education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1
SEPTEMBER 2025

MARKS: 150

TIME: 3 hours

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

QUESTION 1

1.1 Solve for x:

1.1.1 $(x-3)(3x+15)=0$ (2)

1.1.2 $7x^2-4x-5=0$ (correct to TWO decimal places) (3)

1.1.3 $x^2(x+4)<0$ (2)

1.1.4 $\sqrt{5-2^{2x}}=2^x-3$ (6)

1.2 Solve for x and y simultaneously:

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

1.3 Show that the roots of $p=\dfrac{19-3x^2}{x}$ are real for all values of $p \in \mathbb{R}$.

Show ALL calculations. (4)
[23]

QUESTION 2

2.1 Consider the following geometric series: $p+21+63+\ldots+137\,781$

2.1.1 Determine the value of p. (2)

2.1.2 Determine the number of terms in the series. (3)

2.1.3 Calculate the sum of this series. (2)

2.2 A school hall is filling up at a rate of 10 learners in the first minute, 14 learners in the second minute, 18 learners in the third minute, and so on.

2.2.1 How many learners will enter the school hall during the 8th minute? (3)

2.2.2 The school hall is a fifth full after 8 minutes. After how many minutes will the school hall be full? (6)
[16]

QUESTION 3

Consider the following quadratic sequence: 10; 21; 38 ...

3.1 Determine the general term of the quadratic sequence. (4)

3.2 Determine the tenth term of the quadratic sequence. (2)

3.3 Determine which two consecutive terms of the quadratic sequence differ with 95. (3)

[9]

QUESTION 4

Given: $f(x) = \log_{\frac{1}{2}} x$

4.1 Write down the equation of the asymptote of f. (1)

4.2 Determine the equation of f^{-1} in the form $y =$ ... (2)

4.3 If $g(x) = f^{-1}(x-3) - 2$, determine the x-intercept of g. (3)

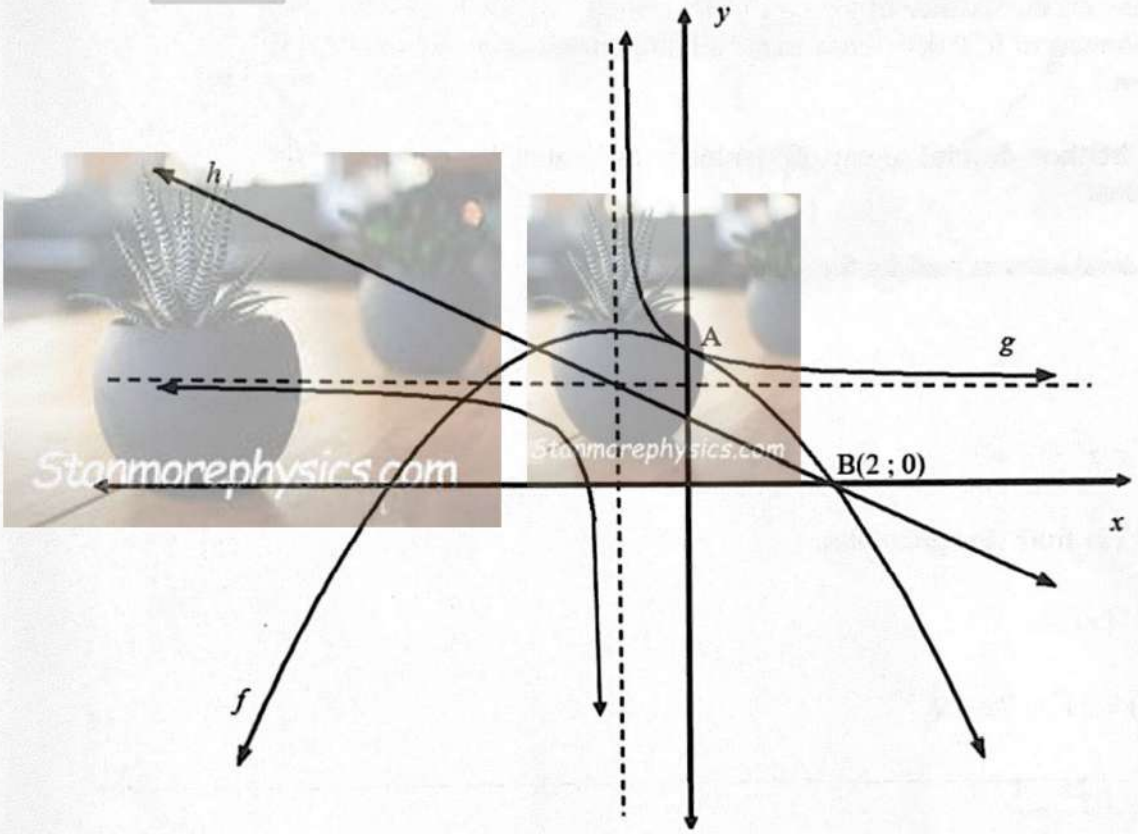
4.4 Write down the equation of the asymptote of g. (1)

