GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION GRADE 12

2026

MATHEMATICS

(PAPER 1)

SURNAME:	
NAME:	
NAME OF SCHOOL:	
DATE:	**2 0 2 6** M M D D

ANSWER ALL THE QUESTIONS IN THE QUESTION PAPER.

	MARKER				MODERATOR			
QUESTION	**MARKS**			**MARKER'S INITIALS**	**MARKS**			**MODERATOR'S INITIALS**
1	0				0			
2	0				0			
3	0				0			
4	0				0			
5	0				0			
6	0				0			
7	0				0			
8	0				0			
9	0				0			
				TOTAL				

TIME: 3 hours

MARKS: 150

30 pages + an information sheet

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 9 questions. Answer ALL the questions in the spaces provided for answers.

2 Clearly show ALL calculations, diagrams, graphs, etc. that you have used in determining your answers.

3. Answers only will NOT necessarily be awarded full marks.

4. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.

5. If necessary, round-off answers to TWO decimal places, unless stated otherwise.

6. Diagrams are NOT necessarily drawn to scale.

7. An INFORMATION SHEET with formulae is included at the end of the question paper.

8. No pages may be torn from the question paper.

9. Candidates may not retain a question paper or remove it from the examination room. Question papers must be returned to the invigilator at the end of the examination session.

10. Answers must be written in black/blue ink as distinctly as possible. DO NOT write in the margins. stanmorephysics.com

11. Indicate the questions that you have answered by drawing a circle around the relevant numbers on the front cover of the question paper where marks are to be recorded.

12. Draw a neat line through any work/rough work that must NOT be marked.

13. In the event that you use the additional space provided:

    13.1 Write down the number of the question.

    13.2 Leave a line and rule off after your answer.

14. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

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

1.1.2 $2x^2 + 6x = 6$ (Correct to TWO decimal places) (4)

1.1.3 $-x^2 - 2x \leq -8$ (4)

1.1.4 $2^{2x} - 2^x = 12$

(4)

1.1.5 $\sqrt{4x - 3} = x$

(4)

1.2 Solve for x and y simultaneously:

$4^{2x+1} = 16^{\frac{y}{2}}$

$x^2 - 2xy = -1$

(6)

1.3	Simplify fully, **without using a calculator**. $\sqrt[4]{\frac{4^{1013}-2^{2025}}{2^{2017}}}$	
		(4)
1.4	Determine the values of p for which the roots of the equation $x^2 = px - 1$ are real.	
		(6)

[34]

QUESTION 2

The first three terms of a quadratic pattern are:

$-12\ ;\ -15\ ;\ -16\ ;\ ...$

2.1	Write down the next two terms of the pattern.	(2)
2.2	Determine the n^{th} term of the pattern and write your answer in the form: $T_n = an^2 + bn + c$	(4)

2.3	Determine, which terms of the pattern are positive. Stanmorephysics.com	(4)
2.4	Which TWO consecutive terms in the quadratic number pattern have a first difference of 113?	(4)

[14]

QUESTION 3

3.1	Given the arithmetic sequence: 5 ; 9 ; 13 ; ... ; 1001. Determine the number of terms in the sequence.	(3)
3.2	Prove that for any arithmetic sequence with first term a, and a common difference d, the sum of the first n terms is given by the formula: $S_n = \frac{n}{2}[2a + (n-1)d]$.	(4)

3.3 Evaluate:

$$\sum_{p=-1}^{19} (3p-2)$$

(5)

3.4	A metal rod of 15, 9375 metres is cut into eight pieces whose lengths form a geometric sequence. The pieces are then used to support a structure. The pieces are welded vertically, starting with the longest piece, to support two metal beams as shown in the diagram below. The length of the longest piece is 128 times the length of the shortest piece.		
			
	If the length of the shortest piece, the 8^{th} piece, is x metres:		
	3.4.1	Write down the length of the longest piece in terms of x.	(1)

	3.4.2	Determine the common ratio of the sequence formed by the pieces of the rod.	(3)

3.4.3 Hence, determine the length of the longest piece of the rod.

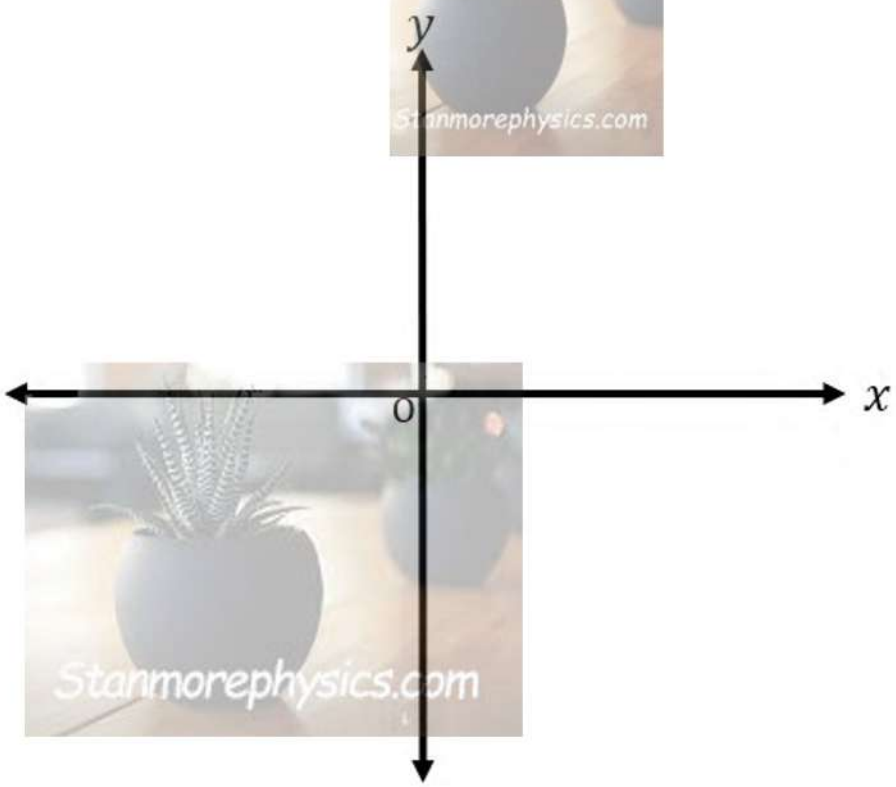
(4)

[20]

QUESTION 4

Given: $f(x) = \left(\frac{1}{3}\right)^x$

4.1	Determine the inverse of graph f and write your answer in the form $y = \cdots$	(2)
4.2	Sketch the graph of f and f^{-1}. Show intercept(s) with axes and at least ONE other point on each graph.	(6)



