$	<ul style="list-style-type: none"> <li>✓ <math>27 - b = b - 13</math></li> <li>✓ <math>27 - 20 = 13 - a</math></li> <li>✓ <math>d = 7</math> or <math>27 - 13 = 2d</math></li> <li>✓ <math>b = 13 + 7</math></li> <li>✓ <math>a = 13 - 7</math></li> </ul> <p style="text-align: right;">(2) (2)</p>
2.1.2	$a = 6 \quad d = 7$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{20} = \frac{20}{2}[2(6) + (20-1)(7)]$ $= 1450$ <p style="text-align: center;"><b>OR/OF</b></p> $T_{20} = a + 19(d)$ $= 6 + 19(7)$ $= 139$ $S_n = \frac{n}{2}[a + T_n]$ $S_{20} = \frac{20}{2}[6 + 139]$ $= 1450$	<ul style="list-style-type: none"> <li>✓ <math>d = 7</math></li> <li>✓ correct substitution into correct formula</li> <li>✓ answer</li> <li>✓ <math>d = 7</math></li> <li>✓ <math>T_{20} = 139</math></li> <li>✓ answer</li> </ul> <p style="text-align: right;">(3) (3)</p>

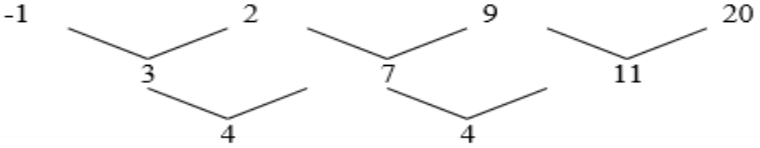




2.1.3	$T_n = 6 + (n-1)(7)$ $= 7n - 1$ $\sum_{n=1}^{20} (6 + 7(n-1))$ $= \sum_{n=1}^{20} (7n - 1)$	$\checkmark T_n = 6 + (n-1)(7) \text{ or } 7n-1$ $\checkmark \sum_{n=1}^{20}$ <p style="text-align: right;">(2)</p>
2.2.1	$r = \frac{(x-2)(x+2)}{x-2} \quad \text{or} \quad r = \frac{(x^2-4)(x+2)}{x^2-4}$ $= x+2$ <p>For convergence/Om te konvergeer:</p> $-1 < r < 1$ $-1 < x+2 < 1$ $-3 < x < -1$	$\checkmark \frac{(x^2-4)}{x-2} \text{ or } \frac{(x-2)(x+2)}{x-2} \text{ or}$ $\frac{(x^2-4)(x+2)}{x^2-4}$ $\checkmark r = x+2$ $\checkmark -1 < r < 1$ $\checkmark \text{ answer}$ <p style="text-align: right;">(4)</p>
2.2.2	$\left(-\frac{7}{2}\right) + \left(-\frac{7}{4}\right) + \left(-\frac{7}{8}\right) + \dots$ $S_\infty = \frac{a}{1-r}$ $= \frac{-\frac{7}{2}}{1-\frac{1}{2}}$ $= -7$ <p><b>OR/OF</b></p> $S_\infty = \frac{a}{1-r}$ $= \frac{(x-2)}{1-(x+2)}$ $= \frac{x-2}{-x-1}$ $= \frac{-\frac{3}{2}-2}{\frac{3}{2}-1}$ $= \frac{-\frac{7}{2}}{\frac{1}{2}}$ $= -7$	$\checkmark a = -\frac{7}{2}$ $\checkmark \text{ substitution into correct formula}$ $\checkmark \text{ answer}$ <p style="text-align: right;">(3)</p> $\checkmark \text{ substitution into correct formula}$ $\checkmark \text{ substitution of } x = -\frac{3}{2}$ $\checkmark \text{ answer}$ <p style="text-align: right;">(3)</p> <p style="text-align: right;"><b>[14]</b></p>

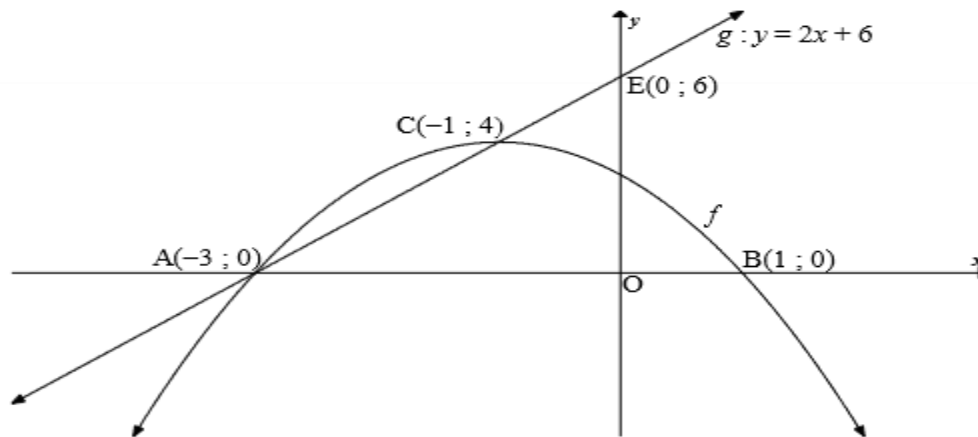


## QUESTION/VRAAG 3

3.1	<p style="text-align: center;">  </p> $2a = 4$ $a = 2$ $3a + b = 3$ $b = -3$ $a + b + c = -1$ $c = 0$ $T_n = 2n^2 - 3n$ <p><b>OR/OF</b></p> $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)}{2}d_2$ $= (-1) + (n-1)(3) + \frac{(n-1)(n-2)}{2}(4)$ $= -1 + 3n - 3 + 2n^2 - 6n + 4$ $= 2n^2 - 3n$	<p>✓ 2<sup>nd</sup> difference = 4</p> <p>✓ a = 2</p> <p>✓ b = -3</p> <p>✓ <math>T_n = 2n^2 - 3n</math> (4)</p> <p>✓ formula</p> <p>✓ 2<sup>nd</sup> difference = 4</p> <p>✓ simplifying</p> <p>✓ <math>T_n = 2n^2 - 3n</math> (4)</p>
3.2	$T_n = 2n^2 - 3n$ $T_{48} = 2(48)^2 - 3(48)$ $= 4464$	<p>✓ substitution</p> <p>✓ answer (2)</p>
3.3	$3 + 7 + 11 \dots$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $= \frac{n}{2}[2(3) + (n-1)4]$ $= \frac{n}{2}[6 + 4n - 4]$ $= 2n^2 + n$	<p>✓ a = 3</p> <p>✓ d = 4</p> <p>✓ substitution into correct formula (3)</p>

3.4	$S_{69} = 9591$ and $T_1 = -1$ (of the original sequence/ <i>van die oorspronklike ry</i> )  $9591 + (-1) = 9590$ $S_{69} + T_1 = 9590$ The 70 <sup>th</sup> term of the original sequence will have a value of 9590  <b>OR/OF</b> $2n^2 - 3n = 9590$ $2n^2 - 3n - 9590 = 0$ $(n - 70)(2n + 137) = 0$ $n = 70$ $T_{70} = 9590$	$\checkmark (9591) + (-1)$  $\checkmark 70$  $\checkmark 2n^2 - 3n - 9590 = 0$  $\checkmark 70$ (2)  <b>[11]</b>
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## QUESTION/VRAAG 4



4.1	(0 ; 3)	$\checkmark (0 ; 3)$ (1)
4.2	$x = -\frac{b}{2a}$ or $-2x - 2 = 0$ $= -\frac{(-2)}{2(-1)}$ $\therefore x = -1$ $= -1$ $y = -(-1)^2 - 2(-1) + 3$ or $y = \frac{4ac - b^2}{4a}$ $= 4$ $= \frac{4(-1)(3) - (-2)^2}{4(-1)}$ $C(-1 ; 4)$	$\checkmark x = -\frac{(-2)}{2(-1)}$ or $-2x - 2 = 0$ $\checkmark$ simplification $\checkmark$ in the context of a turning point $-(-1)^2 - 2(-1) + 3$ $\frac{4(-1)(3) - (-2)^2}{4(-1)}$ (3)



4.3	<p>B(1 ; 0) By symmetry/<i>Deur simmetrie</i> A(-3 ; 0)</p> <p><b>OR/OF</b></p> $x^2 + 2x - 3 = 0$ $(x + 3)(x - 1) = 0$ $x = -3 \text{ or } x = 1$ <p>A(-3 ; 0)</p>	<p>✓ A(-3 ; 0) (1)</p> <p>✓ A(-3 ; 0) (1)</p>
4.4	<p>Equation of <i>g</i>:</p> $m = \frac{4 - 0}{-1 + 3}$ $= 2$ $y = 2x + q$ <p><b>OR/OF</b> <math>y - 0 = 2(x + 3)</math></p> $0 = 2(-3) + q \text{ or } 4 = 2(-1) + q$ $q = 6$ <p><math>y = 2x + 6</math></p> <p>or <math>y - 4 = 2(x + 1)</math></p> $y = 2x + 6$ <p>E(0 ; 6) C(-1 ; 4)</p> $CE = \sqrt{(0 + 1)^2 + (6 - 4)^2}$ $= \sqrt{5} \text{ units/2,24 units}$	<p>✓ <math>m = 2</math></p> <p>✓ subs of A(-3;0) or C(-1;4)</p> <p>✓ <math>y = 2x + 6</math></p> <p>✓ E(0 ; 6)</p> <p>✓ substitution into distance formula</p> <p>✓ answer (6)</p>
4.5	<p><math>f'(x) = -2x - 2</math>. But <math>m_{\tan} = 2</math></p> $-2x - 2 = 2$ $x = -2$ $f(-2) = 3$ $y = 2x + k$ $3 = 2(-2) + k$ $k = 7$ <p><b>OR/OF</b></p> $-x^2 - 2x + 3 = 2x + k$ $-x^2 - 4x + 3 - k = 0$ $x^2 + 4x - 3 + k = 0$ <p>For equal roots: <math>\Delta = b^2 - 4ac = 0</math></p> $(-4)^2 - 4(-1)(3 - k) = 0$ $16 + 12 - 4k = 0$ $k = 7$ <p><math>(4)^2 - 4(1)(k - 3) = 0</math></p> $16 - 4k + 12 = 0$ $k = 7$	<p>✓ <math>-2x - 2</math></p> <p>✓ <math>-2x - 2 = 2</math></p> <p>✓ <math>x = -2</math></p> <p>✓ <math>y = 3</math></p> <p>✓ answer (5)</p> <p>✓ <math>-x^2 - 2x + 3 = 2x + k</math></p> <p>✓ standard form</p> <p>✓ <math>b^2 - 4ac = 0</math></p> <p>✓ substitution</p> <p>✓ answer (5)</p>





4.6	$g: y = 2x + 6$ $g^{-1}: x = 2y + 6$ $2y = x - 6$ $y = \frac{x-6}{2}$ or $y = \frac{x}{2} - 3$	$\checkmark x = 2y + 6$ $\checkmark y = \frac{x-6}{2}$ or $y = \frac{x}{2} - 3$ (2)
4.7	$g(x) \geq g^{-1}(x)$ $2x + 6 \geq \frac{x-6}{2}$ $4x + 12 \geq x - 6$ $3x \geq -18$ $x \geq -6$	$\checkmark 2x + 6 \geq \frac{x-6}{2}$ $\checkmark 4x + 12 \geq x - 6$ $\checkmark x \geq -6$ (3) <b>[21]</b>

**QUESTION/VRAAG 5**

5.1	$r = 2$	$\checkmark r = 2$ (1)
5.2	$g(x) = 2^x + 2$ $g(0) = 2^0 + 2 = 3$ $B(0; 3)$ $3 = \frac{3}{0-p} + 2$ $p = -3$	$\checkmark g(0) = 2^0 + 2$ $\checkmark y = 3$ $\checkmark$ substitute $B(0; 3)$ and $q = 2$ $\checkmark p = -3$ (4)
5.3	at A: $x = -3$ $y = 2^{-3} + 2 = 2\frac{1}{8}$ $A\left(-3; 2\frac{1}{8}\right)$ or $A\left(-3; \frac{17}{8}\right)$ or $A(-3; 2,125)$	$\checkmark$ at A : $x = -3$ (p-value) $\checkmark$ substitute $x = -3$ into exponential equation $\checkmark$ y-value (3)
5.4	$-3 < x \leq 0$ <b>OR/ OF</b> $(-3; 0]$	$\checkmark -3 < x$ $\checkmark x \leq 0$ (2)
5.5	$f(x) = \frac{3}{x+3} + 2$ $f(x-2) = \frac{3}{x-2+3} + 2$ $h(x) = \frac{3}{x+1} + 2$	$\checkmark$ substitution of $x-2$ $\checkmark h(x) = \frac{3}{x+1} + 2$ (2) <b>[12]</b>





## QUESTION/VRAAG 6

6.1	$A = P(1 - i)^n$ $\frac{2}{3}P = P(1 - 0,047)^n$ $\frac{2}{3} = (1 - 0,047)^n$ $\log \frac{2}{3} = n \log(1 - 0,047)$ $n = \frac{\log \frac{2}{3}}{\log(1 - 0,047)}$ $n = 8,42 \text{ years}$	$\checkmark A = \frac{2}{3}P$ $\checkmark$ substitution into correct formula  $\checkmark$ logs $\checkmark$ answer (4)
6.2.1	The book value of the tractor after 5 years/ <i>Die boekwaarde van die trekker na 5 jaar</i> $\text{Book value} = x(1 - 0,2)^5 \quad \text{or} \quad x(0,8)^5$ $= 0,32768x$	$\checkmark x(1 - 0,2)^5$ or $x(0,8)^5$ $\checkmark 0,32768x$ (2)
6.2.2	Price of new tractor after 5 years/ <i>Prys van nuwe trekker na 5 jaar</i> $\text{Book value} = x(1 + 0,18)^5 \quad \text{or} \quad x(1,18)^5$ $= 2,28776x$	$\checkmark x(1 + 0,18)^5$ or $x(1,18)^5$ $\checkmark 2,28776x$ (2)
6.2.3	$F = \frac{x[(1 + i)^n - 1]}{i}$ $= \frac{8000 \left[ \left(1 + \frac{0,10}{12}\right)^{60} - 1 \right]}{\frac{0,10}{12}}$ $= R619\,496,58$	$\checkmark i = \frac{0,10}{12}$ $\checkmark n = 60$ $\checkmark$ subst. into future value formula  $\checkmark$ answer (4)





6.2.4	<p>Sinking fund = New tractor price – Scrap value  <i>Delgingsfonds = Nuwe trekker se prys – boekwaarde</i></p> $619\,496,58 = x(1 + 0,18)^5 - x(1 - 0,2)^5$ $619\,496,58 = x[(1,18)^5 - (0,8)^5]$ $x = \frac{619\,496,58}{[(1,18)^5 - (0,8)^5]}$ $x = R\,316\,057,15$ $x = R\,316\,000$ <p><b>OR/OF</b></p> $619\,496,58 = x(2,28776) - x(0,32768)$ $619\,496,58 = x[1,96008]$ $x = \frac{619\,496,58}{1,96008}$ $x = R\,316\,056,78$ $x = R\,316\,000$	<p>✓ 619 496,58          ✓ <math>x(1 + 0,18)^5 - x(1 - 0,2)^5</math>          ✓ common factor <math>x</math></p> <p>✓ R 316 000 (4)</p> <p>✓ 619 496,58          ✓ <math>x(2,28776) - x(0,32768)</math></p> <p>✓ simplification</p> <p>✓ R 316 000 (4)</p> <p><b>[16]</b></p>
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## QUESTION/VRAAG 7

7.1	$f(x+h) = 3(x+h)^2 - 5 = 3(x^2 + 2xh + h^2) - 5$ $= 3x^2 + 6xh + 3h^2 - 5$ $f(x+h) - f(x) = 3x^2 + 6xh + 3h^2 - 5 - 3x^2 + 5$ $= 6xh + 3h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h}$ $= \lim_{h \rightarrow 0} (6x + 3h)$ $= 6x$ <p><b>OR/OF</b></p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{3(x+h)^2 - 5 - (3x^2 - 5)}{h}$ $= \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 - 5 - 3x^2 + 5}{h}$ $= \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h}$ $= \lim_{h \rightarrow 0} (6x + 3h)$ $= 6x$	<p>✓ <math>3x^2 + 6xh + 3h^2 - 5</math></p> <p>✓ <math>6xh + 3h^2</math></p> <p>✓ <math>\frac{f(x+h) - f(x)}{h}</math></p> <p>✓ common factor/ <math>(6x + 3h)</math></p> <p>✓ answer (5)</p> <p>✓ <math>\frac{f(x+h) - f(x)}{h}</math></p> <p>✓ <math>3x^2 + 6xh + 3h^2 - 5</math></p> <p>✓ <math>6xh + 3h^2</math></p> <p>✓ common factor/ <math>(6x + 3h)</math></p> <p>✓ answer (5)</p>
7.2.1	$y = 2x^5 + \frac{4}{x^3}$ $y = 2x^5 + 4x^{-3}$ $\frac{dy}{dx} = 10x^4 - 12x^{-4}$	<p>✓ <math>2x^5 + 4x^{-3}</math></p> <p>✓ <math>10x^4</math></p> <p>✓ <math>-12x^{-4}</math></p> <p>(3)</p>



Mathematics P1/Wiskunde VI

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SCE/SSE – Memorandum

DBE/2016

7.2.2	$y = (\sqrt{x} - x^2)^2$ $y = \left(x^{\frac{1}{2}} - x^2\right)^2$ $= x - 2x^{\frac{5}{2}} + x^4$ $\frac{dy}{dx} = 1 - 5x^{\frac{3}{2}} + 4x^3$	$\checkmark x - 2x^{\frac{5}{2}} + x^4$ $\checkmark 1$ $\checkmark -5x^{\frac{3}{2}}$ $\checkmark 4x^3$ <p style="text-align: right;">(4) <b>[12]</b></p>
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## QUESTION/VRAAG 8

8.1	$y = 12$	✓ answer (1)
8.2	$12 = (0 - 2)^2(0 - k)$ $k = -3$ $(x - 2)^2(x + 3) = 0$ $x = -3$ <p><b>OR/OF</b></p> $y = 0$ $(x - 2)^2(x - k) = 0$ $(x^2 - 4x + 4)(x - k) = 0$ $x^3 - kx^2 - 4x^2 + 4kx + 4x - 4k = 0$ <p style="text-align: center;">But <math>-4k</math> is the <math>y</math> - intercept Maar <math>-4k</math> is die <math>y</math>-afsnit</p> $-4k = 12$ $k = -3$ $x = -3$	✓ substituting (0;12) ✓ $k = -3$  ✓ $x = -3$  ✓ $-4k$  ✓ $-4k = 12$ or $k = -3$  ✓ $x = -3$ (3)
8.3	$f(x) = x^3 + 3x^2 - 4x^2 - 12x + 4x + 12$ $f(x) = x^3 - x^2 - 8x + 12$ $f'(x) = 3x^2 - 2x - 8$ $3x^2 - 2x - 8 = 0$ $(3x + 4)(x - 2) = 0$ $x = -\frac{4}{3} \text{ or } x = 2$ $y = \frac{500}{27} \text{ or } 18,52 \text{ or } 18\frac{14}{27}$ $C\left(-\frac{4}{3}; 18,52\right)$	✓ $f(x) = x^3 - x^2 - 8x + 12$ ✓ derivative ✓ derivative equal to 0 ✓ factors or formula ✓ $x = -\frac{4}{3}$  ✓ $y = \frac{500}{27}$  or 18,52 or $18\frac{14}{27}$ (6)





8.4	$f''(x) = 6x - 2$ $6x - 2 < 0$ $x < \frac{1}{3}$ <p><math>f</math> is concave down when <math>x &lt; \frac{1}{3}</math></p> <p><math>f</math> is konkkaaf na onder vir <math>x &lt; \frac{1}{3}</math></p> <p><b>OR/OF</b></p> $f''(x) = 6x - 2$ $6x - 2 = 0$ $x = \frac{1}{3}$ <p><math>f</math> is concave down when <math>x &lt; \frac{1}{3}</math></p> <p><math>f</math> is konkkaaf na onder vir <math>x &lt; \frac{1}{3}</math></p> <p><b>OR/OF</b></p> $x = \frac{x_c + x_d}{2}$ $= \frac{-\frac{4}{3} + 2}{2}$ $= \frac{1}{3}$ <p><math>f</math> is concave down when <math>x &lt; \frac{1}{3}</math></p> <p><math>f</math> is konkkaaf na onder vir <math>x &lt; \frac{1}{3}</math></p>	$\checkmark 6x - 2$  $\checkmark\checkmark x < \frac{1}{3}$ <p style="text-align: right;">(3)</p>  $\checkmark 6x - 2$  $\checkmark\checkmark x < \frac{1}{3}$ <p style="text-align: right;">(3)</p>  $\checkmark \frac{-\frac{4}{3} + 2}{2} \quad \text{or} \quad -\frac{-1}{3(1)}$  $\checkmark\checkmark x < \frac{1}{3}$ <p style="text-align: right;">(3)</p> <p style="text-align: right;"><b>[13]</b></p>
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## QUESTION/VRAAG 9

9.1	$V = \pi r^2 h$ $\pi r^2 h = 340$ $h = \frac{340}{\pi r^2}$	✓ formula ✓ equating to 340 ✓ $h = \frac{340}{\pi r^2}$ (3)
9.2	$A = 2\pi r^2 + 2\pi rh$ $= 2\pi r^2 + 2\pi r \left( \frac{340}{\pi r^2} \right)$ $= 2\pi r^2 + \frac{680}{r}$ $A'(r) = 4\pi r - \frac{680}{r^2}$ $A'(r) = 0 \text{ for minimum surface area/}$ $\text{vir minimum buite-oppervlakte}$ $4\pi r - \frac{680}{r^2} = 0$ $r^3 = \frac{680}{4\pi} = \frac{170}{\pi}$ $= 54,11268$ $r = 3,78 \text{ cm}$	✓ $2\pi r^2 + 2\pi rh$ ✓ substituting $h$ ✓ $4\pi r - \frac{680}{r^2}$ ✓ $A'(r) = 0$ ✓ $r^3 = \frac{680}{4\pi}$ ✓ answer (6) [9]



**QUESTION/VRAAG 10**

10.1.1 (a)	$P(\text{Female/Vroulik}) = \frac{70}{150} = \frac{7}{15} = 0,47$	✓ 70 ✓ answer (2)
10.1.1 (b)	$P(\text{Female playing tennis/Vroulik speel tennis}) = \frac{20}{150} = \frac{2}{15} = 0,13$	✓ answer (1)

10.1.2	$P(\text{Female/Vroulik}) = \frac{70}{150}$ $P(\text{Playing/Speel tennis}) = \frac{70}{150}$ $P(\text{Female playing tennis/Vrouliks speel tennis}) = \frac{20}{150} = 0,13$ $P(\text{Female/Vroulik}) \times P(\text{Playing/Speel tennis}) = \left(\frac{70}{150}\right)\left(\frac{70}{150}\right) = \frac{4900}{22500} = 0,22$ $P(\text{Female playing tennis/Vroulik speel tennis}) \neq P(\text{Female/Vroulik}) \times P(\text{Playing/Speel tennis})$ <p>Therefore the event of playing tennis is not independent of gender./ Dus is die gebeurtenis om tennis te speel nie onafhanklik van geslag nie</p> <p><b>OR/OF</b></p> $P(\text{Male/Manlik}) = \frac{80}{150}$ $P(\text{Playing/Speel tennis}) = \frac{70}{150}$ $P(\text{Male playing tennis/Manlik speel tennis}) = \frac{50}{150} = 0,33333$ $P(\text{Male/Manlik}) \times P(\text{Playing/Speel tennis}) = \left(\frac{80}{150}\right)\left(\frac{70}{150}\right) = \frac{5600}{22500} = 0,25$ $P(\text{Male playing tennis/Manlik speel tennis}) \neq P(\text{Male/Manlik}) \times P(\text{Playing/Speel tennis})$ <p>Therefore the event of playing tennis is not independent of gender./ Dus is die gebeurtenis om tennis te speel nie onafhanklik van geslag nie.</p> <p><b>OR/OF</b></p>	$\checkmark P(\text{Play ten}) = \frac{70}{150}$ $\checkmark \left(\frac{70}{150}\right)\left(\frac{70}{150}\right) = \frac{4900}{22500} = 0,22$ $\checkmark P(\text{F play t}) \neq P(\text{F}) \times P(\text{Play t})$ <p>Not independent (3)</p> $\checkmark P(\text{Play ten}) = \frac{70}{150}$ $\checkmark \left(\frac{80}{150}\right)\left(\frac{70}{150}\right) = \frac{5600}{22500} = 0,25$ $\checkmark P(\text{M play t}) \neq P(\text{M}) \times P(\text{Play t})$ <p>Not independent (3)</p>
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	$P(\text{Male}) = \frac{80}{150}$ $P(\text{Not playing tennis}) = \frac{80}{150}$ $P(\text{Male not playing tennis}) = \frac{80}{150} = 0,53333$ $P(\text{Male}) \times P(\text{Not playing tennis}) = \left(\frac{80}{150}\right)\left(\frac{80}{150}\right) = \frac{6400}{22500} = 0,28$ $P(\text{Male not playing tennis}) \neq P(\text{Male}) \times P(\text{Not playing tennis})$ <p>Therefore the event of playing tennis is not independent of gender.</p> <p><b>OR/OF</b></p> $P(\text{Female}) = \frac{70}{150}$ $P(\text{Not playing tennis}) = \frac{80}{150}$ $P(\text{Female not playing tennis}) = \frac{50}{150} = 0,33333$ $P(\text{Female}) \times P(\text{Not playing tennis}) = \left(\frac{70}{150}\right)\left(\frac{80}{150}\right) = \frac{5600}{22500} = 0,25$ $P(\text{Female not playing tennis}) \neq P(\text{Female}) \times P(\text{Not playing tennis})$ <p>Therefore the events of playing tennis and gender are not independent.</p>	<p>✓ <math>P(\text{not play ten}) = \frac{80}{150}</math></p> <p>✓</p> $\left(\frac{80}{150}\right)\left(\frac{80}{150}\right) = \frac{6400}{22500} = 0,28$ <p>✓ <math>P(\text{M not play t}) \neq P(\text{M}) \times P(\text{Not play t})</math></p> <p>Not independent (3)</p> <p>✓ <math>P(\text{not play ten}) = \frac{80}{150}</math></p> <p>✓</p> $\left(\frac{70}{150}\right)\left(\frac{80}{150}\right) = \frac{5600}{22500} = 0,25$ <p>✓ <math>P(\text{F not play t}) \neq P(\text{F}) \times P(\text{Not play t})</math></p> <p>Not independent (3)</p>
10.2	$P(B) = 1 - P(B')$ $= 1 - 0,28$ $= 0,72$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $0,96 = 0,24 + 0,72 - P(A \text{ and } B)$ $0,96 = 0,96 - P(A \text{ and } B)$ $P(A \text{ and } B) = 0$ <p>Events A and B are mutually exclusive <i>Gebeurtenis A en B is onderling uitsluitend</i></p>	<p>✓ <math>P(B) = 0,72</math></p> <p>✓ <math>P(A) = 0,24</math></p> <p>✓ substitution into correct formula</p> <p>✓ <math>P(A \text{ and } B) = 0</math></p> <p>(4)</p>

**[10]**



## QUESTION/VRAAG 11

11.1	$2 \times 2! \times 7! = 20\,160$	✓ $2 \times 2!$ ✓ $7!$ ✓ $20\,160$ (3)
11.2	<p>All seated in <math>9! = 362\,880</math> ways</p> <p>Girls seated together in <math>4!</math> ways.</p> <p>With the girls as one unit they can all be seated in <math>4! \, 6!</math> ways = <math>17\,280</math></p> <p><i>Almal sit op <math>9!</math> = <math>362\,880</math> maniere</i></p> <p><i>Meisies sit saam op <math>4!</math> maniere.</i></p> <p><i>Met die meisies as 'n eenheid kan almal op <math>4! \, 6!</math> maniere = <math>17\,280</math> sit</i></p> $P(\text{all girls seated together/al die meisies sit saam}) = \frac{4! \, 6!}{9!}$ $= \frac{17\,280}{362\,880}$ $= \frac{1}{21}$ $= 0,047619\dots$ $= 4,76\%$	✓ $9!$ or $362\,880$  ✓ $4! \, 6!$ or $17\,280$  ✓ $\frac{17\,280}{362\,880}$ or $\frac{1}{21}$ or $0,047619$ or $4,76\%$  (3) <b>[6]</b>
<b>TOTAL/TOTAAL:</b>		<b>150</b>





# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## SENIOR CERTIFICATE EXAMINATIONS

**MATHEMATICS P1**

**2017**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages and 1 information sheet.**

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Mathematics/P1

3  
SCE

DBE/2017

**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $3x^2 + 10x + 6 = 0$  (correct to TWO decimal places) (3)

1.1.2  $\sqrt{6x^2 - 15} = x + 1$  (5)

1.1.3  $x^2 + 2x - 24 \geq 0$  (3)

1.2 Solve simultaneously for  $x$  and  $y$ :

$5x + y = 3$  and  $3x^2 - 2xy = y^2 - 105$  (6)

1.3 1.3.1 Solve for  $p$  if  $p^2 - 48p - 49 = 0$  (3)1.3.2 Hence, or otherwise, solve for  $x$  if  $7^{2x} - 48(7^x) - 49 = 0$  (3)  
[23]**QUESTION 2**2.1 Given the geometric sequence: 3; 2;  $k$ ; ...

2.1.1 Write down the value of the common ratio. (1)

2.1.2 Calculate the value of  $k$ . (2)2.1.3 Calculate the value of  $n$  if  $T_n = \frac{128}{729}$ . (4)

2.2 In a Mathematics competition, the total prize money for the finalists is R30 500. Each finalist will receive a part of the prize money according to his/her position at the end of the competition. The table below shows the position of the finalists at the end of the competition and the prize money received.

POSITION OF THE FINALIST AT THE END OF THE COMPETITION	PRIZE MONEY
Last	R100
Second from last	R250
Third from last	R400
Fourth from last	R550
.	.
.	.
.	.
First	R $x$

2.2.1 Calculate the prize money of the finalist finishing 18<sup>th</sup> from last. (2)2.2.2 Calculate  $x$ . (6)  
[15]

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Mathematics/P1

4  
SCE

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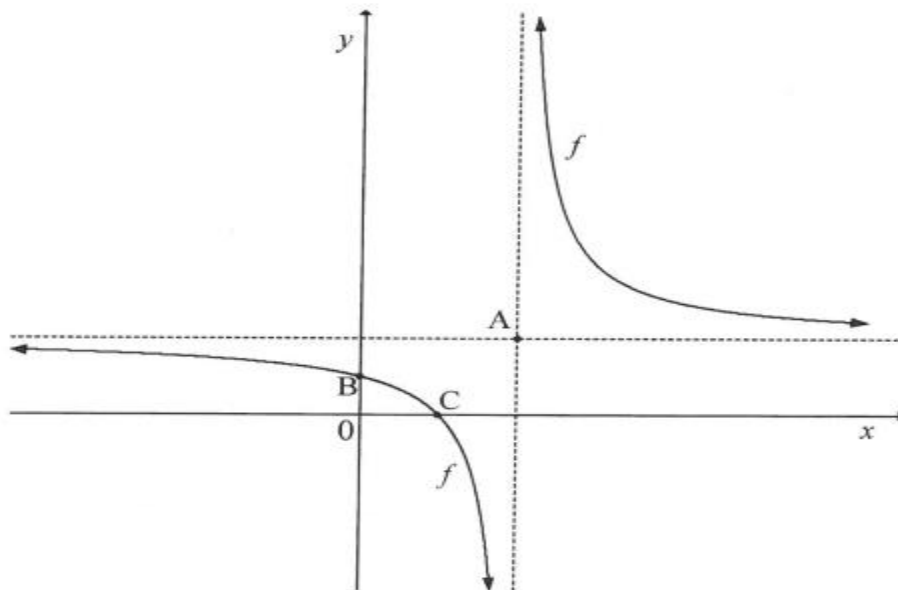
**QUESTION 3**

Given the quadratic sequence: 0; 17; 32; ...

- 3.1 Determine an expression for the general term,  $T_n$ , of the quadratic sequence. (4)
- 3.2 Which terms in the quadratic sequence have a value of 56? (3)
- 3.3 Hence, or otherwise, calculate the value of  $\sum_{n=5}^{10} T_n - \sum_{n=11}^{15} T_n$ . (4)
- [11]**

**QUESTION 4**

The sketch below shows the graph of  $f(x) = \frac{6}{x-4} + 3$ . The asymptotes of  $f$  intersect at A. The graph  $f$  intersects the  $x$ -axis and  $y$ -axis at C and B respectively.



- 4.1 Write down the coordinates of A. (1)
- 4.2 Calculate the coordinates of B. (2)
- 4.3 Calculate the coordinates of C. (2)
- 4.4 Calculate the average gradient of  $f$  between B and C. (2)
- 4.5 Determine the equation of a line of symmetry of  $f$  which has a positive  $y$ -intercept. (2)
- [9]**

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Mathematics/P1

5  
SCE

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**QUESTION 5**Given:  $f(x) = x^2 - 5x - 14$  and  $g(x) = 2x - 14$ 

- 5.1 On the same set of axes, sketch the graphs of  $f$  and  $g$ . Clearly indicate all intercepts with the axes and turning points. (6)
- 5.2 Determine the equation of the tangent to  $f$  at  $x = 2\frac{1}{2}$ . (2)
- 5.3 Determine the value(s) of  $k$  for which  $f(x) = k$  will have two unequal positive real roots. (2)
- 5.4 A new graph  $h$  is obtained by first reflecting  $g$  in the  $x$ -axis and then translating it 7 units to the left. Write down the equation of  $h$  in the form  $h(x) = mx + c$ . (2)
- [12]

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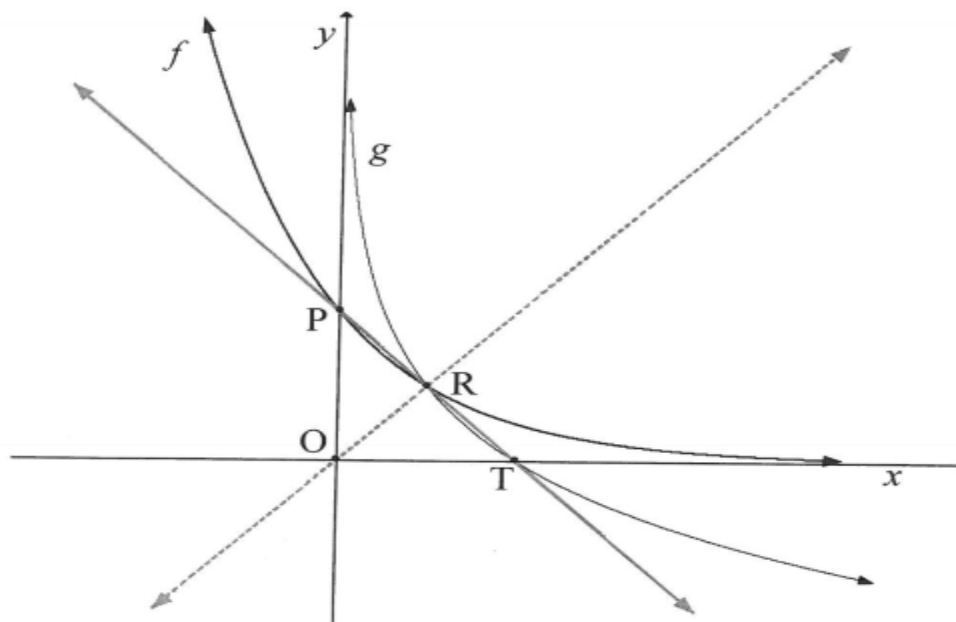
Mathematics/P1

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SCE

DBE/2017

**QUESTION 6**

In the sketch below, P is the  $y$ -intercept of the graph of  $f(x) = b^x$ . T is the  $x$ -intercept of graph  $g$ , the inverse of  $f$ . R is the point of intersection of  $f$  and  $g$ . Straight lines are drawn through O and R and through P and T.



- 6.1 Determine the equation of  $g$  (in terms of  $b$ ) in the form  $y = \dots$  (2)
- 6.2 Write down the equation of the line passing through O and R. (1)
- 6.3 Write down the coordinates of point P. (1)
- 6.4 Determine the equation of the line passing through P and T. (2)
- 6.5 Calculate the value of  $b$ . (5)
- [11]**

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**QUESTION 7**

- 7.1 A company bought a new machine for R500 000. After 3 years, the machine has a book value of R331 527. Calculate the yearly rate of depreciation if the machine was depreciated according to the reducing-balance method. (3)
- 7.2 Musa takes a personal loan from a bank to buy a motorcycle that costs R46 000. The bank charges interest at 24% per annum, compounded monthly.
- How many months will it take Musa to repay the loan, if the monthly instalment is R1 900? (4)
- 7.3 Neil set up an investment fund. Exactly 3 months later and every 3 months thereafter he deposited R3 500 into the fund. The fund pays interest at 7,5% p.a., compounded quarterly. He continued to make quarterly deposits into the fund for  $6\frac{1}{2}$  years from the time that he originally set up the fund.
- Neil made no further deposits into the fund, but left the money in the same fund at the same rate of interest. Calculate how much he will have in the fund 10 years after he originally set it up. (6)  
[13]

**QUESTION 8**

- 8.1 Given  $f(x) = 3 - 2x^2$ . Determine  $f'(x)$ , using first principles. (5)
- 8.2 Determine  $\frac{dy}{dx}$  if  $y = \frac{12x^2 + 2x + 1}{6x}$ . (4)
- 8.3 The function  $f(x) = x^3 + bx^2 + cx - 4$  has a point of inflection at (2 ; 4). Calculate the values of  $b$  and  $c$ . (7)  
[16]

**QUESTION 9**Given:  $f(x) = x^3 - x^2 - x + 1$ 

- 9.1 Write down the coordinates of the  $y$ -intercept of  $f$ . (1)
- 9.2 Calculate the coordinates of the  $x$ -intercepts of  $f$ . (5)
- 9.3 Calculate the coordinates of the turning points of  $f$ . (6)
- 9.4 Sketch the graph of  $f$  in your ANSWER BOOK. Clearly indicate all intercepts with the axes and the turning points. (3)
- 9.5 Write down the values of  $x$  for which  $f'(x) < 0$ . (2)  
[17]

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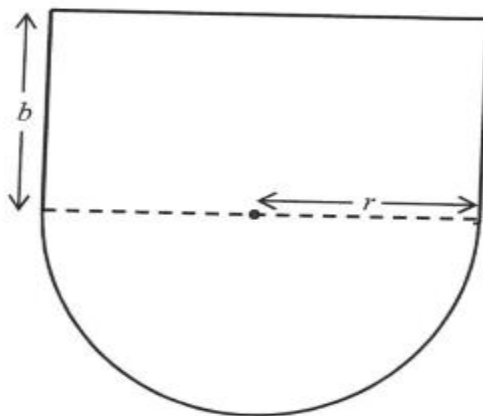


Mathematics/P1

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## QUESTION 10



The figure above shows the design of a theatre stage which is in the shape of a semicircle attached to a rectangle. The semicircle has a radius  $r$  and the rectangle has a breadth  $b$ . The perimeter of the stage is 60 m.

- 10.1 Determine an expression for  $b$  in terms of  $r$ . (2)
- 10.2 For which value of  $r$  will the area of the stage be a maximum? (6)
- [8]



Mathematics/P1

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**QUESTION 11**

- 11.1 The letters of the word EQUATION are randomly used to form a new word consisting of five letters. How many of these words are possible if letters may not be repeated? (2)
- 11.2 It is given that two events, A and B, are independent.  $P(A) = \frac{2}{5}$  and  $P(B) = 0,35$ . Calculate  $P(A \text{ or } B)$ . (4)
- 11.3 Grade 12 learners in a certain town may choose to attend any one of three high schools. The table below shows the number of Grade 12 learners (as a percentage) attending the different schools in 2016 and the matric pass rate in that school (as a percentage) in 2016.

SCHOOLS	NUMBER OF LEARNERS ATTENDING (%)	MATRIC PASS RATE (%)
A	20	35
B	30	65
C	50	90

If a learner from this town, who was in Grade 12 in 2016, is selected at random, determine the probability that the learner:

- 11.3.1 Did not attend School A (2)
- 11.3.2 Attended School B and failed Grade 12 in 2016 (3)
- 11.3.3 Passed Grade 12 in 2016 (4)

**[15]****TOTAL: 150**

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# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

## SENIOR CERTIFICATE EXAMNATIONS *SENIORSERTIFIKAAT-EKSAMEN*

**MATHEMATICS P1/WISKUNDE VI**

**2017**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS: 150**  
**PUNTE: 150**

**These marking guidelines consist of 20 pages.**  
***Hierdie nasienriglyne bestaan uit 20 bladsye.***



**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking memorandum.

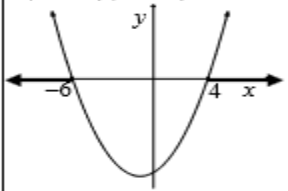
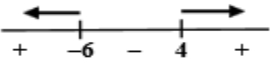
**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$3x^2 + 10x + 6 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-10 \pm \sqrt{(10)^2 - 4(3)(6)}}{2(3)}$ $x = -2,55 \text{ or } x = -0,78$ <p><b>OR/OF</b></p> $x^2 + \frac{10}{3}x + \frac{100}{36} = -2 + \frac{100}{36}$ $\left(x + \frac{5}{3}\right)^2 = \frac{7}{9}$ $x + \frac{5}{3} = \pm \frac{\sqrt{7}}{3}$ $x = \frac{-5 \pm \sqrt{7}}{3}$ $x = -0,78 \text{ or } x = -2,55$	<ul style="list-style-type: none"> <li>✓ substitution into correct formula</li> <li>✓ <math>x = -2,55</math></li> <li>✓ <math>x = -0,78</math></li> </ul> <p>(3)</p> <ul style="list-style-type: none"> <li>✓ for adding <math>\frac{100}{36}</math> on both sides</li> <li>✓ <math>x = -2,55</math></li> <li>✓ <math>x = -0,78</math></li> </ul> <p>(3)</p>
1.1.2	$\sqrt{6x^2 - 15} = x + 1$ $6x^2 - 15 = (x + 1)^2$ $6x^2 - 15 = x^2 + 2x + 1$ $5x^2 - 2x - 16 = 0$ $(5x + 8)(x - 2) = 0$ $x = -\frac{8}{5} \text{ or } x = 2$ $\therefore x = 2$	<ul style="list-style-type: none"> <li>✓ concept of squaring both sides</li> <li>✓ standard form (accurate)</li> <li>✓ factors</li> <li>✓ both answers</li> <li>✓ correct selection</li> </ul> <p>(5)</p>



1.1.3	$x^2 + 2x - 24 \geq 0$ $(x + 6)(x - 4) \geq 0$  <p style="text-align: center;"><b>OR</b></p>  $x \leq -6 \text{ or } x \geq 4$	<ul style="list-style-type: none"> <li>✓ factors</li> <li>✓✓ <math>x \leq -6 \text{ or } x \geq 4</math></li> </ul> <p style="text-align: right;">(3)</p>
1.2	$y = -5x + 3$ $3x^2 - 2x(-5x + 3) = (-5x + 3)^2 - 105$ $3x^2 + 10x^2 - 6x = 25x^2 - 30x + 9 - 105$ $-12x^2 + 24x + 96 = 0$ $x^2 - 2x - 8 = 0$ $(x - 4)(x + 2) = 0$ $x = -2 \text{ or } x = 4$ $y = 13 \text{ or } y = -17$ <p style="text-align: center;"><b>OR/OF</b></p> $x = \frac{3 - y}{5}$ $3\left(\frac{3 - y}{5}\right)^2 - 2y\left(\frac{3 - y}{5}\right) = y^2 - 105$ $3\left(\frac{9 - 6y + y^2}{25}\right) - 2y\left(\frac{3 - y}{5}\right) = y^2 - 105$ $27 - 18y + 3y^2 - 30y + 10y^2 = 25y^2 - 2625$ $12y^2 + 48y - 2652 = 0$ $y^2 + 4y - 221 = 0$ $(y - 13)(y + 17) = 0$ $y = -17 \text{ or } y = 13$ $x = \frac{3 + 17}{5} \text{ or } x = \frac{3 - 13}{5}$ $x = 4 \text{ or } x = -2$	<ul style="list-style-type: none"> <li>✓ <math>y</math> subject of formula</li> <li>✓ substitution</li> <li>✓ simplification</li> <li>✓ factors</li> <li>✓ values of <math>x</math></li> <li>✓ values of <math>y</math></li> <li>✓ <math>x</math> subject of formula</li> <li>✓ substitution</li> <li>✓ simplification</li> <li>✓ factors</li> <li>✓ values of <math>y</math></li> <li>✓ values of <math>x</math></li> </ul> <p style="text-align: right;">(6)</p>
1.3.1	$p^2 - 48p - 49 = 0$ $(p - 49)(p + 1) = 0$ $p = -1 \text{ or } p = 49$	<ul style="list-style-type: none"> <li>✓ factors</li> <li>✓ <math>p = -1</math></li> <li>✓ <math>p = 49</math></li> </ul> <p style="text-align: right;">(3)</p>
1.3.2	$7^x = -1 \quad \text{or} \quad 7^x = 49$ $\text{no solution} \quad x = 2$	<ul style="list-style-type: none"> <li>✓ <math>7^x = -1 \text{ or } 7^x = 49</math></li> <li>✓ no solution</li> <li>✓ <math>x = 2</math></li> </ul> <p style="text-align: right;">(3)</p>

**[23]**

**QUESTION/VRAAG 2**

2.1.1	$3; 2; k; \dots$ $r = \frac{2}{3}$	$\checkmark r = \frac{2}{3} / 0,67$  (1)
2.1.2	$r = \frac{T_3}{T_2}$ $T_3 = r \times T_2$ $= \frac{2}{3} \times 2$ $= \frac{4}{3}$ Thus $k = \frac{4}{3}$	$\checkmark \frac{2}{3} \times 2$  $\checkmark \frac{4}{3} / 1,34$  (2)
2.1.3	$T_n = ar^{n-1}$ $\frac{128}{729} = 3 \times \left(\frac{2}{3}\right)^{n-1}$ $\left(\frac{2}{3}\right)^{n-1} = \frac{128}{2187}$ $\left(\frac{2}{3}\right)^{n-1} = \left(\frac{2}{3}\right)^7$ $n-1 = 7$ $n = 8$  <b>OR / OF</b> $T_n = ar^{n-1}$ $\frac{128}{729} = 3 \times \left(\frac{2}{3}\right)^{n-1}$ $\left(\frac{2}{3}\right)^{n-1} = \frac{128}{2187}$ $n-1 = \log_{\frac{2}{3}} \frac{128}{2187}$ $n-1 = 7$ $n = 8$	$\checkmark \frac{128}{729} = 3 \times \left(\frac{2}{3}\right)^{n-1}$ $\checkmark \left(\frac{2}{3}\right)^{n-1} = \frac{128}{2187}$ $\checkmark \left(\frac{2}{3}\right)^7$  $\checkmark$ answer  <b>OR / OF</b> $\checkmark \frac{128}{729} = 3 \times \left(\frac{2}{3}\right)^{n-1}$ $\checkmark \left(\frac{2}{3}\right)^{n-1} = \frac{128}{2187}$ $\checkmark n-1 = \log_{\frac{2}{3}} \frac{128}{2187}$ $\checkmark$ answer  (4)
2.2.1	$T_n = a + (n-1)d$ $T_{18} = 100 + (18-1)(150)$ $= R\ 2\ 650$	$\checkmark$ substitution of $n$ , $a$ and $d$ into AS $\checkmark 2\ 650$  (2)



Mathematics/P1/Wiskunde/V1

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2.2.2	$S_n = \frac{n}{2}[2a + (n-1)d]$ $30\,500 = \frac{n}{2}[2(100) + (n-1)(150)]$ $61\,000 = n(150n + 50)$ $61\,000 = 150n^2 + 50n$ $3n^2 + n - 1\,220 = 0$ $(3n + 61)(n - 20) = 0$ $n = -\frac{61}{3} \text{ or } n = 20$ <p style="text-align: center;">N/A</p> $x = 100 + (20-1)(150)$ $= R\,2\,950$	<ul style="list-style-type: none"> <li>✓ substitute 30 500, <math>a</math> and <math>d</math> into sum formula for AS</li> <li>✓ simplification</li> <li>✓ factors or quad formula</li> <li>✓ <math>n = 20</math></li> <li>✓ substitution <math>T_n</math> of AS</li> <li>✓ 2 950</li> </ul>
		(6) [15]

**QUESTION/VRAAG 3**

3.1	<p>First differences: 17; 15 Second difference: -2</p> $T_n = an^2 + bn + c$ $a = \frac{\text{second difference}}{2} = \frac{-2}{2} = -1$ $3a + b = 17$ $3(-1) + b = 17$ $b = 20$ $a + b + c = 0$ $-1 + 20 + c = 0$ $c = -19$ $T_n = -n^2 + 20n - 19$ <p><b>OR / OF</b></p> <p>First differences: 17; 15</p> $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)}{2}d_2$ $= (0) + (n-1)(17) + \frac{(n-1)(n-2)}{2}(-2)$ $= 17n - 17 - n^2 + 3n - 2$ $= -n^2 + 20n - 19$	<ul style="list-style-type: none"> <li>✓ 17; 15</li> <li>✓ value of <math>a</math></li> <li>✓ value of <math>b</math></li> <li>✓ value of <math>c</math></li> <li>✓ 17; 15</li> <li>✓ value of <math>a</math></li> <li>✓ value of <math>b</math></li> <li>✓ value of <math>c</math></li> </ul>
		(4)





Mathematics/P1/Wiskunde/V1

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3.2	$56 = -n^2 + 20n - 19$ $n^2 - 20n + 75 = 0$ $(n - 15)(n - 5) = 0$ $n = 5 \text{ or } n = 15$	✓ $T_n = 56$  ✓ factors ✓ both answers (3)
3.3	$\sum_{n=5}^{10} T_n - \sum_{n=11}^{15} T_n$ $= T_5 + T_6 + T_7 + T_8 + T_9 + T_{10} - T_{11} - T_{12} - T_{13} - T_{14} - T_{15}$ $= (T_5 - T_{15}) + (T_6 - T_{14}) + \dots + (T_9 - T_{13}) + T_{10}$ $= T_{10}$ <p>because by symmetry <math>T_5 = T_{15}</math> ; <math>T_6 = T_{14}</math> .....</p> $T_{10} = -(10)^2 + 20(10) - 19$ $= 81$ <p><b>OR/OF</b></p> $0; 17; 32; 45; \overset{T_5}{56}; 65; 72; 77; 80; \overset{T_{10}}{81}; 80; 77; 72; 65; \overset{T_{15}}{56}$ <p>Hence,</p> $\sum_{n=5}^{10} T_n - \sum_{n=11}^{15} T_n$ $= (56 + 65 + 72 + 77 + 80 + 81) - (80 + 77 + 72 + 65 + 56)$ $= 81$	✓✓ symmetry of terms  ✓ $T_{10}$ ✓ 81 (4)  ✓ writing out the symmetry of terms  ✓ $56 + 65 + 72 + 77 + 80 + 81$ ✓ $80 + 77 + 72 + 65 + 56$ ✓ 81 (4) <b>[11]</b>

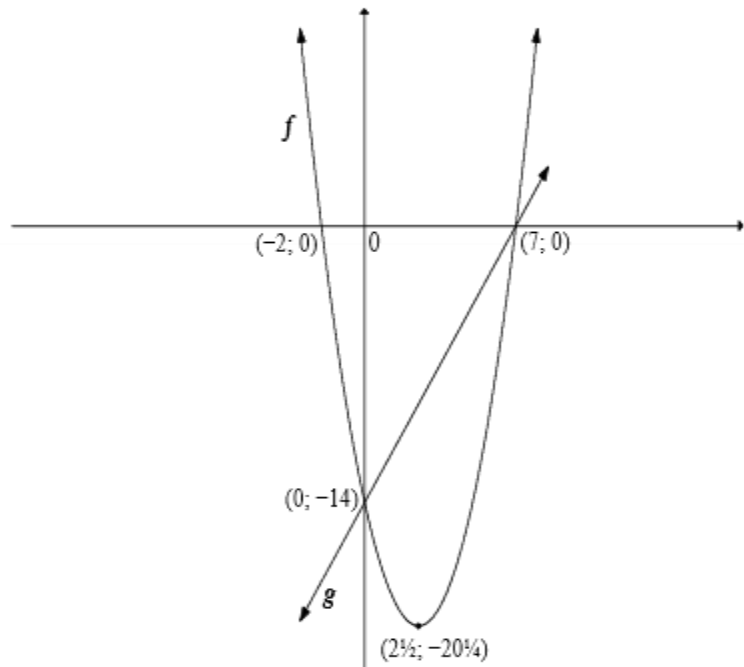


**QUESTION/VRAAG 4**

4.1	A (4; 3)	✓(4; 3) (1)
4.2	$y = \frac{6}{-4} + 3$ $= \frac{3}{2}$ $B\left(0; \frac{3}{2}\right)$	✓ $x = 0$ ✓ $y = \frac{3}{2}$ (2)
4.3	$0 = \frac{6}{x-4} + 3$ $-3 = \frac{6}{x-4}$ $-3(x-4) = 6$ $-3x + 12 = 6$ $x = 2$ $C(2; 0)$	✓ $y = 0$  ✓ $x = 2$ (2)
4.4	$\text{Average gradient} = \frac{0 - \frac{3}{2}}{2 - 0}$ $= -\frac{3}{4}$	✓ $\frac{0 - \frac{3}{2}}{2 - 0}$ ✓ $-\frac{3}{4}$ (2)
4.5	$y = -x + 7$  <b>OR/OF</b>  $m = -1$ $\therefore y - 3 = -(x - 4)$ $y = -x + 7$	✓ $m = -1$ ✓ $y = -x + 7$ <b>OR/OF</b>  ✓ $m = -1$ ✓ $y = -x + 7$ (2) <b>[9]</b>



## QUESTION/VRAAG 5

5.1		<p><i>f</i>:</p> <ul style="list-style-type: none"> <li>✓ <i>x</i>-intercepts</li> <li>✓ <i>y</i>-intercept</li> <li>✓ shape</li> <li>✓ TP</li> </ul> <p><i>g</i>:</p> <ul style="list-style-type: none"> <li>✓ <i>x</i>-intercept and <i>y</i>-intercept</li> <li>✓ shape</li> </ul> <p>(6)</p>
5.2	$y = -20\frac{1}{4}$	<ul style="list-style-type: none"> <li>✓✓ <math>y = -20\frac{1}{4} / -\frac{81}{4}</math></li> </ul> <p>(2)</p>
5.3	$-20\frac{1}{4} < k < -14$	<ul style="list-style-type: none"> <li>✓ <math>-20\frac{1}{4} &lt; k</math></li> <li>✓ <math>k &lt; -14</math></li> </ul> <p>(2)</p>
5.4	<p>Reflecting in the <i>x</i>-axis: <math>y = -2x + 14</math></p> $y = -2(x + 7) + 14$ <p>Shifting 7 units to the left: <math>= -2x - 14 + 14</math>  <math>= -2x</math></p>	<ul style="list-style-type: none"> <li>✓ <math>y = -2x + 14</math></li> <li>✓ <math>y = -2x</math></li> </ul> <p>(2) [12]</p>

**QUESTION/VRAAG 6**

6.1	$f : y = b^x$ $f^{-1} : x = b^y$ $y = \log_b x$	✓ interchange $x$ and $y$ ✓ answer (2)
6.2	$y = x$	✓ answer (1)
6.3	P(0; 1)	✓ answer (1)
6.4	T(1; 0)  $y = mx + c$ $y = -x + 1$	✓ coordinates of T   ✓ $y = -x + 1$ (2)
6.5	At point R, PT and OR intersect: $-x + 1 = x$ $2x = 1$ $x = \frac{1}{2}$ $y = \frac{1}{2}$  Substitute $\left(\frac{1}{2}; \frac{1}{2}\right)$ into the equation of $f$ :  $y = b^x$ $\frac{1}{2} = b^{\frac{1}{2}}$ $b = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$  <b>OR/OF</b>  At point R, PT and OR intersect: $-x + 1 = x$ $2x = 1$ $x = \frac{1}{2}$ $y = \frac{1}{2}$  Substitute $\left(\frac{1}{2}; \frac{1}{2}\right)$ into the equation of $g$ :  $y = \log_b x$ $\frac{1}{2} = \log_b \left(\frac{1}{2}\right)$ $b^{\frac{1}{2}} = \frac{1}{2}$ $b = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$	✓ $-x + 1 = x$  ✓ $x = \frac{1}{2}$ ✓ $y = \frac{1}{2}$   ✓ substitution ✓ $b = \frac{1}{4}$      ✓ $-x + 1 = x$  ✓ $x = \frac{1}{2}$ ✓ $y = \frac{1}{2}$      ✓ substitution   ✓ $b = \frac{1}{4}$  (5) <b>[11]</b>

## QUESTION/VRAAG 7

7.1	$A = P(1-i)^n$ $331527 = 500000(1-i)^3$ $(1-i)^3 = \frac{331527}{500000}$ $1-i = \sqrt[3]{\frac{331527}{500000}}$ $i = 0,12800\dots$ $= 12,8\%$	<ul style="list-style-type: none"> <li>✓ substitution of A, P &amp; n in correct formula</li> <li>✓ <math>1-i = \sqrt[3]{\frac{331527}{500000}}</math> or</li> <li><math>1-i = \sqrt[3]{0,663054}</math></li> <li>✓ answer</li> </ul> <p style="text-align: right;">(3)</p>
7.2	$P = \frac{x[1-(1+i)^{-n}]}{i}$ $46\ 000 = \frac{1900 \left[ 1 - \left( 1 + \frac{0,24}{12} \right)^{-n} \right]}{\frac{0,24}{12}}$ $\frac{46}{95} = 1 - \left( 1 + \frac{0,24}{12} \right)^{-n}$ $\left( 1 + \frac{0,24}{12} \right)^{-n} = \frac{49}{95}$ $n = -\log_{\left( 1 + \frac{0,24}{12} \right)} \frac{49}{95} \quad \text{OR/OF} \quad -n \log \left( 1 + \frac{0,24}{12} \right) = \log \frac{49}{95}$ $= 33,43276544\dots \text{ months}$ <p>It will take him 34 months to pay back the loan.</p>	<ul style="list-style-type: none"> <li>✓ <math>i = \frac{0,24}{12} / 0,02 / \frac{1}{50}</math></li> <li>✓ substitution of P, x and i in correct formula</li> <li>✓ 33,43</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(4)</p>
7.3	$F = \frac{x[(1+i)^n - 1]}{i}$ $3500 \left[ \left( 1 + \frac{0,075}{4} \right)^{4 \times 6,5} - 1 \right]$ $= \frac{0,075}{4}$ $= R\ 115\ 902,69$ $A = P(1+i)^n$ $= 115\ 902,69 \left( 1 + \frac{0,075}{4} \right)^{4 \times 3,5}$ $= R\ 150\ 328,12$	<ul style="list-style-type: none"> <li>✓ <math>i = \frac{0,075}{4} / 0,01875</math></li> <li>✓ <math>n = 4 \times 6,5 = 26</math></li> <li>✓ substitution into correct formula</li> <li>✓ 115 902,69</li> <li>✓ substitution into correct formula</li> <li>✓ 150 328,12</li> </ul> <p style="text-align: right;">(6)</p> <p style="text-align: right;"><b>[13]</b></p>



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**QUESTION/VRAAG 8**

8.1	$f(x+h) = 3 - 2(x+h)^2$ $= 3 - 2x^2 - 4xh - 2h^2$ $f(x+h) - f(x) = 3 - 2x^2 - 4xh - 2h^2 - 3 + 2x^2$ $= -4xh - 2h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-4xh - 2h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-4x - 2h)}{h}$ $= \lim_{h \rightarrow 0} (-4x - 2h)$ $= -4x$ <p><b>OR/OF</b></p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{3 - 2(x+h)^2 - (3 - 2x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{3 - 2x^2 - 4xh - 2h^2 - 3 + 2x^2}{h}$ $= \lim_{h \rightarrow 0} \frac{-4xh - 2h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-4x - 2h)}{h}$ $= \lim_{h \rightarrow 0} (-4x - 2h)$ $= -4x$	$\checkmark 3 - 2x^2 - 4xh - 2h^2$ $\checkmark -4xh - 2h^2$ $\checkmark f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $\checkmark \lim_{h \rightarrow 0} (-4x - 2h)$ $\checkmark -4x \quad (5)$ $\checkmark f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $\checkmark 3 - 2x^2 - 4xh - 2h^2$ $\checkmark -4xh - 2h^2$ $\checkmark \lim_{h \rightarrow 0} (-4x - 2h)$ $\checkmark -4x \quad (5)$
8.2	$y = \frac{12x^2 + 2x + 1}{6x}$ $= 2x + \frac{1}{3} + \frac{1}{6x}$ $= 2x + \frac{1}{3} + \frac{1}{6}x^{-1}$ $\frac{dy}{dx} = 2 - \frac{1}{6}x^{-2}$ $= 2 - \frac{1}{6x^2}$	$\checkmark \frac{12x^2}{6x} + \frac{2x}{6x} + \frac{1}{6x}$ $\checkmark \frac{1}{6}x^{-1}$ $\checkmark 2$ $\checkmark -\frac{1}{6}x^{-2}$ $(4)$



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8.3	$y = x^3 + bx^2 + cx - 4$ $y' = 3x^2 + 2bx + c$ $y'' = 6x + 2b$ <p>At point of inflection:</p> $y'' = 6x + 2b = 0$ <p>Substitute <math>x = 2</math>:</p> $6(2) + 2b = 0$ $2b = -12$ $b = -6$ $y = x^3 - 6x^2 + cx - 4$ <p>Substitute (2; 4):</p> $4 = 2^3 - 6(2)^2 + c(2) - 4$ $2c = 24$ $c = 12$ $y = x^3 - 6x^2 + 12x - 4$	$\checkmark y' = 3x^2 + 2bx + c$ $\checkmark y'' = 6x + 2b$ $\checkmark y'' = 0$ $\checkmark \text{sub } x = 2 \text{ into } y'' = 0$ $\checkmark \text{value of } b$ $\checkmark \text{substitute } (2; 4)$ $\checkmark \text{value of } c$ <p style="text-align: right;">(7) [16]</p>
-----	--	---

**QUESTION/VRAAG 9**

9.1	(0 ; 1)	$\checkmark \text{ answer}$ <p style="text-align: right;">(1)</p>
9.2	$f(x) = x^3 - x^2 - x + 1$ $f(x) = x^2(x - 1) - (x - 1)$ $f(x) = (x - 1)(x^2 - 1)$ $f(x) = (x - 1)(x - 1)(x + 1)$ $f(x) = 0$ $(x - 1)(x - 1)(x + 1) = 0$ <p>x-intercepts: (-1; 0); (1; 0)</p> <p><b>OR</b></p> $f(x) = x^3 - x^2 - x + 1$ $f(x) = (x - 1)(x^2 - 1)$ $f(x) = (x - 1)(x - 1)(x + 1)$ $f(x) = 0$ $(x - 1)(x - 1)(x + 1) = 0$ <p>x-intercepts: (-1; 0); (1; 0)</p> <p><b>OR</b></p>	$\checkmark (x - 1)$ $\checkmark (x^2 - 1)$ $\checkmark (x - 1)(x - 1)(x + 1)$ $\checkmark (-1; 0)$ $\checkmark (1; 0)$ <p style="text-align: right;">(5)</p> $\checkmark (x - 1)$ $\checkmark (x^2 - 1)$ $\checkmark (x - 1)(x - 1)(x + 1)$ $\checkmark (-1; 0)$ $\checkmark (1; 0)$ <p style="text-align: right;">(5)</p>

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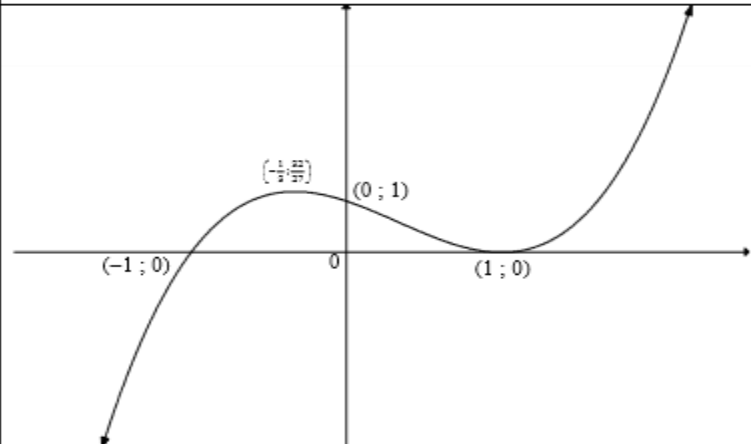
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Mathematics/P1/Wiskunde/V1

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	$f(x) = x^3 - x^2 - x + 1$ $f(x) = (x+1)(x^2 - 2x + 1)$ $f(x) = (x+1)(x-1)(x-1)$ $f(x) = 0$ $(x-1)(x-1)(x+1) = 0$ $x\text{-intercepts: } (-1; 0); (1; 0)$	$\checkmark (x+1)$ $\checkmark (x^2 - 2x + 1)$ $\checkmark (x-1)(x-1)(x+1)$ $\checkmark (-1; 0)$ $\checkmark (1; 0)$	(5)
9.3	$f(x) = x^3 - x^2 - x + 1$ $f'(x) = 3x^2 - 2x - 1$ $f'(x) = 0$ $(3x+1)(x-1) = 0$ $x = -\frac{1}{3} \text{ or } x = 1$ $y = \frac{32}{27} \quad y = 0$ $\left(-\frac{1}{3}; \frac{32}{27}\right) (1; 0)$	$\checkmark f'(x) = 3x^2 - 2x - 1$ $\checkmark f'(x) = 0$ $\checkmark \text{factorisation}$ $\checkmark x \text{ value}$ $\checkmark x \text{ value}$ $\checkmark y = \frac{32}{27}$	(6)
9.4		$\checkmark y\text{- and } x\text{-intercepts}$ $\checkmark \text{shape}$ $\checkmark \text{turning points}$	(3)
9.5	$f'(x) < 0$ $-\frac{1}{3} < x < 1$ <p><b>OR/OF</b></p> $\left(-\frac{1}{3}; 1\right)$	$\checkmark x > -\frac{1}{3}$ $\checkmark x < 1$ $\checkmark \left(-\frac{1}{3}; 1\right)$ $\checkmark 1)$	(2)
			(2)
			[17]



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**QUESTION/VRAAG 10**

10.1	$60 = 2b + 2r + \frac{1}{2}(2\pi r)$ $2b = 60 - 2r - \pi r$ $b = 30 - r - \frac{1}{2}\pi r$	$\checkmark 60 = 2b + 2r + \frac{1}{2}(2\pi r)$ $\checkmark b = 30 - r - \frac{1}{2}\pi r$
10.2	<p>Area = area of rectangle + area of semicircle</p> $A(r) = \text{length} \times \text{breadth} + \frac{1}{2}(\text{area of circle})$ $= (2r)\left(30 - r - \frac{1}{2}\pi r\right) + \frac{1}{2}(\pi r^2)$ $= 60r - 2r^2 - \pi r^2 + \frac{1}{2}\pi r^2$ $= 60r - 2r^2 - \frac{1}{2}\pi r^2$ $= 60r - \left(2 + \frac{1}{2}\pi\right)r^2$ <p>For a maximum,</p> $A'(r) = 0$ $60 - 2\left(2 + \frac{1}{2}\pi\right)r = 0$ $60 - (4 + \pi)r = 0$ $r = \frac{60}{4 + \pi}$ $= 8,40 \text{ m}$	$\checkmark (2r)\left(30 - r - \frac{1}{2}\pi r\right)$ $\checkmark \frac{1}{2}(\pi r^2)$ $\checkmark 60r - 2r^2 - \frac{1}{2}\pi r^2$ $\checkmark A'(r) = 0$ $\checkmark 60 - 2\left(2 + \frac{1}{2}\pi\right)r$ $\checkmark \text{answer}$



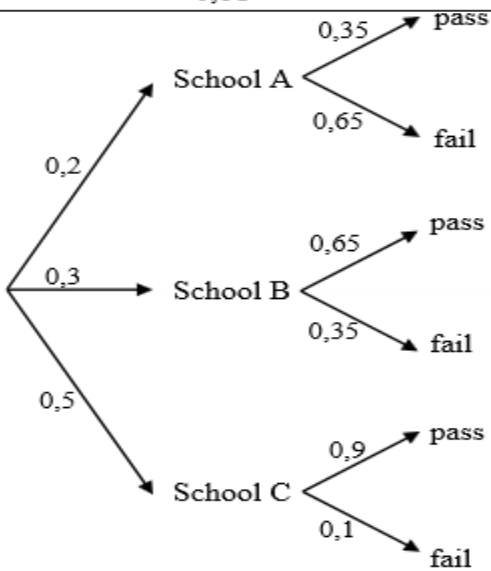
Mathematics/P1/Wiskunde/V1

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**QUESTION/VRAAG 11**

11.1	$8 \times 7 \times 6 \times 5 \times 4$ or $\frac{8!}{3!}$ $= 6720$	$\checkmark 8 \times 7 \times 6 \times 5 \times 4 / \frac{8!}{3!}$ $\checkmark 6720$ (2)
11.2	$P(A \text{ and } B) = P(A) \times P(B)$ $= 0,4 \times 0,35$ $= 0,14$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $= 0,4 + 0,35 - 0,14$ $= 0,61$	$\checkmark 0,4 \times 0,35$ $\checkmark 0,14$ $\checkmark$ substitution $\checkmark$ answer (4)
		
11.3.1	$100\% - 20\%$ or/of $1 - 0,2$ $= 80\%$ or/of $= 0,8$ <b>OR/OF</b> $30\% + 50\% = 80\%$ or/of $0,3 + 0,5 = 0,8$	$\checkmark 100\% - 20\%$ or $1 - 0,2$ $\checkmark 80\%$ or $0,8$ $\checkmark 30\% + 50\%$ or $0,3 + 0,5$ $\checkmark 80\%$ or $0,8$ (2)
11.3.2	$0,3 \times 0,35 = 0,105$ $= 10,5\%$	$\checkmark 0,3$ $\checkmark 0,35$ $\checkmark 0,105 = 10,5\%$ (3)
11.3.3	$(0,2 \times 0,35) + (0,3 \times 0,65) + (0,5 \times 0,9)$ $= 0,715$ $= 71,5\%$	$\checkmark 0,2 \times 0,35$ $\checkmark 0,3 \times 0,65$ $\checkmark 0,5 \times 0,9$ $\checkmark$ answer (4)

**[15]****TOTAL/TOTAAL: 150**

*Mathematics/P1/Wiskunde/V1*

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REPUBLIC OF SOUTH AFRICA****SENIOR CERTIFICATE EXAMINATIONS/  
SENIORSERTIFIKAAT-EKSAMEN****MATHEMATICS P1/WISKUNDE V1****2016****MARKING GUIDELINE (ADDENDUM)****MARKS/PUNTE: 150**

**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking memorandum.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.
- Volgehoue akkuraatheid is op ALLE aspekte van die memorandum van toepassing.

Once a candidate has reached 2 errors related to marks: stop marking.

**QUESTION/VRAAG 1**

1.1.1	<ul style="list-style-type: none"> <li>• incorrect rounding 2/3 – only rounding penalization</li> <li>• use of calculator 2/3 – this is where use of calculator for factors get used</li> <li>• answer in surd form 2/3 ( at least simplified under square root)</li> </ul>
1.1.2	<ul style="list-style-type: none"> <li>• CA mark only if quadratic equation</li> <li>• check answers</li> <li>• if <math>6x^2 - 15 = x + 1</math> breakdown 0/3</li> <li>• both answer must be seen before selection if no factors are shown</li> <li>• if in the context of their incorrect sum, both of the answers are NA, both need to be shown as NA</li> </ul>
1.1.3	$(x + 6)(x - 4) \geq 0$ <ul style="list-style-type: none"> <li>• <math>x \geq 4</math> or / and <math>x \geq -6</math>, award 1/3 marks (factors)</li> <li>• <math>x \leq 4</math> or / and <math>x \leq -6</math>, award 1/3 marks (factors)</li> <li>• <math>-6 \leq x \leq 4</math>, award 1/3 marks (factors)</li> <li>• <math>x \leq -6</math> and <math>x \geq 4</math>, award 2/3 marks</li> <li>• equal is left out: -1</li> </ul> <p>Answer only 3/3</p>
1.2	<p><b>NB:</b> At the second error related to a mark (two skills) – no further marking. If incorrect algebra leads to the equation being linear: max 2/6 These marks will be the changing of the formula and the substitution mark.</p>
1.3.2	<p>CA from 1.3.1</p> <ul style="list-style-type: none"> <li>• If <math>7^x = p</math> can award 1 mark for the concept</li> <li>• If answer <math>x = 2</math> only 2/3</li> </ul>

**QUESTION/VRAAG 2**

2.1.2	<p>CA from 2.1.1</p> <p>Answer only 2/2</p>
2.1.3	<p>Answer only 1/4</p> <ul style="list-style-type: none"> <li>• If <math>n = 7</math> 2/4</li> <li>• Incorrect working that leads to use of logs and an not a natural number max 2/4</li> </ul>
2.2.1	<p>Answer only 2/2</p>
2.2.2	<ul style="list-style-type: none"> <li>• Answer only 1/6</li> </ul>





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	<ul style="list-style-type: none"> <li><math>S_n</math> has to equal 30 500 otherwise a BD</li> </ul>
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**QUESTION/VRAAG 3**

3.2	$n = 5$ only 1/3
3.3	Answer only 1/4

**QUESTION/VRAAG 4**

4.1	$x = 4$ ; $y = 3$ 1/1
4.3	$y = 0$ can be implied
4.4	CA from 4.2 and 4.3

**QUESTION/VRAAG 5**

5.1	Only working out, but no sketch max 4/6 – loose shape mark per graph not sketched
5.2	CA from turning point in 5.1
5.3	CA from sketch (TP to $y$ -intercept)
5.4	Answer only 2/2

**QUESTION/VRAAG 6**

6.1	Answer only 2/2 If answer not in terms of $b$ max 1/2
6.3	Coordinate from not needed

**QUESTION/VRAAG 7****Penalise candidates a maximum of one mark (overall) for notation error in 7.1 and 7.2**

7.1	<ul style="list-style-type: none"> <li>Interchange A and P – breakdown 0/3</li> <li>Wrong formula 0/3</li> <li>Early rounding: answer is 12,93% – 2/3</li> </ul>
7.3	<ul style="list-style-type: none"> <li><math>i</math> and <math>n</math> incorrect – learner can still get the substitution mark 1/6</li> <li>If quarterly is taken as monthly consistently in both parts 5/6</li> </ul> $A = P(1 + i)^n$ <ul style="list-style-type: none"> <li>If 10 years is used: <math>= 115\,902,69 \left(1 + \frac{0,075}{4}\right)^{4 \times 10}</math> 5/6 <math>= R\,243\,667,94</math></li> </ul>

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Mathematics/P1

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**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $(3x-1)(x+4) = 0$  (2)

1.1.2  $2x^2 + 9x - 14 = 0$  (correct to TWO decimal places) (4)

1.1.3  $\sqrt{3-26x} = 3x$  (4)

1.1.4  $(x-1)(x-4) > x+11$  (5)

1.2 Simplify fully:

$$\frac{\sqrt{16x^7} - \sqrt{25x^7}}{\sqrt{x}}$$
 (3)

1.3 Solve simultaneously for  $x$  and  $y$ :

$$xy = 9 \text{ and } x - 2y - 3 = 0$$
 (5)

1.4 Prove that  $x^2 + 2xy + 2y^2$  cannot be negative for  $x, y \in \mathbb{R}$ . (4)

[27]

**QUESTION 2**

2.1 Given the quadratic pattern: 5 ; 10 ; 17 ; 26 ; ...

2.1.1 Write down the next TWO terms of the pattern. (2)

2.1.2 Determine the formula for the  $n^{\text{th}}$  term of the pattern. (4)

2.1.3 Which term of the pattern will have a value of 1 765? (4)

2.2 The first 24 terms of an arithmetic series are:  $35 + 42 + 49 + \dots + 196$ .

Calculate the sum of ALL natural numbers from 35 to 196 that are NOT divisible by 7. (5)

[15]





Mathematics/P1/Wiskunde/V1

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**QUESTION/VRAAG 8****Penalise candidates a maximum of one mark (overall) for notation error in 8.1 and 8.2**

8.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ <p>Notation                      formula                      Formula can be implied</p>
8.2	<ul style="list-style-type: none"> <li>• If function and derivative is mixed but splitting of fractions is evident max 3/4</li> <li>• If they start with differentiation – breakdown 0/4</li> </ul>
8.3	$y'' = 0$ can be implied

**QUESTION/VRAAG 9**

9.2	No working is shown(calculator used) <ul style="list-style-type: none"> <li>• If the cubic becomes a quadratic 2/5</li> <li>• If three brackets 5/5</li> </ul>
9.3	$f'(x) = 0$ cannot be implied $f'(x) = 3x^2 - 2x - 1$ $x = -\left(\frac{-2}{2(3)}\right)$ <b>BE CAREFUL</b> 1/6 for derivative $= \frac{1}{3}$
9.4	If dots only indicated on the graph 1/3 – x and y-intercepts
9.5	Only CA from a cubic graph Each answer gets evaluated independently

**QUESTION/VRAAG 10**

10.2	Derivative equal to zero is an independent mark $A'(r) = 0$ can be implied if working is correct
------	---

**QUESTION/VRAAG 11****If percentages are used – penalize once per question**

11.1	Answer only 2/2 2 or 0 marks
11.3.2	Do not penalize rounding
11.3.3	Do not penalize rounding

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# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## SENIOR CERTIFICATE EXAMINATIONS

**MATHEMATICS P1**

**2018**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages and 1 information sheet.**

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Mathematics/P1

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**QUESTION 3**

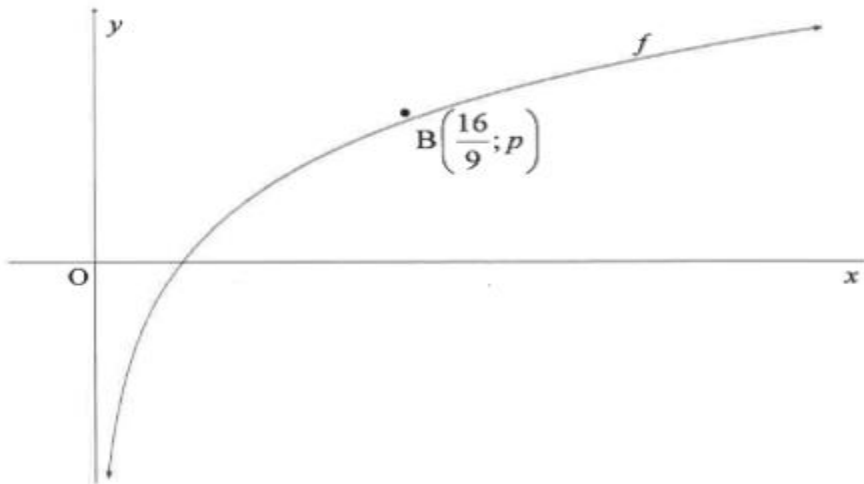
Themba is planning a bicycle trip from Cape Town to Pretoria. The total distance covered during the trip will be 1 500 km. He plans to travel 100 km on the first day. For every following day he plans to cover 94% of the distance he covered the previous day.

- 3.1 What distance will he cover on day 3 of the trip? (2)
- 3.2 On what day of the trip will Themba pass the halfway point? (4)
- 3.3 Themba must cover a certain percentage of the previous day's distance to ensure that he will eventually reach Pretoria. Calculate ALL possible value(s) of this percentage. (3)

[9]

**QUESTION 4**

The graph of  $f(x) = \log_{\frac{4}{3}} x$  is drawn below.  $B\left(\frac{16}{9}; p\right)$  is a point on  $f$ .



- 4.1 For which value(s) of  $x$  is  $\log_{\frac{4}{3}} x \leq 0$ ? (2)
- 4.2 Determine the value of  $p$ , without the use of a calculator. (3)
- 4.3 Write down the equation of the inverse of  $f$  in the form  $y = \dots$  (2)
- 4.4 Write down the range of  $y = f^{-1}(x)$ . (2)
- 4.5 The function  $h(x) = \left(\frac{3}{4}\right)^x$  is obtained after applying two reflections on  $f$ .  
Write down the coordinates of  $B''$ , the image of  $B$  on  $h$ . (2)

[11]

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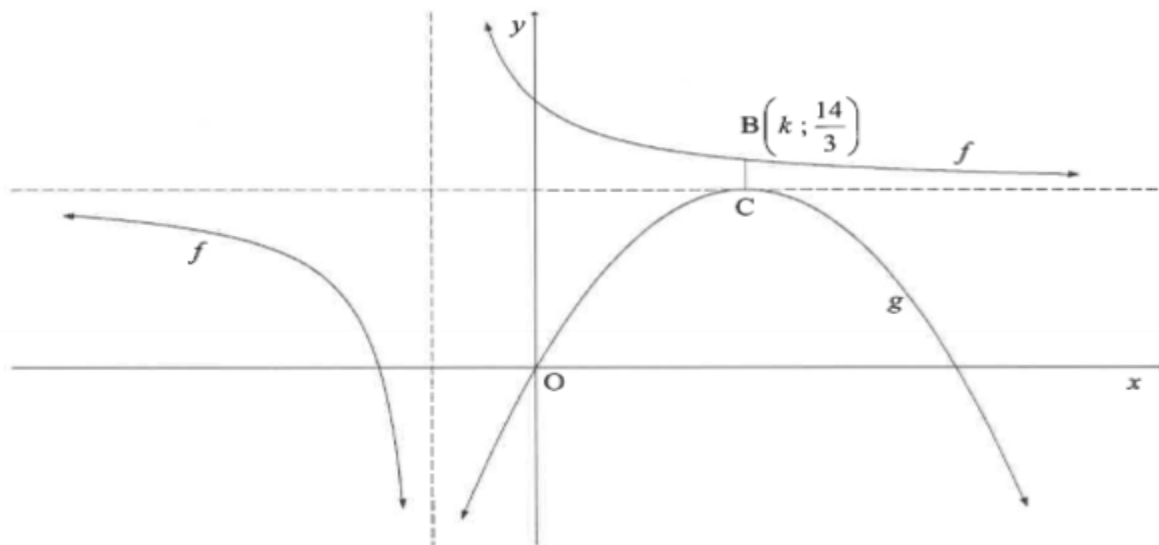
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**QUESTION 5**

The graphs of  $f(x) = \frac{2}{x+1} + 4$  and parabola  $g$  are drawn below.

- C, the turning point of  $g$ , lies on the horizontal asymptote of  $f$ .
- The graph of  $g$  passes through the origin.
- B  $\left(k; \frac{14}{3}\right)$  is a point on  $f$  such that BC is parallel to the  $y$ -axis.



- 5.1 Write down the domain of  $f$ . (2)
- 5.2 Determine the  $x$ -intercept of  $f$ . (2)
- 5.3 Calculate the value of  $k$ . (3)
- 5.4 Write down the coordinates of C. (2)
- 5.5 Determine the equation of  $g$  in the form  $y = a(x + p)^2 + q$ . (3)
- 5.6 For which value(s) of  $x$  will  $\frac{f(x)}{g(x)} \leq 0$ ? (4)
- 5.7 Use the graphs of  $f$  and  $g$  to determine the number of real roots of  $\frac{2}{x} - 5 = -(x - 3)^2 - 5$ . Give reasons for your answer. (4)
- [20]**

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**QUESTION 6**

- 6.1 Calculate how many years it will take for the value of a truck to decrease to 50% of its original value if depreciation is calculated at 15% per annum using the reducing-balance method. (4)
- 6.2 Every month Tshepo deposited R1 500 for his retirement into an account that paid interest at a rate of 9,2% per annum, compounded monthly. Tshepo made his first instalment on his 23<sup>rd</sup> birthday and the last instalment one month before his 55<sup>th</sup> birthday. Calculate how much money he had in the account on his 55<sup>th</sup> birthday. (5)
- 6.3 Abram has R150 000 to invest in two separate accounts. One account pays interest at a rate of 8,4% per annum, compounded quarterly, and the other account at a rate of 9,6% per annum, compounded monthly. How much money should he invest in each account so that he will collect the same amount from each account at the end of 12 years? (6)  
[15]

**QUESTION 7**

- 7.1 Given:  $f(x) = 2 - 3x^2$   
Determine  $f'(x)$  from first principles. (5)
- 7.2 Determine:
- 7.2.1  $D_x[(4x + 5)^2]$  (3)
- 7.2.2  $\frac{dy}{dx}$  if  $y = \sqrt[4]{x} + \frac{x^2 - 8}{x^2}$  (4)  
[12]

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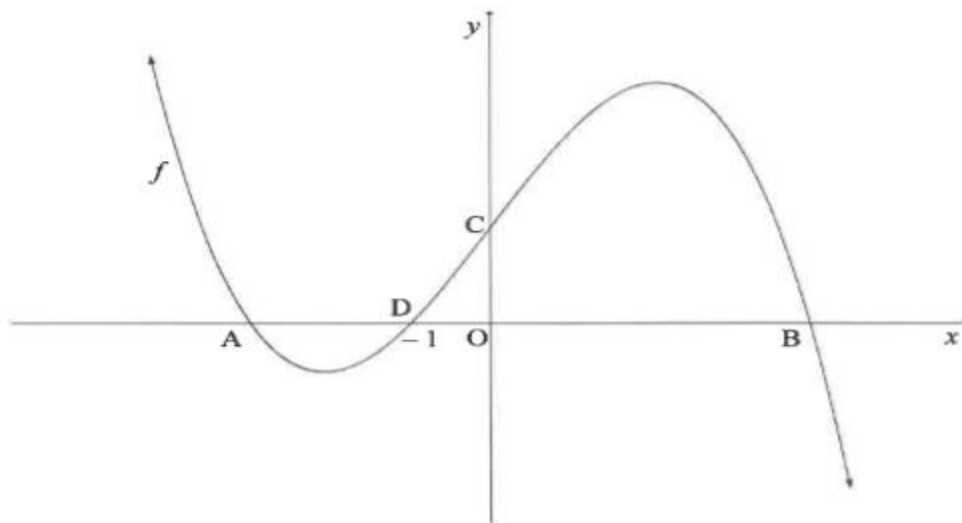
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**QUESTION 8**

The graph of  $f(x) = -x^3 + 13x + 12$  is sketched below.

A, B and D(-1 ; 0) are the  $x$ -intercepts of  $f$ .

C is the  $y$ -intercept of  $f$ .