4.5 Sketch the graph of g. Clearly show ALL the intercepts with the axes and the asymptote. (4)

[11]

QUESTION 5

Sketched below are the graphs of $f(x) = -\frac{1}{2}x^2 + bx + c$ and $g(x) = \frac{a}{x+p} + q$. The axis of symmetry of f, $x = -1$, is the vertical asymptote of g. The line h is an axis of symmetry of g. A is the y-intercept of f and g. B(2 ; 0) is a x-intercept of f and h.



5.1 Show that the equation of f is $f(x) = -\frac{1}{2}x^2 - x + 4$. (2)

5.2 Write down the coordinates of the y-intercept of f. (2)

5.3 Determine the coordinates of the turning point of f. (2)

5.4 Determine the equation of h. (3)

5.5 Determine the equation of g. (4)

5.6 Determine the coordinates of the x-intercept of g. (3)

5.7 For which values of x will it be: $g(x) \cdot f'(x) \leq 0$? (3)

5.8 Determine the equation of $k(x)$ if k is the reflection of g about the line $x = 4$. (3)

5.9 For which values of p will both x-intercepts of $f(x) + p$ be greater than -2? (4)

[26]

QUESTION 6

Mathew's dad died and he inherited the farm. His dad planned to install solar panels and already paid a deposit of R202 500 which is 15% of the cost of the solar panels.

6.1 Determine the cost of the solar panels. (2)

6.2 The bank grants Mathew a loan at an interest rate of 9,8% per annum, compounded monthly, to pay off the balance of the cost of the panels. Mathew agreed to pay monthly instalments of R20 000. How many monthly instalments are required to pay off the loan? (6)

6.3 After 2 years Mathew decided to pay off the loan. Determine the balance of the loan after 2 years. (3)

6.4 Calculate the total amount paid for the panels. (3)
[14]

QUESTION 7

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

Determine $f'(x)$ from first principles. (5)