4.3	Determine the values of x for which $f^{-1}(x) > -3$.	(2)

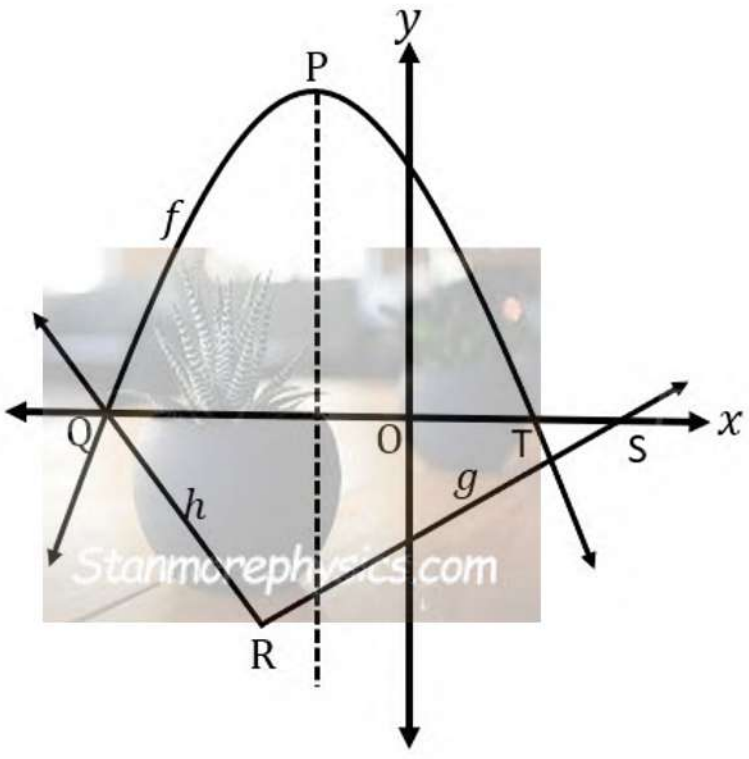
[10]

QUESTION 5

The graphs of $f(x) = -x^2 - 6x + 7$, $g(x) = \frac{1}{2}x - 4$ and $h(x) = -2x - 14$ are sketched below.

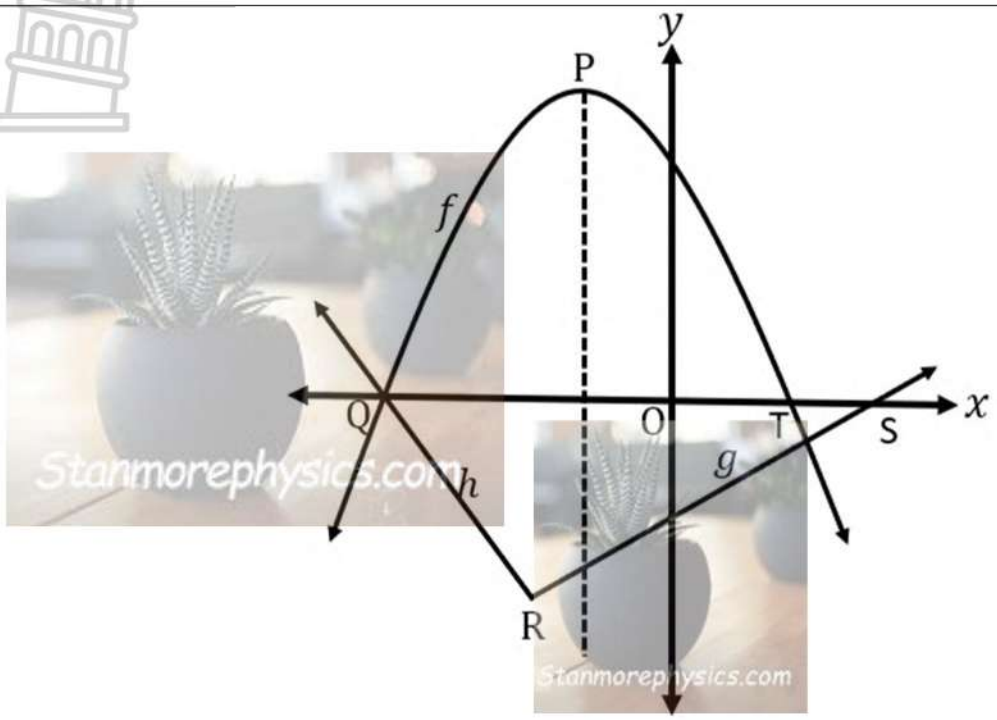
Graph f cuts the x-axis at points Q and T. Graphs g and h meet at point R.

The x-intercepts of graphs g and h are S and Q respectively. P is the turning point of graph f.



5.1	Show, with necessary calculations, that graphs g and h are perpendicular to each other.	(2)
5.2	Determine the coordinates of R.	(3)
5.3	Determine the length of QT.	(3)

5.4 $w(x)$ is the equation of the line obtained by shifting graph g perpendicularly along graph h until it reaches point Q.



5.4.1 Determine the y-intercept of graph w. (2)

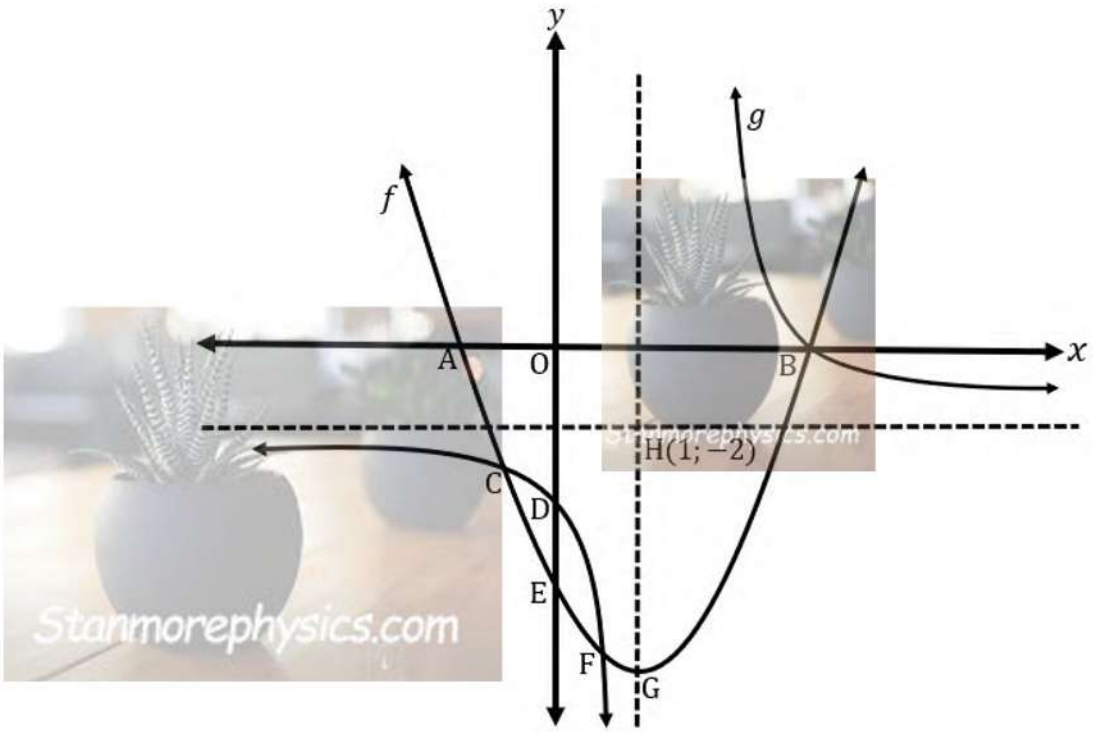
5.4.2 If graph w meets the line of symmetry of graph f at point M (not shown in the sketch), determine PM.