- 8.1 Write down the coordinates of C. (1)
- 8.2 Calculate the coordinates of A and B. (5)
- 8.3 Determine the point of inflection of  $g$  if it is given that  $g(x) = -f(x)$ . (4)
- 8.4 Calculate the value(s) of  $x$  for which the tangent to  $f$  is parallel to the line  $y = -14x + c$ . (4)
- [14]**

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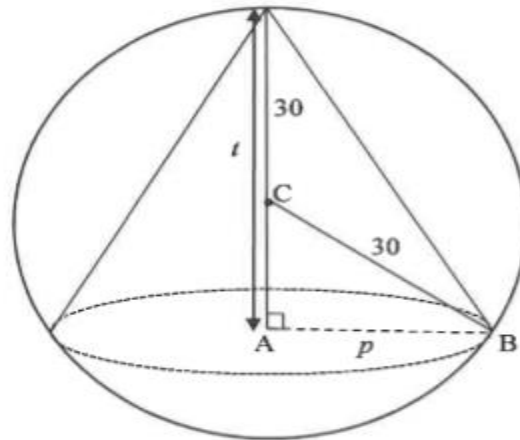
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**QUESTION 9**

A right circular cone with radius  $p$  and height  $t$  is machined (cut out) from a solid sphere (with centre  $C$ ) with a radius of 30 cm, as shown in the sketch.



$$\text{Sphere: } V = \frac{4}{3} \pi r^3$$

$$\text{Cone: } V = \frac{1}{3} \pi r^2 h$$

- 9.1 From the given information, express the following:
- 9.1.1 AC in terms of  $t$ . (1)
- 9.1.2  $p^2$ , in its simplest form, in terms of  $t$ . (3)
- 9.2 Show that the volume of the cone can be written as  $V(t) = 20\pi t^2 - \frac{1}{3}\pi t^3$ . (1)
- 9.3 Calculate the value of  $t$  for which the volume of the cone will be a maximum. (3)
- 9.4 What percentage of the sphere was used to obtain this cone having maximum volume? (4)
- [12]**

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**QUESTION 10**

Ben, Nhlanhla, Owen, Derick and 6 other athletes take part in a 100 m race. Each athlete will be allocated a lane in which to run. The athletic track has 10 lanes.

- 10.1 In how many different ways can all the athletes be allocated a lane? (2)
- 10.2 Four athletes taking part in the event insist on being placed in lanes next to each other. In how many different ways can the lanes be allocated to the athletes now? (3)
- 10.3 If lanes are randomly allocated to athletes, determine the probability that Ben will be placed in lane 1, Nhlanhla in lane 3, Owen in lane 5 and Derick in lane 7. (2)
- [7]

**QUESTION 11**

A survey on their preference of exercise was conducted among 140 people in two age groups. The information is summarised below.

AGE	TENNIS	RUNNING	GYM	TOTAL
35 years and younger	$a$	28	$c$	80
Older than 35 years	$b$	21	$d$	60
	21	49	70	140

- 11.1 If it is given that preferring to play tennis and age are independent of each other, determine the value of  $a$ . (3)
- 11.2 If it is given that  $a = 12$ , determine the probability that a randomly selected person prefers going to the gym or is in the age group 35 years and younger. (5)
- [8]

**TOTAL: 150**

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# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## **SENIOR CERTIFICATE EXAMINATIONS** ***SENIORSERTIFIKAAT-EKSAMEN***

**MATHEMATICS P1/*WISKUNDE V1***

**2018**

**MARKING GUIDELINES/*NASIENRIGLYNE***

**MARKS: 150**  
***PUNTE: 150***

**These marking guidelines consist of 19 pages.**  
***Hierdie nasienriglyne bestaan uit 19 bladsye.***



**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking guidelines.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$(3x-1)(x+4)=0$ $x = \frac{1}{3} \text{ or } x = -4$	✓ $x = \frac{1}{3}$ ✓ $x = -4$ (2)
1.1.2	$2x^2 + 9x - 14 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-9 \pm \sqrt{9^2 - 4(2)(-14)}}{2(2)}$ $= \frac{-9 \pm \sqrt{193}}{4}$ $x = 1,22 \text{ or } x = -5,72$ <p><b>OR/OF</b></p> $x^2 + \frac{9}{2}x + \frac{81}{16} = 7 + \frac{81}{16}$ $\left(x + \frac{9}{4}\right)^2 = \frac{193}{16}$ $x + \frac{9}{4} = \pm \frac{\sqrt{193}}{4}$ $x = \frac{-9 \pm \sqrt{193}}{4}$ $x = 1,22 \text{ or } x = -5,72$	✓ substitution into correct formula ✓ simplification ✓ $x = 1,22$ ✓ $x = -5,72$ (4)
1.1.3	$\sqrt{3-26x} = 3x$ $3-26x = 9x^2$ $9x^2 + 26x - 3 = 0$ $(9x-1)(x+3) = 0$ $x = \frac{1}{9} \text{ or } x = -3$ <p>N/A</p>	✓ $3-26x = 9x^2$ ✓ standard form ✓ factors ✓ answer with selection (4)

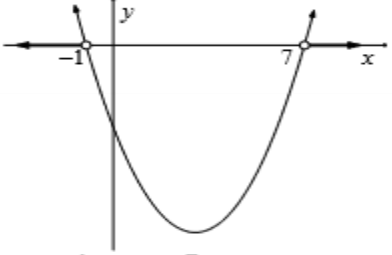
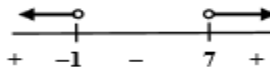


Mathematics P1/Wiskunde V1

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1.1.4	$(x-1)(x-4) > x+11$ $x^2 - 5x + 4 > x + 11$ $x^2 - 6x - 7 > 0$ $(x-7)(x+1) > 0$  <p style="text-align: center;">OR</p>  <p><math>x &lt; -1</math> or <math>x &gt; 7</math></p>	<ul style="list-style-type: none"> <li>✓ <math>x^2 - 5x + 4</math></li> <li>✓ standard form</li> <li>✓ factors</li> </ul> <p>✓✓ <math>x &lt; -1</math> or <math>x &gt; 7</math></p> <p style="text-align: right;">(5)</p>
1.2	$\frac{4\sqrt{x^7} - 5\sqrt{x^7}}{\sqrt{x}}$ $= \frac{-\sqrt{x^7}}{\sqrt{x}}$ $= \frac{-x^{\frac{7}{2}}}{x^{\frac{1}{2}}}$ $= -x^3$ <p><b>OR/OF</b></p> $\frac{\sqrt{x^7}(4-5)}{\sqrt{x}}$ $= \sqrt{x^6}(-1)$ $= -x^3$ <p><b>OR/OF</b></p> $\frac{(16x^7)^{\frac{1}{2}} - (25x^7)^{\frac{1}{2}}}{x^{\frac{1}{2}}}$ $= \frac{4x^{\frac{7}{2}} - 5x^{\frac{7}{2}}}{x^{\frac{1}{2}}}$ $= \frac{-x^{\frac{7}{2}}}{x^{\frac{1}{2}}}$ $= -x^3$	<ul style="list-style-type: none"> <li>✓ <math>4\sqrt{x^7} - 5\sqrt{x^7}</math></li> <li>✓ <math>-\sqrt{x^7}</math></li> </ul> <p>✓ <math>-x^3</math></p> <p style="text-align: right;">(3)</p> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ <math>\sqrt{x^7}(4-5)</math></li> <li>✓ <math>\sqrt{x^6}(-1)</math></li> <li>✓ <math>-x^3</math></li> </ul> <p style="text-align: right;">(3)</p> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ <math>\frac{4x^{\frac{7}{2}} - 5x^{\frac{7}{2}}}{x^{\frac{1}{2}}}</math></li> <li>✓ <math>-x^{\frac{7}{2}}</math></li> <li>✓ <math>-x^3</math></li> </ul> <p style="text-align: right;">(3)</p>

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Mathematics P1/Wiskunde V1

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1.3	$x - 2y - 3 = 0$ $x = 2y + 3 \dots\dots\dots(1)$ $xy = 9 \dots\dots\dots(2)$ <p>Substitute (1) into (2)</p> $(2y + 3)y = 9$ $2y^2 + 3y = 9$ $2y^2 + 3y - 9 = 0$ $(2y - 3)(y + 3) = 0$ $y = \frac{3}{2} \text{ or } y = -3$ $x = 6 \text{ or } x = -3$ <p><b>OR/OF</b></p> $y = \frac{x-3}{2} \dots\dots\dots(1)$ $xy = 9 \dots\dots\dots(2)$ <p>Substitute (1) into (2)</p> $x\left(\frac{x-3}{2}\right) = 9$ $x^2 - 3x = 18$ $x^2 - 3x - 18 = 0$ $(x - 6)(x + 3) = 0$ $x = 6 \text{ or } x = -3$ $y = \frac{3}{2} \text{ or } y = -3$ <p><b>OR/OF</b></p> $x - 2y - 3 = 0$ $x = 2y + 3 \dots\dots\dots(1)$ $y = \frac{9}{x} \dots\dots\dots(2)$ <p>Substitute (2) into (1)</p> $x = 2\left(\frac{9}{x}\right) + 3$ $x^2 - 2(9) - 3x = 0$ $x^2 - 3x - 18 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-3 \pm \sqrt{(-3)^2 - 4(1)(-18)}}{2(1)}$ $= \frac{-3 \pm \sqrt{81}}{2}$ $x = 6 \text{ or } x = -3$ $y = \frac{9}{6} = 1,5 \text{ or } y = \frac{9}{-3} = -3$	<p>✓ <math>x = 2y + 3</math></p> <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ y-values</p> <p>✓ x-values (5)</p> <p><b>OR/OF</b></p> <p>✓ <math>y = \frac{x-3}{2}</math></p> <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ x-values</p> <p>✓ y-values (5)</p> <p><b>OR/OF</b></p> <p>✓ <math>y = \frac{9}{x}</math></p> <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ x-values</p> <p>✓ y-values (5)</p>
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Mathematics P1/*Wiskunde V1*

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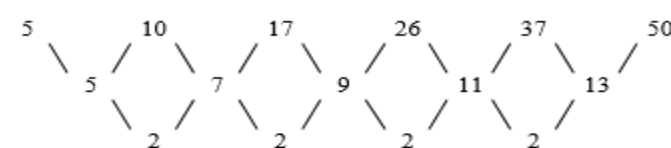
1.4	$x^2 + 2xy + 2y^2$ $= x^2 + 2xy + y^2 + y^2$ $= (x + y)^2 + y^2$ $(x + y)^2 \geq 0 \text{ and } y^2 \geq 0$ <p>Therefore <math>(x + y)^2 + y^2 \geq 0</math></p>	<ul style="list-style-type: none"> <li>✓ <math>x^2 + 2xy + y^2 + y^2</math></li> <li>✓ <math>(x + y)^2</math></li> <li>✓ <math>(x + y)^2 \geq 0 \text{ and } y^2 \geq 0</math></li> <li>✓ <math>(x + y)^2 + y^2 \geq 0</math></li> </ul> <p style="text-align: right;">(4) [27]</p>
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KEEP WORKING HARD, YOU WILL BE GREATFUL FOR YOUR EFFORT AT THE END.



**QUESTION/VRAAG 2**

2.1.1	 <p>37; 50</p>	<ul style="list-style-type: none"> <li>✓ 37</li> <li>✓ 50</li> </ul> <p style="text-align: right;">(2)</p>
2.1.2	$a = \frac{\text{second difference}}{2} = \frac{2}{2} = 1$ $3a + b = 5$ $3 + b = 5$ $b = 2$ $a + b + c = 5$ $1 + 2 + c = 5$ $c = 2$ $T_n = an^2 + bn + c$ $= n^2 + 2n + 2$	<ul style="list-style-type: none"> <li>✓ second difference of 2</li> <li>✓ <math>a = 1</math></li>   <li>✓ <math>b = 2</math></li>   <li>✓ <math>c = 2</math></li> </ul> <p style="text-align: right;">(4)</p>
2.1.3	$n^2 + 2n + 2 = 1765$ $n^2 + 2n - 1763 = 0$ $(n + 43)(n - 41) = 0$ $n = -43 \text{ or } n = 41$ <p style="text-align: center;">N/A</p> <p><b>OR/OF</b></p> $n^2 + 2n + 2 = 1765$ $n^2 + 2n - 1763 = 0$ $n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-2 \pm \sqrt{2^2 - 4(1)(-1763)}}{2(1)}$ $= \frac{-2 \pm \sqrt{7056}}{2}$ $n = -43 \text{ or } n = 41$ <p style="text-align: center;">N/A</p>	<ul style="list-style-type: none"> <li>✓ equating <math>T_n</math> to 1765</li> <li>✓ standard form</li> <li>✓ factors</li>   <li>✓ answer with rejection</li> </ul> <p style="text-align: right;">(4)</p> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ equating <math>T_n</math> to 1765</li> <li>✓ standard form</li>   <li>✓ subt in correct formula</li>   <li>✓ answer with rejection</li> </ul> <p style="text-align: right;">(4)</p>





## QUESTION/VRAAG 3

3.1	$r = 0,94; a = 100$ $T_3 = ar^2$ $= 100(0,94)^2$ $= 88,36 \text{ km}$	✓ $r = 0,94$  ✓ answer (2)
3.2	$S_n = \frac{a(r^n - 1)}{r - 1}$ $750 = \frac{100(0,94^n - 1)}{0,94 - 1}$ $\frac{750(-0,06)}{100} = 0,94^n - 1$ $0,94^n = 1 - \frac{9}{20} \quad \text{or} \quad \left(\frac{47}{50}\right)^n = \frac{11}{20}$ $0,94^n = 0,55$ $n = \frac{\log 0,55}{\log 0,94}$ $= 9,66$ <p>He will pass the halfway point on the 10<sup>th</sup> day  <i>Hy sal die halfpadmerk verbysteeek op die 10<sup>de</sup> dag</i></p>	✓ substitution into correct formula  ✓ $0,94^n = 0,55$ ✓ use of logarithms  ✓ answer (4)
3.3	$S_\infty = \frac{a}{1 - r}$ $1500 < \frac{100}{1 - r}$ $1 - r < \frac{100}{1500}$ $r > \frac{14}{15} \quad \text{or} \quad 93,33\%$	✓ use of $S_\infty$ formula  ✓ substitution  ✓ answer (3)

[9]





## QUESTION/VRAAG 4

4.1	$0 < x \leq 1$ or $(0 ; 1]$	✓✓ answer (2)
4.2	$p = \log_4 \frac{16}{3}$ $\left(\frac{4}{3}\right)^p = \frac{16}{9}$ $\left(\frac{4}{3}\right)^p = \left(\frac{4}{3}\right)^2$ $p = 2$	✓ substitution  ✓ $\left(\frac{4}{3}\right)^2$ ✓ answer (3)
4.3	$f : y = \log_{\frac{4}{3}} x$ $f^{-1} : x = \log_{\frac{4}{3}} y$ $y = \left(\frac{4}{3}\right)^x$	✓ $x = \log_{\frac{4}{3}} y$ ✓ $y = \left(\frac{4}{3}\right)^x$ (2)
4.4	$y > 0$ or $y \in (0; \infty)$	✓✓ answer (2)
4.5	$\left(-2; \frac{16}{9}\right)$	✓ -2 ✓ $\frac{16}{9}$ (2) <b>[11]</b>





## QUESTION/VRAAG 5

5.1	$x \in R; x \neq -1$	✓ $x \in R$ ✓ $x \neq -1$ (2)
5.2	$x$ -intercept of $f$ : $0 = \frac{2}{x+1} + 4$ $\frac{2}{x+1} = -4$ $2 = -4x - 4$ $4x = -6$ $x = -\frac{3}{2}$	✓ equating to 0       ✓ answer (2)
5.3	$y = \frac{2}{x+1} + 4$ $\frac{14}{3} = \frac{2}{k+1} + 4$ $\frac{2}{k+1} = \frac{14}{3} - 4$ $\frac{2}{k+1} = \frac{2}{3}$ $2k + 2 = 6$ $k + 1 = 3$ $k = 2$	✓ substitution     ✓ simplification   ✓ answer (3)
5.4	$C(2; 4)$	✓ 2 ✓ 4 (2)
5.5	$y = a(x+p)^2 + q$ $= a(x-2)^2 + 4$ Substitute $(0; 0)$ : $0 = a(0-2)^2 + 4$ $0 = 4a + 4$ $a = -1$ $y = -(x-2)^2 + 4$	✓ $a(x-2)^2 + 4$  ✓ Substitute $(0; 0)$   ✓ $a = -1$ (3)
5.6	$x \leq -\frac{3}{2}$ or $-1 < x < 0$ or $x > 4$	✓ $x \leq -\frac{3}{2}$ ✓✓ $-1 < x < 0$ ✓ $x > 4$ (4)





Mathematics P1/Wiskunde V1

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5.7	<p><math>\frac{2}{x} - 5</math>: <math>f</math> shifted 1 unit to the right and 9 units down.  <i>f is 1 eenheid na regs en 9 eenhede afgeskuif.</i></p> <p><math>-(x-3)^2 - 5</math>: <math>g</math> shifted 1 unit to the right and 9 units down.  <i>g is 1 eenheid na regs en 9 eenhede afgeskuif.</i></p> <p>Therefore the shift of both graphs took place relative to each other/<i>Dus het die skuif van die grafieke relatief tot mekaar plaasgevind.</i></p> <p>They only intersect in the third quadrant.  <i>Hulle sny mekaar slegs in die derde kwadrant.</i></p> <p>Therefore there is only one point of intersection.  <i>Daar is dus slegs een snypunt.</i></p>	<ul style="list-style-type: none"> <li>✓ both shifted 1 unit to the right</li> <li>✓ both shifted 9 units down</li> <li>✓ relative shift</li> <li>✓ one real root</li> </ul> <p style="text-align: right;">(4) [20]</p>
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## QUESTION/VRAAG 6

6.1	$A = P(1 - i)^n$ $0,5P = P(1 - 0,15)^n$ $(1 - 0,15)^n = 0,5$ $(0,85)^n = 0,5$ $n = \frac{\log 0,5}{\log 0,85} \text{ or } \log_{0,85} 0,5$ $= 4,27 \text{ years}$	<ul style="list-style-type: none"> <li>✓ <math>A = 0,5P</math></li> <li>✓ substitution into correct formula</li> <li>✓ use of logs</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(4)</p>
6.2	<p>In account one month before his 55<sup>th</sup> birthday:  <i>In rekening een maand voor sy 55<sup>ste</sup> verjaardag:</i></p> $F = \frac{x[(1 + i)^n - 1]}{i}$ $= \frac{1500 \left[ \left(1 + \frac{0,092}{12}\right)^{384} - 1 \right]}{\frac{0,092}{12}}$ $= 3\,478\,620,49$ <p>In account on his 55<sup>th</sup> birthday:  <i>In rekening op sy 55<sup>ste</sup> verjaardag:</i></p> $A = P(1 + i)^n$ $= 3\,478\,620,49 \left(1 + \frac{0,092}{12}\right)^1$ $= R3\,505\,289,91$ <p><b>OR/OF</b></p> $F = \frac{x(1 + i)[(1 + i)^n - 1]}{i}$ $= \frac{1500 \left(1 + \frac{0,092}{12}\right) \left[ \left(1 + \frac{0,092}{12}\right)^{384} - 1 \right]}{\frac{0,092}{12}}$ $= R3\,505\,289,91$	<ul style="list-style-type: none"> <li>✓ value of <math>i</math></li> <li>✓ value of <math>n</math></li> <li>✓ substitution into correct formula</li> </ul> <ul style="list-style-type: none"> <li>✓ adding last month's interest</li> <li>✓ answer</li> </ul> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ value of <math>i</math></li> <li>✓ value of <math>n</math></li> <li>✓ substitution into correct formula</li> <li>✓ adding last month's interest</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(5)</p>



<p>6.3</p> <p>Invest R<math>x</math> in account A paying 8,4% p.a. compounded quarterly./Belê R<math>x</math> in rekening A wat 8,4% p.a rente betaal, kwartaalliks saamgestel.</p> $A = P(1+i)^n$ $= x\left(1 + \frac{0,084}{4}\right)^{48}$ $= 2,711662406x$ <p>Invest (R150 000 – <math>x</math>) in Account B paying 9,6% compounded monthly./Belê (R150 000 – <math>x</math> in rekening A wat 9,6% p.a rente betaal, maandeliks saamgestel.</p> <p>After 12 years, the amounts are equal:</p> $x\left(1 + \frac{0,084}{4}\right)^{48} = (150\,000 - x)\left(1 + \frac{0,096}{12}\right)^{144}$ $2,711662406x = 3,150044027(150\,000 - x)$ $2,711662406x = 472506,6041 - 3,150044027x$ $5,861706433x = 472506,6041$ $x = R80\,609,05$ <p>Invest R80 609 in Account A and R150 000 – R80 609,05 = R69 390,95 in Account B</p> <p><b>OR/OF</b></p> <p>a = amount invested at 8,4% p.a. compounded quarterly bedrag belê teen 8,4% p.a. kwartaalliks saamgestel</p> <p>b = amount invested at 9,6% p.a. compounded monthly bedrag belê teen 9,6% p.a. maandeliks saamgestel</p> $a + b = 150\,000$ $a = 150\,000 - b$ $(150\,000 - b)\left(1 + \frac{0,084}{4}\right)^{48} = b\left(1 + \frac{0,096}{12}\right)^{144}$ $150\,000\left(1 + \frac{0,084}{4}\right)^{48} = b\left[\left(1 + \frac{0,096}{12}\right)^{144} + \left(1 + \frac{0,084}{4}\right)^{48}\right]$ $b = R69\,390,95$ $a = R80\,609,05$	$\checkmark \left(1 + \frac{0,084}{4}\right)^{48}$  $\checkmark \checkmark$ $(150\,000 - x)\left(1 + \frac{0,096}{12}\right)^{144}$ $\checkmark \text{ equation}$  $\checkmark R80\,609,05$  $\checkmark R69\,390,95$  <p>(6)</p> <p><b>OR/OF</b></p> $\checkmark \left(1 + \frac{0,096}{12}\right)^{144}$ $\checkmark \checkmark (150\,000 - b)\left(1 + \frac{0,084}{4}\right)^{48}$ $\checkmark \text{ equation}$  $\checkmark b$ $\checkmark a$  <p>(6)</p> <p>[15]</p>
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**QUESTION/VRAAG 7****Penalize 1 mark for incorrect notation in the whole question.**

7.1	$f(x+h) = 2 - 3(x+h)^2$ $= 2 - 3(x^2 + 2xh + h^2)$ $= 2 - 3x^2 - 6xh - 3h^2$ $f(x+h) - f(x) = 2 - 3x^2 - 6xh - 3h^2 - (2 - 3x^2)$ $= -6xh - 3h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-6xh - 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-6x - 3h)}{h}$ $= \lim_{h \rightarrow 0} (-6x - 3h)$ $= -6x$ <p><b>OR/OF</b></p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2 - 3(x+h)^2 - (2 - 3x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{2 - 3x^2 - 6xh - 3h^2 - (2 - 3x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{-6xh - 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-6x - 3h)}{h}$ $= \lim_{h \rightarrow 0} (-6x - 3h)$ $= -6x$	$\checkmark 2 - 3x^2 - 6xh - 3h^2$ $\checkmark -6xh - 3h^2$ $\checkmark \text{subst. into formula}$ $\checkmark \text{factorisation}$ $\checkmark \text{answer} \quad (5)$ <p><b>OR/OF</b></p> $\checkmark \text{subst. into formula}$ $\checkmark \text{simplification}$ $\checkmark -6xh - 3h^2$ $\checkmark \text{common factor}$ $\checkmark \text{answer} \quad (5)$
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Mathematics P1/*Wiskunde V1*

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7.2.1	$D_x [(4x+5)^2]$ $= D_x (16x^2 + 40x + 25)$ $= 32x + 40$	$\checkmark 16x^2 + 40x + 25$ $\checkmark 32x$ $\checkmark + 40$	(3)
7.2.2	$y = \sqrt[4]{x} + \frac{x^2 - 8}{x^2}$ $y = x^{\frac{1}{4}} + 1 - 8x^{-2}$ $\frac{dy}{dx} = \frac{1}{4}x^{-\frac{3}{4}} + 16x^{-3}$	$\checkmark x^{\frac{1}{4}}$ $\checkmark 1 - 8x^{-2}$ $\checkmark \frac{1}{4}x^{-\frac{3}{4}}$ $\checkmark 16x^{-3}$	(4) [12]





## QUESTION/VRAAG 8

8.1	$C(0;12)$	✓ $C(0;12)$ (1)
8.2	$-x^3 + 13x + 12 = 0$ $x^3 - 13x - 12 = 0$ $(x+1)(x^2 - x - 12) = 0$ $(x+1)(x-4)(x+3) = 0$ A(-3;0) B(4;0)	✓ $f(x) = 0$  ✓ $(x+1)$ ✓ $(x^2 - x - 12)$  ✓ $x = -3$ or 4 ✓ clearly indicating A and B (5)
8.3	$f'(x) = -3x^2 + 13$ $f''(x) = -6x$ $-6x = 0$ $x = 0$ For $f(x)$ , point of inflection will be at (0 ; 12). Vir $f(x)$ , sal buigpunt wees by (0 ; 12) For $g(x)$ , point of inflection will be at (0 ; -12). Vir $g(x)$ , sal buigpunt wees by (0 ; -12).  <b>OR/OF</b>  $g(x) = x^3 - 13x - 12$ $g'(x) = 3x^2 - 13$ $g''(x) = 6x$ $6x = 0$ $x = 0$ (0; -12)  <b>OR/OF</b> $f'(x) = -3x^2 + 13$ TP's where $-3x^2 + 13 = 0$ $x^2 = \frac{13}{3}$ $x = \pm \sqrt{\frac{13}{3}}$ $= \pm 2,08$ x-value of point of inflection: $\frac{-2,08 + 2,08}{2} = 0$ For $f(x)$ , point of inflection will be at (0 ; 12). Vir $f(x)$ , sal buigpunt wees by (0 ; 12) For $g(x)$ , point of inflection will be at (0 ; -12). Vir $g(x)$ , sal buigpunt wees by (0 ; -12).	✓ $f'(x) = -3x^2 + 13$ ✓ $f''(x) = -6x$  ✓ equating to zero  ✓ (0; -12) (4)  <b>OF/OR</b>  ✓ $g'(x) = 3x^2 - 13$ ✓ $g''(x) = 6x$ ✓ equating to zero  ✓ (0; -12) (4)  <b>OR/OF</b> ✓ $f'(x) = -3x^2 + 13$  ✓ $-3x^2 + 13 = 0$  ✓ x-values of TPs  ✓ (0; -12) (4)



Mathematics P1/*Wiskunde V1*

17

DBE/2018

SCE/SSE – Marking Guidelines/*Nasienriglyne*

8.4	$f'(x) = -3x^2 + 13$ $-3x^2 + 13 = -14$ $-3x^2 = -27$ $x^2 = 9$ $x = 3 \text{ or } x = -3$	<ul style="list-style-type: none"><li>✓ equating derivative to <math>-14</math></li><li>✓ simplification</li> <li>✓✓ answers <span style="float: right;">(4)</span></li><li style="text-align: right;"><b>[14]</b></li></ul>
-----	--	--



**QUESTION/VRAAG 9**

9.1.1	$AC = t - 30$	✓ answer (1)
9.1.2	$30^2 = (t - 30)^2 + p^2$ [Pythagoras] $p^2 = 900 - (t - 30)^2$ $p^2 = 900 - (t^2 - 60t + 900)$ $p^2 = 900 - t^2 + 60t - 900$ $p^2 = 60t - t^2$	✓ $p^2 = 900 - (t - 30)^2$ ✓ $(t^2 - 60t + 900)$ ✓ $p^2 = 60t - t^2$ (3)
9.2	$V(t) = \frac{1}{3} \pi r^2 t$ $= \frac{1}{3} \pi (60t - t^2) t$ $= 20\pi t^2 - \frac{1}{3} \pi t^3$	✓ substitution (1)
9.3	$V(t) = 20\pi t^2 - \frac{1}{3} \pi t^3$ $V'(t) = 40\pi t - \pi t^2$ $40\pi t - \pi t^2 = 0$ $t(40\pi - t\pi) = 0$ $t = 0$ OR $t = 40$ cm N/A	✓ $40\pi t$ ✓ $-\pi t^2$ ✓ answer with selection (3)
9.4	Volume of cone/keël $= 20(\pi)(40)^2 - \frac{1}{3} \pi (40)^3$ $= 10\,666,67\pi$ or $33510,33211$  Volume of sphere/sfeer $= \frac{4}{3} \pi r^3$ $= \frac{4}{3} \pi (30)^3$ $= 36000\pi$ or $113097,3355$  $\frac{10\,666,67\pi}{36000\pi}$ $= 0,296296$ $\approx 29,63\%$	✓ volume of cone  ✓ volume of sphere  ✓ $\frac{10\,666,67\pi}{36000\pi}$ ✓ % cut out (4)

**[12]**



## QUESTION/VRAAG 10

10.1	$10!$ $= 3\,628\,800$	✓ $10!$ ✓ answer (2)
10.2	$4! \times 7!$ $= 120\,960$  <b>OR/OF</b> $4! \times 6! \times 7$ $= 120\,960$	✓ $4!$ ✓ $7!$ ✓ $4! \times 7!$ or 120 960 (3)  <b>OR/OF</b> ✓ $4!$ ✓ $6! \times 7$ ✓ $4! \times 6! \times 7$ or 120 960 (3)
10.3	$\frac{6!}{10!}$ $= \frac{1}{5040}$ or 0,000198	✓ $6!$ ✓ $\frac{6!}{10!}$ or $\frac{1}{5040}$ or 0,000198 (2) <b>[7]</b>

## QUESTION/VRAAG 11

11.1	$P(\text{tennis}) \times P(\leq 35 \text{ years}) = P(\text{tennis and } \leq 35 \text{ years})$ $\frac{21}{140} \times \frac{80}{140} = \frac{a}{140}$ $a = 12$	✓ statement ✓ substitution ✓ answer (3)
11.2	$P(\text{gym or } \leq 35 \text{ years})$ $= P(\text{gym}) + P(\leq 35 \text{ years}) - P(\text{gym and } \leq 35 \text{ years})$ $= \frac{70}{140} + \frac{80}{140} - \frac{40}{140}$ $= \frac{110}{140}$ $= \frac{11}{14}$ or 0,79	✓ statement ✓ $\frac{70}{140}$ ✓ $\frac{80}{140}$ ✓ $\frac{40}{140}$ ✓ $\frac{110}{140}$ or $\frac{11}{14}$ or 0,79 (5) <b>[8]</b>

TOTAL/TOTAAL: 150





# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## **SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS**

**MATHEMATICS P1**

**2019**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 8 pages and 1 information sheet.**

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Mathematics/P1

3  
SC/NSC

DBE/2019

**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 - 5x - 6 = 0$  (2)

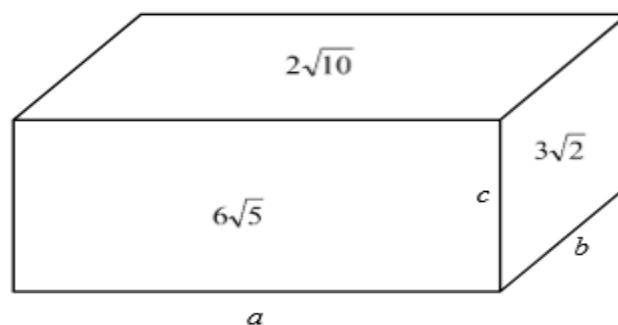
1.1.2  $(3x - 1)(x - 4) = 16$  (correct to TWO decimal places) (4)

1.1.3  $4x - x^2 \geq 0$  (3)

1.1.4  $\frac{5^{2x} - 1}{5^x + 1} = 4$  (3)

1.2 Solve simultaneously for  $x$  and  $y$ :

$x + 3y = 2$  and  $x^2 + 4xy - 5 = 0$  (5)

1.3 A rectangular box has dimensions  $a$ ,  $b$  and  $c$ . The area of the surfaces are  $2\sqrt{10}$ ,  $3\sqrt{2}$  and  $6\sqrt{5}$ , as shown in the diagram below.Calculate, **without using a calculator**, the volume of the rectangular box. (5)  
[22]**QUESTION 2**

2.1 The first FOUR terms of a quadratic pattern are: 15 ; 29 ; 41 ; 51

2.1.1 Write down the value of the 5<sup>th</sup> term. (1)2.1.2 Determine an expression for the  $n^{\text{th}}$  term of the pattern in the form  $T_n = an^2 + bn + c$ . (4)2.1.3 Determine the value of  $T_{27}$  (2)

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Mathematics/P1

4  
SC/NSC

DBE/2019

- 2.2 Given a geometric sequence:  $36 ; -18 ; 9 ; \dots$
- 2.2.1 Determine the value of  $r$ , the common ratio. (1)
- 2.2.2 Calculate  $n$  if  $T_n = \frac{9}{4\,096}$  (3)
- 2.2.3 Calculate  $S_\infty$  (2)
- 2.2.4 Calculate the value of  $\frac{T_1 + T_3 + T_5 + T_7 + \dots + T_{499}}{T_2 + T_4 + T_6 + T_8 + \dots + T_{500}}$  (4)
- [17]

**QUESTION 3**

- 3.1 The first three terms of an arithmetic sequence are:  $2p + 3 ; p + 6$  and  $p - 2$ .
- 3.1.1 Show that  $p = 11$ . (2)
- 3.1.2 Calculate the smallest value of  $n$  for which  $T_n < -55$ . (3)
- 3.2 Given that  $\sum_{k=1}^6 (x - 3k) = \sum_{k=1}^9 (x - 3k)$ , prove that  $\sum_{k=1}^{15} (x - 3k) = 0$ . (5)
- [10]

**QUESTION 4**

Given the exponential function:  $g(x) = \left(\frac{1}{2}\right)^x$

- 4.1 Write down the range of  $g$ . (1)
- 4.2 Determine the equation of  $g^{-1}$  in the form  $y = \dots$  (2)
- 4.3 Is  $g^{-1}$  a function? Justify your answer. (2)
- 4.4 The point  $M(a ; 2)$  lies on  $g^{-1}$ .
- 4.4.1 Calculate the value of  $a$ . (2)
- 4.4.2  $M'$ , the image of  $M$ , lies on  $g$ . Write down the coordinates of  $M'$ . (1)
- 4.5 If  $h(x) = g(x + 3) + 2$ , write down the coordinates of the image of  $M'$  on  $h$ . (3)
- [11]

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Mathematics/P1

5  
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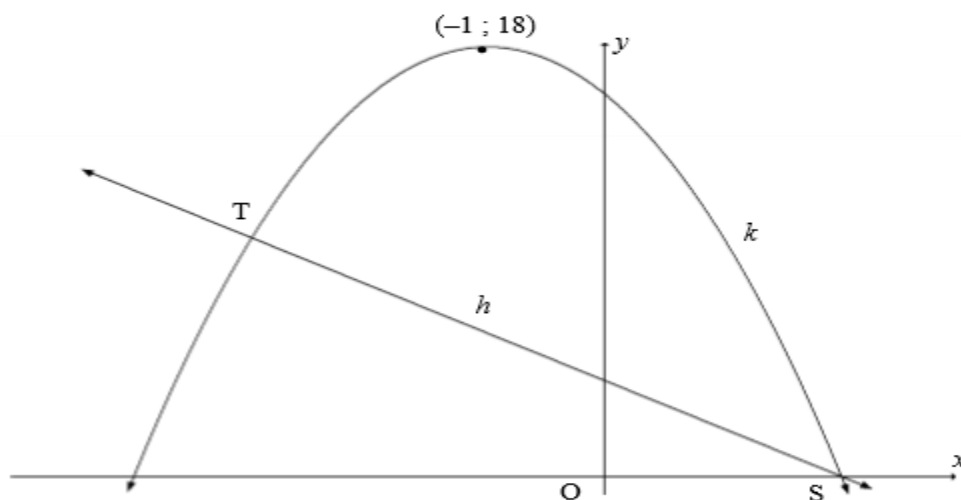
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**QUESTION 5**

5.1 Given:  $f(x) = \frac{1}{x+2} + 3$

- 5.1.1 Determine the equations of the asymptotes of  $f$ . (2)
- 5.1.2 Write down the  $y$ -intercept of  $f$ . (1)
- 5.1.3 Calculate the  $x$ -intercept of  $f$ . (2)
- 5.1.4 Sketch the graph of  $f$ . Clearly label ALL intercepts with the axes and any asymptotes. (3)

- 5.2 Sketched below are the graphs of  $k(x) = ax^2 + bx + c$  and  $h(x) = -2x + 4$ . Graph  $k$  has a turning point at  $(-1 ; 18)$ .  $S$  is the  $x$ -intercept of  $h$  and  $k$ . Graphs  $h$  and  $k$  also intersect at  $T$ .



- 5.2.1 Calculate the coordinates of  $S$ . (2)
- 5.2.2 Determine the equation of  $k$  in the form  $y = a(x+p)^2 + q$ . (3)
- 5.2.3 If  $k(x) = -2x^2 - 4x + 16$ , determine the coordinates of  $T$ . (5)
- 5.2.4 Determine the value(s) of  $x$  for which  $k(x) < h(x)$ . (2)
- 5.2.5 It is further given that  $k$  is the graph of  $g'(x)$ .
- (a) For which values of  $x$  will the graph of  $g$  be concave up? (2)
- (b) Sketch the graph of  $g$ , showing clearly the  $x$ -values of the turning points and the point of inflection. (3)

**[25]**

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Mathematics/P1

6  
SC/NSC

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**QUESTION 6**

- 6.1 Sandile bought a car for R180 000. The value of the car depreciated at 15% per annum according to the reducing-balance method. The book value of Sandile's car is currently R79 866,96.
- 6.1.1 How many years ago did Sandile buy the car? (3)
- 6.1.2 At exactly the same time that Sandile bought the car, Anil deposited R49 000 into a savings account at an interest rate of 10% p.a., compounded quarterly. Has Anil accumulated enough money in his savings account to buy Sandile's car now? (3)
- 6.2 Exactly 10 months ago, a bank granted Jane a loan of R800 000 at an interest rate of 10,25% p.a., compounded monthly. The bank stipulated that the loan:
- Must be repaid over 20 years
  - Must be repaid by means of monthly repayments of R7 853,15, starting one month after the loan was granted
- 6.2.1 How much did Jane owe immediately after making her 6<sup>th</sup> repayment? (4)
- 6.2.2 Due to financial difficulties, Jane missed the 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> payments. She was able to make payments from the end of the 10<sup>th</sup> month onwards. Calculate Jane's increased monthly payment in order to settle the loan in the original 20 years. (5)
- [15]

**QUESTION 7**

- 7.1 Given  $f(x) = x^2 + 2$ .
- Determine  $f'(x)$  from first principles. (4)
- 7.2 Determine  $\frac{dy}{dx}$  if:
- 7.2.1  $y = 4x^3 + \frac{2}{x}$  (3)
- 7.2.2  $y = 4\sqrt[3]{x} + (3x^3)^2$  (4)
- 7.3 If  $g$  is a linear function with  $g(1) = 5$  and  $g'(3) = 2$ , determine the equation of  $g$  in the form  $y = \dots$  (3)
- [14]

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Mathematics/P1

7  
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**QUESTION 8**

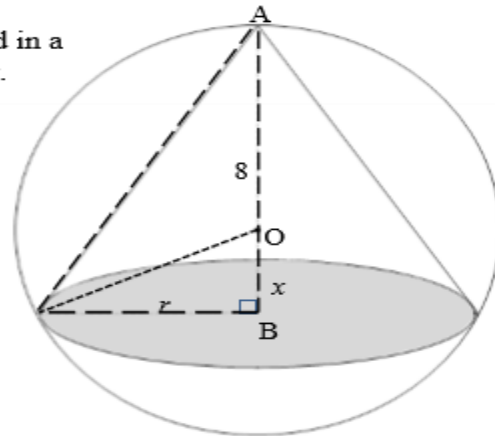
A cubic function  $h(x) = -2x^3 + bx^2 + cx + d$  cuts the  $x$ -axis at  $(-3; 0)$ ;  $(-\frac{3}{2}; 0)$  and  $(1; 0)$ .

- 8.1 Show that  $h(x) = -2x^3 - 7x^2 + 9$ . (3)
- 8.2 Calculate the  $x$ -coordinates of the turning points of  $h$ . (3)
- 8.3 Determine the value(s) of  $x$  for which  $h$  will be decreasing. (2)
- 8.4 For which value(s) of  $x$  will there be a tangent to the curve of  $h$  that is parallel to the line  $y - 4x = 7$ . (4)
- [12]**

**QUESTION 9**

A cone with radius  $r$  cm and height  $AB$  is inscribed in a sphere with centre  $O$  and a radius of 8 cm.  $OB = x$ .

<p>Volume of sphere = <math>\frac{4}{3}\pi r^3</math></p> <p>Volume of cone = <math>\frac{1}{3}\pi r^2 h</math></p>
---



- 9.1 Calculate the volume of the sphere. (1)
- 9.2 Show that  $r^2 = 64 - x^2$ . (1)
- 9.3 Determine the ratio between the largest volume of this cone and the volume of the sphere. (7)
- [9]**

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Mathematics/P1

8  
SC/NSC

DBE/2019

**QUESTION 10**

- 10.1 A bag contains 7 yellow balls, 3 red balls and 2 blue balls. A ball is chosen at random from the bag and not replaced. A second ball is then chosen. Determine the probability that of the two balls chosen, one is red and the other is blue. (4)
- 10.2 Learners at a hostel may choose a meal and a drink for lunch. Their selections on a certain day were recorded and shown in the partially completed table below.

		MEAL		TOTAL
		SANDWICH (S)	PASTA (P)	
DRINK	Fruit Juice (F)	$a$	30	$b$
	Bottled Water (W)			
TOTAL		200		250

The probability of a learner choosing fruit juice and a sandwich on that day was 0,48.

- 10.2.1 Calculate the number of learners who chose fruit juice and a sandwich for lunch on that day. (1)
- 10.2.2 Is the choice of fruit juice independent of the choice of a sandwich for lunch on that day? Show ALL calculations to motivate your answer. (4)
- [9]

**QUESTION 11**

Two learners from each grade at a high school (Grades 8, 9, 10, 11 and 12) are elected to form a sports committee.

- 11.1 In how many different ways can the chairperson and the deputy chairperson of the sports committee be elected if there is no restriction on who may be elected? (2)
- 11.2 A photographer wants to take a photograph of the sports committee. In how many different ways can the members be arranged in a straight line if:
- 11.2.1 Any member may stand in any position? (1)
- 11.2.2 Members from the same grade must stand next to each other and the Grade 12 members must be in the centre? (3)
- [6]

**TOTAL: 150**

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# basic education

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**REPUBLIC OF SOUTH AFRICA**

**SENIOR CERTIFICATE EXAMINATIONS/  
SENIORSERTIFIKAAT-EKSAMEN  
NATIONAL SENIOR CERTIFICATE EXAMINATIONS/  
NASIONALE SENIORSERTIFIKAAT-EKSAMEN**

**MATHEMATICS P1/  
WISKUNDE V1**

**MARKING GUIDELINES/NASIENRIGLYNE**

**2019**

**MARKS: 150  
PUNTE: 150**

**These marking guidelines consist of 15 pages.  
Hierdie nasienriglyne bestaan uit 15 bladsye.**



**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking memorandum.

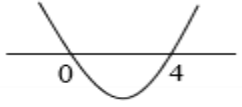
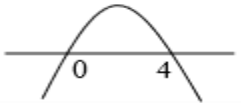
**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$x^2 - 5x - 6 = 0$ $(x - 6)(x + 1) = 0$ $x = 6 \text{ or } x = -1$ <p><b>OR/OF</b></p> $x^2 - 5x - 6 = 0$ $x = \frac{5 \pm \sqrt{(-5)^2 - 4(1)(-6)}}{2(1)}$ $x = \frac{5 \pm \sqrt{49}}{2}$ $x = 6 \text{ or } x = -1$	<ul style="list-style-type: none"> <li>✓ factors</li> <li>✓ both answers</li> </ul> <p>(2)</p> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ correct subst into correct formula</li> </ul> <ul style="list-style-type: none"> <li>✓ both answers</li> </ul> <p>(2)</p>
1.1.2	$(3x - 1)(x - 4) = 16$ $3x^2 - 13x - 12 = 0$ $x = \frac{13 \pm \sqrt{(-13)^2 - 4(3)(-12)}}{2(3)}$ $x = \frac{13 \pm \sqrt{313}}{6}$ $x = 5,12 \text{ or } x = -0,78$ <p><b>OR/OF</b></p> $3x^2 - 13x - 12 = 0$ $x^2 - \frac{13}{3}x = 4$ $x^2 - \frac{13}{3}x + \left(-\frac{13}{6}\right)^2 = 4 + \left(-\frac{13}{6}\right)^2$ $\left(x - \frac{13}{6}\right)^2 = \frac{313}{36}$ $x = \frac{13 \pm \sqrt{313}}{6}$ $x = 5,12 \text{ or } x = -0,78$	<ul style="list-style-type: none"> <li>✓ standard form</li> <li>✓ correct subst into correct formula</li> </ul> <ul style="list-style-type: none"> <li>✓ ✓ answers</li> </ul> <p>(4)</p> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ standard form</li> <li>✓ adding <math>\left(-\frac{13}{6}\right)^2</math> both sides</li> </ul> <ul style="list-style-type: none"> <li>✓ ✓ answers</li> </ul> <p>(4)</p>



1.1.3	$x(4-x) \geq 0$ $-x(x-4) \geq 0 \quad \text{or} \quad -x(x-4) \geq 0$ $x(x-4) \leq 0$   $0 \leq x \leq 4 \quad \text{or} \quad x \in [0; 4]$	<p>✓ factorisation</p> <p>✓✓ <math>0 \leq x \leq 4</math></p> <p>(3)</p>
1.1.4	$\frac{5^{2x} - 1}{5^x + 1} = 4$ $\frac{(5^x + 1)(5^x - 1)}{5^x + 1} = 4$ $5^x - 1 = 4$ $5^x = 5$ $x = 1$ <p><b>OR/OF</b></p> $\frac{5^{2x} - 1}{5^x + 1} = 4$ $5^{2x} - 1 = 4 \cdot 5^x + 4$ $5^{2x} - 4 \cdot 5^x - 5 = 0$ $(5^x - 5)(5^x + 1) = 0$ $5^x = 5 \quad \text{or} \quad 5^x \neq -1$ $x = 1$	<p>✓ factors in numerator</p> <p>✓ <math>5^x - 1 = 4</math></p> <p>✓ answer</p> <p><b>OR/OF</b></p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ answer</p> <p>(3)</p>
1.2	$x = 2 - 3y \dots\dots\dots(1)$ $x^2 + 4xy - 5 = 0 \dots\dots\dots(2)$ <p>Substitute (1) in (2):</p> $(2 - 3y)^2 + 4y(2 - 3y) - 5 = 0$ $4 - 12y + 9y^2 + 8y - 12y^2 - 5 = 0$ $-3y^2 - 4y - 1 = 0$ $3y^2 + 4y + 1 = 0$ $(3y + 1)(y + 1) = 0$ $y = -\frac{1}{3} \quad \text{or} \quad y = -1$ $x = 3 \quad \text{or} \quad x = 5$ <p><b>OR/OF</b></p>	<p>✓ <math>x = 2 - 3y</math></p> <p>✓ correct subst into correct formula</p> <p>✓ either standard form</p> <p>✓ y-values</p> <p>✓ x-values</p> <p>(5)</p> <p><b>OR/OF</b></p>



	$y = \frac{2}{3} - \frac{x}{3} \dots\dots\dots(1)$ $x^2 + 4xy - 5 = 0 \dots\dots\dots(2)$ <p>Substitute (1) in (2):</p> $x^2 + 4x\left(\frac{2}{3} - \frac{x}{3}\right) - 5 = 0$ $3x^2 + 8x - 4x^2 - 15 = 0$ $-x^2 + 8x - 15 = 0$ $x^2 - 8x + 15 = 0$ $(x - 5)(x - 3) = 0$ $x = 3 \text{ or } x = 5$ $y = -\frac{1}{3} \text{ or } y = -1$	$\checkmark y = \frac{2}{3} - \frac{x}{3}$ $\checkmark \text{ correct subst into correct formula}$ $\checkmark \text{ either standard form}$ $\checkmark x - \text{ values}$ $\checkmark y - \text{ values} \quad (5)$
1.3	$ab = 2\sqrt{10}$ $bc = 3\sqrt{2}$ $ac = 6\sqrt{5}$ $ab \cdot bc \cdot ac = 2\sqrt{10} \cdot 6\sqrt{5} \cdot 3\sqrt{2}$ $(abc)^2 = 36\sqrt{100}$ $abc = \sqrt{360} = 6\sqrt{10}$ <p><b>OR/OF</b></p> $ac = 6\sqrt{5} \quad \therefore a = \frac{6\sqrt{5}}{c}$ $bc = 3\sqrt{2} \quad \therefore b = \frac{3\sqrt{2}}{c}$ $ab = 2\sqrt{10}$ $\left(\frac{6\sqrt{5}}{c}\right)\left(\frac{3\sqrt{2}}{c}\right) = 2\sqrt{10}$ $18\sqrt{10} = 2\sqrt{10} \cdot c^2$ $c^2 = 9$ $c = 3$ $\text{Volume} = abc = 2\sqrt{10} \cdot 3 = \sqrt{360} = 6\sqrt{10}$	$\checkmark \text{ volume} = abc$ $\checkmark \checkmark ab \cdot bc \cdot ac = 2\sqrt{10} \cdot 6\sqrt{5} \cdot 3\sqrt{2}$ $\checkmark (abc)^2 = 36\sqrt{100}$ $\checkmark \text{ answer} \quad (5)$ <p><b>OR/OF</b></p> $\checkmark a = \frac{6\sqrt{5}}{c}$ $\checkmark b = \frac{3\sqrt{2}}{c}$ $\checkmark \text{ value of } c$ $\checkmark \text{ Volume} = abc$ $\checkmark \text{ answer} \quad (5)$



## QUESTION/VRAAG 2

2.1.1	59	✓ answer (1)
2.1.2	$  \begin{array}{ccccccc}  15 & & 29 & & 41 & & 51 \\  & \backslash & / & \backslash & / & \backslash & / \\  & 14 & & 12 & & 10 & \\  & & \backslash & / & \backslash & / & \\  & & -2 & & -2 & &   \end{array}  $ $2a = -2$ $a = -1$ $3(-1) + b = 14$ $b = 17$ $(-1) + (17) + c = 15$ $c = -1$ $T_n = -n^2 + 17n - 1$	✓ second difference of $-2$ ✓ $a$  ✓ $b$ ✓ $c$ (4)
2.1.3	$T_{27} = -(27)^2 + 17(27) - 1$ $= -271$	✓ substitution ✓ answer (2)
2.2.1	$r = \frac{-18}{36} = -\frac{1}{2}$	✓ answer (1)
2.2.2	$T_n = 36\left(-\frac{1}{2}\right)^{n-1}$ $\frac{9}{4096} = 36\left(-\frac{1}{2}\right)^{n-1}$ $\frac{1}{16384} = \left(-\frac{1}{2}\right)^{n-1}$ $\left(-\frac{1}{2}\right)^{14} = \left(-\frac{1}{2}\right)^{n-1}$ $14 = n - 1$ $n = 15$ <p><b>OR/OF</b></p> $36; -18; 9; \frac{-9}{2}; \frac{9}{4}; \frac{-9}{8}; \dots; \frac{9}{4096}$ <p>If you look only at the denominator: <math>2; 4; 8; \dots; 4096</math></p> $2^k = 4096$ $2^k = 2^{12}$ $k = 12$ $\therefore n = 15 \text{ terms}$	✓ $T_n = 36\left(-\frac{1}{2}\right)^{n-1}$  ✓ $\frac{1}{16384} = \left(-\frac{1}{2}\right)^{n-1}$  ✓ answer (3) <p><b>OR/OF</b></p> ✓ $2^k = 4096$  ✓ $k = 12$ ✓ answer (3)



2.2.3	$S_{\infty} = \frac{a}{1-r}$ $= \frac{36}{1 - \left(-\frac{1}{2}\right)}$ $= 24$	<p>✓ correct subst into correct formula with <math>-1 &lt; r &lt; 1</math></p> <p>✓ answer if <math>-1 &lt; r &lt; 1</math></p> <p>(2)</p>
2.2.4	$S_{250 \text{ even}} = \frac{-18 \left( \left(\frac{1}{4}\right)^{250} - 1 \right)}{\frac{1}{4} - 1}$ $= -24$ $S_{250 \text{ odd}} = \frac{36 \left( \left(\frac{1}{4}\right)^{250} - 1 \right)}{\frac{1}{4} - 1}$ $= 48$ $\frac{S_{\text{odd}}}{S_{\text{even}}} = \frac{48}{-24}$ $= -2$ <p><b>OR/OF</b></p> $\frac{T_1 + T_3 + T_5 + T_7 + \dots + T_{499}}{T_2 + T_4 + T_6 + T_8 + \dots + T_{500}}$ $= \frac{a + ar^2 + ar^4 + \dots + ar^{498}}{ar + ar^3 + ar^5 + \dots + ar^{499}}$ $= \frac{a + ar^2 + ar^4 + \dots + ar^{498}}{r(a + ar^2 + ar^4 + \dots + ar^{498})}$ $= \frac{1}{r}$ $= -2$	<p>✓ <math>r = \frac{1}{4}</math> and <math>n = 250</math></p> <p>✓ <math>S_{250 \text{ even}} = -24</math></p> <p>✓ <math>S_{250 \text{ odd}} = 48</math></p> <p>✓ answer</p> <p><b>OR/OF</b></p> <p>✓ <math>a + ar^2 + ar^4 + \dots + ar^{498}</math></p> <p>✓ <math>ar + ar^3 + ar^5 + \dots + ar^{499}</math></p> <p>✓ <math>r(a + ar^2 + ar^4 + \dots + ar^{498})</math></p> <p>✓ answer</p> <p>(4)</p> <p>(4)</p> <p>[17]</p>





## QUESTION/VRAAG 3

3.1.1	$p + 6 - (2p + 3) = p - 2 - (p + 6)$ $-p + 3 = -8$ $p = 11$	✓ equating i.t.o $p$ ✓ simplifying (2)
3.1.2	$T_n = 25 + (n-1)(-8) = 33 - 8n$ $33 - 8n < -55$ $-8n < -88$ $n > 11$ <p>∴ Term 12 will be the first term smaller than <math>-55</math>            ∴ Term 12 sal die eerste term kleiner as <math>-55</math> wees.</p>	✓ subst into $T_n$ formula  ✓ $n > 11$ ✓ $n = 12$ (3)
3.2	$S_6 = \frac{n}{2}[a+l] = \frac{6}{2}[(x-3) + (x-18)]$ $= 6x - 63$ $S_9 = \frac{n}{2}[a+l] = \frac{9}{2}[(x-3) + (x-27)]$ $= 9x - 135$ $6x - 63 = 9x - 135$ $3x = 72$ $x = 24$ $\therefore S_{15} = \frac{n}{2}[a+l] = \frac{15}{2}[(x-3) + (x-45)]$ $= \frac{15}{2}[2x - 48]$ $= \frac{15}{2}[2(24) - 48] = 0 = \text{RHS}$ <p><b>OR/OF</b></p> $\sum_{k=7}^9 (x - 3k) = 0$ $(x - 21) + (x - 24) + (x - 27) = 0$ $\therefore 3x - 72 = 0$ $3x = 72$ $x = 24$ $\sum_{k=1}^{15} (24 - 3k)$ $= 21 + 18 + 15 + \dots + -21.$ $S_n = \frac{n}{2}[a+l]$ $= \frac{15}{2}[21 - 21]$ $= 0 = \text{RHS}$ <p><b>OR/OF</b></p>	✓ $6x - 63$  ✓ $9x - 135$  ✓ $24$ ✓ $\frac{15}{2}[(x-3) + (x-45)]$  ✓ substitution of $x$ (5)  <b>OR/OF</b>  ✓ expansion ✓ $3x - 72 = 0$  ✓ $24$  ✓ substitution of $x$  ✓ sum of 15 terms (5)  <b>OR/OF</b>





$(x-3) + (x-6) + (x-9) + (x-12) + (x-15) + (x-18)$ $= (x-3) + (x-6) + (x-9) + (x-12) + (x-15) + (x-18)$ $+ (x-21) + (x-24) + (x-27)$ $\therefore 3x - 72 = 0$ $3x = 72$ $x = 24$ $\sum_{k=1}^{15} (24 - 3k)$ $= 21 + 18 + 15 + \dots + -21.$ $S_n = \frac{n}{2}[a + l]$ $= \frac{15}{2}[21 - 21]$ $= 0 = \text{RHS}$	<p>✓ expansion</p> <p>✓ <math>3x - 72 = 0</math></p> <p>✓ 24</p> <p>✓ substitution of <math>x</math></p> <p>✓ sum of 15 terms (5)</p> <p style="text-align: right;"><b>[10]</b></p>
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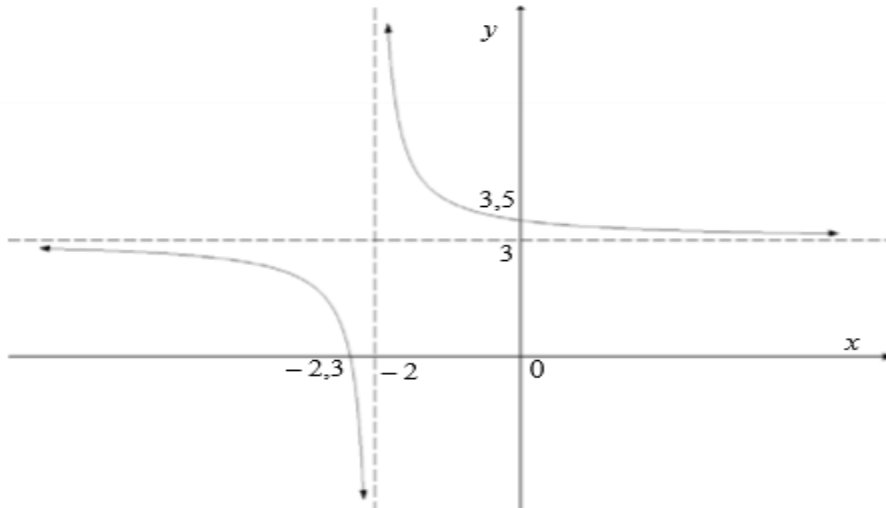
**QUESTION/VRAAG 4**

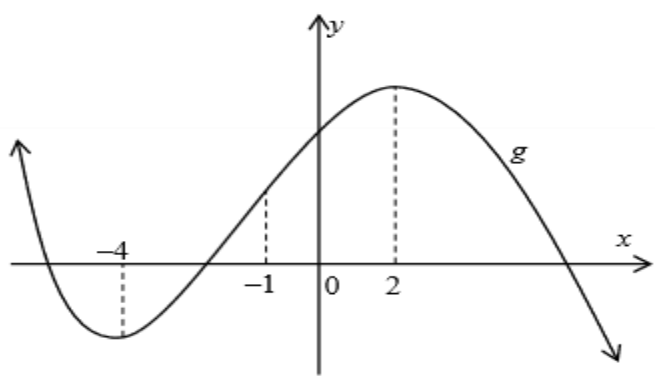
4.1	$y > 0$  <b>OR/OF</b> $y \in (0 ; \infty)$	<p>✓ answer (1)</p> <p><b>OR/OF</b></p> <p>✓ answer (1)</p>
4.2	$g: y = \left(\frac{1}{2}\right)^x$  $g^{-1}: x = \left(\frac{1}{2}\right)^y$  $y = \log_{\frac{1}{2}} x$ or $y = -\log_2 x$ or $y = \log_2 \frac{1}{x}$	<p>✓ <math>x = \left(\frac{1}{2}\right)^y</math></p> <p>✓ equation (2)</p>
4.3	<p>Yes. The vertical line test cuts <math>g^{-1}</math> once  <i>Ja. Die vertikale lyn toets sny <math>g^{-1}</math> slegs eenkeer.</i></p> <p><b>OR/OF</b>          Yes. For every <math>x</math>-value there is a unique <math>y</math>-value  <i>Ja. Vir elke <math>x</math>-waarde is daar 'n unieke <math>y</math>-waarde</i></p> <p><b>OR/OF</b>          Yes. <math>g</math> is a one-to-one function / <i>Ja. <math>g</math> is 'n een-tot-een funksie</i></p> <p><b>OR/OF</b>          Yes. The horizontal line cuts <math>g</math> only once  <i>Ja. Die horisontale lyn sny <math>g</math> slegs een keer</i></p>	<p>✓ yes (2)</p> <p>✓ valid reason (2)</p> <p><b>OR/OF</b></p> <p>✓ yes (2)</p> <p>✓ valid reason (2)</p> <p><b>OR/OF</b></p> <p>✓ yes (2)</p> <p>✓ valid reason (2)</p> <p><b>OR/OF</b></p> <p>✓ yes (2)</p> <p>✓ valid reason (2)</p>



4.4.1	$y = -\log_2 x$ $2 = -\log_2 a$ $a = 2^{-2} = \frac{1}{4}$ or $a = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$	✓ correct subst into correct formula ( $a; 2$ ) ✓ answer (2)
4.4.2	$M' \left(2; \frac{1}{4}\right)$ or $M'(2; a)$	✓ answer (1)
4.5	$M'' \left(-1; \frac{9}{4}\right)$	✓ -1 ✓ ✓ $\frac{9}{4}$ (3)
		<b>[11]</b>

**QUESTION/VRAAG 5**

5.1.1	$x = -2$ $y = 3$	✓ answer ✓ answer (2)
5.1.2	$\left(0; \frac{7}{2}\right)$	✓ answer (1)
5.1.3	$\frac{1}{x+2} + 3 = 0$ $1 + 3(x+2) = 0$ $3x = -7$ $x = -\frac{7}{3}$ x-intercept $\left(-\frac{7}{3}; 0\right)$	✓ $y = 0$ ✓ answer (2)
5.1.4		✓ asymptotes at $y = 3$ and $x = -2$ ✓ intercepts at $y = 3,5$ and $x = -2,3$ ✓ shape (reasonable representation in correct quadrants) (3)

5.2.1	$-2x + 4 = 0$ $2x = 4$ $x = 2$ $\therefore S(2 ; 0)$	$\checkmark y = 0$ $\checkmark x = 2$	(2)
5.2.2	Equation of $k$ : $y = a(x+1)^2 + 18$ $0 = a(2+1)^2 + 18 \quad \text{or} \quad 0 = a(-4+1)^2 + 18$ $9a = -18$ $a = -2$ $y = -2(x+1)^2 + 18$	$\checkmark y = a(x+1)^2 + 18$ $\checkmark$ substitute $(2 ; 0)$ or $(-4 ; 0)$ $\checkmark a$	(3)
5.2.3	$-2x^2 - 4x + 16 = -2x + 4$ $-2x^2 - 2x + 12 = 0$ $x^2 + x - 6 = 0$ $(x+3)(x-2) = 0$ $x = -3 \text{ or } x = 2$ $y = -2(-3) + 4 = 10$ $T(-3 ; 10)$	$\checkmark$ equating $\checkmark$ standard form $\checkmark$ factors $\checkmark$ choosing $x = -3$ $\checkmark$ answer	(5)
5.2.4	$x < -3$ or $x > 2$ <b>OR/OF</b> $(-\infty ; -3) \cup (2 ; \infty)$	$\checkmark\checkmark$ answer <b>OR/OF</b> $\checkmark\checkmark$ answer	(2) (2)
5.2.5(a)	$x < -1$ <b>OR/OF</b> $(-\infty ; -1)$	$\checkmark\checkmark$ answer <b>OR/OF</b> $\checkmark\checkmark$ answer	(2) (2)
5.2.5(b)		$\checkmark$ shape of cubic with local min tp moving to local max tp $\checkmark$ turning points at $x = 2$ and $x = -4$ $\checkmark$ point of inflection at $x = -1$	(3) <b>[25]</b>



## QUESTION/VRAAG 6

6.1.1	$A = P(1 - i)^n$ $79866,96 = 180\,000(1 - 0,15)^n$ $(1 - 0,15)^n = \frac{79866,96}{180\,000}$ $n = \frac{\log\left(\frac{79866,96}{180\,000}\right)}{\log(1 - 0,15)}$ $n = 4,999 \dots \text{ years}$ $n \approx 5 \text{ years}$	<p>✓ substitution</p> <p>✓ use of logs</p> <p>✓ answer</p> <p>(3)</p>
6.1.2	$A = P(1 + i)^n$ $= 49\,000\left(1 + \frac{0,1}{4}\right)^{20}$ $= R80\,292,21$ <p>The money will be enough to buy the car. Die geld sal genoeg wees om die motor te koop.</p>	<p>✓ values of <math>i</math> and <math>n</math></p> <p>✓ substitution</p> <p>✓ conclusion (consistent with answer)</p> <p>(3)</p>
6.2.1	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $P = \frac{7853,15\left[1 - \left(1 + \frac{0,1025}{12}\right)^{-234}\right]}{\frac{0,1025}{12}}$ $P = R793\,749,25$ <p><b>OR/OF</b></p> <p>Balance Outstanding / Uitstaande balans</p> $= 800\,000\left(1 + \frac{0,1025}{12}\right)^6 - \frac{7853,15\left[\left(1 + \frac{0,1025}{12}\right)^6 - 1\right]}{\frac{0,1025}{12}}$ $= 841\,885,56 - 48\,136,62$ $= R793\,748,94$	<p>✓ <math>n = 234</math> ✓ <math>i = \frac{0,1025}{12}</math></p> <p>✓ substitution in present value formula</p> <p>✓ answer</p> <p><b>OR/OF</b></p> <p>✓ <math>n = 6</math> in both</p> <p>✓ <math>i = \frac{0,1025}{12}</math></p> <p>✓ A – F</p> <p>✓ R793 748,94</p> <p>(4)</p>



6.2.2	$A = P(1+i)^n$ $= 793749,25 \left(1 + \frac{0,1025}{12}\right)^3$ $= R814\,263,3052$ <p>New instalment/Nuwe paaiement:</p> $P = \frac{x[1-(1+i)^{-n}]}{i}$ $814263,3052 = \frac{x \left[1 - \left(1 + \frac{0,1025}{12}\right)^{-231}\right]}{\frac{0,1025}{12}}$ $x = R8\,089,20$	$\checkmark 793749,25 \left(1 + \frac{0,1025}{12}\right)^3$ $\checkmark n = 231$ $\checkmark \text{substitution of new } P$ $\checkmark \text{substitution of } n \text{ and } i \text{ into formula}$ $\checkmark \text{answer} \quad (5)$ <p style="text-align: right;"><b>[15]</b></p>
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## QUESTION/VRAAG 7

7.1	$f(x) = x^2 + 2$ $f(x+h) = (x+h)^2 + 2$ $= x^2 + 2xh + h^2 + 2$ $f(x+h) - f(x) = x^2 + 2xh + h^2 + 2 - (x^2 + 2)$ $= 2xh + h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x+h)}{h}$ $= \lim_{h \rightarrow 0} (2x+h)$ $= 2x$ <p><b>OR/OF</b></p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 + 2 - (x^2 + 2)}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x+h)}{h}$ $= \lim_{h \rightarrow 0} (2x+h)$ $= 2x$	$\checkmark x^2 + 2xh + h^2 + 2$ $\checkmark \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$ $\checkmark \lim_{h \rightarrow 0} \frac{h(2x+h)}{h}$ $\checkmark \text{answer} \quad (4)$ <p><b>OR/OF</b></p> $\checkmark x^2 + 2xh + h^2 + 2$ $\checkmark \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$ $\checkmark \lim_{h \rightarrow 0} \frac{h(2x+h)}{h}$ $\checkmark \text{answer} \quad (4)$
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7.2.1	$y = 4x^3 + 2x^{-1}$ $\frac{dy}{dx} = 12x^2 - 2x^{-2}$	$\checkmark + 2x^{-1}$ $\checkmark 12x^2$ $\checkmark - 2x^{-2}$	(3)
7.2.2	$y = 4\sqrt[3]{x} + (3x^3)^2$ $= 4x^{\frac{1}{3}} + 9x^6$ $\frac{dy}{dx} = \frac{4}{3}x^{-\frac{2}{3}} + 54x^5$	$\checkmark 4x^{\frac{1}{3}}$ $\checkmark 9x^6$ $\checkmark \frac{4}{3}x^{-\frac{2}{3}}$ $\checkmark 54x^5$	(4)
7.3	Point of contact: (1 ; 5) $m = 2$ $y - y_1 = m(x - x_1)$ or $y = 2x + c$ $y - 5 = 2(x - 1)$ $5 = 2 + c$ $c = 3$ $y = 2x + 3$	$\checkmark m = 2$ $\checkmark$ substitution of (1 ; 5) $\checkmark$ answer	(3) [14]

## QUESTION/VRAAG 8

8.1	$h(x) = -2(x + \frac{3}{2})(x - 1)(x + 3)$ $h(x) = -(2x + 3)(x^2 + 2x - 3)$ $h(x) = -2x^3 - 7x^2 + 9$ <b>OR/OF</b> $h(x) = -(2x + 3)(x - 1)(x + 3)$ $h(x) = -(2x + 3)(x^2 + 2x - 3)$ $h(x) = -2x^3 - 7x^2 + 9$	$\checkmark\checkmark - 2(x + \frac{3}{2})(x - 1)(x + 3)$ $\checkmark$ correct simplification (3) <b>OR/OF</b> $\checkmark\checkmark -(2x + 3)(x - 1)(x + 3)$ $\checkmark$ correct simplification (3)
8.2	$h'(x) = -6x^2 - 14x$ $-6x^2 - 14x = 0$ $-2x(3x + 7) = 0$ $x = 0$ or $x = -\frac{7}{3}$	$\checkmark$ first derivative $\checkmark = 0$ $\checkmark$ both answers (3)
8.3	$x < -\frac{7}{3}$ or $x > 0$ <b>OR/OF</b> $x \in \left(-\infty; -\frac{7}{3}\right) \cup (0; \infty)$	$\checkmark\checkmark$ answer (2) <b>OR/OF</b> $\checkmark\checkmark$ answer (2)





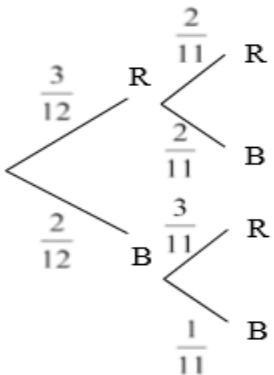
8.4	$y = 4x + 7$ $-6x^2 - 14x = 4$ $0 = 6x^2 + 14x + 4$ $0 = 3x^2 + 7x + 2$ $0 = (3x + 1)(x + 2)$ $x = -\frac{1}{3} \text{ or } x = -2$	<ul style="list-style-type: none"> <li>✓ <math>y = 4x + 7</math></li> <li>✓ <math>h'(x) = 4</math></li>   <li>✓ standard form</li>   <li>✓ both answers</li> </ul>
		(4) [12]

**QUESTION/VRAAG 9**

9.1	<p>Volume of Sphere</p> $= \frac{4}{3}\pi(8)^3 \quad \text{or} \quad = \frac{2048\pi}{3} \quad \text{or} \quad = 2144,66$	<ul style="list-style-type: none"> <li>✓ answer</li> </ul>
9.2	$r^2 + x^2 = 8^2 \quad (\text{Pythagoras})$ $r^2 = 64 - x^2$	<ul style="list-style-type: none"> <li>✓ substitution or reason Pythagoras</li> </ul>
9.3	$V_{\text{cone}} = \frac{1}{3}\pi r^2 h$ $= \frac{1}{3}\pi(64 - x^2)(8 + x)$ $= \frac{\pi}{3}(512 + 64x - 8x^2 - x^3)$ $\frac{dV}{dx} = \frac{64\pi}{3} - \frac{16\pi}{3}x - \frac{3\pi}{3}x^2$ $0 = 64 - 16x - 3x^2$ $0 = (8 - 3x)(x + 8)$ $x = \frac{8}{3} \quad x \neq -8$ $\frac{V_{\text{cone}}}{V_{\text{sphere}}} = \frac{\frac{1}{3}\pi\left(\frac{512}{9}\right)\left(\frac{32}{3}\right)}{\frac{2048\pi}{3}}$ $= \frac{8}{27} = 0,3$	<ul style="list-style-type: none"> <li>✓ <math>h = 8 + x</math></li> <li>✓ <math>\frac{1}{3}\pi(64 - x^2)(8 + x)</math></li> <li>✓ expansion</li>   <li>✓ <math>\frac{dV}{dx} = \frac{64\pi}{3} - \frac{16\pi}{3}x - \frac{3\pi}{3}x^2</math></li>   <li>✓ <math>x = \frac{8}{3}</math></li>   <li>✓ volume of the cone</li>   <li>✓ <math>\frac{8}{27}</math> or 0,3</li> </ul>
		(7) [9]



## QUESTION/VRAAG 10

10.1	 <p> <math>P(\text{One Red and One Blue})</math>  <math>= P(\text{Red, Blue}) + P(\text{Blue, Red})</math>  <math>= \left(\frac{3}{12}\right) \times \left(\frac{2}{11}\right) + \left(\frac{2}{12}\right) \times \left(\frac{3}{11}\right)</math>  <math>= \frac{1}{11}</math> </p>	<p> <math>\checkmark \left(\frac{3}{12}\right) \times \left(\frac{2}{11}\right)</math>  <math>\checkmark \left(\frac{2}{12}\right) \times \left(\frac{3}{11}\right)</math>  <math>\checkmark</math> addition of products  <math>\checkmark</math> answer </p> <p>(4)</p>
10.2.1	$a = 0,48 \times 250$ $a = 120$	<p><math>\checkmark</math> answer</p> <p>(1)</p>
10.2.2	$b = 150$ $P(S) \times P(F)$ $= \frac{200}{250} \times \frac{150}{250}$ $= 0,48$ $= P(S \text{ and } F)$ These events are independent / <i>Hierdie gebeurtenisse is onafhanklik</i>	<p><math>\checkmark b</math></p> <p><math>\checkmark P(S) \times P(F)</math>  <math>\checkmark \frac{200}{250}</math> and <math>\frac{150}{250}</math></p> <p><math>\checkmark</math> conclusion            (with realistic probabilities)</p> <p>(4)</p>
		[9]

## QUESTION/VRAAG 11

11.1	$10 \times 9$ $= 90$	<p><math>\checkmark \checkmark 10 \times 9</math></p> <p>(2)</p>
11.2.1	$10!$ $= 3\,628\,800$	<p><math>\checkmark 10!</math></p> <p>(1)</p>
11.2.2	$2! \times 2! \times 2! \times 2! \times 2! \times 4!$ $= 768$	<p><math>\checkmark 2! \times 2! \times 2! \times 2! \times 2!</math>  <math>\checkmark 4!</math>  <math>\checkmark 2! \times 2! \times 2! \times 2! \times 2! \times 4!</math>            or 768</p> <p>(3)</p>
		[6]

TOTAL/TOTAAL: 150



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

**MATHEMATICS P1**

**2021**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 10 pages and 1 information sheet.**

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Mathematics/P1

3  
SC/NSC

DBE/2021

**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 - x - 20 = 0$  (3)

1.1.2  $3x^2 - 2x - 6 = 0$  (correct to TWO decimal places) (4)

1.1.3  $(x-1)^2 > 9$  (4)

1.1.4  $2\sqrt{x+6} + 2 = x$  (4)

1.2 Solve simultaneously for  $x$  and  $y$ :

$4x + y = 2$  and  $4x + y^2 = 8$  (5)

1.3 If it is given that  $2^x \times 3^y = 24^6$ , determine the numerical value of  $x - y$ . (4)  
[24]**QUESTION 2**

2.1 Consider the quadratic sequence: 72 ; 100 ; 120 ; 132 ; ...

2.1.1 Determine  $T_n$ , the  $n^{\text{th}}$  term of the quadratic sequence. (4)

2.1.2 A term in the quadratic sequence 72 ; 100 ; 120 ; 132 ; ... is equal to the twelfth term of the sequence of first-differences. Determine the position of this term in the quadratic sequence. (5)

2.1.3 Determine the maximum value of the quadratic sequence. (3)

2.1.4 Determine the maximum value of the sequence:  
 $-23 ; 5 ; 25 ; 37 ; \dots$  (1)2.2 Consider the sequence:  $-11 ; 2 \sin 3x ; 15 ; \dots$   
Determine the values of  $x$  in the interval  $[0^\circ ; 90^\circ]$  for which the sequence will be arithmetic. (4)  
[17]

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Mathematics/P1

4  
SC/NSC

DBE/2021

**QUESTION 3**

3.1 If  $r = \frac{1}{5}$  and  $a = 2\,000$ , determine:

3.1.1  $T_n$ , the general term of the series (1)

3.1.2  $T_7$  (1)

3.1.3 Which term of the series will have a value of  $\frac{16}{15\,625}$  (3)

3.2 Consider the geometric series where  $\sum_{n=1}^{\infty} T_n = 27$  and  $S_3 = 26$ .

Calculate the value of the constant ratio ( $r$ ) of the series. (4)  
[9]

**QUESTION 4**

The lines  $y = x + 1$  and  $y = -x - 7$  are the axes of symmetry of the function  $f(x) = \frac{-2}{x+p} + q$ .

4.1 Show that  $p = 4$  and  $q = -3$ . (4)

4.2 Calculate the  $x$ -intercept of  $f$ . (2)

4.3 Sketch the graph of  $f$ . Clearly label ALL intercepts with the axes and the asymptotes. (4)  
[10]

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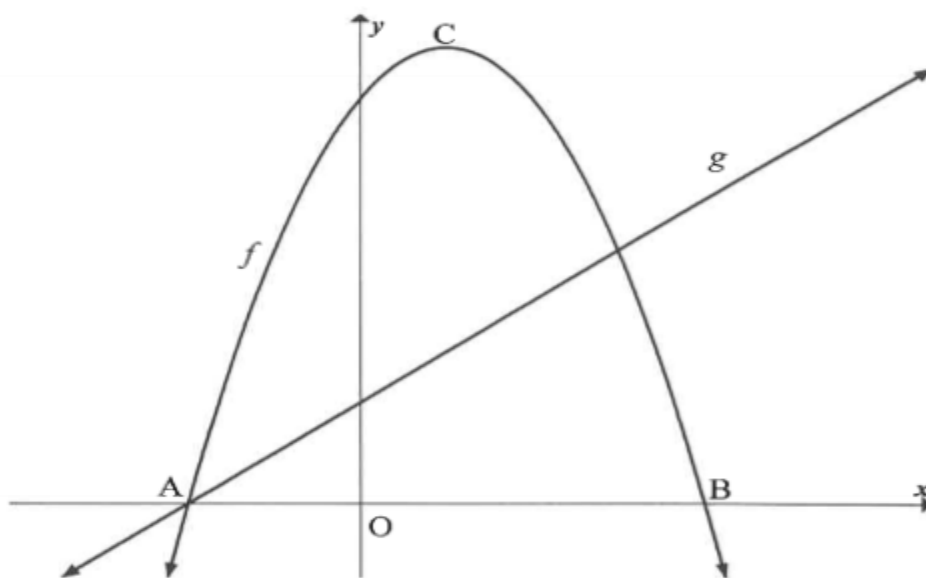
Mathematics/P1

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**QUESTION 5**

Sketched below are the graphs of  $f(x) = -2x^2 + 4x + 16$  and  $g(x) = 2x + 4$ .  
A and B are the  $x$ -intercepts of  $f$ . C is the turning point of  $f$ .



- 5.1 Calculate the coordinates of A and B. (3)
- 5.2 Determine the coordinates of C, the turning point of  $f$ . (2)
- 5.3 Write down the range of  $f$ . (1)
- 5.4 The graph of  $h(x) = f(x + p) + q$  has a maximum value of 15 at  $x = 2$ .  
Determine the values of  $p$  and  $q$ . (3)
- 5.5 Determine the equation of  $g^{-1}$ , the inverse of  $g$ , in the form  $y = \dots$  (2)
- 5.6 For which value(s) of  $x$  will  $g^{-1}(x) \cdot g(x) = 0$ ? (2)
- 5.7 If  $p(x) = f(x) + k$ , determine the value(s) of  $k$  for which  $p$  and  $g$  will NOT intersect. (5)
- [18]**

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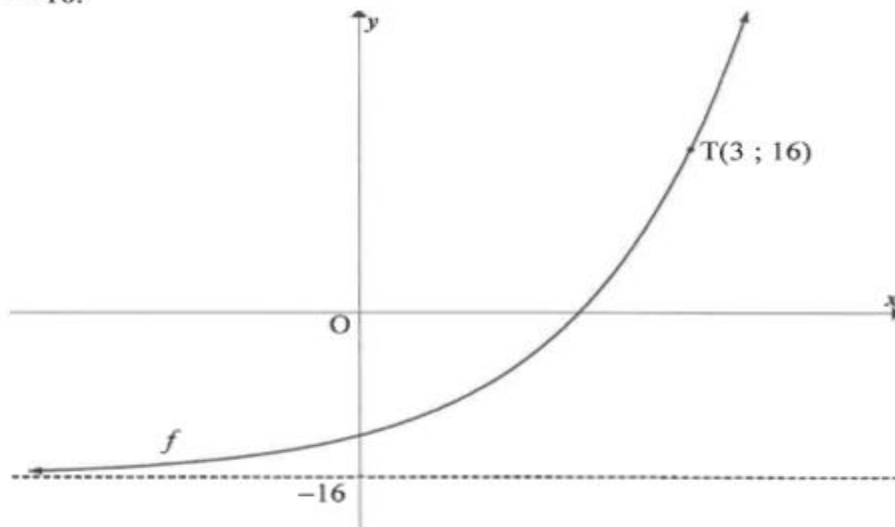
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**QUESTION 6**6.1 Given:  $g(x) = 3^x$ 6.1.1 Write down the equation of  $g^{-1}$  in the form  $y = \dots$  (2)6.1.2 Point P(6 ; 11) lies on  $h(x) = 3^{x-4} + 2$ . The graph of  $h$  is translated to form  $g$ . Write down the coordinates of the image of P on  $g$ . (2)6.2 Sketched is the graph of  $f(x) = 2^{x+p} + q$ . T(3 ; 16) is a point on  $f$  and the asymptote of  $f$  is  $y = -16$ .Determine the values of  $p$  and  $q$ .(4)  
[8]**QUESTION 7**7.1 An amount of R10 000 was invested for 4 years, earning interest at  $r\%$  p.a., compounded quarterly. At the end of the 4 years, the total amount in the account was R13 080. Determine the value of  $r$ . (4)

7.2 A businesswoman deposited R9 000 into an account at the end of January 2014. She continued to make monthly deposits of R9 000 at the end of each month up to the end of December 2018. The account earned interest at a rate of 7,5% p.a., compounded monthly.

7.2.1 Calculate how much money was in the account immediately after 60 deposits had been made. (3)

7.2.2 The businesswoman left the amount calculated in QUESTION 7.2.1 for a further  $n$  months in the account. The interest rate remained unchanged and no further payments were made. The total interest earned over the entire investment period was R190 214,14. Determine the value of  $n$ . (6)  
[13]

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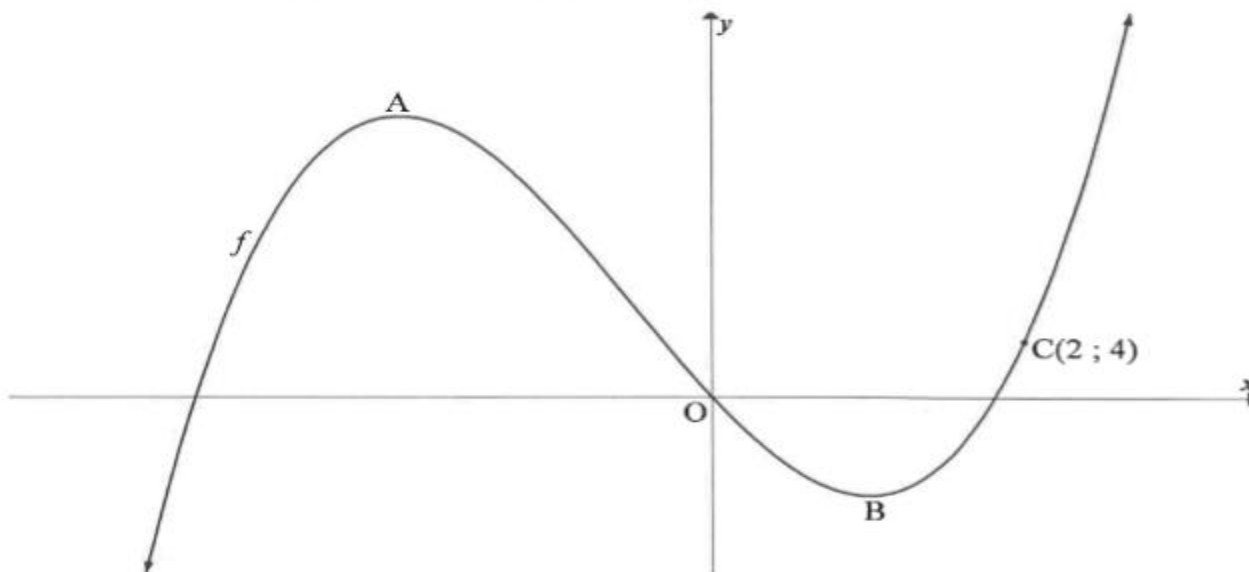
Mathematics/P1

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**QUESTION 8**8.1 Determine  $f'(x)$  from first principles if it is given that  $f(x) = 3x^2$ . (5)

8.2 Determine:

8.2.1  $f'(x)$  if  $f(x) = x^2 - 3 + \frac{9}{x^2}$  (3)8.2.2  $g'(x)$  if  $g(x) = (\sqrt{x} + 3)(\sqrt{x} - 1)$  (4)  
[12]**QUESTION 9**The graph of  $f(x) = 2x^3 + 3x^2 - 12x$  is sketched below.A and B are the turning points of  $f$ . C(2 ; 4) is a point on  $f$ .

9.1 Determine the coordinates of A and B. (5)

9.2 For which values of  $x$  will  $f$  be concave up? (3)9.3 Determine the equation of the tangent to  $f$  at C(2 ; 4). (3)  
[11]

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**QUESTION 10**

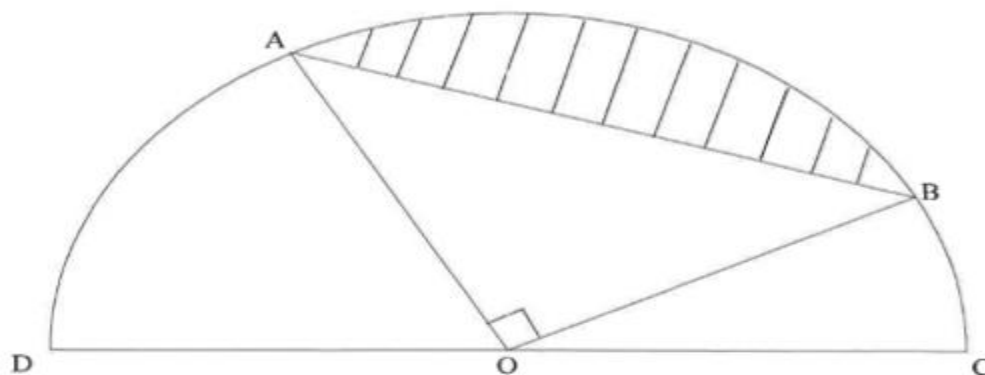
10.1 The graph of  $f(x) = ax^3 + bx^2 + cx + d$  has two turning points.

The following information about  $f$  is also given:

- $f(2) = 0$
- The  $x$ -axis is a tangent to the graph of  $f$  at  $x = -1$
- $f'(1) = 0$
- $f'\left(\frac{1}{2}\right) > 0$

Without calculating the equation of  $f$ , use this information to draw a sketch graph of  $f$ , only indicating the  $x$ -coordinates of the  $x$ -intercepts and turning points. (4)

10.2  $O$  is the centre of a semicircle passing through  $A$ ,  $B$ ,  $C$  and  $D$ . The radius of the semicircle is  $(x - x^2)$  units for  $0 < x < 1$ .  $\triangle AOB$  is right-angled at  $O$ .



10.2.1 Show that the area of the shaded part is given by:

$$\text{Area} = \left(\frac{\pi - 2}{4}\right)(x^4 - 2x^3 + x^2) \quad (5)$$

10.2.2 Determine the value of  $x$  for which the shaded area will be a maximum. (4)

[13]

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## QUESTION 11

11.1 Two events, A and B, are such that:

- Events A and B are independent
- $P(\text{not } A) = 0,4$
- $P(B) = 0,3$

Calculate  $P(A \text{ and } B)$ .