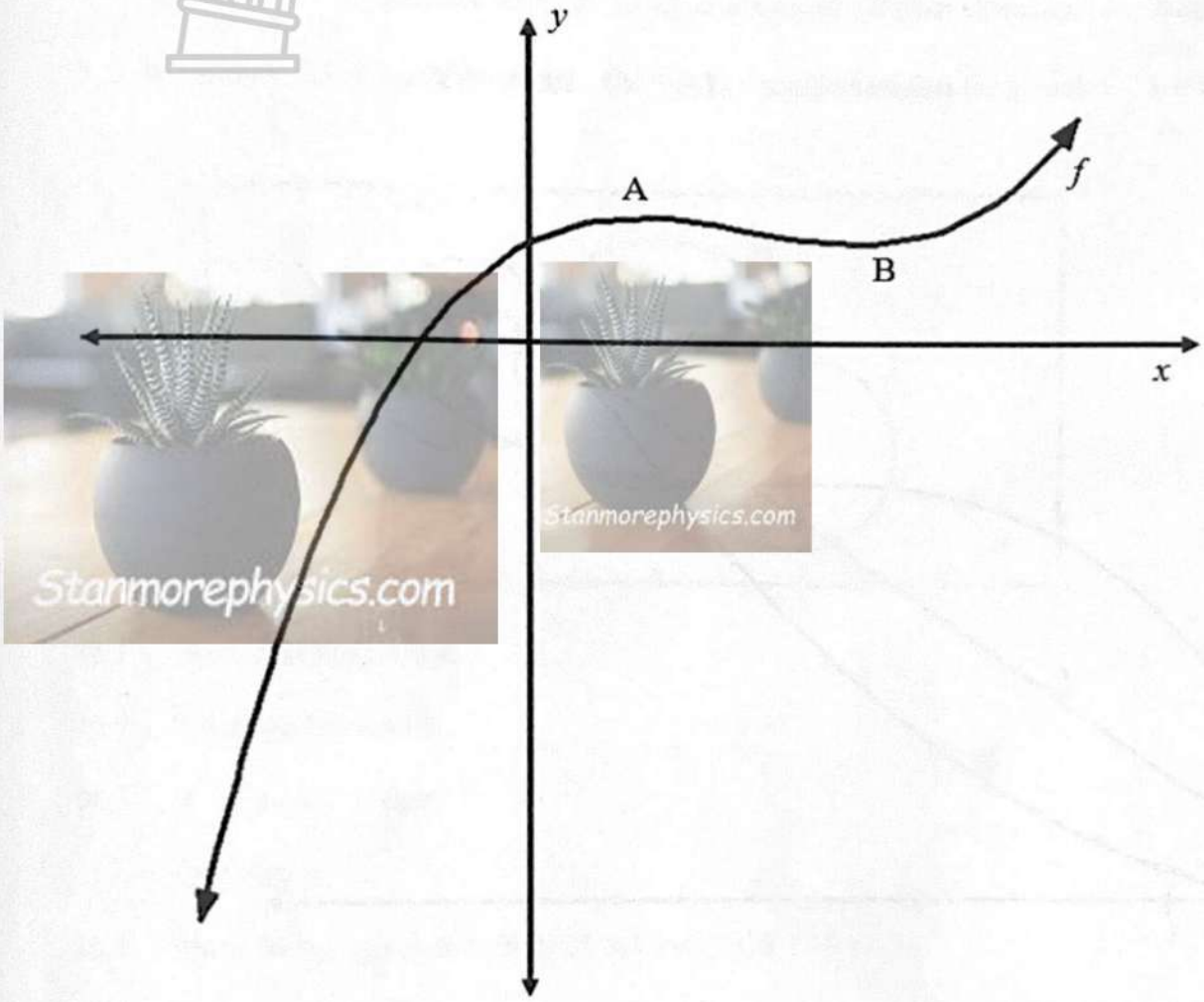
7.2 Determine $f'(x)$ if:

7.2.1 $f(x) = 5x^3 - 7x + 2$ (2)

7.2.2 $f(x) = \dfrac{2x+1}{\sqrt[3]{x}}$ (4)
[11]

QUESTION 8

The graph of $f(x) = x^3 + bx^2 + cx + d$ is sketched below. A and B are the turning points of f. $f''(x) > 0$ for $x > 2$. The line $y = 20$ is a tangent to f at $x = 1$.



8.1 Show that $b = -6$, $c = 9$ and $d = 16$. (5)

8.2 For which values of x is f strictly decreasing? (2)

8.3 $g(x) = mx - 16$ is a tangent to f.