(4)

[14]

QUESTION 6

The graphs of $f(x) = x^2 - 2x - 15$ and $g(x) = \frac{a}{x+p} + q$ are sketched below. The asymptotes of graph g intersect at point H$(1; -2)$. Graph f cuts the x-axis at points A and B, and intersects the y-axis at point E. Graphs f and g intersect at points B, C and F. The turning point G, of graph f lies on the vertical asymptote of graph g.

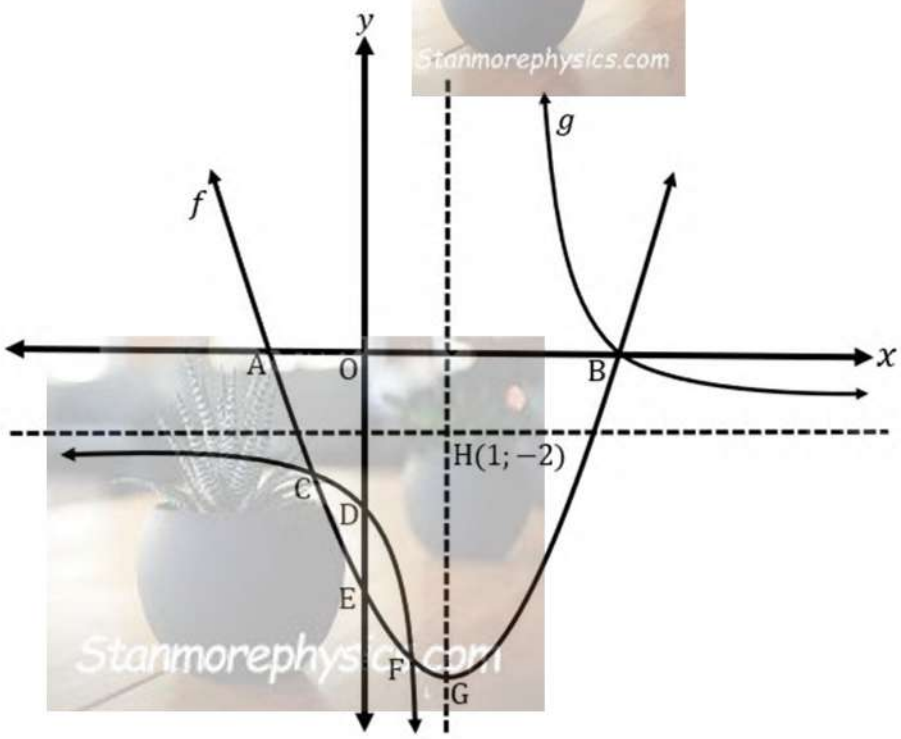


6.1	Write down the coordinates of point E.	(1)

6.2	Determine the coordinates of B.	(3)
6.3	Determine the range of graph f.	(2)
6.4	Consider graph $g(x) = \frac{a}{x+p} + q$:	
6.4.1	Write down the values of p and q.	(2)
6.4.2	Show that $a = 8$.	(3)

6.4.3 Hence, determine the equation of the axis of symmetry of g with a negative gradient.

(2)



6.5	If it is further given that the x values at C and F are $x = -2{,}41$ and $x = 0{,}41$ respectively, determine the values of x for which $g(x) - f(x) > 0$.	
		(3)

6.6	If $h(x) = -2x + k$ is a straight line drawn on the same set of axes as f and g, determine the values of k for which graphs g and h will NOT intersect.	(5)

[21]

QUESTION 7

7.1	Determine $f'(x)$ from first principles if $f(x) = 4x^2 - 3x$.	(5)
7.2	Determine: $D_x\left[\frac{x^2-9}{3-x}\right]$	(3)

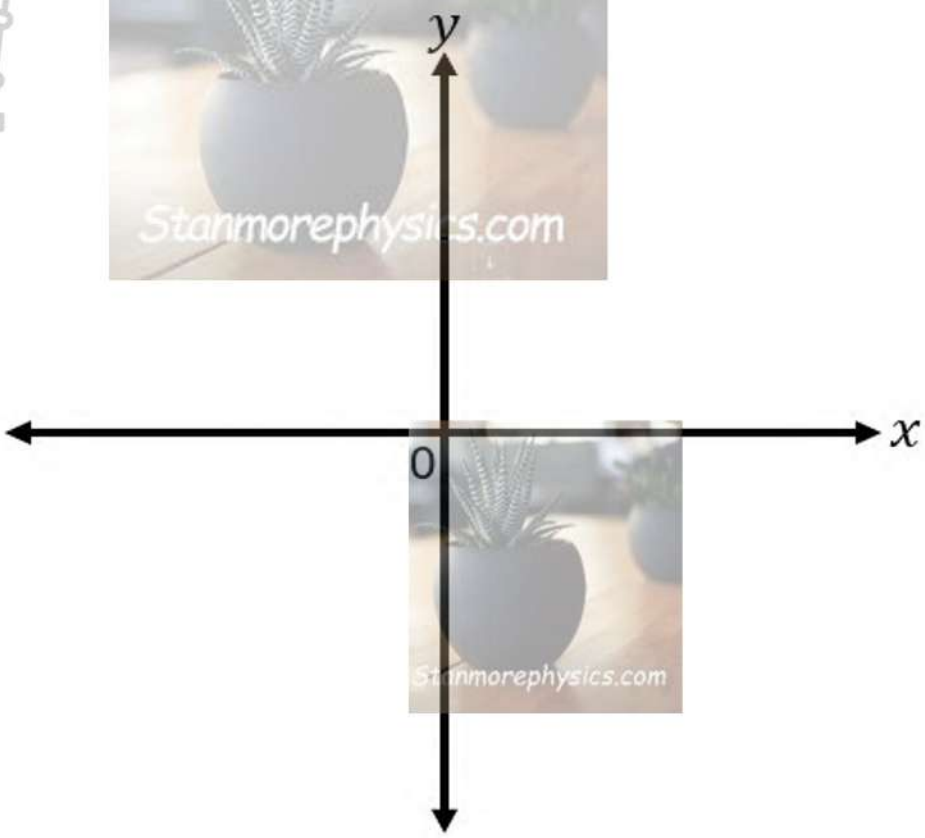
7.3	Given that $y = (2x - 3)^2$, show that $\frac{dy}{dx} = 4\sqrt{y}$.	(4)

[12]

QUESTION 8

Given: $f(x) = x^3 - 3x^2 + 4$

8.1	Determine the coordinates of the intercepts of f with the axes.	(5)
8.2	Calculate the coordinates of the turning points of f.	(4)

8.3	Draw a neat sketch of f and clearly label all the intercepts with the axes and the turning points.	
		(4)

8.4	For which values of x will f be concave up?	
		(2)

8.5	Use your graph in QUESTION 8.3 to determine the values of p for which $f(x) = x^3 - 3x^2 + 4 + p$ will have one distinct root.	
		(2)

[17]

QUESTION 9

A school fundraising committee is planning a matric dance for the Grade 12 learners. The weekly profit P, in rand, depends on the number of teachers involved in the fundraising activities. The relationship between profit and the number of teachers is given by the formula:

$P(x) = -2x^2 + 160x + 19\,600$, where x is the number of teachers.