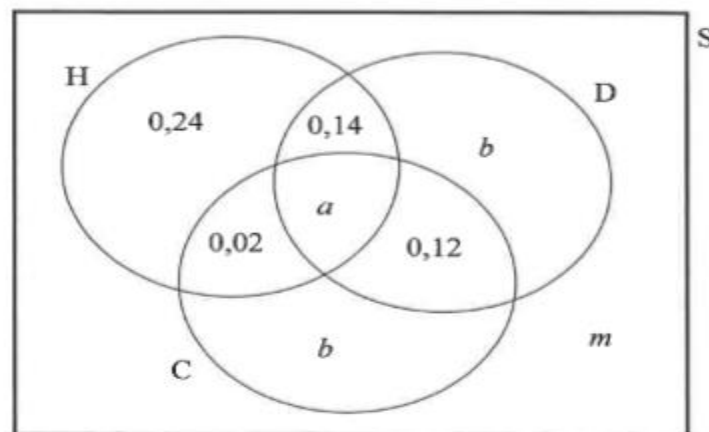
(3)

11.2 A survey was conducted among 150 learners at a school.

The following observations were made:

- The probability that a learner, selected at random, will take part in:
  - Only hockey (H) is 0,24
  - Hockey and debating (D), but not chess (C) is 0,14
  - Debating and chess, but not hockey is 0,12
  - Hockey and chess, but not debating is 0,02
- The probability that a learner, selected at random, participates in at least one activity is 0,7.
- 15 learners participated in all three activities.
- The number of learners that participate only in debating is the same as the number of learners who participate only in chess.

The Venn diagram below shows some of the above information.

11.2.1 Determine  $a$ , the probability that a learner, selected at random, participates in all three activities.

(1)

11.2.2 Determine  $m$ , the probability that a learner, selected at random, does NOT participate in any of the three activities.

(1)

11.2.3 How many learners play only chess?

(4)

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*Mathematics/P1**10  
SC/NSC**DBE/2021*

11.3 A three-digit number is made up by using three randomly selected digits from 0 to 9. NO digit may be repeated.

11.3.1 Determine the total number of possible three-digit numbers, greater than 100, that can be formed. (2)

11.3.2 Determine the total number of possible three-digit numbers, both even and greater than 600, that can be formed. (4)

**[15]****TOTAL: 150***Copyright reserved*



# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**SENIOR CERTIFICATE EXAMINATIONS/  
SENIORSERTIFIKAAT-EKSAMEN  
NATIONAL SENIOR CERTIFICATE EXAMINATIONS/  
NASIONALE SENIORSERTIFIKAAT-EKSAMEN**

**MATHEMATICS P1/  
WISKUNDE V1**

**MARKING GUIDELINES/NASIENRIGLYNE**

**2021**

**MARKS: 150  
PUNTE: 150**

**These marking guidelines consist of 13 pages.  
Hierdie nasienriglyne bestaan uit 13 bladsye.**





Mathematics P1/Wiskunde V1

2

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SC/SS/NSC/NSS – Marking Guidelines/Nasienriglyne


**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking memorandum.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$x^2 - x - 20 = 0$ $(x - 5)(x + 4) = 0$ $x = 5 \quad \text{or} \quad x = -4$	✓ factors ✓ $x = 5$ ✓ $x = -4$ (3)
1.1.2	$3x^2 - 2x - 6 = 0$ $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-6)}}{2(3)}$ $x = \frac{1 \pm \sqrt{19}}{3}$ $x = -1,12 \quad \text{or} \quad x = 1,79$	✓ substitution  ✓ simplification ✓ $x = -1,12$ ✓ $x = 1,79$ (4)
1.1.3	$(x - 1)^2 > 9$ $x^2 - 2x - 8 > 0$ $(x - 4)(x + 2) > 0$ <p>Critical values: <math>x = 4 \quad \text{or} \quad x = -2</math></p>  $x < -2 \quad \text{or} \quad x > 4$ <p><b>OR/OF</b>  <math>(-\infty; -2) \quad \text{or} \quad (4; \infty)</math></p> <p><b>OR/OF</b>  <math>x - 1 &gt; 3 \quad \text{or} \quad x - 1 &lt; -3</math>  <math>x &gt; 4 \quad \text{or} \quad x &lt; -2</math></p>	✓ standard form  ✓ critical values  ✓✓ $x < -2 \quad \text{or} \quad x > 4$ (4) <b>OR/OF</b> ✓✓ $(-\infty; -2) \quad \text{or} \quad (4; \infty)$  <b>OR/OF</b> ✓ $x - 1 > 3$ ✓ $x - 1 < -3$ ✓✓ $x > 4 \quad \text{or} \quad x < -2$ (4)

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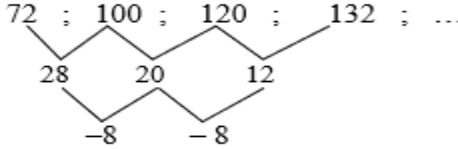




1.1.4	$2\sqrt{x+6} + 2 = x$ $2\sqrt{x+6} = x - 2$ $4(x+6) = (x-2)^2$ $4x + 24 = x^2 - 4x + 4$ $x^2 - 8x - 20 = 0$ $(x-10)(x+2) = 0$ $x = 10 \quad \text{or} \quad x \neq -2$	<p>✓ isolating the surd</p> <p>✓ <math>4x + 24 = x^2 - 4x + 4</math></p> <p>✓ <math>x = 10</math></p> <p>✓ <math>x \neq -2</math></p> <p style="text-align: right;">(4)</p>
1.2	$4x = 2 - y \dots (1)$ $4x + y^2 = 8 \dots (2)$ $\therefore 2 - y + y^2 = 8$ $y^2 - y - 6 = 0$ $(y-3)(y+2) = 0$ $y = 3 \quad \text{or} \quad y = -2$ $x = -\frac{1}{4} \quad \text{or} \quad x = 1$ <p><b>OR/OF</b></p> $y = -4x + 2 \dots (1)$ $4x + y^2 = 8 \dots (2)$ $4x + (-4x + 2)^2 = 8$ $4x + 16x^2 - 16x + 4 - 8 = 0$ $16x^2 - 12x - 4 = 0$ $4x^2 - 3x - 1 = 0$ $(4x+1)(x-1) = 0$ $x = -\frac{1}{4} \quad \text{or} \quad x = 1$ $y = 3 \quad \text{or} \quad y = -2$	<p>✓ <math>4x = 2 - y</math></p> <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ y-values</p> <p>✓ x-values</p> <p style="text-align: right;">(5)</p> <p><b>OR/OF</b></p> <p>✓ <math>y = -4x + 2</math></p> <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ x-values</p> <p>✓ y-values</p> <p style="text-align: right;">(5)</p>
1.3	$2^x \times 3^y = (2^3 \times 3)^6$ $2^x \times 3^y = 2^{18} \times 3^6$ $2^x = 2^{18} \quad \text{and} \quad 3^y = 3^6$ $x = 18 \quad \text{and} \quad y = 6$ $\therefore x - y = 18 - 6$ $\therefore x - y = 12$	<p>✓ <math>2^3 \times 3</math></p> <p>✓ <math>2^{18}</math> or <math>3^6</math></p> <p>✓ <math>x = 18</math> or <math>y = 6</math></p> <p>✓ answer (A)</p> <p style="text-align: right;">(4)</p>
		<b>[24]</b>



## QUESTION/VRAAG 2

2.1.1	 $2a = -8$ $a = -4$ $3a + b = 28$ $b = 40$ $a + b + c = 72$ $c = 36$ $T_n = -4n^2 + 40n + 36$	<ul style="list-style-type: none"> <li>✓ second differences = - 8</li> <li>✓ <math>a = -4</math></li> <li>✓ <math>b = 40</math></li> <li>✓ <math>c = 36</math></li> </ul> <p style="text-align: right;">(4)</p>
2.1.2	$T_{12} = 36 - 8n = 36 - 8(12) = -60$ $-4n^2 + 40n + 36 = -60$ $n^2 - 10n - 24 = 0$ $(n - 12)(n + 2) = 0$ $\therefore n = 12$	<ul style="list-style-type: none"> <li>✓ <math>36 - 8n</math></li> <li>✓ <math>-60</math></li> <li>✓ standard form</li> <li>✓ factors</li> <li>✓ <math>n = 12</math></li> </ul> <p style="text-align: right;">(5)</p>
2.1.3	$T_n' = -8n + 40 = 0$ $n = 5$ $T_n = -4(5)^2 + 40(5) + 36 = 136$ <p><b>OR/OF</b></p> $\frac{-b}{2a} = \frac{40}{8} = 5$ $T_n = -4(5)^2 + 40(5) + 36$ $= 136$	<ul style="list-style-type: none"> <li>✓ <math>-8n + 40</math></li> <li>✓ <math>n = 5</math></li> <li>✓ 136</li> </ul> <p style="text-align: right;">(3)</p> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ substitution</li> <li>✓ <math>n = 5</math></li> <li>✓ 136</li> </ul> <p style="text-align: right;">(3)</p>
2.1.4	Maximum value = 41	<ul style="list-style-type: none"> <li>✓ value</li> </ul> <p style="text-align: right;">(1)</p>
2.2	$2 \sin 3x - (-11) = 15 - 2 \sin 3x$ $4 \sin 3x = 4$ $\sin 3x = 1$ $3x = 90^\circ$ $\therefore x = 30^\circ$	<ul style="list-style-type: none"> <li>✓ equating</li> <li>✓ <math>4 \sin 3x = 4</math></li> <li>✓ <math>\sin 3x = 1</math></li> <li>✓ answer</li> </ul> <p style="text-align: right;">(4)</p>
		[17]



Mathematics P1/Wiskunde V1

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**QUESTION/VRAAG 3**

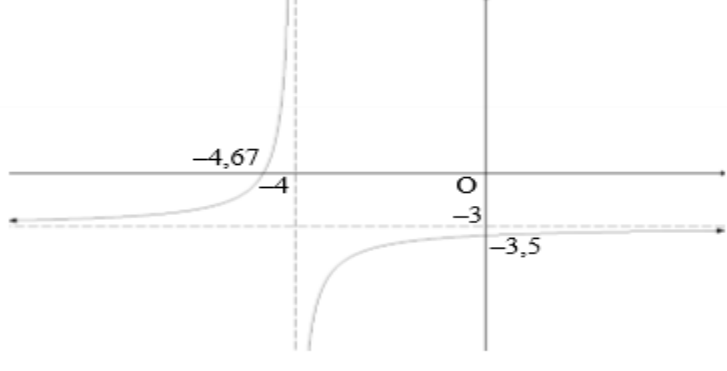
3.1.1	$T_n = ar^{n-1} = 2000\left(\frac{1}{5}\right)^{n-1}$	✓ $2000\left(\frac{1}{5}\right)^{n-1}$ (1)
3.1.2	$T_7 = 2000\left(\frac{1}{5}\right)^{7-1} = \frac{16}{125}$	✓ $\frac{16}{125}$ (1)
3.1.3	$\frac{16}{15625} = 2000\left(\frac{1}{5}\right)^{n-1}$ $\frac{1}{1953125} = \left(\frac{1}{5}\right)^{n-1}$ $\left(\frac{1}{5}\right)^9 = \left(\frac{1}{5}\right)^{n-1} \quad \text{OR} \quad n-1 = \log_{\frac{1}{5}} \frac{1}{1953125}$ $n-1 = 9$ $n = 10$	✓ equating ✓ same base / use of log ✓ answer (3)
3.2	$S_\infty = 27 = \frac{a}{1-r}$ $S_3 = \frac{a(1-r^3)}{1-r} = 26$ $27(1-r^3) = 26$ $1-r^3 = \frac{26}{27}$ $r^3 = \frac{1}{27}$ $\therefore r = \frac{1}{3}$ <p><b>OR/OF</b></p> $S_\infty = 27 = \frac{a}{1-r}$ $a = 27(1-r)$ <p>But <math>a + ar + ar^2 = 26</math></p> $a(1+r+r^2) = 26$ $27(1-r)(1+r+r^2) = 26$ $(1-r)(1+r+r^2) = \frac{26}{27}$ $r^2 + r + 1 - r^3 - r^2 - r = \frac{26}{27}$ $-r^3 + 1 = \frac{26}{27}$ $r^3 = \frac{1}{27}$ $\therefore r = \frac{1}{3}$	✓ $S_\infty = 27 = \frac{a}{1-r}$ ✓ $S_3 = \frac{a(1-r^3)}{1-r} = 26$ ✓ substitution  ✓ $r = \frac{1}{3}$  <b>OR/OF</b> ✓ $a = 27(1-r)$ ✓ $a + ar + ar^2 = 26$ ✓ substitution  ✓ $r = \frac{1}{3}$ (4)
		[9]

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## QUESTION/VRAAG 4

4.1	$x+1 = -x-7$ $2x = -8$ $x = -4$ $\therefore y = -3$ $\therefore f(x) = \frac{-2}{x+4} - 3$ $\therefore p = 4 \text{ and } q = -3$ <p><b>OR/OF</b></p> $p + q = 1 \dots\dots(1)$ $-p + q = -7$ $q = p - 7 \dots\dots(2)$ <p>subs. (2) into (1)</p> $p + p - 7 = 1$ $2p = 8$ $p = 4$ $q = -3$	$\checkmark x+1 = -x-7$ $\checkmark 2x = -8$ $\checkmark x = -4$ $\checkmark y = -3$ <p style="text-align: right;">(4)</p> <p><b>OR/OF</b></p> $\checkmark p + q = 1$ $\checkmark q = p - 7$ $\checkmark \text{substitution}$ $\checkmark \text{simplification}$ <p style="text-align: right;">(4)</p>
4.2	$y = \frac{-2}{x+4} - 3$ $0 = \frac{-2}{x+4} - 3$ $-2 - 3(x+4) = 0$ $-3x - 14 = 0$ $\therefore x = -\frac{14}{3}$	$\checkmark y = 0$ $\checkmark x = -\frac{14}{3}$ <p style="text-align: right;">(2)</p>
4.3		$\checkmark \text{horizontal asymptote}$ $\checkmark \text{vertical asymptote}$ $\checkmark y \text{ intercept}$ $\checkmark \text{shape}$ <p style="text-align: right;">(4)</p>
<b>[10]</b>		



## QUESTION/VRAAG 5

5.1	$-2x^2 + 4x + 16 = 0$ $x^2 - 2x - 8 = 0$ $(x - 4)(x + 2) = 0$ $x = 4 \text{ or } x = -2$ $\therefore A(-2; 0) \text{ and } B(4; 0)$	✓ factors ✓ $x = -2$ ✓ $x = 4$ (3)
5.2	$f(x) = -2x^2 + 4x + 16$ $-\frac{b}{2a} = -\frac{-4}{-2(2)} = 1$ $f(1) = -2(1)^2 + 4(1) + 16 = 18$ $\therefore C(1; 18)$ <p><b>OR/OF</b></p> $f(x) = -2x^2 + 4x + 16$ $f'(x) = -4x + 4$ $-4x + 4 = 0$ $x = 1$ $f(1) = -2(1)^2 + 4(1) + 16 = 18$ $\therefore C(1; 18)$	✓ 1 ✓ 18 <b>OR/OF</b> ✓ 1 ✓ 18 (2)
5.3	$y \leq 18$ <p><b>OR/OF</b></p> $y \in (-\infty; 18]$	✓ $y \leq 18$ <b>OR/OF</b> ✓ $y \in (-\infty; 18]$ (1) (1)
5.4	TP (1 ; 18) for $f$ TP (2 ; 15) for $h$ $\therefore p = -1 \quad q = -3$	✓ TP for $h$ at (2 ; 15) ✓ $p = -1$ ✓ $q = -3$ (3)
5.5	$y = 2x + 4$ $x = 2y + 4$ $\therefore y = \frac{1}{2}x - 2$	✓ swop $x$ and $y$ ✓ $y = \frac{1}{2}x - 2$ (2)
5.6	$g(x) = 0 \text{ or } g^{-1}(x) = 0$ $x = 4 \text{ or } x = -2 \text{ (product 0 at } x\text{-intercepts)}$	✓ $x = 4$ ✓ $x = -2$ (2)



<p>5.7</p> $-2x^2 + 4x + 16 + k = 2x + 4$ $-2x^2 + 2x + 12 + k = 0$ $b^2 - 4ac < 0$ $(2)^2 - 4(-2)(12 + k) < 0$ $4 + 8(12 + k) < 0$ $100 + 8k < 0$ $k < -12,5$ <p><b>OR/OF</b></p> $g'(x) = 2$ $f'(x) = -4x + 4 = 2$ $x = \frac{1}{2}$ $f\left(\frac{1}{2}\right) = 17,5$ $g\left(\frac{1}{2}\right) = 5$ $\therefore k < -12,5$		<p>✓ equating          ✓ standard form          ✓ <math>b^2 - 4ac &lt; 0</math>          ✓ substitution</p> <p>✓ answer (5)</p> <p><b>OR/OF</b></p> <p>✓ <math>g'(x) = 2</math>          ✓ <math>f'(x) = -4x + 4</math></p> <p>✓ <math>f\left(\frac{1}{2}\right) = 17,5</math>          ✓ <math>g\left(\frac{1}{2}\right) = 5</math>          ✓ answer (5)</p>
		<b>[18]</b>

**QUESTION/VRAAG 6**

6.1.1	$y = 3^x$ $x = 3^y$ $y = \log_3 x$	<p>✓ swop <math>x</math> and <math>y</math>          ✓ equation (2)</p>
6.1.2	$h(x) = 3^{x-4} + 2$ <p>Transformation: 4 units left, 2 units down  <math>P'(2;9)</math></p>	<p>✓ <math>x = 2</math> (A)          ✓ <math>y = 9</math> (A) (2)</p>
6.2	$f(x) = 2^{x+p} + q$ $q = -16$ $16 = 2^{p+3} - 16$ $2^{p+3} = 32$ $2^{p+3} = 2^5$ $\therefore p + 3 = 5$ $p = 2$	<p>✓ <math>q = -16</math>          ✓ substitute (3 ; 16)          ✓ <math>2^{p+3} = 2^5</math> or <math>p + 3 = \log_2 32</math>          ✓ <math>p = 2</math> (4)</p>
		<b>[8]</b>



## QUESTION/VRAAG 7

7.1	$13\,080 = 10\,000 \left(1 + \frac{i}{4}\right)^{16}$ $\left(1 + \frac{i}{4}\right)^{16} = \frac{13\,080}{10\,000}$ $1 + \frac{i}{4} = \sqrt[16]{\frac{13\,080}{10\,000}}$ $\frac{i}{4} = 0,0169227\dots$ $i = 0,06769\dots$ $i = 6,77\%$	<ul style="list-style-type: none"> <li>✓ substitution into correct formula</li> <li>✓ <math>n = 16</math></li> <li>✓ simplification</li> <li>✓ answer (A)</li> </ul> <p style="text-align: right;">(4)</p>
7.2.1	$F = \frac{x[(1+i)^n - 1]}{i}$ $F = \frac{9\,000 \left[ \left(1 + \frac{0,075}{12}\right)^{60} - 1 \right]}{\frac{0,075}{12}}$ $F = \text{R } 652\,743,95$	<ul style="list-style-type: none"> <li>✓ <math>\frac{0,075}{12}</math></li> <li>✓ substitution into correct Formula</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(3)</p>
7.2.2	$60 \times 9\,000 = \text{R } 540\,000$ $A = P(1+i)^n$ $652\,743,95 \left(1 + \frac{0,075}{12}\right)^n = 190\,214,14 + 540\,000$ $730\,214,14 = 652\,743,95 \left(1 + \frac{0,075}{12}\right)^n$ $1,1186\dots = (1,00625)^n$ $n = \log_{1,00625} (1,1186)$ $\therefore n = 18 \text{ months}$	<ul style="list-style-type: none"> <li>✓ <math>60 \times 9\,000 = \text{R } 540\,000</math></li> <li>✓ ✓ equation</li> <li>✓ simplification</li> <li>✓ use of logs</li> <li>✓ 18 months</li> </ul> <p style="text-align: right;">(6)</p>



	<p><b>OR/OF</b></p> <p>Interest over 5 years = <math>652\,743,95 - 9\,000 \times 60</math>  <math>= 112\,743,95</math></p> <p><math>\therefore</math> interest on <math>n</math> years  <math>= 190\,214,14 - 112\,743,95 = 77\,470,19</math></p> <p><math>652\,743,95 + 77\,470,19 = 652\,743,95 \left(1 + \frac{0,075}{12}\right)^n</math></p> <p><math>1,1186\dots = (1,00625)^n</math></p> <p><math>n = \log_{1,00625} (1,1186)</math></p> <p><math>\therefore n = 18</math> months</p>	<p><b>OR/OF</b></p> <p>✓ <math>60 \times 9\,000</math></p> <p>✓ answer</p> <p>✓ equating</p> <p>✓ simplification</p> <p>✓ use of logs</p> <p>✓ 18 months</p> <p>(6)</p>
		[13]

## QUESTION/VRAAG 8

8.1	<p><math>f(x) = 3x^2</math></p> <p><math>f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}</math></p> <p><math>f'(x) = \lim_{h \rightarrow 0} \frac{3(x+h)^2 - 3x^2}{h}</math></p> <p><math>f'(x) = \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 - 3x^2}{h}</math></p> <p><math>= \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}</math></p> <p><math>= \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h}</math></p> <p><math>= 6x</math></p>	<p>✓ substitution</p> <p>✓ expansion</p> <p>✓ simplification</p> <p>✓ <math>\lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h}</math></p> <p>✓ <math>6x</math></p> <p>(5)</p>
8.2.1	<p><math>f(x) = x^2 - 3 + 9x^{-2}</math></p> <p><math>f'(x) = 2x - 18x^{-3}</math></p>	<p>✓ <math>9x^{-2}</math></p> <p>✓ <math>2x</math></p> <p>✓ <math>-18x^{-3}</math></p> <p>(3)</p>



Mathematics P1/Wiskunde V1

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8.2.2	$g(x) = (\sqrt{x} + 3)(\sqrt{x} - 1)$ $g(x) = x + 2x^{\frac{1}{2}} - 3$ $g'(x) = 1 + x^{-\frac{1}{2}}$	$\checkmark x \quad \checkmark 2x^{\frac{1}{2}}$ $\checkmark 1 \quad \checkmark x^{-\frac{1}{2}}$	(4)
			[12]

**QUESTION/VRAAG 9**

9.1	$f'(x) = 6x^2 + 6x - 12$ $6x^2 + 6x - 12 = 0$ $x^2 + x - 2 = 0$ $(x+2)(x-1) = 0$ $x = -2 \quad \text{or} \quad x = 1$ $y = 20 \quad \text{or} \quad y = -7$ $\therefore A(-2 ; 20) \text{ and } B(1 ; -7)$	$\checkmark 6x^2 + 6x - 12$ $\checkmark = 0$ $\checkmark \text{ factors}$ $\checkmark x \text{-values}$ $\checkmark y \text{-values}$	(5)
9.2	$f''(x) = 12x + 6$ $12x + 6 > 0$ $12x > -6$ $x > -\frac{1}{2}$ <b>OR/OF</b> $x = \frac{-2+1}{2} = -\frac{1}{2}$ $\therefore x > -\frac{1}{2}$	$\checkmark 12x + 6$ $\checkmark f''(x) > 0$ $\checkmark x > -\frac{1}{2}$ <b>OR/OF</b> $\checkmark x = -\frac{1}{2}$ $\checkmark \checkmark x > -\frac{1}{2}$	(3)  (3)
9.3	$f'(2) = 24$ Equation of the tangent: $y - 4 = 24(x - 2)$ $y = 24x - 44$	$\checkmark f'(2)$ $\checkmark 24$ $\checkmark \text{ equation}$	(3)
			[11]

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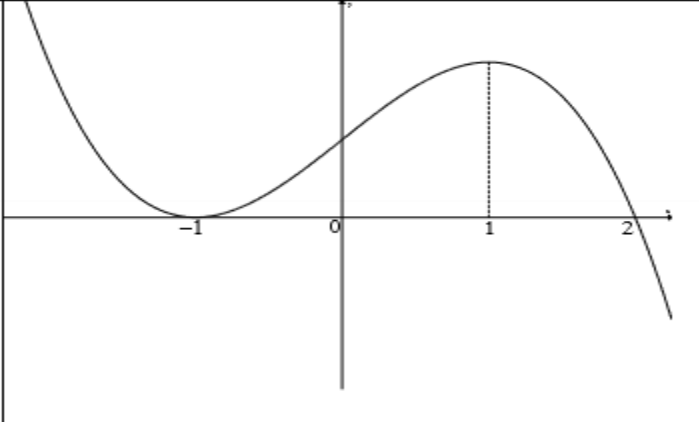
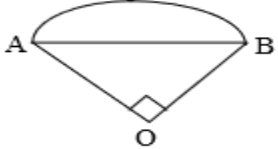
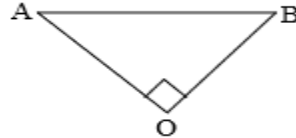
Mathematics P1/Wiskunde V1

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## QUESTION/VRAAG 10

10.1		<ul style="list-style-type: none"> <li>✓ <math>x = -1</math> and <math>x = 2</math></li> <li>✓ TP at <math>x = -1</math></li> <li>✓ TP at <math>x = 1</math></li> <li>✓ shape</li> </ul> <p style="text-align: right;">(4)</p>
10.2.1	 <p>Area of segment = <math>\frac{1}{4}</math> Area of big circle</p> $= \frac{1}{4} \pi (x - x^2)^2$  <p>Area triangle ABO counted</p> $= \text{Area } \Delta = \frac{1}{2} (x - x^2)^2$ <p>Area of shaded region</p> $= \frac{1}{4} \pi (x - x^2)^2 - \frac{1}{2} (x - x^2)^2$ $= \frac{\pi - 2}{4} (x - x^2)^2$ $= \left( \frac{\pi - 2}{4} \right) (x^2 - 2x^3 + x^4)$	<ul style="list-style-type: none"> <li>✓✓ <math>\frac{1}{4} \pi (x - x^2)^2</math></li> <li>✓ Area <math>\Delta = \frac{1}{2} (x - x^2)^2</math></li> <li>✓ subtract areas</li> <li>✓ common factor</li> </ul> <p style="text-align: right;">(5)</p>



10.2.2	<p>Area of shaded region</p> $= \frac{(\pi - 2)}{4}(x^4 - 2x^3 + x^2)$ $\frac{dA}{dx} = \left(\frac{\pi - 2}{4}\right)(4x^3 - 6x^2 + 2x)$ $4x^3 - 6x^2 + 2x = 0$ $x(2x^2 - 3x + 1) = 0$ $x(2x - 1)(x - 1) = 0$ $x \neq 0 \quad \text{or} \quad x = \frac{1}{2} \quad \text{or} \quad x \neq 1$	<p>✓ <math>\left(\frac{\pi - 2}{4}\right)(4x^3 - 6x^2 + 2x)</math></p> <p>✓ factors</p> <p>✓ <math>x = 0; x = 1; x = \frac{1}{2}</math></p> <p>✓ <math>x = \frac{1}{2}</math> (4)</p>
		<b>[13]</b>

**QUESTION/VRAAG 11**

11.1	<p><math>P(A) = 1 - P(\text{not } A) = 0,6</math></p> <p><math>P(A \text{ and } B) = P(A) \times P(B)</math>  <math>= 0,6 \times 0,3</math>  <math>= \frac{9}{50}</math>  <math>= 0,18</math></p>	<p>✓ 0,6</p> <p>✓ <math>P(A \text{ and } B) = P(A) \times P(B)</math></p> <p>✓ answer (A) (3)</p>
11.2.1	$a = \frac{15}{150} = 0,1$	✓ $\frac{15}{150}$ (A) (1)
11.2.2	$m = 1 - 0,7 = 0,3$	✓ 0,3 (A) (1)
11.2.3	<p><math>0,24 + 0,14 + 0,02 + 0,12 + 0,1 + 2b = 0,7</math></p> <p><math>2b = 0,08</math></p> <p><math>b = 0,04</math></p> <p><math>0,04 \times 150 = 6</math></p>	<p>✓ addition</p> <p>✓ simplification</p> <p>✓ <math>b = 0,04</math></p> <p>✓ 6 (4)</p>
11.3.1	$9 \times 9 \times 8 = 648$	✓9 ✓9 × 8 (2)
11.3.2	<p><math>2 \times 8 \times 4 = 64</math></p> <p><math>2 \times 8 \times 5 = 80</math></p> <p>Total number = <math>64 + 80 = 144</math></p>	<p>✓✓ <math>2 \times 8 \times 4</math></p> <p>✓ <math>2 \times 8 \times 5</math></p> <p>✓144 (A) (4)</p>
		<b>[15]</b>

**TOTAL/TOTAAL: 150**



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

**MATHEMATICS P1**

**2022**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages and 1 information sheet.**

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Mathematics/P1

3  
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**QUESTION 1**

- 1.1 Solve for  $x$ :
- 1.1.1  $x^2 + 2x - 15 = 0$  (3)
- 1.1.2  $5x^2 - x - 9 = 0$  (Leave your answer correct to TWO decimal places.) (3)
- 1.1.3  $x^2 \leq 3x$  (4)
- 1.2 Given:  $a + \frac{64}{a} = 16$
- 1.2.1 Solve for  $a$ . (3)
- 1.2.2 Hence, solve for  $x$ :  $2^x + 2^{6-x} = 16$  (3)
- 1.3 Without using a calculator, calculate the value of  $\sqrt{\frac{2^{1002} + 2^{1006}}{17(2)^{998}}}$  (4)
- 1.4 Solve for  $x$  and  $y$  simultaneously:  
 $2x - y = 2$  and  $\frac{1}{x} - 3y = 1$  (6)  
**[26]**

**QUESTION 2**

- 2.1 The first term of an arithmetic sequence is  $-1$  and the 7<sup>th</sup> term is 35.  
 Determine:
- 2.1.1 The common difference of the sequence (2)
- 2.1.2 The number of terms in the sequence if the last term of the sequence is 473 (3)
- 2.1.3 The sum of the first 40 terms in this sequence (2)
- 2.2  $75 ; 53 ; 35 ; 21 ; \dots$  is a quadratic number pattern.
- 2.2.1 Write down the FIFTH term of the number pattern. (1)
- 2.2.2 Determine the  $n^{\text{th}}$  term of the number pattern. (4)
- 2.2.3 Determine the maximum value of the following number pattern:  
 $-15 ; -\frac{53}{5} ; -7 ; -\frac{21}{5} ; \dots$  (4)  
**[16]**

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Mathematics/P1

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**QUESTION 3**

3.1 Consider the following geometric sequence: 1 024 ; 256 ; 64 ; ...

Calculate:

3.1.1 The 10<sup>th</sup> term of the sequence (2)3.1.2  $\sum_{p=0}^8 256(4^{1-p})$  (4)

3.2 The first two terms of a geometric sequence are:

$$-t^2 - 6t - 9 \text{ and } \frac{t^3 + 9t^2 + 27t + 27}{2}$$

Determine the values of  $t$  for which the sequence will converge. (5)  
[11]**QUESTION 4**The graph of  $g(x) = a\left(\frac{1}{3}\right)^x + 7$  passes through point E(-2 ; 10).4.1 Calculate the value of  $a$ . (3)4.2 Calculate the coordinates of the  $y$ -intercept of  $g$ . (2)4.3 Consider:  $h(x) = \left(\frac{1}{3}\right)^x$ 4.3.1 Describe the translation from  $g$  to  $h$ . (2)4.3.2 Determine the equation of the inverse of  $h$ , in the form  $y = \dots$  (2)  
[9]

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Mathematics/P1

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**QUESTION 5**Consider:  $g(x) = \frac{a}{x+p} + q$ The following information of  $g$  is given:

- Domain:  $x \in \mathbb{R}; x \neq -2$
- $x$ -intercept at  $K(1; 0)$
- $y$ -intercept at  $N\left(0; -\frac{1}{2}\right)$

5.1 Show that the equation of  $g$  is given by:  $g(x) = \frac{-3}{x+2} + 1$  (6)5.2 Write down the range of  $g$ . (1)5.3 Determine the equation of  $h$ , the axis of symmetry of  $g$ , in the form  $y = mx + c$ , where  $m > 0$ . (3)5.4 Write down the coordinates of  $K'$ , the image of  $K$  reflected over  $h$ . (2)  
[12]

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Mathematics/P1

6  
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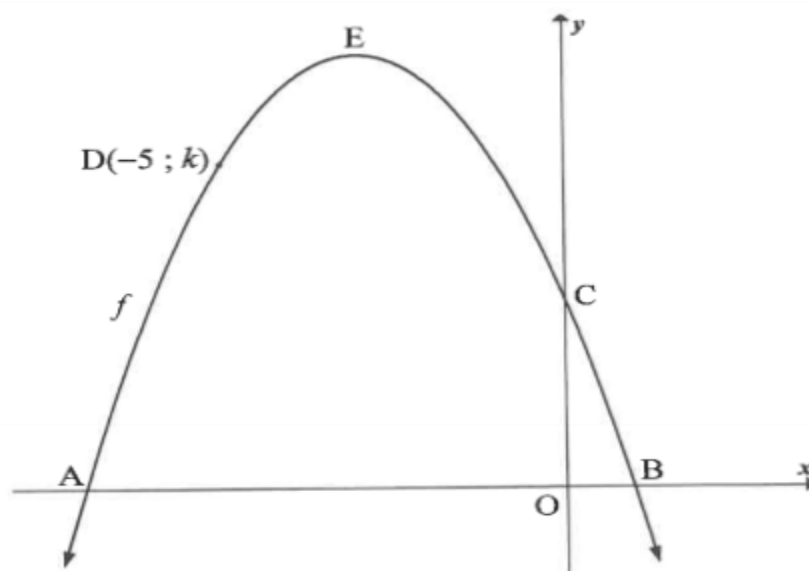
**QUESTION 6**

The sketch below shows the graph of  $f(x) = -x^2 - 6x + 7$ .

C is the  $y$ -intercept of  $f$ .

A and B are the  $x$ -intercepts of  $f$ .

D(-5 ;  $k$ ) is a point on  $f$ .



- 6.1 Calculate the coordinates of E, the turning point of  $f$ . (3)
- 6.2 Write down the value of  $k$ . (1)
- 6.3 Determine the equation of the straight line passing through C and D. (4)
- 6.4 A tangent, parallel to CD, touches  $f$  at P. Determine the coordinates of P. (4)
- 6.5 For which values of  $x$  will  $f(x) - 12 > 0$ ? (2)
- [14]**

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Mathematics/P1

7  
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**QUESTION 7**

- 7.1 How many years will it take for an investment to double in value, if it earns interest at a rate of 8,5% p.a., compounded quarterly? (4)
- 7.2 A company purchased machinery for R500 000. After 5 years, the machinery was sold for R180 000 and new machinery was bought.
- 7.2.1 Calculate the rate of depreciation of the old machinery over the 5 years, using the reducing-balance method. (4)
- 7.2.2 The rate of inflation for the cost of the new machinery is 6,3% p.a. over the 5 years. What will the new machinery cost at the end of 5 years? (2)
- 7.2.3 The company set up a sinking fund and made the first payment into this fund on the day the old machinery was bought. The last payment was made three months before the new machinery was purchased at the end of the 5 years. The interest earned on the sinking fund was 10,25% p.a., compounded monthly. The money from the sinking fund and the R180 000 from the sale of the old machinery was used to pay for the new machinery.
- Calculate the monthly payment into the sinking fund. (5)  
[15]

**QUESTION 8**

- 8.1 Determine  $f'(x)$  from first principles if it is given that  $f(x) = -x^2$ . (5)
- 8.2 Determine:
- 8.2.1  $f'(x)$ , if it is given that  $f(x) = 4x^3 - 5x^2$  (2)
- 8.2.2  $D_x \left[ \frac{-6\sqrt[3]{x} + 2}{x^4} \right]$  (4)  
[11]

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Mathematics/P1

8  
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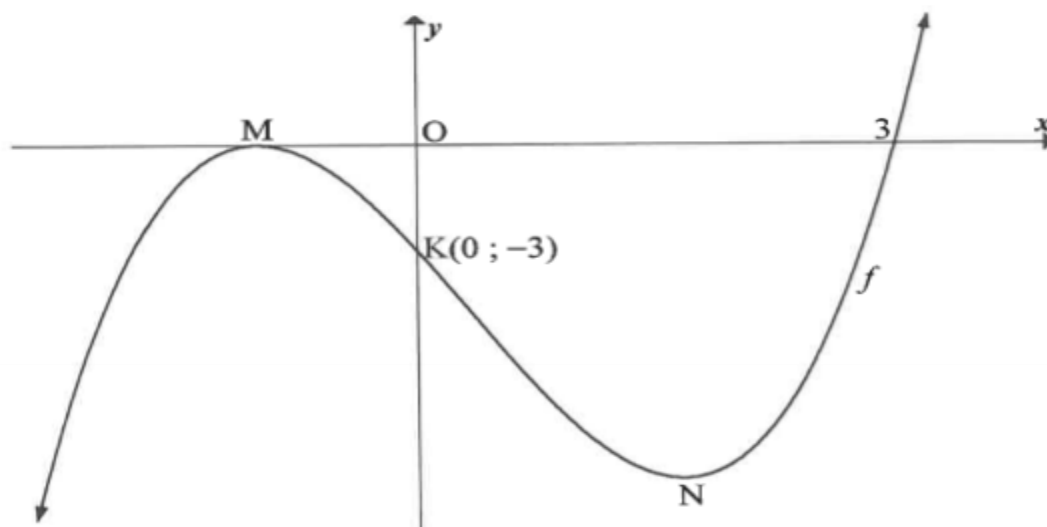
**QUESTION 9**

Sketched below is the graph of  $f(x) = x^3 + ax^2 + bx + c$ .

The  $x$ -intercepts of  $f$  are at  $(3 ; 0)$  and  $M$ , where  $M$  lies on the negative  $x$ -axis.

$K(0 ; -3)$  is the  $y$ -intercept of  $f$ .

$M$  and  $N$  are the turning points of  $f$ .



- 9.1 Show that the equation of  $f$  is given by  $f(x) = x^3 - x^2 - 5x - 3$ . (5)
- 9.2 Calculate the coordinates of  $N$ . (5)
- 9.3 For which values of  $x$  will:
- 9.3.1  $f(x) < 0$  (2)
- 9.3.2  $f$  be increasing (2)
- 9.3.3  $f$  be concave up (3)
- 9.4 Determine the maximum vertical distance between the graphs of  $f$  and  $f'$  in the interval  $-1 < x < 0$ . (6)
- [23]

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Mathematics/P1

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SC/NSC

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**QUESTION 10**

- 10.1 Flags from four African countries and three European countries were displayed in a row during the 2021 Olympics.

Determine:

10.1.1 The total number of possible ways in which all 7 flags from these countries could be displayed (2)

10.1.2 The probability that the flags from the African countries were displayed next to each other (3)

- 10.2 A and B are two independent events.

$$P(A) = 0,4 \text{ and } P(A \text{ or } B) = 0,88$$

Calculate  $P(B)$ . (3)

- 10.3 There are 120 passengers on board an aeroplane. Passengers have a choice between a meat sandwich or a cheese sandwich, but more passengers will choose a meat sandwich. There are only 120 sandwiches available to choose from. The probability that the first passenger chooses a meat sandwich and the second passenger chooses a cheese sandwich is  $\frac{18}{85}$ . Calculate the probability that the first passenger will choose a cheese sandwich. (5)

[13]

**TOTAL: 150**

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**SENIOR CERTIFICATE EXAMINATIONS/  
SENIORSERTIFIKAAT-EKSAMEN  
NATIONAL SENIOR CERTIFICATE EXAMINATIONS/  
NASIONALE SENIORSERTIFIKAAT-EKSAMEN**

**MATHEMATICS P1/WISKUNDE V1**

**MARKING GUIDELINES/NASIENRIGLYNE**

**2022**

**MARKS: 150  
PUNTE: 150**

**These marking guidelines consist of 16 pages.  
Hierdie nasienriglyne bestaan uit 16 bladsye.**



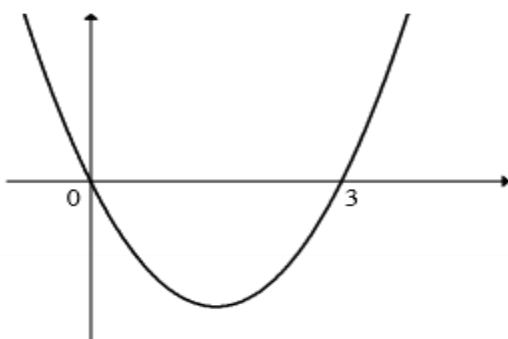
**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking guidelines.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die nasienriglyne van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$x^2 + 2x - 15 = 0$ $(x + 5)(x - 3) = 0$ $x = -5$ or $x = 3$	✓ factors ✓ $x = -5$ ✓ $x = 3$	(3)
1.1.2	$5x^2 - x - 9 = 0$ $x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(5)(-9)}}{2(5)}$ $x = \frac{1 \pm \sqrt{181}}{10}$ $x = 1,45$ or $x = -1,25$	✓ substitution into the correct formula  ✓ $x = 1,45$ ✓ $x = -1,25$	(3)
1.1.3	$x^2 \leq 3x$ $x^2 - 3x \leq 0$ $x(x - 3) \leq 0$  $0 \leq x \leq 3$ OR $x \in [0;3]$	✓ standard form ✓ factors  ✓✓ answer	(4)
1.2.1	$a + \frac{64}{a} = 16$ $a^2 - 16a + 64 = 0$ $(a - 8)^2 = 0$ $a = 8$	✓ standard form ✓ factors  ✓ answer	(3)





1.2.2	$2^x + 2^{6-x} = 16$ $2^x + \frac{64}{2^x} = 16$ $2^x = 8 \text{ (from 1.2.1)}$ $2^x = 2^3$ $x = 3$	✓ exp law ✓ $2^x = 8$ ✓ answer (3)
1.3	$\sqrt{\frac{2^{1002}(1+2^4)}{17(2)^{998}}}$ $= \sqrt{\frac{2^4(17)}{17}}$ $= \sqrt{2^4}$ $= 2^2$ $= 4$	✓ common factor ✓ second factor ✓ simplification ✓ answer (4)
1.4	$2x - y = 2 \quad \dots(1)$ $\frac{1}{x} - 3y = 1 \quad \dots(2)$ $y = 2x - 2$ $\frac{1}{x} - 3(2x - 2) = 1$ $\frac{1}{x} - 6x + 6 - 1 = 0$ $1 - 6x^2 + 6x - x = 0$ $-6x^2 + 5x + 1 = 0$ $6x^2 - 5x - 1 = 0$ $(6x + 1)(x - 1) = 0$ $x = -\frac{1}{6} \text{ or } x = 1$ $y = 2\left(-\frac{1}{6}\right) - 2 \text{ or } y = 2(1) - 2$ $y = -\frac{7}{3} \text{ or } y = 0$	✓ $y = 2x - 2$ ✓ substitution ✓ simplification ✓ standard form ✓ x-values ✓ y-values (6)





Mathematics P1/Wiskunde V1

4

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**OR/OF**

$$x = \frac{2+y}{2} \quad \dots(1)$$

$$\frac{1}{x} - 3y = 1 \quad \dots(2)$$

$$\frac{1}{\frac{2+y}{2}} - 3y = 1$$

$$\frac{2}{2+y} - 3y = 1$$

$$\frac{2 - 6y - 3y^2}{2+y} = 1$$

$$2 - 6y - 3y^2 = 2 + y$$

$$-3y^2 - 7y = 0$$

$$-y(3y + 7) = 0$$

$$y = 0 \quad \text{or} \quad y = -\frac{7}{3}$$

$$x = 1 \quad \text{or} \quad x = -\frac{1}{6}$$

**OR/OF**

$$\checkmark x = \frac{2+y}{2}$$

✓ substitution

✓ simplification

✓ standard form

✓ y-values

✓ x-values

(6)  
[26]



## QUESTION/VRAAG 2

2.1.1	$a + 6d = 35$ $-1 + 6d = 35$ $6d = 36$ $d = 6$ <b>OR/OF</b> $\frac{35 - (-1)}{7 - 1} = 6$	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;">ANSWER ONLY: FULL MARKS</div>	✓ substitution  ✓ answer (2) <b>OR/OF</b> ✓ substitution ✓ answer (2)
2.1.2	$T_n = a + (n - 1)d$ $473 = -1 + (n - 1)(6)$ $79 = n - 1$ $\therefore n = 80$	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;">ANSWER ONLY: FULL MARKS</div>	✓ substitution into the correct formula ✓ equating to 473 ✓ answer (3)
2.1.3	$S_n = \frac{n}{2}[2a + (n - 1)d]$ $S_{40} = \frac{40}{2}[2(-1) + (40 - 1)(6)]$ $\therefore S_{40} = 4640$  <b>OR/OF</b> $T_{40} = 6(40) - 7$ $= 233$ $S_n = \frac{n}{2}(a + l)$ $= \frac{40}{2}(-1 + 233)$ $= 4640$		✓ substitution  ✓ answer (2)  <b>OR/OF</b>  ✓ substitution ✓ answer (2)
2.2.1	$  \begin{array}{ccccccc}  75 & & 53 & & 35 & & 21 \\  & \searrow & / & \searrow & / & \searrow & / \\  & -22 & & -18 & & -14 & \\  & / & \searrow & / & \searrow & / & \\  & 4 & & 4 & & &   \end{array}  $ $T_5 = 11$		✓ answer (A) (1)
2.2.2	$T_n = an^2 + bn + c$ $2a = 4$ $a = 2$ $3a + b = -22$ $6 + b = -22$ $b = -28$ $a + b + c = 75$ $2 - 28 + c = 75$ $c = 101$ $\therefore T_n = 2n^2 - 28n + 101$		✓ $T_n = an^2 + bn + c$  ✓ $a = 2$ ✓ $b = -28$  ✓ $c = 101$ (4)



2.2.3

Minimum value of  $T_n$ 

$$n = -\frac{b}{2a} = -\frac{(-28)}{2(2)}$$

$$n = 7$$

$$\text{Minimum value of } T_n = 2(7)^2 - 28(7) + 101 = 3$$

Each term in the new pattern is  $-\frac{1}{5}$  the value of the terms in the old pattern.

$$\text{Maximum value of new pattern} = -\frac{3}{5}$$

**OR/OF**

$$T_n' = 4n - 28$$

$$4n - 28 = 0$$

$$4n = 28$$

$$n = 7$$

$$\text{Minimum value of } T_n = 2(7)^2 - 28(7) + 101 = 3$$

Each term in the new pattern is  $-\frac{1}{5}$  the value of the terms in the old pattern.

$$\text{Maximum value of new pattern} = -\frac{3}{5}$$

**OR/OF**

$$T_n = -\frac{2}{5}n^2 + \frac{28}{5}n - \frac{101}{5}$$

$$n = -\frac{b}{2a} = \frac{-\frac{28}{5}}{2\left(\frac{-2}{5}\right)}$$

$$= 7$$

$$T_7 = -\frac{3}{5}$$

**OR/OF**

$$\checkmark n = 7$$

$$\checkmark \text{min value} = 3$$

$$\checkmark -\frac{1}{5} \text{ value of term of old pattern}$$

$$\checkmark \text{max value} = -\frac{3}{5} \quad (4)$$

**OR/OF**

$$\checkmark n = 7$$

$$\checkmark \text{min value} = 3$$

$$\checkmark -\frac{1}{5} \text{ value of term of old pattern}$$

$$\checkmark \text{max value} = -\frac{3}{5} \quad (4)$$

**OR/OF**

$$\checkmark \checkmark T_n = (-5)$$

$$\checkmark n = 7$$

$$\checkmark \text{max value} = -\frac{3}{5} \quad (4)$$

**OR/OF**



Mathematics P1/Wiskunde V1

7

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$$T_n = -\frac{2}{5}n^2 + \frac{28}{5}n - \frac{101}{5}$$

$$T'_n = -\frac{4}{5}n + \frac{28}{5}$$

$$-\frac{4}{5}n + \frac{28}{5} = 0$$

$$-4n = -28$$

$$n = 7$$

$$\text{Minimum value of } T_n = 2(7)^2 - 28(7) + 101 = 3$$

Each term in the new pattern is  $-\frac{1}{5}$  the value of the terms in the old pattern.

$$\text{Maximum value of new pattern} = -\frac{3}{5}$$

$$\checkmark\checkmark T_n \neq (-5)$$

$$\checkmark n = 7$$

$$\checkmark \text{max value} = -\frac{3}{5}$$

(4)

**[16]**

## QUESTION/VRAAG 3

3.1.1	$T_n = ar^{n-1}$ $T_{10} = 1024 \left(\frac{1}{4}\right)^{10-1}$ $\therefore T_{10} = \frac{1}{256}$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">ANSWER ONLY: FULL MARKS</div>	✓ substitution into the correct formula ✓ answer (2)
3.1.2	$\sum_{p=0}^8 256(4^{1-p}) = 1024 + 256 + 64 + \dots$ $S_n = \frac{a[1-r^n]}{1-r}$ $S_9 = \frac{1024 \left[1 - \left(\frac{1}{4}\right)^9\right]}{1 - \frac{1}{4}}$ $S_9 = \frac{87381}{64}$ $= 1365,33$ <p><b>OR/OF</b></p> $\sum_{p=0}^8 256(4^{1-p})$ $= 1024 + 256 + 64 + 16 + 4 + 1 + \frac{1}{4} + \frac{1}{16} + \frac{1}{64}$ $S_9 = \frac{87381}{64}$ $= 1365,33$	✓ 1024 ✓ $n = 9$ ✓ substitution into the correct formula ✓ answer (4) <p><b>OR/OF</b></p> ✓ 1024 ✓ rest of expansion ✓ $n = 9$ terms ✓ answer (4)
3.2	$-t^2 - 6t - 9; \frac{t^3 + 9t^2 + 27t + 27}{2}$ $-(t^2 + 6t + 9); \frac{1}{2}(t+3)(t^2 + 6t + 9)$ $-(t+3)^2; \frac{1}{2}(t+3)^3$ $r = \frac{-(t+3)}{2}$ $-1 < \frac{-t-3}{2} < 1$ $-2 < -t-3 < 2$ $1 < -t < 5$ $-5 < t < -1$	$r = \frac{t^3 + 9t^2 + 27t + 27}{-t^2 - 6t - 9}$ ✓ $-(t^2 + 6t + 9)$ ✓ $\frac{1}{2}(t+3)(t^2 + 6t + 9)$ ✓ $-1 < \frac{-t-3}{2} < 1$ ✓ answer (5)
		<b>[11]</b>



## QUESTION 4

4.1	$10 = a\left(\frac{1}{3}\right)^{-2} + 7$ $3 = 9a$ $\therefore a = \frac{1}{3}$	✓ subs (-2 ; 10) ✓ simplification ✓ answer (3)
4.2	$y = g(0)$ $y = \frac{1}{3} \times \left(\frac{1}{3}\right)^0 + 7$ $y = \frac{22}{3} = 7,33$ $\therefore \left(0 ; \frac{22}{3}\right)$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">ANSWER ONLY: FULL MARKS</div>	✓ substitution of $x = 0$ ✓ answer (2)
4.3.1	Translation by 1 unit to the right and 7 units downwards	✓ 1 unit right ✓ 7 units downwards (2)
4.3.2	$h(x) = \left(\frac{1}{3}\right)^x$ $h^{-1}: x = \left(\frac{1}{3}\right)^y$ $y = \log_{\frac{1}{3}}(x) \quad \text{OR/OF} \quad y = -\log_3(x)$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">ANSWER ONLY: FULL MARKS</div>	✓ swap $x$ and $y$ ✓ answer (2)
		<b>[9]</b>





## QUESTION 5

5.1	$g(x) = \frac{a}{x+2} + q$ Subs (1 ; 0): $0 = \frac{a}{1+2} + q$ $0 = a + 3q$ Subs $\left(0 ; -\frac{1}{2}\right)$ $-\frac{1}{2} = \frac{a}{0+2} + q$ $-1 = a + 2q$ Solving simultaneously: $q = 1$ $a = -3$ $\therefore g(x) = \frac{-3}{x+2} + 1$	$\checkmark g(x) = \frac{a}{x+2} + q$ $\checkmark 0 = a + 3q$ $\checkmark -1 = a + 2q$ $\checkmark \text{ solving simultaneously}$ $\checkmark q = 1$ $\checkmark a = -3$ (6)
5.2	$y \in \mathbb{R}; y \neq 1$ <b>OR/OF</b> $(-\infty; 1) \text{ or } (1; \infty)$ <b>OR/OF</b> $y < 1 \text{ or } y > 1$	$\checkmark \text{ answer}$ (1)
5.3	$y - 1 = 1(x + 2) \quad \text{OR/OF} \quad 1 = 1(-2) + c$ $y = x + 3$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 5px;"> <b>ANSWER ONLY: FULL MARKS</b> </div> $c = 3$ $y = x + 3$	$\checkmark m = 1$ $\checkmark \text{ subs point } (-2; 1)$ $\checkmark \text{ answer}$ (3)
5.4	$K'(-3; 4)$	$\checkmark \text{ x-value}$ $\checkmark \text{ y-value}$ (2)
		<b>[12]</b>





## QUESTION 6

6.1	$f(x) = -x^2 - 6x + 7$ $f'(x) = -2x - 6$ $-2x - 6 = 0$ <b>OR/OF</b> $x = -\frac{(-6)}{2(-1)}$ $x = -3$ $E(-3 ; 16)$	<div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 10px 0;">ANSWER ONLY: FULL MARKS</div> ✓ method ✓ x-value ✓ y-value (3)
6.2	$k = f(-5)$ $k = -(-5)^2 - 6(-5) + 7$ $\therefore k = 12$	✓ answer (A)      (1)
6.3	$C(0 ; 7)$ $D(-5 ; 12)$ $m_{CD} = \frac{12 - 7}{-5 - 0}$ $m_{CD} = -1$ <b>Equation of CD:</b> $y = -x + 7$	✓ coordinates of C ✓ substitution ✓ m ✓ answer (4)
6.4	$-2x - 6 = -1$ $-2x = 5$ $x = -\frac{5}{2}$ $y = f\left(\frac{-5}{2}\right) = -\left(\frac{-5}{2}\right)^2 - 6\left(\frac{-5}{2}\right) + 7 = \frac{63}{4} = 15,75$ $\therefore P\left(-\frac{5}{2}; \frac{63}{4}\right)$	✓ $f'(x) = -2x - 6$ ✓ equating to $-1$ ✓ x-value ✓ y-value (A) (4)
6.5	<b>Point by symmetry:</b> $(-1 ; 12)$ $-5 < x < -1$ <b>OR/OF</b> $-x^2 - 6x + 7 > 12$ $-x^2 - 6x - 5 > 0$ $x^2 + 6x + 5 < 0$ $(x + 1)(x + 5) < 0$ $-5 < x < -1$	<div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 10px 0;">ANSWER ONLY: FULL MARKS</div> ✓ $-1$ ✓ answer (2)  ✓ $-1$ ✓ answer (2)
		<b>[14]</b>





## QUESTION 7

7.1	$A = P(1+i)^n$ $2 = 1\left(1 + \frac{0,085}{4}\right)^{4n}$ $4n = \log_{\left(1 + \frac{0,085}{4}\right)} 2$ $n = 8,24 \text{ years}$	<ul style="list-style-type: none"> <li>✓ 2</li> <li>✓ <math>\frac{0,085}{4}</math> } In correct formula</li> <li>✓ use of logs</li> <li>✓ answer in years</li> </ul> <p style="text-align: right;">(4)</p>
7.2.1	$A = P(1-i)^n$ $180\,000 = 500\,000(1-i)^5$ $\frac{9}{25} = (1-i)^5$ $\sqrt[5]{\frac{9}{25}} = 1-i$ $i = 0,1848068\dots$ $r = 18,48\%$	<ul style="list-style-type: none"> <li>✓ subs into correct formula</li> <li>✓ simplification</li> <li>✓ <math>i = 0,1848\dots</math></li> <li>✓ answer</li> </ul> <p style="text-align: right;">(4)</p>
7.2.2	$A = P(1+i)^n$ $A = 500\,000(1+0,063)^5$ $A = R678\,635,11$	<ul style="list-style-type: none"> <li>✓ subs into correct formula</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(2)</p>
7.2.3	$\text{Sinking Fund} = 678\,635,11 - 180\,000$ $= R\,498\,635,11$ $498\,635,11 = \frac{x \left[ \left(1 + \frac{0,1025}{12}\right)^{58} - 1 \right] \left(1 + \frac{0,1025}{12}\right)^3}{\frac{0,1025}{12}}$ $x = R6\,510,36$	<ul style="list-style-type: none"> <li>✓ value of sinking fund</li> <li>✓ <math>\frac{0,1025}{12}</math></li> <li>✓ <math>n = 58</math> (A)</li> <li>✓ <math>\left(1 + \frac{0,1025}{12}\right)^3</math></li> <li>✓ answer (A)</li> </ul> <p style="text-align: right;">(5)</p>
		<b>[15]</b>



## QUESTION/VRAAG 8

8.1	$f(x) = -x^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-(x+h)^2 + x^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-x^2 - 2xh - h^2 + x^2}{h}$ $= \lim_{h \rightarrow 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \rightarrow 0} (-2x - h)$ $\therefore f'(x) = -2x$ <p><b>OR/OF</b></p> $f(x) = -x^2$ $f(x+h) = -(x+h)^2 = -x^2 - 2xh - h^2$ $f(x+h) - f(x) = -x^2 - 2xh - h^2 - (-x^2) = -2xh - h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \rightarrow 0} (-2x - h)$ $\therefore f'(x) = -2x$	<p>✓ substitution into formula</p> <p>✓ <math>-(x^2 + 2xh + h^2)</math></p> <p>✓ <math>-2xh - h^2</math></p> <p>✓ <math>-2x - h</math></p> <p>✓ answer (5)</p> <p><b>OR/OF</b></p> <p>✓ <math>-x^2 - 2xh - h^2</math></p> <p>✓ <math>-2xh - h^2</math></p> <p>✓ substitution into the formula</p> <p>✓ <math>-2x - h</math></p> <p>✓ answer (5)</p>
8.2.1	$f(x) = 4x^3 - 5x^2$ $f'(x) = 12x^2 - 10x$	<p>✓ <math>12x^2</math> (A)</p> <p>✓ <math>-10x</math> (A)</p> <p>(2)</p>
8.2.2	$D_x \left[ \frac{-6\sqrt[3]{x} + 2}{x^4} \right]$ $= D_x \left[ \frac{-6(x)^{\frac{1}{3}}}{x^4} + \frac{2}{x^4} \right]$ $= D_x \left[ -6x^{-\frac{11}{3}} + 2x^{-4} \right]$ $= 22x^{-\frac{14}{3}} - 8x^{-5}$	<p>✓ <math>x^{\frac{1}{3}}</math></p> <p>✓ <math>-6x^{-\frac{11}{3}} + 2x^{-4}</math></p> <p>✓ <math>22x^{-\frac{14}{3}}</math></p> <p>✓ <math>-8x^{-5}</math></p> <p>(4)</p>
		<b>[11]</b>



## QUESTION/VRAAG 9

9.1	$f(x) = (x+t)^2(x-3)$ $-3 = (0+t)^2(0-3)$ $1 = t^2$ $t = \pm 1$ $\therefore t = 1$ $f(x) = (x+1)^2(x-3)$ $f(x) = (x^2 + 2x + 1)(x-3)$ $f(x) = x^3 - x^2 - 5x - 3$	$\checkmark f(x) = (x+t)^2(x-3)$ $\checkmark$ subs $(0; -3)$  $\checkmark t$  $\checkmark f(x) = (x+1)^2(x-3)$ $\checkmark$ expansion  (5)
9.2	$f'(x) = 3x^2 - 2x - 5$ $0 = 3x^2 - 2x - 5$ $0 = (x+1)(3x-5)$ $x = -1$ or $x = \frac{5}{3}$ $N\left(\frac{5}{3}; -\frac{256}{27}\right) = (1,67; -9,48)$	$\checkmark f'(x) = 3x^2 - 2x - 5$ $\checkmark = 0$  $\checkmark$ factors $\checkmark$ x-value $(x > 0)$  $\checkmark$ y-value (A) (5)
9.3.1	$x < 3$ ; $x \neq -1$  <b>OR/OF</b> $x < -1$ or $-1 < x < 3$  <b>OR/OF</b> $(-\infty; -1)$ or $(-1; 3)$	$\checkmark x < 3$ $\checkmark x \neq -1$ (2)  <b>OR/OF</b> $\checkmark x < -1$ $\checkmark -1 < x < 3$ (2)  <b>OR/OF</b> $\checkmark (-\infty; -1)$ $\checkmark (-1; 3)$ (2)
9.3.2	$x < -1$ or $x > \frac{5}{3}$ OR/OF $x \leq -1$ or $x \geq \frac{5}{3}$  <b>OR/OF</b> $(-\infty; -1)$ or $\left(\frac{5}{3}; \infty\right)$ OR/OF $(-\infty; -1]$ or $\left[\frac{5}{3}; \infty\right)$	$\checkmark x < -1$ $\checkmark x > \frac{5}{3}$ (2)  <b>OR/OF</b> $\checkmark (-\infty; -1)$ $\checkmark \left(\frac{5}{3}; \infty\right)$ (2)
9.3.3	$f''(x) > 0$ $6x - 2 > 0$ $x > \frac{1}{3}$ or $\left(\frac{1}{3}; \infty\right)$  <b>OR/OF</b> $\frac{\frac{5}{3} + (-1)}{2} = \frac{1}{3}$ $x > \frac{1}{3}$ or $\left(\frac{1}{3}; \infty\right)$	$\checkmark 6x - 2$ $\checkmark \frac{1}{3}$ $\checkmark x > \frac{1}{3}$ (3)  <b>OR/OF</b> $\checkmark$ substitution $\checkmark \frac{1}{3}$ $\checkmark x > \frac{1}{3}$ (3)

ANSWER ONLY:  
FULL MARKS





Mathematics P1/Wiskunde V1

15

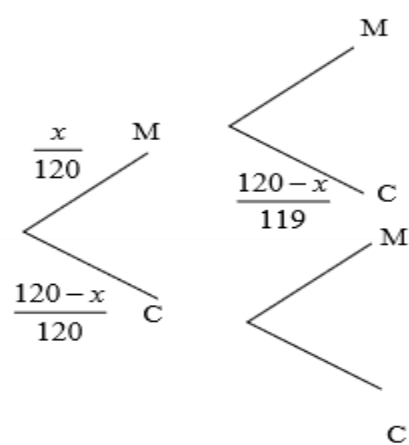
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9.4	$\text{Distance} = x^3 - x^2 - 5x - 3 - (3x^2 - 2x - 5)$ $= x^3 - 4x^2 - 3x + 2$ $\frac{d\text{Distance}}{dx} = 3x^2 - 8x - 3$ $0 = 3x^2 - 8x - 3$ $0 = (3x + 1)(x - 3)$ $x = 3 \text{ or } x = -\frac{1}{3}$ <p>Max distance</p> $= \left(-\frac{1}{3}\right)^3 - 4\left(-\frac{1}{3}\right)^2 - 3\left(-\frac{1}{3}\right) + 2$ $= \frac{68}{27} = 2,52$	<ul style="list-style-type: none"> <li>✓ <math>x^3 - 4x^2 - 3x + 2</math></li> <li>✓ <math>\frac{d\text{Distance}}{dx} = 3x^2 - 8x - 3</math></li> <li>✓ factors</li> <li>✓ x-values</li> <li>✓ <math>x = -\frac{1}{3}</math></li> <li>✓ answer</li> </ul> <p style="text-align: right;">(6)</p> <p style="text-align: right;"><b>[23]</b></p>
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**QUESTION/VRAAG 10**

10.1.1	$7! = 5\,040$	✓✓ answer (2)
10.1.2	$4! \times 4!$ $= 576$ $P(\text{African flags together}) = \frac{576}{5040} \left( = \frac{4}{35} = 0,11 \right)$	✓ $4!$ ✓ $4! \times 4!$ ✓ answer (A) (3)
10.2	$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $0,88 = 0,4 + P(B) - P(A \text{ and } B)$ $0,88 = 0,4 + P(B) - 0,4P(B)$ $0,48 = 0,6P(B)$ $P(B) = 0,8$	✓ subs into rule ✓ $P(A \text{ and } B) = 0,4P(B)$ ✓ answer (3)
10.3	<p>First Passenger      Second Passenger</p>  <p>Probability of first passenger choosing meat = <math>\frac{x}{120}</math></p> <p>Probability of second passenger choosing cheese = <math>\frac{120-x}{119}</math></p> $\frac{x}{120} \times \frac{120-x}{119} = \frac{18}{85}$ $120x - x^2 = 3\,024$ $x^2 - 120x + 3\,024 = 0$ $(x-84)(x-36) = 0$ $x = 84 \text{ or } x = 36$ <p><math>\therefore P(\text{1st cheese}) = \frac{36}{120} = \frac{3}{10}</math></p>	✓ $\frac{x}{120}$ ✓ $\frac{120-x}{119}$ ✓ $\frac{x}{120} \times \frac{120-x}{119} = \frac{18}{85}$ ✓ $x = 84 \text{ or } x = 36$ ✓ $\frac{3}{10}$ (5)
		[13]

**TOTAL/TOTAAL: 150**



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

**MATHEMATICS P1**

**MAY/JUNE 2023**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 8 pages and 1 information sheet.**





Mathematics/P1

3  
SC/NSC

DBE/May/June 2023

**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 - 7x + 12 = 0$  (3)

1.1.2  $x(3x + 5) = 1$  (correct to TWO decimal places) (4)

1.1.3  $x^2 < -2x + 15$  (4)

1.1.4  $\sqrt{2(1-x)} = x - 1$  (4)

1.2 Solve for  $x$  and  $y$  simultaneously:

$3^{x+y} = 27$  and  $x^2 + y^2 = 17$  (6)

1.3 Determine, **without the use of a calculator**, the value of:

$$\frac{1}{\sqrt{1} + \sqrt{2}} + \frac{1}{\sqrt{2} + \sqrt{3}} + \frac{1}{\sqrt{3} + \sqrt{4}} + \dots + \frac{1}{\sqrt{99} + \sqrt{100}}$$

(3)  
[24]**QUESTION 2**2.1 Given the geometric series:  $\frac{1}{5} + \frac{1}{15} + \frac{1}{45} + \dots$ 

2.1.1 Is this a convergent geometric series? Justify your answer with the necessary calculations. (2)

2.1.2 Calculate the sum to infinity of this series. (2)

2.2 An arithmetic and a geometric sequence are combined to form the pattern, which is given by:  $P_n = x; \frac{1}{3}; 2x; \frac{1}{9}; 3x; \frac{1}{27}; \dots$ 

2.2.1 Write down the next TWO terms of the pattern. (2)

2.2.2 Determine the general term ( $T_n$ ) for the odd terms of this pattern. Write down your answer in terms of  $x$ . (2)2.2.3 Calculate the value of  $P_{26}$ . (3)2.2.4 If  $\sum_{n=1}^{21} P_n = 33,5$ , determine the value of  $x$ . (6)

[17]

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Mathematics/P1

4  
SC/NSC

DBE/May/June 2023

**QUESTION 3**

A quadratic sequence has the following properties:

- The second difference is 10.
- The first two terms are equal, i.e.  $T_1 = T_2$ .
- $T_1 + T_2 + T_3 = 28$

3.1 Show that the general term of the sequence is  $T_n = 5n^2 - 15n + 16$ . (6)3.2 Is 216 a term in this sequence? Justify your answer with the necessary calculations. (3)  
[9]**QUESTION 4**4.1 Given the function  $p(x) = \left(\frac{1}{3}\right)^x$ .4.1.1 Is  $p$  an increasing or decreasing function? (1)4.1.2 Determine  $p^{-1}$ , the inverse of  $p$ , in the form  $y = \dots$  (2)4.1.3 Write down the domain of  $p^{-1}$ . (1)4.1.4 Write down the equation of the asymptote of  $p(x) - 5$ . (1)4.2 Given:  $f(x) = \frac{4}{x-1} + 2$ 4.2.1 Write down the equations of the asymptotes of  $f$ . (2)4.2.2 Calculate the  $x$ -intercept of  $f$ . (2)4.2.3 Sketch the graph of  $f$ , label all asymptotes and indicate the intercepts with the axes. (4)4.2.4 Use your graph to determine the values of  $x$  for which  $\frac{4}{x-1} \geq -2$ . (2)4.2.5 Determine the equation of the axis of symmetry of  $f(x-2)$ , that has a negative gradient. (3)  
[18]

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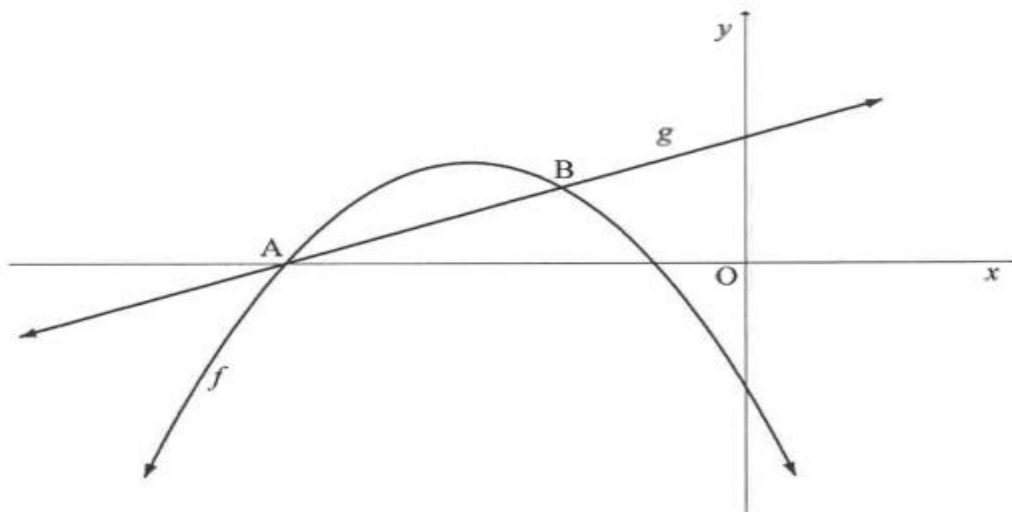
Mathematics/P1

5  
SC/NSC

DBE/May/June 2023

**QUESTION 5**

The graphs of the functions  $f(x) = -(x+3)^2 + 4$  and  $g(x) = x + 5$  are drawn below. The graphs intersect at A and B.



- 5.1 Write down the coordinates of the turning point of  $f$ . (2)
- 5.2 Write down the range of  $f$ . (1)
- 5.3 Show that the  $x$ -coordinates of A and B are  $-5$  and  $-2$  respectively. (4)
- 5.4 Hence, determine the values of  $c$  for which the equation  $-(x+c+3)^2 + 4 = (x+c) + 5$  has ONE negative and ONE positive root. (2)
- 5.5 The maximum distance between  $f$  and  $g$  in the interval  $x_A < x < x_B$  is  $k$ .  
If  $h(x) = g(x) + k$ , determine the equation of  $h$  in the form  $h(x) = \dots$  (5)
- [14]**

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Mathematics/P1

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**QUESTION 6**

- 6.1 A company bought a photocopier for R150 000 on 1 July 2022. They will use the old photocopier as a trade-in when they replace it with a similar new photocopier in 5 years' time on 30 June 2027.
- 6.1.1 The average rate of inflation over the next 5 years will be 6,5% p.a. Determine the price of a similar new photocopier in 5 years' time. (2)
- 6.1.2 Calculate the trade-in value of the old photocopier after 5 years, if it depreciates at a rate of 9% p.a. on a straight-line method. (2)
- 6.1.3 The company set up a sinking fund to cover the replacement cost of the new photocopier. The fund earns interest at the rate of 7,85% p.a., compounded monthly. The company made its first monthly deposit on 31 July 2022 and will continue to do so until 31 May 2027, one month prior to the new photocopier being bought. How much should be deposited at the end of each month so that the company will be able to buy the new photocopier? (4)
- 6.2 Today, Andrew borrowed R200 000 from a bank. The bank charges interest at 5,25% p.a., compounded quarterly. Andrew will make repayments of R6 000 at the end of every 3 months. His first repayment will be made in 3 months from now. How long, in years, will it take Andrew to settle the loan? (5)  
[13]

**QUESTION 7**

- 7.1 Determine  $f'(x)$  from first principles if  $f(x) = -2x^2 - 1$ . (5)
- 7.2 Determine:
- 7.2.1  $f'(x)$ , if it is given that  $f(x) = -2x^3 + 3x^2$  (2)
- 7.2.2  $\frac{dy}{dx}$  if  $y = 2x + \frac{1}{\sqrt{4x}}$  (4)
- 7.3 The graph  $y = f'(x)$  has a minimum turning point at  $(1; -3)$ . Determine the values of  $x$  for which  $f$  is concave down. (2)  
[13]

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Mathematics/P1

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SC/NSC

DBE/May/June 2023

**QUESTION 8**Given:  $f(x) = x^3 + 4x^2 - 7x - 10$ 

- 8.1 Write down the  $y$ -intercept of  $f$ . (1)
- 8.2 Show that 2 is a root of the equation  $f(x) = 0$ . (2)
- 8.3 Hence, factorise  $f(x)$  completely. (3)
- 8.4 If it is further given that the coordinates of the turning points are approximately at  $(0,7 ; -12,6)$  and  $(-3,4 ; 20,8)$ , draw a sketch graph of  $f$  and label all intercepts and turning points. (3)
- 8.5 Use your graph to determine the values of  $x$  for which:
- 8.5.1  $f'(x) < 0$  (2)
- 8.5.2 The gradient of a tangent to  $f$  will be a minimum (2)
- 8.5.3  $f'(x) \cdot f''(x) \leq 0$  (3)
- [16]**

**QUESTION 9**

A wire, 12 metres long, is cut into two pieces. One part is bent to form an equilateral triangle and the other a square. A side of the triangle has a length of  $2x$  metres.

- 9.1 Write down the length of a side of the square in terms of  $x$ . (2)
- 9.2 If this square is now used as the base of a rectangular prism with a height of  $4x$  metres, determine the maximum volume of the rectangular prism. (7)
- [9]**

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Mathematics/P1

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SC/NSC

DBE/May/June 2023

**QUESTION 10**

- 10.1 A group of people participated in a trial to test a new headache pill.
- 50% of the participants received the headache pill.
  - 50% of the participants received a sugar pill.
  - $\frac{2}{5}$  of the group receiving the headache pill were not cured.
  - $\frac{3}{10}$  of the group receiving the sugar pill were cured.
- 10.1.1 Represent the given information on a tree diagram. Indicate on your diagram the probability associated with each branch as well as the outcomes. (3)
- 10.1.2 Determine the probability that a person chosen at random from the group will NOT be cured. (2)
- 10.2 Three events, A, B and C, are considered:  
 $P(A) = \frac{2}{5}$ ,  $P(B) = \frac{1}{4}$  and  $P(A \text{ or } B) = \frac{13}{20}$ .
- 10.2.1 Are events A and B mutually exclusive? Support your answer with the necessary calculations. (2)
- 10.2.2 Determine  $P(\text{only } C)$ , if it is further given that  
 $P(A \text{ or } C) = \frac{7}{10}$ ,  $P(A \text{ and } C) = \frac{2}{5}$  and  $2P(B \text{ and } C) = P(A \text{ and } C)$ . (3)
- 10.2.3 Determine the probability that events A, B or C do NOT take place. (2)
- 10.3 Seven friends (4 boys and 3 girls) want to stand in a straight line next to each other to take a photo.
- 10.3.1 In how many ways can the 3 girls stand next to each other in the photo? (2)
- 10.3.2 In the next photo, determine the probability that Selwyn (a boy) and Lindiwe (a girl) will NOT stand next to each other in the photo. (3)
- [17]**
- TOTAL: 150**

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# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**SENIOR CERTIFICATE EXAMINATIONS/  
SENIORSERTIFIKAAT-EKSAMEN  
NATIONAL SENIOR CERTIFICATE EXAMINATIONS/  
NASIONALE SENIORSERTIFIKAAT-EKSAMEN**

**MATHEMATICS P1/WISKUNDE V1**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MAY/JUNE/MEI/JUNIE 2023**

**MARKS: 150  
PUNTE: 150**

**These marking guidelines consist of 15 pages./  
Hierdie nasienriglyne bestaan uit 15 bladsye.**





Mathematics P1/Wiskunde V1

2

DBE/May/June/Mei/Junie 2023

SC/SS/NSC/NSS – Marking Guidelines/Nasienriglyne

**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking guidelines.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die nasienriglyne van toepassing.