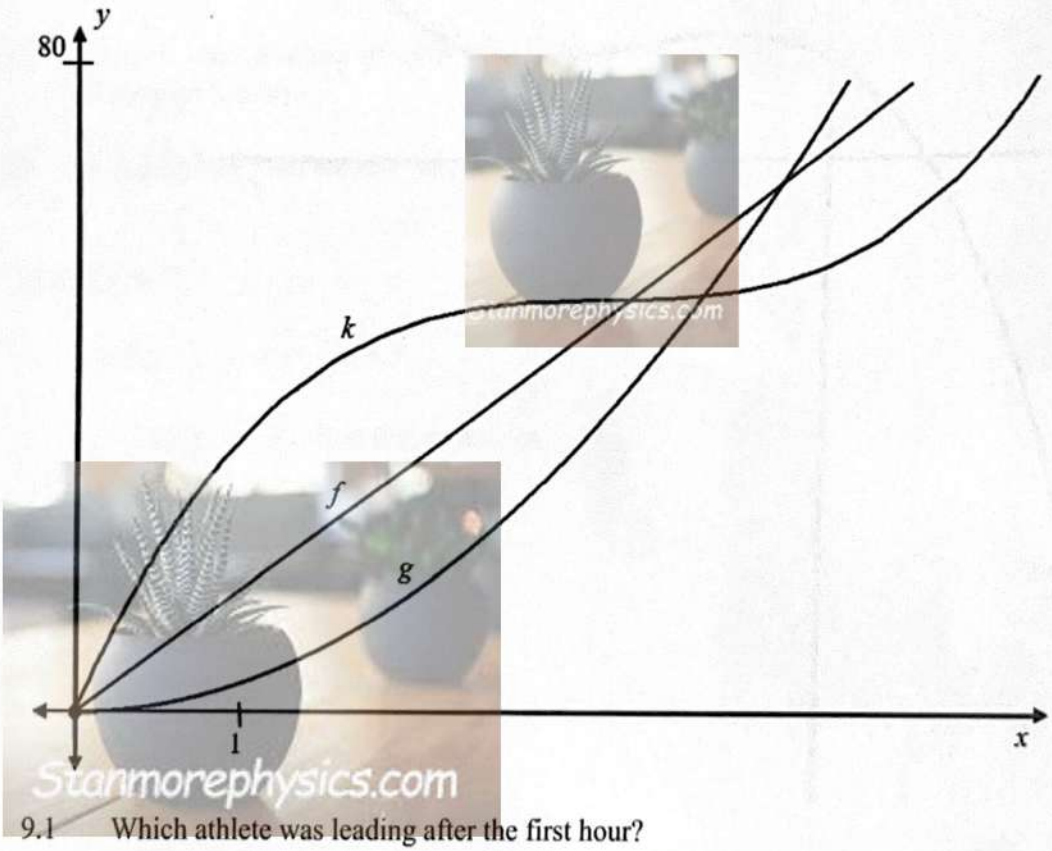
Determine the value of m. (6)
[13]

QUESTION 9

The rough sketch graphs below represent the distance covered by each of the three athletes: Ben, John and Chris, in a marathon race of 80 km at different times from the start of the race. The y-axis represents the distance in km and x-axis the time in hours.

The following equations represents roughly the movements of the three athletes:

Ben: $f(x) = mx + c$; John: $g(x) = 2,6x^2$ Chris: $k(x) = x^3 - 10,5x^2 + 37x$



9.1 Which athlete was leading after the first hour? (1)

9.2 Which athlete completed the race in the shortest time? (1)

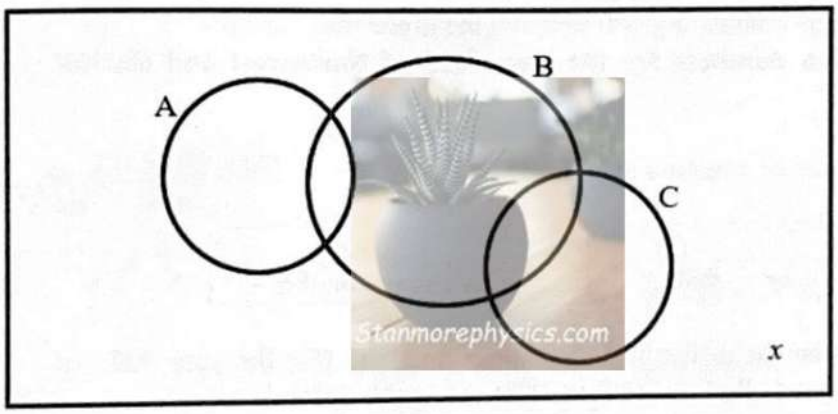
9.3 During the race, Chris slowed down to drink water. Determine after how many kilometres Chris run at his slowest speed.
(NOTE: Chris never actually stopped during the race.) (5)

9.4 At what time during the first part of the race, were John and Chris the furthest apart from one another? Show ALL calculations. Give your answer in hours and minutes. (4)
[11]

QUESTION 10

Three events A, B and C are represented on the Venn-diagram below.

- A and B are independent events.
- A and C are mutually exclusive events.
- P(A) = 0,25.
- P(A or B) = 0,55.
- x lies outside the P(A), P(B) or P(C), but inside the sample space.