9.1	Determine the profit when 5 teachers are involved in the fundraising.	(2)
9.2	Calculate the number of teachers that would need to be involved in the fundraising activities to achieve a maximum profit. Show ALL your working.	(4)
9.3	Determine the maximum profit that the committee can make.	(2)

[8]

ADDITIONAL SPACE

ADDITIONAL SPACE

TOTAL: 150

END

INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1 + in)$$

$$A = P(1 - in)$$

$$A = P(1 + i)^n$$

$$A = P(1 - i)^n$$

$$\sum_{i=1}^{n} 1 = n$$

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

$$T_n = a + (n-1)d$$

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(1-r^n)}{1-r};\ r \neq 1$$

$$S_\infty = \frac{a}{1-r};\ -1 < r < 1$$

$$F_v = \frac{x[(1+i)^n - 1]}{i}$$

$$P_V = \frac{x[1-(1+i)^{-n}]}{i}$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan\theta$$

$$(x-a)^2 + (y-b)^2 = r^2$$

In ΔABC: $\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC}$

$$a^2 = b^2 + c^2 - 2bc.\cos A$$

Area of $\Delta ABC = \frac{1}{2}ab.\sin C$

$$\sin(\alpha+\beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$$

$$\sin(\alpha-\beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$$

$$\cos(\alpha+\beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta$$

$$\cos(\alpha-\beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$$

$$\cos 2\alpha = \begin{cases} cos^2\alpha - sin^2\alpha \\ 2cos^2\alpha - 1 \\ 1 - 2sin^2\alpha \end{cases}$$

$$\cos 2\alpha = 2\sin\alpha.\cos\alpha$$

$$\bar{x} = \frac{\sum x}{n}$$

$$\sigma^2 = \frac{\sum_i^n (x_i - \bar{x})^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx$$

$$b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$

GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE/*JUNIE* EXAMINATION/*EKSAMEN* GRADE/*GRAAD* 12

2026

MARKING GUIDELINES/NASIENRIGLYNE

MATHEMATICS/*WISKUNDE*

(PAPER/*VRAESTEL* 1)

22 pages/*bladsye*

GENERAL NOTES/*ALGEMENE NOTAS*

1. Consistent accuracy applies in this marking guideline.
2. If a learner answers the same question TWICE, but does not cancel one of the answers, ONLY consider the FIRST attempt.
3. If a learner cancels the answer but does not make a second attempt, consider the cancelled attempt.
4. If a learner provided an answer not mentioned in this memorandum, first check/prove it before disqualifying their attempt. Please check through all OPTIONS provided in this marking guideline.

1. *Konsekwente akkuraatheid geld in hierdie nasienriglyne.*
2. *Indien 'n leerder dieselfde vraag TWEE KEER beantwoord, maar nie een van die antwoorde kanselleer nie, oorweeg SLEGS die EERSTE poging.*
3. *Indien 'n leerder die antwoord kanselleer, maar nie 'n tweede poging aanwend nie, oorweeg die gekanselleerde poging.*
4. *Indien 'n leerder 'n antwoord verskaf het wat nie in hierdie memorandum genoem word nie, moet dit eers nagegaan/bewys word voordat hul poging gediskwalifiseer word. Gaan asseblief al die OPSIES wat in hierdie nasienriglyne verskaf word deur.*

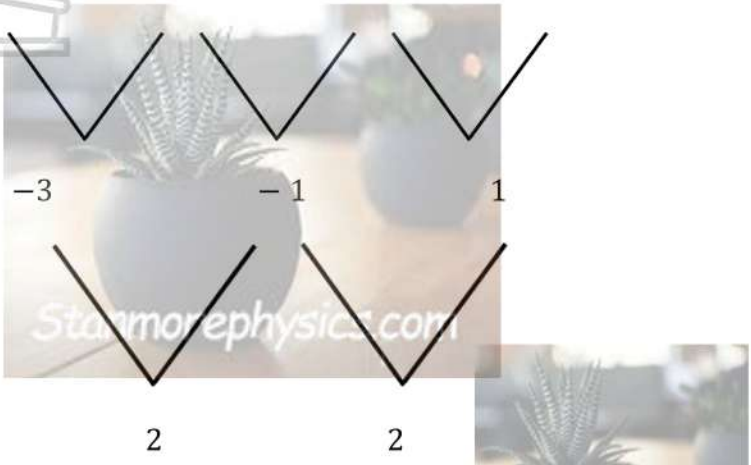
QUESTION/*VRAAG* 1			
1.1.1	$3x^2 - x = 0$ $x(3x - 1) = 0$ $x = 0$ or/*of* $3x - 1 = 0$ $x = \frac{1}{3}$	✓ factors/*faktore* ✓ both x values/*beide x-waardes*	(2)
1.1.2	$2x^2 + 6x = 6$ $2x^2 + 6x - 6 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(6) \pm \sqrt{(6)^2 - 4(2)(-6)}}{2 \times 2}$ $x = \frac{-6 \pm \sqrt{84}}{4}$ $x = 0{,}79$ or/*of* $x = -3{,}79$ **Penalize ONE mark for incorrect rounding**	✓ standard form/*standaardvorm* ✓ correct substitution in the equation *korrekte substutisie in vergelyking* ✓ $x = 0{,}79$ ✓ $x = -3{,}79$	(4)

1.1.3	$-x^2 - 2x \leq -8$ $x^2 + 2x - 8 \geq 0$ $(x+4)(x-2) \geq 0$ Critical values/*Kritieke waardes* $x + 4 = 0$ or/*of* $x - 2 = 0$ $x = -4$ and/*en* $x = 2$ $x \leq -4$ or/*of* $x \geq 2$	✓ standard form/*standaardvorm* ✓ factors/*faktore* ✓ critical values/*kritiese waardes* $x = -4$ and $x = 2$ ✓ $x \leq -4$ or/*of* $x \geq 2$ Note: If $x < -4$ *or* $x > 2$ award 3 *out* 4	(4)
1.1.4	$2^{2x} - 2^x = 12$ Let/*Laat* $k = 2^x$ $k^2 - k = 12$ $k^2 - k - 12 = 0$ $(k-4)(k+3) = 0$ $k = 4$ or $k = -3$ $2^x \neq -3$ No Solution/*Geen oplossing nie* $2^x = 4$ $2^x = 2^2$ $x = 2$ **OR/*OF*** Alternative method/*Alternatiewe metode* $2^{2x} - 2^x - 12 = 0$ $(2^x - 4)(2^x + 3) = 0$ $2^x = 4$ $2^x = -3$ $2^x \neq -3$ No Solution/*Geen oplossing nie* $2^x = 2^2$ $x = 2$	✓ K-method/*K-metode* ✓ standard form/*standaardvorm* ✓ factors/*faktore* ✓ $x = 2$ or $2^x \neq -3$ **OR/*OF*** ✓Std form ✓ $(2^x - 4)(2^x + 3) = 0$ ✓ $2^x = 4$ or $2^x \neq -3$ No Solution/*Geen oplossing* $2^x = 2^2$ ✓$x = 2$	(4)