**QUESTION 1/VRAAG 1**

1.1.1	$x^2 - 7x + 12 = 0$ $(x - 4)(x - 3) = 0$ $x = 4$ or $x = 3$	<div style="border: 1px solid black; padding: 5px; display: inline-block;">           Answer only:            Full Marks         </div>	✓ factors ✓ $x = 4$ ✓ $x = 3$	(3)
1.1.2	$3x^2 + 5x - 1 = 0$ $x = \frac{-5 \pm \sqrt{5^2 - 4(3)(-1)}}{2(3)} = \frac{-5 \pm \sqrt{37}}{6}$ $\therefore x = 0,18$ or $x = -1,85$		✓ standard form ✓ substitution into the correct formula ✓ $x = 0,18$ ✓ $x = -1,85$	(4)
1.1.3	$x^2 + 2x - 15 < 0$ $(x - 3)(x + 5) < 0$ $x = 3$ or $x = -5$ $-5 < x < 3$		✓ standard form ✓ critical values ✓✓ answer	(4)
1.1.4	$\sqrt{2(1-x)} = x - 1$ $(\sqrt{2(1-x)})^2 = (x - 1)^2$ $2 - 2x = x^2 - 2x + 1$ $x^2 - 1 = 0$ $\therefore x = 1$ and $x \neq -1$		✓ squaring both sides ✓ simplification ✓ standard form ✓ answer with selection	(4)





1.2	$3^{x+y} = 27$ $x^2 + y^2 = 17$ $3^{x+y} = 3^3$ $x + y = 3 \dots\dots(1)$ $y = 3 - x$ $x^2 + (3 - x)^2 = 17$ $2x^2 - 6x - 8 = 0$ $x^2 - 3x - 4 = 0$ $(x - 4)(x + 1) = 0$ $x = 4 \text{ or } x = -1$ $y = -1 \text{ or } y = 4$ <p><b>OR/OF</b></p> $3^{x+y} = 27$ $x^2 + y^2 = 17$ $3^{x+y} = 3^3$ $x + y = 3 \dots\dots(1)$ $x = 3 - y$ $(3 - y)^2 + y^2 = 17$ $9 - 6y + y^2 + y^2 - 17 = 0$ $2y^2 - 6y - 8 = 0$ $y^2 - 3y - 4 = 0$ $(y - 4)(y + 1) = 0$ $y = -1 \text{ or } y = 4$ $x = 4 \text{ or } x = -1$	$\checkmark 3^{x+y} = 3^3$ $\checkmark x + y = 3$ $\checkmark \text{substitution}$ $\checkmark \text{standard form}$ $\checkmark x\text{-values}$ $\checkmark y\text{-values} \quad (6)$ <p><b>OR/OF</b></p> $\checkmark 3^{x+y} = 3^3$ $\checkmark x + y = 3$ $\checkmark \text{substitution}$ $\checkmark \text{standard form}$ $\checkmark y\text{-values}$ $\checkmark x\text{-values} \quad (6)$
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Mathematics P1/Wiskunde V1

4

DBE/May/June/Mei/Junie 2023

SC/SS/NSC/NSS – Marking Guidelines/Nasienriglyne

1.3	$\frac{1}{\sqrt{1} + \sqrt{2}} + \frac{1}{\sqrt{2} + \sqrt{3}} + \frac{1}{\sqrt{3} + \sqrt{4}} + \dots + \frac{1}{\sqrt{99} + \sqrt{100}}$ $= \frac{1}{\sqrt{1} + \sqrt{2}} \times \frac{\sqrt{1} - \sqrt{2}}{\sqrt{1} - \sqrt{2}} + \dots$ $+ \frac{1}{\sqrt{99} + \sqrt{100}} \times \frac{\sqrt{99} - \sqrt{100}}{\sqrt{99} - \sqrt{100}}$ $= -1 + \sqrt{2} - \sqrt{2} + \sqrt{3} - \sqrt{3} + 2 \dots - \sqrt{99} + 10$ $= -1 + 10$ $= 9$	<p>✓ rationalisation</p> <p>✓ simplification</p> <p>✓ answer (3)</p>
		<b>[24]</b>





## QUESTION 2/VRAAG 2

2.1.1	$\frac{1}{5} + \frac{1}{15} + \frac{1}{45} + \dots$ $r = \frac{\frac{1}{15}}{\frac{1}{5}} = \frac{1}{3}$ $-1 < \frac{1}{3} < 1$ <p><math>\therefore</math> the series is convergent.</p>	<p>✓ <math>r = \frac{1}{3}</math></p> <p>✓ answer (any indicator of convergence) (2)</p>
2.1.2	$S_{\infty} = \frac{a}{1-r}$ $= \frac{\frac{1}{5}}{1-\frac{1}{3}}$ $= \frac{3}{10}$	<p>✓ substitution</p> <p>✓ answer (2)</p>
2.2.1	$4x ; \frac{1}{81}$	<p>✓ <math>4x</math> ✓ <math>\frac{1}{81}</math> (2)</p>
2.2.2	$T_n = x + (n-1)x$ $= x + nx - x$ $= nx$	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <p>Answer only: Full Marks</p> </div> <p>✓ substitution</p> <p>✓ answer (2)</p>
2.2.3	$T_n = ar^{n-1}$ $T_{13} = \frac{1}{3} \left( \frac{1}{3} \right)^{13-1}$ $T_{13} = \left( \frac{1}{3} \right)^{13} \text{ or } \frac{1}{1594323} \text{ or } 6,27 \times 10^{-7} \text{ or } 3^{-13}$	<p>✓ <math>n = 13</math></p> <p>✓ <math>r = \frac{1}{3}</math></p> <p>✓ answer (3)</p>
2.2.4	$\sum_{n=1}^{21} P_n = S_{11} + S_{10}$ $= \frac{11}{2} [2x + 10x] + \frac{\frac{1}{3} \left[ 1 - \left( \frac{1}{3} \right)^{10} \right]}{1 - \frac{1}{3}}$ $= 66x + 0,5$ $33,5 = 66x + 0,5$ $\therefore x = \frac{1}{2}$	<p>✓ <math>S_{11}</math> ✓ <math>+S_{10}</math></p> <p>✓ arithmetic sum</p> <p>✓ geometric sum</p> <p>✓ <math>66x + 0,5</math> (A)</p> <p>✓ answer (6)</p>
		<b>[17]</b>



## QUESTION 3/VRAAG 3

3.1	$  \begin{array}{c}  x \quad ; \quad x \quad ; \quad T_3 \quad ; \quad \dots \\  \swarrow \quad \searrow \quad \swarrow \quad \searrow \\  0 \quad \quad T_3 - x \\  \swarrow \quad \searrow \\  10  \end{array}  $ $  \begin{array}{l}  2a = 10 \quad 3a + b = 0 \\  a = 5 \quad \quad b = -15  \end{array}  $ $  \begin{array}{l}  T_3 - x - 0 = 10 \\  \therefore T_3 = x + 10  \end{array}  $ $  \begin{array}{l}  2x + T_3 = 28 \\  2x + x + 10 = 28 \\  3x = 18 \\  x = 6  \end{array}  $ $  \begin{array}{l}  a + b + c = 6 \\  5 - 15 + c = 6 \\  c = 16  \end{array}  $ $\therefore T_n = 5n^2 - 15n + 16$ <p><b>OR/OF</b></p> $  \begin{array}{l}  2a = 10 \\  \therefore a = 5  \end{array}  $ $  \begin{array}{l}  T_1 = a + b + c \quad T_2 = 4a + 2b + c \quad T_3 = 9a + 3b + c \\  = 5 + b + c \quad = 20 + 2b + c \quad = 45 + 3b + c  \end{array}  $ $  \begin{array}{l}  5 + b + c = 20 + 2b + c \\  b = -15  \end{array}  $ $  \begin{array}{l}  T_1 = -10 + c \quad T_2 = -10 + c \quad T_3 = c  \end{array}  $ $  \begin{array}{l}  T_1 + T_2 + T_3 = -10 + c - 10 + c + c \\  28 = 3c - 20 \\  c = 16  \end{array}  $	$  \begin{array}{l}  \checkmark 2a = 10 \\  \checkmark 3a + b = 0  \end{array}  $ $\checkmark T_3 = x + 10$ $\checkmark 2x + T_3 = 28$ $\checkmark x = 6$ $\checkmark 5 - 15 + c = 6$ <p style="text-align: right;">(6)</p> <p><b>OR/OF</b></p> $\checkmark 2a = 10$ $\checkmark 5 + b + c = 20 + 2b + c$ $\checkmark T_1 = -10 + c$ $\checkmark T_2 = -10 + c$ $\checkmark 28 = 3c - 20$ $\checkmark c = 16$ <p style="text-align: right;">(6)</p>
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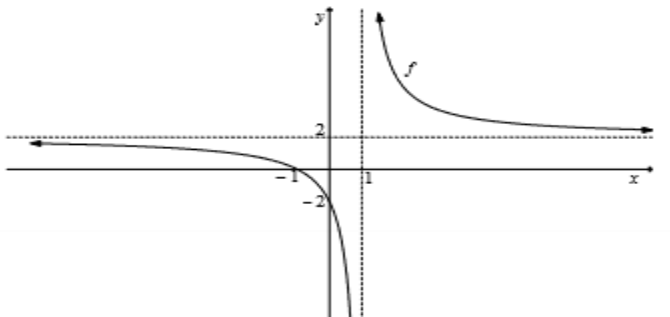


3.2	$T_n = 5n^2 - 15n + 16$ $216 = 5n^2 - 15n + 16$ $5n^2 - 15n - 200 = 0$ $n^2 - 3n - 40 = 0$ $(n-8)(n+5) = 0$ $n = 8 \text{ or } n = -5$ $\therefore T_8 = 216$	✓ equating ✓ standard form ✓ $n = 8$	(3)
			[9]

**QUESTION 4/VRAAG 4**

4.1.1	decreasing	✓ decreasing	(1)
4.1.2	$y = \left(\frac{1}{3}\right)^x$ $x = \left(\frac{1}{3}\right)^y$ $\therefore y = \log_{\frac{1}{3}} x$ <p><b>OR/OF</b></p> $y = 3^{-x}$ $x = 3^{-y}$ $\therefore y = -\log_3 x$	✓ swop $x$ and $y$ ✓ answer	(2)
4.1.3	$x > 0; x \in R$	✓ answer	(1)
4.1.4	$y = -5$	✓ answer	(1)
4.2.1	$x = 1$ $y = 2$	✓ $x = 1$ ✓ $y = 2$	(2)
4.2.2	$\frac{4}{x-1} + 2 = 0$ $4 = -2x + 2$ $2x = -2$ $x = -1$	✓ let $y = 0$ ✓ $x = -1$	(2)



4.2.3		<ul style="list-style-type: none"> <li>✓ asymptotes</li> <li>✓ x-intercept</li> <li>✓ y-intercept</li> <li>✓ shape</li> </ul> <p style="text-align: right;">(4)</p>
4.2.4	$\frac{4}{x-1} \geq -2$ $\frac{4}{x-1} + 2 \geq 0$ $x \leq -1 \text{ or } x > 1$	<ul style="list-style-type: none"> <li>✓ <math>x \leq -1</math></li> <li>✓ <math>x &gt; 1</math></li> </ul> <p style="text-align: right;">(2)</p>
4.2.5	$y = -x + c$ $2 = -3 + c$ $c = 5$ $y = -x + 5$ <p><b>OR/OF</b></p> $y = -x + c$ $2 = -1 + c$ $c = 3$ $y = -x + 3$ $y = -(x-2) + 3$ $y = -x + 5$ <p><b>OR/OF</b></p> $y = -(x+p) + q$ $y = -((x-2) + (-1)) + 2$ $y = -x + 5$	<ul style="list-style-type: none"> <li>✓ intersection of axes at (3 ; 2)</li> <li>✓ subst (3 ; 2) and <math>m = -1</math></li> <li>✓ <math>y = -x + 5</math></li> </ul> <p style="text-align: right;">(3)</p> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓✓ <math>-(x-2) + 3</math></li> <li>✓ <math>y = -x + 5</math></li> </ul> <p style="text-align: right;">(3)</p> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓✓ <math>y = -((x-2) + (-1)) + 2</math></li> <li>✓ <math>y = -x + 5</math></li> </ul> <p style="text-align: right;">(3)</p>
		<b>[18]</b>



## QUESTION 5/VRAAG 5

5.1	T.P(-3;4)	<ul style="list-style-type: none"> <li>✓ -3</li> <li>✓ 4</li> </ul> (2)
5.2	$y \leq 4$ or $y \in (-\infty; 4]$	<ul style="list-style-type: none"> <li>✓ answer</li> </ul> (1)
5.3	$f(x) = g(x)$ $-(x+3)^2 + 4 = x + 5$ $-x^2 - 6x - 9 + 4 = x + 5$ $-x^2 - 7x - 10 = 0$ $x^2 + 7x + 10 = 0$ $(x+5)(x+2) = 0$ $x = -5$ or $x = -2$	<ul style="list-style-type: none"> <li>✓ equating</li> <li>✓ <math>-x^2 - 6x - 9</math></li> <li>✓ standard form</li> <li>✓ factors</li> </ul> (4)
5.4	The graph must shift more than 2 and less than 5 units to the right $\therefore -5 < c < -2$	<ul style="list-style-type: none"> <li>✓✓ answer</li> </ul> (2)
5.5	$D(x) = f(x) - g(x) = -x^2 - 7x - 10$  Max: $-2x - 7 = 0$ <b>OR/OF</b> $x = \frac{-(-7)}{2(-1)}$  $x = -\frac{7}{2}$  $D\left(-\frac{7}{2}\right) = -\left(-\frac{7}{2}\right)^2 - 7\left(-\frac{7}{2}\right) - 10 = 2,25$ $\therefore k = 2,25$ $\therefore h(x) = x + 7,25$	<ul style="list-style-type: none"> <li>✓ distance</li> <li>✓ <math>-2x - 7 = 0</math></li> <li>✓ <math>x = -\frac{7}{2}</math></li> <li>✓ <math>k = 2,25</math></li> <li>✓ <math>h(x) = x + 7,25</math></li> </ul> (5)
		<b>[14]</b>



**QUESTION 6/VRAAG 6**

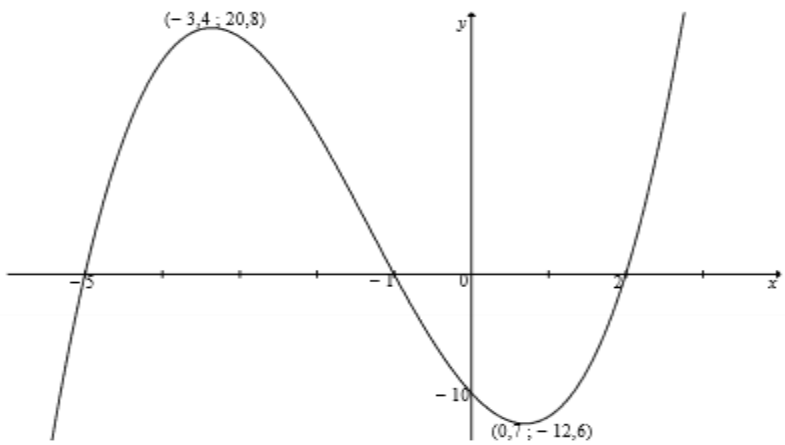
6.1.1	$A = P(1+i)^n$ $A = 150\,000(1+0,065)^5$ $A = R205\,513$	✓ substitution into the correct formula ✓ answer (2)
6.1.2	$A = P(1-in)$ $A = 150\,000(1-0,09 \times 5)$ $A = 150\,000 - 67\,000$ $A = R82\,500$	✓ substitution into the correct formula ✓ answer (2)
6.1.3	$SF = A - T = 205\,513 - 82\,500$ $= R123\,013$ $F = \frac{x[(1+i)^n - 1]}{i}$ $x = \frac{F \times i}{(1+i)^n - 1}$ $x = \frac{123\,013 \times \frac{0,0785}{12}}{\left[\left(1 + \frac{0,0785}{12}\right)^{59} - 1\right] \left(1 + \frac{0,0785}{12}\right)}$ $= R1\,704,01$	✓ answer  ✓ $i = \frac{0,0785}{12}$ ✓ 59 and $\left(1 + \frac{0,0785}{12}\right)$ (A)  ✓ answer (A) (4)
6.2	$P = \frac{x[1-(1+i)^{-n}]}{i}$ $200\,000 = \frac{6\,000 \left[1 - \left(1 + \frac{0,0525}{4}\right)^{-4n}\right]}{\frac{0,0525}{4}}$ $\frac{7}{16} = 1 - \left(1 + \frac{0,0525}{4}\right)^{-4n}$ $\frac{9}{16} = \left(\frac{1621}{1600}\right)^{-4n}$ $-4n = \frac{\log \frac{9}{16}}{\log \left(\frac{1621}{1600}\right)}$ $-4n = -44,1243\dots$ $n = 11,03 \text{ years}$	✓ substitution into correct formula  ✓ simplification  ✓ use of logs  ✓ $-4n = -44,1243\dots$ ✓ $n = 11,03 \text{ years}$ (5)
		<b>[13]</b>



## QUESTION 7/VRAAG 7

7.1	$f(x) = -2x^2 - 1$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2(x+h)^2 - 1 - (-2x^2 - 1)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 - 1 + 2x^2 + 1}{h}$ $= \lim_{h \rightarrow 0} \frac{-4xh - 2h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-4x - 2h)}{h}$ $= -4x$ <p><b>OR/OF</b></p> $f(x+h) = -2(x+h)^2 - 1$ $f(x+h) = -2x^2 - 4xh - 2h^2 - 1$ $f(x+h) - f(x) = -2x^2 - 4xh - 2h^2 - 1 + 2x^2 + 1$ $f(x+h) - f(x) = -4xh - 2h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-4xh - 2h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-4x - 2h)}{h}$ $= -4x$	<p>✓ substitution into the correct formula</p> <p>✓ <math>-2x^2 - 4xh - 2h^2 - 1</math></p> <p>✓ <math>-4xh - 2h^2</math></p> <p>✓ common factor</p> <p>✓ answer (5)</p> <p><b>OR/OF</b></p> <p>✓ <math>-2x^2 - 4xh - 2h^2 - 1</math></p> <p>✓ <math>-4xh - 2h^2</math></p> <p>✓ substitution into the correct formula</p> <p>✓ common factor</p> <p>✓ answer (5)</p>
7.2.1	$f(x) = -2x^3 + 3x^2$ $f'(x) = -6x^2 + 6x$	<p>✓ <math>-6x^2</math></p> <p>✓ <math>+6x</math> (2)</p>
7.2.2	$y = 2x + \frac{1}{\sqrt{4x}}$ $y = 2x + \frac{1}{2}x^{-\frac{1}{2}}$ $\frac{dy}{dx} = 2 - \frac{1}{4}x^{-\frac{3}{2}}$	<p>✓ <math>\frac{1}{2} \checkmark x^{-\frac{1}{2}}</math></p> <p>✓ <math>2 \checkmark -\frac{1}{4}x^{-\frac{3}{2}}</math> (4)</p>
7.3	$x < 1$	✓✓ answer (2)
		<b>[13]</b>

## QUESTION 8/VRAAG 8

8.1	$y = -10$	✓ answer (1)
8.2	$f(x) = x^3 + 4x^2 - 7x - 10$ $f(2) = 2^3 + 4(2)^2 - 7(2) - 10 = 0$	✓ substitution of $x = 2$ ✓ $f(2) = 0$ (2)
8.3	$f(x) = (x - 2)(x^2 + 6x + 5)$ $f(x) = (x - 2)(x + 5)(x + 1)$	✓ $(x - 2)$ ✓ $(x + 5)$ ✓ $(x + 1)$ (3)
8.4		✓ x- intercepts ✓ y-intercept ✓ sketching the graph with turning points in 2 <sup>nd</sup> and 4 <sup>th</sup> quadrant (3)
8.5.1	$x \in (-3,4 ; 0,7)$ <b>OR/OF</b> $-3,4 < x < 0,7$	✓ ✓ $x \in (-3,4 ; 0,7)$ (2)
8.5.2	$f(x) = x^3 + 4x^2 - 7x - 10$ $f'(x) = 3x^2 + 8x - 7$ $f''(x) = 6x + 8 = 0$ $\therefore x = -\frac{8}{6} = -\frac{4}{3} = -1,33$ <b>OR/OF</b> $\frac{-3,4 + 0,7}{2} = -1,35 = -1,35$	✓ $f''(x) = 6x + 8$ ✓ answer (2)  <b>OR/OF</b> ✓ substitution ✓ answer (2)
8.5.3	$x \leq -3,4$ or $-1,33 \leq x \leq 0,7$ <b>OR/OF</b> $x \in (-\infty ; -3,4] \cup [-1,33 ; 0,7]$	✓ $x \leq -3,4$ (A) ✓ ✓ $-1,33 \leq x \leq 0,7$ (A 0,7) (3)
		[16]



## QUESTION 9/VRAAG 9

9.1	Perimeter of the square = $12 - 6x$ Side length of square = $\frac{12 - 6x}{4} = \frac{6 - 3x}{2} = 3 - \frac{3}{2}x$	✓ $12 - 6x$ ✓ answer (2)
9.2	$V = \left(\frac{6-3x}{2}\right)^2 (4x)$ $= \left(\frac{36 - 36x + 9x^2}{4}\right)(4x)$ $= 36x - 36x^2 + 9x^3$ $V(x) = 36x - 36x^2 + 9x^3$ $V'(x) = 36 - 72x + 27x^2$ $36 - 72x + 27x^2 = 0$ $9x^2 - 24x + 12 = 0$ $3x^2 - 8x + 4 = 0$ $(3x - 2)(x - 2) = 0$ $x = \frac{2}{3} \quad \text{or} \quad x = 2$ $V\left(\frac{2}{3}\right) = 36\left(\frac{2}{3}\right) - 36\left(\frac{2}{3}\right)^2 + 9\left(\frac{2}{3}\right)^3$ $= \frac{32}{3} \text{ m}^3 = 10,67 \text{ m}^3$	✓ $\left(\frac{6-3x}{2}\right)^2 (4x)$ ✓ $\left(\frac{36 - 36x + 9x^2}{4}\right)$ ✓ $36x - 36x^2 + 9x^3$ ✓ $V'$ ✓ $V' = 0$  ✓ values  ✓ answer (7)
		[9]





## QUESTION 10/VRAAG 10

10.1.1	<p>Event A</p> <p>Event B</p> <p>HC</p> <p>HN</p> <p>SC</p> <p>SN</p>	<p>✓ Event A</p> <p>✓ Event B Medication: for <math>P(C) = \frac{3}{5}</math></p> <p>✓ Event B sugar pill: for <math>P(NC) = \frac{7}{10}</math></p> <p>(3)</p>
10.1.2	<p><math>P(\text{Not Cured}) = P(H) \times P(NC) + P(S) \times P(NC)</math></p> $= \left(\frac{1}{2}\right)\left(\frac{2}{5}\right) + \left(\frac{1}{2}\right)\left(\frac{7}{10}\right)$ $= \frac{11}{20} = 0,55$	<p>✓ substitution</p> <p>✓ answer</p> <p>(2)</p>
10.2.1	<p><math>P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)</math></p> $P(A \text{ and } B) = \frac{13}{20} - \frac{2}{5} - \frac{1}{4} = 0$ <p>Events are mutually exclusive</p> <p><b>OR/OF</b></p> $P(A) + P(B) = \frac{2}{5} + \frac{1}{4}$ $= \frac{13}{20}$ <p><math>P(A \text{ or } B) = P(A) + P(B)</math></p> <p><math>P(A \text{ and } B) = 0</math></p> <p>Events are mutually exclusive</p>	<p>✓ substitution</p> <p>✓ answer (<math>P(A \text{ and } B) = 0</math>)</p> <p>(2)</p> <p><b>OR/OF</b></p> <p>✓ substitution</p> <p>✓ answer (<math>P(A \text{ and } B) = 0</math>)</p> <p>(2)</p>





Mathematics P1/Wiskunde V1

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DBE/May/June/Mei/Junie 2023

SC/SS/NSC/NSS – Marking Guidelines/Nasienriglyne

10.2.2	$P(\text{B and C}) = \frac{1}{5} = 0,2$ $P(\text{only C}) = \frac{7}{10} - \frac{2}{5} - \frac{1}{5} = \frac{1}{10} = 0,1$	$\checkmark P(\text{B and C}) = \frac{1}{5} \text{ (A)}$ $\checkmark \frac{7}{10} - \frac{2}{5} - \frac{1}{5}$ $\checkmark \frac{1}{10} \quad (3)$
10.2.3	$P(\text{no event}) = 1 - \left( \frac{2}{5} + \frac{1}{10} + \frac{1}{5} + \frac{1}{20} \right) = \frac{1}{4} = 0,25$	$\checkmark 1 - (P(A) \text{ or } P(B) \text{ or } P(C))$ $\checkmark \text{answer} \quad (2)$
10.3.1	$3! \times 5!$ $= 720$	<p style="text-align: center;">Answer only: Full Marks</p> $\checkmark 3!$ $\checkmark 3! \times 5! \text{ (A)} \quad (2)$
10.3.2	$\frac{7! - 6! \times 2}{7!} = \frac{5}{7} = 0,71$ <p><b>OR/OF</b></p> $1 - \frac{6! \times 2}{7!}$ $= 1 - \frac{2}{7}$ $= \frac{5}{7} = 0,71$	$\checkmark 7! - 6! \times 2$ $\checkmark \text{denominator (7!)}$ $\checkmark \text{answer} \quad (3)$ <p><b>OR/OF</b></p> $\checkmark 6! \times 2$ $\checkmark \text{denominator (7!)}$ $\checkmark \text{answer} \quad (3)$
		<b>[17]</b>

**TOTAL/TOTAAL: 150**

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# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**NOVEMBER 2015**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 10 pages and 1 information sheet.**

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Mathematics/P1

3  
NSC

DBE/November 2015

**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 - 9x + 20 = 0$  (3)

1.1.2  $3x^2 + 5x = 4$  (correct to TWO decimal places) (4)

1.1.3  $2x^{\frac{-5}{3}} = 64$  (4)

1.1.4  $\sqrt{2-x} = x-2$  (4)

1.1.5  $x^2 + 7x < 0$  (3)

1.2 Given:  $(3x - y)^2 + (x - 5)^2 = 0$ Solve for  $x$  and  $y$ . (4)1.3 For which value of  $k$  will the equation  $x^2 + x = k$  have no real roots? (4)**[26]****QUESTION 2**The following geometric sequence is given:  $10 ; 5 ; 2,5 ; 1,25 ; \dots$ 2.1 Calculate the value of the 5<sup>th</sup> term,  $T_5$ , of this sequence. (2)2.2 Determine the  $n^{\text{th}}$  term,  $T_n$ , in terms of  $n$ . (2)2.3 Explain why the infinite series  $10 + 5 + 2,5 + 1,25 + \dots$  converges. (2)2.4 Determine  $S_\infty - S_n$  in the form  $ab^n$ , where  $S_n$  is the sum of the first  $n$  terms of the sequence. (4)**[10]**



Mathematics/P1

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NSC

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**QUESTION 3**Consider the series:  $S_n = -3 + 5 + 13 + 21 + \dots$  to  $n$  terms.3.1 Determine the general term of the series in the form  $T_k = bk + c$ . (2)3.2 Write  $S_n$  in sigma notation. (2)3.3 Show that  $S_n = 4n^2 - 7n$ . (3)

3.4 Another sequence is defined as:

$$Q_1 = -6$$

$$Q_2 = -6 - 3$$

$$Q_3 = -6 - 3 + 5$$

$$Q_4 = -6 - 3 + 5 + 13$$

$$Q_5 = -6 - 3 + 5 + 13 + 21$$

3.4.1 Write down a numerical expression for  $Q_6$ . (2)3.4.2 Calculate the value of  $Q_{129}$ . (3)  
[12]**QUESTION 4**Given:  $f(x) = 2^{x+1} - 8$ 4.1 Write down the equation of the asymptote of  $f$ . (1)4.2 Sketch the graph of  $f$ . Clearly indicate ALL intercepts with the axes as well as the asymptote. (4)4.3 The graph of  $g$  is obtained by reflecting the graph of  $f$  in the  $y$ -axis. Write down the equation of  $g$ . (1)  
[6]

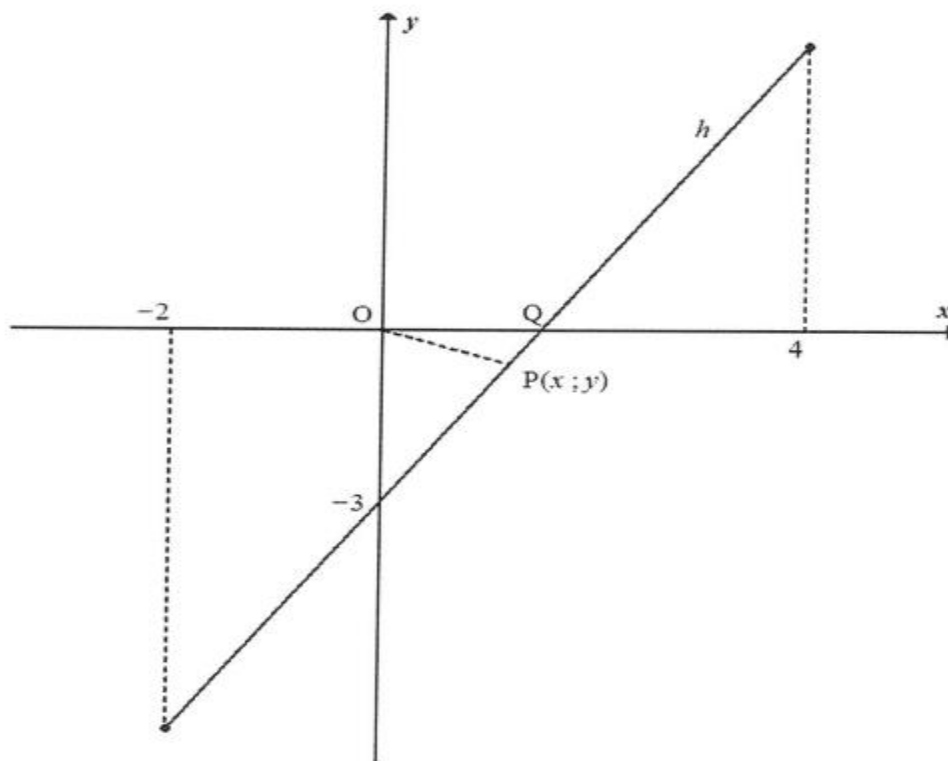
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**QUESTION 5**

Given:  $h(x) = 2x - 3$  for  $-2 \leq x \leq 4$ . The  $x$ -intercept of  $h$  is  $Q$ .



- 5.1 Determine the coordinates of  $Q$ . (2)
- 5.2 Write down the domain of  $h^{-1}$ . (3)
- 5.3 Sketch the graph of  $h^{-1}$  in your ANSWER BOOK, clearly indicating the  $y$ -intercept and the end points. (3)
- 5.4 For which value(s) of  $x$  will  $h(x) = h^{-1}(x)$ ? (3)
- 5.5  $P(x; y)$  is the point on the graph of  $h$  that is closest to the origin. Calculate the distance  $OP$ . (5)
- 5.6 Given:  $h(x) = f'(x)$  where  $f$  is a function defined for  $-2 \leq x \leq 4$ .
- 5.6.1 Explain why  $f$  has a local minimum. (2)
- 5.6.2 Write down the value of the maximum gradient of the tangent to the graph of  $f$ . (1)

**[19]**

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Mathematics/P1

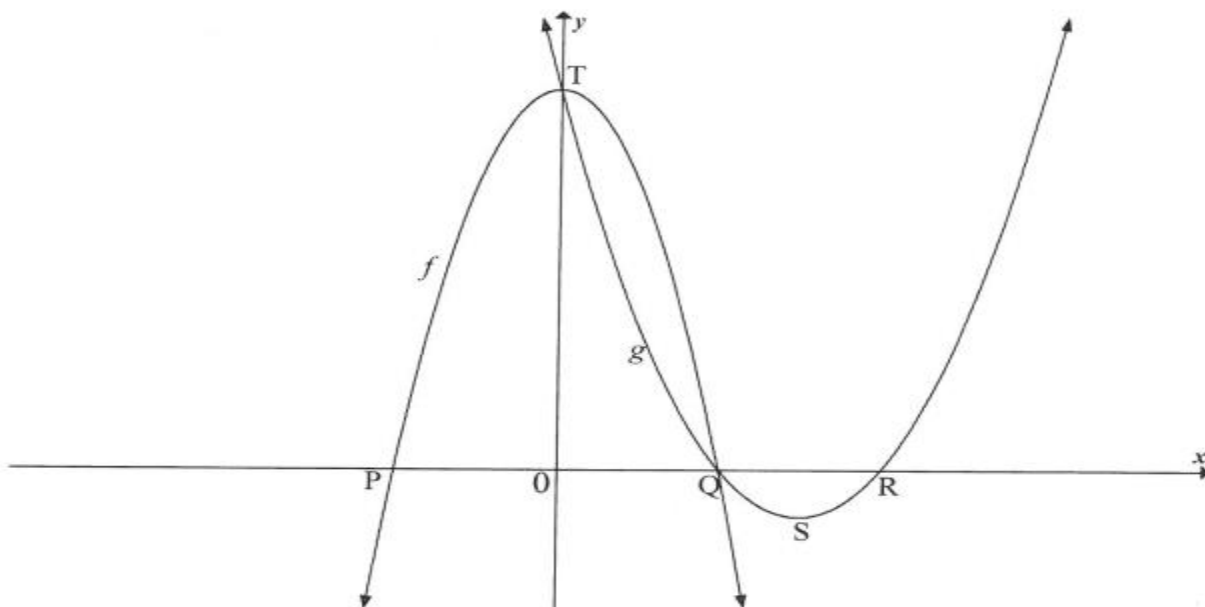
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**QUESTION 6**

6.1 The graphs of  $f(x) = -2x^2 + 18$  and  $g(x) = ax^2 + bx + c$  are sketched below.

Points P and Q are the  $x$ -intercepts of  $f$ . Points Q and R are the  $x$ -intercepts of  $g$ . S is the turning point of  $g$ . T is the  $y$ -intercept of both  $f$  and  $g$ .



- 6.1.1 Write down the coordinates of T. (1)
- 6.1.2 Determine the coordinates of Q. (3)
- 6.1.3 Given that  $x = 4,5$  at S, determine the coordinates of R. (2)
- 6.1.4 Determine the value(s) of  $x$  for which  $g''(x) > 0$ . (2)

6.2 The function defined as  $y = \frac{a}{x+p} + q$  has the following properties:

- The domain is  $x \in R, x \neq -2$ .
- $y = x + 6$  is an axis of symmetry.
- The function is increasing for all  $x \in R, x \neq -2$ .

Draw a neat sketch graph of this function. Your sketch must include the asymptotes, if any.

(4)  
[12]

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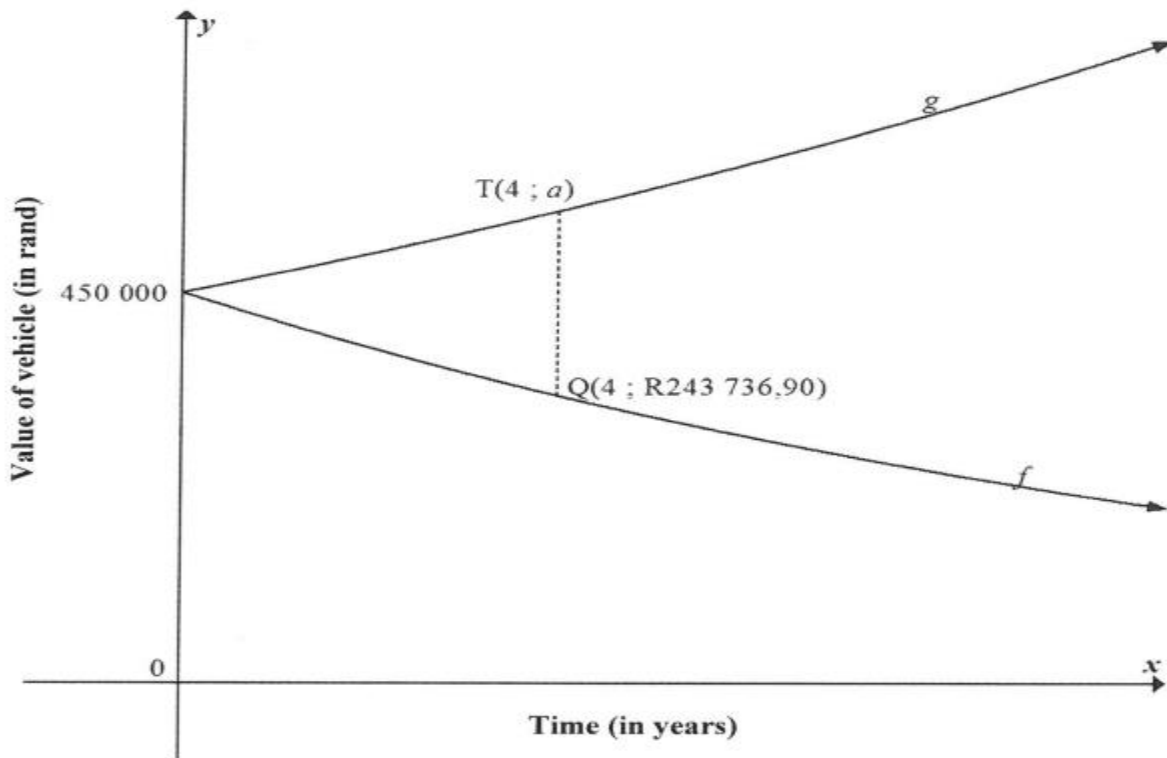
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**QUESTION 7**

The graph of  $f$  shows the book value of a vehicle  $x$  years after the time Joe bought it.  
The graph of  $g$  shows the cost price of a similar new vehicle  $x$  years later.



- 7.1 How much did Joe pay for the vehicle? (1)
- 7.2 Use the reducing-balance method to calculate the percentage annual rate of depreciation of the vehicle that Joe bought. (4)
- 7.3 If the average rate of the price increase of the vehicle is 8,1% p.a., calculate the value of  $a$ . (3)
- 7.4 A vehicle that costs R450 000 now, is to be replaced at the end of 4 years. The old vehicle will be used as a trade-in. A sinking fund is created to cover the replacement cost of this vehicle. Payments will be made at the end of each month. The first payment will be made at the end of the 13<sup>th</sup> month and the last payment will be made at the end of the 48<sup>th</sup> month. The sinking fund earns interest at a rate of 6,2% p.a., compounded monthly.
- Calculate the monthly payment to the fund. (5)
- [13]

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**QUESTION 8**

8.1 If  $f(x) = x^2 - 3x$ , determine  $f'(x)$  from first principles. (5)

8.2 Determine:

8.2.1  $\frac{dy}{dx}$  if  $y = \left(x^2 - \frac{1}{x^2}\right)^2$  (3)

8.2.2  $D_x \left( \frac{x^3 - 1}{x - 1} \right)$  (3)  
[11]

**QUESTION 9**

Given:  $h(x) = -x^3 + ax^2 + bx$  and  $g(x) = -12x$ . P and Q(2 ; 10) are the turning points of  $h$ . The graph of  $h$  passes through the origin.

9.1 Show that  $a = \frac{3}{2}$  and  $b = 6$ . (5)

9.2 Calculate the average gradient of  $h$  between P and Q, if it is given that  $x = -1$  at P. (4)

9.3 Show that the concavity of  $h$  changes at  $x = \frac{1}{2}$ . (3)

9.4 Explain the significance of the change in QUESTION 9.3 with respect to  $h$ . (1)

9.5 Determine the value of  $x$ , given  $x < 0$ , at which the tangent to  $h$  is parallel to  $g$ . (4)  
[17]

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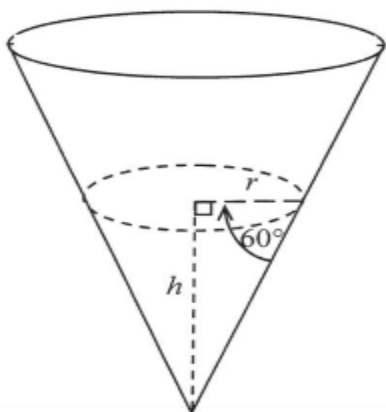
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**QUESTION 10**

A rain gauge is in the shape of a cone. Water flows into the gauge. The height of the water is  $h$  cm when the radius is  $r$  cm. The angle between the cone edge and the radius is  $60^\circ$ , as shown in the diagram below.



Formulae for volume:

$$V = \pi r^2 h$$

$$V = \frac{1}{3} \pi r^2 h$$

$$V = lbh$$

$$V = \frac{4}{3} \pi r^3$$

- 10.1 Determine  $r$  in terms of  $h$ . Leave your answer in surd form. (2)
- 10.2 Determine the derivative of the volume of water with respect to  $h$  when  $h$  is equal to 9 cm. (5)
- [7]

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**QUESTION 11**

11.1 For two events, A and B, it is given that:

$$P(A) = 0,2$$

$$P(B) = 0,63$$

$$P(A \text{ and } B) = 0,126$$

Are the events, A and B, independent? Justify your answer with appropriate calculations. (3)

11.2 The letters of the word DECIMAL are randomly arranged into a new 'word', also consisting of seven letters. How many different arrangements are possible if:

11.2.1 Letters may be repeated (2)

11.2.2 Letters may not be repeated (2)

11.2.3 The arrangements must start with a vowel and end in a consonant and no repetition of letters is allowed (4)

11.3 There are  $t$  orange balls and 2 yellow balls in a bag. Craig randomly selects one ball from the bag, records his choice and returns the ball to the bag. He then randomly selects a second ball from the bag, records his choice and returns it to bag. It is known that the probability that Craig will select two balls of the same colour from the bag is 52%.

Calculate how many orange balls are in the bag. (6)

[17]

**TOTAL: 150**



# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

## NATIONAL SENIOR CERTIFICATE

GRADE 12/*GRAAD 12*

MATHEMATICS P1/*WISKUNDE V1*

NOVEMBER 2015

MEMORANDUM

MARKS: 150

PUNTE: 150

This memorandum consists of 25 pages.  
*Hierdie memorandum bestaan uit 25 bladsye.*



**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking memorandum.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is op ALLE aspekte van die memorandum van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$x^2 - 9x + 20 = 0$ $(x - 4)(x - 5) = 0$ $x = 4 \text{ or } x = 5$	✓ factors  ✓ $x = 4$ ✓ $x = 5$ (3)
1.1.2	$3x^2 + 5x - 4 = 0$ $x = \frac{-5 \pm \sqrt{(5)^2 - 4(3)(-4)}}{2(3)}$ $x = \frac{-5 \pm \sqrt{73}}{6}$ $x = -2,26 \text{ or } x = 0,59$ <p><b>OR/OF</b></p> $x^2 + \frac{5}{3}x + \frac{25}{36} = \frac{4}{3} + \frac{25}{36}$ $\left(x + \frac{5}{6}\right)^2 = \frac{73}{36}$ $x + \frac{5}{6} = \pm \frac{\sqrt{73}}{6}$ $x = \frac{-5 \pm \sqrt{73}}{6}$ $x = -2,26 \text{ or } x = 0,59$	✓ standard form  ✓ substitution into correct formula  ✓ ✓ answers (4)  ✓ for adding $\frac{25}{36}$ on both sides  ✓ $x = \frac{-5 \pm \sqrt{73}}{6}$  ✓ ✓ answers (4)
1.1.3	$2x^{\frac{-5}{3}} = 64$ $x^{\frac{-5}{3}} = 32$ $x = (2^5)^{\frac{-3}{5}}$ $x = 2^{-3} \text{ or } \frac{1}{8} \text{ or } 0,125$ <p><b>OR/OF</b></p>	✓ dividing both sides by 2 ✓ $32 = 2^5$ or $64 = 2^6$ ✓ raising RHS to $\frac{-3}{5}$ ✓ answer (4)



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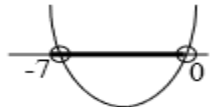
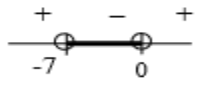
	$2x^{\frac{-5}{3}} = 64$ $x^{\frac{-5}{3}} = 32$ $x = (32)^{\frac{-3}{5}}$ $x = \sqrt[5]{32^{-3}}$ $x = 2^{-3} \text{ or } \frac{1}{8} \text{ or } 0,125$ <p><b>OR/OF</b></p> $\left(2x^{\frac{-5}{3}}\right)^{\frac{-3}{5}} = 64^{\frac{-3}{5}}$ $0,659x = 0,0825$ $x = 0,125$ <p><b>OR/OF</b></p> $x^{\frac{-5}{3}} = 32$ $\frac{-5}{3} \log x = \log 32$ $\log x = \frac{3}{-5} \log 32$ $\log x = -0,903$ $x = 10^{-0,903}$ $= 0,125 \text{ or } \frac{1}{8}$	<p>✓ dividing both sides by 2          ✓ raising RHS to <math>\frac{-3}{5}</math>          ✓ <math>\sqrt[5]{32^{-3}}</math>          ✓ answer (4)</p> <p>✓ raising both sides to <math>\frac{-3}{5}</math>          ✓ 0,659 and 0,0825          ✓ dividing both sides by 0,659          ✓ answer (4)</p> <p>✓ dividing both sides by 2          ✓ logs on both sides</p> <p>✓ <math>\log x = -0,903</math></p> <p>✓ answer (4)</p>
1.1.4	$\sqrt{2-x} = x-2$ $2-x = (x-2)^2$ $2-x = x^2 - 4x + 4$ $x^2 - 3x + 2 = 0$ $(x-1)(x-2) = 0$ $x = 1 \text{ or } x = 2$ <p>if <math>x = 1</math>, <math>\sqrt{2-x} = 1</math> and <math>x-2 = -1</math>  <math>x = 2</math> only</p> <p><b>OR/OF</b></p>	<p>✓ squaring both sides</p> <p>✓ factors          ✓ <math>x = 1</math> or <math>x = 2</math>          ✓ <math>x = 2</math> only (4)</p>

Mathematics/P1/Wiskunde V1

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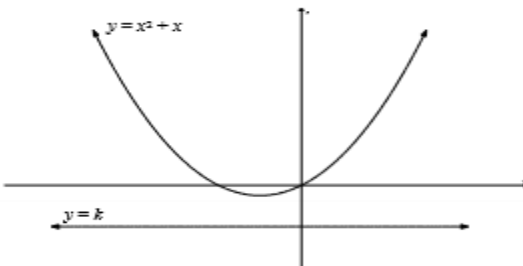
	$\sqrt{2-x} = x-2$ $2-x = (x-2)^2$ $2-x = (2-x)^2$ $2-x = 1 \text{ or } 2-x = 0$ $x = 1 \text{ or } x = 2$ <p>if <math>x = 1</math>, <math>\sqrt{2-x} = 1</math> and <math>x-2 = -1</math>  <math>\therefore x = 2</math> only</p> <p><b>OR/OF</b></p> $\sqrt{2-x} = x-2$ $2-x \geq 0 \text{ and } x-2 \geq 0$ $x \leq 2 \text{ and } x \geq 2$ $\therefore x = 2 \text{ only}$	<p>✓ squaring both sides</p> <p>✓ <math>2-x=1</math> or <math>2-x=0</math></p> <p>✓ <math>x = 1</math> or <math>x = 2</math></p> <p>✓ <math>x = 2</math> only (4)</p> <p>✓ <math>2-x \geq 0</math></p> <p>✓ <math>x-2 \geq 0</math></p> <p>✓ <math>x \leq 2</math> and <math>x \geq 2</math></p> <p>✓ <math>x = 2</math> (4)</p>
1.1.5	$x^2 + 7x < 0$ $x(x+7) < 0$ <div style="display: flex; align-items: center; justify-content: center;">  <p style="margin: 0 10px;"><b>OR/OF</b></p>  </div> $-7 < x < 0 \text{ OR/OF } x \in (-7; 0)$	<p>✓ factors</p> <p>✓ inequality or interval (3)</p>
1.2	<p>The square of any number is always positive or zero          So for the sum of two squares to be zero, both squares must be zero, i.e.  <i>Die kwadraat van enige getal is altyd positief of nul. Vir die som van twee kwadrate om nul te wees, moet beide die kwadrate nul wees, d.i.</i></p> $(3x-y)^2 = 0 \text{ and/en } (x-5)^2 = 0$ $3x-y = 0 \text{ and/en } x-5 = 0$ $x = 5$ $3(5)-y = 0$ $y = 15$	<p>✓ <math>3x-y = 0</math></p> <p>✓ <math>x-5 = 0</math></p> <p>✓ <math>x = 5</math></p> <p>✓ <math>y = 15</math> (4)</p>

Mathematics/P1/Wiskunde V1

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<p>1.3</p>	$x^2 + x = k$ $x^2 + x - k = 0$ $\Delta < 0$ $b^2 - 4ac < 0$ $1^2 - 4(1)(-k) < 0$ $1 + 4k < 0$ $k < \frac{-1}{4}$ <p><b>OR/OF</b></p> $x^2 + x = k$ $x^2 + x + \frac{1}{4} = k + \frac{1}{4}$ $\left(x + \frac{1}{2}\right)^2 = k + \frac{1}{4}$ <p>for nonreal roots <math>k + \frac{1}{4} &lt; 0</math></p> $k < \frac{-1}{4}$ <p><b>OR/OF</b></p> <p>Consider the functions <math>y = x^2 + x</math> and <math>y = k</math>  <i>Beskou die funksies <math>y = x^2 + x</math> en <math>y = k</math></i></p>  <p>Turning point of/<i>Draaipunt van</i> <math>y = x^2 + x</math> is <math>\left(\frac{-1}{2}; \frac{-1}{4}\right)</math></p> <p><math>x^2 + x = k</math> does not have real roots when the line <math>y = k</math> does not intersect <math>y = x^2 + x</math>.</p> <p><math>x^2 + x = k</math> <i>het geen reële wortels as die lyn <math>y = k</math> nie met <math>y = x^2 + x</math> sny nie.</i></p> <p>Therefore <math>k &lt; \frac{-1}{4}</math></p>	<p>✓ standard form</p> <p>✓ <math>\Delta &lt; 0</math></p> <p>✓ <math>1^2 - 4(1)(-k)</math></p> <p>✓ <math>k &lt; \frac{-1}{4}</math></p> <p>(4)</p> <p>✓ adds <math>\frac{1}{4}</math> to both sides</p> <p>✓ <math>\left(x + \frac{1}{2}\right)^2 = k + \frac{1}{4}</math></p> <p>✓ <math>k + \frac{1}{4} &lt; 0</math></p> <p>✓ <math>k &lt; \frac{-1}{4}</math></p> <p>(4)</p> <p>✓ sketch or explanation</p> <p>✓ <math>x = -\frac{1}{2}</math></p> <p>✓ <math>y = -\frac{1}{4}</math></p> <p>✓ <math>k &lt; \frac{-1}{4}</math></p> <p>(4)</p> <p>[26]</p>
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## QUESTION/VRAAG 2

2.1	$r = \frac{T_2}{T_1}$ $= \frac{5}{10}$ $= \frac{1}{2}$ $T_5 = 1,25 \left(\frac{1}{2}\right)$ $= \frac{5}{8} \text{ or } 0,625$ <p style="text-align: center;"><b>OR/OF</b></p> $T_5 = 10 \left(\frac{1}{2}\right)^4$ $= \frac{5}{8} \text{ or } 0,625$	<p>✓ <math>r = \frac{1}{2}</math></p> <p>✓ answer (2)</p>
2.2	$T_n = 10 \left(\frac{1}{2}\right)^{n-1}$	<p>✓ substitutes <math>a = 10</math> into GP formula</p> <p>✓ substitutes <math>r = \frac{1}{2}</math> into GP formula (2)</p>
2.3	<p>For convergence/Om te konvergeer <math>-1 &lt; r &lt; 1</math></p> <p>Since/Aangesien <math>r = \frac{1}{2}</math> and/en <math>-1 &lt; \frac{1}{2} &lt; 1</math></p> <p>the sequence converges/die ry konvergeer</p>	<p>✓ <math>-1 &lt; r &lt; 1</math></p> <p>✓ show that <math>r = \frac{1}{2}</math> is <math>-1 &lt; r &lt; 1</math> (2)</p>
2.4	$S_\infty - S_n = \frac{a}{1-r} - \frac{a(1-r^n)}{1-r}$ $= \frac{10}{1-\frac{1}{2}} - \frac{10\left(1-\frac{1}{2}^n\right)}{1-\frac{1}{2}}$ $= 20 - 20\left(1-\frac{1}{2}^n\right)$ $= 20 - 20 + 20\left(\frac{1}{2}\right)^n$ $= 20\left(\frac{1}{2}\right)^n$ <p style="text-align: center;"><b>OR/OF</b></p>	<p>✓ <math>\frac{10}{1-\frac{1}{2}}</math></p> <p>✓ <math>\frac{10\left(1-\frac{1}{2}^n\right)}{1-\frac{1}{2}}</math></p> <p>✓ <math>20\left(1-\frac{1}{2}^n\right)</math></p> <p>✓ answer (4)</p> <p>✓ constructing the series</p>





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	$S_{\infty} - S_n = T_{n+1} + T_{n+2} + T_{n+3} + \dots$ $= 10\left(\frac{1}{2}\right)^n \left[1 + \frac{1}{2} + \frac{1}{4} + \dots\right]$ $= 10\left(\frac{1}{2}\right)^n \left[\frac{1}{1 - \frac{1}{2}}\right]$ $= 20\left(\frac{1}{2}\right)^n$ <p><b>OR/OF</b></p> $S_{\infty} - S_n = \frac{a}{1-r} - \frac{a(1-r^n)}{1-r}$ $= \frac{a - a + ar^n}{1-r}$ $= \frac{ar^n}{1-r}$ $= \frac{10\left(\frac{1}{2}\right)^n}{\frac{1}{2}}$ $= 20\left(\frac{1}{2}\right)^n$	$\checkmark$ $10\left(\frac{1}{2}\right)^n \left[1 + \frac{1}{2} + \frac{1}{4} + \dots\right]$ $\checkmark \frac{1}{1 - \frac{1}{2}}$ $\checkmark \text{answer}$ <p style="text-align: right;">(4)</p> $\checkmark \frac{a - a + ar^n}{1-r}$ $\checkmark \frac{ar^n}{1-r}$ $\checkmark \frac{10\left(\frac{1}{2}\right)^n}{\frac{1}{2}}$ $\checkmark \text{answer}$ <p style="text-align: right;">(4)</p> <p style="text-align: right;"><b>[10]</b></p>
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## QUESTION/VRAAG 3

3.1	$d = 8$ $T_k = a + (k - 1)d$ $= -3 + (k - 1)(8)$ $= -3 + 8k - 8$ $= 8k - 11$	✓ $d$ value  ✓ answer (2)
3.2	$\sum_{k=1}^n (8k - 11) \quad \text{OR/OF} \quad \sum_{k=0}^{n-1} (8(k+1) - 11) = \sum_{k=0}^{n-1} (8k - 3)$	✓ for general term ✓ lower and upper values in sigma notation (2)
3.3	$S_n = \frac{n}{2} [2a + (n - 1)d]$ $= \frac{n}{2} [2(-3) + (n - 1)(8)]$ $= \frac{n}{2} [-6 + 8n - 8]$ $= \frac{n}{2} [8n - 14]$ $= n(4n - 7)$ $= 4n^2 - 7n$ <p><b>OR/OF</b></p> $S_n = \frac{n}{2} [2a + (n - 1)d]$ $= \frac{n}{2} [2(-3) + (n - 1)(8)]$ $= \frac{n}{2} [-6 + 8n - 8]$ $= \frac{n}{2} [8n - 14]$ $= 4n^2 - 7n$ <p><b>OR/OF</b></p> $S_n = \frac{n}{2} [a + l]$ $= \frac{n}{2} [-3 + 8n - 11]$ $= \frac{n}{2} [8n - 14]$ $= 4n^2 - 7n$	✓ formula ✓ substitution  ✓ $\frac{n}{2} [8n - 14]$ (3)
		✓ formula ✓ substitution  ✓ $\frac{n}{2} [8n - 14]$ (3)
		✓ formula ✓ substitution  ✓ $\frac{n}{2} [8n - 14]$ (3)





	<p><b>OR/OF</b></p> $  \begin{array}{ccccccc}  S_1 & & S_2 & & S_3 & & S_4 \\  -3 & & 2 & & 15 & & 36 \\  & \diagdown & / & \diagdown & / & \diagdown & / \\  & 5 & & 13 & & 21 & \\  & / & \diagdown & / & \diagdown & / & \\  & & 8 & & 8 & &   \end{array}  $ <p> <math>S_n = an^2 + bn + c</math>  <math>a = \frac{8}{2}</math>  <math>a = 4</math>  <math>S_1 = 4 + b + c = -3</math>      <math>b + c = -7</math> .....(1)  <math>S_2 = 16 + 2b + c = 2</math>      <math>2b + c = -14</math> .....(2)  <math>b = -7</math> .....(2) - (1)  <math>c = 0</math> </p> <p>Hence <math>S_n = 4n^2 - 7n</math></p>	<p> <math>S_2 = -3 + 5 = 2</math>  <math>S_3 = 2 + 13 = 15</math>  <math>S_4 = 15 + 21 = 36</math>                  ✓ calculates <math>S_1, S_2, S_3</math> and <math>S_4</math>,                   ✓ <math>a = 4</math>                   ✓ solves simultaneously for <math>b</math> and <math>c</math>.                  (3)             </p>
<p>3.4.1</p>	<p><math>Q_6 = -6 - 3 + 5 + 13 + 21 + 29</math></p>	<p>✓✓ answer (2)</p>
<p>3.4.2</p>	<p> <math>Q_{129} = -6 + S_{128}</math>  <math>= -6 + 4(128)^2 - 7(128)</math>  <math>= 64634</math> </p> <p><b>OR/OF</b></p> $  \begin{array}{ccccccc}  Q_1 & & Q_2 & & Q_3 & & Q_4 \\  -6 & & -9 & & -4 & & 9 \\  & \diagdown & / & \diagdown & / & \diagdown & / \\  & -3 & & 5 & & 13 & \\  & / & \diagdown & / & \diagdown & / & \\  & & 8 & & 8 & & 8  \end{array}  $ <p> <math>Q_n = an^2 + bn + c</math>  <math>a = 4</math>  <math>Q_1 = 4 + b + c = -6</math>      <math>b + c = -10</math> .....(1)  <math>Q_2 = 16 + 2b + c = -9</math>      <math>2b + c = -25</math> .....(2)  <math>b = -15</math> .....(2) - (1)  <math>c = 5</math> </p> <p>Hence <math>Q_n = 4n^2 - 15n + 5</math>  <math>Q_{129} = 4(129)^2 - 15(129) + 5</math>  <math>= 64\ 634</math></p>	<p>                 ✓✓  <math>-6 + 4(128)^2 - 7(128)</math>                  ✓ answer                  (3)                   ✓ <math>a = 4</math>                   ✓ <math>Q_n = 4n^2 - 15n + 5</math>                  ✓ answer                  (3)             </p>





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## QUESTION/VRAAG 4

Given: $f(x) = 2^{x+1} - 8$		
4.1	$y = -8$	✓ $y = -8$ (1)
4.2		✓ $x$ -intercept ✓ $y$ -intercept ✓ shape ✓ asymptote (only if the graph does not cut the asymptote)
4.3	$g(x) = 2^{-x+1} - 8$  <b>OR/OF</b>  $g(x) = \left(\frac{1}{2}\right)^{x-1} - 8$	✓ answer (1)  ✓ answer (1) <b>[6]</b>



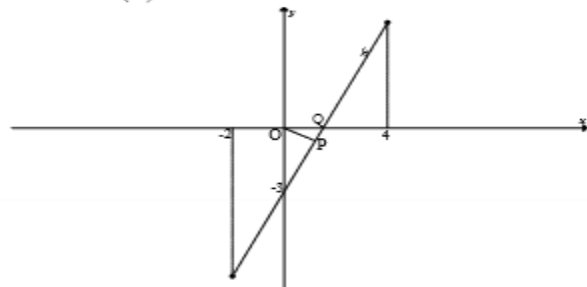
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## QUESTION/VRAAG 5

Given  $h(x) = 2x - 3$  for  $-2 \leq x \leq 4$ .5.1 For x-intercepts,  $y = 0$ 

$$2x - 3 = 0$$

$$x = 1,5$$

$$Q(1,5; 0)$$

$$\checkmark x = 1,5$$

$$\checkmark y = 0$$

(2)

5.2

 $h$ :

$$x = -2: y = 2(-2) - 3 = -7$$

$$x = 4: y = 2(4) - 3 = 5$$

Domain of  $h^{-1}$ :  $-7 \leq x \leq 5$  **OR/OF**  $[-7; 5]$ 

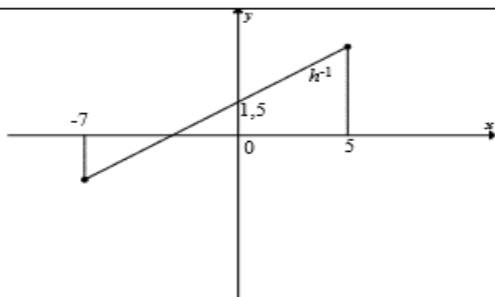
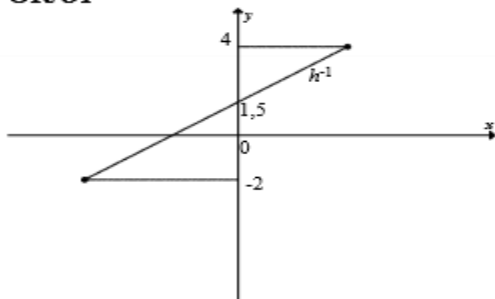
$$\checkmark h(-2) = -7$$

$$\checkmark h(4) = 5$$

$$\checkmark -7 \leq x \leq 5$$

(3)

5.3

**OR/OF** $\checkmark$  y-intercept on a straight line $\checkmark$  line segment $\checkmark$  accurate endpoints (x or y or both)

(3)



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5.4	$h(x) = 2x - 3$ <p>For the inverse of <math>h</math>,</p> $x = 2y - 3$ $y = \frac{x+3}{2}$ $h^{-1}(x) = \frac{x+3}{2}$ $h(x) = h^{-1}(x)$ $2x - 3 = \frac{x+3}{2}$ $4x - 6 = x + 3$ $x = 3$ <p><b>OR/OF</b></p> $h(x) = 2x - 3$ <p><math>h</math> and <math>h^{-1}</math> intersect when <math>y = x</math></p> $h(x) = x$ $2x - 3 = x$ $x = 3$ <p><b>OR/OF</b></p> $h(x) = 2x - 3$ <p>For the inverse of <math>h</math>,</p> $x = 2y - 3$ $y = \frac{x+3}{2}$ $h^{-1}(x) = x$ $\frac{x+3}{2} = x$ $x + 3 = 2x$ $x = 3$	$\checkmark y = \frac{x+3}{2}$  $\checkmark 2x - 3 = \frac{x+3}{2}$  $\checkmark x = 3$ <p style="text-align: right;">(3)</p>  $\checkmark h(x) = x$ $\checkmark 2x - 3 = x$ $\checkmark x = 3$ <p style="text-align: right;">(3)</p>  $\checkmark y = \frac{x+3}{2}$  $\checkmark \frac{x+3}{2} = x$  $\checkmark x = 3$ <p style="text-align: right;">(3)</p>
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5.5	$\begin{aligned} OP^2 &= (x-0)^2 + (y-0)^2 \\ &= x^2 + (2x-3)^2 \\ &= x^2 + 4x^2 - 12x + 9 \\ &= 5x^2 - 12x + 9 \end{aligned}$ <p>For OP to be at its minimum, <math>OP^2</math> has to be a minimum  <i>Vir OP om minimum te wees, moet <math>OP^2</math> 'n minimum wees</i></p> $\frac{d(OP^2)}{dx} = 0 \quad \text{OR / OF} \quad x = -\frac{b}{2a}$ $10x - 12 = 0 \quad \quad \quad = -\frac{-12}{2(5)}$ $\therefore x = \frac{6}{5}$ <p>Minimum length of OP = <math>\sqrt{5\left(\frac{6}{5}\right)^2 - 12\left(\frac{6}{5}\right) + 9} = \sqrt{\frac{9}{5}}</math> or <math>\frac{3}{\sqrt{5}}</math> or 1,34 units</p> <p><b>OR/OF</b>  For minimum distance <math>OP \perp</math> the line  <math>m_h = 2</math> (given)  <math>m_{OP} = \frac{-1}{2}</math>  <math>\therefore</math> OP has equation <math>y = \frac{-1}{2}x</math></p> $\frac{-1}{2}x = 2x - 3$ $-x = 4x - 6$ $5x = 6$ $x_p = 1,2$ $y_p = -\frac{1}{2}(1,2) = -0,6$ $OP = \sqrt{(1,2-0)^2 + (-0,6-0)^2}$ $= 1,34 \text{ or } \sqrt{1,8} \text{ units}$	$\checkmark OP^2 = x^2 + y^2$ $\checkmark$ substitute $y = 2x - 3$ $\checkmark 5x^2 - 12x + 9$  $\checkmark x$ -value  $\checkmark$ answer (5)         $\checkmark m_{OP} = \frac{-1}{2}$ $\checkmark$ equation of OP $\checkmark \frac{-1}{2}x = 2x - 3$  $\checkmark x$ -value $\checkmark$ answer (5)
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<p><b>OR/OF</b> For minimum distance <math>OP \perp</math> the line  <math>O(0;0) \quad P(x; 2x-3) \quad Q\left(\frac{3}{2}; 0\right)</math></p> $OP^2 + PQ^2 = OQ^2 \quad (\text{pythag})$ $(x-0)^2 + (2x-3-0)^2 + \left(x-\frac{3}{2}\right)^2 + (2x-3-0)^2 = \left(\frac{3}{2}\right)^2$ $x^2 + 4x^2 - 12x + 9 + x^2 - 3x + \frac{9}{4} + 4x^2 - 12x + 9 = \frac{9}{4}$ $10x^2 - 27x + 18 = 0$ $(5x-6)(2x-3) = 0$ $x = \frac{6}{5} \text{ or } \frac{3}{2}$ <p>Hence, <math>x = \frac{6}{5}</math> at P</p> $OP^2 = x^2 + (2x-3)^2$ $= \left(\frac{6}{5}\right)^2 + \left(2\left(\frac{6}{5}\right) - 3\right)^2$ $= \frac{36}{25} + \frac{9}{25}$ $= \frac{9}{5}$ $OP = 1,34$	<p>✓ <math>OP^2 = x^2 + y^2</math>          ✓ substitute  <math>y = 2x - 3</math></p> <p>✓  <math>10x^2 - 27x + 18</math></p> <p>✓ x-value</p> <p>✓ answer (5)</p>
<p><b>OR/OF</b> For minimum distance <math>OP \perp</math> the line  <math>\tan \hat{Q} = 2</math>  <math>\hat{Q} = 63,43^\circ</math></p> $\sin 63,43^\circ = \frac{OP}{1,5}$ $OP = 1,34$	<p>✓ <math>\tan \hat{Q} = 2</math>          ✓ <math>\hat{Q} = 63,43^\circ</math>          ✓ <math>\sin 63,43^\circ</math>          ✓ <math>\frac{OP}{1,5}</math>          ✓ answer (5)</p>

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**OR/OF**

$$\begin{aligned} OP &= \sqrt{(x-0)^2 + (y-0)^2} \\ &= \sqrt{(x-0)^2 + (2x-3-0)^2} \\ &= \sqrt{x^2 + 4x^2 - 12x + 9} \\ &= \sqrt{5x^2 - 12x + 9} \end{aligned}$$

By using the chain rule (which is not in the CAPS):

$$\frac{dOP}{dx} = \frac{1}{2}(5x^2 - 12x + 9)^{-\frac{1}{2}} \cdot (10x - 12)$$

$$0 = \frac{1}{2}(5x^2 - 12x + 9)^{-\frac{1}{2}} \cdot (10x - 12)$$

$$0 = \frac{1}{2}(10x - 12)$$

$$0 = 5x - 6$$

$$x = \frac{6}{5}$$

$$\begin{aligned} OP &= \sqrt{5\left(\frac{6}{5}\right)^2 - 12\left(\frac{6}{5}\right) + 9} \\ &= 1,34 \end{aligned}$$

**OR/OF**For minimum distance  $OP \perp$  the line

Let the y-intercept be R

$$OR = 3 \text{ units}$$

$$OQ = \frac{3}{2} \text{ units}$$

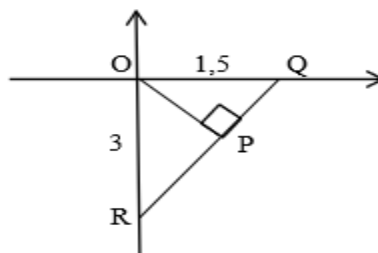
$$RQ = \frac{3}{2}\sqrt{5} \text{ (Pythagoras)}$$

$$\text{Area OQR} = \frac{1}{2} \times \text{base} \times \perp \text{height}$$

$$\frac{1}{2} \cdot OR \cdot OQ = \frac{1}{2} \left( \frac{3}{2} \sqrt{5} \right) \cdot OP$$

$$\frac{1}{2} \cdot 3 \cdot \left( \frac{3}{2} \right) = \frac{1}{2} \left( \frac{3}{2} \sqrt{5} \right) \cdot OP$$

$$OP = \frac{3}{\sqrt{5}} = 1,34$$



$$\checkmark$$

$$OP = \sqrt{(x-0)^2 + (y-0)^2}$$

$$\checkmark \text{ substitute}$$

$$y = 2x - 3$$

$$\checkmark 5x^2 - 12x + 9$$

$$\checkmark x\text{-value}$$

$$\checkmark \text{ answer}$$

(5)

$$\checkmark RQ = \frac{3}{2}\sqrt{5}$$

$$\checkmark \frac{1}{2} \left( \frac{3}{2} \sqrt{5} \right) \cdot OP$$

$$\checkmark \frac{1}{2} \cdot 3 \cdot \left( \frac{3}{2} \right)$$

$$\checkmark \text{ equating}$$

$$\checkmark \text{ answer}$$

(5)



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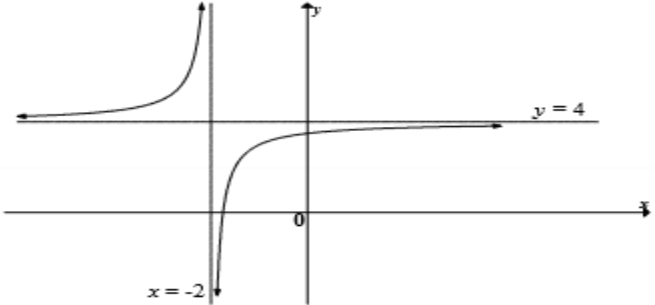
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5.6.1	$f'(x) = 2x - 3$ Turning point at $x = \frac{3}{2}$ $f''(x) = 2 > 0$ or $f''\left(\frac{3}{2}\right) > 0$ $f$ has a local minimum at $x = \frac{3}{2}$ $f$ het 'n lokale minimum by $x = \frac{3}{2}$  <b>OR/OF</b> $h(x) = f'(x) < 0$ for $x \in (-2 ; 1,5) \Rightarrow f$ is decreasing on the left of Q / <i>f is dalend links van Q.</i> $h(x) = f'(x) > 0$ for $x \in (1,5 ; 4) \Rightarrow f$ is increasing on the right of Q / <i>f is stygend regs van Q.</i> $\therefore f(x)$ has a local minimum when $x = \frac{3}{2}$ / $\therefore f(x)$ het 'n lokaal minimum by $x = \frac{3}{2}$  <b>OR/OF</b> $f(x) = x^2 - 3x + c$ $f$ has a minimum value since $a > 0$ $f$ het 'n minimum waarde omdat $a > 0$	✓ Turning point at $x = \frac{3}{2}$  ✓ $f''(x) = 2 > 0$  (2)  ✓ decreasing left of Q ✓ increasing right of Q  (2)  ✓ $f(x) = x^2 - 3x + c$  ✓ explanation (2)
5.6.2	$m = f'(4) = h(4) = 5$	✓ answer (1) <b>[19]</b>



## QUESTION/VRAAG 6

6.1.1	$T(0;18)$	✓ $(0;18)$ (1)
6.1.2	$-2x^2 + 18 = 0$ $(x-3)(x+3) = 0$ $Q(3; 0)$  <b>OR/OF</b> $-2x^2 + 18 = 0$ $x^2 = 9$ $Q(3; 0)$	✓ $y = 0$ ✓ factors ✓ $x = 3$ (3)  ✓ $y = 0$ ✓ $x^2 = 9$ ✓ $x = 3$ (3)
6.1.3	<i>x</i> -coordinate of S is 4,5/ <i>x</i> -koördinaat van S is 4,5 By symmetry about the line $x = 4,5$ / <i>Deur simmetrie om die lyn</i> $x = 4,5$ : $R = (4,5 + 4,5 - 3; 0) = (6; 0)$	✓ $x = 6$ ✓ $y = 0$ (2)
6.1.4	For all $x \in \mathbf{R}$ <b>OR/OF</b> $(-\infty; \infty)$	✓ ✓ answer (2)
6.2	If $C(x; y)$ is the centre of the hyperbola/ <i>As</i> $C(x; y)$ <i>die middelpunt is van die hiperbool</i> $y = x + 6$ and $x = -2$ $\therefore y = -2 + 6 = 4$  	✓ ✓ asymptote $y = 4$  ✓ asymptote $x = -2$  ✓ shape (increasing hyperbolic function) (4) <b>[12]</b>



## QUESTION/VRAAG 7

7.1	R450 000	✓ answer (1)
7.2	$A = P(1-i)^n$ $f(x) = 450000(1-i)^x$ $243\,736,90 = 450000(1-i)^4$ $i = 1 - \sqrt[4]{\frac{243\,736,90}{450000}}$ $i = 0,1421$ <p>The rate of depreciation is 14,21% p.a. Die waardeverminderingskoers is 14,21% p.j.</p>	✓ substitution of 450 000 into correct formula ✓ substitution of (4; 243 736,90) into correct formula  ✓ making $i$ the subject  ✓ answer (4)
7.3	At T : $A = P(1+i)^n$ $g(x) = 450000(1+i)^x$ $a = 450000(1+0,081)^4$ $= R614490,66$	✓ $i = 0,081$ & $n = 4$ ✓ correct substitution into formula ✓ answer (3)
7.4	Future Value = R614 490, 66 – R243 736 ,90 $= R370\,753,76$ Let $x$ be the value of monthly payment $F_v = \frac{x[(1+i)^n - 1]}{i}$ $370753,76 = \frac{x \left[ \left( 1 + \frac{0.062}{12} \right)^{36} - 1 \right]}{\frac{0.062}{12}}$ $x = R9397,11$	✓ R370 753,76  ✓ $i = \frac{0,062}{12}$ ✓ $n = 36$  ✓ substitution into correct formula  ✓ answer (5) <b>[13]</b>





## QUESTION/VRAAG 8

8.1	$f(x+h) = (x+h)^2 - 3(x+h)$ $= x^2 + 2xh + h^2 - 3x - 3h$ $f(x+h) - f(x) = x^2 + 2xh + h^2 - 3x - 3h - (x^2 - 3x)$ $= 2xh + h^2 - 3h$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2 - 3h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h - 3)}{h}$ $= \lim_{h \rightarrow 0} (2x + h - 3)$ $= 2x - 3$ <p><b>OR/OF</b></p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{(x+h)^2 - 3(x+h) - (x^2 - 3x)}{h}$ $= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - 3x - 3h - x^2 + 3x}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2 - 3h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h - 3)}{h}$ $= \lim_{h \rightarrow 0} (2x + h - 3)$ $= 2x - 3$	<p>✓ finding <math>f(x+h)</math></p> <p>✓ <math>2xh + h^2 - 3h</math></p> <p>✓ formula</p> <p>✓ factorisation</p> <p>✓ answer (5)</p> <p>✓ formula</p> <p>✓ finding <math>f(x+h)</math></p> <p>✓ <math>2xh + h^2 - 3h</math></p> <p>✓ factorisation</p> <p>✓ answer (5)</p>
8.2.1	$y = \left(x^2 - \frac{1}{x^2}\right)^2$ $y = x^4 - 2 + \frac{1}{x^4}$ $= x^4 - 2 + x^{-4}$ $\frac{dy}{dx} = 4x^3 - 4x^{-5}$ <p><b>OR/OF</b></p>	<p>✓ <math>x^4 - 2 + \frac{1}{x^4}</math></p> <p>✓ <math>4x^3</math></p> <p>✓ <math>-4x^{-5}</math></p> <p>(3)</p>





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	<p>By using the chain rule (which is not part of CAPS):</p> $y = (x^2 - x^{-2})^2$ $\frac{dy}{dx} = 2(x^2 - x^{-2})(2x + 2x^{-3})$ $= 2(2x^3 + 2x^{-1} - 2x^{-1} - 2x^{-5})$ $= 2(2x^3 - 2x^{-5})$ $= 4x^3 - 4x^{-5}$	<p>✓✓✓</p> $2(x^2 - x^{-2})(2x + 2x^{-3})$ <p>(3)</p>
8.2.2	$D_x \left[ \frac{(x-1)(x^2+x+1)}{x-1} \right]$ $= D_x [x^2 + x + 1]$ $= 2x + 1$ <p><b>OR/OF</b></p> <p>By using the quotient rule (with is not part of CAPS):</p> $D_x \left[ \frac{x^3 - 1}{x - 1} \right]$ $= \frac{3x^2(x-1) - (x^3 - 1)}{(x-1)^2}$	<p>✓ factorisation</p> <p>✓ <math>x^2 + x + 1</math></p> <p>✓ <math>2x + 1</math></p> <p>(3)</p> <p>✓✓✓</p> $\frac{3x^2(x-1) - (x^3 - 1)}{(x-1)^2}$ <p>(3)</p> <p><b>[11]</b></p>






## QUESTION/VRAAG 9

9.1	<p>Substitute Q(2; 10) into  <math>h(x) = -x^3 + ax^2 + bx</math>  <math>-2^3 + a(2^2) + b(2) = 10</math>  <math>-8 + 4a + 2b = 10</math>  <math>2a + b = 9</math> .....line 1  <math>h'(x) = -3x^2 + 2ax + b</math>            At Q: <math>h'(2) = 0</math>  <math>-3(2)^2 + 2a(2) + b = 0</math>  <math>-12 + 4a + b = 0</math>  <math>4a + b = 12</math> .....line 2            line 2 – line 1: <math>2a = 3</math>  <math>a = \frac{3}{2}</math>            Substitute in line 1: <math>b = 6</math></p>	<p>✓ substitute Q into <math>h</math></p> <p>✓ finding derivative            ✓ <math>h'(2)</math>            ✓ equating derivative to 0</p> <p>✓ solving simultaneously for <math>a</math> and <math>b</math></p> <p>(5)</p>
9.2	<p><math>f(-1) = -(-1)^3 + \frac{3}{2}(-1)^2 + 6(-1)</math>  <math>= -3,5</math></p> <p>Average gradient/<i>Gemiddelde gradiënt</i> = <math>\frac{f(x_Q) - f(x_P)}{x_Q - x_P}</math></p> <p>Average gradient/<i>Gemiddelde gradiënt</i> = <math>\frac{10 - (-3,5)}{2 - (-1)}</math>  <math>= 4,5</math></p>	<p>✓ <math>f(-1) = -3,5</math></p> <p>✓ formula</p> <p>✓ substitution</p> <p>✓ answer</p> <p>(4)</p>



9.3	$h'(x) = -3x^2 + 3x + 6$ $h''(x) = -6x + 3$ $= -3(2x - 1)$  For $x < \frac{1}{2}$ , $h$ is concave up and for $x > \frac{1}{2}$ , $h$ is concave down <i>Vir <math>x &lt; \frac{1}{2}</math>, is <math>h</math> konkaaf na bo en vir <math>x &gt; \frac{1}{2}</math>, is <math>h</math> konkaaf na onder</i> $\therefore$ concavity changes at $x = \frac{1}{2}$ / $\therefore$ konkwiteit verander by $x = \frac{1}{2}$	$\checkmark h'(x) = -3x^2 + 3x + 6$ $\checkmark h''(x) = -6x + 3$  $\checkmark$ explanation using $h''(x)$  (3)
9.4	The graph of $h$ has a point of inflection at $x = \frac{1}{2}$ / <i>Die grafiek van <math>h</math> het 'n buigpunt by <math>x = \frac{1}{2}</math>.</i>  <b>OR/OF</b>  The graph of $h$ changes from concave up to concave down at $x = \frac{1}{2}$ / <i>Die grafiek van <math>h</math> verander by <math>x = \frac{1}{2}</math> van konkaaf op na konkaaf af</i>	$\checkmark$ answer (1)   $\checkmark$ answer (1)
9.5	Gradient of $g$ is $-12$ / <i>Gradiënt van <math>g</math> is <math>-12</math></i> Gradient of tangent is / <i>Gradiënt van die raaklyn is:</i> $h'(x) = -3x^2 + 3x + 6$ $h'(x) = -12$ $-3x^2 + 3x + 6 = -12$ $3x^2 - 3x + 18 = 0$ $x^2 - x + 6 = 0$ $(x - 3)(x + 2) = 0$ $x = -2 \text{ only}$	$\checkmark h'(x) = -3x^2 + 3x + 6$ $\checkmark h'(x) = -12$  $\checkmark$ factors $\checkmark$ selection of $x$ -value  (4) <b>[17]</b>



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**QUESTION/VRAAG 10**

10.1	$\frac{h}{r} = \tan 60^\circ$ $r = \frac{h}{\tan 60^\circ}$ $\therefore r = \frac{h}{\sqrt{3}}$	$\checkmark \frac{h}{r} = \tan 60^\circ$  $\checkmark \text{answer}$ <p style="text-align: right;">(2)</p>
10.2	$V_{\text{cone}} = \frac{1}{3} \pi r^2 h$ $= \frac{1}{3} \pi \left( \frac{h}{\sqrt{3}} \right)^2 h$ $= \frac{1}{9} \pi h^3$ $\frac{dV}{dh} = \frac{1}{3} \pi h^2$ $\left. \frac{dV}{dh} \right _{h=9} = \frac{1}{3} \pi (9)^2$ $= 27\pi \text{ or } 84,82 \text{ cm}^3/\text{cm}$	$\checkmark \text{formula}$  $\checkmark \text{substitution of the value of } r \text{ in terms of } h$  $\checkmark \text{simplified volume answer}$  $\checkmark \text{derivative}$  $\checkmark \text{answer}$ <p style="text-align: right;">(5) [7]</p>

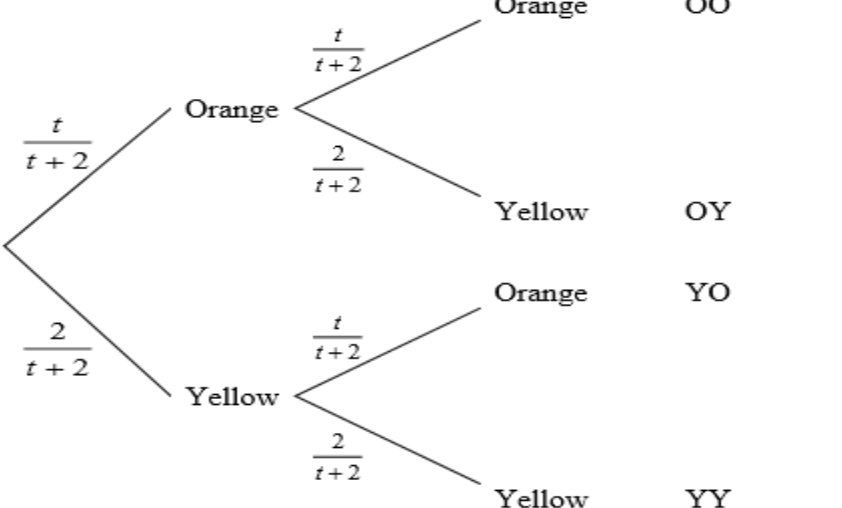




## QUESTION/VRAAG 11

11.1	$P(A) \times P(B)$ $= 0,2 \times 0,63$ $= 0,126$ i.e. $P(A) \times P(B) = P(A \text{ and } B)$ Therefore A and B are independent/ <i>Dus is A en B onafhanklik</i>	$\checkmark 0,2 \times 0,63$ $\checkmark P(A) \times P(B) = P(A \text{ and } B)$ $\checkmark$ conclusion (3)
11.2.1	$7^7 = 823\ 543$	$\checkmark \checkmark 7^7$ (2)
11.2.2	$7! = 5040$	$\checkmark \checkmark 7!$ (2)
11.2.3	There are 3 vowels $\Rightarrow$ 3 options for first position There are 4 consonants $\Rightarrow$ 4 options for last position The remaining 5 letters can be arranged in $5 \times 4 \times 3 \times 2 \times 1$ ways $3 \times (5 \times 4 \times 3 \times 2 \times 1) \times 4 = 1440$  <i>Daar is 3 klinkers <math>\Rightarrow</math> 3 opsies vir die eerste posisie</i> <i>Daar is 4 konsonante <math>\Rightarrow</math> 4 opsies vir die laaste posisie</i> <i>Die oorblywende 5 letters kan as volg gerangskik word</i>  $5 \times 4 \times 3 \times 2 \times 1$ ways/ <i>maniere</i> $3 \times (5 \times 4 \times 3 \times 2 \times 1) \times 4 = 1440$	$\checkmark \times 3$ $\checkmark \times 4$ $\checkmark 5 \times 4 \times 3 \times 2 \times 1$ $\checkmark$ answer (4)



11.3	<p style="text-align: right;">Orange      OO</p>  <p style="text-align: right;">Yellow      OY</p> <p style="text-align: right;">Orange      YO</p> <p style="text-align: right;">Yellow      YY</p> $P(\text{Orange, Orange}) + P(\text{Yellow, Yellow}) = \frac{52}{100}$ $\left(\frac{t}{t+2}\right)\left(\frac{t}{t+2}\right) + \left(\frac{2}{t+2}\right)\left(\frac{2}{t+2}\right) = \frac{52}{100}$ $\frac{t^2}{t^2 + 4t + 4} + \frac{4}{t^2 + 4t + 4} = \frac{52}{100}$ $25(t^2 + 4) = 52(t^2 + 4t + 4)$ $3t^2 - 13t + 12 = 0$ $(3t - 4)(t - 3) = 0$ $t = 3$ <p>There are 3 orange balls in the bag/<i>Daar is 3 oranje balle in die sak</i></p>	$\checkmark P(O) = \left(\frac{t}{t+2}\right)$ $\checkmark P(Y) = \left(\frac{2}{t+2}\right)$ $\checkmark P(O,O) = \left(\frac{t}{t+2}\right)^2$ $\checkmark P(Y,Y) = \left(\frac{2}{t+2}\right)^2$ $\checkmark \left(\frac{t}{t+2}\right)\left(\frac{t}{t+2}\right) + \left(\frac{2}{t+2}\right)\left(\frac{2}{t+2}\right) = \frac{52}{100}$ $\checkmark t = 3 \text{ (no ca)}$ <p style="text-align: right;">(6) [17]</p>
<b>TOTAL/TOTAAL:</b>		<b>150 marks</b>



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**NOVEMBER 2016**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages and 1 information sheet.**





Mathematics/P1

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**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x(x - 7) = 0$  (2)

1.1.2  $x^2 - 6x + 2 = 0$  (correct to TWO decimal places) (3)

1.1.3  $\sqrt{x-1} + 1 = x$  (5)

1.1.4  $3^{x+3} - 3^{x+2} = 486$  (4)

1.2 Given:  $f(x) = x^2 + 3x - 4$ 

1.2.1 Solve for  $x$  if  $f(x) = 0$  (2)

1.2.2 Solve for  $x$  if  $f(x) < 0$  (2)

1.2.3 Determine the values of  $x$  for which  $f'(x) \geq 0$  (2)

1.3 Solve for  $x$  and  $y$ :  $x = 2y$  and  $x^2 - 5xy = -24$  (4)  
[24]**QUESTION 2**Given the finite arithmetic sequence:  $5 ; 1 ; -3 ; \dots ; -83 ; -87$ 2.1 Write down the fourth term ( $T_4$ ) of the sequence. (1)

2.2 Calculate the number of terms in the sequence. (3)

2.3 Calculate the sum of all the negative numbers in the sequence. (3)

2.4 Consider the sequence:  $5 ; 1 ; -3 ; \dots ; -83 ; -87 ; \dots ; -4187$   
Determine the number of terms in this sequence that will be exactly divisible by 5. (4)  
[11]



Mathematics/P1

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DBE/November 2016

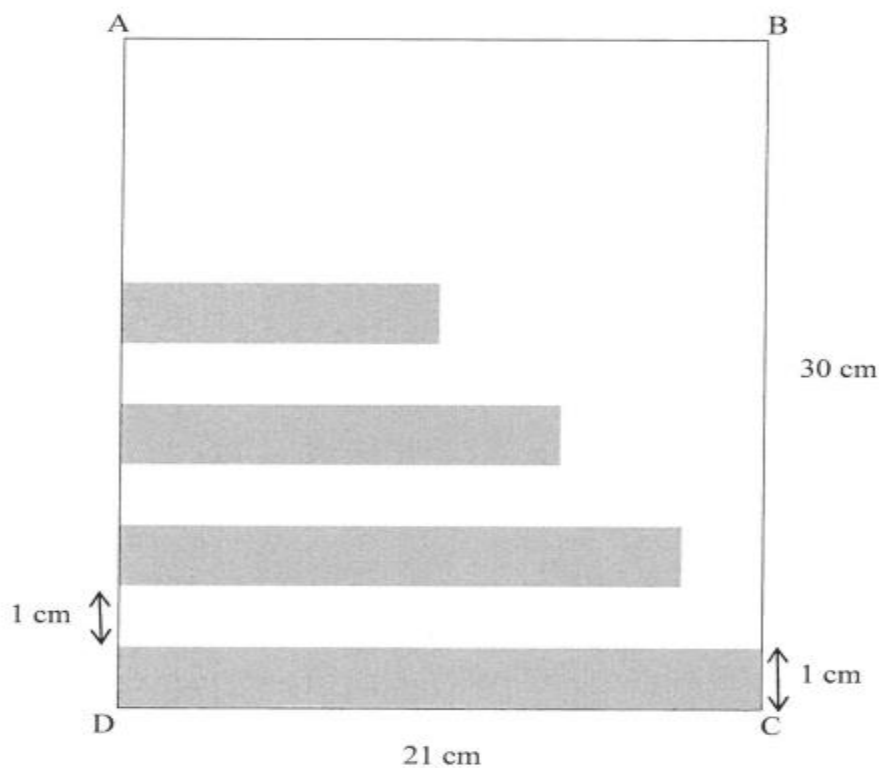
**QUESTION 3**

3.1 The first four terms of a quadratic number pattern are  $-1$  ;  $x$  ;  $3$  ;  $x + 8$

3.1.1 Calculate the value(s) of  $x$ . (4)

3.1.2 If  $x = 0$ , determine the position of the first term in the quadratic number pattern for which the sum of the first  $n$  first differences will be greater than 250. (4)

3.2 Rectangles of width 1 cm are drawn from the edge of a sheet of paper that is 30 cm long such that there is a 1 cm gap between one rectangle and the next. The length of the first rectangle is 21 cm and the length of each successive rectangle is 85% of the length of the previous rectangle until there are rectangles drawn along the entire length of AD. Each rectangle is coloured grey.



3.2.1 Calculate the length of the 10<sup>th</sup> rectangle. (3)

3.2.2 Calculate the percentage of the paper that is coloured grey. (4)  
[15]

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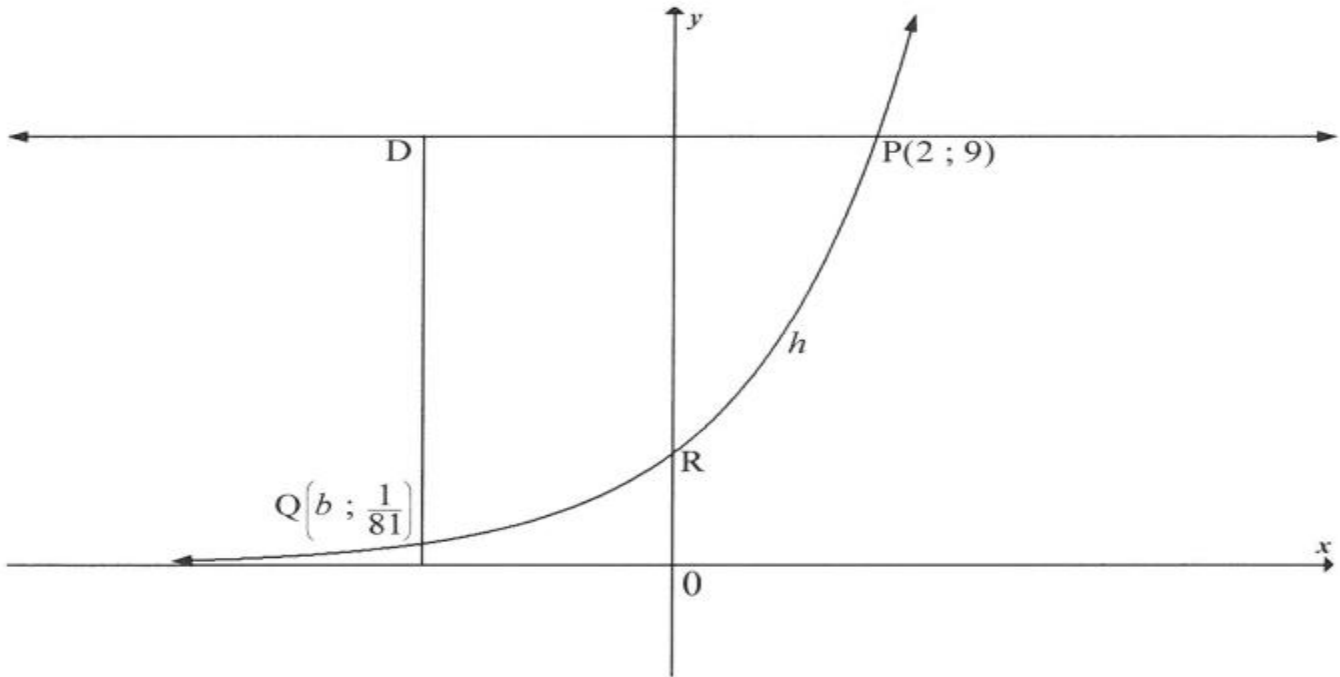
Mathematics/P1

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**QUESTION 4**

Sketched below is the graph of  $h(x) = a^x$ ,  $a > 0$ . R is the  $y$ -intercept of  $h$ .  
The points  $P(2; 9)$  and  $Q\left(b; \frac{1}{81}\right)$  lie on  $h$ .



- 4.1 Write down the equation of the asymptote of  $h$ . (1)
- 4.2 Determine the coordinates of R. (1)
- 4.3 Calculate the value of  $a$ . (2)
- 4.4 D is a point such that  $DQ \parallel y$ -axis and  $DP \parallel x$ -axis. Calculate the length of DP. (4)
- 4.5 Determine the values of  $k$  for which the equation  $h(x+2) + k = 0$  will have a root that is less than  $-6$ . (3)
- [11]

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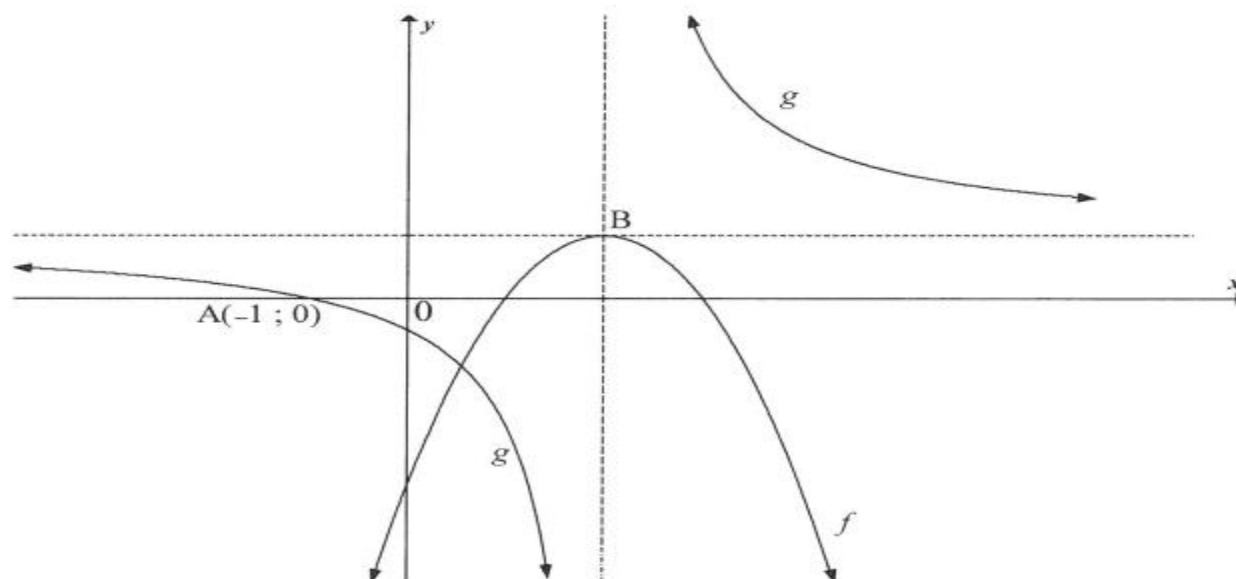
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**QUESTION 5**

Sketched below is the parabola  $f$ , with equation  $f(x) = -x^2 + 4x - 3$  and a hyperbola  $g$ , with equation  $(x - p)(y + t) = 3$ .

- B, the turning point of  $f$ , lies at the point of intersection of the asymptotes of  $g$ .
- $A(-1; 0)$  is the  $x$ -intercept of  $g$ .



- 5.1 Show that the coordinates of B are  $(2; 1)$  (2)
- 5.2 Write down the range of  $f$ . (1)
- 5.3 For which value(s) of  $x$  will  $g(x) \geq 0$ ? (2)
- 5.4 Determine the equation of the vertical asymptote of the graph of  $h$  if  $h(x) = g(x + 4)$  (1)
- 5.5 Determine the values of  $p$  and  $t$ . (4)
- 5.6 Write down the values of  $x$  for which  $f(x) \cdot g'(x) \geq 0$  (4)
- [14]**

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**QUESTION 6**Given:  $f(x) = -x + 3$  and  $g(x) = \log_2 x$ 

- 6.1 On the same set of axes, sketch the graphs of  $f$  and  $g$ , clearly showing ALL intercepts with the axes. (4)
- 6.2 Write down the equation of  $g^{-1}(x)$ , the inverse of  $g$ , in the form  $y = \dots$  (2)
- 6.3 Explain how you will use QUESTION 6.1 and/or QUESTION 6.2 to solve the equation  $\log_2(3-x) = x$ . (3)
- 6.4 Write down the solution to  $\log_2(3-x) = x$ . (1)
- [10]**

**QUESTION 7**

On 1 June 2016 a bank granted Thabiso a loan of R250 000 at an interest rate of 15% p.a. compounded monthly, to buy a car. Thabiso agreed to repay the loan in monthly instalments commencing on 1 July 2016 and ending 4 years later on 1 June 2020. However, Thabiso was unable to make the first two instalments and only commenced with the monthly instalments on 1 September 2016.