10.1 Show that P(B) = 0,4. (3)

10.2 Calculate P(A and B). (2)

10.3 If P (only C) = 0,25.

Calculate x. (2)

10.4 If it is further given that P[(NOT A) and (NOT C)] = 0,38.

Calculate P(only B). (2)
[9]

QUESTION 11

Examination numbers for the grade 12 final examination are determined in the following way:

province	year	district	centre	candidate number
9	25	4		

11.1 Determine the number of different examination numbers (for the year 2025 of Northwest and district 4) that can be formed by using this system. (2)

11.2 An examination number (for the year 2025 of Northwest and district 4) is randomly selected.

Calculate the probability that this examination number will have a **centre number**:

- that is an even number between 1000 and 5000
- where the digits may not repeat

(5)
[7]

TOTAL: 150

QUESTION 11

Examination numbers for the grade 12 final examination are determined in the following way:

- The first digit is the province number. Northwest is number 9.
- The 2nd and 3rd digits are the year. For this year it will be 25.
- The 4th digit is the district number.
- Digits 5 to 8 are the centre or school number.
- The last 4 digits are the candidate's number in his/her school.

The examination number may contain digits 0 to 9 and the digits may repeat.
Consider only examination numbers for the year 2025 of Northwest and district number 4.

An example of an examination number:

9	25	4	4085	0001
province	year	district	centre	candidate number

11.1 Determine the number of different examination numbers (for the year 2025 of Northwest and district 4) that can be formed by using this system. (2)

11.2 An examination number (for the year 2025 of Northwest and district 4) is randomly selected.

Calculate the probability that this examination number will have a **centre number**:

- that is an even number between 1000 and 5000
- where the digits may not repeat

(5)
[7]

TOTAL: 150

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SEPTEMBER 2025

MARKING GUIDELINES

MARKS: 150

These marking guidelines consist of 18 pages.

NOTE:

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

QUESTION 1

1.1.1	$(x-3)(3x+15)=0$ $x=3$ or $3x=-15$ $x=-5$	✓ $x=3$ ✓ $x=-5$ (2)
1.1.2	$7x^2-4x-5=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-(-4)\pm\sqrt{(-4)^2-4(7)(-5)}}{2(7)}$ $=\frac{2\pm\sqrt{39}}{7}$ $x=1{,}18$ or $x=-0{,}61$	✓ substitution into correct formula ✓ $x=1{,}18$ ✓ $x=-0{,}61$ (3)
1.1.3	$x^2(x+4)<0$ $x^2>0$ for all $x\in\mathbb{R}$ $\therefore\ x+4<0$ $\therefore x<-4$	✓ $x^2>0$ ✓ $x<-4$ (2)
1.1.4	$\sqrt{5-2^{2x}}=2^x-3$ $\left(\sqrt{5-2^{2x}}\right)^2=\left(2^x-3\right)^2$ $5-2^{2x}=2^{2x}-6.2^x+9$ $0=2.2^{2x}-6.2^x+4$ OR Let k = 2^x $0=2^{2x}-3.2^x+2$ $0=k^2-3k+2$ $0=\left(2^x-2\right)\left(2^x-1\right)$ $0=(k-2)(k-1)$ $2^x=2$ or $2^x=1$ $k=2$ or $k=1$ $2^x=2^1$ $2^x=2^0$ $x=1$ $x=0$ *n.a* *n.a* $\therefore$ no solution	✓ square both sides ✓ simplify ✓ standard form ✓ factors ✓ both answers ✓ no solution (6)

1.2	$2y - x = 3$ $2y - 3 = x$	✓ x subject
	$y^2 - 2x^2 - x - 1 = 0$ $y^2 - 2(2y-3)^2 - (2y-3) - 1 = 0$	✓substitution
	$y^2 - 2(4y^2 - 12y + 9) - 2y + 3 - 1 = 0$ $y^2 - 8y^2 + 24y - 18 - 2y + 3 - 1 = 0$	
	$0 = 7y^2 - 22y + 16$	✓ standard form
	$0 = (7y - 8)(y - 2)$	✓ factors
	$7y = 8$ or $y = 2$	✓ both y-values
	$y = \frac{8}{7}$ $x = 2\left(\frac{8}{7}\right) - 3$ $x = 2(2) - 3$ $= -\frac{5}{7}$ $= 1$	✓ both x-values (6)
	OR	
	$2y - x = 3$ $2y = x + 3$ $y = \frac{x+3}{2}$	✓ y subject
	$y^2 - 2x^2 - x - 1 = 0$ $\left(\frac{x+3}{2}\right)^2 - 2x^2 - x - 1 = 0$	✓substitution
	$\left(\frac{x^2 + 6x + 9}{4}\right) - 2x^2 - x - 1 = 0$ $x^2 + 6x + 9 - 8x^2 - 4x - 4 = 0$	
	$0 = 7x^2 - 2x - 5$	✓ standard form
	$0 = (7x + 5)(x - 1)$	✓ factors
	$7x = -5$ or $x = 1$ $x = -\frac{5}{7}$	✓ both x-values
	$y = \frac{-\frac{5}{7} + 3}{2}$ $y = \frac{1+3}{2}$ $= \frac{8}{7}$ $= 2$	✓ both y-values (6)