1.1.5	$\sqrt{4x-3} = x$ $\left(\sqrt{4x-3}\right)^2 = (x)^2$ $4x - 3 = x^2$ $x^2 - 4x + 3 = 0$ $(x-3)(x-1) = 0$ $x = 3$ or/*of* $x = 1$	✓ squaring both sides/*kwadreer beide kante* stanmorephysics.com ✓ standard form/*standaardvorm* ✓ factors/*faktore* ✓ x-values/*waardes*	(4)
1.2	$4^{2x+1} = 16^{\frac{y}{2}}$ and $x^2 - 2xy = -1$ .....② $4^{2x+1} = 4^{2\left(\frac{y}{2}\right)}$ $2x + 1 = 2\left(\frac{y}{2}\right)$ $y = 2x + 1$ .....③ Substitution equation 3 into 2/*Substitusie gelykstelling 3 in 2* $x^2 - 2xy = -1$ $x^2 - 2x(2x+1) + 1 = 0$ $x^2 - 4x^2 - 2x + 1 = 0$ $-3x^2 - 2x + 1 = 0$ $3x^2 + 2x - 1 = 0$ $(x+1)(3x-1) = 0$ $x = -1$ or/*of* $x = \frac{1}{3}$ When/*Wanneer* $x = -1$ When/*Wanneer* $x = \frac{1}{3}$ $y = 2x + 1$ $y = 2\left(\frac{1}{3}\right) + 1$ $y = 2(-1) + 1$ $y = \frac{2}{3} + 1$ $y = -2 + 1$ $y = -1$ $y = \frac{5}{3}$	✓ $4^{2x+1} = 4^{2\left(\frac{y}{2}\right)}$ ✓ $y = 2x + 1$ ✓ substitution/*substitusie* ✓ factors/*faktore* ✓ x-values/*waardes* ✓ y-values/*waardes* Note CA only if solving a quadratic function.	(6)

1.3	$\sqrt[4]{\frac{4^{1013}-2^{2025}}{2^{2017}}}$ $\left(\frac{2^{2(1013)}-2^{2025}}{2^{2017}}\right)^{\frac{1}{4}}$ $\left(\frac{2^{2026}-2^{2025}}{2^{2017}}\right)^{\frac{1}{4}}$ $\left[\frac{2^{2025}(2^1-1)}{2^{2017}}\right]^{\frac{1}{4}}$ $(2^8)^{\frac{1}{4}}$ 4	✓ 2^{2026} ✓ common factor/*vereenvouding* ✓ Simplify ✓ answer/*antwoord*	(4)
1.4	$x^2 - px + 1 = 0$ $\Delta \geq 0$ $(-p)^2 - 4(1)(1) \geq 0$ $p^2 - 4 \geq 0$ Critical values/*Kritieke waardes*: $p = \pm\sqrt{4}$ $p = -2$ and/*en* $p = 2$ $p \leq -2$ or/*of* $p \geq 2$	✓Standard form/*standaardvorm* ✓ $p^2 - 4$ ✓ $\Delta \geq 0$ ✓ critical values/*kritieke waardes* ✓ $p \leq -2$ ✓ $p \geq 2$	(6)
			[34]

QUESTION/*VRAAG* 2

2.1	$-15\ ;-12$	✓ -15 ✓ -12	(2)
2.2	$-12 \quad -15 \quad -16 \quad -15$  $-3 \quad -1 \quad 1$ $2 \quad 2$ $2a = 2$ $\therefore a = 1$ $1 + (-6) + c = -12$ $\therefore c = -12 + 5 = -7$ $T_n = n^2 - 6n - 7$ $3(1) + b = -3$ $\therefore b = -3 - 3 = -6$	✓ $a = 1$ ✓ $b = -6$ ✓ $c = -7$ ✓ $n^2 - 6n - 7$	(4)

2.3	$n^2 - 6n - 7 > 0$ $(n-7)(n+1) > 0$ Critical values/*Kritieke waardes*: $n = 7$ and/*en* $n \neq -1$ **AWARD A MARK FOR CRITICAL VALUES EVEN IF A CANDIDATE WRITES $n = -1$** ***KEN 'N PUNT TOE VIR KRITIEKE WAARDES SELFS AL SKRYF 'N KANDIDAAT $n = -1$*** **Do not penalize if** $n \in \mathbb{N}$ is omitted. $n \in \mathbb{N},\ n > 7$ (accept $n \geq 8$) **OR/*OF*** $n^2 - 6n - 7 > 0$ $n = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(-7)}}{2(1)}$ $n = \frac{6 \pm \sqrt{64}}{2}$ **Critical values/*Kritieke waardes*:** $n = 7$ or/*of* $n \neq -1$ $n \in \mathbb{N},\ n > 7$ (Accept $n \geq 8$) **OR/*OF*** $n^2 - 6n - 7 > 0$ $(n-3)^2 = 7 + 9$ $(n-3)^2 = 16$ $n = 3 \pm 4$ **Critical values/*Kritieke waaardes*:** $n = 7$ or/*of* $n \neq -1$ $n \in \mathbb{N},\ n > 7$ (accept $n \geq 8$) **OR** Accept when expanded (and Shown) the terms and made a conclusion Stanmorephysics.com (FULL marks)	✓ inequality/ *ongelykheid* ✓ factorization/ *faktorisering* ✓ critical values./ *kritieke waardes* ✓ $n \in \mathbb{N},\ n > 7$ **OR/*OF*** ✓ inequality/ *ongelykheid* ✓ quadratic formula/ *kwadratiese formule* ✓ critical values/ *kritieke waardes* ✓ $n \in \mathbb{N},\ n > 7$ **OR/*OF*** ✓ Inequality/ *Ongelykheid* ✓ Completion of a Square./ *Vierkantvoltooiing* ✓ Critical values/ *Kritieke waardes* ✓ $n \in \mathbb{N},\ n > 7$	(4)