- 7.1 Calculate the amount Thabiso owed the bank on 1 August 2016, a month before he paid his first monthly instalment. (2)
- 7.2 Having paid the first monthly instalment on 1 September 2016, Thabiso will still pay his last monthly instalment on 1 June 2020. Calculate his monthly instalment. (4)
- 7.3 If Thabiso paid R9 000 as his monthly instalment starting on 1 September 2016, how many months sooner will he repay the loan? (5)
- 7.4 If Thabiso paid R9 000 as a monthly instalment starting on 1 September 2016, calculate the final instalment to repay the loan. (4)
- [15]**





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**QUESTION 8**

- 8.1 Determine  $f'(x)$  from first principles if  $f(x) = 3x^2$  (5)
- 8.2 John determines  $g'(a)$ , the derivative of a certain function  $g$  at  $x = a$ , and arrives at the answer:  $\lim_{h \rightarrow 0} \frac{\sqrt{4+h} - 2}{h}$   
Write down the equation of  $g$  and the value of  $a$ . (2)
- 8.3 Determine  $\frac{dy}{dx}$  if  $y = \sqrt{x^3} - \frac{5}{x^3}$  (4)
- 8.4  $g(x) = -8x + 20$  is a tangent to  $f(x) = x^3 + ax^2 + bx + 18$  at  $x = 1$ . Calculate the values of  $a$  and  $b$ . (5)  
**[16]**

**QUESTION 9**

For a certain function  $f$ , the first derivative is given as  $f'(x) = 3x^2 + 8x - 3$

- 9.1 Calculate the  $x$ -coordinates of the stationary points of  $f$ . (3)
- 9.2 For which values of  $x$  is  $f$  concave down? (3)
- 9.3 Determine the values of  $x$  for which  $f$  is strictly increasing. (2)
- 9.4 If it is further given that  $f(x) = ax^3 + bx^2 + cx + d$  and  $f(0) = -18$ , determine the equation of  $f$ . (5)  
**[13]**

**QUESTION 10**

The number of molecules of a certain drug in the bloodstream  $t$  hours after it has been taken is represented by the equation  $M(t) = -t^3 + 3t^2 + 72t$ ,  $0 < t < 10$ .

- 10.1 Determine the number of molecules of the drug in the bloodstream 3 hours after the drug was taken. (2)
- 10.2 Determine the rate at which the number of molecules of the drug in the bloodstream is changing at exactly 2 hours after the drug was taken. (3)
- 10.3 How many hours after taking the drug will the rate at which the number of molecules of the drug in the bloodstream is changing, be a maximum? (3)  
**[8]**

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**QUESTION 11**

A survey was conducted among 100 boys and 60 girls to determine how many of them watched TV in the period during which examinations were written. Their responses are shown in the partially completed table below.

	WATCHED TV DURING EXAMINATIONS	DID NOT WATCH TV DURING EXAMINATIONS	TOTALS
<b>Male</b>	80	$a$	
<b>Female</b>	48	12	
<b>Totals</b>	$b$	32	160

- 11.1 Calculate the values of  $a$  and  $b$ . (2)
- 11.2 Are the events 'being a male' and 'did not watch TV during examinations' mutually exclusive? Give a reason for your answer. (2)
- 11.3 If a learner who participated in this survey is chosen at random, what is the probability that the learner:
- 11.3.1 Watched TV in the period during which the examinations were written? (2)
- 11.3.2 Is not a male and did not watch TV in the period during which examinations were written? (2)
- [8]

**QUESTION 12**

The digits 1 to 7 are used to create a four-digit code to enter a locked room. How many different codes are possible if the digits may not be repeated and the code must be an even number bigger than 5 000?

[5]

**TOTAL: 150**

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# basic education

Department:  
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REPUBLIC OF SOUTH AFRICA

**GRADE 12/GRAAD 12**

**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE  
SENIOR SERTIFIKAAT**

**MATHEMATICS P1/WISKUNDE V1**

**NOVEMBER 2016**

**MEMORANDUM**

**MARKS: 150  
PUNTE: 150**

**This memorandum consists of 20 pages.  
Hierdie memorandum bestaan uit 20 bladsye.**





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**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in all aspects of the marking memorandum.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.
- Volgehoue akkuraatheid is op ALLE aspekte van die memorandum van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$x(x-7)=0$ $x=0$ or $x=7$	✓ $x=0$ ✓ $x=7$	(2)
1.1.2	$x^2 - 6x + 2 = 0$ $x = \frac{6 \pm \sqrt{(-6)^2 - 4(1)(2)}}{2(1)}$ $x = \frac{6 \pm \sqrt{28}}{2}$ $x = 0,35$ or $x = 5,65$ <b>OR/OF</b> $x^2 - 6x + 2 = 0$ $x^2 - 6x + 9 = -2 + 9$ $(x-3)^2 = 7$ $x-3 = \pm\sqrt{7}$ $x = 3 \pm \sqrt{7}$ $x = 0,35$ or $x = 5,65$	✓ correct substitution into correct formula ✓ $x = 0,35$ ✓ $x = 5,65$ ✓ $(x-3)^2 = 7$ ✓ $x = 0,35$ ✓ $x = 5,65$	(3)
1.1.3	$\sqrt{x-1} + 1 = x$ $\sqrt{x-1} = x-1$ $x-1 = x^2 - 2x + 1$ $x^2 - 3x + 2 = 0$ $(x-2)(x-1) = 0$ $x = 2$ or $x = 1$ Both answers are valid <b>OR/OF</b>	✓ isolate $\sqrt{x-1}$ ✓ $x^2 - 2x + 1$ ✓ standard form ✓ factors ✓ both answers	(5)

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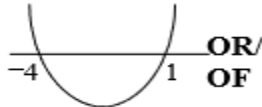
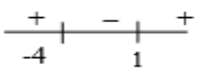
	$\sqrt{x-1}+1=x$ $\sqrt{x-1}=x-1$ <p>Let <math>x-1=k</math></p> $\sqrt{k}=k \quad k \geq 0$ $k=k^2$ $k^2-k=0$ $k(k-1)=0$ $(x-1)(x-2)=0$ $x=2 \text{ or } x=1 \quad ; \quad x \geq 1$ <p>Both answers are valid</p> <p><b>OR/OF</b></p> $\sqrt{x-1}+1=x$ $\sqrt{x-1}=x-1$ <p>By inspection :</p> $x-1=0 \quad \text{or} \quad x-1=1$ $x=2 \quad \text{or} \quad x=1$	<p>✓ isolate <math>\sqrt{x-1}</math></p> <p>✓ <math>k^2</math></p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ both answers (5)</p> <p>✓ isolate <math>\sqrt{x-1}</math></p> <p>✓ <math>x-1=0</math></p> <p>✓ <math>x-1=1</math></p> <p>✓ <math>x=2</math></p> <p>✓ <math>x=1</math> (5)</p>
1.1.4	$3^{x+3} - 3^{x+2} = 486$ $3^x 3^3 - 3^x 3^2 = 486$ $3^x (3^3 - 3^2) = 486$ $3^x = 27$ $3^x = 3^3$ $x = 3$ <p><b>OR/OF</b></p> $3^{x+3} - 3^{x+2} = 486$ $3^{x+2}(3^1 - 1) = 486$ $3^{x+2} = 243$ $3^{x+2} = 3^5$ $x+2=5$ $x=3$	<p>✓ expansion</p> <p>✓ common factor</p> <p>✓ <math>3^x = 27</math></p> <p>✓ <math>x = 3</math> (4)</p> <p>✓ common factor</p> <p>✓ <math>(3^1 - 1)</math></p> <p>✓ <math>3^{x+2} = 243</math></p> <p>✓ <math>x = 3</math> (4)</p>
1.2.1	$f(x) = x^2 + 3x - 4$ $0 = (x+4)(x-1)$ $x = -4 \text{ or } x = 1$	<p>✓ factors</p> <p>✓ both answers (2)</p>



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1.2.2	$x^2 + 3x - 4 < 0$ $(x + 4)(x - 1) < 0$  <b>OR/OF</b>  $-4 < x < 1 \quad \text{OR/OF} \quad x \in (-4 ; 1)$	$\checkmark \checkmark -4 < x < 1$ <p style="text-align: right;">(2)</p>
1.2.3	$2x + 3 \geq 0$ $x \geq -\frac{3}{2}$ <p><math>f'(x) \geq 0</math> when <math>f</math> is increasing</p> <p>The turning point occurs at <math>x = \frac{-4 + 1}{2}</math></p> $x \geq -\frac{3}{2}$	$\checkmark 2x + 3$ $\checkmark x \geq -\frac{3}{2}$ <p style="text-align: right;">(2)</p> $\checkmark x = \frac{-4 + 1}{2}$ $\checkmark x \geq -\frac{3}{2}$ <p style="text-align: right;">(2)</p>
1.3	$x = 2y \quad \text{and} \quad x^2 - 5xy = -24$ $(2y)^2 - 5(2y)(y) = -24$ $4y^2 - 10y^2 = -24$ $-6y^2 = -24$ $y^2 = 4$ $y = -2 \quad \text{or} \quad y = 2$ $x = -4 \quad \text{or} \quad x = 4$ <p><b>OR/OF</b></p> $x = 2y \quad \text{and} \quad x^2 - 5xy = -24$ $y = \frac{x}{2}$ $x^2 - 5\left(x\right)\left(\frac{x}{2}\right) = -24$ $x^2 - \frac{5}{2}x^2 = -24$ $-\frac{3}{2}x^2 = -24$ $x^2 = 16$ $x = -4 \quad \text{or} \quad x = 4$ $y = -2 \quad \text{or} \quad y = 2$ <p><b>OR/OF</b></p>	$\checkmark \text{ substitution of } 2y$ $\checkmark -6y^2 = -24$ $\checkmark \text{ both } y\text{-values}$ $\checkmark \text{ both } x\text{-values}$ <p style="text-align: right;">(4)</p> $\checkmark \text{ substitution of } \frac{x}{2}$ $\checkmark -\frac{3}{2}x^2 = -24$ $\checkmark \text{ both } x\text{-values}$ $\checkmark \text{ both } y\text{-values}$ <p style="text-align: right;">(4)</p>



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	$x = 2y \text{ and } x^2 - 5xy = -24$ $y = \frac{x}{2}$ $y = \frac{-x^2 - 24}{-5x}$ $\frac{x}{2} = \frac{x^2 + 24}{5x}$ $5x^2 = 2x^2 + 48$ $3x^2 = 48$ $x^2 = 16$ $x = -4 \text{ or } x = 4$ $y = -2 \text{ or } y = 2$	<p>✓ equating <math>\frac{x}{2} = \frac{x^2 + 24}{5x}</math></p> <p>✓ <math>3x^2 = 48</math></p> <p>✓ both <math>x</math>-values ✓ both <math>y</math>-values (4)</p>
	<b>[24]</b>	

**QUESTION/VRAAG 2**

2.1	$T_4 = -7$	<p>✓ <math>-7</math> (1)</p>
2.2	$T_n = a + (n-1)d$ $-87 = 5 + (n-1)(-4)$ $-87 = 5 - 4n + 4$ $4n = 96$ $n = 24$ <p><b>OR/OF</b></p> $-4n + 9 = -87$ $-4n = -96$ $n = 24$	<p>✓ <math>a = 5</math> and <math>d = -4</math></p> <p>✓ <math>-87 = 5 + (n-1)(-4)</math></p> <p>✓ <math>n = 24</math> (3)</p> <p>✓ <math>-4n + 9 = -87</math></p> <p>✓ <math>n = 24</math> (3)</p>
2.3	$-3; -7; \dots; -87$ $S_n = \frac{n}{2}[a + T_n]$ $S_{22} = \frac{22}{2}[-3 - 87]$ $= -990$ <p><b>OR/OF</b></p>	<p>✓ <math>n = 22</math></p> <p>✓ <math>a = -3</math></p> <p>✓ answer (3)</p>

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	$-3; -7; \dots; -87$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{22} = \frac{22}{2}[2(-3) + (22-1)(-4)]$ $= -990$ <p><b>OR/OF</b></p> <p>All negative terms can be written down and added to get the answer of <math>-990</math>. / <i>Alle negatiewe terme kan neergeskryf word en dan bymekaar getel word om <math>-990</math> te kry.</i></p> <p><b>OR/OF</b></p> $\text{Sum} = S_{24} - (5+1)$ $= \frac{24}{2}[5 - 87] - 6$ $= -990$	$\checkmark n = 22$ $\checkmark a = -3$ $\checkmark$ answer (3)
2.4	$5; -15; -35 \dots$ $d = -20$ $T_n = -20n + 25$ <p>Last term in the sequence divisible by 5 is: / <i>Laaste term in die ry deelbaar deur 5 is:</i></p> $-4187 + 4(3)$ $= -4175$ $T_n = -20n + 25$ $-4175 = -20n + 25$ $20n = 4200$ $n = 210$ <p>There will be 210 terms in the sequence that is divisible by 5. / <i>Daar is 210 terme in die ry deelbaar deur 5.</i></p> <p><b>OR/OF</b></p>	$\checkmark d = -20$ $\checkmark T_n = -20n + 25$  $\checkmark -4175 = -20n + 25$  $\checkmark n = 210$ (4)

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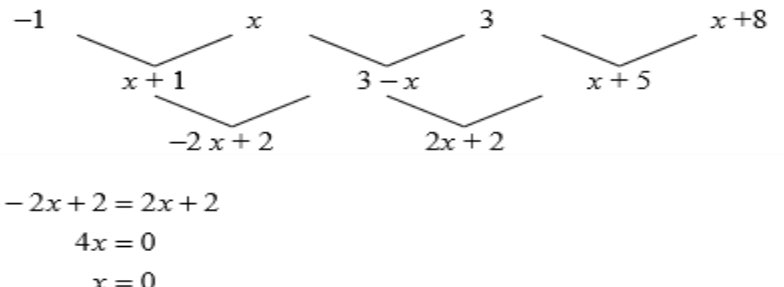
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<p>5 ; 1 ; -3 ; ... ; -83 ; -87 ; ..... ; - 4187</p> $T_n = -4n + 9$ $- 4187 = -4n + 9$ $4n = 4196$ $n = 1049$ <p>There are 1049 terms in the sequence./Daar is 1049 terme in die ry.</p> <p><math>T_1 ; T_6 ; T_{11} ; T_{16} \dots</math> are divisible by 5./is deelbaar deur 5. The largest integer value of <math>k</math> such that</p> $5k - 4 \leq 1049$ $5k \leq 1053$ $k \leq 210,6$ $k = 210$ <p><b>OR/OF</b></p> <p>5 ; 1 -3 ; -7 ; ... ; -4175 ; -4179 ; -4183 ; -4187</p> $T_n = a + (n-1)d$ $- 4175 = 5 + (n-1)(- 4)$ $- 4180 = -4(n-1)$ $n = 1046$ <p>Number of terms divisible by 5</p> $= \frac{1046 - 1}{5} + 1$ $= 210$	<p>✓ <math>- 4n + 9 = -4187</math></p> <p>✓ <math>n = 1049</math></p> <p>✓ <math>5k - 4 \leq 1049</math></p> <p>✓ <math>k = 210</math></p> <p style="text-align: right;">(4)</p> <p>✓ <math>d = -4</math></p> <p>✓ <math>- 4175 = -4n + 9</math></p> <p>✓ 1046</p> <p>✓ <math>n = 210</math></p> <p style="text-align: right;">(4)</p> <p style="text-align: right;"><b>[11]</b></p>
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## QUESTION/VRAAG 3

3.1.1	$-1 \quad ; \quad x \quad ; \quad 3 \quad ; \quad x+8 \quad ; \dots$  $-2x+2 = 2x+2$ $4x = 0$ $x = 0$	<ul style="list-style-type: none"> <li>✓ <math>x+1; 3-x</math> and <math>x+5</math></li> <li>✓ calculating second differences</li> <li>✓ <math>-2x+2 = 2x+2</math></li> <li>✓ <math>x = 0</math> (4)</li> </ul>
3.1.2	<p>First differences/<i>Eerste verskille</i>: <math>1; 3; 5; \dots</math></p> $S_n = \frac{n}{2}[2(1) + (n-1)(2)]$ $= n^2$ $250 < n^2$ $n > \sqrt{250}$ $\therefore n > 15,8$ <p>The sum of the 16 first differences will be greater than 250. Therefore the 17<sup>th</sup> term of the quadratic number pattern is the first satisfying this condition. /<i>Die som van 16 eerste verskille sal groter as 250 wees. Gevolglik sal die 17<sup>de</sup> term van die kwadratiese getalpatroon die eerste wees wat aan die voorwaarde voldoen.</i></p>	<ul style="list-style-type: none"> <li>✓ <math>S_n = n^2</math></li> <li>✓ <math>S_n &gt; 250</math></li> <li>✓ <math>n &gt; 15,8</math></li> <li>✓ <math>n = 17</math> (4)</li> </ul>
3.2.1	$21 + 21(0,85) + 21(0,85)^2 + \dots$ $T_n = ar^{n-1}$ $T_{10} = (21)(0,85)^9$ $= 4,86 \text{ cm}$	<ul style="list-style-type: none"> <li>✓ <math>n = 10; r = 0,85</math> or <math>\frac{17}{20}</math></li> <li>✓ substitution into correct formula</li> <li>✓ answer (3)</li> </ul>
3.2.2	$S_n = \frac{a(1-r^n)}{1-r}$ $S_{15} = \frac{21(1-(0,85)^{15})}{1-0,85}$ $= 127,77$ <p>Area of the page = <math>30 \times 21 = 630</math> Percentage of paper covered in grey ink:</p> $= \frac{127,77}{630} \times 100\%$ $= 20,28\%$	<ul style="list-style-type: none"> <li>✓ <math>n = 15</math></li> <li>✓ 127,77</li> <li>✓ 630</li> <li>✓ 20,28 (4)</li> </ul>

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**QUESTION/VRAAG 4**

4.1	$y = 0$	✓ $y = 0$ (1)
4.2	$R(0 ; 1)$	✓ answer (1)
4.3	$y = a^x$ $9 = a^2$ $\therefore a = 3$	✓ substitution ✓ $a = 3$ (2)
4.4	$DP = 2 - b$ $y = 3^x$ $\frac{1}{81} = 3^b$ $3^{-4} = 3^b$ $b = -4$ $DP = 2 - (-4)$ $= 6$ units	✓ $\frac{1}{81} = 3^b$ ✓ $3^{-4}$ or use of logs ✓ $b = -4$ ✓ DP = 6 units (4)
4.5	$h(x+2) + k = 0$ $h(x+2) = -k$ $0 < -k < \frac{1}{81}$ $-\frac{1}{81} < k < 0$	✓✓ $-k < \frac{1}{81}$ or $k > -\frac{1}{81}$ ✓ $-\frac{1}{81} < k < 0$ (3)
		<b>[11]</b>





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**QUESTION/VRAAG 5**

5.1	$f(x) = -x^2 + 4x - 3$ $f'(x) = 0 \quad \text{or} \quad x = -\frac{4}{2(-1)}$ $-2x + 4 = 0$ $x = 2$ $y = -(2)^2 + 4(2) - 3$ $= 1$ $\mathbf{B(2; 1)}$ <p><b>OR/OF</b></p> $-x^2 + 4x - 3 = 0$ $x^2 - 4x + 3 = 0$ $(x-3)(x-1) = 0$ $x = 3 \text{ or } x = 1$ $x = \frac{3+1}{2}$ $x = 2$ $y = -(2)^2 + 4(2) - 3$ $= 1$ $\mathbf{B(2; 1)}$	$\checkmark -2x + 4 = 0 \text{ or}$ $x = -\frac{4}{2(-1)}$ $\checkmark y = -(2)^2 + 4(2) - 3 \quad (2)$ $\checkmark x = \frac{3+1}{2}$ $\checkmark y = -(2)^2 + 4(2) - 3 \quad (2)$
5.2	<p>Range/Waardeversameling : <math>y \leq 1</math></p> <p><b>OR/OF</b></p> <p>Range/Waardeversameling : <math>y \in (-\infty; 1]</math></p>	$\checkmark y \leq 1 \quad (1)$ $\checkmark (-\infty; 1] \quad (1)$
5.3	$x \leq -1 \text{ or } x > 2$ <p><b>OR/OF</b></p> $(-\infty; -1] \cup (2; \infty)$	$\checkmark \text{critical values}$ $\checkmark x \leq -1 \text{ or } x > 2 \quad (2)$ $\checkmark \text{critical values}$ $\checkmark x \leq -1 \text{ or } x > 2 \quad (2)$
5.4	$(x-p)(y+t) = 3$ <p>Vertical asymptote of <math>h(x)</math> / <i>vertikale asimptoot</i> at <math>x = 2</math>          Translation 4 units to the left / <i>Translasie 4 eenhede links</i>  <math>x = 2 - 4 = -2</math> is the equation of the vertical asymptote of <math>h(x+4)</math>  <math>x = 2 - 4 = -2</math> is die vergelyking van die vertikale asimptoot</p> <p><b>OR/OF</b></p>	$\checkmark x = -2 \quad (1)$

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	<p><b>OR/OF</b></p> $h(x) = \frac{3}{x-2+4} + 1$ $= \frac{3}{x+2} + 1$ $x = -2$ <p>is the equation of the vertical asymptote / is die vergelyking van die vertikale asimptoot</p>	<p>✓ <math>x = -2</math></p> <p>(1)</p>
5.5	$(x-p)(y+t) = 3$ $(y+t) = \frac{3}{(x-p)}$ $y = \frac{3}{x-p} - t$ <p>B(2;1) Point of intersection of the asymptotes Snypunt van die asimptote</p> $p = 2$ $-t = 1$ $t = -1$	<p>✓ <math>\frac{3}{x-p}</math></p> <p>✓ <math>-t</math></p> <p>✓ <math>p = 2</math></p> <p>✓ <math>t = -1</math></p> <p>(4)</p>
5.6	<p><math>x</math>-intercepts of <math>f</math> / <math>x</math>-afsnitte van <math>f</math>:</p> $x^2 - 4x + 3 = 0$ $(x-3)(x-1) = 0$ $x = 1 \text{ or } x = 3$ $g'(x) < 0 \text{ for } x \in R; x \neq 2$ <p>Hence <math>f(x) &lt; 0</math></p> $x \leq 1 \text{ or } x \geq 3 \quad \text{OR/OF} \quad (-\infty; 1] \cup [3; \infty)$	<p>✓ both critical values</p> <p>✓ <math>x \leq 1</math></p> <p>✓ or</p> <p>✓ <math>x \geq 3</math></p> <p>(4) <b>[14]</b></p>

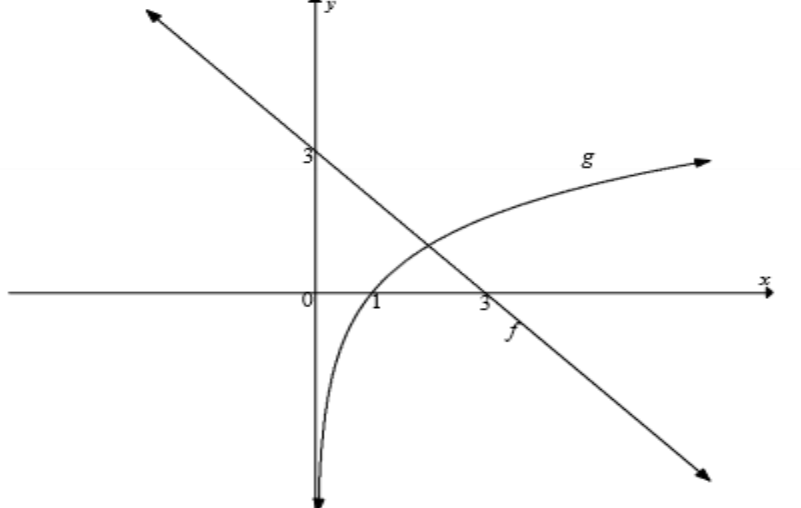


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## QUESTION/VRAAG 6

6.1		<p><math>g</math>:</p> <ul style="list-style-type: none"> <li>✓ shape: increasing curve</li> <li>✓ <math>(1 ; 0)</math>: only on log graph</li> </ul> <p><math>f</math>:</p> <ul style="list-style-type: none"> <li>✓ <math>(3 ; 0)</math></li> <li>✓ <math>(0 ; 3)</math></li> </ul> <p style="text-align: right;">(4)</p>
6.2	$y = \log_2 x$ $g^{-1} : x = \log_2 y$ $y = 2^x$	<ul style="list-style-type: none"> <li>✓ interchange <math>x</math> and <math>y</math></li> <li>✓ <math>y = 2^x</math></li> </ul> <p style="text-align: right;">(2)</p>
6.3	$\log_2(3 - x) = x$ $2^x = 3 - x$ $2^x = -x + 3$ <p>Reflect the graph of <math>g</math> about the line <math>y = x</math> to obtain <math>g^{-1}</math> and determine the point of intersection of <math>f</math> and <math>g^{-1}</math>. / Reflekteer die grafiek van <math>g</math> om die lyn <math>y = x</math> en bepaal die snypunt van <math>f</math> and <math>g^{-1}</math></p>	<ul style="list-style-type: none"> <li>✓✓ <math>2^x = -x + 3</math></li> <li>✓ point of intersection of <math>f</math> and <math>g^{-1}</math></li> </ul> <p style="text-align: right;">(3)</p>
6.4	$x = 1$	<ul style="list-style-type: none"> <li>✓ answer</li> </ul> <p style="text-align: right;">(1) <b>[10]</b></p>



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**QUESTION/VRAAG 7**

7.1	$A = P(1+i)^n$ $= 250000 \left(1 + \frac{0,15}{12}\right)^2$ $= R256\,289,06$	<p>✓ substituting <math>i</math> and <math>n</math> values in correct formula</p> <p>✓ answer</p> <p style="text-align: right;">(2)</p>
7.2	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $256\,289,06 = \frac{x \left[1 - \left(1 + \frac{0,15}{12}\right)^{-46}\right]}{\frac{0,15}{12}}$ $3203,6133 = x \left[1 - \left(1 + \frac{0,15}{12}\right)^{-46}\right]$ <p style="text-align: center;"><math>x = R\,7\,359,79</math> per month</p> <p><b>OR/OF</b></p> $250000 = \frac{x \left(1 + \frac{0,15}{12}\right)^{-2} \left[1 - \left(1 + \frac{0,15}{12}\right)^{-46}\right]}{\frac{0,15}{12}}$ <p style="text-align: center;"><math>x = R\,7\,359,79</math></p>	<p>✓ <math>i = \frac{0,15}{12}</math></p> <p>✓ <math>n = 46</math></p> <p>✓ substitution into correct formula</p> <p>✓ answer</p> <p style="text-align: right;">(4)</p> <p>✓ <math>i = \frac{0,15}{12}</math></p> <p>✓ <math>n = 46</math></p> <p>✓ substitution into correct formula</p> <p>✓ answer</p> <p style="text-align: right;">(4)</p>
7.3	$256\,289,06 = \frac{9\,000 \left[1 - \left(1 + \frac{0,15}{12}\right)^{-n}\right]}{\frac{0,15}{12}}$ $\left(1 + \frac{0,15}{12}\right)^{-n} = 0,6440429722$ $-n \log \left(1 + \frac{0,15}{12}\right) = \log 0,6440429722$ <p style="text-align: center;"><math>n = 35,41872568</math> months/ maande</p> <p style="text-align: center;">∴ 36 payments are required</p> <p style="text-align: center;">∴ 36 paaiemente moet betaal word</p> <p>∴ Thabiso will pay his loan off 10 months sooner./Thabiso los sy lening 10 maande vroeër af.</p> <p><b>OR/OF</b></p>	<p>✓ <math>x = 9\,000</math></p> <p>✓ substitute into correct formula</p> <p>✓ use of logs</p> <p>✓ <math>n = 35,42</math></p> <p>✓ 10 months</p> <p style="text-align: right;">(5)</p>



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	$256289,06 \left(1 + \frac{0,15}{12}\right)^n = \frac{9000 \left[ \left(1 + \frac{0,15}{12}\right)^n - 1 \right]}{\frac{0,15}{12}}$ $3203,61325 \left(1 + \frac{0,15}{12}\right)^n = 9000 \left(1 + \frac{0,15}{12}\right)^n - 9000$ $9000 = 5796,38675 \left(1 + \frac{0,15}{12}\right)^n$ $n = \log_{\left(1 + \frac{0,15}{12}\right)} 1,5523691425$ $n = 35,41872568$ <p>∴ 36 payments are required ∴ 36 paaiemente moet betaal word ∴ Thabiso will pay his loan off 10 months sooner./Thabiso los sy lening 10 maande vroeër af.</p>	<p>✓ 9 000</p> <p>✓ substitute into correct formula</p> <p>✓ use of logs</p> <p>✓ <math>n = 35,42</math></p> <p>✓ 10 months</p> <p>(5)</p>
7.4	<p>The balance of his loan after the 35<sup>th</sup> payment was made: Die balans van sy lening nadat die 35<sup>ste</sup> paaiement betaal is:</p> $\text{Balance} = 256289,06 \left(1 + \frac{0,15}{12}\right)^{35} - \frac{9000 \left[ \left(1 + \frac{0,15}{12}\right)^{35} - 1 \right]}{\frac{0,15}{12}}$ $= R 3 735,45$ $\text{Final instalment} = 3 735,45 \left(1 + \frac{0,15}{12}\right)$ $= R 3 782,14$ <p><b>OR/OF</b></p> $P = \frac{x [1 - (1 + i)^{-n}]}{i}$ <p>Final instalment</p> $= \frac{9 000 \left[ 1 - \left(1 + \frac{0,15}{12}\right)^{-0,41872568} \right]}{\frac{0,15}{12}} \left(1 + \frac{0,15}{12}\right)$ $= R 3 782,14$ <p><b>OR/OF</b></p>	<p>✓ <math>256289,06 \left(1 + \frac{0,15}{12}\right)^{35}</math></p> <p>✓ <math>\frac{9000 \left[ \left(1 + \frac{0,15}{12}\right)^{35} - 1 \right]}{\frac{0,15}{12}}</math></p> <p>✓ <math>3 735,45 \left(1 + \frac{0,15}{12}\right)</math></p> <p>✓ answer</p> <p>(4)</p> <p>✓ 0,41872568</p> <p>✓ <math>\frac{9 000 \left[ 1 - \left(1 + \frac{0,15}{12}\right)^{-0,41872568} \right]}{\frac{0,15}{12}}</math></p> <p>✓ <math>\times \left(1 + \frac{0,15}{12}\right)</math></p> <p>✓ answer</p> <p>(4)</p>



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	$\text{Balance} = 256289,06 \left(1 + \frac{0,15}{12}\right)^{36} - \frac{9000 \left( \left(1 + \frac{0,15}{12}\right)^{36} - 1 \right)}{\frac{0,15}{12}}$ $= \text{R } -5\,217,86$ $\text{Final payment} = 9\,000 - 5217,86$ $= \text{R } 3\,782,14$	<ul style="list-style-type: none"> <li>✓ <math>256289,06 \left(1 + \frac{0,15}{12}\right)^{36}</math></li> <li>✓ <math>\frac{9000 \left( \left(1 + \frac{0,15}{12}\right)^{36} - 1 \right)}{\frac{0,15}{12}}</math></li> <li>✓ <math>9\,000 - 5217,86</math></li> <li>✓ answer</li> </ul> <p style="text-align: right;">(4)</p>
		[15]

## QUESTION/VRAAG 8

8.1	$f(x+h) = 3(x+h)^2$ $= 3(x^2 + 2xh + h^2)$ $= 3x^2 + 6xh + 3h^2$ $f(x+h) - f(x) = 3x^2 + 6xh + 3h^2 - 3x^2$ $= 6xh + 3h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h}$ $= \lim_{h \rightarrow 0} (6x + 3h)$ $= 6x$ <p><b>OR/OF</b></p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{3(x+h)^2 - 3x^2}{h}$ $= \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 - 3x^2}{h}$ $= \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h}$ $= \lim_{h \rightarrow 0} (6x + 3h)$ $= 6x$	<ul style="list-style-type: none"> <li>✓ <math>3(x+h)^2</math></li> <li>✓ <math>6xh + 3h^2</math></li> <li>✓ <math>f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}</math></li> <li>✓ <math>\lim_{h \rightarrow 0} (6x + 3h)</math></li> <li>✓ <math>6x</math></li> </ul> <p style="text-align: right;">(5)</p> <ul style="list-style-type: none"> <li>✓ <math>f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}</math></li> <li>✓ <math>3(x+h)^2 - 3x^2</math></li> <li>✓ <math>6xh + 3h^2</math></li> <li>✓ <math>\lim_{h \rightarrow 0} (6x + 3h)</math></li> <li>✓ <math>6x</math></li> </ul> <p style="text-align: right;">(5)</p>
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Mathematics/P1

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8.2	$\lim_{h \rightarrow 0} \frac{\sqrt{4+h} - 2}{h}$ $g(x) = \sqrt{x}$ $a = 4$	✓ answer ✓ answer (2)
8.3	$y = \sqrt{x^3} - \frac{5}{x^3}$ $y = x^{\frac{3}{2}} - 5x^{-3}$ $\frac{dy}{dx} = \frac{3}{2}x^{\frac{1}{2}} + 15x^{-4}$	✓ $x^{\frac{3}{2}}$ ✓ $-5x^{-3}$ ✓ $\frac{3}{2}x^{\frac{1}{2}}$ ✓ $15x^{-4}$ (4)
8.4	$f(x) = x^3 + ax^2 + bx + 18$ $f'(x) = 3x^2 + 2ax + b$ At $x = 1$ , $m_{\text{tan}} = -8$ $f'(1) = -8$ $3(1)^2 + 2a(1) + b = -8$ $3 + 2a + b = -8$ $2a + b = -11 \dots\dots(1)$ $y = f(1)$ $= g(1)$ $= -8(1) + 20$ $= 12$ $1 + a + b + 18 = 12$ $a + b = -7 \dots\dots(2)$ $a = -4$ $b = -3$	✓ $3x^2 + 2ax + b$  ✓ $f'(1) = -8$ or $3(1)^2 + 2a(1) + b = -8$  ✓ $1 + a + b + 18 = 12$  ✓ $a = -4$ ✓ $b = -3$ (5) <b>[16]</b>



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## QUESTION/VRAAG 9

9.1	$f'(x) = 3x^2 + 8x - 3 = 0$ $(3x - 1)(x + 3) = 0$ $x = \frac{1}{3} \quad \text{or} \quad x = -3$	✓ equating derivative to zero ✓ factors ✓ x - values (3)
9.2	$f''(x) = 6x + 8$ $6x + 8 < 0$ $x < -\frac{4}{3}$ <p><b>OR</b></p> $x = \frac{\frac{1}{3} - 3}{2}$ $= \frac{4}{3}$ $\therefore x < -\frac{4}{3}$	✓ $6x + 8$ ✓✓ $x < -\frac{4}{3}$  ✓ $\frac{\frac{1}{3} - 3}{2}$  ✓✓ $x < -\frac{4}{3}$ (3)
9.3	$x \leq -3 \quad \text{or} \quad x \geq \frac{1}{3}$ <p><b>OR/OF</b></p> $[-\infty; -3] \cup \left[\frac{1}{3}; \infty\right]$	✓ $x \leq -3$ ✓ $x \geq \frac{1}{3}$ ✓ $[-\infty; -3]$ ✓ $\left[\frac{1}{3}; \infty\right]$ (2) (2)
9.4	$f(0) = -18$ $d = -18$ $f(x) = ax^3 + bx^2 + cx - 18$ $f'(x) = 3ax^2 + 2bx + c$ $f'(x) = 3x^2 + 8x - 3$ $3a = 3 \quad 2b = 8$ $a = 1 \quad b = 4 \quad c = -3$ $f(x) = x^3 + 4x^2 - 3x - 18$ <p><b>OR/OF</b></p> $f'(x) = 3x^2 + 8x - 3$ <p>By integration/Deur integrasie</p> $f(x) = x^3 + 4x^2 - 3x + d$ $f(0) = d = -18$ $a = 1$ $b = 4$ $c = -3$	✓ $d = -18$ ✓ $f'(x) = 3ax^2 + 2bx + c$  ✓ $a = 1$ ✓ $b = 4$ ✓ $c = -3$ (5)  ✓ $f(x) = x^3 + 4x^2 - 3x + d$  ✓ $d = -18$ ✓ $a = 1$ ✓ $b = 4$ ✓ $c = -3$ (5)
		[13]

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**QUESTION/VRAAG 10**

10.1	$M(t) = -t^3 + 3t^2 + 72t$ $M(3) = -(3)^3 + 3(3)^2 + 72(3)$ $= 216$ <p>216 molecules/molekules</p>	$\checkmark M(3) = -(3)^3 + 3(3)^2 + 72(3)$ $\checkmark 216$ <p>(2)</p>
10.2	$M(t) = -t^3 + 3t^2 + 72t$ $M'(t) = -3t^2 + 6t + 72$ $M'(2) = -3(2)^2 + 6(2) + 72$ $= 72$ <p>72 molecules per hour/molekules per uur</p>	$\checkmark M'(t) = -3t^2 + 6t + 72$ $\checkmark M'(2)$ $\checkmark 72$ <p>(3)</p>
10.3	$M(t) = -t^3 + 3t^2 + 72t$ $M'(t) = -3t^2 + 6t + 72$ $M''(t) = 0$ $-6t + 6 = 0$ $t = 1$ <p>Maximum rate of change of the number of molecules of the drug in the bloodstream is after 1 hour./Maksimum tempo van verandering van die getal molekules in die bloedstroom is na 1 uur</p>	$\checkmark M''(t)$ $\checkmark M''(t) = 0$ $\checkmark \text{answer}$ <p>(3) <b>[8]</b></p>





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**QUESTION/VRAAG 11**

11.1		Watches TV during exams	Do not watch TV during exams	Total	
	Male	80	$a$	$80+a$	
	Female	48	12	60	
	Total	$b$	32	160	
	$a + 12 = 32$ $a = 20$ $b = 80 + 48$ $= 128$				$\checkmark a = 20$ $\checkmark b = 128$ (2)
11.2	No $P(\text{M and not watching TV}) = \frac{20}{160} \neq 0$				$\checkmark$ No $\checkmark$ reason (2)
11.3.1	$P(\text{watching TV}) = \frac{128}{160} = \frac{4}{5} = 0,8 = 80\%$				$\checkmark$ 128 $\checkmark$ 160 (2)
11.3.2	$P(\text{female and not watching TV}) = \frac{12}{160} = \frac{3}{40} = 0,075 = 7,5\%$				$\checkmark$ 12 $\checkmark$ 160 (2)
					<b>[8]</b>



**QUESTION/VRAAG 12**

<p>12. We want to create codes that are even numbers greater than 5000. The digit 6 can be used in one of two places in these codes and therefore this presents two scenarios. <i>Ons wil kodes kry wat ewe getalle groter as 5000 is. Die syfer 6 kan in twee posisies in die kode gebruik word en twee opsies is moontlik:</i></p> <p><b>CASE 1: The first digit is a 6./Die eerste syfer is 'n 6.</b></p> $\begin{array}{ccccccc} & & & & & & 2 \\ & & & & & & 4 \\ 6 & & & & & & \\ \underline{1} & \times & \underline{5} & \times & \underline{4} & \times & \underline{2} \end{array}$ <p>Number of codes starting with 6./<i>Getal kodes wat met 6 begin.</i> <math>= 1 \times 5 \times 4 \times 2 = 40</math></p> <p><b>CASE 2: The first digit is a 5 or 7./Die eerste syfer is 'n 5 of 7.</b></p> $\begin{array}{ccccccc} & & & & & & 2 \\ & & & & & & 4 \\ 5 & & & & & & \\ 7 & & & & & & 6 \\ \underline{2} & \times & \underline{5} & \times & \underline{4} & \times & \underline{3} \end{array}$ <p>Number of codes not starting with 6./<i>Getal kodes wat nie met 6 begin</i> <math>= 2 \times 5 \times 4 \times 3 = 120</math></p> <p>Therefore total number of possible codes./<i>Die totale getal moontlike kodes</i> <math>= 40 + 120 = 160</math>.</p> <p><b>OR/OF</b></p> $\begin{aligned} & (3 \times 5 \times 4 \times 1) + (3 \times 5 \times 4 \times 1) + (2 \times 5 \times 4 \times 1) \\ & = 60 + 60 + 40 \\ & = 160 \end{aligned}$ <p><b>OR/OF</b></p> $\begin{aligned} & (3 \times 5 \times 4 \times 3) - (1 \times 5 \times 4 \times 1) \\ & = 180 - 20 \\ & = 160 \end{aligned}$	<p>✓ <math>1 \times 5 \times 4 \times 2</math> ✓ 40</p> <p>✓ <math>2 \times 5 \times 4 \times 3</math> ✓ 120 ✓ 160</p> <p>[5]</p> <p>✓ <math>(3 \times 5 \times 4 \times 1)</math> ✓ <math>(3 \times 5 \times 4 \times 1)</math> ✓ <math>(2 \times 5 \times 4 \times 1)</math> ✓✓ 160</p> <p>[5]</p> <p>✓✓ <math>(3 \times 5 \times 4 \times 3)</math> ✓✓ <math>(1 \times 5 \times 4 \times 1)</math> ✓ 160</p> <p>[5]</p>
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**TOTAL/TOTAAL: 150**



# basic education

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Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**NOVEMBER 2017**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 8 pages and 1 information sheet.**

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Mathematics/P1

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**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 + 9x + 14 = 0$  (3)

1.1.2  $4x^2 + 9x - 3 = 0$  (correct to TWO decimal places) (4)

1.1.3  $\sqrt{x^2 - 5} = 2\sqrt{x}$  (4)

1.2 Solve for  $x$  and  $y$  if:

$3x - y = 4$  and  $x^2 + 2xy - y^2 = -2$  (6)

1.3 Given:  $f(x) = x^2 + 8x + 16$ 

1.3.1 Solve for  $x$  if  $f(x) > 0$ . (3)

1.3.2 For which values of  $p$  will  $f(x) = p$  have TWO unequal negative roots? (4)  
[24]

**QUESTION 2**2.1 Given the following quadratic number pattern:  $5 ; -4 ; -19 ; -40 ; \dots$ 

2.1.1 Determine the constant second difference of the sequence. (2)

2.1.2 Determine the  $n^{\text{th}}$  term ( $T_n$ ) of the pattern. (4)

2.1.3 Which term of the pattern will be equal to  $-25\,939$ ? (3)

2.2 The first three terms of an arithmetic sequence are  $2k - 7 ; k + 8$  and  $2k - 1$ .

2.2.1 Calculate the value of the  $15^{\text{th}}$  term of the sequence. (5)

2.2.2 Calculate the sum of the first 30 even terms of the sequence. (4)  
[18]

**QUESTION 3**

A convergent geometric series consisting of only positive terms has first term  $a$ , constant ratio  $r$  and  $n^{\text{th}}$  term,  $T_n$ , such that  $\sum_{n=3}^{\infty} T_n = \frac{1}{4}$ .

3.1 If  $T_1 + T_2 = 2$ , write down an expression for  $a$  in terms of  $r$ . (2)

3.2 Calculate the values of  $a$  and  $r$ . (6)  
[8]

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Mathematics/P1

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**QUESTION 4**Given:  $f(x) = -ax^2 + bx + 6$ 

- 4.1 The gradient of the tangent to the graph of  $f$  at the point  $\left(-1; \frac{7}{2}\right)$  is 3.  
Show that  $a = \frac{1}{2}$  and  $b = 2$ . (5)
- 4.2 Calculate the  $x$ -intercepts of  $f$ . (3)
- 4.3 Calculate the coordinates of the turning point of  $f$ . (3)
- 4.4 Sketch the graph of  $f$ . Clearly indicate ALL intercepts with the axes and the turning point. (4)
- 4.5 Use the graph to determine the values of  $x$  for which  $f(x) > 6$ . (3)
- 4.6 Sketch the graph of  $g(x) = -x - 1$  on the same set of axes as  $f$ . Clearly indicate ALL intercepts with the axes. (2)
- 4.7 Write down the values of  $x$  for which  $f(x) \cdot g(x) \leq 0$ . (3)
- [23]

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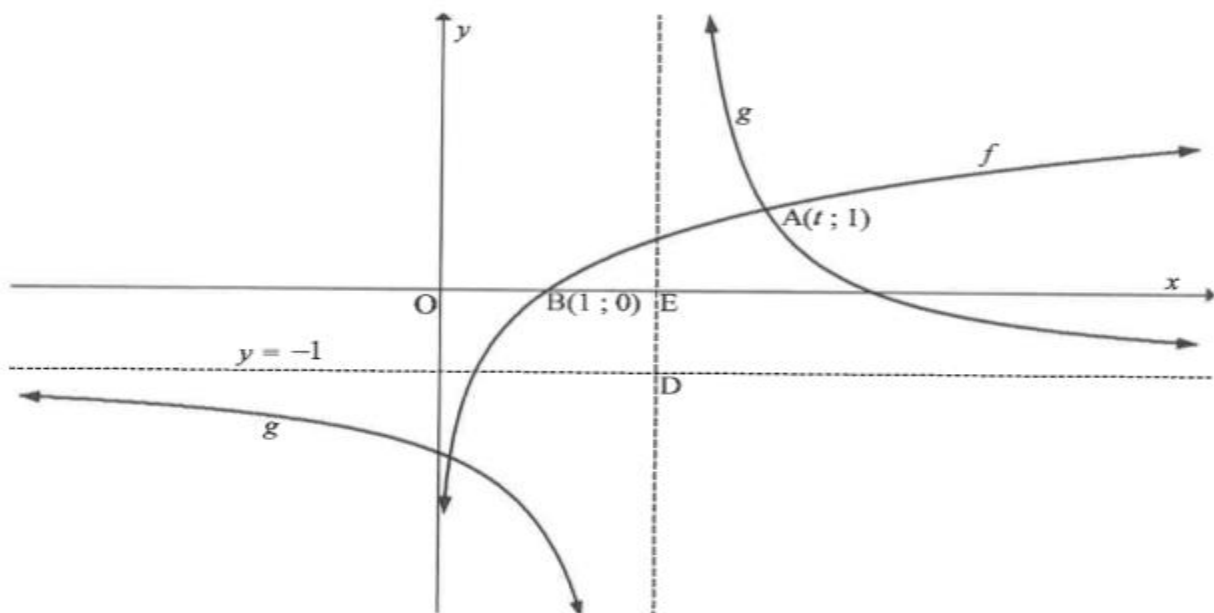
5  
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**QUESTION 5**

The diagram below shows the graphs of  $g(x) = \frac{2}{x+p} + q$  and  $f(x) = \log_3 x$ .

- $y = -1$  is the horizontal asymptote of  $g$ .
- $B(1 ; 0)$  is the  $x$ -intercept of  $f$ .
- $A(t ; 1)$  is a point of intersection between  $f$  and  $g$ .
- The vertical asymptote of  $g$  intersects the  $x$ -axis at  $E$  and the horizontal asymptote at  $D$ .
- $OB = BE$ .



- 5.1 Write down the range of  $g$ . (2)
- 5.2 Determine the equation of  $g$ . (2)
- 5.3 Calculate the value of  $t$ . (3)
- 5.4 Write down the equation of  $f^{-1}$ , the inverse of  $f$ , in the form  $y = \dots$  (2)
- 5.5 For which values of  $x$  will  $f^{-1}(x) < 3$ ? (2)
- 5.6 Determine the point of intersection of the graphs of  $f$  and the axis of symmetry of  $g$  that has a negative gradient. (3)
- [14]

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**QUESTION 6**

- 6.1 Mbali invested R10 000 for 3 years at an interest rate of  $r$  % p.a., compounded monthly. At the end of this period, she received R12 146,72. Calculate  $r$ , correct to ONE decimal place. (5)
- 6.2 Piet takes a loan from a bank to buy a car for R235 000. He agrees to repay the loan over a period of 54 months. The first instalment will be paid one month after the loan is granted. The bank charges interest at 11% p.a., compounded monthly.
- 6.2.1 Calculate Piet's monthly instalment. (4)
- 6.2.2 Calculate the total amount of interest that Piet will pay during the first year of the repayment of the loan. (6)
- [15]**

**QUESTION 7**

- 7.1 Given:  $f(x) = 2x^2 - x$   
Determine  $f'(x)$  from first principles. (6)
- 7.2 Determine:
- 7.2.1  $D_x[(x+1)(3x-7)]$  (2)
- 7.2.2  $\frac{dy}{dx}$  if  $y = \sqrt{x^3} - \frac{5}{x} + \frac{1}{2}\pi$  (4)
- [12]**





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**QUESTION 8**

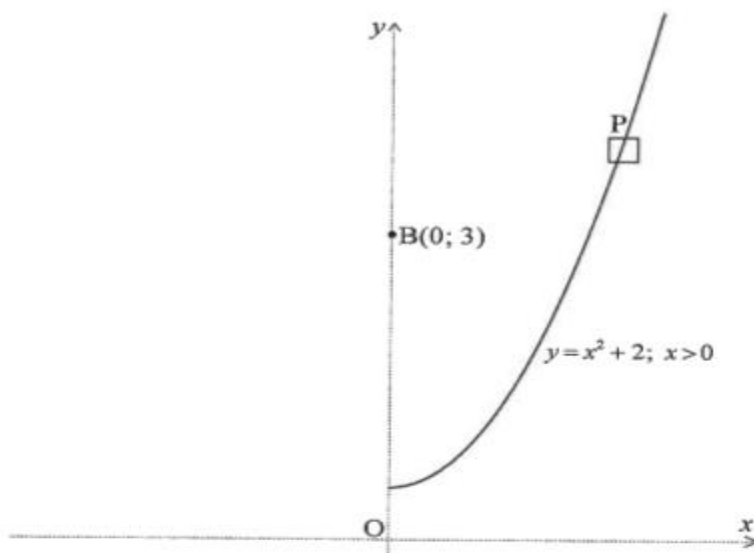
Given:  $f(x) = x(x-3)^2$  with  $f'(1) = f'(3) = 0$  and  $f(1) = 4$

- 8.1 Show that  $f$  has a point of inflection at  $x = 2$ . (5)
- 8.2 Sketch the graph of  $f$ , clearly indicating the intercepts with the axes and the turning points. (4)
- 8.3 For which values of  $x$  will  $y = -f(x)$  be concave down? (2)
- 8.4 Use your graph to answer the following questions:
- 8.4.1 Determine the coordinates of the local maximum of  $h$  if  $h(x) = f(x-2) + 3$ . (2)
- 8.4.2 Claire claims that  $f'(2) = 1$ .  
Do you agree with Claire? Justify your answer. (2)
- [15]

**QUESTION 9**

An aerial view of a stretch of road is shown in the diagram below. The road can be described by the function  $y = x^2 + 2$ ,  $x \geq 0$  if the coordinate axes (dotted lines) are chosen as shown in the diagram.

Benny sits at a vantage point  $B(0; 3)$  and observes a car, P, travelling along the road.



Calculate the distance between Benny and the car, when the car is closest to Benny. (7)

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Mathematics/P1

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**QUESTION 10**

A survey was conducted among 100 Grade 12 learners about their use of Instagram (I), Twitter (T) and WhatsApp (W) on their cell phones. The survey revealed the following:

- 8 use all three.
- 12 use Instagram and Twitter.
- 5 use Twitter and WhatsApp, but not Instagram.
- $x$  use Instagram and WhatsApp, but not Twitter.
- 61 use Instagram.
- 19 use Twitter.
- 73 use WhatsApp.
- 14 use none of these applications.

- 10.1 Draw a Venn diagram to illustrate the information above. (4)
- 10.2 Calculate the value of  $x$ . (2)
- 10.3 Calculate the probability that a learner, chosen randomly, uses only ONE of these applications. (2)
- [8]**

**QUESTION 11**

A company uses a coding system to identify its clients. Each code is made up of two letters and a sequence of digits, for example AD108 or RR 45789.

The letters are chosen from A; D; R; S and U. Letters may be repeated in the code.

The digits 0 to 9 are used, but NO digit may be repeated in the code.

- 11.1 How many different clients can be identified with a coding system that is made up of TWO letters and TWO digits? (3)
- 11.2 Determine the least number of digits that is required for a company to uniquely identify 700 000 clients using their coding system. (3)
- [6]**

**TOTAL: 150**

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**GRADE 12/GRAAD 12**

**MATHEMATICS P1/WISKUNDE V1**

**NOVEMBER 2017**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS/PUNTE: 150**

**This memorandum consists of 22 pages.  
Hierdie memorandum bestaan uit 22 bladsye.**



**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking guidelines.

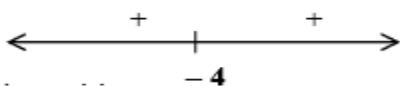
**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$x^2 + 9x + 14 = 0$ $(x + 7)(x + 2) = 0$ $x = -7 \text{ or } x = -2$	<ul style="list-style-type: none"> <li>✓ factors</li> <li>✓ <math>x = -7</math></li> <li>✓ <math>x = -2</math></li> </ul>	(3)
1.1.2	$4x^2 + 9x - 3 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-9 \pm \sqrt{9^2 - 4(4)(-3)}}{2(4)}$ $= \frac{-9 \pm \sqrt{129}}{8}$ $x = 0,29 \text{ or } x = -2,54$ <p><b>OR/OF</b></p> $x^2 + \frac{9}{4}x + \frac{81}{64} = \frac{3}{4} + \frac{81}{64}$ $\left(x + \frac{9}{8}\right)^2 = \frac{129}{64}$ $x + \frac{9}{8} = \pm \frac{\sqrt{129}}{8}$ $x = \frac{-9 \pm \sqrt{129}}{8}$ $x = 0,29 \text{ or } x = -2,54$	<ul style="list-style-type: none"> <li>✓ substitution</li> <li>✓ simplification</li> <li>✓ <math>x = 0,29</math></li> <li>✓ <math>x = -2,54</math></li> </ul> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ for adding <math>\frac{81}{64}</math> on both sides</li> <li>✓ simplification</li> <li>✓ <math>x = 0,29</math></li> <li>✓ <math>x = -2,54</math></li> </ul>	(4)
1.1.3	$\sqrt{x^2 - 5} = 2\sqrt{x}$ $x^2 - 5 = 4x$ $x^2 - 4x - 5 = 0$ $(x - 5)(x + 1) = 0$ $x = 5 \text{ or } x = -1$ $x = 5$	<ul style="list-style-type: none"> <li>✓ <math>x^2 - 5 = 4x</math></li> <li>✓ standard form</li> <li>✓ both answers</li> <li>✓ select <math>x = 5</math></li> </ul>	(4)



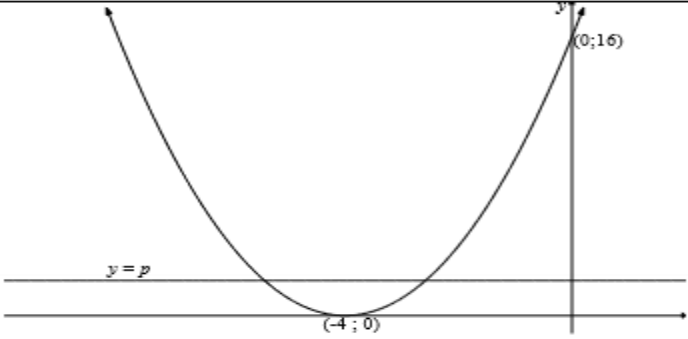
1.2	$3x - y = 4$ $y = 3x - 4$ $x^2 + 2xy - y^2 = -2$ $x^2 + 2x(3x - 4) - (3x - 4)^2 = -2$ $x^2 + 6x^2 - 8x - (9x^2 - 24x + 16) = -2$ $7x^2 - 8x - 9x^2 + 24x - 16 = -2$ $-2x^2 + 16x - 14 = 0$ $x^2 - 8x + 7 = 0$ $(x - 7)(x - 1) = 0$ $x = 1 \quad \text{or} \quad x = 7$ $y = 3(1) - 4 \quad y = 3(7) - 4$ $y = -1 \quad \text{or} \quad y = 17$ <p><b>OR/OF</b></p> $3x - y = 4$ $x = \frac{y + 4}{3}$ $x^2 + 2xy - y^2 = -2$ $x^2 + 2xy - y^2 = -2$ $\left(\frac{y + 4}{3}\right)^2 + 2\left(\frac{y + 4}{3}\right)y - y^2 = -2$ $y^2 + 8y + 16 + 6y^2 + 24y - 9y^2 = -18$ $-2y^2 + 32y + 34 = 0$ $y^2 - 16y - 17 = 0$ $(y - 17)(y + 1) = 0$ $y = -1 \quad \text{or} \quad y = 17$ $x = \frac{-1 + 4}{3} \quad x = \frac{17 + 4}{3}$ $x = 1 \quad \text{or} \quad x = 7$	<p>✓ <math>y</math> subject of formula</p> <p>✓ substitution</p> <p>✓ correct standard form</p> <p>✓ factors</p> <p>✓ <math>x</math>-values</p> <p>✓ <math>y</math>-values</p> <p><b>OR/OF</b></p> <p>✓ <math>x</math> subject of formula</p> <p>✓ substitution</p> <p>✓ correct standard form</p> <p>✓ factors</p> <p>✓ <math>y</math>-values</p> <p>✓ <math>x</math>-values</p> <p>(6)</p>
1.3.1	$x^2 + 8x + 16 > 0$ $(x + 4)(x + 4) > 0$ $x \in R, x \neq -4 \quad \text{or}$ $x \in (-\infty; -4) \quad \text{or} \quad x \in (-4; \infty) \quad \text{or}$ $x < -4 \quad \text{or} \quad x > -4$ <p><b>OR/OF</b></p> $x^2 + 8x + 16 > 0$ $(x + 4)(x + 4) > 0$ <div style="text-align: center;">  </div> <p>The function values remain positive</p> $x \in R, x \neq -4$	<p>✓ <math>(x + 4)(x + 4)</math></p> <p>✓✓ any one of the solutions</p> <p><b>OR/OF</b></p> <p>✓ <math>(x + 4)(x + 4)</math></p> <p>✓✓ any one of the solutions</p> <p>(3)</p>

Mathematics/P1/Wiskunde/V1

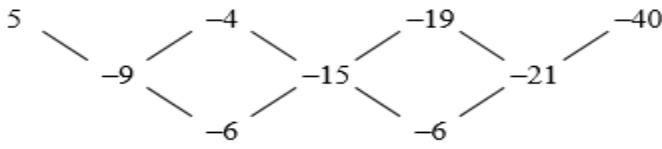
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1.3.2	 <p>For two negative unequal roots:  <math>0 &lt; p &lt; 16</math></p> <p><b>OR/OF</b></p> $x^2 + 8x + 16 = p$ $x^2 + 8x + 16 - p = 0$ $0 < 16 - p < 16$ $-16 < -p < 0$ $0 < p < 16$ <p><b>OR/OF</b></p> $x^2 + 8x + 16 - p = 0$ $x = \frac{-8 \pm \sqrt{64 - 4(16 - p)}}{2}$ $0 < 64 - 4(16 - p) < 64$ $0 < 4p < 64$ $0 < p < 16$ <p><b>OR/OF</b></p> $x^2 + 8x + 16 = p$ $x^2 + 8x + 16 - p = 0$ <p>Roots are real and unequal:</p> $8^2 - 4(16 - p) > 0$ $4p > 0$ $p > 0$ <p>Roots are: <math>\frac{-8 \pm \sqrt{4p}}{2}</math></p> <p>For both roots to be negative:</p> $\sqrt{4p} < 8$ $4p < 64$ $p < 16$ $0 < p < 16$	<p>✓ 0          ✓ 16</p> <p>✓ ✓ <math>0 &lt; p &lt; 16</math> (4)</p> <p><b>OR/OF</b></p> <p>✓ 0          ✓ 16</p> <p>✓ ✓ <math>0 &lt; p &lt; 16</math> (4)</p> <p>✓ 0          ✓ 16</p> <p>✓ ✓ <math>0 &lt; p &lt; 16</math> (4)</p> <p>✓ 0          ✓ 16</p> <p>✓ ✓ <math>0 &lt; p &lt; 16</math> (4)</p> <p>✓ 0          ✓ 16</p> <p>✓ ✓ <math>0 &lt; p &lt; 16</math> (4)</p> <p>[24]</p>
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## QUESTION/VRAAG 2

2.1.1	 <p>first differences: <math>-9; -15; -21</math> second difference = <math>-6</math></p>	<p>✓ first differences ✓ <math>-6</math></p> <p>(2)</p>
2.1.2	$T_n = an^2 + bn + c$ $a = \frac{\text{second difference}}{2} = -3$ $3a + b = -9$ $3(-3) + b = -9$ $b = 0$ $a + b + c = 5$ $-3 + 0 + c = 5$ $c = 8$ $T_n = -3n^2 + 8$ <p><b>OR/OF</b></p> $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)d_2}{2}$ $= 5 + (n-1)(-9) + \frac{(n-1)(n-2)(-6)}{2}$ $= 5 - 9n + 9 - 3n^2 + 9n - 6$ $T_n = -3n^2 + 8$	<p>✓ <math>a = -3</math></p> <p>✓ <math>b = 0</math></p> <p>✓ <math>c = 8</math></p> <p>✓ <math>T_n = -3n^2 + 8</math></p> <p><b>OR/OF</b></p> <p>✓ <math>a = -3</math> ✓ <math>b = 0</math> ✓ <math>c = 8</math> ✓ <math>T_n = -3n^2 + 8</math></p> <p>(4)</p>
2.1.3	$-3n^2 + 8 = -25\,939$ $-3n^2 = -25947$ $n^2 = 8649$ $n = -93 \text{ or } n = 93$ <p>The 93<sup>rd</sup> term has a value of <math>-25\,939</math></p>	<p>✓ <math>T_n = -25\,939</math></p> <p>✓ <math>n^2 = 8649</math> ✓ answer</p> <p>(3)</p>



2.2.1	$2k - 7; k + 8$ and $2k - 1$ $k + 8 - (2k - 7) = 2k - 1 - (k + 8)$ $-k + 15 = k - 9$ $2k = 24$ $k = 12$ $2k - 7; k + 8$ and $2k - 1$ $17; 20; 23 \dots\dots$ $d = 3$ $T_{15} = 17 + 14(3)$ $= 59$	$\checkmark$ $k + 8 - (2k - 7) = 2k - 1 - (k + 8)$  $\checkmark k = 12$  $\checkmark 17$ $\checkmark d = 3$  $\checkmark T_{15} = 59$  (5)
2.2.2	Sequence is $17; 20; 23; 26; 29; 32 \dots\dots$ Every alternate term of the sequence will be even / <i>Elke tweede term van die ry sal ewe wees</i> $20 + 26 + 32 + \dots\dots$ $S_{30} = \frac{30}{2} [2(20) + (29)(6)]$ $= 15[40 + 174]$ $= 3210$  <b>OR/OF</b> $T_{30} = 20 + 29(6)$ $= 94$  $S_{30} = \frac{30}{2} (20 + 194)$ $= 3210$	$\checkmark 20 + 26 + 32 + \dots\dots$  $\checkmark a = 20 \quad d = 6$ $\checkmark$ subst into correct formula  $\checkmark$ answer  (4)  $\checkmark a = 20 \quad d = 6$  $\checkmark T_{30} = 94$ $\checkmark S_{30} = \frac{30}{2} (20 + 194)$ $\checkmark$ answer  (4)

**[18]**



## QUESTION/VRAAG 3

3.1	$a + ar = 2$ $a(1+r) = 2$ $a = \frac{2}{1+r}$ <p><b>OR/OF</b></p> $\frac{a}{1-r} - 2 = \frac{1}{4}$ $4a - 8(1-r) = 1-r$ $4a - 8 + 8r = 1-r$ $4a = 9 - 9r$ $a = \frac{9-9r}{4}$ <p><b>OR/OF</b></p> $S_n = \frac{a(r^n - 1)}{r - 1}$ $2 = \frac{a(r^2 - 1)}{r - 1}$ $2 = \frac{a(r-1)(r+1)}{r-1}$ $2 = a(r+1)$ $a = \frac{2}{r+1}$ <p><b>OR/OF</b></p> $\frac{ar^2}{1-r} = \frac{1}{4}$ $a = \frac{1-r}{4r^2}$	$\checkmark a + ar = 2$ $\checkmark a = \frac{2}{1+r} \quad (2)$ $\checkmark \frac{a}{1-r} - 2 = \frac{1}{4}$ $\checkmark a = \frac{9-9r}{4} \quad (2)$ <p><b>OR/OF</b></p> $\checkmark 2 = \frac{a(r^2 - 1)}{r - 1}$ $\checkmark a = \frac{2}{r+1} \quad (2)$ <p><b>OR/OF</b></p> $\checkmark \frac{ar^2}{1-r} = \frac{1}{4}$ $\checkmark a = \frac{1-r}{4r^2} \quad (2)$
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3.2	$S_{\infty} = T_1 + T_2 + \sum_{n=3}^{\infty} T_n$ $S_{\infty} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = \frac{9}{4}$ $\left(\frac{2}{1+r}\right) \times \left(\frac{1}{1-r}\right) = \frac{9}{4}$ $\frac{2}{1-r^2} = \frac{9}{4}$ $8 = 9 - 9r^2$ $9r^2 = 1$ $r = \frac{1}{3}$ $a = \frac{3}{2}$	$\checkmark S_{\infty} = 2 + \frac{1}{4}$ $\checkmark \frac{a}{1-r} = \frac{9}{4}$ $\checkmark \text{substitution of } a \text{ into the correct formula}$ $\checkmark 9r^2 = 1$ $\checkmark r = \frac{1}{3}$ $\checkmark a = \frac{3}{2}$
	<p><b>OR/OF</b></p> $S_{\infty} = T_1 + T_2 + \sum_{n=3}^{\infty} T_n$ $S_{\infty} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = \frac{9}{4}$ $4a = 9 - 9r$ $r = \frac{9-4a}{9}$ $a + a\left(\frac{9-4a}{9}\right) = 2$ $9a + 9a - 4a^2 = 18$ $2a^2 - 9a + 9 = 0$ $(a-3)(2a-3) = 0$ $a = \frac{3}{2} \quad \text{or} \quad a = 3$ $r = \frac{1}{3} \quad \text{or} \quad r = -\frac{1}{3}$ <p style="text-align: center;">N/A</p>	<p><b>OR/OF</b></p> $\checkmark S_{\infty} = 2 + \frac{1}{4}$ $\checkmark \frac{a}{1-r} = \frac{9}{4}$ $\checkmark r = \frac{9-4a}{9}$ $\checkmark \text{substitution of } a \text{ into the correct formula}$ $\checkmark a = \frac{3}{2}$



<p><b>OR/OF</b></p> $r = \frac{2-a}{a}$ $\frac{ar^2}{1-r} = \frac{1}{4}$ $4ar^2 = 1-r$ $4a\left(\frac{2-a}{a}\right)^2 = 1 - \frac{2-a}{a}$ $16 - 16a + 4a^2 = 2a + 2$ $2a^2 - 9a + 9 = 0$ $(2a-3)(a-3) = 0$ $a = \frac{3}{2} \quad a \neq 3$ $r = \frac{1}{3} \quad r \neq -\frac{1}{3}$ <p><b>OR/OF</b></p> $S_{\infty} = T_1 + T_2 + \sum_{n=3}^{\infty} T_n$ $S_{\infty} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = \frac{9}{4}$ $\left(\frac{1-r}{4r^2}\right) \times \left(\frac{1}{1-r}\right) = \frac{9}{4}$ $\frac{1}{4r^2} = \frac{9}{4}$ $4 = 36r^2$ $9r^2 = 1$ $r = \frac{1}{3}$ $a = \frac{3}{2}$	$\checkmark r = \frac{1}{3} \quad (6)$ <p><b>OR/OF</b></p> $\checkmark r = \frac{2-a}{a}$ $\checkmark \frac{ar^2}{1-r} = \frac{1}{4}$ <p><math>\checkmark</math> substitution of <math>a</math></p> $\checkmark (2a-3)(a-3) = 0$ $\checkmark a = \frac{3}{2}$ $\checkmark r = \frac{1}{3}$ <p><b>OR/OF</b> <span style="float: right;">(6)</span></p> $\checkmark S_{\infty} = 2 + \frac{1}{4}$ $\checkmark \frac{a}{1-r} = \frac{9}{4}$ <p><math>\checkmark</math> substitution of <math>a</math></p> $\checkmark 9r^2 = 1$ $\checkmark r = \frac{1}{3}$ $\checkmark a = \frac{3}{2}$ <p style="text-align: right;">(6)</p> <p style="text-align: right;"><b>[8]</b></p>
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## QUESTION/VRAAG 4

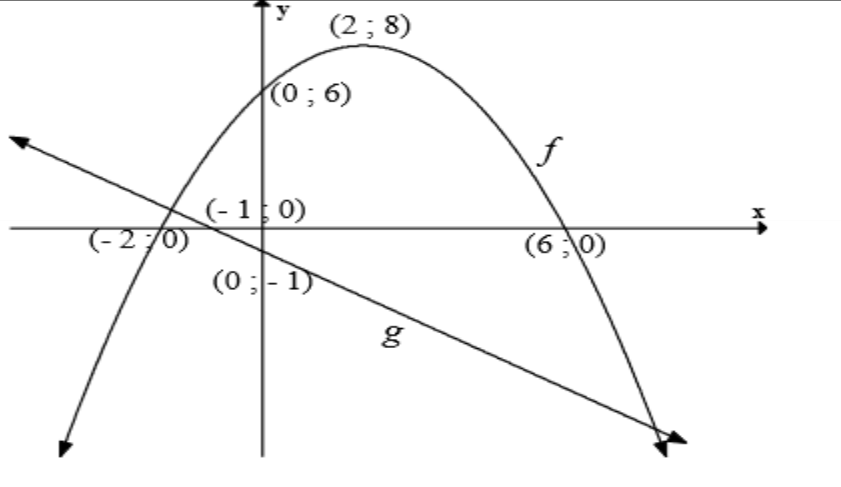
4.1	$f(x) = -ax^2 + bx + 6$ $f'(x) = -2ax + b$ $-2ax + b = 3$ <p style="text-align: center;">at <math>x = -1</math></p> $2a + b = 3 \quad [1]$ $f(-1) = \frac{7}{2}$ $-a - b + 6 = \frac{7}{2}$ $-2a - 2b + 12 = 7$ $2a + 2b = 5 \quad [2]$ <p style="text-align: center;">[2] - [1]</p> $b = 2$ $2a + 2 = 3$ $a = \frac{1}{2}$ <p><b>OR/OF</b></p> $f'(x) = -2ax + b$ $3 = 2a + b$ $b = 3 - 2a$ $\frac{7}{2} = -a(-1)^2 + (3 - 2a)(-1) + 6$ $a + 3 = \frac{7}{2}$ $a = \frac{1}{2}$ $b = 2$	$\checkmark -2ax + b$ $\checkmark \checkmark 2a + b = 3$ $\checkmark -a - b + 6 = \frac{7}{2}$ $\checkmark \text{solve simultaneously}$ <p style="text-align: right;">(5)</p>
4.2	$f(x) = -\frac{1}{2}x^2 + 2x + 6$ <p><math>x</math> - intercepts :</p> $-\frac{1}{2}x^2 + 2x + 6 = 0$ $-x^2 + 4x + 12 = 0$ $x^2 - 4x - 12 = 0$ $(x - 6)(x + 2) = 0$ <p style="text-align: center;">(-2 ; 0)    (6 ; 0)</p>	$\checkmark -\frac{1}{2}x^2 + 2x + 6 = 0$ $\checkmark (-2 ; 0)$ $\checkmark (6 ; 0)$ <p style="text-align: right;">(3)</p>

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4.3	$f(x) = -\frac{1}{2}x^2 + 2x + 6$ $f'(x) = 0 \quad \text{or} \quad x = -\frac{b}{2a} \quad \text{or} \quad x = \frac{-2+6}{2}$ $-x+2=0 \quad \quad \quad x = -\frac{2}{2\left(-\frac{1}{2}\right)} \quad \quad \quad x = 2$ $x = 2 \quad \quad \quad x = 2$ $y = -\frac{1}{2}(2)^2 + 2(2) + 6$ $= -2 + 4 + 6$ $= 8$ <p>TP (2; 8)</p> <p><b>OR/OF</b></p> $y = -\frac{1}{2}(x^2 - 4x - 12)$ $= -\frac{1}{2}[(x-2)^2 - 4 - 12]$ $= -\frac{1}{2}(x-2)^2 + 8$ <p>TP (2; 8)</p>	$\checkmark -x+2 \quad / \quad -\frac{2}{2\left(-\frac{1}{2}\right)} \quad /$ $\frac{-2+6}{2}$ $\checkmark x = 2$ $\checkmark y = 8$ <p><b>OR/OF</b></p> $\checkmark -\frac{1}{2}(x-2)^2 + 8$ $\checkmark x = 2$ $\checkmark y = 8$ <p>(3)</p>
4.4 4.6		<p>4.4: f:</p> <ul style="list-style-type: none"> <li>✓ shape</li> <li>✓ x- intercepts</li> <li>✓ y- intercept</li> <li>✓ (2; 8)</li> </ul> <p>(4)</p> <p>4.6: g:</p> <ul style="list-style-type: none"> <li>✓ x- intercept</li> <li>✓ y- intercept</li> </ul> <p>(2)</p>
4.5	$0 < x < 4$ or (0; 4)	<ul style="list-style-type: none"> <li>✓ 4</li> <li>✓✓ <math>0 &lt; x &lt; 4</math></li> </ul> <p>(3)</p>
4.7	$x \leq -2$ or $-1 \leq x \leq 6$ <p><b>OR/OF</b></p> $(-\infty; -2]$ or $[-1; 6]$	<ul style="list-style-type: none"> <li>✓ <math>x \leq -2</math></li> <li>✓✓ <math>-1 \leq x \leq 6</math></li> </ul> <p>(3)</p> <p><b>[23]</b></p>

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## QUESTION/VRAAG 6

6.1	$A = P(1+i)^n$ $12\ 146,72 = 10\ 000 \left(1 + \frac{r}{12}\right)^{36}$ $\left(1 + \frac{r}{12}\right)^{36} = 1,214672$ $1 + \frac{r}{12} = \sqrt[36]{1,214672}$ $= 1,005416$ $\frac{r}{12} = 0,005416$ $r = 0,06500$ $r = 6,5\%$	<ul style="list-style-type: none"> <li>✓ <math>\frac{r}{12}</math></li> <li>✓ <math>n = 36</math></li> <li>✓ correct substitution into formula</li> <li>✓ <math>1 + \frac{r}{12} = \sqrt[36]{1,214672}</math></li> <li>✓ 6,5%</li> </ul>
6.2.1	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $235\ 000 = \frac{x \left[1 - \left(1 + \frac{0,11}{12}\right)^{-54}\right]}{\frac{0,11}{12}}$ $x = \frac{235\ 000 \times \frac{0,11}{12}}{\left[1 - \left(1 + \frac{0,11}{12}\right)^{-54}\right]}$ $= R5\ 536,95$ <p>His monthly instalment is R 5 536,95</p>	<ul style="list-style-type: none"> <li>✓ <math>i = \frac{0,11}{12}</math></li> <li>✓ <math>n = 54</math></li> <li>✓ correct substitution in P</li> <li>✓ answer</li> </ul>
6.2.2	<p>Amount paid for the year : <math>(5\ 536,95 \times 12) = R66\ 443,40</math></p> $\text{Balance} = 235\ 000 \left(1 + \frac{0,11}{12}\right)^{12} - \frac{5\ 536,95 \left[\left(1 + \frac{0,11}{12}\right)^{12} - 1\right]}{\frac{0,11}{12}}$ $= 192\ 296,17$ <p>Interest = <math>(5\ 536,95 \times 12) - (235\ 000 - 192\ 296,17)</math></p> $= 66\ 443,40 - 42\ 703,83$ $= 23\ 739,57$ <p><b>OR/OF</b></p>	<ul style="list-style-type: none"> <li>✓ R66 443,40</li> <li>✓ <math>235\ 000 \left(1 + \frac{0,11}{12}\right)^{12}</math></li> <li>✓ <math>\frac{5\ 536,95 \left[\left(1 + \frac{0,11}{12}\right)^{12} - 1\right]}{\frac{0,11}{12}}</math></li> <li>✓ R192 296,17</li> <li>✓ R42 703,83</li> <li>✓ R23 739,57</li> </ul> <p><b>OR/OF</b></p>



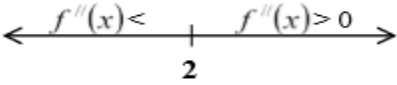
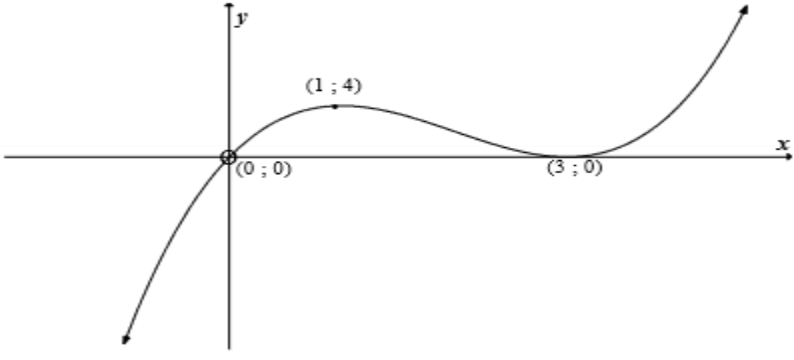
<p>Total amount paid in first year = R 5 536,95 × 12 = R66 443,40</p> <p>Balance on loan after 1 year = P of remaining installments</p> $P = \frac{x[1 - (1+i)^{-n}]}{i}$ $= \frac{5\,536,95 \left[ 1 - \left( 1 + \frac{0,11}{12} \right)^{-42} \right]}{\frac{0,11}{12}}$ <p>= R192 296,20</p> <p>Amount paid off in the first year: R235 000 – R192 296,20 = R42 703,80</p> <p>Amount of interest = R66 443,40 – R42 703,80 = R23 739,60</p> <p><b>OR/OF</b></p> $P = \frac{5536,95 \left[ 1 - \left( 1 + \frac{0,11}{12} \right)^{-12} \right]}{\frac{0,11}{12}}$ <p>= R 62 648,18</p> <p>235 000 – 62 648,18 = R172 351,82</p> <p>After 12 months, money owed on house is</p> $172\,351,82 \left( 1 + \frac{0,11}{12} \right)^{12}$ <p>= 192 296,17</p> <p>Amount paid after 12 months is</p> <p>5 536,95 × 12 = R 66 443, 40</p> <p>Amount of interest paid:</p> <p>R 66 443, 40 – (235 000 – 192 296,17) = R 23 739, 57</p>	<p>✓ R66 443,40</p> <p>✓ <math>n = - 42</math></p> <p>✓ substitution into correct formula</p> <p>✓ R192 296,20</p> <p>✓ R42 703,80</p> <p>✓ R23 739,60</p> <p><b>OR/OF</b> (6)</p> <p>✓ R62 648,18</p> <p>✓ R172 351,82</p> <p>✓ R192 296,17</p> <p>✓ R66 443,40</p> <p>✓ 235 000 – 192 296,17</p> <p>✓ R23 739,57</p> <p>(6) [15]</p>
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## QUESTION/VRAAG 7

7.1	$f(x+h) = 2(x+h)^2 - (x+h)$ $= 2(x^2 + 2xh + h^2) - x - h$ $= 2x^2 + 4xh + 2h^2 - x - h$ $f(x+h) - f(x) = 2x^2 + 4xh + 2h^2 - x - h - 2x^2 + x$ $= 4xh + 2h^2 - h$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{4xh + 2h^2 - h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(4x + 2h - 1)}{h}$ $= \lim_{h \rightarrow 0} (4x + 2h - 1)$ $= 4x - 1$ <p><b>OR/OF</b></p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2(x+h)^2 - (x+h) - (2x^2 - x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2x^2 + 4xh + 2h^2 - x - h - 2x^2 + x}{h}$ $= \lim_{h \rightarrow 0} \frac{4xh + 2h^2 - h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(4x + 2h - 1)}{h}$ $= \lim_{h \rightarrow 0} (4x + 2h - 1)$ $= 4x - 1$	$\checkmark 2x^2 + 4xh + 2h^2 - x - h$ $\checkmark 4xh + 2h^2 - h$ $\checkmark f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $\checkmark \text{subst. into formula}$ $\checkmark \lim_{h \rightarrow 0} (4x + 2h - 1)$ $\checkmark 4x - 1$ <p><b>OR/OF</b></p> $\checkmark f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $\checkmark \text{subst. into formula}$ $\checkmark 2x^2 + 4xh + 2h^2 - x - h$ $\checkmark 4xh + 2h^2 - h$ $\checkmark \lim_{h \rightarrow 0} (4x + 2h - 1)$ $\checkmark 4x - 1$ <p style="text-align: right;">(6)</p>
7.2.1	$D_x[(x+1)(3x-7)]$ $= D_x(3x^2 - 4x - 7)$ $= 6x - 4$	$\checkmark 3x^2 - 4x - 7$ $\checkmark 6x - 4$ <p style="text-align: right;">(2)</p>
7.2.2	$y = \sqrt{x^3} - \frac{5}{x} + \frac{1}{2}\pi$ $y = x^{\frac{3}{2}} - 5x^{-1} + \frac{1}{2}\pi$ $\frac{dy}{dx} = \frac{3}{2}x^{\frac{1}{2}} + 5x^{-2}$	$\checkmark x^{\frac{3}{2}} - 5x^{-1}$ $\checkmark \frac{3}{2}x^{\frac{1}{2}}$ $\checkmark + 5x^{-2}$ $\checkmark \text{derivative of } \frac{1}{2}\pi \text{ is } 0$ <p style="text-align: right;">(4) [12]</p>

## QUESTION/VRAAG 8

8.1	$f(x) = x^3 - 6x^2 + 9x$ $f'(x) = 3x^2 - 12x + 9$ $f''(x) = 6x - 12 = 0$ $x = 2$ $f''(0) = 6(0) - 12$ $= -12$ $f''(3) = 6(3) - 12$ $= 6$ <p style="text-align: center;">  </p> <p>Point of inflection at <math>x = 2</math></p>	<ul style="list-style-type: none"> <li>✓ <math>x^3 - 6x^2 + 9x</math></li> <li>✓ <math>3x^2 - 12x + 9</math></li> <li>✓ <math>6x - 12</math></li> <li>✓ <math>6x - 12 = 0</math></li>   <li>✓ explanation</li> </ul> <p style="text-align: right;">(5)</p>
8.2		<ul style="list-style-type: none"> <li>✓ shape</li> <li>✓ (0; 0)</li> <li>✓ (3; 0) as TP</li> <li>✓ (1; 4)</li> </ul> <p style="text-align: right;">(4)</p>
8.3	$f$ concave up for $x > 2$ $y = -f(x)$ will be concave down for $x > 2$	<ul style="list-style-type: none"> <li>✓✓ <math>x &gt; 2</math></li> </ul> <p style="text-align: right;">(2)</p>
8.4.1	(3; 7)	<ul style="list-style-type: none"> <li>✓ 3</li> <li>✓ 7</li> </ul> <p style="text-align: right;">(2)</p>
8.4.2	<p>Do not agree with Claire as her statement is incorrect. Between <math>x = 1</math> and <math>x = 3</math> the graph of <math>f</math> is decreasing. Therefore at <math>x = 2</math> the gradient will have a negative value.</p> <p><i>Stem nie saam met Claire nie, want haar stelling in verkeerd. Die grafiek van <math>f</math> is dalend/afnemend tussen <math>x = 1</math> en <math>x = 3</math>. By <math>x = 2</math> moet die gradiënt dus 'n negatiewe waarde hê.</i></p> <p style="text-align: center;"><b>OR/OF</b></p> $f'(2) = 3(2)^2 - 12(2) + 9$ $= -3$ $\neq 1$	<ul style="list-style-type: none"> <li>✓ no</li>   <li>✓ justification</li> </ul> <p style="text-align: right;">(2)</p> <p style="text-align: right;"><b>[15]</b></p>

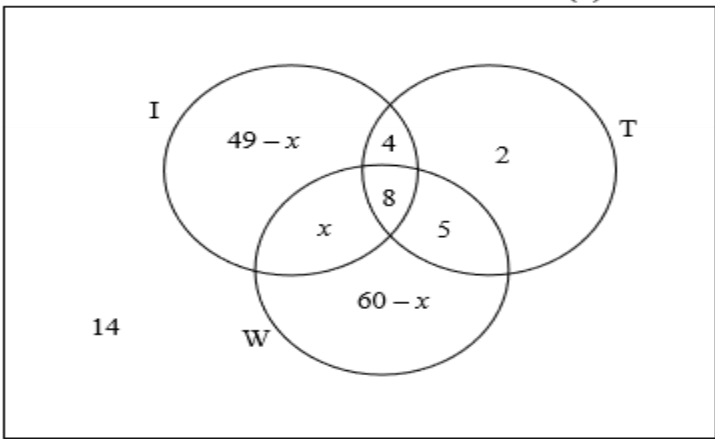
**QUESTION/VRAAG 9**

	$y = x^2 + 2$ $P(x; x^2 + 2)$ $B(0; 3)$ $PB^2 = (x - 0)^2 + (x^2 + 2 - 3)^2$ $= x^2 + x^4 - 2x^2 + 1$ $= x^4 - x^2 + 1$ <p>PB will be a minimum if <math>PB^2</math> is a minimum</p> $\frac{d(PB^2)}{dx} = 4x^3 - 2x$ $4x^3 - 2x = 0$ $x(2x^2 - 1) = 0$ $x = 0 \text{ or } x^2 = \frac{1}{2}$ $x = \frac{1}{\sqrt{2}}$ $PB^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1$ $= \frac{1}{4} - \frac{1}{2} + 1$ $= \frac{3}{4}$ $PB = \frac{\sqrt{3}}{2} = 0,87$ <p><b>OR/OF</b></p>	$\checkmark (x - 0)^2 + (x^2 + 2 - 3)^2$ $\checkmark x^4 - x^2 + 1$ $\checkmark 4x^3 - 2x$ $\checkmark \frac{d(PB^2)}{dx} = 0$ $\checkmark x = \frac{1}{\sqrt{2}}$ $\checkmark PB^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1$ $\checkmark \text{ answer}$ <p><b>OR/OF</b></p>
--	---	--



<p>Gradient of tangent to curve = <math>2x</math></p> <p>Gradient of line joining B and the curve = <math>\frac{x^2 + 2 - 3}{x - 0}</math></p> $= \frac{x^2 - 1}{x}$ <p>Shortest distance will be where tangent to curve is perpendicular to the line joining P and the curve.</p> $\frac{x^2 - 1}{x} = -\frac{1}{2x}$ $2x(x^2 - 1) = -x$ $2x^3 - 2x = 0$ $x(2x^2 - 1) = 0$ $x = 0 \text{ or } x^2 = \frac{1}{2}$ $x = \frac{1}{\sqrt{2}}$ $PB^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1$ $= \frac{1}{4} - \frac{1}{2} + 1$ $= \frac{3}{4}$ $PB = \frac{\sqrt{3}}{2} = 0,87$ <p><b>OR/OF</b></p> <p>P(<math>k; k^2 + 2</math>) and B(0; 3)</p> <p>BP <math>\perp</math> tangent passing through <math>y = x^2 + 2</math> at P.</p> $m_{\text{tangent at P}} = 2k$ $m_{BP} = -\frac{1}{2k}$ <p>Equation of BP: <math>y = \left(-\frac{1}{2k}\right)x + 3</math></p> $y_P = \left(-\frac{1}{2k}\right)(k) + 3 = 2,5$ $\Rightarrow k^2 + 2 = 2,5 \text{ and so } k = \sqrt{0,5} \text{ and } P(\sqrt{0,5}; 2,5)$ $BP = \sqrt{(\sqrt{0,5} - 0)^2 + (2,5 - 3)^2} = \sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2} = 0,87$	<p>✓ = <math>2x</math></p> <p>✓ = <math>\frac{x^2 - 1}{x}</math></p> <p>✓ <math>\frac{x^2 - 1}{x} = -\frac{1}{2x}</math></p> <p>✓ <math>2x^3 - 2x = 0</math></p> <p>✓ <math>x = \frac{1}{\sqrt{2}}</math></p> <p>✓ <math>PB^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1</math></p> <p>✓ answer</p> <p><b>OR/OF</b></p> <p>✓ P(<math>k; k^2 + 2</math>)</p> <p>✓ <math>m_{\text{tangent at P}} = 2k</math></p> <p>✓ <math>m_{BP} = -\frac{1}{2k}</math></p> <p>✓ <math>y = \left(-\frac{1}{2k}\right)x + 3</math></p> <p>✓ value of y at P</p> <p>✓ value of k</p> <p>✓ answer</p> <p style="text-align: right;">[7]</p>
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**QUESTION/VRAAG 10**

10.1	<p style="text-align: right;"><math>n(S) = 100</math></p> 	<p>8 values need to be placed in correct position:</p> <p>2 or 3 correct: 1 mark 4 or 5 correct: 2 marks 6 or 7 correct: 3 marks 8 correct: 4 marks</p> <p style="text-align: right;">(4)</p>
10.2	$(49 - x) + x + 8 + 4 + 5 + 2 + (60 - x) + 14 = 100$ $-x + 142 = 100$ $x = 42$	<p>✓ setting up equation</p> <p>✓ answer</p> <p style="text-align: right;">(2)</p>
10.3	<p>P (use only one application) = <math>\frac{7 + 2 + 18}{100}</math></p> $= \frac{27}{100} \text{ or } 27\%$	<p>✓ <math>\frac{7 + 2 + 18}{100}</math></p> <p>✓ answer</p> <p style="text-align: right;">(2)</p>

**[8]****QUESTION/VRAAG 11**

11.1	$5 \times 5 \times 10 \times 9$ $= 2250$	<p>✓ <math>5 \times 5</math> ✓ <math>10 \times 9</math> ✓ 2250</p> <p style="text-align: right;">(3)</p>																								
11.2	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>No of digits used</th> <th>Letters</th> <th>Digits</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>1</td> <td><math>5 \times 5</math></td> <td>10</td> <td>250</td> </tr> <tr> <td>2</td> <td><math>5 \times 5</math></td> <td><math>10 \times 9</math></td> <td>2 250</td> </tr> <tr> <td>3</td> <td><math>5 \times 5</math></td> <td><math>10 \times 9 \times 8</math></td> <td>18 000</td> </tr> <tr> <td>4</td> <td><math>5 \times 5</math></td> <td><math>10 \times 9 \times 8 \times 7</math></td> <td>126 000</td> </tr> <tr> <td>5</td> <td><math>5 \times 5</math></td> <td><math>10 \times 9 \times 8 \times 7 \times 6</math></td> <td>756 000</td> </tr> </tbody> </table> <p>Codes of two letters and five digits will ensure unique numbers for 700 000 clients.</p>	No of digits used	Letters	Digits	Total	1	$5 \times 5$	10	250	2	$5 \times 5$	$10 \times 9$	2 250	3	$5 \times 5$	$10 \times 9 \times 8$	18 000	4	$5 \times 5$	$10 \times 9 \times 8 \times 7$	126 000	5	$5 \times 5$	$10 \times 9 \times 8 \times 7 \times 6$	756 000	<p>✓ <math>5 \times 5 \times 10 \times 9 \times 8 \times 7 \times 6</math> ✓ five digits</p> <p style="text-align: right;">(3)</p> <p style="text-align: right;"><b>[6]</b></p>
No of digits used	Letters	Digits	Total																							
1	$5 \times 5$	10	250																							
2	$5 \times 5$	$10 \times 9$	2 250																							
3	$5 \times 5$	$10 \times 9 \times 8$	18 000																							
4	$5 \times 5$	$10 \times 9 \times 8 \times 7$	126 000																							
5	$5 \times 5$	$10 \times 9 \times 8 \times 7 \times 6$	756 000																							

**TOTAL/TOTAAL: 150**



# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**NOVEMBER 2018**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages and 1 information sheet.**

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Mathematics/P1

3  
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DBE/November 2018

**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 - 4x + 3 = 0$  (3)

1.1.2  $5x^2 - 5x + 1 = 0$  (correct to TWO decimal places) (3)

1.1.3  $x^2 - 3x - 10 > 0$  (3)

1.1.4  $3\sqrt{x} = x - 4$  (4)

1.2 Solve simultaneously for  $x$  and  $y$ :

$3x - y = 2$  and  $2y + 9x^2 = -1$  (6)

1.3 If  $3^{9x} = 64$  and  $5^{\sqrt{p}} = 64$ , calculate, WITHOUT the use of a calculator, the value of:  $\frac{[3^{x-1}]^3}{\sqrt{5}^{\sqrt{p}}}$  (4)**[23]****QUESTION 2**

2.1 Given the quadratic sequence: 2 ; 3 ; 10 ; 23 ; ...

2.1.1 Write down the next term of the sequence. (1)

2.1.2 Determine the  $n^{\text{th}}$  term of the sequence. (4)2.1.3 Calculate the 20<sup>th</sup> term of the sequence. (2)

2.2 Given the arithmetic sequence: 35 ; 28 ; 21 ; ...

Calculate which term of the sequence will have a value of  $-140$ . (3)2.3 For which value of  $n$  will the sum of the first  $n$  terms of the arithmetic sequence in QUESTION 2.2 be equal to the  $n^{\text{th}}$  term of the quadratic sequence in QUESTION 2.1? (6)**[16]**



Mathematics/P1

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**QUESTION 3**

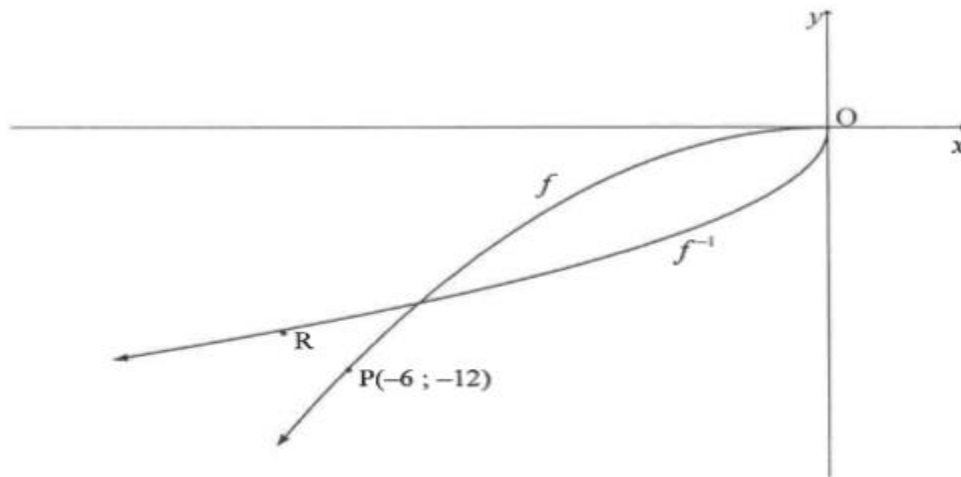
A geometric series has a constant ratio of  $\frac{1}{2}$  and a sum to infinity of 6.