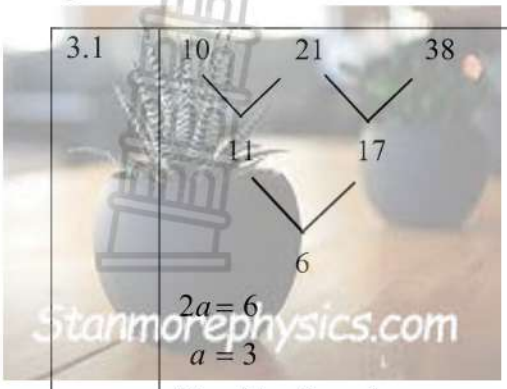
1.3	$p = \dfrac{19 - 3x^2}{x}$	
	$3x^2 + px - 19 = 0$	✓ standard form
	$\Delta = b^2 - 4ac$	
	$= p^2 - 4(3)(-19)$	
	$= p^2 + 228$	✓ $\Delta = p^2 + 228$
	$\therefore p^2 \geq 0$ for all $p \in \mathbb{R}$	✓ $p^2 \geq 0$
	$\therefore p^2 + 228 > 0$ for all $p \in \mathbb{R}$	
	$\therefore \Delta > 0$ for all $p \in \mathbb{R}$	✓ $\Delta > 0$
	Thus, the roots are real for all $p \in \mathbb{R}$.	(4) **[23]**

QUESTION 2

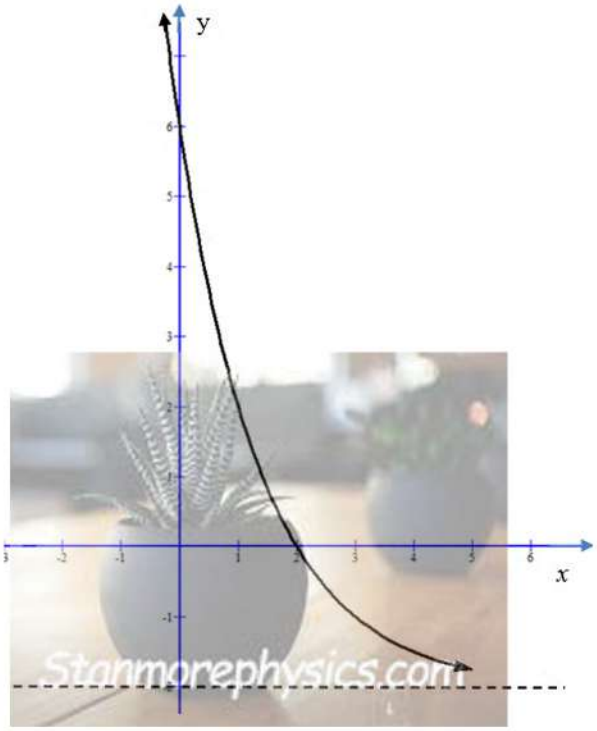
2.1.1	$r = \frac{63}{21} = 3$ $p = \frac{21}{3} = 7$ **OR** $\frac{21}{p} = \frac{63}{21}$ $p = \frac{(21)(21)}{63} = 7$	✓ $r = 3$ ✓ answer (2) ✓ ratio ✓ answer (2)
2.1.2	$T_n = ar^{n-1}$ $137\,781 = 7(3)^{n-1}$ $19\,683 = 3^{n-1}$ $n - 1 = \log_3 19\,683$ or $3^{n-1} = 3^9$ $n - 1 = 9$ $n = 10$ $\therefore$ 10 terms in the series	✓ substitution ✓ log/basis same ✓ answer (3)
2.1.3.	$s_n = \frac{a(r^n - 1)}{r - 1}$ $s_{10} = \frac{7(3^{10} - 1)}{3 - 1}$ $= 206\,668$	✓ substitution ✓ sum of 10 terms (2)
2.2.1	$10; 14; 18; \ldots$ $T_n = a + (n-1)d$ $T_8 = 10 + (8-1)(4)$ $= 38$ 38 learners will enter the hall during the 8th minute.	✓ $d = 4$ ✓ substitution ✓ answer (3)