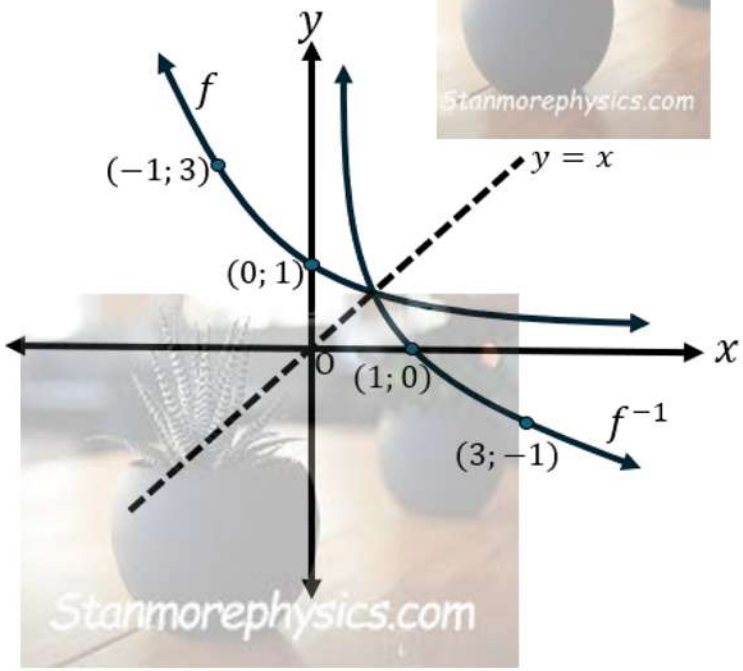
2.4	$T_n = a + (n-1)d$ $T_n = -3 + (n-1)(2)$ $T_n = 2n - 5$ $2n - 5 = 113$ $2n = 118$ $n = 59$ $\therefore$ T_{59} *and* T_{60} are the two consecutive terms with a first difference of 113./*is die twee opeenvolgende terme met 'n eerste verskil van 113.*	✓ $T_n = 2n - 5$ ✓ equating to 113/ *stel gelyk aan 113* ✓ 59 ✓ 60	
	OR/*OF*	**OR/*OF***	
	$T_n = n^2 - 6n - 7$ $T_{n-1} = (n-1)^2 - 6(n-1) - 7$ $T_{n-1} = n^2 - 2n + 1 - 6n + 6 - 7 = n^2 - 8n$ $T_n - T_{n-1} = n^2 - 6n - 7 - (n^2 - 8n)$ $2n - 7 = 113$ $n = 60$ $\therefore n - 1 = 60 - 1 = 59$ T_{59} *and* T_{60} are the two consecutive terms with a first difference of 113/*is die twee opeenvolgende terme met 'n eerste verskil van 113*.	✓ $T_n = 2n - 7$ ✓ equating to 113 *stel gelyk aan 113* ✓ 60 ✓ 59	
	OR/*OF*	**OR/*OF***	
	$T_n = n^2 - 6n - 7$ $T_{n+1} = (n+1)^2 - 6(n+1) - 7$ $T_{n+1} = n^2 + 2n + 1 - 6n - 6 - 7 = n^2 - 4n - 12$ $T_{n+1} - T_n = n^2 - 4n - 12 - (n^2 - 6n - 7)$ $2n - 5 = 113$ $n = 59$ $\therefore n + 1 = 59 + 1 = 60$ T_{59} *and* T_{60} are the two consecutive terms with a first difference of 113/*is die twee opeenvolgende terme met 'n eerste verskil van 113*.	✓ $T_n = 2n - 5$ ✓ equating to 113/ *stel gelyk aan 113* ✓ 59 ✓ 60	(4)
			[14]

QUESTION/*VRAAG* 3

3.1	$T_n = a + (n-1)d$ $T_n = 5 + (n-1)(4)$ $T_n = 4n + 1$ $4n + 1 = 1001$ $4n = 1000$ $n = 250$	✓ $T_n = 4n + 1$ ✓ equating to 1001 *stel gelyk aan 1001* ✓ 250	(3)
3.2	$S_n = a + (a+d) + (a+2d) + (a+3d) + \cdots + l$ $+[S_n = l + (l-d) + (l-2d) + (l-3d) + \cdots + a]$ $2S_n = (a+l) + (a+l) + (a+l) + \cdots + (a+l)$ *n times/keer* $2S_n = n(a+l)$ $S_n = \frac{n}{2}(a+l)$ But $l = a + (n-1)d$ $\therefore S_n = \frac{n}{2}[a + a + (n-1)d]$ $\therefore S_n = \frac{n}{2}[2a + (n-1)d]$	✓ $S_n = a + (a+d) + \cdots + l$ ✓ $+[S_n = l + (l-d) + \cdots + a$ ✓ $S_n = \frac{n}{2}(a+l)$ ✓ substitution of l using/ *substitusie van l deur gebruik van* $l = a + (n-1)d$	(4)
3.3	$\sum_{p=-1}^{19}(3p-2) = (-5) + (-2) + 1 + \cdots + 55$ $n = 19 - (-1) + 1 = 21$ $S_{21} = \frac{21}{2}(-5 + 55)$ $S_{21} = \frac{21}{2}(50)$ $= 525$	✓ expansion/*uitbreiding* ✓ $n = 21$ ✓ substitution into correct formula/ *substitusie in korrekte formule* ✓ 55 ✓ 525	

	OR/*OF* $\sum_{p=-1}^{19}(3p-2) = (-5)+(-2)+1+\cdots+55$ $n = 19-(-1)+1 = 21$ $d = 3$ $S_n = \frac{n}{2}[2a+(n-1)d]$ $S_{21} = \frac{21}{2}[2(-5)+(21-1)3]$ $S_{21} = \frac{21}{2}[-10+60]$ $= 525$	**OR/*OF*** ✓ expand ✓ $n = 21$ ✓ $d = 3$ ✓ substitution into correct formula *substitusie in korrekte formule* ✓ 525	(5)
3.4.1	$128x$	✓ $128x$	(1)
3.4.2	$T_n = ar^{n-1}$ $T_8 = ar^7$ $x = (128x)r^7$ $r^7 = \frac{1}{128}$ $r = \left(\frac{1}{128}\right)^{\frac{1}{7}} = \frac{1}{2}$	✓ substitution into correct formula *substitusie in formule* ✓ simplification *vereenvoudiging* ✓ $r = \frac{1}{2}$	(3)
3.4.3	$S_n = \frac{a[1-r^n]}{1-r}$ $15{,}9375 = \frac{128x[1-\left(\frac{1}{2}\right)^8]}{1-\frac{1}{2}}$ $x = \frac{\frac{1}{2}[15.9375]}{128[1-\left(\frac{1}{2}\right)^8]} = 0{,}0625$ metres The longest piece is/Die langste stuk is $= 128 \times 0{,}0625$ m $= 8$ metres/*meter*	✓ substitution into correct formula *substitusie in korrekte formule* ✓ simplification/ *vereenvoudiging* ✓ 0,0625 ✓ 8	(4)
			[20]