- 3.1 Calculate the first term of the series. (2)
- 3.2 Calculate the 8<sup>th</sup> term of the series. (2)
- 3.3 Given:  $\sum_{k=1}^n 3(2)^{1-k} = 5,8125$  Calculate the value of  $n$ . (4)
- 3.4 If  $\sum_{k=1}^{20} 3(2)^{1-k} = p$ , write down  $\sum_{k=1}^{20} 24(2)^{-k}$  in terms of  $p$ . (3)
- [11]

**QUESTION 4**

In the diagram below, the graph of  $f(x) = ax^2$  is drawn in the interval  $x \leq 0$ .

The graph of  $f^{-1}$  is also drawn. P(-6 ; -12) is a point on  $f$  and R is a point on  $f^{-1}$ .



- 4.1 Is  $f^{-1}$  a function? Motivate your answer. (2)
- 4.2 If R is the reflection of P in the line  $y = x$ , write down the coordinates of R. (1)
- 4.3 Calculate the value of  $a$ . (2)
- 4.4 Write down the equation of  $f^{-1}$  in the form  $y = \dots$  (3)
- [8]

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Mathematics/P1

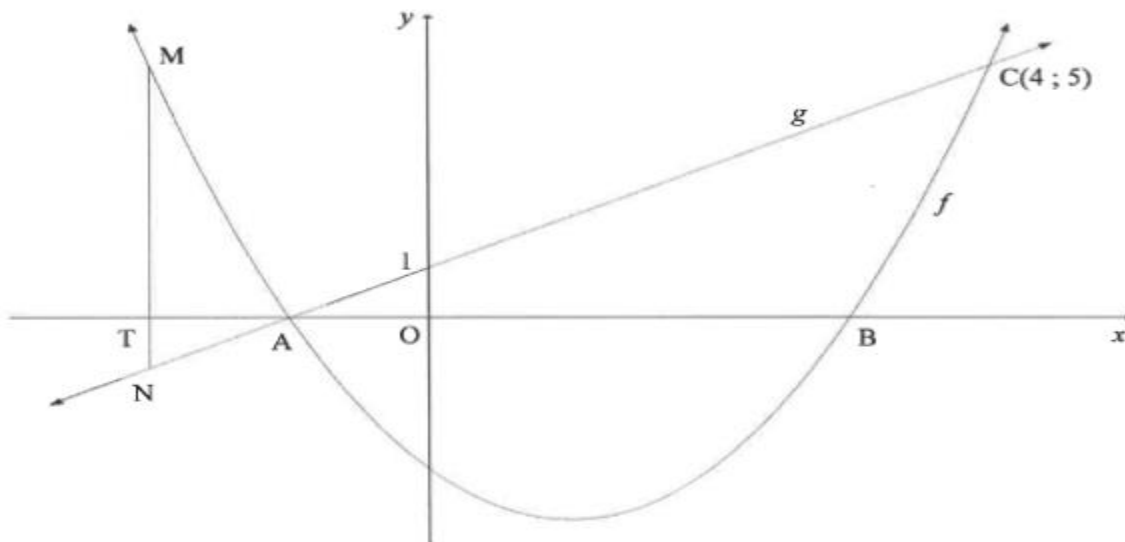
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**QUESTION 5**

Given:  $f(x) = \frac{-1}{x-1}$

- 5.1 Write down the domain of  $f$ . (1)
- 5.2 Write down the asymptotes of  $f$ . (2)
- 5.3 Sketch the graph of  $f$ , clearly showing all intercepts with the axes and any asymptotes. (3)
- 5.4 For which values of  $x$  will  $x \cdot f'(x) \geq 0$ ? (2)
- [8]

**QUESTION 6**In the diagram below, A and B are the  $x$ -intercepts of the graph of  $f(x) = x^2 - 2x - 3$ .A straight line,  $g$ , through A cuts  $f$  at  $C(4; 5)$  and the  $y$ -axis at  $(0; 1)$ .M is a point on  $f$  and N is a point on  $g$  such that MN is parallel to the  $y$ -axis.MN cuts the  $x$ -axis at T.

- 6.1 Show that  $g(x) = x + 1$ . (2)
- 6.2 Calculate the coordinates of A and B. (3)
- 6.3 Determine the range of  $f$ . (3)
- 6.4 If  $MN = 6$ :
- 6.4.1 Determine the length of OT if T lies on the negative  $x$ -axis. Show ALL your working. (4)
- 6.4.2 Hence, write down the coordinates of N. (2)
- 6.5 Determine the equation of the tangent to  $f$  drawn parallel to  $g$ . (5)
- 6.6 For which value(s) of  $k$  will  $f(x) = x^2 - 2x - 3$  and  $h(x) = x + k$  NOT intersect? (1)
- [20]

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Mathematics/P1

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**QUESTION 7**

- 7.1 Selby decided today that he will save R15 000 per quarter over the next four years. He will make the first deposit into a savings account in three months' time and he will make his last deposit at the end of four years from now.
- 7.1.1 How much will Selby have at the end of four years if interest is earned at 8,8% per annum, compounded quarterly? (3)
- 7.1.2 If Selby decides to withdraw R100 000 from the account at the end of three years from now, how much will he have in the account at the end of four years from now? (3)
- 7.2 Tshepo takes out a home loan over 20 years to buy a house that costs R1 500 000.
- 7.2.1 Calculate the monthly instalment if interest is charged at 10,5% p.a., compounded monthly. (4)
- 7.2.2 Calculate the outstanding balance immediately after the 144<sup>th</sup> payment was made. (5)  
[15]

**QUESTION 8**

- 8.1 Determine  $f'(x)$  from first principles if it is given  $f(x) = x^2 - 5$ . (5)
- 8.2 Determine  $\frac{dy}{dx}$  if:
- 8.2.1  $y = 3x^3 + 6x^2 + x - 4$  (3)
- 8.2.2  $yx - y = 2x^2 - 2x$  ;  $x \neq 1$  (4)  
[12]

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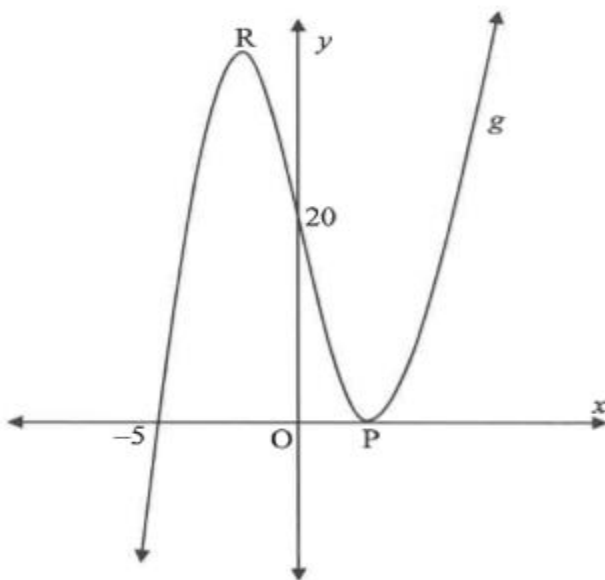
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**QUESTION 9**

- 9.1 The graph of  $g(x) = x^3 + bx^2 + cx + d$  is sketched below.  
The graph of  $g$  intersects the  $x$ -axis at  $(-5; 0)$  and at  $P$ , and the  $y$ -axis at  $(0; 20)$ .  
 $P$  and  $R$  are turning points of  $g$ .



- 9.1.1 Show that  $b = 1$ ,  $c = -16$  and  $d = 20$ . (4)
- 9.1.2 Calculate the coordinates of  $P$  and  $R$ . (5)
- 9.1.3 Is the graph concave up or concave down at  $(0; 20)$ ? Show ALL your calculations. (3)
- 9.2 If  $g$  is a cubic function with:
- $g(3) = g'(3) = 0$
  - $g(0) = 27$
  - $g''(x) > 0$  when  $x < 3$  and  $g''(x) < 0$  when  $x > 3$ ,
- draw a sketch graph of  $g$  indicating ALL relevant points. (3)
- [15]

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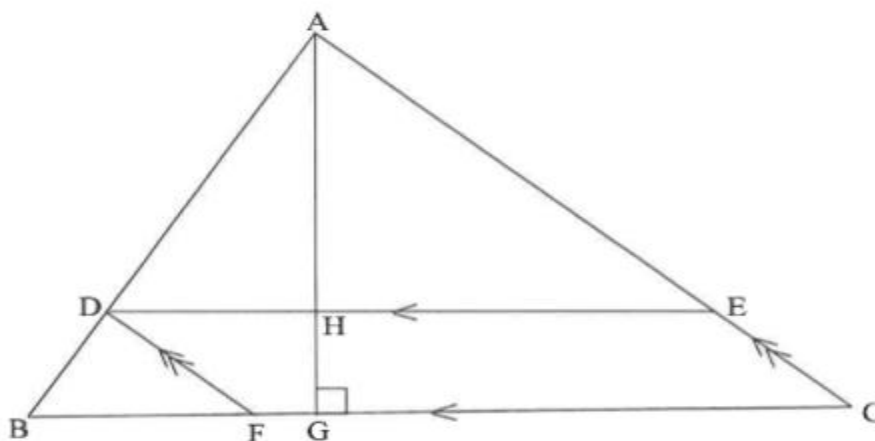
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**QUESTION 10**In  $\triangle ABC$ :

- D is a point on AB, E is a point on AC and F is a point on BC such that DECF is a parallelogram.
- $BF : FC = 2 : 3$ .
- The perpendicular height AG is drawn intersecting DE at H.
- $AG = t$  units.
- $BC = (5 - t)$  units.



10.1 Write down  $AH : HG$ . (1)

10.2 Calculate  $t$  if the area of the parallelogram is a maximum.  
(NOTE: Area of a parallelogram = base  $\times$   $\perp$  height) (5)  
[6]

**QUESTION 11**

Given the digits: 3 ; 4 ; 5 ; 6 ; 7 ; 8 and 9

- 11.1 Calculate how many unique 5-digit codes can be formed using the digits above, if:
- 11.1.1 The digits may be repeated (2)
- 11.1.2 The digits may not be repeated (2)
- 11.2 How many unique 3-digit codes can be formed using the above digits, if:
- Digits may be repeated
  - The code is greater than 400 but less than 600
  - The code is divisible by 5
- (3)  
[7]

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Mathematics/P1

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**QUESTION 12**12.1 Given:  $P(A) = 0,45$ ;  $P(B) = y$  and  $P(A \text{ or } B) = 0,74$ Determine the value(s) of  $y$  if  $A$  and  $B$  are mutually exclusive.

(3)

12.2 An organisation decided to distribute gift bags of sweets to a Grade R class at a certain school. There is a mystery gift in exactly  $\frac{1}{4}$  of the total number of bags.

Each learner in the class may randomly select two gift bags of sweets, one after the other. The probability that a learner selects two bags of sweets with a mystery gift is  $\frac{7}{118}$ . Calculate the number of gift bags of sweets with a mystery gift inside.

(6)

[9]

**TOTAL: 150**

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# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE SENIOR  
SERTIFIKAAT**

**GRADE 12/GRAAD 12**

**MATHEMATICS P1/WISKUNDE VI**

**NOVEMBER 2018**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS: 150**

**PUNTE: 150**

**These marking guidelines consist of 18 pages.  
*Hierdie nasienriglyne bestaan uit 18 bladsye***



**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking memorandum.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$x^2 - 4x + 3 = 0$ $(x - 3)(x - 1) = 0$ $x = 3 \text{ or } x = 1$	✓ factors/correct sub in formula ✓ $x = 3$ ✓ $x = 1$	(3)
1.1.2	$5x^2 - 5x + 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{5 \pm \sqrt{25 - 4(5)(1)}}{2(5)}$ $= \frac{5 \pm \sqrt{5}}{10}$ $x = 0,72 \text{ or } x = 0,28$	✓ substitution into the correct formula  ✓ $x = 0,72$ ✓ $x = 0,28$	(3)
1.1.3	$x^2 - 3x - 10 > 0$ $(x - 5)(x + 2) > 0$ <p><b>OR/OF</b></p> <p><math>x &lt; -2 \text{ or } x &gt; 5</math></p>	✓ factors/ critical values  ✓✓ $x < -2 \text{ or } x > 5$	(3)
1.1.4	$3\sqrt{x} = x - 4$ $9x = x^2 - 8x + 16$ $x^2 - 17x + 16 = 0$ $(x - 16)(x - 1) = 0$ $x = 16 \text{ or } x = 1$ <p>NA</p>	✓ squaring both sides ✓ $x^2 - 17x + 16 = 0$ ✓ factors ✓ answer with selection	(4)



	<p><b>OR/OF</b></p> $3x^{\frac{1}{2}} = x - 4$ $x - 3x^{\frac{1}{2}} - 4 = 0$ $\left(x^{\frac{1}{2}} - 4\right)\left(x^{\frac{1}{2}} + 1\right) = 0$ $x^{\frac{1}{2}} = 4 \quad \text{or} \quad x^{\frac{1}{2}} = -1$ $x = 16 \quad \quad \quad \text{NA}$	<p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ standard form</li> <li>✓ recognize <math>x = \left(x^{\frac{1}{2}}\right)^2</math></li> <li>✓ factors</li> <li>✓ answer with selection (4)</li> </ul>
1.2	$2y + 9x^2 = -1 \dots\dots(1)$ $3x - y = 2 \dots\dots (2)$ $y = 3x - 2 \dots\dots(3)$ $2(3x - 2) + 9x^2 = -1$ $6x - 4 + 9x^2 = -1$ $9x^2 + 6x - 3 = 0$ $3x^2 + 2x - 1 = 0$ $(3x - 1)(x + 1) = 0$ $x = \frac{1}{3} \quad \text{or} \quad x = -1$ $y = -1 \quad \text{or} \quad y = -5$ <p><b>OR/OF</b></p> $2y + 9x^2 = -1 \dots\dots(1)$ $3x - y = 2 \dots\dots (2)$ $x = \frac{y + 2}{3}$ $2y + 9\left(\frac{y + 2}{3}\right)^2 = -1$ $2y + 9\left(\frac{y^2 + 4y + 4}{9}\right) = -1$ $2y + y^2 + 4y + 4 + 1 = 0$ $y^2 + 6y + 5 = 0$ $(y + 5)(y + 1) = 0$ $y = -1 \quad \text{or} \quad y = -5$ $x = \frac{1}{3} \quad \text{or} \quad x = -1$	<ul style="list-style-type: none"> <li>✓ <math>y = 3x - 2</math></li> <li>✓ substitution</li> <li>✓ standard form</li> <li>✓ factors</li> <li>✓ both <math>x</math> values</li> <li>✓ both <math>y</math> values</li> </ul> <p style="text-align: right;">(6)</p> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ <math>x = \frac{y + 2}{3}</math></li> <li>✓ substitution</li> <li>✓ standard form</li> <li>✓ factors</li> <li>✓ both <math>y</math> values</li> <li>✓ both <math>x</math> values</li> </ul> <p style="text-align: right;">(6)</p>



1.3	$3^{9x} = 64$ $(3^{3x})^3 = (4)^3$ $3^{3x} = 4$ $5^{\sqrt{p}} = 64$ $\sqrt{5}^{\sqrt{p}} = \sqrt{64}$ $\sqrt{5}^{\sqrt{p}} = 8$ $\frac{[3^{x-1}]^3}{\sqrt{5}^{\sqrt{p}}} = \frac{3^{3x-3}}{\sqrt{5}^{\sqrt{p}}}$ $= \frac{3^{3x}}{27 \times \sqrt{5}^{\sqrt{p}}}$ $= \frac{4}{27 \times 8}$ $= \frac{1}{54}$ <b>OR/OF</b> $\frac{(3^{x-1})^3}{\sqrt{5}^{\sqrt{p}}} = \frac{3^{3x} \cdot 3^{-3}}{(5^{0.5})^{\sqrt{p}}}$ $= \frac{3^{3x} \cdot 3^{-3}}{(5\sqrt{p})^{0.5}}$ $= \frac{4 \cdot 3^{-3}}{\sqrt{64}}$ $= \frac{4 \cdot \frac{1}{27}}{8} = \frac{1}{54}$ <b>OR/OF</b> $= \frac{3^{3x} \cdot 3^{-3}}{5^{\frac{\sqrt{p}}{2}}}$ $= \frac{\sqrt[3]{64} \cdot 3^{-3}}{\sqrt{64}}$	$\checkmark 3^{3x} = 4$  $\checkmark \sqrt{5}^{\sqrt{p}} = 8$  $\checkmark 3^{3x-3} \text{ or } 3^{3x} \cdot 3^{-3}$  $\checkmark \text{answer}$ <b>(4)</b>  <b>OR/OF</b>  $\checkmark 3^{3x-3} \text{ or } 3^{3x} \cdot 3^{-3}$  $\checkmark 3^{3x} = 4$ $\checkmark \sqrt{5}^{\sqrt{p}} = 8$ $\checkmark \text{answer}$ <b>(4)</b>  <b>[23]</b>
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**QUESTION/VRAAG 2**

2.1.1	42	✓ answer	(1)	
2.1.2	$2a = 6$ $a = 3$ $T_n = 3n^2 - 8n + 7$ <b>OR/OF</b> $2a = 6$ $a = 3$ $T_n = 3n^2 + bn + c$ $T_1 : 3 + b + c = 2$ $T_2 : 12 + 2b + c = 3$ $T_2 - T_1 : b = -8$ Subst. in (1): $-8 + c = -1$ $c = 7$ $T_n = 3n^2 - 8n + 7$	$3a + b = 1$ $3(3) + b = 1$ $b = -8$ $a + b + c = 2$ $(3) + (-8) + c = 2$ $c = 7$ $b + c = -1$ .....(1) $2b + c = -9$ .....(2)	$\checkmark a = 3$ $\checkmark b = -8$ $\checkmark c = 7$ $\checkmark T_n = an^2 + bn + c$ <b>OR/OF</b> $\checkmark a = 3$ $\checkmark b = -8$ $\checkmark c = 7$ $\checkmark T_n = an^2 + bn + c$	(4)
2.1.3	$T_{20} = 3(20)^2 - 8(20) + 7$ $= 1047$	$\checkmark$ substitution $\checkmark$ answer	(2)	
2.2	$T_n = -7n + 42$ $-7n + 42 = -140$ $-7n = -182$ $n = 26$	$\checkmark T_n = -7n + 42$ $\checkmark -7n + 42 = -140$ $\checkmark n = 26$	(3)	
2.3	$S_n = \frac{n}{2}(a + l)$ $S_n = \frac{n}{2}(35 - 7n + 42)$ $S_n = \frac{n}{2}(-7n + 77)$ $S_n = -\frac{7}{2}n^2 + \frac{77}{2}n$ $-\frac{7}{2}n^2 + \frac{77}{2}n = 3n^2 - 8n + 7$ $13n^2 - 93n + 14 = 0$ $(n - 7)(13n - 2) = 0$ $n = 7$ or $n = \frac{2}{13}$ NA $\therefore n = 7$	<b>OR/OF</b> $S_n = \frac{n}{2}[2a + (n - 1)d]$ $S_n = \frac{n}{2}(70 - 7n + 7)$ $\checkmark$ simplification of $S_n$ $\checkmark$ equating $\checkmark$ standard form $\checkmark$ factors $\checkmark$ answer with selection	(6)	
			<b>[16]</b>	



## QUESTION/VRAAG 3

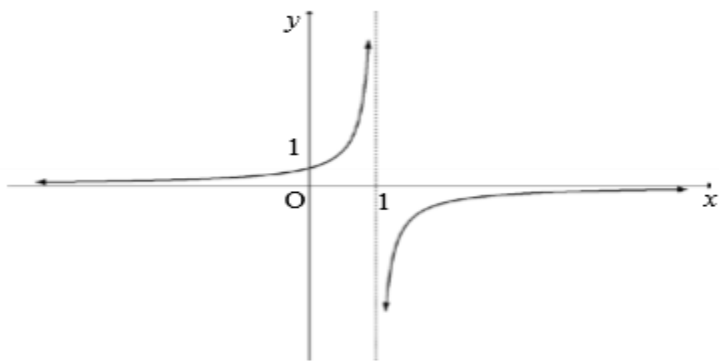
3.1	$r = \frac{1}{2} \text{ and } S_{\infty} = 6$ $S_{\infty} = \frac{a}{1-r}$ $6 = \frac{a}{1-\frac{1}{2}}$ $a = 3$	<p>✓ substitution</p> <p>✓ answer</p> <p>(2)</p>
3.2	$T_n = ar^{n-1}$ $T_8 = 3\left(\frac{1}{2}\right)^7$ $T_8 = \frac{3}{128}$	<p>✓✓ <math>T_8 = 3\left(\frac{1}{2}\right)^7</math></p> <p>(2)</p>
3.3	$\sum_{k=1}^n 3(2)^{1-k} = 5,8125$ $3 + \frac{3}{2} + \frac{3}{4} + \dots = 5,8125$ $S_n = \frac{a(1-r^n)}{1-r} = 5,8125$ $\frac{3\left[1 - \left(\frac{1}{2}\right)^n\right]}{1 - \frac{1}{2}} = 5,8125$ $6\left[1 - \left(\frac{1}{2}\right)^n\right] = 5,8125$ $\left(\frac{1}{2}\right)^n = \frac{1}{32} = 0,03125$ $2^{-n} = 2^{-5} \quad \text{or} \quad n \log \frac{1}{2} = \log \frac{1}{32}$ $n = 5 \quad \quad \quad n = 5$	<p>✓ <math>r = \frac{1}{2}</math></p> <p>✓ substitution</p> <p>✓ simplification</p> <p>✓ answer</p> <p>(4)</p>

3.4	$\sum_{k=1}^{20} 3(2)^{1-k} = p$ $3 + \frac{3}{2} + \frac{3}{4} + \dots + 3 \cdot 2^{-19} = p$ $\sum_{k=1}^{20} 24(2)^{-k}$ $= 12 + 6 + 3 + \dots + 24 \cdot 2^{-20}$ $= 4 \left( 3 + \frac{3}{2} + \frac{3}{4} + \dots + 3 \cdot 2^{-19} \right)$ $= 4p$ <p><b>OR/OF</b></p> $\sum_{k=1}^{20} 3(2)^{1-k} = p$ $\sum_{k=1}^{20} 6(2)^{-k} = p$ $\therefore \sum_{k=1}^{20} 24(2)^{-k} = 4p$ <p><b>OR/OF</b></p> $\sum_{k=1}^{20} 24(2)^{-k} = \sum_{k=1}^{20} 4 \times 3 \times 2(2)^{-k}$ $= 4 \sum_{k=1}^{20} 3 \times 2(2)^{-k}$ $= 4 \sum_{k=1}^{20} 3 \times (2)^{1-k} = 4p$ <p><b>OR/OF</b></p> $S_{20} = \frac{3 \left( \left( \frac{1}{2} \right)^{20} - 1 \right)}{\frac{1}{2} - 1} = 6 = p$ $S_{20} = \frac{12 \left( \left( \frac{1}{2} \right)^{20} - 1 \right)}{\frac{1}{2} - 1} = 24$ $24 = 4 \times 6 = 4p$	<p>✓ expansion</p> <p>✓ expansion</p> <p>✓ answer (3)</p> <p><b>OR/OF</b></p> <p>✓ <math>\sum_{k=1}^{20} 6(2)^{-k} = p</math></p> <p>✓ <math>\sum_{k=1}^{20} 4 \times 6(2)^{-k}</math></p> <p>✓ <math>4p</math> (3)</p> <p><b>OR/OF</b></p> <p>✓ <math>\sum_{k=1}^{20} 4 \times 3 \times 2(2)^{-k}</math></p> <p>✓ <math>4 \sum_{k=1}^{20} 3 \times 2(2)^{-k}</math></p> <p>✓ <math>4p</math> (3)</p> <p><b>OR/OF</b></p> <p>✓ substitution and answer</p> <p>✓ substitution and answer</p> <p>✓ <math>4p</math> (3)</p> <p><b>[11]</b></p>
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**QUESTION/VRAAG 4**

4.1	Yes For every $x$ -value there is only one corresponding $y$ value <b>OR/OF</b> One to one mapping (vertical line test)	✓ answer ✓ reason	(2)
4.2	$R(-12; -6)$	✓ answer	(1)
4.3	$f(x) = ax^2$ substitute $(-6; -12)$ $-12 = a(-6)^2$ $a = \frac{-1}{3}$	✓ substitution ✓ answer	(2)
4.4	$f: y = -\left(\frac{1}{3}\right)x^2$ $f^{-1}: x = -\left(\frac{1}{3}\right)y^2$ $y^2 = -3x$ $y = \pm\sqrt{-3x}$ Only $y = -\sqrt{-3x}$ and $x \leq 0$	✓ swapping $x$ and $y$ ✓ $y^2 = -3x$ ✓ $y = -\sqrt{-3x}$	(3)
			<b>[8]</b>

**QUESTION/VRAAG 5**

5.1	Domain: $x \in R; x \neq 1$ <b>OR/OF</b> $x \in (-\infty; 1) \cup (1; \infty)$	✓ answer	(1)
5.2	$x = 1$ $y = 0$	✓ $x = 1$ ✓ $y = 0$	(2)
5.3		✓ $y$ intercept ✓ vertical asymptote ✓ shape	(3)
5.4	$x \geq 0; x \neq 1$ <b>OR/OF</b> $0 \leq x < 1$ or $x > 1$ <b>OR/OF</b> $x \in [0; 1) \cup (1; \infty)$	✓ $x \geq 0$ ✓ $x \neq 1$ <b>OR/OF</b> ✓ $0 \leq x < 1$ ✓ $x > 1$	(2)
			<b>[8]</b>



## QUESTION/VRAAG 6

6.1	$y = mx + c$ $m = \frac{5-1}{4-0}$ $m = 1$ $c = 1$ $g(x) = x + 1$ <b>OR/OF</b> $y = mx + c$ $5 = m(4) + 1$ $m = 1$ $g(x) = x + 1$	✓ substitution into gradient formula ✓ y-intercept (0 ; 1) <b>OR/OF</b> ✓ substitute (4 ; 5) ✓ c = 1 (2)
6.2	$x^2 - 2x - 3 = 0$ $(x+1)(x-3) = 0$ $x = -1$ or $x = 3$ <b>A(-1 ; 0) B(3 ; 0)</b>	✓ y = 0 ✓ factors ✓ x-values (3)
6.3	$x = \frac{-1+3}{2}$ or $x = \frac{-b}{2a} = \frac{-(-2)}{2(1)}$ or $f'(x) = 2x - 2 = 0$ $x = 1$ $f(x) = x^2 - 2x - 3$ $y = (1)^2 - 2(1) - 3$ or $y = (x^2 - 2x + (-1)^2) - 3 - 1$ $y = -4$ $= (x-1)^2 - 4$ $y \geq -4$ or $[-4; \infty)$	✓ x -value ✓ substitution/ completing the square ✓ answer (3)
6.4.1	<b>MN:</b> $y = (x^2 - 2x - 3) - (x + 1)$ $= x^2 - 3x - 4$ $6 = x^2 - 3x - 4$ $0 = x^2 - 3x - 10$ $0 = (x-5)(x+2)$ $x = 5$ or $x = -2$  <b>OT = 2 or OT = 5</b> <b>NA</b>	✓ $x^2 - 3x - 4$ ✓ substituting $y = 6$  ✓ values of x ✓ OT = 2 (4)
6.4.2	$y = x + 1$ substitute $x = -2$ $= (-2) + 1$ $= -1$ <b>N(-2 ; -1)</b>	✓ substituting $x = -2$  ✓ answer (2)





6.5	$f'(x) = 2x - 2$ $2x - 2 = 1$ $x = \frac{3}{2}$ $f\left(\frac{3}{2}\right) = \frac{-15}{4}$ $y + \frac{15}{4} = 1\left(x - \frac{3}{2}\right) \quad \text{or} \quad -\frac{15}{4} = \frac{1}{2} + c$ $y = x - \frac{21}{4}$ <p><b>OR/OF</b></p> $x^2 - 2x - 3 = x + p$ $x^2 - 2x - 3 - x - p = 0$ <p>This equation will have equal roots, therefore:</p> $b^2 - 4ac = 0$ $(-3)^2 - 4(1)(-3 - p) = 0$ $9 + 12 + 4p = 0$ $p = \frac{-21}{4}$ $y = x - \frac{21}{4}$	$\checkmark f'(x) = 2x - 2$ $\checkmark 2x - 2 = 1$ $\checkmark x = \frac{3}{2}$ $\checkmark f\left(\frac{3}{2}\right) = \frac{-15}{4}$ $\checkmark \text{answer} \quad (5)$ <p><b>OR/OF</b></p> $\checkmark \text{equating}$ $\checkmark \text{equal roots}$ $\checkmark \text{substitution}$ $\checkmark \text{simplification}$ $\checkmark \text{answer} \quad (5)$
6.6	$k < \frac{-21}{4}$	$\checkmark \text{answer} \quad (1)$
		<b>[20]</b>



## QUESTION/VRAAG 7

7.1.1	$F = \frac{x[(1+i)^n - 1]}{i}$ $F = \frac{15\,000 \left[ \left( 1 + \frac{0,088}{4} \right)^{16} - 1 \right]}{\frac{0,088}{4}}$ $F = R283\,972,28$	<p>✓ <math>\frac{0,088}{4}</math> and <math>n = 16</math></p> <p>✓ substitution into correct formula</p> <p>✓ answer</p> <p style="text-align: right;">(3)</p>
7.1.2	$A = R283\,972,28 - 100\,000 \left( 1 + \frac{0,088}{4} \right)^4$ $= R\,174\,877,60$ <p><b>OR/OF</b> Amount at end of 3 years:</p> $F = \frac{15\,000 \left[ \left( 1 + \frac{0,088}{4} \right)^{12} - 1 \right]}{\frac{0,088}{4}} - 100\,000$ $= R103\,459,12$ <p>Amount at end of 4 years:</p> $P(1+i)^n + \frac{x[(1+i)^n - 1]}{i}$ $= 103\,459,12 \left( 1 + \frac{0,088}{4} \right)^4 + \frac{15\,000 \left[ \left( 1 + \frac{0,088}{4} \right)^4 - 1 \right]}{\frac{0,088}{4}}$ $= R\,174\,877,60$	<p>✓ future value – amount including interest</p> <p>✓ <math>100\,000 \left( 1 + \frac{0,088}{4} \right)^4</math></p> <p>✓ answer</p> <p style="text-align: right;">(3)</p> <p><b>OR/OF</b></p> <p>✓ R15 000 including interest – R100 000</p> <p>✓ <math>\left( 1 + \frac{0,088}{4} \right)^4</math> on <math>P</math> and <math>x</math> in <math>F_v</math></p> <p>✓ method</p> <p style="text-align: right;">(3)</p>
7.2.1	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $1\,500\,000 = \frac{x \left[ 1 - \left( 1 + \frac{0,105}{12} \right)^{-12 \times 20} \right]}{\frac{0,105}{12}}$ $x = R14\,975,70$	<p>✓ <math>i = \frac{0,105}{12}</math></p> <p>✓ <math>n = 240</math></p> <p>✓ substitution into correct formula</p> <p>✓ answer</p> <p style="text-align: right;">(4)</p>



7.2.2	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $P = \frac{14\,975,70 \left[ 1 - \left( 1 + \frac{0,105}{12} \right)^{-12 \times 8} \right]}{\frac{0,105}{12}}$ $P = R969\,927,74$ <p><b>OR/OF</b></p> <p>Balance outstanding = A – F</p> $= 1\,500\,000 \left( 1 + \frac{0,105}{12} \right)^{144} - \frac{14\,975,70 \left[ \left( 1 + \frac{0,105}{12} \right)^{144} - 1 \right]}{\frac{0,105}{12}}$ $= R5\,259\,229,61 - R4\,289\,302,47$ $= R969\,927,14$	<p>✓ R14 975,70 in P<sub>v</sub>-formula  ✓✓ n = 96</p> <p>✓ substitution into correct formula</p> <p>✓ answer (5)</p> <p><b>OR/OF</b></p> <p>✓ n = 144 in A-formula  ✓ n = 144 in F<sub>v</sub>-formula  ✓ R14 975,70  ✓ A – F</p> <p>✓ answer (5)</p>
		<b>[15]</b>



## QUESTION/VRAAG 8

8.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - 5 - x^2 + 5}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x+h)}{h}$ $= \lim_{h \rightarrow 0} (2x+h)$ $= 2x$ <p><b>OR/OF</b></p> $f(x+h) = (x+h)^2 - 5$ $= x^2 + 2xh + h^2 - 5$ $f(x+h) - f(x) = x^2 + 2xh + h^2 - 5 - (x^2 - 5)$ $= 2xh + h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x+h)}{h}$ $= \lim_{h \rightarrow 0} (2x+h)$ $= 2x$	<ul style="list-style-type: none"> <li>✓ <math>x^2 + 2xh + h^2 - 5</math></li> <li>✓ simplification</li> <li>✓ factorisation</li> <li>✓ <math>\lim_{h \rightarrow 0} (2x+h)</math></li> <li>✓ <math>2x</math></li> </ul> <p style="text-align: right;">(5)</p> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ <math>x^2 + 2xh + h^2 - 5</math></li> <li>✓ simplification</li> <li>✓ factorisation</li> <li>✓ <math>\lim_{h \rightarrow 0} (2x+h)</math></li> <li>✓ <math>2x</math></li> </ul> <p style="text-align: right;">(5)</p>
8.2.1	$y = 3x^3 + 6x^2 + x - 4$ $\frac{dy}{dx} = 9x^2 + 12x + 1$	<ul style="list-style-type: none"> <li>✓ <math>9x^2</math></li> <li>✓ <math>12x</math></li> <li>✓ <math>1</math></li> </ul> <p style="text-align: right;">(3)</p>
8.2.2	$y(x-1) = 2x(x-1)$ $y = \frac{2x(x-1)}{x-1} \text{ if } x \neq 1$ $y = 2x$ $\frac{dy}{dx} = 2$	<ul style="list-style-type: none"> <li>✓ <math>y(x-1)</math></li> <li>✓ <math>2x(x-1)</math></li> <li>✓ <math>y = 2x</math></li> <li>✓ answer</li> </ul> <p style="text-align: right;">(4)</p>
		<b>[12]</b>

**QUESTION/VRAAG 9**

9.1.1	$g(x) = (x + 5)(x - x_1)^2$ $20 = 5(x_1)^2$ $x_1^2 = 4$ $x_1 = 2$ $g(x) = (x + 5)(x - 2)^2$ $g(x) = (x + 5)(x^2 - 4x + 4)$ $g(x) = x^3 + x^2 - 16x + 20$	<p>✓ <math>(x + 5)</math></p> <p>✓ repeated root</p> <p>✓ <math>x_1 = 2</math></p> <p>✓ <math>g(x) = (x + 5)(x^2 - 4x + 4)</math></p> <p>(4)</p>
9.1.2	$g(x) = x^3 + x^2 - 16x + 20$ $g'(x) = 3x^2 + 2x - 16$ $3x^2 + 2x - 16 = 0$ $(3x + 8)(x - 2) = 0$ $x = \frac{-8}{3} \text{ or } x = 2$ $R\left(\frac{-8}{3}; \frac{1372}{27}\right) \text{ or } R(-2,67; 50,81)$ $P(2; 0)$	<p>✓ derivative</p> <p>✓ equating to zero</p> <p>✓ factors</p> <p>✓ co-ordinates of R</p> <p>✓ co-ordinates of P</p> <p>(5)</p>
9.1.3	$g''(x) = 6x + 2$ $g''(0) = 2$ <p>∴ concave up</p> <p><b>OR/OF</b></p> $g''(x) = 6x + 2$ $6x + 2 = 0$ $x = -\frac{1}{3} \text{ is the point of inflection}$ <p>∴ concave up</p>	<p>✓ <math>g''(x) = 6x + 2</math></p> <p>✓ <math>g''(0) = 2</math></p> <p>✓ conclusion</p> <p>(3)</p> <p><b>OR/OF</b></p> <p>✓ <math>g''(x) = 6x + 2</math></p> <p>✓ <math>x = -\frac{1}{3}</math></p> <p>✓ conclusion</p> <p>(3)</p>

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9.2		<ul style="list-style-type: none"> <li>✓ <math>y</math> – intercept of a cubic graph</li> <li>✓ point of inflection and stationary point, <math>x = 3</math></li> <li>✓ concave up for <math>x &lt; 3</math> and concave down for <math>x &gt; 3</math></li> </ul>
		(3) [15]



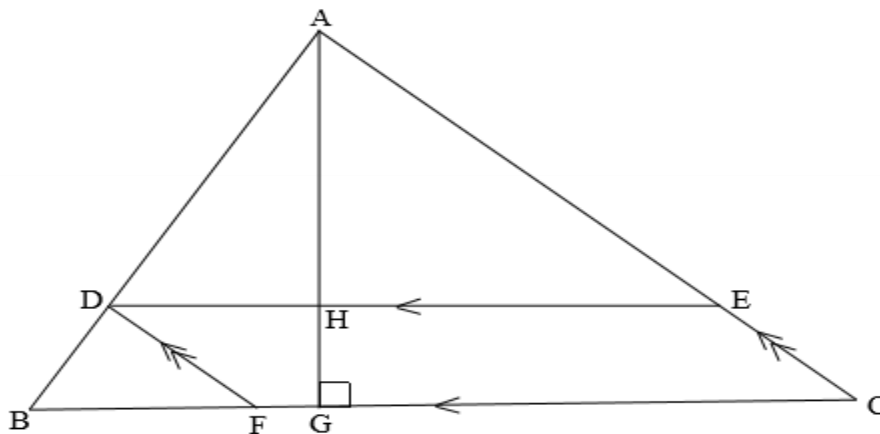
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## QUESTION/VRAAG 10



10.1	$\frac{AH}{HG} = \frac{3}{2}$	✓ answer (1)
10.2	<p>Area of a parallelogram = base <math>\times</math> <math>\perp</math> height</p> <p>Area = <math>\frac{3}{5}(5-t) \cdot \frac{2}{5}t</math></p> <p>Area = <math>\frac{6}{25}(5-t)t</math></p> <p><math>A(t) = -\frac{6}{25}t^2 + \frac{6}{5}t</math></p> <p><math>A'(t) = -\frac{12}{25}t + \frac{6}{5}</math></p> <p><math>-\frac{12}{25}t + \frac{6}{5} = 0</math></p> <p><math>12t - 30 = 0</math></p> <p><math>t = \frac{30}{12}</math> or <math>\frac{5}{2}</math></p>	<p>✓ <math>\frac{2}{5}t</math></p> <p>✓ <math>\frac{3}{5}(5-t)</math></p> <p>✓ <math>A(t) = -\frac{6}{25}t^2 + \frac{6}{5}t</math></p> <p>✓ <math>-\frac{12}{25}t + \frac{6}{5}</math></p> <p>✓ answer (5)</p>
		<b>[6]</b>

**QUESTION/VRAAG 11**

11.1.1	$7^5 = 16\ 807$	✓✓ answer (2)
11.1.2	$7 \times 6 \times 5 \times 4 \times 3$ $= \frac{7!}{2!} = 2520$	✓ $7 \times 6 \times 5 \times 4 \times 3$ or $\frac{7!}{2!}$ ✓ answer (2)
11.2	$2 \times 7 \times 1 = 14$	✓✓✓ $2 \times 7 \times 1$ (3)
		[7]

**QUESTION/VRAAG 12**

12.1	$P(A \text{ or } B) = P(A) + P(B)$ $0,74 = 0,45 + y$ $y = 0,29$	✓ $P(A \text{ or } B) = P(A) + P(B)$ ✓ substitution ✓ answer (3)
12.2	<p>Let the number of mystery gift bags = <math>x</math> The total number of bags = <math>4x</math></p> $\left(\frac{x}{4x}\right) \times \left(\frac{x-1}{4x-1}\right) = \frac{7}{118}$ $\frac{1}{4} \times \frac{x-1}{4x-1} = \frac{7}{118}$ $\frac{x-1}{4x-1} = \frac{28}{118}$ $118x - 118 = 112x - 28$ $x = 15$	✓ $4x$ ✓ $\left(\frac{x}{4x}\right)$ or $\left(\frac{1}{4}\right)$ ✓ $\left(\frac{x-1}{4x-1}\right)$ ✓ $\frac{1}{4} \times \frac{x-1}{4x-1}$ ✓ equating to $\frac{7}{118}$ ✓ answer (6)





	<p><b>OR/OF</b>  <math>P(\text{gift and gift}) = P(\text{gift at first draw}) \times P(\text{gift at second draw})</math>  <math>\frac{7}{118} = \frac{1}{4} \times P(\text{gift at second draw})</math></p> $P(\text{gift at second draw}) = \frac{7}{118} \div \frac{1}{4}$ $= \frac{14}{59}$ <p>Therefore: <math>P(\text{gift at first draw}) = \frac{15}{60}</math></p> <p>And: 15 bags had mystery gifts inside</p>	<p><b>OR/OF</b></p> <p>✓ <math>\frac{1}{4}</math></p> <p>✓ <math>\frac{1}{4} \times P(\text{gift at 2}^{\text{nd}} \text{ draw})</math></p> <p>✓ <math>\frac{7}{118} = \frac{1}{4} \times P(\text{gift at 2}^{\text{nd}} \text{ draw})</math></p> <p>✓ <math>\frac{14}{59}</math></p> <p>✓ <math>\frac{15}{60}</math></p> <p>✓ answer (6)</p>
		<b>[9]</b>

**TOTAL/TOTAAL: 150**



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**NOVEMBER 2019**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages and 1 information sheet**





Mathematics/P1

3  
NSC

DBE/November 2019

**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 + 5x - 6 = 0$  (3)

1.1.2  $4x^2 + 3x - 5 = 0$  (correct to TWO decimal places) (3)

1.1.3  $4x^2 - 1 < 0$  (3)

1.1.4  $(\sqrt{\sqrt{32} + x})(\sqrt{\sqrt{32} - x}) = x$  (4)

1.2 Solve simultaneously for  $x$  and  $y$ :

$y + x = 12$  and  $xy = 14 - 3x$  (5)

1.3 Consider the product  $1 \times 2 \times 3 \times 4 \times \dots \times 30$ .Determine the largest value of  $k$  such that  $3^k$  is a factor of this product. (4)  
[22]**QUESTION 2**

2.1 Given the quadratic sequence: 321 ; 290 ; 261 ; 234 ; ....

2.1.1 Write down the values of the next TWO terms of the sequence. (2)

2.1.2 Determine the general term of the sequence in the form  $T_n = an^2 + bn + c$ . (4)

2.1.3 Which term(s) of the sequence will have a value of 74? (4)

2.1.4 Which term in the sequence has the least value? (2)

2.2 Given the geometric series:  $\frac{5}{8} + \frac{5}{16} + \frac{5}{32} + \dots = K$ 2.2.1 Determine the value of  $K$  if the series has 21 terms. (3)2.2.2 Determine the largest value of  $n$  for which  $T_n > \frac{5}{8192}$  (4)  
[19]

Mathematics/P1

4  
NSC

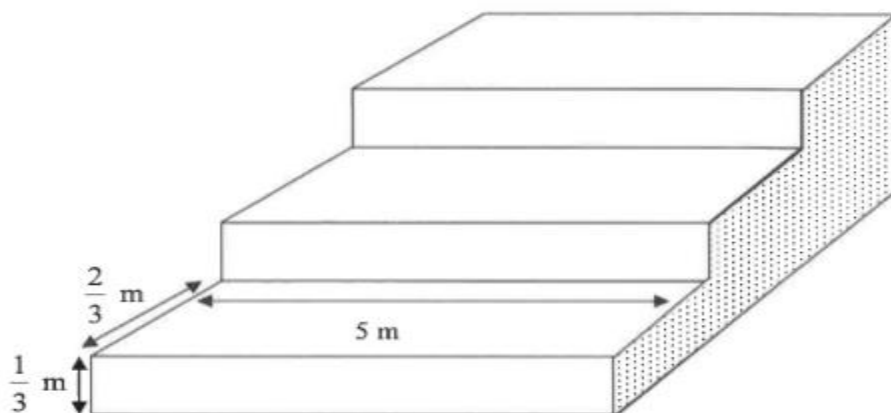
DBE/November 2019

**QUESTION 3**

3.1 Without using a calculator, determine the value of:  $\sum_{y=3}^{10} \frac{1}{y-2} - \sum_{y=3}^{10} \frac{1}{y-1}$  (3)

3.2 A steel pavilion at a sports ground comprises of a series of 12 steps, of which the first 3 are shown in the diagram below.

Each step is 5 m wide. Each step has a rise of  $\frac{1}{3}$  m and has a tread of  $\frac{2}{3}$  m, as shown in the diagram below.



The open side (shaded on sketch) on each side of the pavilion must be covered with metal sheeting. Calculate the area (in  $\text{m}^2$ ) of metal sheeting needed to cover both open sides.

(6)  
[9]

Mathematics/P1

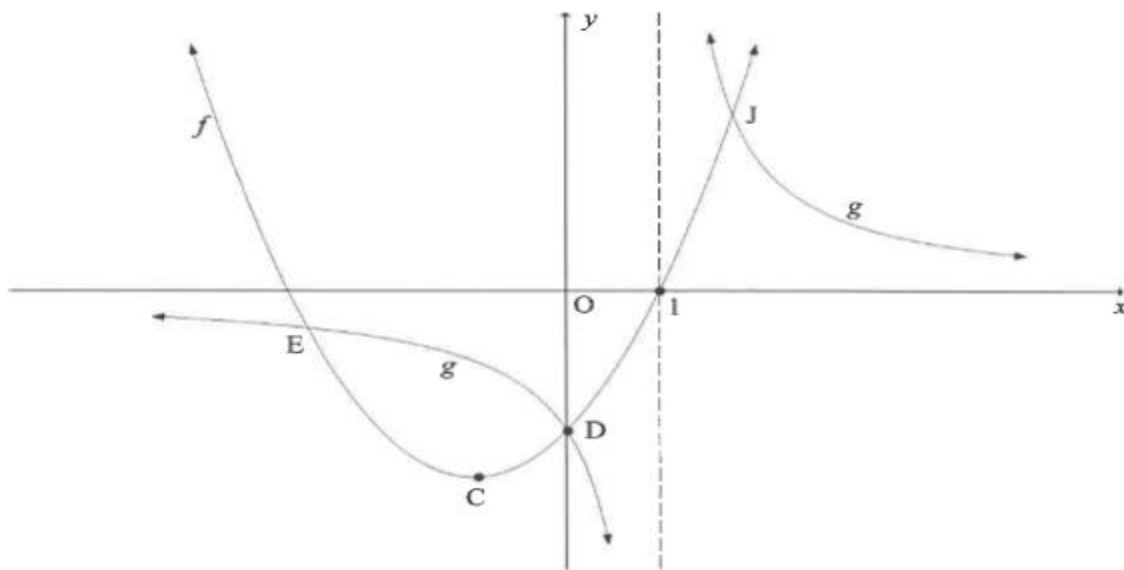
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**QUESTION 4**

Below are the graphs of  $f(x) = x^2 + bx - 3$  and  $g(x) = \frac{a}{x+p}$ .

- $f$  has a turning point at  $C$  and passes through the  $x$ -axis at  $(1; 0)$ .
- $D$  is the  $y$ -intercept of both  $f$  and  $g$ . The graphs  $f$  and  $g$  also intersect each other at  $E$  and  $J$ .
- The vertical asymptote of  $g$  passes through the  $x$ -intercept of  $f$ .



- 4.1 Write down the value of  $p$ . (1)
- 4.2 Show that  $a = 3$  and  $b = 2$ . (3)
- 4.3 Calculate the coordinates of  $C$ . (4)
- 4.4 Write down the range of  $f$ . (2)
- 4.5 Determine the equation of the line through  $C$  that makes an angle of  $45^\circ$  with the positive  $x$ -axis. Write your answer in the form  $y = \dots$  (3)
- 4.6 Is the straight line, determined in QUESTION 4.5, a tangent to  $f$ ? Explain your answer. (2)
- 4.7 The function  $h(x) = f(m-x) + q$  has only one  $x$ -intercept at  $x = 0$ . Determine the values of  $m$  and  $q$ . (4)
- [19]**



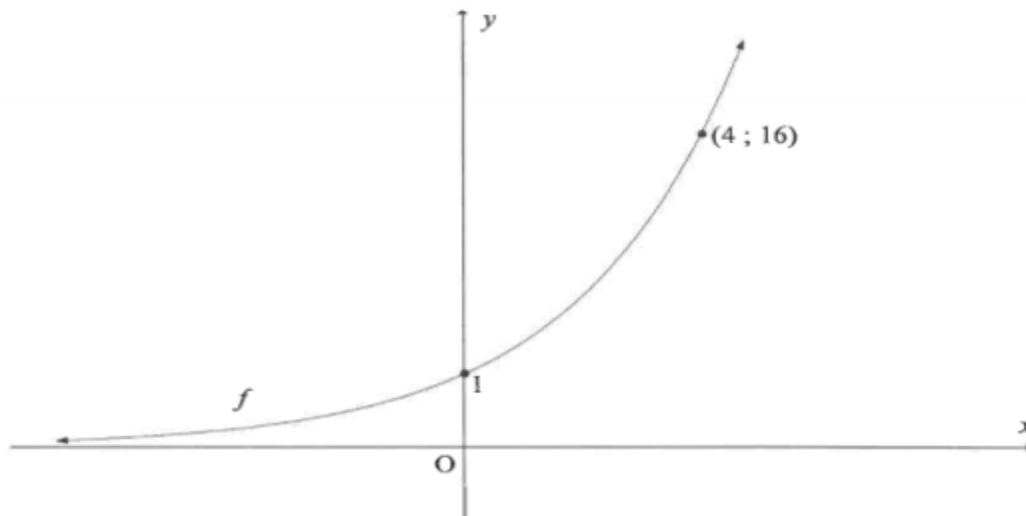
Mathematics/P1

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**QUESTION 5**

Sketched below is the graph of  $f(x) = k^x$ ;  $k > 0$ . The point  $(4 ; 16)$  lies on  $f$ .



- 5.1 Determine the value of  $k$ . (2)
- 5.2 Graph  $g$  is obtained by reflecting graph  $f$  about the line  $y = x$ . Determine the equation of  $g$  in the form  $y = \dots$  (2)
- 5.3 Sketch the graph  $g$ . Indicate on your graph the coordinates of two points on  $g$ . (4)
- 5.4 Use your graph to determine the value(s) of  $x$  for which:
- 5.4.1  $f(x) \times g(x) > 0$  (2)
- 5.4.2  $g(x) \leq -1$  (2)
- 5.5 If  $h(x) = f(-x)$ , calculate the value of  $x$  for which  $f(x) - h(x) = \frac{15}{4}$  (4)
- [16]**





Mathematics/P1

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DBE/November 2019

**QUESTION 6**

- 6.1 Two friends, Kuda and Thabo, each want to invest R5 000 for four years. Kuda invests his money in an account that pays simple interest at 8,3% per annum. At the end of four years, he will receive a bonus of exactly 4% of the accumulated amount. Thabo invests his money in an account that pays interest at 8,1% p.a., compounded monthly.

Whose investment will yield a better return at the end of four years? Justify your answer with appropriate calculations. (5)

- 6.2 Nine years ago, a bank granted Mandy a home loan of R525 000. This loan was to be repaid over 20 years at an interest rate of 10% p.a., compounded monthly. Mandy's monthly repayments commenced exactly one month after the loan was granted.

6.2.1 Mandy decided to make monthly repayments of R6 000 instead of the required R5 066,36. How many payments will she make to settle the loan? (5)

6.2.2 After making monthly repayments of R6 000 for nine years, Mandy required money to fund her daughter's university fees. She approached the bank for another loan. Instead, the bank advised Mandy that the extra amount repaid every month could be regarded as an investment and that she could withdraw this full amount to fund her daughter's studies. Calculate the maximum amount that Mandy may withdraw from the loan account. (4)

**[14]****QUESTION 7**

- 7.1 Determine  $f'(x)$  from first principles if it is given that  $f(x) = 4 - 7x$ . (4)

- 7.2 Determine  $\frac{dy}{dx}$  if  $y = 4x^8 + \sqrt{x^3}$  (3)

- 7.3 Given:  $y = ax^2 + a$

Determine:

- 7.3.1  $\frac{dy}{dx}$  (1)

- 7.3.2  $\frac{dy}{da}$  (2)

- 7.4 The curve with equation  $y = x + \frac{12}{x}$  passes through the point  $A(2; b)$ . Determine the equation of the line perpendicular to the tangent to the curve at A. (4)

**[14]**

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Mathematics/PI

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**QUESTION 8**

After flying a short distance, an insect came to rest on a wall. Thereafter the insect started crawling on the wall. The path that the insect crawled can be described by  $h(t) = (t - 6)(-2t^2 + 3t - 6)$ , where  $h$  is the height (in cm) above the floor and  $t$  is the time (in minutes) since the insect started crawling.

- 8.1 At what height above the floor did the insect start to crawl? (1)
- 8.2 How many times did the insect reach the floor? (3)
- 8.3 Determine the maximum height that the insect reached above the floor. (4)
- [8]

**QUESTION 9**Given:  $f(x) = 3x^3$ 

- 9.1 Solve  $f(x) = f'(x)$  (3)
- 9.2 The graphs  $f$ ,  $f'$  and  $f''$  all pass through the point  $(0; 0)$ .
- 9.2.1 For which of the graphs will  $(0; 0)$  be a stationary point? (1)
- 9.2.2 Explain the difference, if any, in the stationary points referred to in QUESTION 9.2.1. (2)
- 9.3 Determine the vertical distance between the graphs of  $f'$  and  $f''$  at  $x = 1$ . (3)
- 9.4 For which value(s) of  $x$  is  $f(x) - f'(x) < 0$ ? (4)
- [13]

**QUESTION 10**

The school library is open from Monday to Thursday. Anna and Ben both studied in the school library one day this week. If the chance of studying any day in the week is equally likely, calculate the probability that Anna and Ben studied on:

- 10.1 The same day (2)
- 10.2 Consecutive days (3)
- [5]





Mathematics/P1

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NSC

DBE/November 2019

**QUESTION 11**

- 11.1 Events **A** and **B** are independent.  $P(A) = 0,4$  and  $P(B) = 0,25$ .
- 11.1.1 Represent the given information on a Venn diagram. Indicate on the Venn diagram the probabilities associated with each region. (3)
- 11.1.2 Determine  $P(A \text{ or NOT } B)$ . (2)
- 11.2 Motors Incorporated manufacture cars with 5 different body styles, 4 different interior colours and 6 different exterior colours, as indicated in the table below.

BODY STYLES	INTERIOR COLOURS	EXTERIOR COLOURS
Five body styles	Blue	Silver
	Grey	Blue
	Black	White
	Red	Green
		Red
		Gold

The interior colour of the car must NOT be the same as the exterior colour.

Motors Incorporated wants to display one of each possible variation of its car in their showroom. The showroom has a floor space of  $500 \text{ m}^2$  and each car requires a floor space of  $5 \text{ m}^2$ .

Is this display possible? Justify your answer with the necessary calculations. (6)  
[11]

**TOTAL: 150**

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# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE SENIOR  
SERTIFIKAAT**

**GRADE 12/GRAAD 12**

**MATHEMATICS P1/WISKUNDE V1**

**NOVEMBER 2019**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS/PUNTE: 150**

**These marking guidelines consist of 18 pages.  
*Hierdie nasienriglyne bestaan uit 18 bladsye.***



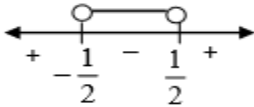
**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking memorandum.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$x^2 + 5x - 6 = 0$ $(x + 6)(x - 1) = 0$ $x = -6$ or $x = 1$	✓ factors ✓ $x = -6$ ✓ $x = 1$ (3)
1.1.2	$4x^2 + 3x - 5 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-3 \pm \sqrt{(3)^2 - 4(4)(-5)}}{2(4)}$ $x = \frac{-3 \pm \sqrt{89}}{8}$ $x = -1,55$ or $x = 0,8$	✓ substitution into the correct formula ✓ $x = -1,55$ ✓ $x = 0,8$ (3)
1.1.3	$4x^2 - 1 < 0$ $(2x + 1)(2x - 1) < 0$ $\frac{-1}{2} < x < \frac{1}{2}$ 	✓ factors ✓ method ✓ answer (3)
1.1.4	$(\sqrt{\sqrt{32} + x})(\sqrt{\sqrt{32} - x}) = x$ $\sqrt{32 - x^2} = x$ $32 - x^2 = x^2$ $-2x^2 = -32$ $x^2 = 16$ $x = \pm 4$ $\therefore x = 4$	✓ $\sqrt{32 - x^2}$ ✓ squaring both sides ✓ $x^2 = 16$ ✓ $x = 4$ (selection) (4)





1.2	$y + x = 12$ $y = -x + 12 \dots\dots\dots(1)$ $xy = 14 - 3x \dots\dots\dots(2)$ Sub (1) into (2) $x(-x + 12) = 14 - 3x$ $-x^2 + 12x - 14 + 3x = 0$ $-x^2 + 15x - 14 = 0$ $x^2 - 15x + 14 = 0$ $(x - 14)(x - 1) = 0$ $x = 14$ or $x = 1$ $y = -2$ or $y = 11$ <b>OR/OF</b> $y + x = 12$ $x = -y + 12 \dots\dots\dots(1)$ $xy = 14 - 3x \dots\dots\dots(2)$ Sub (1) into (2) $y(-y + 12) = 14 - 3(-y + 12)$ $12y - y^2 - 14 + 36 - 3y = 0$ $-y^2 + 9y + 22 = 0$ $y^2 - 9y - 22 = 0$ $(y + 2)(y - 11) = 0$ $y = -2$ or $y = 11$ $x = 14$ or $x = 1$	✓ $y$ subject of the formula  ✓ substitution  ✓ simplification  ✓ both values of $x$ ✓ both values of $y$ (5) <b>OR/OF</b> ✓ $x$ subject of the formula  ✓ substitution ✓ simplification  ✓ both values of $y$ ✓ both values of $x$ (5)
1.3	$3 \quad 6 \quad 9 \quad 12 \quad 15 \quad 18 \quad 21 \quad 24 \quad 27 \quad 30$ $3 \quad 3 \quad 3^2 \quad 3 \quad 3 \quad 3^2 \quad 3 \quad 3 \quad 3^3 \quad 3$ $\therefore k = 14$	✓ identifying multiples of 3 ✓ ten multiples of 3 ✓ powers of 3 ✓ answer (4)
<b>[22]</b>		



## QUESTION/VRAAG 2

2.1.1	209 ; 186	✓209 ✓186 (2)
2.1.2	$  \begin{array}{ccccccc}  & & 321 & ; & 290 & ; & 261 & ; & 234 \\  & & \swarrow & & \swarrow & & \swarrow & & \\  1st \text{ diff} & & -31 & & -29 & & -27 & & \\  & & \swarrow & & \swarrow & & & & \\  2nd \text{ diff} & & & & 2 & & 2 & & \\  \\  2a = 2 & 3a + b = -31 & a + b + c = 321 \\  a = 1 & 3(1) + b = -31 & 1 + (-34) + c = 321 \\  & b = -34 & c = 354 \\  \\  T_n = n^2 - 34n + 354  \end{array}  $	✓ 2 <sup>nd</sup> diff = 2 ✓ a = 1 ✓ b = -34 ✓ c = 354 (4)
2.1.3	$n^2 - 34n + 354 = 74$ $n^2 - 34n + 280 = 0$ $(n - 14)(n - 20) = 0$ $n = 14 \text{ or } n = 20$	✓ equating $T_n$ to 74 ✓ standard form ✓14 ✓ 20 (4)
2.1.4	$f'(n) = 0$ $2n - 34 = 0$ $2n = 34$ $n = 17$ Term 17 will have the smallest value <b>OR/OF</b> $n = \frac{-b}{2a}$ $n = \frac{34}{2}$ $n = 17$ Term 17 will have the smallest value <b>OR/OF</b> $n = \frac{14 + 20}{2} = 17$ Term 17 will have the smallest value	✓ $2n - 34 = 0$ ✓ answer (2) <b>OR/OF</b> ✓ substitution ✓ answer (2) <b>OR/OF</b> ✓ substitution ✓ answer (2)



2.2.1	$a = \frac{5}{8} ; r = \frac{1}{2} ; n = 21$ $S_n = \frac{a(1-r^n)}{1-r}$ $S_{21} = \frac{\frac{5}{8} \left( 1 - \left( \frac{1}{2} \right)^{21} \right)}{1 - \frac{1}{2}}$ $= 1,2499\dots$ $= 1,25$	<p>✓ <math>r</math></p> <p>✓ substitution into the correct formula</p> <p>✓ answer (3)</p>
2.2.2	$T_n > \frac{5}{8192}$ $ar^{n-1} > \frac{5}{8192}$ $\frac{5}{8} \left( \frac{1}{2} \right)^{n-1} > \frac{5}{8192}$ $\left( \frac{1}{2} \right)^{n-1} > \frac{1}{1024}$ $\left( \frac{1}{2} \right)^{n-1} > \left( \frac{1}{2} \right)^{10} \quad \text{or} \quad 2^{-n+1} > 2^{-10}$ $\therefore n-1 < 10 \quad \quad \quad -n+1 > -10$ $n < 11 \quad \quad \quad n < 11$ $\therefore n = 10 \quad \quad \quad \therefore n = 10$ <p><b>OR/OF</b></p> $8 ; 16 ; 32 ; \dots ; 8192$ $8 \cdot 2^{n-1} < 8192$ $2^{n-1} < 1024$ $2^{n-1} < 2^{10}$ $n-1 < 10$ $n < 11$ $\therefore n = 10$	<p>✓ substitution into the correct formula</p> <p>✓ method /same base or log</p> <p>✓ calculating <math>n</math></p> <p>✓ answer (4)</p> <p><b>OR/OF</b></p> <p>✓ substitution into the correct formula</p> <p>✓ method</p> <p>✓ calculating <math>n</math></p> <p>✓ answer (4)</p>
		<b>[19]</b>



**QUESTION/VRAAG 3**

3.1	$\sum_{y=3}^{10} \frac{1}{y-2} - \sum_{y=3}^{10} \frac{1}{y-1}$ $= \left( \frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{8} \right) - \left( \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{8} + \frac{1}{9} \right)$ $= 1 - \frac{1}{9}$ $= \frac{8}{9}$	$\checkmark \left( \frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{8} \right)$ $\checkmark \left( \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{8} + \frac{1}{9} \right)$ $\checkmark \text{ answer} \quad (3)$
3.2	$\left( \frac{1}{3} \times \frac{2}{3} \right) + \left( \frac{2}{3} \times \frac{2}{3} \right) + \left( 1 \times \frac{2}{3} \right) + \dots + \left( 4 \times \frac{2}{3} \right)$ $= \frac{2}{9} + \frac{4}{9} + \frac{2}{3} + \dots + \frac{8}{3}$ $a = \frac{2}{9} \quad \text{and} \quad d = \frac{2}{3} - \frac{4}{9} = \frac{2}{9}$ $S_n = \frac{n}{2} [2a + (n-1)d] \quad \text{OR} \quad S_n = \frac{n}{2} (a + l)$ $S_{12} = \frac{12}{2} \left[ 2 \left( \frac{2}{9} \right) + (12-1) \frac{2}{9} \right] \quad S_{12} = \frac{12}{2} \left( \frac{2}{9} + \frac{8}{3} \right)$ $= \frac{52}{3} \text{ m}^2 \quad = \frac{52}{3} \text{ m}^2$ $\therefore \text{ for both sides} = 2 \times \frac{52}{3} = \frac{104}{3} = 34,67 \text{ m}^2$ <b>OR/OF</b> $\frac{2}{9} \times (1+2+3+4+5+6+7+8+9+10+11+12) \times 2$ $= 34,67 \text{ m}^2$ <b>OR/OF</b> $T_1 = \frac{2}{9} \times 12 = \frac{8}{3} \quad l = \frac{2}{9} \times 1 = \frac{2}{9}$ $2S_{12} = 2 \left( \frac{12}{2} \right) \left( \frac{8}{3} + \frac{2}{9} \right)$ $= 34,67 \text{ m}^2$	$\checkmark \checkmark a$ $\checkmark d$ $\checkmark \text{ substitution into the correct formula}$ $\checkmark \text{ answer}$ $\checkmark \text{ answer for both sides} \quad (6)$ <b>OR/OF</b> $\checkmark \checkmark a$ $\checkmark \checkmark (1 + \dots + 12)$ $\checkmark \times 2$ $\checkmark \text{ answer} \quad (6)$ <b>OR/OF</b> $\checkmark \checkmark a$ $\checkmark T_1 = \frac{8}{3} \quad \checkmark l = \frac{2}{9}$ $\checkmark \text{ substitution into correct formula}$ $\checkmark \text{ answer} \quad (6)$ <p style="text-align: right;"><b>[9]</b></p>



## QUESTION/VRAAG 4

4.1	$p = -1$	✓ $p = -1$ (1)
4.2	$y = \frac{a}{x-1}$ $-3 = \frac{a}{0-1}$ $a = 3$ $y = x^2 + bx - 3$ $0 = (1)^2 + (1)b - 3$ $b = 2$	✓ coordinates D(0 ; -3) ✓ substitute (0 ; -3)  ✓ substitute (1 ; 0) (3)
4.3	$y = x^2 + 2x - 3$ axis of sym: $x = \frac{-b}{2a}$ $x = \frac{-2}{2(1)}$ $x = -1$ $y = (-1)^2 + 2(-1) - 3 = -4$ C(-1; -4)  <b>OR/OF</b> $\frac{dy}{dx} = 0$ $2x + 2 = 0$ $x = -1$ $y = (-1)^2 + 2(-1) - 3 = -4$ C(-1; -4)	✓ substitution ✓ $x = -1$  ✓ substitution ✓ $y = -4$ (4)  <b>OR/OF</b>  ✓ derivative ✓ $x = -1$ ✓ substitution ✓ $y = -4$ (4)
4.4	$y \in [-4; \infty)$ or $y \geq -4$	✓ -4 ✓ answer (2)
4.5	$m = \tan 45^\circ = 1$ $y = mx + c$ $-4 = (1)(-1) + c$ $c = -3$ $y = x - 3$	✓ gradient  ✓ subs $m$ and (-1 ; -4)  ✓ equation (3)
4.6	No, the line passes through C and D  <b>OR/OF</b> No, a tangent through turning point C will have a gradient of 0	✓ No ✓ reason (2)  <b>OR/OF</b> ✓ No ✓ reason (2)





4.7	$f(m-x) = f[-(x-m)]$ <p><math>f</math> is reflected in the <math>y</math>-axis and translated 1 unit to the left and 4 units upwards. Therefore: <math>m = -1</math> <math>q = 4</math></p> <p><b>OR/OF</b></p> <p>Substitute <math>x = 0</math> and <math>q = 4</math> for one <math>x</math>- intercept  <math>h(x) = (m-x)^2 + 2(m-x) - 3 + q</math>  <math>h(0) = (m-0)^2 + 2(m-0) - 3 + 4</math>  <math>0 = m^2 + 2m + 1</math>  <math>0 = (m+1)^2</math>  <math>m = -1</math>  <math>q = 4</math></p>	<p>✓✓ value of <math>m</math>          ✓✓ value of <math>q</math> (4)</p> <p><b>OR/OF</b></p> <p>✓✓ value of <math>m</math>          ✓✓ value of <math>q</math> (4)</p>
<b>[19]</b>		





## QUESTION/VRAAG 5

5.1	$f(x) = k^x$ $16 = k^4$ $k = 2$	✓ substitution (4 ; 16) ✓ answer (2)
5.2	$f : y = 2^x$ $f^{-1} : x = 2^y$ $y = \log_2 x$	✓ $x = 2^y$ ✓ $y = \log_2 x$ (2)
5.3		✓ asymptote ✓ shape ✓ for any two valid points eg. (16 ; 4) or (2 ; 1) or (4 ; 2) or (1 ; 0) (4)
5.4.1	$x \in (1 ; \infty)$ or $x > 1$	✓ 1 ✓ answer (2)
5.4.2	$0 < x \leq \frac{1}{2}$ or $x \in \left(0 ; \frac{1}{2}\right]$	✓ $\frac{1}{2}$ ✓ answer (2)





5.5	$2^x - 2^{-x} = \frac{15}{4}$ $2^x - \frac{1}{2^x} = \frac{15}{4}$ $2^{2x} - 1 = \frac{15}{4} \times 2^x$ $4 \cdot 2^{2x} - 4 = 15 \times 2^x$ $4 \cdot 2^{2x} - 15 \cdot 2^x - 4 = 0$ $(4 \cdot 2^x + 1)(2^x - 4) = 0$ $4 \cdot 2^x + 1 = 0 \text{ or } 2^x - 4 = 0$ $2^x = \frac{-1}{4} \text{ or } 2^x = 2^2$ <p>N/A <math>x = 2</math></p> <p><b>OR/OF</b></p> $2^x - 2^{-x} = \frac{15}{4}$ $2^x - \frac{1}{2^x} = \frac{15}{4}$ <p>Let <math>k = 2^x</math></p> $k^2 - 1 = \frac{15}{4} \times k$ $4k^2 - 4 = 15 \times k$ $4k^2 - 15k - 4 = 0$ $(4k + 1)(k - 4) = 0$ $k = \frac{-1}{4} \text{ or } k = 4$ $2^x = \frac{-1}{4} \text{ or } 2^x = 2^2$ <p>N/A <math>x = 2</math></p>	$\checkmark 2^x - 2^{-x} = \frac{15}{4}$ $\checkmark \text{ standard form}$ $\checkmark \text{ factors}$ $\checkmark \text{ answer} \quad (4)$ <p><b>OR/OF</b></p> $\checkmark$ $2^x - 2^{-x} = \frac{15}{4}$ $\checkmark \text{ standard form}$ $\checkmark \text{ factors}$ $\checkmark \text{ answer} \quad (4)$
		<b>[16]</b>





## QUESTION/VRAAG 6

6.1	<p>Kuda: <math>A = P(1 + in)</math>  <math>= 5\,000(1 + 0,083 \times 4)</math>  <math>= R6\,660,00</math>            Final Answer: <math>R6\,660,00 + R266,40</math>  <math>= R6\,926,40</math></p> <p><b>OR/OF</b>            Kuda: <math>A = P(1 + in) \times 1,04</math>  <math>= 5\,000(1 + 0,083 \times 4) \times 1,04</math>  <math>= R6\,926,40</math></p> <p>Thabo: <math>A = P(1 + i)^n</math>  <math>= 5\,000 \left(1 + \frac{0,081}{12}\right)^{12 \times 4}</math>  <math>= R6\,905,71</math></p> <p>Kuda will have a better investment</p>	<p>✓ substitution into the correct formula</p> <p>✓ final answer</p> <p><b>OR/OF</b></p> <p>✓ substitution into the correct formula</p> <p>✓ final answer</p> <p>✓ substitution into the correct formula</p> <p>✓ answer</p> <p>✓ conclusion (5)</p>
6.2.1	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $525\,000 = \frac{6\,000 \left[1 - \left(1 + \frac{0,1}{12}\right)^{-n}\right]}{\frac{0,1}{12}}$ $\frac{35}{48} = 1 - \left(1 + \frac{0,1}{12}\right)^{-n}$ $-n \log \left(1 + \frac{0,1}{12}\right) = \log \frac{13}{48}$ $-n = \frac{\log \frac{13}{48}}{\log \left(1 + \frac{0,1}{12}\right)}$ $n = 157,40$ $n = 158 \text{ payments}$ <p><b>OR/OF</b></p>	<p>✓ <math>\frac{0,1}{12}</math></p> <p>✓ substitution into the correct formula</p> <p>✓ simplification</p> <p>✓ use of logs</p> <p>✓ answer (5)</p> <p><b>OR/OF</b></p>



	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $525\,000 = \frac{6\,000 \left[ 1 - \left( 1 + \frac{0,1}{12} \right)^{-12n} \right]}{\frac{0,1}{12}}$ $\frac{35}{48} = 1 - \left( 1 + \frac{0,1}{12} \right)^{-12n}$ $-12n \log \left( 1 + \frac{0,1}{12} \right) = \log \frac{13}{48}$ $-12n = \frac{\log \frac{13}{48}}{\log \left( 1 + \frac{0,1}{12} \right)}$ $n = \frac{\log \frac{13}{48}}{\log \left( 1 + \frac{0,1}{12} \right)} \times \frac{1}{12}$ $n = 13,11686841$ <p>Number of payments = <math>13,11686841 \times 12 = 157,40</math>  <math>n = 158</math> payments</p>	<p>✓ <math>\frac{0,1}{12}</math></p> <p>✓ substitution into the correct formula</p> <p>✓ simplification</p> <p>✓ use of logs</p> <p>✓ answer</p> <p>(5)</p>
6.2.2	<p>Difference: <math>R6\,000 - R5\,066,36 = R933,64</math></p> $F = \frac{x[(1 + i)^n - 1]}{i}$ $F = \frac{933,64 \left[ \left( 1 + \frac{0,1}{12} \right)^{108} - 1 \right]}{\frac{0,1}{12}}$ <p>= R162 503,51</p> <p><b>OR/OF</b></p>	<p>✓ R933,64</p> <p>✓ <math>n = 108</math></p> <p>✓ substitution into the correct formula</p> <p>✓ answer</p> <p>(4)</p> <p><b>OR/OF</b></p>



	$F = \frac{x[(1+i)^n - 1]}{i}$ $F = \frac{6000 \left[ \left(1 + \frac{0,1}{12}\right)^{108} - 1 \right]}{\frac{0,1}{12}}$ $= R1\ 044\ 322,28$ $F = \frac{5\ 066,36 \left[ \left(1 + \frac{0,1}{12}\right)^{108} - 1 \right]}{\frac{0,1}{12}}$ $F = R881\ 818,77\dots$ <p>Amount available for withdrawal          = R1 044 322,28 – R 881 818,77          = R162 503,51</p> <p><b>OR/OF</b></p> <p>Outstanding balance with monthly repayment of R5 066,35</p> $= 525000 \left(1 + \frac{0,1}{12}\right)^{108} - \frac{5\ 066,36 \left[ \left(1 + \frac{0,1}{12}\right)^{108} - 1 \right]}{\frac{0,1}{12}}$ $= R404\ 666,23$ <p>Outstanding balance with monthly repayment of R6 000</p> $= 525000 \left(1 + \frac{0,1}{12}\right)^{108} - \frac{6\ 000 \left[ \left(1 + \frac{0,1}{12}\right)^{108} - 1 \right]}{\frac{0,1}{12}}$ $= R242\ 162,72$ <p>Amount available for withdrawal          R404 666,23 – R242 162,72 = R162 512,18</p>	<p>✓ <math>n = 108</math>          ✓ substitution into correct formula</p> <p>✓ substitution into correct formula</p> <p>✓ final answer (4)</p> <p><b>OR/OF</b></p> <p>✓ <math>n = 108</math>          ✓ substitution into the correct formula</p> <p>✓ substitution into the correct formula</p> <p>✓ final answer (4)</p>
		<b>[14]</b>





## QUESTION/VRAAG 7

7.1	$f(x) = 4 - 7x$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{4 - 7(x+h) - (4 - 7x)}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-7)}{h}$ $= -7$	✓ $4 - 7(x+h)$ ✓ substitution ✓ simplification ✓ answer (4)
7.2	$y = 4x^8 + \sqrt{x^3}$ $= 4x^8 + x^{\frac{3}{2}}$ $\frac{dy}{dx} = 32x^7 + \frac{3}{2}x^{\frac{1}{2}}$	✓ $x^{\frac{3}{2}}$ ✓ $32x^7$ ✓ $\frac{3}{2}x^{\frac{1}{2}}$ (3)
7.3.1	$y = ax^2 + a$ $\frac{dy}{dx} = 2ax + 0$ $\frac{dy}{dx} = 2ax$	✓ $2ax$ (1)
7.3.2	$y = ax^2 + a$ $\frac{dy}{da} = x^2 + 1$	✓ ✓ answer (2)

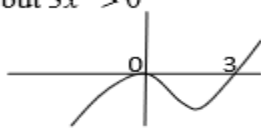


7.4	<p>Substitute (2 ; b) in <math>y = x + \frac{12}{x}</math></p> $b = 2 + \frac{12}{2}$ $b = 8$ $m_{\text{tangent}} = \frac{dy}{dx}$ $\frac{dy}{dx} = 1 - \frac{12}{x^2}$ $m_{\text{tangent}} = 1 - \frac{12}{2^2} = -2$ $m_{\text{perp}} = \frac{1}{2}$ <p>Equation of perpendicular line:</p> $y - y_1 = m(x - x_1) \quad \text{OR} \quad y = mx + c$ $y - 8 = \frac{1}{2}(x - 2) \quad 8 = \frac{1}{2}(2) + c$ $y = \frac{1}{2}x + 7 \quad c = 7$ $y = \frac{1}{2}x + 7$	<p>✓ value of <math>b</math></p> <p>✓ <math>\frac{dy}{dx} = 1 - \frac{12}{x^2}</math></p> <p>✓ gradient of perpendicular line</p> <p>✓ equation (4)</p>
		<b>[14]</b>

**QUESTION/VRAAG 8**

8.1	36cm	✓ answer (1)
8.2	$\therefore t = 6$ $(-2t^2 + 3t - 6)$ have no real roots Insect reaches the floor only once.	✓✓✓ only once (3)
8.3	$h(t) = -2t^3 + 15t^2 - 24t + 36$ $h'(t) = -6t^2 + 30t - 24$ $-6t^2 + 30t - 24 = 0$ $t^2 - 5t + 4 = 0$ $(t - 4)(t - 1) = 0$ $t = 4$ or $t = 1$ Only $t = 4$ because maximum value required $h = -2(4)^3 + 15(4)^2 - 24(4) + 36 = 52 \text{ cm}$	<p>✓ expansion</p> <p>✓ <math>-6t^2 + 30t - 24 = 0</math></p> <p>✓ both values</p> <p>✓ answer (4)</p>
		<b>[8]</b>

## QUESTION/VRAAG 9

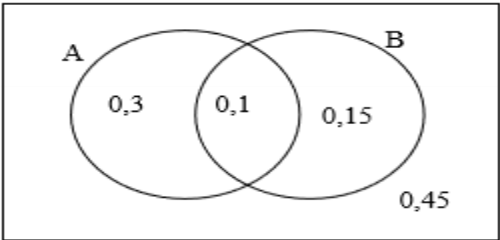
9.1	$f'(x) = 9x^2$ $3x^3 = 9x^2$ $3x^3 - 9x^2 = 0$ $3x^2(x - 3) = 0$ $x = 0$ or $x = 3$	$\checkmark f'(x) = 9x^2$  $\checkmark x = 0$ $\checkmark x = 3$ (3)
9.2.1	For $f$ and $f'$	$\checkmark$ answer (1)
9.2.2	The point $(0; 0)$ is : A point of inflection of $f$ A turning point of $f'$	$\checkmark f$ : inflection point $\checkmark f'$ : turning point (2)
9.3	$f''(x) = 18x$ Distance = $f''(1) - f'(1)$ $= 18(1) - 9(1)^2$ $= 9$	$\checkmark f''(x) = 18x$  $\checkmark$ substitution $\checkmark$ answer (3)
9.4	$3x^3 - 9x^2 < 0$ $3x^2(x - 3) < 0$ but $3x^2 > 0$  $\therefore x - 3 < 0$ $\therefore x < 3, x \neq 0$	$\checkmark 3x^3 - 9x^2 < 0$ $\checkmark$ factors  $\checkmark x < 3$ $\checkmark x \neq 0$ (4)
		<b>[13]</b>

## QUESTION/VRAAG 10

10.1	$P(\text{same day}) = \frac{4}{16}$ or $\frac{1}{4}$ or 0,25 or 25%	$\checkmark 4$ numerator $\checkmark 16$ denominator (2)
10.2	$P(2 \text{ consecutive days}) = \frac{3 \times 2}{16} = \frac{3}{8}$	$\checkmark 3 \checkmark \times 2$ $\checkmark$ answer (3)
		<b>[5]</b>



## QUESTION/VRAAG 11

11.1.1	<p><math>P(A) \times P(B)</math> independent events  <math>= 0,40 \times 0,25 = 0,1</math></p> 	<p>✓0,1</p> <p>✓0,15 and 0,3</p> <p>✓0,45 (3)</p>
11.1.2	<p><math>P(A \text{ or not } B) = P(A) + P(\text{not } B) - P(A \text{ and not } B)</math>  <math>= 0,4 + 0,75 - 0,3</math>  <math>= 0,85</math></p> <p><b>OR/OF</b></p> <p><math>P(A \text{ or not } B) = 1 - P(\text{only } B)</math>  <math>= 1 - 0,15</math>  <math>= 0,85</math></p> <p><b>OR/OF</b></p> <p>From Venn diagram:  <math>0,3 + 0,1 + 0,45 = 0,85</math></p>	<p>✓ substitution</p> <p>✓ answer (2)</p> <p><b>OR/OF</b></p> <p>✓ <math>1 - 0,15</math></p> <p>✓ answer (2)</p> <p><b>OR/OF</b></p> <p>✓ substitution</p> <p>✓ answer (2)</p>
11.2	<p><math>(5 \times 1 \times 5) + (5 \times 1 \times 6) + (5 \times 1 \times 6) + (5 \times 1 \times 5) = 110</math></p> <p><math>110 \times 5 = 550 &gt; 500</math></p> <p>Not possible, because not enough space</p> <p><b>OR/OF</b></p> <p><math>(5 \times 2 \times 5) + (5 \times 2 \times 6) = 110</math></p> <p><math>110 \times 5 = 550 &gt; 500</math></p> <p>Not possible because not enough space</p> <p><b>OR/OF</b></p>	<p>✓ <math>5 \times 1 \times 5</math></p> <p>✓ <math>5 \times 1 \times 6</math></p> <p>✓ <math>5 \times 1 \times 6</math></p> <p>✓ <math>5 \times 1 \times 5</math></p> <p>✓ 110</p> <p>✓ conclusion (6)</p> <p><b>OR/OF</b></p> <p>✓ <math>5 \times 2 \times 5</math></p> <p>✓ <math>5 \times 2 \times 6</math></p> <p>✓ 110</p> <p>✓ conclusion (6)</p> <p><b>OR/OF</b></p>



Mathematics P1/*Wiskunde V1*

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$5 \times 4 \times 6 = 120$ $5 \times 2 = 10$ $\therefore 120 - 10 = 110$  $110 \times 5 = 550 > 500$  Not possible because not enough space	$\checkmark \checkmark 5 \times 4 \times 6 = 120$ $\checkmark 5 \times 2 = 10$ $\checkmark 120 - 10$ $\checkmark 110$ $\checkmark$ conclusion (6)
	<b>[11]</b>

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# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**SENIOR CERTIFICATE/  
NATIONAL SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**NOVEMBER 2020**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 10 pages and 1 information sheet.**

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Mathematics/P1

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**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 - 6x = 0$  (2)

1.1.2  $x^2 + 10x + 8 = 0$  (correct to TWO decimal places) (3)

1.1.3  $(1-x)(x+2) < 0$  (3)

1.1.4  $\sqrt{x+18} = x-2$  (5)

1.2 Solve simultaneously for  $x$  and  $y$ :

$x + y = 3$  and  $2x^2 + 4xy - y = 15$  (6)

1.3 If  $n$  is the largest integer for which  $n^{200} < 5^{300}$ , determine the value of  $n$ . (3)  
[22]**QUESTION 2**2.1  $7 ; x ; y ; -11 ; \dots$  is an arithmetic sequence. Determine the values of  $x$  and  $y$ . (4)2.2 Given the quadratic number pattern:  $-3 ; 6 ; 27 ; 60 ; \dots$ 2.2.1 Determine the general term of the pattern in the form  $T_n = an^2 + bn + c$ . (4)2.2.2 Calculate the value of the 50<sup>th</sup> term of the pattern. (2)2.2.3 Show that the sum of the first  $n$  first-differences of this pattern can be given by  $S_n = 6n^2 + 3n$ . (3)2.2.4 How many consecutive first-differences were added to the first term of the quadratic number pattern to obtain a term in the quadratic number pattern that has a value of 21 060? (4)  
[17]

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**QUESTION 3**

3.1 Prove that  $\sum_{k=1}^{\infty} 4 \cdot 3^{2-k}$  is a convergent geometric series. Show ALL your calculations. (3)

3.2 If  $\sum_{k=p}^{\infty} 4 \cdot 3^{2-k} = \frac{2}{9}$ , determine the value of  $p$ . (5)

**[8]****QUESTION 4**

4.1 Given:  $h(x) = \frac{-3}{x-1} + 2$

4.1.1 Write down the equations of the asymptotes of  $h$ . (2)

4.1.2 Determine the equation of the axis of symmetry of  $h$  that has a negative gradient. (2)

4.1.3 Sketch the graph of  $h$ , showing the asymptotes and the intercepts with the axes. (4)

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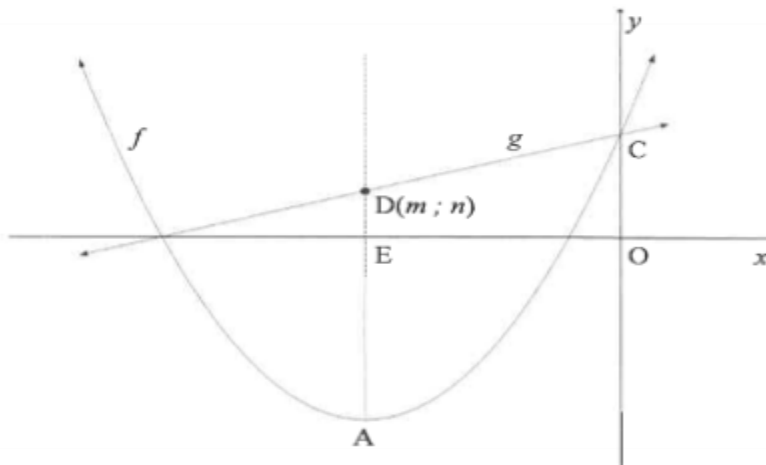
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4.2 The graphs of  $f(x) = \frac{1}{2}(x+5)^2 - 8$  and  $g(x) = \frac{1}{2}x + \frac{9}{2}$  are sketched below.