QUESTION/*VRAAG* 4

4.1	$y = \left(\frac{1}{3}\right)^x$ For inverse/*Vir inversie*: $x = \left(\frac{1}{3}\right)^y$ $y = \log_{\frac{1}{3}} x$ or/*of* $y = -\log_3 x$ **ANSWER ONLY- FULL MARKS/** ***SLEGS ANTWOORD – VOLPUNTE***	✓ interchanging/ *vervanging van* x and/*en* y. *ruil* x *en* y ✓ answer/ *antwoord*	(2)
4.2		FOR f ✓ y-intercept *y-afsnit* ✓ any other point/ *enige and punt* ✓ Shape/*Vorm* *FOR* f^{-1} ✓ x-intercept/ *x-afsnit* ✓ any other point/ *enige ander punt* ✓ shape/*vorm*	(6)

4.3	$f^{-1}(x) > -3$ Critical values/*Kritieke waardes*: $\log_{\frac{1}{3}} x = -3$ or/*of* $-\log_3 x = -3$ $x = 27$ $0 < x < 27$ **OR/*OF*** $\log_{\frac{1}{3}} x > -3$ $x < \left(\frac{1}{3}\right)^{-3}$ $x < 2$; but/*maar* $x > 0$ $\therefore 0 < x < 27$ **ANSWER ONLY – FULL MARKS/** ***SLEGS ANTWOORD – VOLPUNTE***	✓ $x = 27$ ✓ $0 < x < 27$	(2)
			[10]

QUESTION/*VRAAG* 5

5.1	$m_1 \times m_2 = \frac{1}{2} \times (-2) = -1$	✓ $\frac{1}{2} \times (-2)$ ✓ -1	(2)
5.2	At/*By* R: $h(x) = g(x)$ $\frac{1}{2}x - 4 = -2x - 14$ $\frac{1}{2}x = -2x - 10$ $x = -4x - 20$ $5x = -20$ $\therefore x = -4$ $h(-4) = -2x - 14$ $\therefore y = -2(-4) - 14 = -6$ R$(-4; -6)$ **DO NOT PENALISE IF NOT IN COORDINATES FORM/** **MOENIE *PENALISEER INDIEN NIE IN KOÖRDINATE FORMAAT NIE.***	✓ equating the two functions/ *stel twee funksie gelyk* ✓ $x = -4$ ✓ R$(-4; -6)$	(3)
5.3	At Q and/*en* T; $y = 0$ $-x^2 - 6x + 7 = 0$ $x^2 + 6x - 7 = 0$ $(x + 7)(x - 1) = 0$ $x = -7$ or/*of* $x = 1$ $\therefore$ QT $= 1 - (-7) = 8$ units/*eenhede*	✓ factorisation/method *faktorisering/metode* ✓ x-values/*waardes* ✓ 8	(3)

5.4.1	$Q(-7;0)$ $y=\frac{1}{2}x+c$ $0=\frac{1}{2}(-7)+c$ $c=\frac{7}{2}$ $(0;\frac{7}{2})$ $W(x)=\frac{1}{2}x+\frac{7}{2}$	✓ substitution/*substitusie* ✓ $\frac{7}{2}$	(2)
5.4.2	$f(x)=-x^2-6x+7$ $f'(x)=-2x-6$ At the turning point/*By die draaipunt*, $f'(x)=0$ $-2x-6=0$ $\therefore x=-3$ $f(-3)=-(-3)^2-6(-3)+7=16$ $W(-3)=\frac{1}{2}(-3)+\frac{7}{2}=2$ $\therefore$ PM $=16-2=14$ units/*eenhede* **OR/*OF*** $x=\frac{1+(-7)}{2}=-3$ $f(-3)=-(-3)^2-6(-3)+7=16$ $W(-3)=\frac{1}{2}(-3)+\frac{7}{2}=2$ $\therefore$ PM $=16-2=14$ units/*eenhede*	✓ $x=-3$ ✓ 16 ✓ 2 ✓ 14	

OR/*OF*

$f(x) = -(x+3)^2 + 16$

P$(-3;16)$

$W(-3) = \frac{1}{2}(-3) + \frac{7}{2} = 2$

M$(-3;2)$

PM $= 16 - 2 = 14$ units/*eenhede*

OR/*OF*

$x = \frac{1+(-7)}{2} = -3$

PM $= -x^2 - 6x + 7 - (\frac{1}{2}x + \frac{7}{2})$

$= -x^2 - \frac{13x}{2} + \frac{7}{2}$

$\therefore$ PM $= -(-3)^2 - \frac{13(-3)}{2} + \frac{7}{2} =$

14 units/*eenhede*

OR/*OF*

✓ $x = -3$

✓ $f - w$

✓ substitution/*substitusie*

✓ 14

(4)

[14]

QUESTION/*VRAAG* 6

6.1	E $(0\,;-15)$	✓ $(0\,;-15)$	(1)
6.2	$x^2-2x-15=0$ $(x+3)(x-5)=0$ $x=-3$ or $x=5$ B $(5\,;0)$	✓ equate to zero ✓factorisation/method *faktorisering/metode* ✓ $x=5$ \	(3)
6.3	$f(1)=(1)^2-2(1)-15=-16$ $y\geq -16$	✓ substitute ✓ $y\geq -16$	(2)

6.4.1	$p = -1$ $q = -2$	✓ -1 ✓ -2	(2)
6.4.2	$g(x) = \frac{a}{x-1} - 2$ Use/*Gebruik* B (5 ; 0) $0 = \frac{a}{5-1} - 2$ $2 = \frac{a}{4}$ $\therefore a = 8$	✓ substitution for p and q/ *vervang p en q* ✓ substitution / *substitusie* ✓ simplification/ *vereenvoudiging*	(3)
6.4.3	$y = -(x-1) - 2$ $y = -x - 1$ **OR/*OF*** $y = -x + c$ Use/*Gebruik* H $(1 ; -2)$ $-2 = -1 + c \quad \Rightarrow c = -1$ $\therefore y = -x - 1$	✓ $gradient = -1$ ✓ y intercept	(2)
6.5	$-2{,}41 < x < 0{,}41$ **OR/*OF*** $1 < x < 5$	✓ $-2{,}41$ and/*en* 0,41 ✓ 1 and/*en* 5 ✓ correct inequality symbols for both./*korrekte ongelykheid notasie*	(3)

6.6	$\frac{8}{x-1}-2=-2x+k$ $8-2(x-1)=-2x(x-1)+k(x-1)$ $8-2x+2=-2x^2+2x+kx-k$ $2x^2-(4+k)x+10+k=0$ $b^2-4ac<0$ $[-(4+k)]^2-4(2)(10+k)<0$ $k^2+8k+16-80-8k<0$ $k^2-64<0$ $(k+8)(k-8)<0$ Critical values/*Kritieke waardes* $k=-8$ or $k=8$ $-8<k<8$	✓ equating/*gelykstelling* ✓ simplification/*vereenvoudiging* to k^2-64 ✓ factorisation/*faktorisering* ✓ critical values/*kritiese waardes* ✓ $-8<k<8$	(5)
			[21]

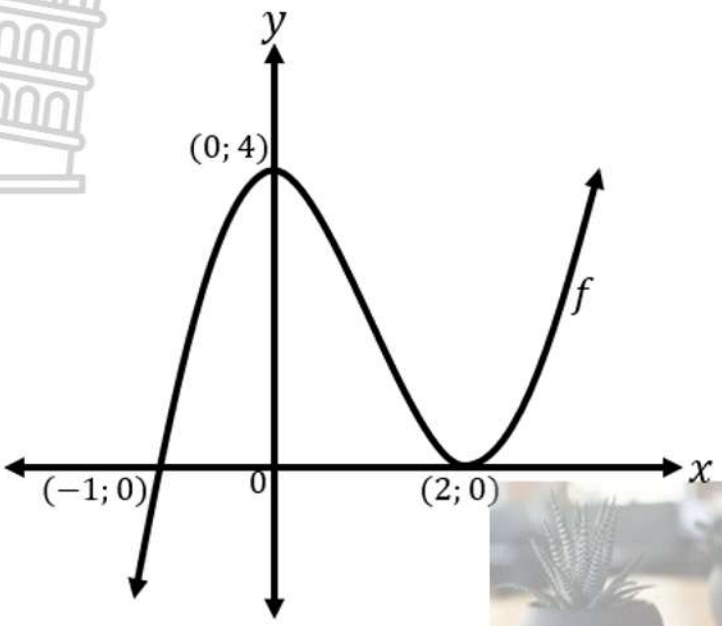
QUESTION/*VRAAG* 7 [ONLY Penalize for notation in 7.1]

7.1	Given/*Gegee*: $f(x)=4x^2-3x$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x+h)}{h}$ $f'(x)$ $=\lim_{h\to 0}\frac{4(x+h)^2-3(x+h)-(4x^2-3x)}{h}$ $=\lim_{h\to 0}\frac{4x^2+8xh+4h^2-3x-3h-4x^2+3x}{h}$ $=\lim_{h\to 0}\frac{8xh+4h^2-3h}{h}$ $=\lim_{h\to 0}\frac{h(8x+4h-3)}{h}$ $=\lim_{h\to 0}(8x+4h-3)$ $\therefore f'(x)=8x-3$	✓$f(x+h)$ $=4x^2+8xh+4h^2-3x-3h$ ✓substitution into correct formula/ *subtitusie in korrekte formule* ✓$8xh+4h^2-3h$ ✓$8x+4h-3$ ✓$f'(x)=8x-3$	(5)

7.2	$D_x\left[\frac{x^2-9}{3-x}\right]$ $D_x\left[\frac{(x-3)(x+3)}{-(x-3)}\right]$ $D_x[-(x+3)]$ $D_x[-x-3)]$ -1	✓ $\frac{(x-3)(x+3)}{-(x-3)}$ ✓ $-(x+3)$ ✓ -1 answer/*antwoord*	(3)
7.3	$y=(2x-3)^2$ $y=(2x-3)^2$ $y=4x^2-12x+9$ $\frac{dy}{dx}=8x-12$ $=4(2x-3)$ But/*Maar* $2x-3=\sqrt{y}$ $\therefore \frac{dy}{dx}=4(\sqrt{y})$	✓expand/*brei uit* $y=4x^2-12x+9$ ✓ $\frac{dy}{dx}=8x-12$ ✓ factorisation/*faktorisering* $4(2x-3)$ ✓ $\sqrt{y}=2x-3$	(4)
			[12]

QUESTION 8

8.1	$f(x) = x^3 - 3x^2 + 4$ x- intercept/*afsnit*, $y = 0$ $x^3 - 3x^2 + 4 = 0$ $x = -1$ $(x-2)(x-2)(x+1) = 0$ $\therefore x = 2$ or $x = -1$ $(2; 0)$ and/*en* $(-1; 0)$ y- intercept/*afsnit*, , $x = 0$ $f(0) = (0)^3 - 3(0)^2 + 4$ $y = 4$ $(0; 4)$ **NO PENALTY IF INTERCEPTS ARE NOT IN COORDINATES FORM/** ***GEEN PENALISERING INDIEN AFSNITTE NIE IN KOÖRDINAATVORM IS NIE***	✓ equating to 0/ *stel gelyk aan 0* ✓ factorisation/*faktoriseer* ✓$x = 2$ ✓$x = -1$ ✓$y = 4$	(5)
8.2	$f(x) = x^3 - 3x^2 + 4$ $f'(x) = 0$ $f'(x) = 3x^2 - 6x$ $3x^2 - 6x = 0$ $3x(x-2) = 0$ $x = 0$ or $x = 2$ When/*Wanneer* $x = 0$ $f(0) = (0)^3 - 3(0)^2 + 4$ $y = 4$ $(0; 4)$ When/*Wanneer* $x = 2$ $f(2) = (2)^3 - 3(2)^2 + 4$ $y = 0$ $(2; 0)$	✓$f'(x) = 3x^2 - 6x$ ✓$f'(x) = 0$ ✓ x values ✓ y values	(4)

8.3		✓ x-intercepts/*afsnitte* ✓ y-intercepts/*afsnitte* ✓ turning points/ *draaipunt* ✓ shape/*vorm*	(4)
8.4	$f(x) = x^3 - 3x^2 + 4$ $f'(x) = 3x^2 - 6x$ $f'(x) = 0$ $f''(x) = 6x - 6$ $f''(x) = 0$ $6x - 6 = 0$ $6x = 6$ $x = 1$ $\therefore x > 1$ **OR/*OF*** $x = \frac{0+2}{2}$ $x = 1$ $\therefore x > 1$	✓$f''(x) = 6x - 6$ ✓ $x > 1$ **OR/*OF*** ✓ $\frac{0+2}{2}$ ✓ $x > 1$	(2)
8.5	$p < -4$ or $p > 0$ NB due to the incorrect naming of the new function allow for answer : $p = 0$ (award FULL MARKS)	✓ $p < -4$ ✓$p > 0$	(2)
			[17]

QUESTION/*VRAAG* 9

9.1	$P(x) = -2x^2 + 160x + 19\,600$ $P(5) = -2(5)^2 + 160(5) + 19\,600$ $=$ R20 350	✓ $-2(5)^2 + 160(5) + 19\,600$ ✓ R20 350	(2)
9.2	$P(x) = -2x^2 + 160x + 19\,600$ $p'(x) = -4x + 160$ $p'(x) = 0$ $-4x + 160 = 0$ $4x = 160$ $x = 40$ $\therefore$ 40 teachers/*onderwysers*	✓ $p'(x) = -4x + 160$ ✓ $-4x + 160 = 0$ ✓ simplify ✓ 40 teachers/*onderwysers*	(4)
9.3	$P(x) = -2x^2 + 160x + 19\,600$ $P(40) = -2(40)^2 + 160(40) + 19\,600$ Maximum profit/*Maksimum profit* $=$ R22 800	✓ $P(40) = -2(40)^2 + 160(40) + 19\,600$ ✓ R22 800	(2)
			[8]

TOTAL/*TOTAAL*: 150