- A is the turning point of  $f$ .
- The axis of symmetry of  $f$  intersects the  $x$ -axis at E and the line  $g$  at  $D(m; n)$ .
- C is the  $y$ -intercept of  $f$  and  $g$ .



- 4.2.1 Write down the coordinates of A. (2)
- 4.2.2 Write down the range of  $f$ . (1)
- 4.2.3 Calculate the values of  $m$  and  $n$ . (3)
- 4.2.4 Calculate the area of OCDE. (3)
- 4.2.5 Determine the equation of  $g^{-1}$ , the inverse of  $g$ , in the form  $y = \dots$  (2)
- 4.2.6 If  $h(x) = g^{-1}(x) + k$  is a tangent to  $f$ , determine the coordinates of the point of contact between  $h$  and  $f$ . (4)

[23]

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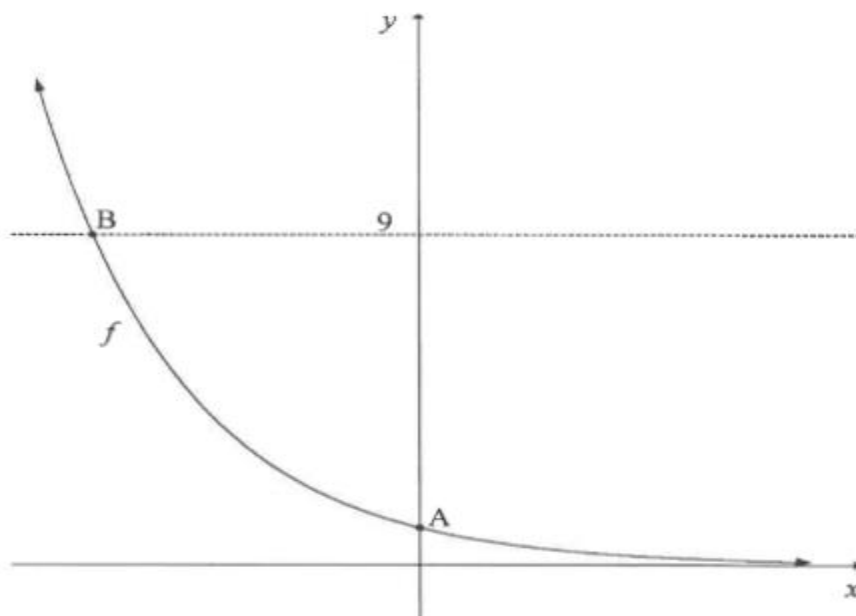
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**QUESTION 5**

The graph of  $f(x) = 3^{-x}$  is sketched below. A is the  $y$ -intercept of  $f$ .  
B is the point of intersection of  $f$  and the line  $y = 9$ .



- 5.1 Write down the coordinates of A. (1)
- 5.2 Determine the coordinates of B. (3)
- 5.3 Write down the domain of  $f^{-1}$ . (2)
- 5.4 Describe the translation from  $f$  to  $h(x) = \frac{27}{3^x}$ . (3)
- 5.5 Determine the values of  $x$  for which  $h(x) < 1$ . (3)
- [12]

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**QUESTION 6**

- 6.1 On 31 January 2020, Tshepo made the first of his monthly deposits of R1 000 into a savings account. He continues to make monthly deposits of R1 000 at the end of each month up until 31 January 2032. The interest rate was fixed at 7,5% p.a., compounded monthly.
- 6.1.1 What will the investment be worth immediately after the last deposit? (4)
- 6.1.2 If he makes no further payments but leaves the money in the account, how much money will be in the account on 31 January 2033? (2)
- 6.2 Jim bought a new car for R250 000. The value of the car depreciated at a rate of 22% p.a. annually according to the reducing-balance method. After how many years will its book value be R92 537,64? (3)
- 6.3 Mpho is granted a loan under the following conditions:
- The interest rate is 11,3% p.a., compounded monthly.
  - The period of the loan is 6 years.
  - The monthly repayment on the loan is R1 500.
  - Her first repayment is made one month after the loan is granted.
- 6.3.1 Calculate the value of the loan. (3)
- 6.3.2 How much interest will Mpho pay in total over the first 5 years? (4)
- [16]**

**QUESTION 7**

- 7.1 Determine  $f'(x)$  from first principles if  $f(x) = 2x^2 - 1$ . (5)
- 7.2 Determine:
- 7.2.1  $\frac{d}{dx}(\sqrt[3]{x^2 + x^3})$  (3)
- 7.2.2  $f'(x)$  if  $f(x) = \frac{4x^2 - 9}{4x + 6}$  ;  $x \neq -\frac{3}{2}$  (4)
- [12]**



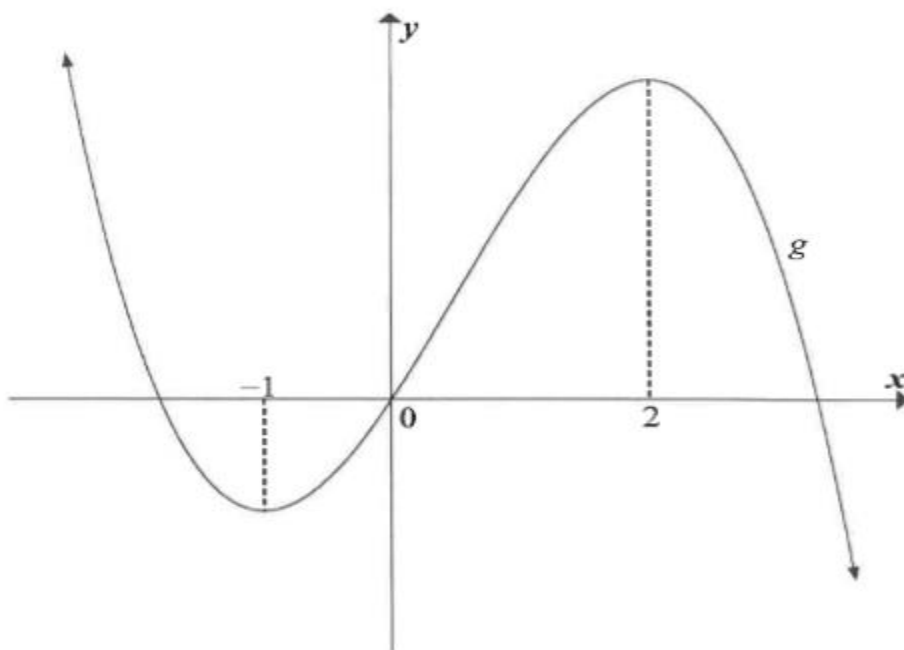
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**QUESTION 8**

The graph of  $g(x) = ax^3 + bx^2 + cx$ , a cubic function having a  $y$ -intercept of 0, is drawn below. The  $x$ -coordinates of the turning points of  $g$  are  $-1$  and  $2$ .



- 8.1 For which values of  $x$  will  $g$  increase? (2)
- 8.2 Write down the  $x$ -coordinate of the point of inflection of  $g$ . (2)
- 8.3 For which values of  $x$  will  $g$  be concave down? (2)
- 8.4 If  $g'(x) = -6x^2 + 6x + 12$ , determine the equation of  $g$ . (4)
- 8.5 Determine the equation of the tangent to  $g$  that has the maximum gradient. Write your answer in the form  $y = mx + c$ . (5)
- [15]**



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**QUESTION 9**

A closed rectangular box has to be constructed as follows:

- Dimensions: length ( $l$ ), width ( $w$ ) and height ( $h$ ).
- The length ( $l$ ) of the base has to be 3 times its width ( $w$ ).
- The volume has to be  $5 \text{ m}^3$ .

The material for the top and the bottom parts costs R15 per square metre and the material for the sides costs R6 per square metre.

9.1 Show that the cost to construct the box can be calculated by:  $\text{Cost} = 90w^2 + 48wh$  (4)

9.2 Determine the width of the box such that the cost to build the box is a minimum. (6)  
[10]

**QUESTION 10**

In a certain country, 10-digit telephone numbers with the following format were introduced:

Format	Area Code	Exchange Code	Number
Number of digits	3 digits	3 digits	4 digits
Example	901	544	1230

Digits may be repeated.

10.1 How many possible 10-digit telephone numbers could be formed? (2)

10.2 Certain restrictions were placed on the groups of digits:

- Area code: must be 3 digits and the first digit can NOT be 0 or 1
- Exchange code: must be 3 digits and the first and second digits can NOT be 0 or 1
- Number: must be 4 digits and the first digit MUST be a 0 or 1

10.2.1 How many valid 10-digit telephone numbers could be formed by applying the given restrictions? (3)

10.2.2 Determine the probability that any randomly chosen 10-digit telephone number would be a valid phone number. (2)  
[7]





Mathematics/P1

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**QUESTION 11**

Harry shoots arrows at a target board. He has a 50% chance of hitting the bull's eye on each shot.

- 11.1 Calculate the probability that Harry will hit the bull's eye in his first shot and his second shot. (2)
- 11.2 Calculate the probability that Harry will hit the bull's eye at least twice in his first three shots. (3)
- 11.3 Glenda also has a 50% chance of hitting the bull's eye on each shot. Harry and Glenda will take turns to shoot an arrow and the first person to hit the bull's eye will be the winner. Calculate the probability that the person who shoots first will be the winner of the challenge. (3)
- [8]

**TOTAL: 150**

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# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**SENIOR CERTIFICATE/*SENIOR SERTIFIKAAT*  
NATIONAL SENIOR CERTIFICATE/  
*NASIONALE SENIOR SERTIFIKAAT***

**GRADE 12/*GRAAD 12***

**MATHEMATICS P1/*WISKUNDE V1***

**NOVEMBER 2020**

**MARKING GUIDELINES/*NASIENRIGLYNE***

**MARKS/*PUNTE*: 150**

**These guidelines consist of 18 pages.  
*Hierdie nasienriglyne bestaan uit 18 bladsye.***



**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in all aspects of the marking memorandum.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

**REMEMBER:** (A) next to the description of a tick implies accuracy mark

**ONTHOU:** (A) langs die beskrywing van 'n regmerk impliseer akkuraatheids-punt

**QUESTION/VRAAG 1**

1.1.1	$x^2 - 6x = 0$ $x(x - 6) = 0$ $x = 0 \text{ or } x = 6$	✓ common factor ✓ both answers (2)
1.1.2	$x^2 + 10x + 8 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-10 \pm \sqrt{10^2 - 4(1)(8)}}{2(1)}$ $= \frac{-10 \pm \sqrt{68}}{2}$ $x = -0,88 \text{ or } x = -9,12$	✓ substitution into the correct formula ✓ -0,88 ✓ -9,12 (3)
1.1.3	$(1-x)(x+2) < 0$ Critical values: $x = 1 \text{ or } x = -2$ <div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: center;"> </div> <div style="margin: 0 20px;">or</div> <div style="text-align: center;"> </div> </div> $x < -2 \text{ or } x > 1$	✓ critical values ✓ correct method ✓ answer (3)
1.1.4	$\sqrt{x+18} = x-2$ $x+18 = x^2 - 4x + 4$ $0 = x^2 - 5x - 14$ $(x-7)(x+2) = 0$ $x = 7 \text{ or } x = -2$	✓ squaring both sides (m) ✓ standard form ✓ factors ✓ both answers ✓ rejection of $x = -2$ (5)



1.2	$x + y = 3$ $y = 3 - x \dots\dots (1)$ $2x^2 + 4xy - y = 15 \dots\dots (2)$ <p>Substitute (1) into (2):</p> $2x^2 + 4x(3 - x) - (3 - x) = 15$ $2x^2 + 12x - 4x^2 - 3 + x - 15 = 0$ $-2x^2 + 13x - 18 = 0$ $2x^2 - 13x + 18 = 0$ $(2x - 9)(x - 2) = 0$ $x = \frac{9}{2} \text{ or } x = 2$ $y = -\frac{3}{2} \text{ or } y = 1$ <p><b>OR</b></p> $x + y = 3$ $x = 3 - y \dots\dots (1)$ $2x^2 + 4xy - y = 15 \dots\dots (2)$ <p>Substitute (1) into (2):</p> $2(3 - y)^2 + 4(3 - y)y - y = 15$ $2y^2 - 12y + 18 - 4y^2 + 12y - y - 15 = 0$ $-2y^2 - y + 3 = 0$ $2y^2 + y - 3 = 0$ $(2y + 3)(y - 1) = 0$ $y = -\frac{3}{2} \text{ or } y = 1$ $x = \frac{9}{2} \text{ or } x = 2$	<p>✓ <math>y</math> subject of the formula</p> <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ <math>x</math>-values</p> <p>✓ <math>y</math>-values</p> <p>(6)</p> <p><b>OR</b></p> <p>✓ <math>x</math> subject of the formula</p> <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ <math>y</math>-values</p> <p>✓ <math>x</math>-values</p> <p>(6)</p>
1.3	$n^{200} < 5^{300}$ $(n^2)^{100} < (5^3)^{100}$ $(n^2)^{100} < (125)^{100}$ $n^2 < 125$ <p>Maximum value of <math>n</math> is 11.</p> <p><b>OR</b></p> $200 \log n < 300 \log 5$ $n < 10^{\frac{3}{2} \log 5}$ $n < 11,18$ $\therefore n = 11$ <p><b>OR</b></p>	<p>✓ <math>(n^2)^{100} &lt; (5^3)^{100}</math></p> <p>✓ <math>n^2 &lt; 125</math></p> <p>✓ 11</p> <p>(3)</p> <p><b>OR</b></p> <p>✓ use of logs</p> <p>✓ <math>n &lt; 11,18</math></p> <p>✓ 11</p> <p>(3)</p> <p><b>OR</b></p>



Mathematics P1/Wiskunde V1

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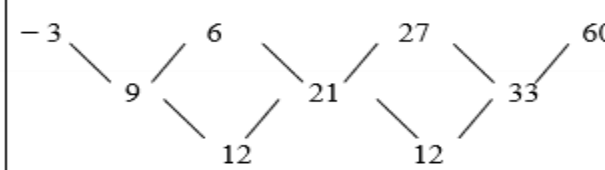
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	$n^{200} < 5^{300}$ $(n^2)^{100} < (5^3)^{100}$ $\sqrt{n^2} < \sqrt{5^3}$ $n < 5^{\frac{3}{2}}$ $n < 11,18$ $\therefore n = 11$ <p><b>OR</b></p> $n^{200} < 5^{300}$ $n < 5^{\frac{300}{200}}$ $n < 11,18$ $\therefore n = 11$	$\checkmark (n^2)^{100} < (5^3)^{100}$ $\checkmark n < 11,18$ $\checkmark 11 \quad (3)$ <p><b>OR</b></p> $\checkmark n < 5^{\frac{300}{200}}$ $\checkmark n < 11,18$ $\checkmark n = 11 \quad (3)$
		<b>[22]</b>



## QUESTION/VRAAG 2

2.1	$7 ; x ; y ; -11 ; \dots$ $a = 7$ $a + 3d = -11$ $7 + 3d = -11$ $d = -6$ $x = a + d = 7 + (-6) = 1$ $y = a + 2d = 7 + 2(-6) = -5$  <b>OR</b> $a + 3d = -11$ $3d = -11 - 7$ $3d = -18$ $d = -6$ $x = 1$ $y = -5$  <b>OR</b> $x - 7 = y - x$ and $y - x = -11 - y$ $2x - 7 = y \dots(1)$ $2y = -11 + x \dots(2)$ (1) into (2) $2(2x - 7) = -11 + x$ $4x - 14 = -11 + x$ $3x = 3$ $x = 1$ $y = 2(1) - 7 = -5$	$\checkmark 7 + 3d = -11$ $\checkmark d = -6$ $\checkmark$ value of $x$ $\checkmark$ value of $y$  (4)  <b>OR</b> $\checkmark 3d = -11 - 7$  $\checkmark d = -6$ $\checkmark x = 1$ $\checkmark y = -5$  (4)  <b>OR</b> $\checkmark 2$ equations  $\checkmark$ substitution  $\checkmark$ value of $x$ $\checkmark$ value of $y$  (4)
2.2.1	$-3 ; 6 ; 27 ; 60 ; \dots$  $2a = 12$ $a = 6$ $3a + b = 9$ $3(6) + b = 9$ $b = -9$ $a + b + c = -3$ $6 - 9 + c = -3$ $c = 0$ $T_n = 6n^2 - 9n$	$\checkmark$ second difference  $\checkmark a = 6$  $\checkmark b = -9$  $\checkmark c = 0$  (4)

2.2.2	$T_{50} = 6(50)^2 - 9(50)$ $= 14\ 550$	<b>Answer Only: Full Marks</b>	✓ substitute 50 ✓ answer (2)
2.2.3	$9 ; 21 ; 33 ; \dots$ $a = 9$ $d = 12$ $S_n = \frac{n}{2} [2a + (n-1)d]$ $S_n = \frac{n}{2} [2(9) + (n-1)(12)]$ $= \frac{n}{2} [18 + 12n - 12]$ $= \frac{n}{2} [12n + 6]$ $= 6n^2 + 3n$		✓ $a$ and $d$  ✓ substitution into the correct formula  ✓ $\frac{n}{2} [12n + 6]$  (3)
2.2.4	$-3 + S_n = 21060$ $S_n = 21063$ $6n^2 + 3n = 21063$ $6n^2 + 3n - 21063 = 0$ $2n^2 + n - 7021 = 0$  $n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$  $n = \frac{-1 \pm \sqrt{(1)^2 - 4(1)(-7021)}}{2(2)}$  $n = 59 \text{ or } n \neq \frac{-119}{2}$ $\therefore n = 59$  <b>OR</b>  $T_n = 21060$ $6n^2 - 9n - 21060 = 0$ $2n^2 - 3n - 7020 = 0$ $n = 60$  $\therefore 59$ first differences must be added.		✓ $-3 + S_n = 21060$  ✓ equation  ✓ standard form    ✓ answer   ✓ equation ✓ standard form   ✓ ✓ answer  (4)
			(4)
			[17]

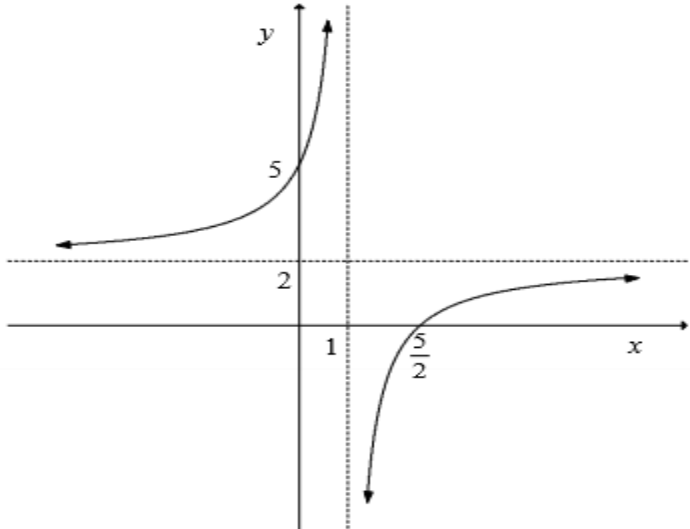
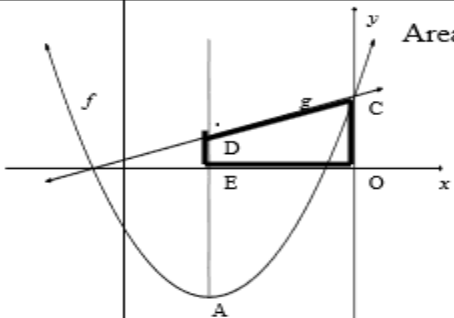


## QUESTION/VRAAG 3

3.1	$\sum_{k=1}^{\infty} 4 \cdot 3^{2-k} = 12 + 4 + \frac{4}{3} + \dots$ $r = \frac{4}{12} = \frac{1}{3}$ $-1 < \frac{1}{3} < 1$ $\therefore \text{series is convergent } (-1 < r < 1)$	<p>✓ <math>12 + 4 + \frac{4}{3} + \dots</math> or <math>36 \left(\frac{1}{3}\right)^k</math></p> <p>✓ value of <math>r</math></p> <p>✓ <math>-1 &lt; r &lt; 1</math></p> <p style="text-align: right;">(3)</p>
3.2	$\sum_{k=p}^{\infty} 4 \cdot 3^{2-k} = 4 \cdot 3^{2-p} + 4 \cdot 3^{1-p} + 4 \cdot 3^{-p} + \dots$ $a = 4 \cdot 3^{2-p}$ $r = \frac{1}{3}$ $S_{\infty} = \frac{a}{1-r}$ $\frac{2}{9} = \frac{4 \cdot 3^{2-p}}{1 - \frac{1}{3}}$ $4 \cdot 3^{2-p} = \frac{4}{27}$ $3^{2-p} = 3^{-3}$ $2 - p = -3$ $p = 5$	<p>✓ expression for <math>a</math></p> <p>✓ substitution of <math>a</math>, <math>r</math> and <math>S_{\infty}</math></p> <p>✓ simplification <math>\left(4 \cdot 3^{2-p} = \frac{4}{27}\right)</math></p> <p>✓ <math>3^{2-p} = 3^{-3}</math></p> <p>✓ answer</p> <p style="text-align: right;">(5)</p>
		<b>[8]</b>



## QUESTION/VRAAG 4

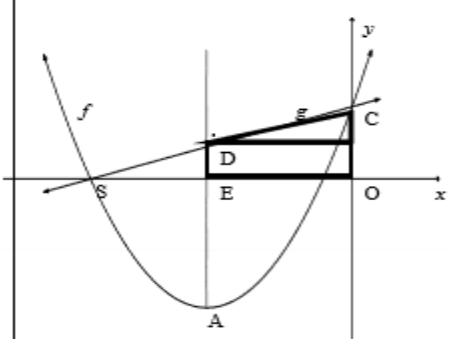
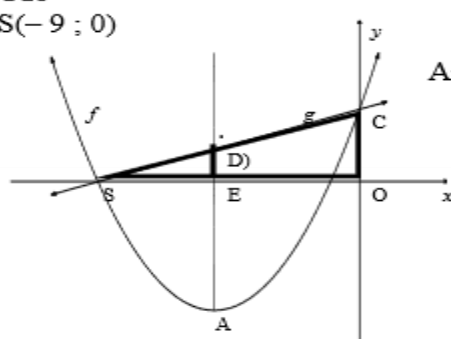
4.1.1	$x = 1$ $y = 2$	<ul style="list-style-type: none"> <li>✓ <math>x = 1</math></li> <li>✓ <math>y = 2</math> (2)</li> </ul>
4.1.2	$y = mx + c$ $y - y_1 = m(x - x_1)$ $y = -(x - p) + q$ $2 = -1 + c$ or $y - 2 = -1(x - 1)$ or $= -(x - 1) + 2$ $c = 3$ $y - 2 = -x + 1$ $y = -x + 3$ $y = -x + 3$ $y = -x + 3$	<ul style="list-style-type: none"> <li>✓ substitution of <math>m = -1</math> and <math>(1; 2)</math></li> <li>✓ answer (2)</li> </ul>
4.1.3		<ul style="list-style-type: none"> <li>✓ vertical asymptote: <math>x = 1</math> and horizontal asymptote: <math>y = 2</math></li> <li>✓ x-intercept: <math>\frac{5}{2}</math></li> <li>✓ y-intercept: 5</li> <li>✓ shape (A) (4)</li> </ul>
4.2.1	$(-5; -8)$	<ul style="list-style-type: none"> <li>✓ <math>x = -5</math> ✓ <math>y = -8</math> (2)</li> </ul>
4.2.2	$y \geq -8$ or $[-8; \infty)$	<ul style="list-style-type: none"> <li>✓ answer (1)</li> </ul>
4.2.3	$m = -5$ $n = g(-5)$ $= \frac{1}{2}(-5) + \frac{9}{2}$ $= 2$	<ul style="list-style-type: none"> <li>✓ <math>m = -5</math></li> <li>✓ substitution</li> <li>✓ <math>n = 2</math> (3)</li> </ul>
4.2.4	 <p>Area trapezium = <math>\frac{1}{2}(DE + OC) \times OE</math>  <math>= \frac{1}{2}(2 + 4,5) \times 5</math>  <math>= \frac{65}{4}</math> or 16,25</p> <p>OR</p>	<ul style="list-style-type: none"> <li>✓ method</li> <li>✓ correct substitution</li> <li>✓ answer (3)</li> </ul> <p>OR</p>

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	 <p>Area <math>\Delta = \frac{1}{2} b.h</math></p> $= \frac{1}{2} (5) \left( \frac{5}{2} \right)$ $= \frac{25}{4}$ <p>Area rect = <math>b.h</math></p> $= (5)(2)$ $= 10$ <p>Area trapezium = <math>\frac{25}{4} + 10 = \frac{65}{4}</math> or 16,25</p> <p><b>OR</b> S(-9 ; 0)</p>  <p>Area <math>\Delta SOC = \frac{1}{2} b.h</math></p> $= \frac{1}{2} (9) \left( \frac{9}{2} \right)$ $= \frac{81}{4}$ <p>Area <math>\Delta SED = \frac{1}{2} b.h = \frac{1}{2} (4)(2) = 4</math></p> <p>Area trapezium = area <math>\Delta SOC - \text{Area } \Delta SED</math></p> $= \frac{81}{4} - 4$ $= \frac{65}{4} \text{ or } 16,25$	<p>✓ method</p> <p>✓ correct substitution</p> <p>✓ answer (3)</p> <p><b>OR</b></p> <p>✓ method</p> <p>✓ correct substitution</p> <p>✓ answer (3)</p>
4.2.5	$g^{-1}: x = \frac{1}{2}y + \frac{9}{2}$ $g^{-1}: y = 2x - 9$	<p>✓ changing x and y</p> <p>✓ answer (2)</p>



4.2.6	$f(x) = \frac{1}{2}(x+5)^2 - 8$ $f(x) = \frac{1}{2}(x^2 + 10x + 25) - 8$ $f(x) = \frac{1}{2}x^2 + 5x + 4,5$ $f'(x) = x + 5$ $h(x) = 2x - 9 + k$ $x + 5 = 2$ $x = -3 \quad y = -6$ $(-3; -6)$ <p><b>OR</b></p> $f(x) = h(x)$ $\frac{1}{2}(x+5)^2 - 8 = 2x - 9 + k$ $\frac{1}{2}x^2 + 3x + \frac{27}{2} - k = 0$ $x = \frac{-3}{2\left(\frac{1}{2}\right)} = -3 \quad b^2 - 4ac = 0$ $y = -6$ $(-3; -6)$	$\checkmark f'(x)$ $\checkmark x + 5 = 2$ $\checkmark x = -3 \quad \checkmark y = -6$ <p style="text-align: right;">(4)</p> <p><b>OR</b></p> $\checkmark \text{equating}$ $\checkmark \text{turning point} / \Delta = 0$ $\checkmark x = -3 \quad \checkmark y = -6$ <p style="text-align: right;">(4)</p> <p style="text-align: right;"><b>[23]</b></p>
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## QUESTION/VRAAG 5

5.1	A(0 ; 1)	✓ answer (1)
5.2	$9 = 3^{-x}$ $3^2 = 3^{-x}$ $x = -2$ B(-2 ; 9)	✓ equating ✓ $3^2 = 3^{-x}$ ✓ $x = -2$ (3)
5.3	$x \in (0; \infty)$ or $x > 0$	✓✓ answer (2)
5.4	$h(x) = 27 \cdot 3^{-x}$ $h(x) = 3^{-(x-3)}$ <i>f</i> shifted 3 units to the right	✓ $h(x) = 3^{-(x-3)}$ ✓ 3 units ✓ right (3)
5.5	$\frac{27}{3^x} < 1$ $3^{-x+3} < 1$ $3^x > 27$ or $3^{-x+3} < 3^0$ $3^x > 3^3$ $-x+3 < 0$ $x > 3$ $x > 3$  <b>OR</b>  The graph shifts 3 units to the right Thus the <i>y</i> -intercept shift 3 units to the right (3 ; 1) $\therefore x > 3$	✓ $3^x > 27$ or $3^{-x+3} < 3^0$ ✓ $3^x > 3^3$ or $-x+3 < 0$ ✓ $x > 3$  <b>OR</b> ✓ translation ✓ <i>y</i> -intercept ✓ answer (3)
		<b>[12]</b>





## QUESTION/VRAAG 6

6.1.1	$F = \frac{x[(1+i)^n - 1]}{i}$ $= \frac{1\,000 \left[ \left(1 + \frac{0,075}{12}\right)^{145} - 1 \right]}{\frac{0,075}{12}}$ $= R234\,888,53$	<ul style="list-style-type: none"> <li>✓ <math>n = 145</math></li> <li>✓ <math>i = \frac{0,075}{12}</math></li> <li>✓ substitution into the correct formula</li> <li>✓ answer</li> </ul>	(4)
6.1.2	$A = P(1+i)^n$ $= 234\,888,53 \left(1 + \frac{0,075}{12}\right)^{12}$ $= R253\,123,54$	<ul style="list-style-type: none"> <li>✓ substitution into the correct formula</li> <li>✓ answer</li> </ul>	(2)
6.2	$A = P(1-i)^n$ $92\,537,64 = 250\,000(1-0,22)^n$ $0,37015056 = (0,78)^n$ $n = \frac{\log 0,37015056}{\log 0,78}$ $n = 4 \text{ years}$	<ul style="list-style-type: none"> <li>✓ substitution into the correct formula</li> <li>✓ correct use of logs</li> <li>✓ answer</li> </ul>	(3)
6.3.1	<p>Loan amount: <math>= \frac{x[1 - (1+i)^{-n}]}{i}</math></p> $= \frac{1\,500 \left[ 1 - \left(1 + \frac{0,113}{12}\right)^{-72} \right]}{\frac{0,113}{12}}$ $= R78\,173,49323$	<ul style="list-style-type: none"> <li>✓ 72</li> <li>✓ substitution into the correct formula</li> <li>✓ answer</li> </ul>	(3)
6.3.2	<p>Balance after 5 years: <math>P = \frac{x[1 - (1+i)^{-n}]}{i}</math></p> $= \frac{1\,500 \left[ 1 - \left(1 + \frac{0,113}{12}\right)^{-12} \right]}{\frac{0,113}{12}}$ $= R16\,945,00629$ <p>Amount paid: <math>R1\,500 \times 60 = R90\,000</math></p> <p>Interest  <math>= \text{Amount paid} - [\text{Loan} - \text{Balance}]</math>  <math>= R90\,000 - [R78\,173,49323 - R16\,945,00629]</math>  <math>= R28\,771,51</math></p>	<ul style="list-style-type: none"> <li>✓ substitution (A)</li> <li>✓ R16 945,00629 (A)</li> <li>✓ R90 000 – [Loan – Balance]</li> <li>✓ answer</li> </ul>	(4)





	<p><b>OR</b> Balance</p> $= 78\,173,49 \left(1 + \frac{0,133}{12}\right)^{60} - \frac{1\,500 \left( \left(1 + \frac{0,113}{12}\right)^{60} - 1 \right)}{\frac{0,113}{12}}$ <p>Balance = R16 945.00</p> <p>Amount paid: R1 500 × 60 = R90 000</p> <p>Interest = Amount paid – [Loan – Balance] = R90 000 – [R78 173,49323 – R16 945,00629] = R28 771,51</p>	<p><b>OR</b></p> <p>✓ substitution</p> <p>✓ R16 945,00629</p> <p>✓ R90 000 – [Loan – Balance]</p> <p>✓ answer (4)</p>
		<b>[16]</b>



**QUESTION/VRAAG 7****Penalty of – 1 for notation only in 7.1**

7.1	$f(x) = 2x^2 - 1$ $f(x+h) = 2(x+h)^2 - 1$ $= 2(x^2 + 2xh + h^2) - 1$ $= 2x^2 + 4xh + 2h^2 - 1$ $f(x+h) - f(x) = 2x^2 + 4xh + 2h^2 - 1 - (2x^2 - 1)$ $= 2x^2 + 4xh + 2h^2 - 1 - 2x^2 + 1$ $= 4xh + 2h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{4xh + 2h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(4x + 2h)}{h}$ $= \lim_{h \rightarrow 0} (4x + 2h)$ $= 4x$	<p>✓ <math>2x^2 + 4xh + 2h^2 - 1</math></p> <p>✓ <math>4xh + 2h^2</math></p> <p>✓ substitution</p> <p>✓ simplification</p> <p>✓ answer</p> <p style="text-align: right;">(5)</p>
7.2.1	$\frac{d}{dx} \left( \sqrt[5]{x^2} + x^3 \right)$ $= \frac{d}{dx} \left( x^{\frac{2}{5}} + x^3 \right)$ $\frac{dy}{dx} = \frac{2}{5} x^{-\frac{3}{5}} + 3x^2$	<p>✓ <math>x^{\frac{2}{5}}</math></p> <p>✓ <math>\frac{2}{5} x^{-\frac{3}{5}}</math> ✓ <math>3x^2</math></p> <p style="text-align: right;">(3)</p>
7.2.2	$f(x) = \frac{4x^2 - 9}{4x + 6}$ $= \frac{(2x-3)(2x+3)}{2(2x+3)}$ $= \frac{2x-3}{2}$ $= x - \frac{3}{2}$ $f'(x) = 1$	<p>✓ <math>(2x-3)(2x+3)</math></p> <p>✓ <math>2(2x+3)</math></p> <p>✓ simplification to two separate terms</p> <p>✓ answer</p> <p style="text-align: right;">(4)</p>
<b>[12]</b>		



## QUESTION/VRAAG 8

8.1	$-1 < x < 2$	✓✓ answer (2)
8.2	$x = \frac{-1+2}{2}$ $x = \frac{1}{2}$	<div style="border: 1px solid black; padding: 5px; display: inline-block; text-align: center;"> <b>Answer Only: Full Marks</b> </div> ✓ method ✓ answer (2)
8.3	From the graph $x > \frac{1}{2}$	<div style="border: 1px solid black; padding: 5px; display: inline-block; text-align: center;"> <b>Answer Only: Full Marks</b> </div> ✓✓ answer (2)
8.4	$g(x) = ax^3 + bx^2 + cx$ $g'(x) = 3ax^2 + 2bx + c = -6x^2 + 6x + 12$ $3a = -6$ $2b = 6$ $c = 12$ $a = -2$ $b = 3$ $g(x) = -2x^3 + 3x^2 + 12x$	✓ $g'(x) = 3ax^2 + 2bx + c$ ✓ $a = -2$ ✓ $b = 3$ ✓ $g(x) = -2x^3 + 3x^2 + 12x$ (4)
8.5	$g'\left(\frac{1}{2}\right) = -6\left(\frac{1}{2}\right)^2 + 6\left(\frac{1}{2}\right) + 12$ $m = \frac{27}{2}$ or 13,5 $y = -2\left(\frac{1}{2}\right)^3 + 3\left(\frac{1}{2}\right)^2 + 12\left(\frac{1}{2}\right)$ $y = \frac{13}{2}$ or 6,5 $y - y_1 = m(x - x_1)$ $y - 6,5 = 13,5(x - 0,5)$ $y = 13,5x - 0,25$	✓ max gradient at $x = \frac{1}{2}$ ✓ answer  ✓ y value ✓ substitution ✓ answer (5)
		<b>[15]</b>





## QUESTION/VRAAG 9

9.1	<p>Total surface area = <math>2\ell w + 2wh + 2\ell h</math>            but: <math>\ell = 3w</math>            Total surface area = <math>6w^2 + 2wh + 6wh</math></p> $C = 15(6w^2) + 6(2wh + 6wh)$ $= 15(6w^2) + 6(8wh)$ $= 90w^2 + 48wh$	<p>✓ <math>2\ell w + 2wh + 2\ell h</math>            ✓ <math>\ell = 3w</math></p> <p>✓ <math>15(6w^2)</math>            ✓ <math>6(2wh + 6wh)</math></p> <p>(4)</p>
9.2	$5 = 3w^2h$ $h = \frac{5}{3w^2}$ $C = 90w^2 + 48wh$ $C(w) = 90w^2 + 48w\left(\frac{5}{3w^2}\right)$ $= 90w^2 + 80w^{-1}$ $C'(w) = 180w - 80w^{-2}$ $180w - 80w^{-2} = 0$ $180w^3 - 80 = 0$ $w^3 = \frac{80}{180}$ $w = \sqrt[3]{\frac{80}{180}}$ $w = 0,76$	<p>✓ <math>h = \frac{5}{3w^2}</math></p> <p>✓ substitution</p> <p>✓ <math>C(w) = 90w^2 + 80w^{-1}</math>            ✓ derivative            ✓ equating derivative to zero</p> <p>✓ value of <math>w</math></p> <p>(6)</p>
		<b>[10]</b>





**QUESTION/VRAAG 10**

10.1	$10^{10}$ or 10 000 000 000	✓✓ answer (2)
10.2.1	$\frac{8 \times 10 \times 10}{\text{Area}} \times \frac{8 \times 8 \times 10}{\text{exchange}} \times \frac{2 \times 10 \times 10 \times 10}{\text{number}}$ <p>No. of valid 10-digit numbers  <math>= (8 \times 10 \times 10) \times (8 \times 8 \times 10) \times (2 \times 10 \times 10 \times 10)</math>  <math>= 1,024 \times 10^9</math></p>	✓ $\frac{8 \times 10 \times 10}{\text{Area}}$ or $8 \times 8 \times 10$ ✓ $2 \times 10 \times 10 \times 10$ ✓ $1,024 \times 10^9$ (A) (3)
10.2.2	Probability = $\frac{1,024 \times 10^9}{10^{10}}$ $= \frac{64}{625} = 0,1024 = 10,24\%$	✓ $\frac{1,024 \times 10^9}{10^{10}}$ ✓ answer (2)
		<b>[7]</b>

**QUESTION/VRAAG 11**

11	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">First shot</th> <th style="width: 20%;">Second shot</th> <th style="width: 20%;">Third shot</th> <th style="width: 40%;"></th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td style="text-align: center;">B 0,5</td> <td style="text-align: right;">BBB</td> </tr> <tr> <td></td> <td style="text-align: center;">B 0,5</td> <td style="text-align: center;">N 0,5</td> <td style="text-align: right;">BBN</td> </tr> <tr> <td></td> <td style="text-align: center;">N 0,5</td> <td style="text-align: center;">B 0,5</td> <td style="text-align: right;">BNB</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">N 0,5</td> <td style="text-align: right;">BNN</td> </tr> <tr> <td></td> <td style="text-align: center;">B 0,5</td> <td style="text-align: center;">B 0,5</td> <td style="text-align: right;">NBB</td> </tr> <tr> <td></td> <td style="text-align: center;">N 0,5</td> <td style="text-align: center;">N 0,5</td> <td style="text-align: right;">NBN</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">B 0,5</td> <td style="text-align: right;">NNB</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">N 0,5</td> <td style="text-align: right;">NNN</td> </tr> </tbody> </table>	First shot	Second shot	Third shot				B 0,5	BBB		B 0,5	N 0,5	BBN		N 0,5	B 0,5	BNB			N 0,5	BNN		B 0,5	B 0,5	NBB		N 0,5	N 0,5	NBN			B 0,5	NNB			N 0,5	NNN	
First shot	Second shot	Third shot																																				
		B 0,5	BBB																																			
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		B 0,5	NNB																																			
		N 0,5	NNN																																			
11.1	P (Bull's eye first shot and second shot) $= 0,5 \times 0,5$ $= 0,25$ or $\frac{1}{4}$	✓ two 0,5's ✓ $0,5 \times 0,5$ (2)																																				





11.2	<p>P (Bull's eye at least twice in 3 shots)</p> $= (0,5 \times 0,5 \times 0,5) + (0,5 \times 0,5 \times 0,5) + (0,5 \times 0,5 \times 0,5) + (0,5 \times 0,5 \times 0,5)$ $= 0,125 + 0,125 + 0,125 + 0,125$ $= 0,5 \quad \text{or} \quad \frac{1}{2}$	<p>✓ <math>0,5 \times 0,5 \times 0,5</math></p> <p>✓ four events</p> <p>✓ answer (A)</p> <p>(3)</p>
11.3	<p>Person shoots first:</p> $(0,5) + (0,5)^3 + (0,5)^5 + \dots$ $P = \frac{a}{1-r}$ $P = \frac{0,5}{1-0,25}$ $P = \frac{2}{3} = 0,67$	<p>✓ <math>(0,5) + (0,5)^3</math></p> <p>✓ <math>\dots + (0,5)^5 + \dots</math></p> <p>✓ <math>P = \frac{0,5}{1-0,25}</math></p> <p>(3)</p>
		[8]

**TOTAL/TOTAAL: 150**



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**NOVEMBER 2021**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages and 1 information sheet.**





Mathematics P1

3  
NSC

DBE/November 2021

**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 - 2x - 24 = 0$  (3)

1.1.2  $2x^2 - 3x - 3 = 0$  (correct to TWO decimal places) (3)

1.1.3  $x^2 + 5x \leq -4$  (4)

1.1.4  $\sqrt{x+28} = 2-x$  (4)

1.2 Solve simultaneously for  $x$  and  $y$  in:

$2y = 3 + x$  and  $2xy + 7 = x^2 + 4y^2$  (6)

1.3 The roots of an equation are  $x = \frac{-n \pm \sqrt{n^2 - 4mp}}{2m}$  where  $m$ ,  $n$  and  $p$  are positive real numbers. The numbers  $m$ ,  $n$  and  $p$ , in that order, form a geometric sequence. Prove that  $x$  is a non-real number. (4)

**[24]****QUESTION 2**Given the geometric series:  $x + 90 + 81 + \dots$ 2.1 Calculate the value of  $x$ . (2)2.2 Show that the sum of the first  $n$  terms is  $S_n = 1\,000(1 - (0,9)^n)$ . (2)

2.3 Hence, or otherwise, calculate the sum to infinity. (2)

**[6]**



Mathematics P1

4  
NSC

DBE/November 2021

**QUESTION 3**Consider the quadratic number pattern:  $-145 ; -122 ; -101 ; \dots$ 

- 3.1 Write down the value of  $T_4$ . (1)
- 3.2 Show that the general term of this number pattern is  $T_n = -n^2 + 26n - 170$ . (3)
- 3.3 Between which TWO terms of the quadratic number pattern will there be a difference of  $-121$ ? (4)
- 3.4 What value must be added to each term in the number pattern so that the value of the maximum term in the new number pattern formed will be 1? (3)
- [11]**

**QUESTION 4**Consider the linear pattern:  $5 ; 7 ; 9 ; \dots$ 

- 4.1 Determine  $T_{51}$ . (3)
- 4.2 Calculate the sum of the first 51 terms. (2)
- 4.3 Write down the expansion of  $\sum_{n=1}^{5000} (2n+3)$ . Show only the first 3 terms and the last term of the expansion. (1)
- 4.4 Hence, or otherwise, calculate  $\sum_{n=1}^{5000} (2n+3) + \sum_{n=1}^{4999} (-2n-1)$ . (4)
- ALL working details must be shown. **[10]**

**QUESTION 5**Given:  $f(x) = \frac{-1}{x-3} + 2$ 

- 5.1 Write down the equations of the asymptotes of  $f$ . (2)
- 5.2 Write down the domain of  $f$ . (1)
- 5.3 Determine the coordinates of the  $x$ -intercept of  $f$ . (2)
- 5.4 Write down the coordinates of the  $y$ -intercept of  $f$ . (2)
- 5.5 Draw the graph of  $f$ . Clearly show ALL the asymptotes and intercepts with the axes. (3)
- [10]**





Mathematics P1

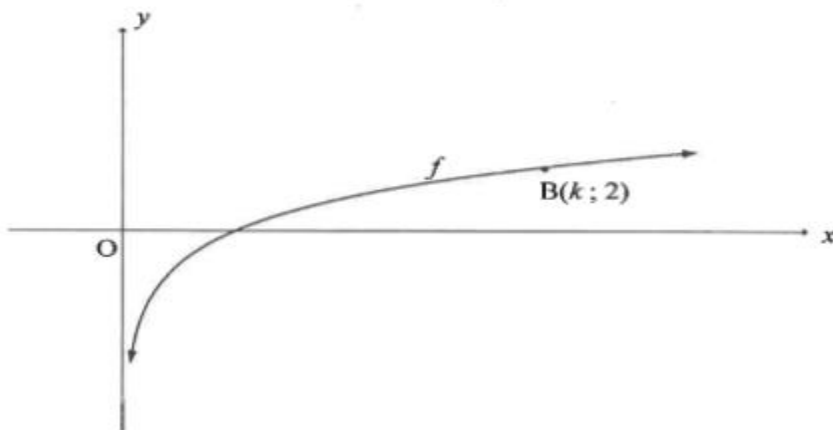
5  
NSC

DBE/November 2021

**QUESTION 6**

The graph of  $f(x) = \log_4 x$  is drawn below.

$B(k; 2)$  is a point on  $f$ .



- 6.1 Calculate the value of  $k$ . (2)
- 6.2 Determine the values of  $x$  for which  $-1 \leq f(x) \leq 2$ . (2)
- 6.3 Write down the equation of  $f^{-1}$ , the inverse of  $f$ , in the form  $y = \dots$  (2)
- 6.4 For which values of  $x$  will  $x \cdot f^{-1}(x) < 0$ ? (2)
- [8]**





Mathematics P1

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DBE/November 2021

**QUESTION 7**

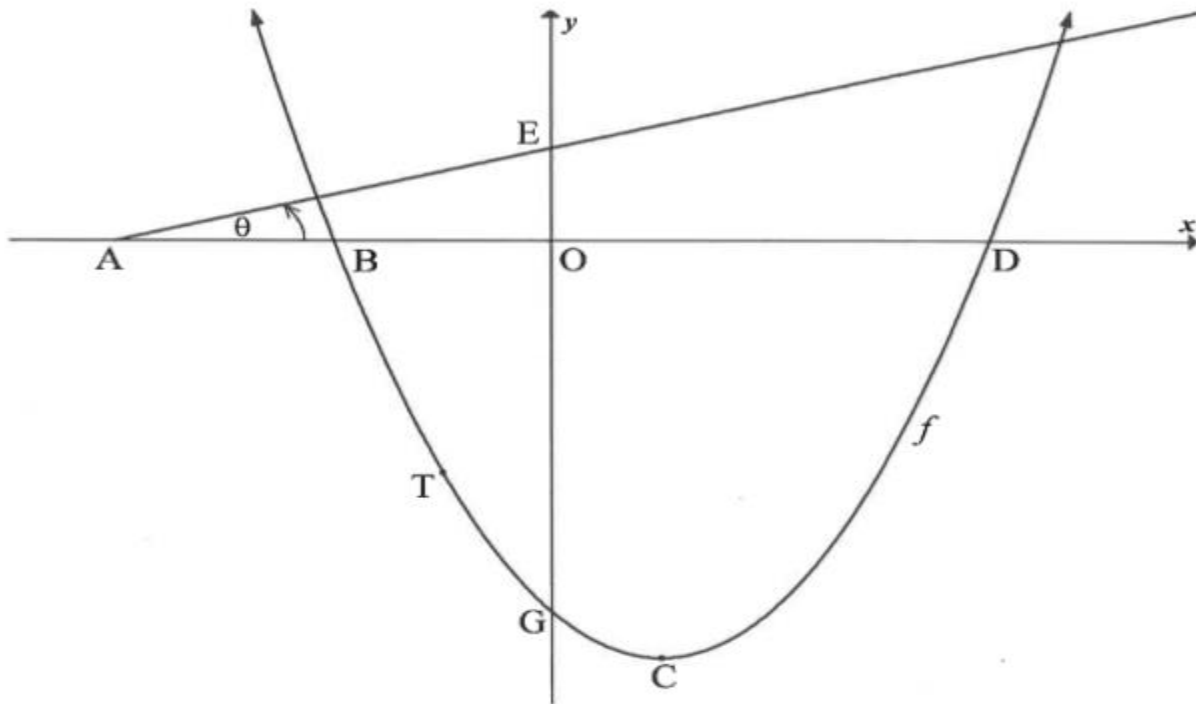
The graph of  $f(x) = (x+4)(x-6)$  is drawn below.

The parabola cuts the  $x$ -axis at B and D and the  $y$ -axis at G.

C is the turning point of  $f$ .

Line AE has an angle of inclination of  $\theta$  and cuts the  $x$ -axis and  $y$ -axis at A and E respectively.

T is a point on  $f$  between B and G.



- 7.1 Write down the coordinates of B and D. (2)
- 7.2 Calculate the coordinates of C. (2)
- 7.3 Write down the range of  $f$ . (1)
- 7.4 Given that  $\theta = 14,04^\circ$  and the tangent to  $f$  at T is perpendicular to AE.
- 7.4.1 Calculate the gradient of AE, correct to TWO decimal places. (1)
- 7.4.2 Calculate the coordinates of T. (5)
- 7.5 A straight line,  $g$ , parallel to AE, cuts  $f$  at  $K(-3; -9)$  and R. Calculate the  $x$ -coordinate of R. (6)
- [17]**

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Mathematics P1

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**QUESTION 8**

- 8.1 A farmer bought a tractor for R980 000. The value of the tractor depreciates annually at a rate of 9,2% p.a. on the reducing-balance method. Calculate the book value of the tractor after 7 years. (3)
- 8.2 How many years will it take for an amount of R75 000 to accrue to R116 253,50 in an account earning interest of 6,8% p.a., compounded quarterly? (4)
- 8.3 Thabo wanted to save R450 000 as a deposit to buy a house on 30 June 2018.
- 8.3.1 He deposited a fixed amount of money at the end of every month into an account earning interest of 8,35% p.a., compounded monthly. His first deposit was made on 31 July 2013 and his 60th deposit on 30 June 2018. Calculate the amount he deposited monthly. (3)
- 8.3.2 Thabo bought a house costing R1 500 000 and used his savings as the deposit. He obtained a home loan for the balance of the purchase price at an interest of 12% p.a., compounded monthly over 25 years. He made his first monthly instalment of R11 058,85 towards the loan on 31 July 2018.
- (a) What will the balance outstanding on the loan be on 30 June 2039, 21 years after the loan was granted? (3)
- (a) Calculate the interest Thabo will have paid over the first 21 years of the loan. (3)

**[16]****QUESTION 9**

- 9.1 Determine  $f'(x)$  from first principles if it is given that  $f(x) = 2x^2 - 3x$ . (5)
- 9.2 Determine:
- 9.2.1  $\frac{dy}{dx}$  if  $y = 4x^5 - 6x^4 + 3x$  (3)
- 9.2.2  $D_x \left[ -\frac{\sqrt{x}}{2} + \left( \frac{1}{3x} \right)^2 \right]$  (4)

**[12]**

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Mathematics P1

8  
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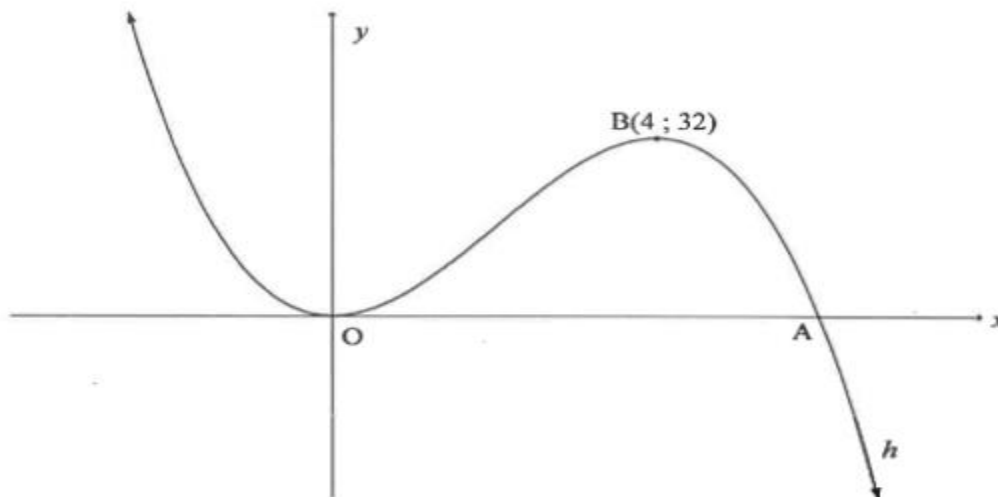
DBE/November 2021

**QUESTION 10**

The graph of  $h(x) = ax^3 + bx^2$  is drawn.

The graph has turning points at the origin,  $O(0 ; 0)$  and  $B(4 ; 32)$ .

A is an  $x$ -intercept of  $h$ .



- 10.1 Show that  $a = -1$  and  $b = 6$ . (5)
- 10.2 Calculate the coordinates of A. (3)
- 10.3 Write down the values of  $x$  for which  $h$  is:
- 10.3.1 Increasing (2)
- 10.3.2 Concave down (2)
- 10.4 For which values of  $k$  will  $-(x-1)^3 + 6(x-1)^2 - k = 0$  have one negative and two distinct positive roots? (3)
- [15]

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Mathematics P1

9  
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**QUESTION 11**

After travelling a distance of 20 km from home, a person suddenly remembers that he did not close a tap in his garden. He decides to turn around immediately and return home to close the tap.

The cost of the water, at the rate at which water is flowing out of the tap, is R1,60 per hour.

The cost of petrol is  $\left(1,2 + \frac{x}{4000}\right)$  rands per km, where  $x$  is the average speed in km/h.

Calculate the average speed at which the person must travel home to keep his cost as low as possible.

[7]

**QUESTION 12**

12.1 A and B are independent events. It is further given that:

$$P(A \text{ and } B) = 0,3 \text{ and } P(\text{only } B) = 0,2$$

12.1.1 Are A and B mutually exclusive? Motivate your answer.

(1)

12.1.2 Determine:

(a)  $P(\text{only } A)$

(4)

(b)  $P(\text{not } A \text{ or not } B)$

(2)

12.2 A teacher has 5 different poetry books, 4 different dramas and 3 different novels. She must arrange these 12 books from left to right on a shelf.

12.2.1 Write down the probability that a novel will be the first book placed on the shelf.

(1)

12.2.2 Calculate the number of different ways these 12 books can be placed on the shelf if any book can be placed in any position.

(2)

12.2.3 Calculate the probability that a poetry book is placed in the first position, the three novels are placed next to each other and a drama is placed in the last position.

(4)

[14]

**TOTAL: 150**

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# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE SENIOR  
SERTIFIKAAT**

**GRADE 12/GRAAD 12**

**MATHEMATICS P1/WISKUNDE V1**

**NOVEMBER 2021**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS/PUNTE: 150**

**These marking guidelines consist of 16 pages.  
Hierdie nasienriglyne bestaan uit 16 bladsye.**




**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in all aspects of the marking guidelines.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$x^2 - 2x - 24 = 0$ $(x - 6)(x + 4) = 0$ $x = 6$ or $x = -4$	✓ factors ✓ $x = 6$ ✓ $x = -4$	(3)
1.1.2	$2x^2 - 3x - 3 = 0$ $x = \frac{3 \pm \sqrt{(-3)^2 - 4(2)(-3)}}{2(2)}$ $x = \frac{3 \pm \sqrt{33}}{4}$ $x = 2,19$ or $x = -0,69$	✓ substitution into the correct formula  ✓ $x = 2,19$ ✓ $x = -0,69$	(3)
1.1.3	$x^2 + 5x \leq -4$ $x^2 + 5x + 4 \leq 0$ $(x + 4)(x + 1) \leq 0$ Critical values: $x = -4$ or $x = -1$  $-4 \leq x \leq -1$ OR/OF $x \in [-4 ; -1]$	✓ standard form  ✓ critical values   ✓ ✓ answer	(4)
1.1.4	$\sqrt{x + 28} = 2 - x$ $(\sqrt{x + 28})^2 = (2 - x)^2$ $x + 28 = 4 - 4x + x^2$ $x^2 - 5x - 24 = 0$ $(x - 8)(x + 3) = 0$ $x \neq 8$ or $x = -3$	✓ squaring both sides  ✓ standard form ✓ factors ✓ answers with selection	(4)



1.2	$2y = 3 + x$ $x = 2y - 3 \quad \dots (1)$ $2xy + 7 = x^2 + 4y^2 \quad \dots (2)$ $2y(2y - 3) + 7 = (2y - 3)^2 + 4y^2$ $4y^2 - 6y + 7 = 4y^2 - 12y + 9 + 4y^2$ $4y^2 - 6y + 2 = 0$ $2y^2 - 3y + 1 = 0$ $(2y - 1)(y - 1) = 0$ $y = \frac{1}{2} \text{ or } y = 1$ $x = -2 \text{ or } x = -1$ <p><b>OR/OF</b></p> $2y = 3 + x$ $y = \frac{3}{2} + \frac{x}{2} \quad \dots (1)$ $2xy + 7 = x^2 + 4y^2 \quad \dots (2)$ $2x\left(\frac{3}{2} + \frac{x}{2}\right) + 7 = x^2 + 4\left(\frac{3}{2} + \frac{x}{2}\right)^2$ $3x + x^2 + 7 = x^2 + 9 + 6x + x^2$ $x^2 + 3x + 2 = 0$ $(x + 2)(x + 1) = 0$ $x = -2 \text{ or } x = -1$ $y = \frac{1}{2} \text{ or } y = 1$	<p>✓ equation 1</p> <p>✓ substitution ✓ simplification</p> <p>✓ standard form</p> <p>✓ y – values ✓ x – values</p> <p>(6)</p> <p><b>OR/OF</b></p> <p>✓ equation 1</p> <p>✓ substitution</p> <p>✓ simplification ✓ standard form</p> <p>✓ x – values ✓ y – values</p> <p>(6)</p>
1.3	$\frac{n}{m} = \frac{p}{n}$ $n^2 = mp$ $\Delta = b^2 - 4ac$ $\Delta = n^2 - 4mp, \text{ but } n^2 = mp$ $\Delta = n^2 - 4n^2 \quad \text{OR/OF} \quad \Delta = mp - 4mp$ $\Delta = -3n^2 \quad \Delta = -3mp$ $n^2 > 0 \quad mp > 0$ $\therefore -3n^2 < 0 \quad \therefore -3mp < 0$ $\therefore \Delta < 0 \Rightarrow x \text{ is a non-real number}$	<p>✓ <math>\frac{n}{m} = \frac{p}{n}</math></p> <p>✓ <math>n^2 = mp</math></p> <p>✓ <math>\Delta = -3n^2</math> or <math>-3mp</math></p> <p>✓ <math>\Delta &lt; 0</math></p> <p>(4)</p>
<b>[24]</b>		

## QUESTION/VRAAG 2

2.1	$\frac{90}{x} = \frac{81}{90}$ $81x = 8100$ $x = 100$ <p><b>OR/OF</b></p> $x = 90 \times \frac{10}{9}$ $x = 100$	$\checkmark \frac{90}{x} = \frac{81}{90}$ $\checkmark \text{ answer} \quad (2)$ <p><b>OR/OF</b></p> $\checkmark \frac{10}{9}$ $\checkmark \text{ answer} \quad (2)$
2.2	$S_n = \frac{a(1-r^n)}{1-r}$ $S_n = \frac{100(1-(0,9)^n)}{1-0,9}$ $S_n = \frac{100(1-(0,9)^n)}{0,1}$ $\therefore S_n = 1\,000(1-(0,9)^n)$	$\checkmark r = 0,9$ $\checkmark \text{ substitution into correct formula} \quad (2)$
2.3	$S_\infty = \frac{a}{1-r}$ $S_\infty = \frac{100}{1-\frac{9}{10}}$ $S_\infty = 1000$ <p><b>OR/OF</b></p> $S_\infty = \lim_{n \rightarrow \infty} [1\,000(1-(0,9)^n)]$ $S_\infty = 1000$	$\checkmark \text{ substitution}$ $\checkmark \text{ answer} \quad (2)$ <p><b>OR/OF</b></p> $\checkmark S_\infty = \lim_{n \rightarrow \infty} [1\,000(1-(0,9)^n)]$ $\checkmark \text{ answer} \quad (2)$
<b>[6]</b>		



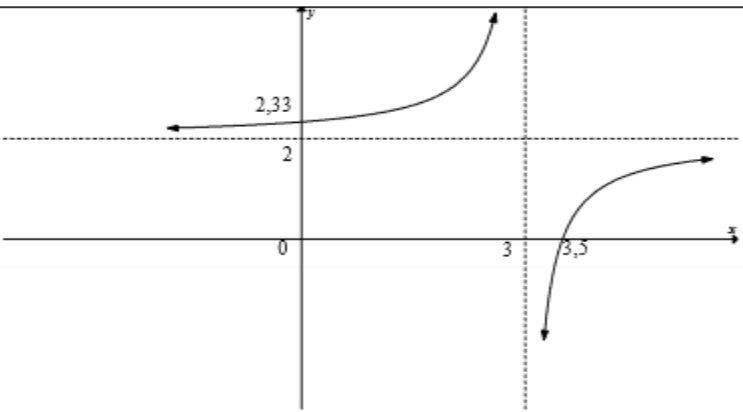


## QUESTION/VRAAG 4

4.1	$a = 5$ and/en $d = 2$ $T_{51} = 5 + (51 - 1)(2)$ $= 105$	✓ $a$ and $d$ ✓ substitution into correct formula ✓ answer (3)
4.2	$S_n = \frac{n}{2}[2a + (n - 1)d]$ $S_{51} = \frac{51}{2}[2(5) + (51 - 1)2]$ or/of $S_{51} = \frac{51}{2}[5 + 105]$ $= 2\ 805$	✓ substitution into correct formula ✓ answer (2)
4.3	$\sum_{n=1}^{5\ 000} (2n + 3) = 5 + 7 + 9 + \dots + 10\ 003$	✓ expansion (1)
4.4	$T_1 = -3$ $T_{4\ 999} = -2(4\ 999) - 1 = -9\ 999$ $\therefore \sum_{n=1}^{5\ 000} (2n + 3) + \sum_{n=1}^{4\ 999} (-2n - 1)$ $= (5 + 7 + 9 + \dots + 9\ 999 + 10\ 001 + 10\ 003) +$ $(-3 - 5 - 7 - 9 - \dots - 9\ 999)$ $= 10\ 001 + 10\ 003 - 3$ $= 20\ 001$ <b>OR/OF</b> $S_{4\ 999} = \frac{4\ 999}{2}[2(-3) + (4\ 999 - 1)(-2)] = -24\ 999\ 999$ $S_{5\ 000} = \frac{5\ 000}{2}((2)(5) + (5\ 000 - 1)(2)) = 25\ 020\ 000$ $\sum_{n=1}^{5\ 000} (2n + 3) + \sum_{n=1}^{4\ 999} (-2n - 1) = 25\ 020\ 000 - 24\ 999\ 999$ $= 20\ 001$	✓ $T_1 = -3$ ✓ $T_{4\ 999} = -9\ 999$  ✓ both expansions  ✓ answer (A) (4) <b>OR/OF</b> ✓ $T_1 = -3$ ✓ $S_{4\ 999} = -24\ 999\ 999$  ✓ $S_{5\ 000} = 25\ 020\ 000$  ✓ answer (A) (4)
		<b>[10]</b>



## QUESTION/VRAAG 5

5.1	$x = 3$ $y = 2$	✓ $x = 3$ ✓ $y = 2$ (2)
5.2	$x \in R, x \neq 3$ <b>OR/OF</b> $x \in (-\infty ; 3) \cup (3 ; \infty)$ <b>OR/OF</b> $x < 3$ or $x > 3$	✓ answer (1) <b>OR/OF</b> ✓ answer (1) <b>OR/OF</b> ✓ answer (1)
5.3	$0 = \frac{-1}{x-3} + 2$ $-2x + 6 = -1$ $x = \frac{7}{2}$ x-int: $\left(\frac{7}{2}; 0\right)$	✓ $y = 0$ ✓ answer (2)
5.4	y-int: $\left(0; \frac{7}{3}\right)$	✓ $x = 0$ ✓ $\frac{7}{3}$ (2)
5.5		✓ asymptotes ✓ intercepts with the axes ✓ shape (3)
		[10]



## QUESTION/VRAAG 6

6.1	$f(x) = \log_4 x$ $2 = \log_4 k$ $4^2 = k$ $\therefore k = 16$	✓ substitution of $(k; 2)$  ✓ answer  (2)
6.2	$-1 = \log_4 x \quad \therefore x = \frac{1}{4}$  $\frac{1}{4} \leq x \leq 16 \quad \text{or/of} \quad x \in \left[ \frac{1}{4}; 16 \right]$	✓ $x = \frac{1}{4}$  ✓ answer  (2)
6.3	$f(x) = \log_4 x$ $y = \log_4 x$ $x = \log_4 y$ $y = 4^x$	✓ swapping $x$ and $y$  ✓ answer  (2)
6.4	$x < 0$  <b>OR/OF</b>  $x \in (-\infty; 0)$	✓✓ answer  <b>OR/OF</b>  ✓✓ answer  (2)
		<b>[8]</b>





## QUESTION 7

7.1	B(-4 ; 0) D(6 ; 0)	✓ B(-4 ; 0) ✓ D(6 ; 0) (2)
7.2	$f(x) = x^2 - 2x - 24$ $x_{tp} = \frac{-b}{2a}$ <b>OR/OF</b> $2x - 2 = 0$ <b>OR/OF</b> $x = \frac{-4+6}{2}$ $x = \frac{-(-2)}{2(1)}$ $\therefore x_{tp} = 1$ $y_{tp} = f(1)$ $= 1^2 - 2(1) - 24$ $= -25$ C(1 ; -25)	✓ $x_{tp} = 1$  ✓ $y_{tp} = -25$ (2)
7.3	$y \geq -25$  <b>OR/OF</b>  $y \in [-25 ; \infty)$	✓ answer (1)  <b>OR/OF</b>  ✓ answer (1)
7.4.1	$m_{AE} = \tan 14,04^\circ = 0,25 = \frac{1}{4}$	✓ answer (1)
7.4.2	$m_{\text{tang}} = -4$ $f'(x) = 2x - 2$  $2x - 2 = -4$ $x_T = -1$ $y_T = -21$	✓ $m_{\text{tang}} = -4$ ✓ $f'(x) = 2x - 2$  ✓ equating ✓ $x_T = -1$ ✓ $y_T = -21$ (5)
7.5	$m_{\text{line}} = \frac{1}{4}$ $y + 9 = \frac{1}{4}(x + 3)$ <b>OR/OF</b> $-9 = \frac{1}{4}(-3) + c$ $y + 9 = \frac{1}{4}x + \frac{3}{4}$ $c = -\frac{33}{4} = -8,25$ $y = \frac{1}{4}x - \frac{33}{4}$ <b>OR/OF</b> $y = 0,25x - 8,25$ $x^2 - 2x - 24 = \frac{1}{4}x - \frac{33}{4}$ $4x^2 - 8x - 96 = x - 33$ $4x^2 - 9x - 63 = 0$ $(4x - 21)(x + 3) = 0$ $\therefore x = \frac{21}{4} = 5,25$ or $x \neq -3$	✓ $m_{\text{line}} = \frac{1}{4}$  ✓ substitution $m$ and $K(-3 ; -9)$  ✓ $y = \frac{1}{4}x - \frac{33}{4}$  ✓ equating  ✓ standard form  ✓ answer with selection (6)
		[17]





## QUESTION/VRAAG 8

8.1	$A = P(1 - i)^n$ $A = 980\,000(1 - 0,092)^7$ $A = R498\,685,82$	✓ correct formula ✓ substitution ✓ answer (A) (3)
8.2	$A = P(1 + i)^n$ $116\,253,50 = 75\,000 \left(1 + \frac{0,068}{4}\right)^{4n}$ $1,550\,046\,667 = (1,017)^{4n}$ $\log(1,550\,046\,667) = 4n \log(1,017)$ $4n = \frac{\log(1,550\,046\,667)}{\log(1,017)} \text{ or } 4n = \log_{1,017}(1,550\,046\,667)$ $4n = 25,99 \dots$ $n = 6,50 \text{ years}$	✓ $\frac{0,068}{4}$ ✓ substitution in correct formula ✓ correct use of logs ✓ answer (4)
8.3.1	$F = \frac{x[(1 + i)^n - 1]}{i}$ $450\,000 = \frac{x \left[ \left(1 + \frac{0,0835}{12}\right)^{60} - 1 \right]}{\frac{0,0835}{12}}$ $x = R6\,068,69$	✓ $i = \frac{0,0835}{12}$ ✓ substitution into correct formula ✓ answer (3)
8.3.2(a)	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $P = \frac{11\,058,85 \left[ 1 - \left(1 + \frac{0,12}{12}\right)^{-4 \times 12} \right]}{\frac{0,12}{12}}$ $P = R419\,948,32$ <p><b>OR/OF</b></p> $\text{Balance} = A - F$ $= P(1 + i)^n - \frac{x[(1 + i)^n - 1]}{i}$ $= 1\,050\,000 \left(1 + \frac{0,12}{12}\right)^{12 \times 21} - \frac{11\,058,85 \left[ \left(1 + \frac{0,12}{12}\right)^{12 \times 21} - 1 \right]}{\frac{0,12}{12}}$ $= R12\,887\,702,20 - R12\,467\,749,81$ $= R419\,952,39$	✓ $n = 48$ in P-formula ✓ substitution into correct formula ✓ answer (A) (3)  <b>OR/OF</b> ✓ $n = 252$ in both formulae ✓ subst into correct formulae ✓ answer (A) (3)



Mathematics P1/*Wiskunde VI*

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8.3.2(b)	<p>Total paid = <math>11\,058,85 \times 21 \times 12 = 2\,786\,830,20</math>          Loan Paid = <math>1\,050\,000 - 419\,948,32 = 630\,051,68</math>          Interest paid = <math>2\,786\,830,20 - 630\,051,68</math>                            = R2 156 778,52</p> <p><b>OR/OF</b></p> <p>Total paid = <math>11\,058,85 \times 21 \times 12 = 2\,786\,830,20</math>          Loan Paid = <math>1\,050\,000 - 419\,952,39 = 630\,047,61</math>          Interest paid = <math>2\,786\,830,20 - 630\,047,61</math>                            = R2 156 782,59</p> <p><b>OR/OF</b></p> <p>Interest paid          = <math>11\,058,85 \times 21 \times 12 - (1\,050\,000 - 419\,948,32)</math>          = <math>2\,786\,830,20 - 630\,051,68</math>          = R2 156 778,52</p>	<p>✓ <math>11\,058,85 \times 21 \times 12</math>          ✓ <math>1\,050\,000 - \text{Balance Outstanding}</math>          ✓ answer (3)</p> <p><b>OR/OF</b></p> <p>✓ <math>11\,058,85 \times 21 \times 12</math>          ✓ <math>1\,050\,000 - \text{Balance Outstanding}</math>          ✓ answer (3)</p> <p><b>OR/OF</b></p> <p>✓ <math>11\,058,85 \times 21 \times 12</math>          ✓ <math>1\,050\,000 - \text{Balance Outstanding}</math>          ✓ answer (3)</p>
		<b>[16]</b>





## QUESTION/VRAAG 9

9.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{2(x+h)^2 - 3(x+h) - (2x^2 - 3x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{2x^2 + 4xh + 2h^2 - 3x - 3h - 2x^2 + 3x}{h}$ $= \lim_{h \rightarrow 0} \frac{4xh + 2h^2 - 3h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(4x + 2h - 3)}{h}$ $= \lim_{h \rightarrow 0} (4x + 2h - 3)$ $\therefore f'(x) = 4x - 3$ <p><b>OR/OF</b></p> $f(x) = 2x^2 - 3x$ $f(x+h) = 2(x+h)^2 - 3(x+h)$ $f(x+h) = 2x^2 + 4xh + 2h^2 - 3x - 3h$ $f(x+h) - f(x) = 4xh + 2h^2 - 3h$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{4xh + 2h^2 - 3h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(4x + 2h - 3)}{h}$ $= \lim_{h \rightarrow 0} (4x + 2h - 3)$ $\therefore f'(x) = 4x - 3$	<p>✓ substitution</p> <p>✓ <math>2x^2 + 4xh + 2h^2 - 3x - 3h</math></p> <p>✓ <math>4xh + 2h^2 - 3h</math></p> <p>✓ factorisation</p> <p>✓ answer (5)</p> <p><b>OR/OF</b></p> <p>✓ substitution</p> <p>✓ <math>2x^2 + 4xh + 2h^2 - 3x - 3h</math></p> <p>✓ <math>4xh + 2h^2 - 3h</math></p> <p>✓ factorisation</p> <p>✓ answer (5)</p>
9.2.1	$y = 4x^5 - 6x^4 + 3x$ $\frac{dy}{dx} = 20x^4 - 24x^3 + 3$	<p>✓ <math>20x^4</math></p> <p>✓ <math>-24x^3</math></p> <p>✓ 3 (3)</p>





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9.2.2	$D_x \left[ \frac{-\sqrt[3]{x}}{2} + \left( \frac{1}{3x} \right)^2 \right]$ $D_x \left[ \frac{-x^{\frac{1}{3}}}{2} + \frac{x^{-2}}{9} \right]$ $D_x \left[ -\frac{1}{2} x^{\frac{1}{3}} + \frac{1}{9} x^{-2} \right]$ $= -\frac{1}{6} x^{-\frac{2}{3}} - \frac{2x^{-3}}{9}$ $= -\frac{1}{6x^{\frac{2}{3}}} - \frac{2}{9x^3}$	$\checkmark -\frac{x^{\frac{1}{3}}}{2} \quad \checkmark \frac{x^{-2}}{9}$ $\checkmark -\frac{1}{6} x^{-\frac{2}{3}} \quad \checkmark -\frac{2x^{-3}}{9}$ <p style="text-align: right;">(4)</p>
		<b>[12]</b>



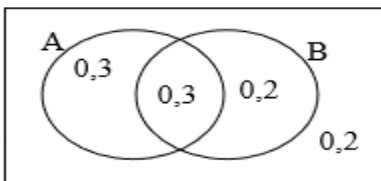




## QUESTION/VRAAG 11

11	$\text{Time} = \frac{20}{x}$ $\text{Cost} = (\text{water cost per hour} \times \text{time}) + (\text{kms} \times \text{R/km})$ $C(x) = 1,6 \times \left(\frac{20}{x}\right) + 20 \left(1,2 + \frac{x}{4000}\right)$ $C(x) = \frac{32}{x} + 24 + \frac{x}{200}$ $C'(x) = -\frac{32}{x^2} + \frac{1}{200} = 0$ $x^2 = 6400$ $x = 80 \text{ km/h}$	$\checkmark \frac{20}{x}$ $\checkmark 1,6 \times \left(\frac{20}{x}\right)$ $\checkmark 20 \left(1,2 + \frac{x}{4000}\right)$ $\checkmark C(x) = \frac{32}{x} + 24 + \frac{x}{200}$ $\checkmark C'(x) = -\frac{32}{x^2} + \frac{1}{200}$ $\checkmark C'(x) = 0$ $\checkmark \text{answer (A)}$
		(7) [7]

## QUESTION/VRAAG 12

12.1.1	No, because $P(A \text{ and } B) \neq 0$	$\checkmark$ answer and reason (1)
12.1.2(a)	$P(A \text{ and } B) = 0,3$ $P(\text{only } B) = 0,2$ $P(A \text{ and } B) = P(A) \times P(B)$ $0,3 = P(A) \times 0,5$ $P(A) = 0,6$ $P(\text{only } A) = 0,3$	$\checkmark P(A \text{ and } B) = P(A) \times P(B)$ $\checkmark 0,5$ $\checkmark P(A) = 0,6$ $\checkmark$ answer (4)
12.1.2(b)	 <p><math>P(\text{not } A \text{ or not } B) = 0,2 + 0,2 + 0,3 = 0,7</math></p> <p><b>OR/OF</b></p> <p><math>P(\text{not } A \text{ or not } B) = 1 - P(A \text{ and } B) = 1 - 0,3 = 0,7</math></p> <p><b>OR/OF</b></p> <p><math>P(A' \text{ or } B') = P(A') + P(B') - P(A' \text{ and } B')</math>  <math>= 0,4 + 0,5 - 0,2 = 0,7</math></p>	$\checkmark$ method $\checkmark$ answer (2) <p><b>OR/OF</b></p> $\checkmark$ method $\checkmark$ answer (2) <p><b>OR/OF</b></p> $\checkmark$ method $\checkmark$ answer (2)





12.2.1	$P(\text{novel}) = \frac{3}{12} = \frac{1}{4}$				✓ answer (1)
12.2.2	$12! = 479\,001\,600$				✓✓ answer (2)
12.2.3	5 (Poetry)	3! (Novels all together)	8! (Arrangements of rest of the books including the novels)	4 (Drama)	✓ $5 \times 4$ ✓ $3! = 6$ ✓ $8!$  ✓ $\frac{5 \times 3! \times 8! \times 4}{12!} = \frac{1}{99}$ (A) (4)
	P(start with poetry, end with drama AND all novels together) $= \frac{5 \times 3! \times 8! \times 4}{12!}$ $= \frac{1}{99}$				[14]

**TOTAL/TOTAAL: 150**



# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**NOVEMBER 2022**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages and 1 information sheet.**





Mathematics/P1

3  
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**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $(3x - 6)(x + 2) = 0$  (2)

1.1.2  $2x^2 - 6x + 1 = 0$  (correct to TWO decimal places) (3)

1.1.3  $x^2 - 90 > x$  (4)

1.1.4  $x - 7\sqrt{x} = -12$  (4)

1.2 Solve for  $x$  and  $y$  simultaneously:

$2x - y = 2$

$xy = 4$  (5)

1.3 Show that  $2 \cdot 5^n - 5^{n+1} + 5^{n+2}$  is even for all positive integer values of  $n$ . (3)1.4 Determine the values of  $x$  and  $y$  if:  $\frac{3^{y+1}}{32} = \sqrt{96^x}$  (4)  
[25]**QUESTION 2**2.1 The first term of a geometric series is 14 and the 6<sup>th</sup> term is 448.2.1.1 Calculate the value of the constant ratio,  $r$ . (2)

2.1.2 Determine the number of consecutive terms that must be added to the first 6 terms of the series in order to obtain a sum of 114 674. (4)

2.1.3 If the first term of another series is 448 and the 6<sup>th</sup> term is 14, calculate the sum to infinity of the new series. (3)2.2 If  $\sum_{p=0}^k \left( \frac{1}{3} p + \frac{1}{6} \right) = 20 \frac{1}{6}$ , determine the value of  $k$ . (5)  
[14]

Mathematics/P1

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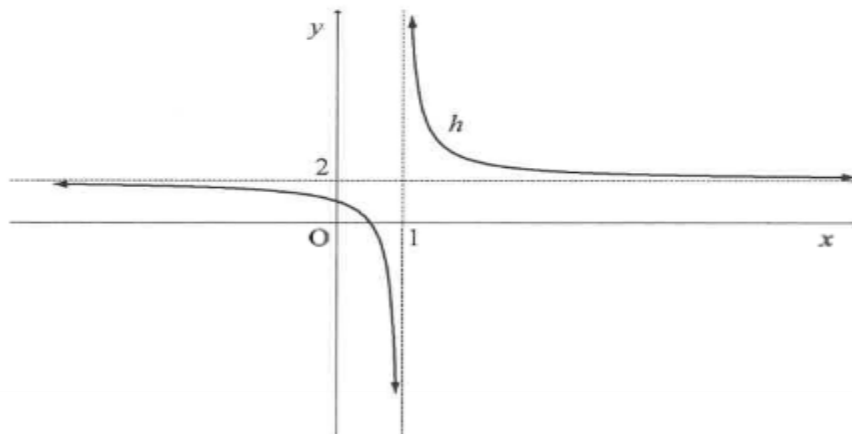
**QUESTION 3**

It is given that the general term of a quadratic number pattern is  $T_n = n^2 + bn + 9$  and the first term of the first differences is 7.

- 3.1 Show that  $b = 4$ . (2)
- 3.2 Determine the value of the 60<sup>th</sup> term of this number pattern. (2)
- 3.3 Determine the general term for the sequence of first differences of the quadratic number pattern. Write your answer in the form  $T_p = mp + q$ . (3)
- 3.4 Which TWO consecutive terms in the quadratic number pattern have a first difference of 157? (3)
- [10]**

**QUESTION 4**

- 4.1 Sketched below is the graph of  $h(x) = \frac{1}{x+p} + q$ . The asymptotes of  $h$  intersect at  $(1; 2)$ .



- 4.1.1 Write down the values of  $p$  and  $q$ . (2)
- 4.1.2 Calculate the coordinates of the  $x$ -intercept of  $h$ . (2)
- 4.1.3 Write down the  $x$ -coordinate of the  $x$ -intercept of  $g$  if  $g(x) = h(x+3)$ . (2)
- 4.1.4 The equation of an axis of symmetry of  $h$  is  $y = x + t$ . Determine the value of  $t$ . (2)
- 4.1.5 Determine the values of  $x$  for which  $-2 \leq \frac{1}{x-1}$ . (3)

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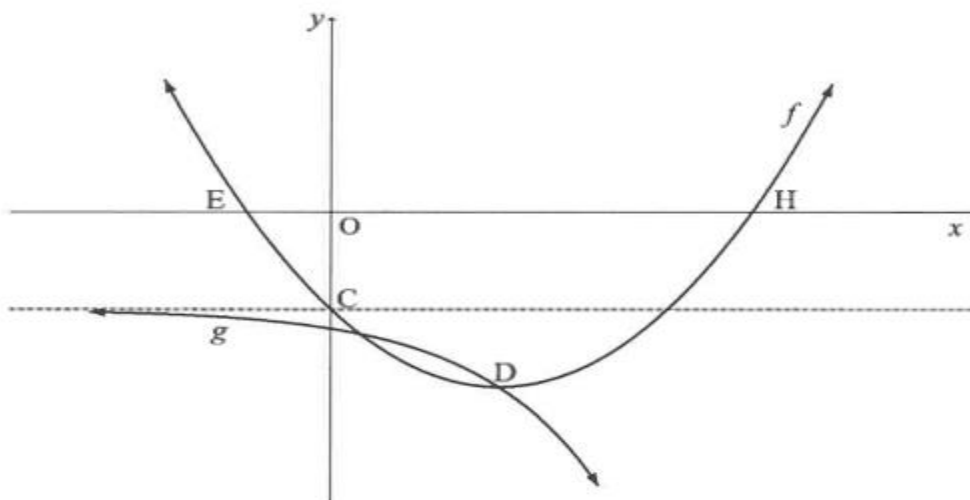
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4.2 The graphs of  $f(x) = x^2 - 4x - 5$  and  $g(x) = a.2^x + q$  are sketched below.

- E and H are the  $x$ -intercepts of  $f$ .
- C is the  $y$ -intercept of  $f$  and lies on the asymptote of  $g$ .
- The two graphs intersect at D, the turning point of  $f$ .



- 4.2.1 Write down the  $y$ -coordinate of C. (1)
- 4.2.2 Determine the coordinates of D. (2)
- 4.2.3 Determine the values of  $a$  and  $q$ . (3)
- 4.2.4 Write down the range of  $g$ . (1)
- 4.2.5 Determine the values of  $k$  for which the value of  $f(x) - k$  will always be positive. (2)
- [20]



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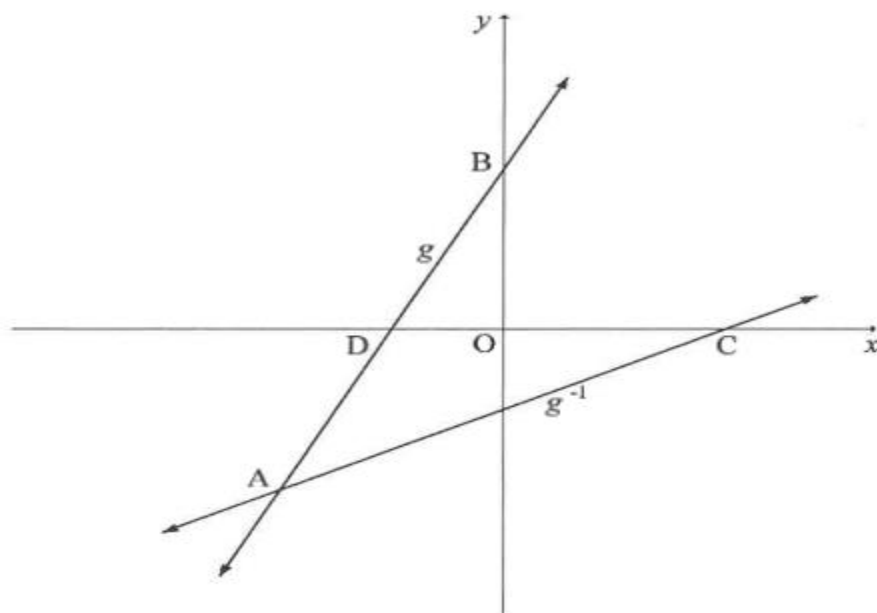
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**QUESTION 5**

The graphs of  $g(x) = 2x + 6$  and  $g^{-1}$ , the inverse of  $g$ , are shown in the diagram below.

- D and B are the  $x$ - and  $y$ -intercepts respectively of  $g$ .
- C is the  $x$ -intercept of  $g^{-1}$ .
- The graphs of  $g$  and  $g^{-1}$  intersect at A.



- 5.1 Write down the  $y$ -coordinate of B. (1)
- 5.2 Determine the equation of  $g^{-1}$  in the form  $g^{-1}(x) = mx + n$ . (2)
- 5.3 Determine the coordinates of A. (3)
- 5.4 Calculate the length of AB. (2)
- 5.5 Calculate the area of  $\triangle ABC$ . (5)
- [13]

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Mathematics/P1

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**QUESTION 6**

- 6.1 R12 000 was invested in a fund that paid interest at  $m\%$  p.a., compounded quarterly. After 24 months, the value of the investment was R13 459.

Determine the value of  $m$ .

(4)

- 6.2 On 31 January 2022, Tino deposited R1 000 in an account that paid interest at 7,5% p.a., compounded monthly. He continued depositing R1 000 on the last day of every month. He will make the last deposit on 31 December 2022.

Will Tino have sufficient funds in the account on 1 January 2023 to buy a computer that costs R13 000? Justify your answer by means of an appropriate calculation.

(4)

- 6.3 Thabo plans to buy a car that costs R250 000. He will pay a deposit of 15% and take out a loan for the balance. The interest on the loan is 13% p.a., compounded monthly.

6.3.1 Calculate the value of the loan.

(1)

6.3.2 The first repayment will be made 6 months after the loan has been granted. The loan will be repaid over a period of 6 years after it has been granted. Calculate the MONTHLY instalment.

(5)

[14]

**QUESTION 7**

- 7.1 Determine  $f'(x)$  from first principles if  $f(x) = x^2 + x$ .

(5)

- 7.2 Determine  $f'(x)$  if  $f(x) = 2x^5 - 3x^4 + 8x$ .

(3)

- 7.3 The tangent to  $g(x) = ax^3 + 3x^2 + bx + c$  has a minimum gradient at the point  $(-1; -7)$ . For which values of  $x$  will  $g$  be concave up?

(4)

[12]



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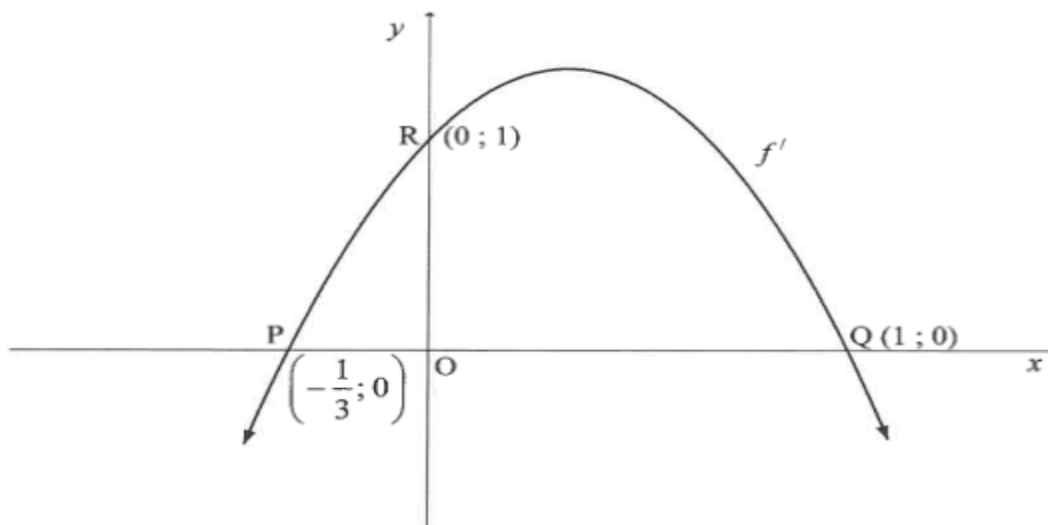
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**QUESTION 8**

The graph of  $y = f'(x) = mx^2 + nx + k$  is drawn below.

The graph passes the points  $P\left(-\frac{1}{3}; 0\right)$ ,  $Q(1; 0)$  and  $R(0; 1)$ .



- 8.1 Determine the values of  $m$ ,  $n$  and  $k$ . (6)
- 8.2 If it is further given that  $f(x) = -x^3 + x^2 + x + 2$ :
- 8.2.1 Determine the coordinates of the turning points of  $f$ . (3)
- 8.2.2 Draw the graph of  $f$ . Indicate on your graph the coordinates of the turning points and the intercepts with the axes. (5)
- 8.3 Points  $E$  and  $W$  are two variable points on  $f'$  and are on the same horizontal line.
- $h$  is a tangent to  $f'$  at  $E$ .
  - $g$  is a tangent to  $f'$  at  $W$ .
  - $h$  and  $g$  intersect at  $D(a; b)$ .
- 8.3.1 Write down the value of  $a$ . (1)
- 8.3.2 Determine the value(s) of  $b$  for which  $h$  and  $g$  will no longer be tangents to  $f'$ . (2)
- [17]**

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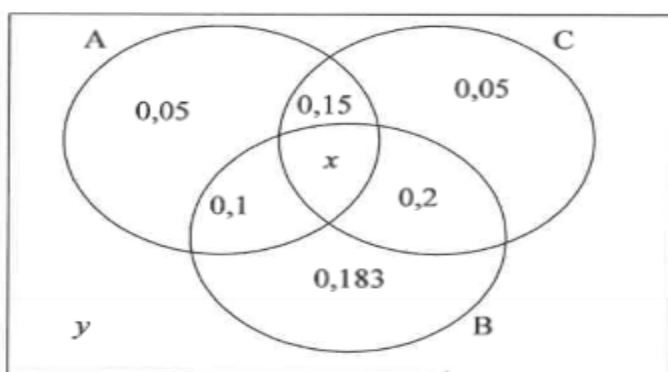
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**QUESTION 9**Given  $f(x) = x^2$ .Determine the minimum distance between the point  $(10 ; 2)$  and a point on  $f$ .**[8]****QUESTION 10**

10.1 A, B and C are three events. The probabilities of these events (or any combination of them) occurring is given in the Venn-diagram below



- 10.1.1 If it is given that the probability that at least one of the events will occur is 0,893, calculate the value of:
- (a)  $y$ , the probability that none of the events will occur. (1)
- (b)  $x$ , the probability that all three events will occur. (1)
- 10.1.2 Determine the probability that at least two of the events will take place. (2)
- 10.1.3 Are events B and C independent? Justify your answer. (5)
- 10.2 A four-digit code is required to open a combination lock. The code must be even-numbered and may not contain the digits 0 or 1. Digits may not be repeated.
- 10.2.1 How many possible 4-digit combinations are there to open the lock? (3)
- 10.2.2 Calculate the probability that you will open the lock at the first attempt if it is given that the code is greater than 5 000 and the third digit is 2. (5)

**[17]****TOTAL: 150**

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# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE SENIOR  
SERTIFIKAAT**

**GRADE 12/GRAAD 12**

**MATHEMATICS P1/WISKUNDE V1**

**NOVEMBER 2022**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS/PUNTE: 150**

**These marking guidelines consist of 21 pages.  
*Hierdie nasienriglyne bestaan uit 21 bladsye.***



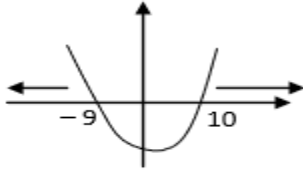
**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking guidelines.

**LET WEL:**

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.
- Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die nasienriglyne van toepassing.

**QUESTION1/VRAAG 1**

1.1.1	$(3x - 6)(x + 2) = 0$ $x = 2$ or $x = -2$	$\checkmark x = 2$ $\checkmark x = -2$ (2)
1.1.2	$2x^2 - 6x + 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{6 \pm \sqrt{(-6)^2 - 4(2)(1)}}{2(2)}$ $x = 2,82$ or $x = 0,18$	$\checkmark$ correct substitution into correct formula $\checkmark 2,82$ $\checkmark 0,18$ (3)
1.1.3	$x^2 - 90 > x$ $x^2 - x - 90 > 0$ $(x + 9)(x - 10) > 0$ CV: $x = -9$ or $x = 10$  $x < -9$ or $x > 10$ <b>OR/OF</b> $(-\infty; -9)$ or $(10; \infty)$	$\checkmark$ standard form $\checkmark$ critical values $\checkmark \checkmark x < -9$ or $x > 10$ (4)





1.1.4	$x - 7\sqrt{x} = -12$ $x + 12 = 7\sqrt{x}$ $(x + 12)^2 = (7\sqrt{x})^2$ $x^2 + 24x + 144 = 49x$ $x^2 - 25x + 144 = 0$ $(x - 16)(x - 9) = 0$ $x = 16 \text{ or } x = 9$ <p><b>OR/OF</b></p> $x - 7\sqrt{x} + 12 = 0$ $(\sqrt{x} - 3)(\sqrt{x} - 4) = 0 \text{ or let } \sqrt{x} = k$ $\sqrt{x} = 3 \text{ or } \sqrt{x} = 4$ $x = 9 \text{ or } x = 16$	<ul style="list-style-type: none"> <li>✓ isolating the root</li> <li>✓ squaring both sides</li>   <li>✓ standard form</li>   <li>✓ both answers (4)</li> </ul> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ standard form</li> <li>✓ factors</li> <li>✓ answers</li> <li>✓ both answers for <math>x</math> (4)</li> </ul>
1.2	$2x - y = 2$ $y = 2x - 2 \quad \dots\dots(1)$ $xy = 4 \quad \dots\dots(2)$ <p>(1) in (2):</p> $x(2x - 2) = 4$ $2x^2 - 2x - 4 = 0$ $x^2 - x - 2 = 0$ $(x - 2)(x + 1) = 0$ $x = 2 \text{ or } x = -1$ $y = 2 \quad y = -4$	<ul style="list-style-type: none"> <li>✓ eq 1</li>   <li>✓ substitution</li> <li>✓ standard form</li>   <li>✓ x-values</li> <li>✓ y-values (5)</li> </ul>





	<p><b>OR/OF</b>  <math>2x - y = 2</math></p> <p><math>x = \frac{1}{2}y + 1</math> .....(1)</p> <p><math>xy = 4</math> .....(2)</p> <p>(1) in (2):</p> <p><math>y\left(\frac{1}{2}y + 1\right) = 4</math></p> <p><math>\frac{1}{2}y^2 + y - 4 = 0</math></p> <p><math>y^2 + 2y - 8 = 0</math></p> <p><math>(y + 4)(y - 2) = 0</math></p> <p><math>y = -4</math> or <math>y = 2</math></p> <p><math>x = -1</math> <math>x = 2</math></p> <p><b>OR/OF</b>  <math>2x - y = 2</math> .....(1)</p> <p><math>y = \frac{4}{x}</math> .....(2)</p> <p>(2) in (1):</p> <p><math>2x - \frac{4}{x} = 2</math></p> <p><math>2x^2 - 2x - 4 = 0</math></p> <p><math>x^2 - x - 2 = 0</math></p> <p><math>(x - 2)(x + 1) = 0</math></p> <p><math>x = 2</math> or <math>x = -1</math></p> <p><math>y = 2</math> <math>y = -4</math></p>	<p><b>OR/OF</b></p> <p>✓ eq 1</p> <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ y-values</p> <p>✓ x-values (5)</p> <p><b>OR/OF</b></p> <p>✓ eq 2</p> <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ x-values</p> <p>✓ y-values (5)</p>
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	<p><b>OR/OF</b></p> $2x - y = 2 \quad \dots\dots(1)$ $x = \frac{4}{y} \quad \dots\dots(2)$ <p>(2)in (1):</p> $2\left(\frac{4}{y}\right) - y = 2$ $8 - y^2 - 2y = 0$ $y^2 + 2y - 8 = 0$ $(y + 4)(y - 2) = 0$ $y = -4 \quad \text{or} \quad y = 2$ $x = -1 \quad x = 2$	<p><b>OR/OF</b></p> <p>✓ eq 2</p> <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ y-values</p> <p>✓ x-values (5)</p>
1.3	$2 \cdot 5^n - 5^{n+1} + 5^{n+2} = 2 \cdot 5^n - 5^n \cdot 5^1 + 5^n \cdot 5^2$ $= 5^n(2 - 5 + 25)$ $= 5^n(22)$ $2(5^n(11))$ <p><b>OR/OF</b></p> <p>Any integer multiplied by an even number will be even</p>	<p>✓ exp law</p> <p>✓ common factor</p> <p>✓ answer/explanation (3)</p>
1.4	$\frac{3^{y+1}}{32} = \sqrt{96^x}$ $\frac{3^{y+1}}{2^5} = (96)^{\frac{x}{2}}$ $3^{y+1} \cdot 2^{-5} = 2^{\frac{5x}{2}} \cdot 3^{\frac{x}{2}}$ $-5 = \frac{5x}{2}$ $\therefore x = -2$ $y+1 = \frac{x}{2}$ $y+1 = \frac{-2}{2}$ $\therefore y = -2$	<p>✓ <math>\frac{3^{y+1}}{2^5} = (96)^{\frac{x}{2}}</math></p> <p>✓ <math>3^{y+1} \cdot 2^{-5} = 2^{\frac{5x}{2}} \cdot 3^{\frac{x}{2}}</math></p> <p>✓ <math>x = -2</math></p> <p>✓ <math>y = -2</math> (4)</p>





Mathematics P1/Wiskunde V1

6

DBE/November 2022

NSC/NSS – Marking Guidelines/Nasienriglyne

	<p><b>OR/OF</b></p> $\frac{3^{y+1}}{32} = \sqrt{96^x}$ $\left(\frac{3^{y+1}}{2^5}\right)^2 = (\sqrt{(96)^x})^2$ $\frac{3^{2y+2}}{2^{10}} = 2^{5x} \cdot 3^x$ $3^{2y+2} \cdot 2^{-10} = 2^{5x} \cdot 3^x$ $-10 = 5x$ $\therefore x = -2$ $2y + 2 = -2$ $\therefore y = -2$	<p><b>OR/OF</b></p> $\checkmark \left(\frac{3^{y+1}}{2^5}\right)^2 = (\sqrt{(96)^x})^2$ $\checkmark 3^{2y+2} \cdot 2^{-10} = 2^{5x} \cdot 3^x$ $\checkmark x = -2$ $\checkmark y = -2 \quad (4)$
		<b>[25]</b>





## QUESTION 2/VRAAG 2

2.1.1	$a = 14$ $T_6 = 14r^5 = 448$ $r^5 = 32$ $\therefore r = 2$	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">Answer only: full marks</div> $\checkmark T_6 = 14r^5 = 448$ $\checkmark r = 2$ (2)
2.1.2	$T_n = 14(2)^{n-1}$ $S_n = \frac{14(2^6 - 1)}{2 - 1}$ $S_6 = 882$ $114\ 674 - 882 = 113\ 792$ $113\ 792 = 896(2^n - 1)$ $128 = 2^n$ $n = 7$ <b>OR/OF</b> $S_n = \frac{a(r^n - 1)}{r - 1}$ $114\ 674 = \frac{14(2^n - 1)}{2 - 1}$ $8\ 191 = 2^n - 1$ $2^n = 8\ 192$ $n = \log_2 8\ 192$ $n = 13$ $\therefore 7$ more terms must be added to the first 6 terms.	$\checkmark$ substitution into correct formula $\checkmark S_6 = 882$ $\checkmark 128 = 2^n$ $\checkmark 7$ (4) <b>OR/OF</b> $\checkmark$ substitution into correct formula $\checkmark 2^n = 8\ 192$ $\checkmark n = 13$ $\checkmark 7$ (4)
2.1.3	$r = \frac{1}{2}$ OR $448r^5 = 14$ $\therefore r = \frac{1}{2}$ $S_\infty = \frac{a}{1 - r}$ $S_\infty = \frac{448}{1 - \frac{1}{2}}$ $S_\infty = 896$	$\checkmark r = \frac{1}{2}$ $\checkmark$ substitution $\checkmark$ answer (3)



<p>2.2</p> $\sum_{p=0}^k \left( \frac{1}{3}p + \frac{1}{6} \right) = 20 \frac{1}{6}$ $T_1 = \frac{1}{6} \quad T_2 = \frac{1}{3} + \frac{1}{6} = \frac{3}{6}$ $d = \frac{3}{6} - \frac{1}{6} = \frac{1}{3}$ $\frac{121}{6} = \frac{n}{2} \left[ 2 \left( \frac{1}{6} \right) + (n-1) \left( \frac{1}{3} \right) \right]$ $\frac{121}{3} = n \left[ \frac{1}{3} + \frac{1}{3}n - \frac{1}{3} \right]$ $\frac{121}{3} = \frac{1}{3}n^2$ $121 = n^2$ $n = 11$ $\therefore k = 10$ <p><b>OR/OF</b></p> $\sum_{p=0}^k \left( \frac{1}{3}p + \frac{1}{6} \right) = 20 \frac{1}{6}$ $a = \frac{1}{6}$ $l = \frac{1}{3}k + \frac{1}{6}$ $n = k + 1$ $S_n = \frac{n}{2} [a + l]$ $\frac{121}{6} = \frac{k+1}{2} \left[ \frac{1}{6} + \frac{1}{3}k + \frac{1}{6} \right]$ $\frac{121}{6} = \frac{k+1}{2} \left[ \frac{1}{3}k + \frac{1}{3} \right]$ $\frac{121}{6} = \frac{k+1}{2} \left[ \frac{k+1}{3} \right]$ $\frac{121}{6} = \frac{(k+1)^2}{6}$ $k+1 = \pm \sqrt{121}$ $k+1 = 11$ $k = 10$	<p>✓ <math>T_1 = \frac{1}{6}</math></p> <p>✓ <math>d</math></p> <p>✓ substitution</p> <p>✓ value of <math>n</math></p> <p>✓ value of <math>k</math> (5)</p> <p><b>OR/OF</b></p> <p>✓ <math>a = \frac{1}{6}</math></p> <p>✓ <math>l</math></p> <p>✓ <math>n = k + 1</math></p> <p>✓ <math>\frac{121}{6} = \frac{(k+1)^2}{6}</math></p> <p>✓ value of <math>k</math> (5)</p>	<p>(5)</p> <p>(5)</p> <p>[14]</p>
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## QUESTION 3/VRAAG 3

3.1	$3a + b = 7$ $3 + b = 7$ $b = 4$  <b>OR/OF</b> $T_2 - T_1 = 7$ $4 + 2b + 9 - (1 + b + 9) = 7$ $b = 4$	$\checkmark 3a + b = 7$ $\checkmark 3 + b = 7$ (2)  <b>OR/OF</b> $\checkmark T_2 - T_1 = 7$ $\checkmark$ substitution (2)
3.2	$T_n = n^2 + 4n + 9$ $T_{60} = (60)^2 + 4(60) + 9$ $= 3849$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only: full marks</div>	$\checkmark$ substitution $\checkmark$ answer (2)
3.3	14 ; 21 ; 30 ; 41 ; First difference: 7 ; 9 ; 11 ; ... Common 2 <sup>nd</sup> difference: 2  $T_p = 2p + 5$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only: full marks</div>  <b>OR/OF</b> First difference: 7 ; 9 ; 11 ; ... $T_n = a + (n-1)d$ $T_p = 7 + (p-1)(2)$ $T_p = 2p + 5$	$\checkmark$ first difference $\checkmark 2$  $\checkmark 2p + 5$ (3)  <b>OR/OF</b> $\checkmark$ first difference  $\checkmark 2$ $\checkmark 2p + 5$ (3)
3.4	$157 = 2p + 5$ $p = 76$ $\therefore$ Between $T_{76}$ and $T_{77}$  <b>OR/OF</b>  $T_{n+1} - T_n = 157$ $(n+1)^2 + 4(n+1) + 9 - (n^2 + 4n + 9) = 157$ $n^2 + 2n + 1 + 4n + 4 + 9 - n^2 - 4n - 9 = 157$ $2n = 152$ $n = 76$ $\therefore$ Between $T_{76}$ and $T_{77}$	$\checkmark 157 = 2p + 5$ $\checkmark p = 76$ $\checkmark T_{76}$ and $T_{77}$ (3)  <b>OR/OF</b>  $\checkmark T_{n+1} - T_n = 157$  $\checkmark n = 76$ $\checkmark T_{76}$ and $T_{77}$ (3)
		<b>[10]</b>





## QUESTION 4/VRAAG 4

4.1.1	$p = -1$ and $q = 2$	✓ $p = -1$ ✓ $q = 2$ (2)
4.1.2	$\frac{1}{x-1} + 2 = 0$ $-2x + 2 = 1$ $x = \frac{1}{2}$ $\left(\frac{1}{2}; 0\right)$	✓ = 0  ✓ answer (2)
4.1.3	$x = \frac{1}{2} - 3$ $= \frac{-5}{2}$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only: full marks</div>	✓ -3 ✓ $x = \frac{-5}{2}$ (2)
4.1.4	$y = x + t$ $2 = 1 + t$ $t = 1$	✓ subst (1 ; 2) ✓ $t = 1$ (2)
4.1.5	$-2 \leq \frac{1}{x-1}$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only: full marks</div> $\frac{1}{x-1} + 2 \geq 0$ $\therefore x \leq \frac{1}{2} \text{ or } x > 1$ <b>OR/OF</b> $x \in \left(-\infty; \frac{1}{2}\right] \text{ or } (1; \infty)$	✓ $\frac{1}{x-1} + 2 \geq 0$ ✓ $x \leq \frac{1}{2}$ ✓ $x > 1$ (3)
4.2.1	$y = -5$	✓ answer (1)
4.2.2	$x = \frac{-b}{2a} = \frac{-(-4)}{2(1)} = 2$ $f(2) = 2^2 - 4(2) - 5 = -9$ $\therefore D(2; -9)$ <b>OR/OF</b> $f'(x) = 2x - 4$ $2x - 4 = 0$ $x = 2$ $f(2) = 2^2 - 4(2) - 5 = -9$ $\therefore D(2; -9)$	✓ $x = 2$ ✓ $y = -9$ (2)  <b>OR/OF</b> ✓ $x = 2$ ✓ $y = -9$ (2)

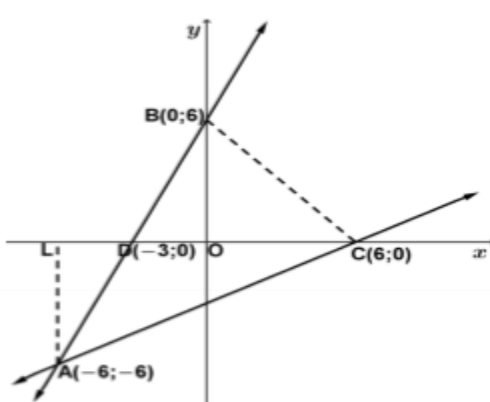




4.2.3	$q = -5$ $-9 = a(2)^2 - 5$ $-4 = 4a$ $a = -1$ $\therefore g(x) = -2^x - 5$	$\checkmark q = -5$ $\checkmark$ substitution of $(2 ; -9)$ $\checkmark a = -1$ (3)
4.2.4	$y \in (-\infty ; -5)$ OR $y < -5 ; y \in \mathcal{R}$	$\checkmark$ answer (1)
4.2.5	$k < -9$	$\checkmark -9$ $\checkmark k < -9$ (2)
		<b>[20]</b>



## QUESTION 5/VRAAG 5

5.1	$g(x) = 2x + 6$ $y = 6$	$\checkmark y = 6$ (1)
5.2	$y = 2x + 6$ $x = 2y + 6$ $y = \frac{1}{2}x - 3$	<div style="border: 1px solid black; padding: 5px; display: inline-block; margin-bottom: 5px;">Answer only: Full marks</div> $\checkmark$ swop $x$ and $y$ $\checkmark$ equation (2)
5.3	$\frac{1}{2}x - 3 = 2x + 6$ $x - 6 = 4x + 12$ $3x = -18$ $x = -6$ $A(-6; -6)$ <b>OR/OF</b> $2x + 6 = x$ $x = -6$ $y = -6$	$\checkmark$ equating $\checkmark x = -6$ $\checkmark y = -6$ (3) <b>OR/OF</b> $\checkmark$ equating $\checkmark x = -6$ $\checkmark y = -6$ (3)
5.4	$AB = \sqrt{(6)^2 + (12)^2}$ $= \sqrt{180} = 6\sqrt{5} = 13,42$	$\checkmark$ substitution $\checkmark$ answer (2)
		



5.5	$BC = \sqrt{6^2 + 6^2} = \sqrt{72} = 6\sqrt{2}$ $AB = AC = \sqrt{180} \quad \text{symmetry of } g \text{ and } g^{-1}$ $\perp h = (\sqrt{180})^2 - \left(\frac{\sqrt{72}}{2}\right)^2$ $= \sqrt{162} = 9\sqrt{2}$ $\text{area of } \triangle ABC = \frac{1}{2} BC \times h$ $= \frac{1}{2} \times \sqrt{72} \times \sqrt{162} = 54 \text{ units}^2$ <p><b>OR/OF</b></p> $\tan \hat{BDC} = 2$ $\therefore \hat{BDC} = 63,43^\circ$ $\tan \hat{DCA} = \frac{1}{2}$ $\therefore \hat{DCA} = 26,57^\circ$ $\therefore \hat{DAC} = 36,86^\circ \quad (\text{ext angle triangle})$ $\text{Area of } \triangle ABC = \frac{1}{2} (\sqrt{180}) (\sqrt{180}) \sin 36,86^\circ$ $= 53,99 \text{ units}^2$ <p><b>OR/OF</b></p> $\text{Area of } \triangle ABC = \text{Area of } \triangle BDC + \text{Area of } \triangle ADC$ $= \frac{1}{2} DC \cdot BO + \frac{1}{2} DC \cdot \text{height}$ $= \frac{1}{2} (9)(6) + \frac{1}{2} (9)(6)$ $= 54 \text{ units}^2$	<ul style="list-style-type: none"> <li>✓ BC</li> <li>✓ AB = AC /midpoint (3 ; 3)</li> <li>✓ <math>\perp h</math> (A)</li> <li>✓ substitution</li> <li>✓ answer (A) (5)</li> </ul> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ <math>\hat{BDC} = 63,43^\circ</math></li> <li>✓ <math>\hat{DAC} = 36,86^\circ</math></li> <li>✓ <math>AC = \sqrt{180}</math></li> <li>✓ substitution into the correct formula</li> <li>✓ answer (A) (5)</li> </ul> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ Areas (<math>\triangle BDC + \triangle ADC</math>)</li> <li>✓ <math>\frac{1}{2} DC \cdot BO</math></li> <li>✓ <math>\frac{1}{2} DC \cdot \text{height}</math></li> <li>✓ substitution</li> <li>✓ answer (A) (5)</li> </ul>
<b>[13]</b>		



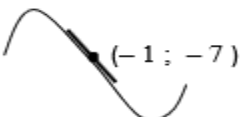

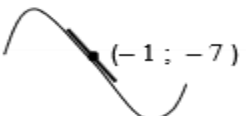

**QUESTION 6/VRAAG 6**

6.1	$A = P(1+i)^n$ $13\,459 = 12\,000\left(1 + \frac{m}{400}\right)^8$ $\left(1 + \frac{m}{400}\right)^8 = 1,121\dots$ $1 + \frac{m}{400} = \sqrt[8]{1,121\dots}$ $\frac{m}{400} = 0,0144\dots$ $\therefore m = 5,78\%$	<ul style="list-style-type: none"> <li>✓ 8</li> <li>✓ subst into correct formula</li> <li>✓ <math>1 + \frac{m}{400} = \sqrt[8]{1,121\dots}</math></li> <li>✓ 5,78 %</li> </ul>	(4)
6.2	$F = \frac{x[(1+i)^n - 1]}{i}$ $F = \frac{1\,000\left[\left(1 + \frac{0,075}{12}\right)^{12} - 1\right]}{\frac{0,075}{12}}$ $= R12\,421,22$ <p>He won't be able to buy the computer because  <math>R13\,000 - R12\,421,22 = R578,78</math>  <b>OR/OF</b>  He won't be able to buy the computer because  <math>R12\,421,22 &lt; R13\,000</math></p>	<ul style="list-style-type: none"> <li>✓ <math>\frac{0,075}{12}</math></li> <li>✓ 12</li> <li>✓ answer</li> <li>✓ conclusion</li> </ul>	(4)
6.3.1	<p>Loan amount = <math>85\% \times R250\,000</math>  <math>= R212\,500</math></p> <p><b>OR/OF</b>  Loan amount = <math>R250\,000 - (15\% \times R250\,000)</math>  <math>= R212\,500</math></p>	<ul style="list-style-type: none"> <li>✓ answer</li> </ul> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ answer</li> </ul>	(1)
6.3.2	$A = 212\,500\left(1 + \frac{0,13}{12}\right)^5$ $A = 224\,262,53$ $P = \frac{x[1 - (1+i)^{-n}]}{i}$ $224\,262,53 = \frac{x\left[1 - \left(1 + \frac{0,13}{12}\right)^{-67}\right]}{\frac{0,13}{12}}$ $\therefore x = R4\,724,96$	<ul style="list-style-type: none"> <li>✓ <math>A = 212\,500\left(1 + \frac{0,13}{12}\right)^5</math></li> <li>✓ answer</li> <li>✓ substitution into correct formula</li> <li>✓ - 67</li> <li>✓ answer</li> </ul>	(5)
			<b>[14]</b>

## QUESTION 7/VRAAG 7

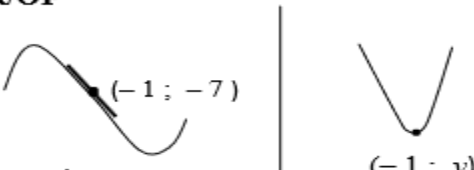
7.1	$f(x) = x^2 + x$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{(x+h)^2 + (x+h) - (x^2 + x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 + x + h - x^2 - x}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2 + h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h + 1)}{h}$ $\therefore f'(x) = 2x + 1$ <p><b>OR/OF</b></p> $f(x) = x^2 + x$ $f(x+h) = (x+h)^2 + (x+h) = x^2 + 2xh + h^2 + x + h$ $f(x+h) - f(x) = x^2 + 2xh + h^2 + x + h - x^2 - x$ $= 2xh + h^2 + h$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2 + h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h + 1)}{h}$ $\therefore f'(x) = 2x + 1$	<p>✓ substitution into the formula</p> <p>✓ <math>x^2 + 2xh + h^2 + x + h</math></p> <p>✓ <math>2xh + h^2 + h</math></p> <p>✓ common factor</p> <p>✓ answer (5)</p> <p><b>OR/OF</b></p> <p>✓ <math>x^2 + 2xh + h^2 + x + h</math></p> <p>✓ <math>2xh + h^2 + h</math></p> <p>✓ substitution into the formula</p> <p>✓ common factor</p> <p>✓ answer (5)</p>
7.2	$f(x) = 2x^5 - 3x^4 + 8x$ $f'(x) = 10x^4 - 12x^3 + 8$	<p>✓ <math>10x^4</math></p> <p>✓ <math>-12x^3</math></p> <p>✓ 8 (3)</p>
7.3	$g(x) = ax^3 + 3x^2 + bx + c$ $g'(x) = 3ax^2 + 6x + b$ $g''(x) = 6ax + 6$ $g''(-1) = 6a(-1) + 6 = 0$ $\therefore a = 1$ <p>For concave up <math>g''(x) &gt; 0</math></p> $6x + 6 > 0$ $x > -1$	<p>✓ <math>g'(x) = 3ax^2 + 6x + b</math></p> <p>✓</p> <p>✓ <math>g''(-1) = 6a(-1) + 6 = 0</math></p> <p>✓ <math>a = 1</math></p> <p>✓ <math>x &gt; -1</math> (4)</p>



	<p><b>OR/OF</b> Min gradient at <math>(-1 ; -7)</math> implies: at <math>x = -1</math> - point of inflection and <math>g</math> will be positive cubic hence <math>a &gt; 0</math></p> <p>Since <math>g</math> is concave up <math>x &gt; -1</math></p> <p><b>OR/OF</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p><math>(-1 ; -7)</math></p> <p>Since <math>g</math> is concave up <math>x &gt; -1</math></p> </div> <div style="text-align: center;">  <p><math>(-1 ; y)</math></p> <p>Since <math>g</math> is concave up <math>x &gt; -1</math></p> </div> </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">Answer only: <math>\frac{1}{4}</math></div>	
	<p><b>OR/OF</b> Min gradient at <math>(-1 ; -7)</math> implies: at <math>x = -1</math> - point of inflection and <math>g</math> will be positive cubic hence <math>a &gt; 0</math></p> <p>Since <math>g</math> is concave up <math>x &gt; -1</math></p> <p><b>OR/OF</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p><math>(-1 ; -7)</math></p> <p>Since <math>g</math> is concave up <math>x &gt; -1</math></p> </div> <div style="text-align: center;">  <p><math>(-1 ; y)</math></p> <p>Since <math>g</math> is concave up <math>x &gt; -1</math></p> </div> </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">Answer only: <math>\frac{1}{4}</math></div>	





	<p><b>OR/OF</b> Min gradient at <math>(-1; -7)</math> implies: at <math>x = -1</math> - point of inflection and <math>g</math> will be positive cubic hence <math>a &gt; 0</math></p> <p>Since <math>g</math> is concave up <math>x &gt; -1</math></p> <p><b>OR/OF</b></p>  <p>Since <math>g</math> is concave up <math>x &gt; -1</math></p> <p>Since <math>g</math> is concave up <math>x &gt; -1</math></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">       Answer only: <math>\frac{1}{4}</math> </div>	<p><b>OR/OF</b></p> <p>✓ point of inflection ✓✓ <math>a &gt; 0</math></p> <p>✓ <math>x &gt; -1</math> (4)</p> <p><b>OR/OF</b></p> <p>✓✓ pos graph ✓ point of inflection</p> <p>✓ <math>x &gt; -1</math> (4)</p>
		<b>[12]</b>

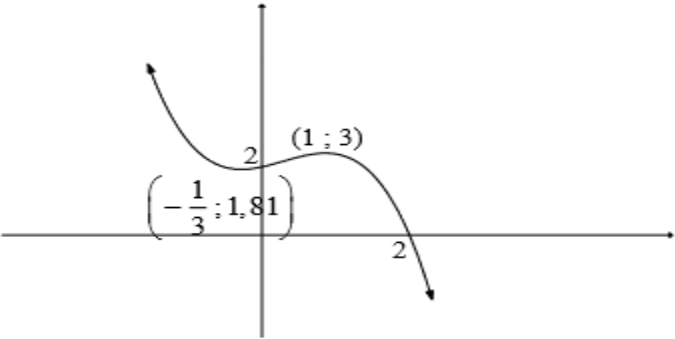




## QUESTION 8/VRAAG 8

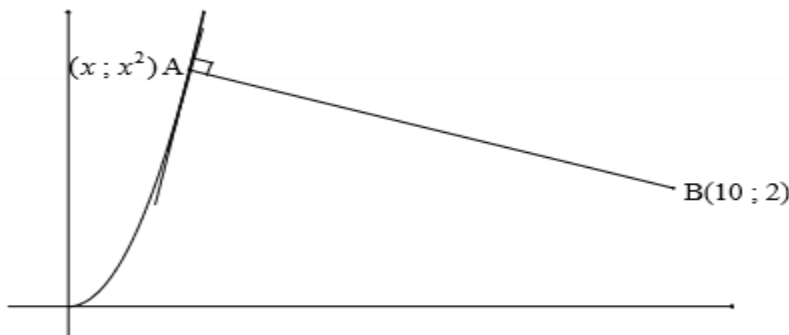
<p>8.1</p>	$f'(x) = mx^2 + nx + k$ $f'(x) = m\left(x + \frac{1}{3}\right)(x-1)$ $1 = m\left(0 + \frac{1}{3}\right)(0-1)$ $1 = -\frac{1}{3}m$ $\therefore m = -3$ $f'(x) = -3\left(x + \frac{1}{3}\right)(x-1)$ $f'(x) = -3\left(x^2 - \frac{2}{3}x - \frac{1}{3}\right)$ $f'(x) = -3x^2 + 2x + 1$ $\therefore n = 2$ $\therefore k = 1$ <p><b>OR/OF</b>  <math>k = 1</math></p> $0 = m + n + 1 \quad \text{and} \quad \frac{1}{9}m - \frac{1}{3}n + 1 = 0$ $m + n = -1 \quad (1)$ $m - 3n = -9 \quad (2)$ $(1) - (2)$ $4n = 8$ $\therefore n = 2$ $m + 2 = -1$ $\therefore m = -3$	<p>✓ substitution of <math>\left(-\frac{1}{3}; 0\right)</math>  and <math>(1; 0)</math>  ✓ substitution of <math>(0; 1)</math></p> <p>✓ <math>m = -3</math></p> <p>✓ <math>f'(x) = -3\left(x^2 - \frac{2}{3}x - \frac{1}{3}\right)</math></p> <p>✓ <math>n = 2</math>  ✓ <math>k = 1</math> (6)</p> <p><b>OR/OF</b>  ✓ <math>k = 1</math></p> <p>✓ <math>m + n = -1</math>  ✓ <math>m - 3n = -9</math></p> <p>✓ <math>4n = 8</math>  ✓ <math>n = 2</math></p> <p>✓ <math>m = -3</math> (6)</p>
<p>8.2.1</p>	$f(x) = -x^3 + x^2 + x + 2$ $f\left(-\frac{1}{3}\right) = \frac{49}{27} = 1,81$ <p>T.P<math>\left(-\frac{1}{3}; \frac{49}{27}\right)</math></p> $f(1) = 3$ <p>T.P<math>(1; 3)</math></p>	<p>✓ <math>x</math>-coordinates of the TP</p> <p>✓ T.P<math>\left(-\frac{1}{3}; \frac{49}{27}\right)</math></p> <p>✓ T.P<math>(1; 3)</math> (3)</p>



8.2.2	$f(x) = -x^3 + x^2 + x + 2$ $-x^3 + x^2 + x + 2 = 0$ $(x-2)(-x^2 - x - 1) = 0$ $x = 2 \text{ or no solution}$ 	<ul style="list-style-type: none"> <li>✓ <math>x = 2</math></li> <li>✓ one <math>x</math>-intercept</li> <li>✓ two turning points</li> <li>✓ <math>y</math>-intercept</li> <li>✓ shape: neg cubic</li> </ul> <p style="text-align: right;">(5)</p>
8.3.1	$a = \frac{-\frac{1}{3} + 1}{2}$ $= \frac{1}{3}$ <p><b>OR/OF</b></p> $f'(x) = -3x^2 + 2x + 1$ $f''(x) = -6x + 2$ $f''(a) = -6a + 2 = 0$ $-6a = -2$ $a = \frac{1}{3}$	<ul style="list-style-type: none"> <li>✓ answer (1)</li> </ul> <p><b>OR/OF</b></p> <ul style="list-style-type: none"> <li>✓ answer (1)</li> </ul>
8.3.2	$b < \frac{4}{3} \text{ units}$	<ul style="list-style-type: none"> <li>✓ <math>\frac{4}{3}</math></li> <li>✓ <math>b &lt; \frac{4}{3}</math></li> </ul> <p style="text-align: right;">(2)</p>
<b>[17]</b>		

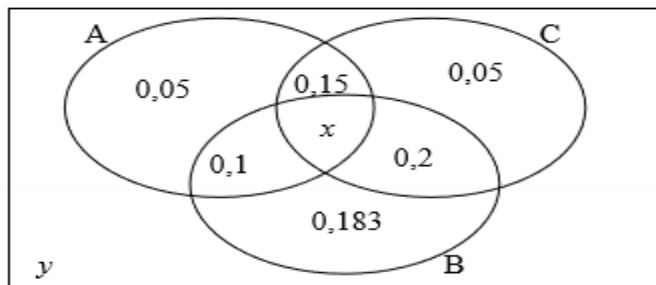
**QUESTION9/VRAAG 9**

9.1	<p>Any point on <math>f : (x; x^2)</math></p> $\text{distance} = \sqrt{(x-10)^2 + (x^2-2)^2}$ $= \sqrt{x^2 - 20x + 100 + x^4 - 4x^2 + 4}$ $= \sqrt{x^4 - 3x^2 - 20x + 104}$ <p>For min distance</p> $\frac{d}{dx}(x^4 - 3x^2 - 20x + 104) = 0$ $4x^3 - 6x - 20 = 0$ $(x-2)(4x^2 + 8x + 10) = 0$ $\Delta = 8^2 - 4(4)(10) = -96 \quad \therefore \text{no roots}$ $\therefore x = 2$ $d = \sqrt{2^4 - 3(2)^2 - 20(2) + 104} = 2\sqrt{17} = 8,25$	<p>✓ <math>(x; x^2)</math></p> <p>✓ substitution</p> <p>✓ simplification</p> <p>✓ answer</p> <p>✓ <math>4x^3 - 6x - 20</math></p> <p>✓ derivative = 0</p> <p>✓ <math>x = 2</math></p> <p>✓ answer (A) (8)</p>
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9.2	$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{x^2 - 2}{x - 10}$ $\therefore m_{\text{tangent}} = -\frac{x-10}{x^2-2}$ $f'(x) = 2x$ $\therefore 2x = -\frac{x-10}{x^2-2}$ $-2x^3 + 4x = x - 10$ $2x^3 - 3x - 10 = 0$ $x = 2$ $y = (2)^2 = 4$ $\therefore AB = \sqrt{(2-10)^2 + (4-2)^2}$ $= 2\sqrt{17} = 8,25$	<p>✓ <math>m_{AB}</math></p> <p>✓ <math>m_{\text{tangent}} = -\frac{x-10}{x^2-2}</math></p> <p>✓ <math>f'(x) = 2x</math></p> <p>✓ equating</p> <p>✓ standard form</p> <p>✓ <math>x = 2</math></p> <p>✓ substitute into distance</p> <p>✓ answer (A) (8)</p>
		<b>[8]</b>

## QUESTION 10/VRAAG 10



10.1.1(a)	$y = 1 - 0,893 = 0,107$ (0,11)	✓ $y = 1 - 0,893$ (1)
10.1.1(b)	$x = 0,893 - 0,733$ $= 0,16$	✓ $x = 0,893 - 0,733$ (1)
10.1.2	$P(\text{at least 2 events}) = 0,1 + 0,15 + 0,16 + 0,2$ $= 0,61$ <span style="border: 1px solid black; padding: 2px;">Answer only: Full Marks</span>	✓ values ✓ answer (2)
10.1.3	$P(B) = 0,643$ $P(C) = 0,56$ $P(B \text{ and } C) = 0,36$ $P(B) \times P(C) = 0,643 \times 0,56 = 0,36$ $\therefore P(B \text{ and } C) = P(B) \times P(C)$ $\therefore B \text{ and } C \text{ are independent}$	✓ $P(B) = 0,643$ ✓ $P(C) = 0,56$ ✓ $P(B \text{ and } C) = 0,36$ ✓ $P(B) \times P(C) = 0,36$ ✓ independent because $P(B \text{ and } C) = P(B) \times P(C)$ (5)
10.2.1	$7 \times 6 \times 5 \times 4 = 840$	✓ $4 \times 7$ ✓ $7 \times 6 \times 5 \times 4 = 840$ (3)
10.2.2	start with 5, 7, 9 or start with 6 or start with 8 $(3 \times 5 \times 1 \times 3) + (1 \times 5 \times 1 \times 2) + (1 \times 5 \times 1 \times 2)$ $= 45 + 10 + 10$ $= 65$ $P = \frac{65}{840} = \frac{13}{168} = 0,08$  <b>OR/OF</b> ends in 4 or ends in 6 or ends in 8 $(5 \times 5 \times 1 \times 1) + (4 \times 5 \times 1 \times 1) + (4 \times 5 \times 1 \times 1)$ $= 25 + 20 + 20$ $= 65$ $P = \frac{65}{840} = \frac{13}{168} = 0,08$	✓ $(3 \times 5 \times 1 \times 3) = 45$ ✓ $(1 \times 5 \times 1 \times 2) = 10$ ✓ $(1 \times 5 \times 1 \times 2) = 10$ ✓ 65 ✓ answer (5)  <b>OR/OF</b> ✓ $(5 \times 5 \times 1 \times 1) = 25$ ✓ $(4 \times 5 \times 1 \times 1) = 20$ ✓ $(4 \times 5 \times 1 \times 1) = 20$ ✓ 65 ✓ answer (5)
		<b>[17]</b>

TOTAL/TOTAAL: 150



# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**NOVEMBER 2023**

**MARKS: 150**

**TIME: 3 hours**

**This question paper consists of 9 pages and 1 information sheet.**

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Mathematics/P1

3  
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**QUESTION 1**1.1 Solve for  $x$ :

1.1.1  $x^2 + x - 12 = 0$  (3)

1.1.2  $3x^2 - 2x = 6$  (answers correct to TWO decimal places) (4)

1.1.3  $\sqrt{2x+1} = x-1$  (4)

1.1.4  $x^2 - 3 > 2x$  (4)

1.2 Solve for  $x$  and  $y$  simultaneously:

$x + 2 = 2y$  and  $\frac{1}{x} + \frac{1}{y} = 1$  (5)

1.3 Given:  $2^{m+1} + 2^m = 3^{n+2} - 3^n$  where  $m$  and  $n$  are integers.Determine the value of  $m + n$ . (4)  
[24]



Mathematics/P1

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NSC

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**QUESTION 2**2.1 Given the arithmetic series:  $7 + 12 + 17 + \dots$ 2.1.1 Determine the value of  $T_{91}$  (3)2.1.2 Calculate  $S_{91}$  (2)2.1.3 Calculate the value of  $n$  for which  $T_n = 517$  (3)

2.2 The following information is given about a quadratic number pattern:

$$T_1 = 3, T_2 - T_1 = 9 \text{ and } T_3 - T_2 = 21$$

2.2.1 Show that  $T_5 = 111$  (2)2.2.2 Show that the general term of the quadratic pattern is  $T_n = 6n^2 - 9n + 6$  (3)2.2.3 Show that the pattern is increasing for all  $n \in N$ . (3)  
[16]**QUESTION 3**3.1 Given the geometric series:  $3 + 6 + 12 + \dots$  to  $n$  terms.

3.1.1 Write down the general term of this series. (1)

3.1.2 Calculate the value of  $k$  such that:  $\sum_{p=1}^k \frac{3}{2}(2)^p = 98\,301$  (4)

3.2 A geometric sequence and an arithmetic sequence have the same first term.

- The common ratio of the geometric sequence is  $\frac{1}{3}$
- The common difference of the arithmetic sequence is 3
- The sum of 22 terms of the arithmetic sequence is 734 more than the sum to infinity of the geometric sequence.

Calculate the value of the first term. (5)  
[10]

Mathematics/P1

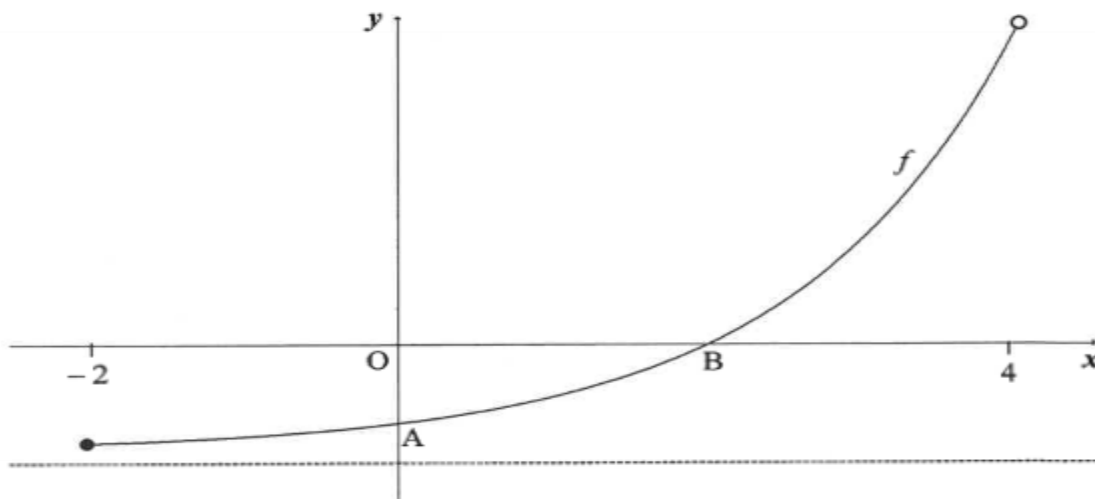
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**QUESTION 4**

Sketched below is the graph of  $f(x) = 2^x - 4$  for  $x \in [-2; 4)$ .

A and B are respectively the  $y$ - and  $x$ -intercepts of  $f$ .



- 4.1 Write down the equation of the asymptote of  $f$ . (1)
- 4.2 Determine the coordinates of B. (2)
- 4.3 Determine the equation of  $k$ , a straight line passing through A and B in the form  $k(x) = \dots$  (3)
- 4.4 Calculate the vertical distance between  $k$  and  $f$  at  $x = 1$  (3)
- 4.5 Write down the equation of  $g$  if it is given that  $g(x) = f(x) + 4$  (1)
- 4.6 Write down the domain of  $g^{-1}$ . (2)
- 4.7 Write down the equation of  $g^{-1}$  in the form  $y = \dots$  (2)

**[14]**

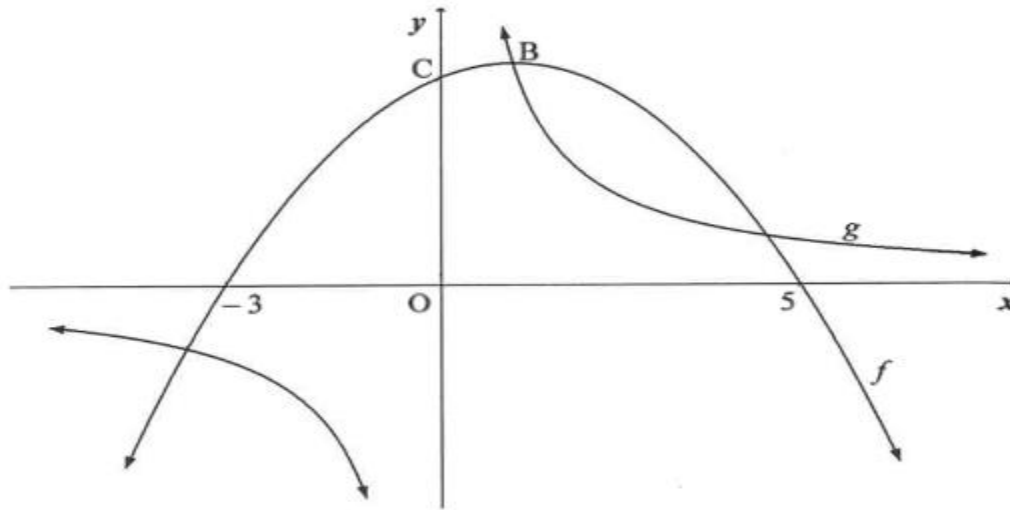
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**QUESTION 5**

The graphs of  $f(x) = -\frac{1}{2}(x-1)^2 + 8$  and  $g(x) = \frac{d}{x}$  are drawn below. A point of intersection of  $f$  and  $g$  is B, the turning point of  $f$ . The graph  $f$  has  $x$ -intercepts at  $(-3; 0)$  and  $(5; 0)$  and a  $y$ -intercept at C.



- 5.1 Write down the coordinates of the turning point of  $f$ . (2)
- 5.2 Calculate the coordinates of C. (2)
- 5.3 Calculate the value of  $d$ . (1)
- 5.4 Write down the range of  $g$ . (1)
- 5.5 For which values of  $x$  will  $f(x) \cdot g(x) \leq 0$ ? (3)
- 5.6 Calculate the values of  $k$  so that  $h(x) = -2x + k$  will not intersect the graph of  $g$ . (5)
- 5.7  $h$  is a tangent to  $g$  at R, a point in the first quadrant. Calculate  $t$  such that  $y = f(x) + t$  intersects  $g$  at R. (4)
- [18]



Mathematics/P1

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**QUESTION 6**

- 6.1 Patrick deposited an amount of R18 500 into an account earning  $r\%$  interest p.a., compounded monthly. After 6 months, his balance was R19 319,48.
- 6.1.1 Calculate the value of  $r$ . (3)
- 6.1.2 Calculate the effective interest rate. (2)
- 6.2 Kuda bought a laptop for R10 000 on 31 January 2019. He will replace it with a new one in 5 years' time on 31 January 2024.
- 6.2.1 The value of the old laptop depreciates annually at a rate of 20% p.a. according to the straight-line method. After how many years will the laptop have a value of R0? (2)
- 6.2.2 Kuda will buy a laptop that costs R20 000. In order to cover the cost price, he made his first monthly deposit into a savings account on 28 February 2019. He will make his 60<sup>th</sup> monthly deposit on 31 January 2024. The savings account pays interest at 8,7% p.a., compounded monthly. Calculate Kuda's monthly deposit into this account. (4)
- 6.3 Tino wins a jackpot of R1 600 000. He invests all of his winnings in a fund that earns interest of 11,2% p.a., compounded monthly. He withdraws R20 000 from the fund at the end of each month. His first withdrawal is exactly 1 month after his initial investment. How many withdrawals of R20 000 will Tino be able to make from this fund? (5)

[16]

**QUESTION 7**

- 7.1 Determine  $f'(x)$  from first principles if  $f(x) = -4x^2$  (5)
- 7.2 Determine:
- 7.2.1  $f'(x)$  if  $f(x) = 2x^3 - 3x$  (2)
- 7.2.2  $D_x(7\sqrt[3]{x^2} + 2x^{-5})$  (3)
- 7.3 For which values of  $x$  will the tangent to  $f(x) = -2x^3 + 8x$  have a positive gradient? (3)

[13]



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8  
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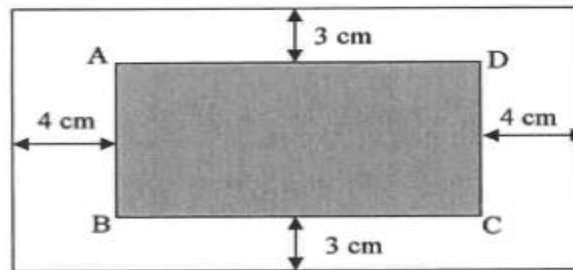
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**QUESTION 8**Given:  $f(x) = -x^3 + 6x^2 - 9x + 4 = (x-1)^2(-x+4)$ 

- 8.1 Determine the coordinates of the turning points of  $f$ . (4)
- 8.2 Draw a sketch graph of  $f$ . Clearly label all the intercepts with the axes and any turning points. (4)
- 8.3 Use the graph to determine the value(s) of  $k$  for which  $-x^3 + 6x^2 - 9x + 4 = k$  will have three real and unequal roots. (2)
- 8.4 The line  $g(x) = ax + b$  is the tangent to  $f$  at the point of inflection of  $f$ . Determine the equation of  $g$ . (6)
- 8.5 Calculate the value of  $\theta$ , the acute angle formed between  $g$  and the  $x$ -axis in the first quadrant. (2)
- [18]

**QUESTION 9**

The diagram below represents a printed poster. Rectangle  $ABCD$  is the part on which the text is printed. This shaded area  $ABCD$  is  $432 \text{ cm}^2$  and  $AD = x \text{ cm}$ .  $ABCD$  is  $4 \text{ cm}$  from the left and right edges of the page and  $3 \text{ cm}$  from the top and bottom of the page.



- 9.1 Show that the total area of the page is given by:  

$$A(x) = \frac{3456}{x} + 6x + 480$$
 (3)
- 9.2 Determine the value of  $x$  such that the total area of the page is a minimum. (3)
- [6]

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**QUESTION 10**

10.1 A and B are independent events.  $P(A) = \frac{1}{3}$  and  $P(B) = \frac{3}{4}$

Determine:

10.1.1  $P(A \text{ and } B)$  (2)

10.1.2  $P(\text{at least ONE event occurs})$  (2)

10.2 The probability that it will snow on the Drakensberg Mountains in June is 5%.

- When it snows on the mountains, the probability that the minimum temperature in Central South Africa will drop below  $0^\circ\text{C}$  is 72%.
- If it does not snow on the mountains, the probability that the minimum temperature in Central South Africa will drop below  $0^\circ\text{C}$  is 35%.

10.2.1 Represent the given information on a tree diagram. Clearly indicate the probabilities associated with EACH branch. (3)

10.2.2 Calculate the probability that the temperature in Central South Africa will NOT drop below  $0^\circ\text{C}$  in June 2024. (3)

10.3 Ten learners stand randomly in a line, one behind the other.

10.3.1 In how many different ways can the ten learners stand in the line? (1)

10.3.2 Calculate the probability that there will be 5 learners between the 2 youngest learners in the line. (4)  
[15]

**TOTAL: 150**



# basic education

Department:  
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REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE/  
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**GRADE 12/GRAAD 12**

**MATHEMATICS P1/WISKUNDE V1**

**NOVEMBER 2023**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS/PUNTE: 150**

**These marking guidelines consist of 17 pages.  
*Hierdie nasienriglyne bestaan uit 17 bladsye.***

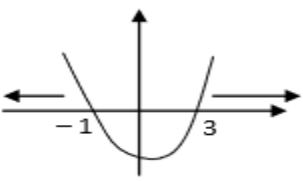




- NOTE:**
- If a candidate answers a question TWICE, only mark the FIRST attempt.
  - Consistent Accuracy applies in all aspects of the marking memorandum.

- LET WEL:**
- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
  - Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.

**QUESTION 1/VRAAG 1**

1.1.1	$x^2 + x - 12 = 0$ $(x - 3)(x + 4) = 0$ $x = 3$ or $x = -4$	✓ factors/formula ✓ answer ✓ answer (3)
1.1.2	$3x^2 - 2x = 6$ $3x^2 - 2x - 6 = 0$ $x = \frac{2 \pm \sqrt{(-2)^2 - 4(3)(-6)}}{2(3)}$ $x = 1,79$ or $x = -1,12$	✓ standard form ✓ substitution into correct formula ✓ answer ✓ answer (4)
1.1.3	$\sqrt{2x+1} = x-1$ $2x+1 = (x-1)^2$ $2x+1 = x^2 - 2x+1$ $x^2 - 4x = 0$ $x(x-4) = 0$ $x = 0$ or $x = 4$ $x \neq 0$ or $x = 4$	✓ squaring both sides ✓ standard form ✓ both x-values ✓ valid answer (4)
1.1.4	$x^2 - 2x > 3$ $x^2 - 2x - 3 > 0$ $(x - 3)(x + 1) > 0$ CV's: $x = -1$ ; $x = 3$  $x < -1$ or $x > 3$	✓ standard form ✓ critical values/factors ✓✓ answer (4)



1.2	$\frac{1}{x} + \frac{1}{y} = 1 \quad \dots \quad (1)$ $x + 2 = 2y \quad \dots \quad (2)$ $x = 2y - 2$ $\frac{1}{2y - 2} + \frac{1}{y} = 1$ $y + 2y - 2 = 2y^2 - 2y$ $2y^2 - 5y + 2 = 0$ $(2y - 1)(y - 2) = 0$ $y = \frac{1}{2} \quad \text{or} \quad y = 2$ $x = -1 \quad \text{or} \quad x = 2$ <p><b>OR/OF</b></p> $\frac{1}{x} + \frac{1}{y} = 1 \quad \dots \quad (1)$ $x + 2 = 2y \quad \dots \quad (2)$ $y = \frac{x}{2} + 1$ $\frac{1}{x} + \frac{1}{\frac{x}{2} + 1} = 1$ $\frac{1}{x} + \frac{2}{x + 2} = 1$ $x + 2 + 2x = x^2 + 2x$ $x^2 - x - 2 = 0$ $(x + 1)(x - 2) = 0$ $x = -1 \quad \text{or} \quad x = 2$ $y = \frac{1}{2} \quad \text{or} \quad y = 2$	$\checkmark x = 2y - 2$ $\checkmark \text{substitution}$ $\checkmark \text{standard form}$ $\checkmark y\text{-values}$ $\checkmark x\text{-values} \quad (5)$ <p><b>OR/OF</b></p> $\checkmark y = \frac{x}{2} + 1$ $\checkmark \text{substitution}$ $\checkmark \text{standard form}$ $\checkmark x\text{-values}$ $\checkmark y\text{-values} \quad (5)$
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1.3	$2^{m+1} + 2^m = 3^{n+2} - 3^n$ $2^m(2+1) = 3^n(3^2 - 1)$ $2^m(3) = 3^n(8)$ $2^m(3) = 3^n(2^3)$ $\therefore m = 3 \text{ and } n = 1$ $\therefore m + n = 4$ <p><b>OR/OF</b></p> $2^{m+1} + 2^m = 3^{n+2} - 3^n$ $2^m(2+1) = 3^n(3^2 - 1)$ $2^m(3) = 3^n(8)$ $2^m(3) = 3^n(2^3)$ $2^{m-3} = 3^{n-1}$ <p>Only true if <math>m - 3 = 0</math> and <math>n - 1 = 0</math></p> $\therefore m + n = 4$	<p>✓ factors</p> <p>✓ <math>2^m(3) = 3^n(2^3)</math> (same bases)</p> <p>✓ <math>m = 3</math> and <math>n = 1</math></p> <p>✓ <math>m + n = 4</math> (4)</p> <p><b>OR/OF</b></p> <p>✓ factors</p> <p>✓ <math>2^m(3) = 3^n(2^3)</math> (same bases)</p> <p>✓ <math>m - 3 = 0</math> and <math>n - 1 = 0</math></p> <p>✓ <math>m + n = 4</math> (4)</p> <p style="text-align: right;"><b>[24]</b></p>
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## QUESTION 2/VRAAG 2

2.1.1	$7 + 12 + 17 + \dots$ $T_n = a + (n-1)d$ $T_{91} = 7 + (91-1)(5)$ $T_{91} = 457$  <b>OR/OF</b> $d = 5$ $T_n = 5n + 2$ $T_{91} = 5(91) + 2$ $T_{91} = 457$	$\checkmark d = 5$ $\checkmark$ substitution into correct formula $\checkmark$ answer (3)  <b>OR/OF</b> $\checkmark d = 5$ $\checkmark$ substitution $n = 91$ $\checkmark$ answer (3)
2.1.2	$S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{91} = \frac{91}{2}[2 \times 7 + (91-1)(5)]$ $S_9 = 21\,112$  <b>OR/OF</b> $S_n = \frac{n}{2}(a+l)$ $S_{91} = \frac{91}{2}(7+457)$ $S_{91} = 21\,112$	$\checkmark$ substitution into correct formula $\checkmark$ answer (2)  <b>OR/OF</b> $\checkmark$ substitution into correct formula $\checkmark$ answer (2)
2.1.3	$T_n = 7 + (n-1)(5)$ $5n + 2 = 517$ $5n = 515$ $n = 103$	$\checkmark$ substitution into correct formula $\checkmark$ equate $\checkmark$ answer (3)
2.2.1	$T_1 = 3; T_2 - T_1 = 9 \quad \text{and} \quad T_3 - T_2 = 21$  $  \begin{array}{cccccc}  3 & & 12 & & 33 & & 66 & & 111 \\  & \swarrow & & \swarrow & & \swarrow & & \swarrow & \\  & 9 & & 21 & & 33 & & 45 & \\  & & \swarrow & & \swarrow & & \swarrow & & \\  & & 12 & & 12 & & 12 & &   \end{array}  $ $\therefore T_5 = 3 + 9 + 21 + 33 + 45 = 111$  <b>OR/OF</b> $2a = 12$ $a = 6$ $3(6) + b = 9$ $b = -9$ $6 - 9 + c = 3$ $T_5 = 6(5)^2 - 9(5) + 6 = 111$	$\checkmark$ constant second diff = 12 $\checkmark$ first differences : 33 and 45 (2)  <b>OR/OF</b> $\checkmark$ constant second diff = 12  $\checkmark$ substitute 5 (2)





2.2.2	$2a = 12$ $a = 6$ $3(6) + b = 9$ or $5 \times 6 + b = 21$ $b = -9$ $6 - 9 + c = 3$ $c = 6$ $T_n = 6n^2 - 9n + 6$	$\checkmark 2a = 12$ $\checkmark 3(6) + b = 9 / 5 \times 6 + b = 21$ $\checkmark 6 - 9 + c = 3$ (3)
2.2.3	$T_n' = 12n - 9 > 0$ $n > \frac{3}{4}$ $\therefore T_n$ is increasing for $n \in N$  <b>OR/OF</b> $n = -\frac{b}{2a} = -\frac{-9}{2(6)}$ $n = \frac{3}{4}$ $\therefore \text{min at } n = 1 \text{ for } n \in N$ $\therefore T_n$ is increasing for $n \in N$	$\checkmark T_n' = 12n - 9$ $\checkmark n > \frac{3}{4}$ $\checkmark$ increasing for $n \in N$ (3)  <b>OR/OF</b> $\checkmark n = -\frac{b}{2a} = \frac{9}{2(6)}$ $\checkmark n = \frac{3}{4}$ $\checkmark$ increasing for $n \in N$ (3)
<b>[16]</b>		





## QUESTION 3/VRAAG 3

3.1.1	$T_n = ar^{n-1}$ $T_n = 3(2)^{n-1}$	$\checkmark T_n = 3(2)^{n-1} \quad (1)$
3.1.2	$\sum_{p=1}^k \frac{3}{2} \cdot 2^p = 98\,301$ $\sum_{p=1}^k \frac{3}{2} \cdot 2^p = 3 + 6 + 12 + \dots$ $n = k$ $\frac{3[(2)^k - 1]}{2 - 1} = 98\,301$ $(2)^k = 32\,768$ $2^k = 2^{15} \quad \text{OR/OF} \quad k = \log_2 32\,768$ $\therefore k = 15$	$\checkmark \text{expansion}$ $\checkmark n = k$ $\checkmark \text{substitution into correct formula}$ $\checkmark k = 15 \quad (4)$
3.2	$S_{22} = \frac{22}{2} [2a + 21(3)]$ $S_{22} = 22a + 693$ $S_{\infty} = \frac{a}{1 - \frac{1}{3}}$ $= \frac{3a}{2}$ $\therefore 22a + 693 = \frac{3a}{2} + 734$ $44a + 1386 = 3a + 1468$ $41a = 82$ $a = 2$	$\checkmark \text{substitution into } S_n$ $\checkmark S_{22} = 22a + 693$ $\checkmark \text{substitution into } S_{\infty}$ $\checkmark S_{22} = S_{\infty} + 734$ $\checkmark \text{answer} \quad (5)$
		<b>[10]</b>





## QUESTION 4/VRAAG 4

4.1	$y = -4$	✓ $y = -4$ (1)
4.2	$x$ - intercept: $0 = 2^x - 4$ $4 = 2^x$ $x = 2$ $\therefore B(2; 0)$	✓ $y = 0$ ✓ $x = 2$ (2)
4.3	$y = 2^0 - 4 = -3$ $\therefore A(0; -3)$  $y = mx + c$ $m = \frac{3}{2}$  $k(x) = \frac{3}{2}x - 3$	✓ $y = -3$  ✓ gradient  ✓ equation (3)
4.4	$k(1) = \frac{3}{2}(1) - 3 = -\frac{3}{2}$ $f(1) = 2^1 - 4 = -2$ Vertical distance = $-\frac{3}{2} - (-2) = \frac{1}{2}$ units	✓ $k(1)$ ✓ $f(1) = -2$ ✓ answer (3)
4.5	$g(x) = f(x) + 4$  $g(x) = 2^x ; x \in [-2 ; 4)$	✓ $g(x) = 2^x$ (1)
4.6	Range of $g : y \in \left[\frac{1}{4}; 16\right)$  Domain of $g^{-1} : x \in \left[\frac{1}{4}; 16\right)$ or/of $\frac{1}{4} \leq x < 16$	✓ $x \in \left[\frac{1}{4}; 16\right)$ (2)
4.7	$g : y = 2^x$ $g^{-1} : x = 2^y$  $g^{-1}(x) = \log_2 x, x \in \left[\frac{1}{4}; 16\right)$	✓ swop $x$ and $y$ ✓ equation (2)
		[14]



## QUESTION 5/VRAAG 5

5.1	$(1 ; 8)$	✓ $x = 1$ ✓ $y = 8$ (2)
5.2	$y = -\frac{1}{2}(0-1)^2 + 8$ $= 7\frac{1}{2}$ $C\left(0; \frac{15}{2}\right)$	✓ $x = 0$  ✓ answer (2)
5.3	$8 = \frac{d}{1}$ $\therefore d = 8$	✓ substitution (1 ; 8) (1)
5.4	$y \in R ; y \neq 0$	✓ $y \neq 0$ (1)
5.5	$-3 \leq x < 0$ or $x \geq 5$ <b>OR/OF</b> $x \in [-3 ; 0) \cup [5 ; \infty)$	✓✓ $-3 \leq x < 0$ ✓ $x \geq 5$ (3)
5.6	$-2x + k = \frac{8}{x}$ $-2x^2 + kx - 8 = 0$ $\Delta = (k)^2 - 4(-2)(-8)$ $k^2 - 64 < 0$ $CV : k = 8 ; k = -8$ $\therefore -8 < k < 8 \quad \text{or/of} \quad k \in (-8 ; 8)$ <b>OR/OF</b> $g'(x) = h'(x)$ $-\frac{8}{x^2} = -2$ $-8 = -2x^2$ $x = \pm 2$ $y = \pm 4 \quad \therefore B(2 ; 4) \text{ and } A(-2 ; -4)$ For tangents: $h(x) = -2x + k \quad \text{or} \quad h(x) = -2x + k$ $4 = -2(2) + k \quad \quad \quad -4 = -2(-2) + k$ $k = 8 \quad \quad \quad \quad \quad \quad \quad k = -8$ $\therefore -8 < k < 8 \quad \text{or/of} \quad k \in (-8 ; 8)$	✓ $-2x + k = \frac{8}{x}$ ✓ standard form ✓ substitution into $\Delta$ ✓ $\Delta < 0$ or $\Delta = 0$  ✓ inequality (5)  <b>OR/OF</b> ✓ $-\frac{8}{x^2}$ ✓ $= -2$  ✓ x-values ✓ y-values   ✓ inequality (5)



**QUESTION 6/VRAAG 6**

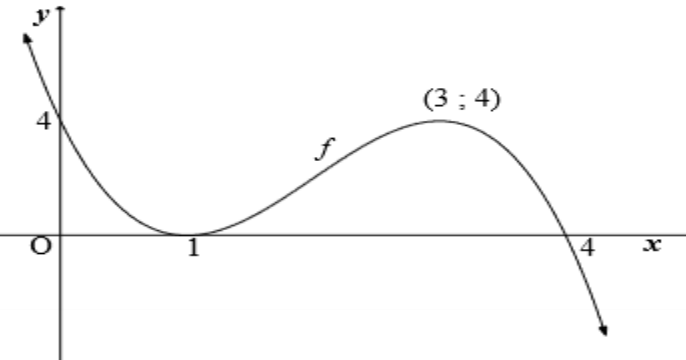
6.1.1	$A = P(1+i)^n$ $19\,319,48 = 18\,500 \left(1 + \frac{r}{1200}\right)^6$ $\left(1 + \frac{r}{1200}\right) = \sqrt[6]{1,04429\dots}$ $\frac{r}{1200} = 0,00725\dots$ $r = 8,7\%$	<ul style="list-style-type: none"> <li>✓ <math>n = 6</math></li> <li>✓ substitution into correct formula</li> </ul> <p>✓ answer (3)</p>
6.1.2	$1 + \frac{i}{100} = \left(1 + \frac{8,7}{1200}\right)^{12}$ $r = 9,06\%$	<ul style="list-style-type: none"> <li>✓ substitution into correct formula</li> </ul> <p>✓ answer (2)</p>
6.2.1	$A = P(1-in)$ $0 = 10\,000(1 - 0,2n)$ $n = 5$	<ul style="list-style-type: none"> <li>✓ substitution into correct formula</li> </ul> <p>✓ answer (2)</p>
6.2.2	$F = \frac{x[(1+i)^n - 1]}{i}$ $20\,000 = \frac{x \left[ \left(1 + \frac{8,7}{1200}\right)^{60} - 1 \right]}{\frac{8,7}{1200}}$ $x = R267,26$	<ul style="list-style-type: none"> <li>✓ <math>i</math></li> <li>✓ <math>n</math></li> <li>✓ substitution into correct formula</li> </ul> <p>✓ answer (4)</p>
6.3	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $1\,600\,000 = \frac{20\,000 \left[ 1 - \left(1 + \frac{0,112}{12}\right)^{-n} \right]}{\frac{0,112}{12}}$ $\frac{56}{75} = 1 - \left(1 + \frac{0,112}{12}\right)^{-n}$ $\left(1 + \frac{0,112}{12}\right)^{-n} = \frac{19}{75}$ $-n = \log_{\left(1 + \frac{0,112}{12}\right)} \left(\frac{19}{75}\right)$ $-n = -147,80$ <p>Tino will make 147 withdrawals of R20 000</p>	<ul style="list-style-type: none"> <li>✓ <math>i</math></li> <li>✓ substitution into correct formula</li> </ul> <p>✓ correct use of logs</p> <p>✓ <math>-n = -147,80</math></p> <p>✓ <math>n = 147</math></p> <p>(5)</p>
		<b>[16]</b>



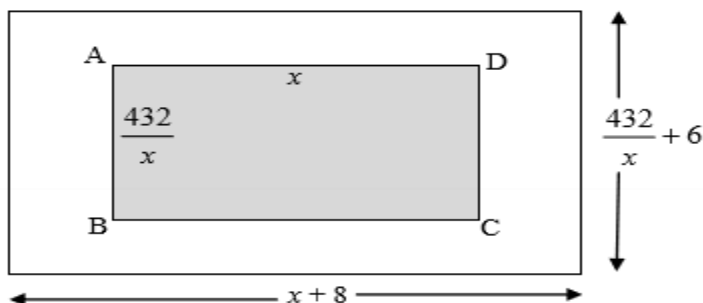
## QUESTION 7/VRAAG 7

7.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-4(x+h)^2 - (-4x^2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-4x^2 - 8xh - 4h^2 + 4x^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-8xh - 4h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(-8x - 4h)}{h}$ $f'(x) = \lim_{h \rightarrow 0} (-8x - 4h)$ $f'(x) = -8x$ <p><b>OR/OF</b></p> $f(x+h) = -4(x+h)^2 = -4x^2 - 8xh - 4h^2$ $f(x+h) - f(x) = -4x^2 - 8xh - 4h^2 - (-4x^2)$ $= -8xh - 4h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-8xh - 4h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(-8x - 4h)}{h}$ $f'(x) = \lim_{h \rightarrow 0} (-8x - 4h)$ $f'(x) = -8x$	<p>✓ substitution into correct formula</p> <p>✓ <math>f(x+h) = -4x^2 - 8xh - 4h^2</math></p> <p>✓ simplification</p> <p>✓ common factor</p> <p>✓ answer (5)</p> <p><b>OR/OF</b></p> <p>✓ <math>f(x+h) = -4x^2 - 8xh - 4h^2</math></p> <p>✓ simplification</p> <p>✓ substitution into correct formula</p> <p>✓ common factor</p> <p>✓ answer (5)</p>
7.2.1	$f(x) = 2x^3 - 3x$ $f'(x) = 6x^2 - 3$	<p>✓ <math>6x^2</math></p> <p>✓ <math>-3</math> (2)</p>
7.2.2	$D_x \left[ 7\sqrt[3]{x^2} + 2x^{-5} \right]$ $D_x \left[ 7x^{\frac{2}{3}} + 2x^{-5} \right]$ $= \frac{14}{3}x^{-\frac{1}{3}} - 10x^{-6}$	<p>✓ <math>x^{\frac{2}{3}}</math></p> <p>✓ derivative with rational exp</p> <p>✓ <math>-10x^{-6}</math> (3)</p>
7.3	$-6x^2 + 8 > 0$ $x^2 < \frac{8}{6}$ $\text{CV's: } x = -\frac{2}{\sqrt{3}} \text{ or } x = \frac{2}{\sqrt{3}}$ $\text{Positive for: } -\frac{2}{\sqrt{3}} < x < \frac{2}{\sqrt{3}}$	<p>✓ CV's: <math>x = \pm \frac{2}{\sqrt{3}}</math></p> <p>✓ ✓ answer (3)</p>
<b>[13]</b>		

## QUESTION 8/VRAAG 8

8.1	$f'(x) = -3x^2 + 12x - 9$ $-3x^2 + 12x - 9 = 0$ $x^2 - 4x + 3 = 0$ $(x-3)(x-1) = 0$ $\therefore x = 3$ or $x = 1$ $f(3) = -(3)^3 + 6(3)^2 - 9(3) + 4 = 4$ $f(1) = -(1)^3 + 6(1)^2 - 9(1) + 4 = 0$ $\therefore$ turning points are: $(3 ; 4)$ and $(1 ; 0)$	✓ $f'(x) = -3x^2 + 12x - 9$ ✓ $f'(x) = 0$  ✓ both $x$ -values  ✓ both $y$ -values (4)
8.2		✓ $y$ -intercept ✓ both $x$ -intercepts ✓ both turning points ✓ shape (4)
8.3	$0 < k < 4$ or/of $k \in (0 ; 4)$	✓ ✓ $k$ between $y$ -values of turning points (2)
8.4	$f''(x) = -6x + 12 = 0$ $x = 2$ Max at $(2 ; 2)$  $f'(2) = 3$ $\therefore y - 2 = 3(x - 2)$ or $2 = 3(2) + c$ $g(x) = 3x - 4$ or $g(x) = 3x - 4$  <b>OR/OF</b> Point of inflection: $x = \frac{3+1}{2}$ $x = 2$ Max at $(2 ; 2)$  $f'(2) = 3$ $\therefore y - 2 = 3(x - 2)$ or $2 = 3(2) + c$ $g(x) = 3x - 4$ or $g(x) = 3x - 4$	✓ $f''(x) = -6x + 12$ ✓ $f''(x) = 0$ ✓ $x$ -value ✓ $y$ -value ✓ gradient at $x$ -value  ✓ equation of tangent (6)  <b>OR/OF</b> ✓ ✓ $\frac{3+1}{2}$ ✓ $x$ -value ✓ $y$ -value  ✓ gradient at $x$ -value  ✓ equation of tangent (6)
8.5	$\tan \theta = 3$ $\therefore \theta = 71,57^\circ$	✓ gradient of $g$ ✓ answer (2)
		[18]

## QUESTION 9/VRAAG 9



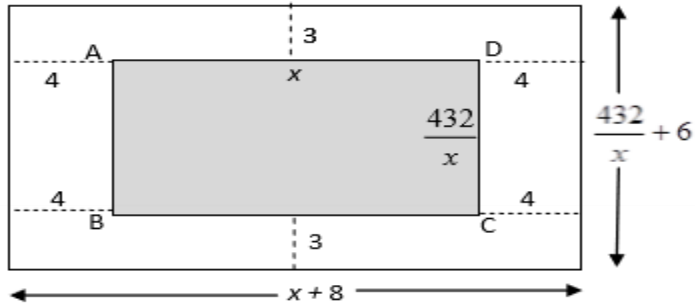
9.1	$432 = xb$ $\therefore b = \frac{432}{x}$ $A(x) = (x+8)\left(\frac{432}{x} + 6\right)$ $A(x) = 432 + 6x + \frac{3456}{x} + 480$ $A(x) = \frac{3456}{x} + 6x + 480$	$\checkmark b = \frac{432}{x}$ $\checkmark (x+8)$ $\checkmark \left(\frac{432}{x} + 6\right)$	(3)
9.2	$A(x) = 3456x^{-1} + 6x + 480$ $A'(x) = -\frac{3456}{x^2} + 6$ $-\frac{3456}{x^2} + 6 = 0$ $3456 = 6x^2$ $\therefore x = \sqrt{576} = 24 \text{ cm}$	$\checkmark 3456x^{-1} + 6x + 480$ $\checkmark A'(x) = -\frac{3456}{x^2} + 6$	$\checkmark$ answer (3)
			[6]

Mathematics P1/Wiskunde V1

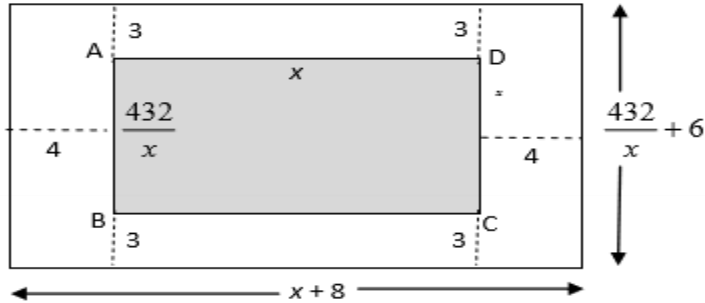
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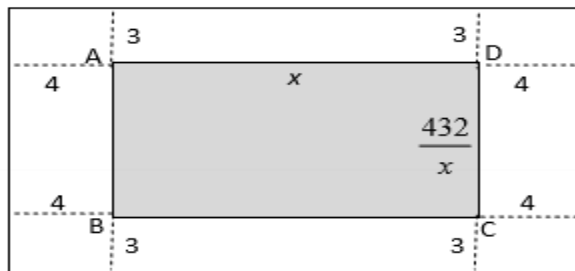
NSC/NSS – Marking Guidelines/Nasienriglyne



$$\text{total area} = 2(x+8)(3) + 2\left(\frac{432}{x}\right)(4) + \left(\frac{432}{x}\right)(x)$$



$$\text{total area} = 2(4)\left(\frac{432}{x} + 6\right) + (x)\left(\frac{432}{x} + 6\right)$$

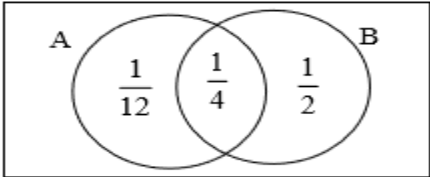
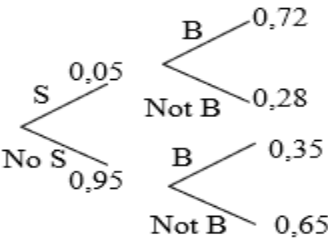


$$\text{total area} = 4(4)(3) + 2(x)(3) + \left(\frac{432}{x}\right)(x) + 2\left(\frac{432}{x}\right)(4)$$

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Please turn over/Blaai om asseblief

## QUESTION 10/VRAAG 10

10.1.1	$P(A \text{ and } B) = P(A) \times P(B)$ $= \frac{1}{3} \times \frac{3}{4}$ $= \frac{1}{4}$	$\checkmark \frac{1}{3} \times \frac{3}{4}$ $\checkmark \frac{1}{4}$	(2)
10.1.2	$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $= \frac{1}{3} + \frac{3}{4} - \frac{1}{4}$ $= \frac{5}{6}$ <p><b>OR/OF</b></p>  $P(A \text{ or } B) = \frac{1}{12} + \frac{1}{4} + \frac{1}{2} = \frac{5}{6}$	$\checkmark \text{ substitution}$ $\checkmark \text{ answer}$ <p><b>OR/OF</b></p> $\checkmark \text{ substitution}$ $\checkmark \text{ answer}$	(2)
10.2.1		$\checkmark \text{ branch 1 with probabilities}$ $\checkmark \text{ branch 2 with probabilities}$ $\checkmark \text{ branch 3 with probabilities}$	(3)
10.2.2	$P(\text{NOT below } 0^\circ)$ $= P(S; \text{NOT below } 0^\circ) + P(NS; \text{NOT below } 0^\circ)$ $= 0,05 \times 0,28 + 0,95 \times 0,65$ $= 0,6315$	$\checkmark \text{ value of } P(S; \text{NOT below } 0^\circ)$ $\checkmark \text{ value of } P(NS; \text{NOT below } 0^\circ)$ $\checkmark \text{ answer}$	(3)
10.3.1	$n(S) = 10!$	$\checkmark 10!$	(1)



10.3.2	<p>4 Options;</p> $2 \times 8 \times 7 \times 6 \times 5 \times 4 \times 1 \times 3 \times 2 \times 1 = 80\ 640$ $8 \times 2 \times 7 \times 6 \times 5 \times 4 \times 3 \times 1 \times 2 \times 1 = 80\ 640$ $8 \times 7 \times 2 \times 6 \times 5 \times 4 \times 3 \times 1 \times 1 \times 1 = 80\ 640$ $8 \times 7 \times 6 \times 2 \times 5 \times 4 \times 3 \times 2 \times 1 \times 1 = 80\ 640$ <p>Total number of possibilities = 322 560</p> $P(5 \text{ learners in between}) = \frac{322\ 560}{10!} = \frac{4}{45}$ <p><b>OR/OF</b></p> $2 \times 8 \times 7 \times 6 \times 5 \times 4 \times 1 \times 3 \times 2 \times 1$ <p>4 possible starting positions</p> $\therefore 4(2 \times 8! \times 1) = 322\ 560$ $8(8!) = 322\ 560$ $P(5 \text{ learners in between}) = \frac{322\ 560}{10!} = \frac{4}{45}$	<p>✓ (2×8!)</p> <p>✓✓4(2 × 8!) or 322 560</p> <p>✓ <math>\frac{322\ 560}{n(S)}</math> (4)</p> <p><b>OR/OF</b></p> <p>✓ (2×8!)</p> <p>✓✓4(2 × 8!) or 322 560</p> <p>✓ <math>\frac{322\ 560}{n(S)}</math></p> <p>(4)</p> <p><b>[15]</b></p>
		<b>TOTAL/TOTAAL: 150</b>