2.2.2	$S_n = \frac{n}{2}[2a + (n-1)d]$	
	$S_8 = \frac{8}{2}[2(10) + (8-1)(4)]$	✓ substitution
	$= 192$	✓ answer for S_8
	Number of learners in full hall = 5(192) = 960	✓ total full hall
	$960 = \frac{n}{2}[2(10) + (n-1)(4)]$	✓ substitution
	$1\,920 = n(20 + 4n - 4)$	
	$1\,920 = 16n + 4n^2$	
	$0 = 4n^2 + 16n - 1\,920$	✓ standard form
	$0 = n^2 + 4n - 480$	
	$0 = (n - 20)(n + 24)$	
	$n = 20$ or $n = -24$	
	n.a	
	∴ The hall will be full after 20 min.	✓ answer
		(6) **[16]**

QUESTION 3

3.1	 $2a = 6$ $a = 3$ $T_2 - T_1 = 3a + b$ $11 = 3(3) + b$ $b = 2$ $T_1 = a + b + c$ $10 = 3 + 2 + c$ $c = 5$ $\therefore T_n = 3n^2 + 2n + 5$	✓ $a = 3$ ✓ $b = 2$ ✓ $c = 5$ ✓ answer (4)
3.2	$T_n = 3n^2 + 2n + 5$ $T_{10} = 3(10)^2 + 2(10) + 5$ $= 325$	✓ substitution ✓ answer (2)
3.3	$T_n = a + (n-1)d$ $95 = 11 + (n-1)(6)$ $84 = (n-1)(6)$ $14 = n - 1$ $n = 15$ Term 15 and 16 differ with 95. **OR** $T_{n+1} - T_n = 95$ $3(n+1)^2 + 2(n+1) + 5 - (3n^2 + 2n + 5) = 95$ $3(n^2 + 2n + 1) + 2n + 2 + 5 - 3n^2 - 2n - 5 = 95$ $3n^2 + 6n + 3 + 2n + 2 + 5 - 3n^2 - 2n - 5 = 95$ $6n = 90$ $n = 15$ Term 15 and 16 differ with 95.	✓ substitution ✓ value of n ✓ answer (3) ✓ substitution ✓ value of n ✓ answer (3) **[9]**

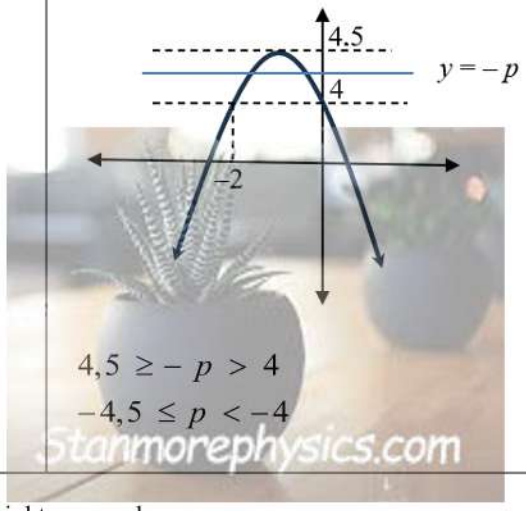
QUESTION 4

4.1	$x = 0$	✓ $x = 0$ (1)
4.2	$f: y = \log_{\frac{1}{2}} x$ $f^{-1}: x = \log_{\frac{1}{2}} y$ $y = \left(\frac{1}{2}\right)^x$	✓ swop x and y ✓ standard form (2)
4.3	$g(x) = \left(\frac{1}{2}\right)^{x-3} - 2$ $0 = \left(\frac{1}{2}\right)^{x-3} - 2$ $2 = \left(\frac{1}{2}\right)^{x-3}$ $\left(\frac{1}{2}\right)^{-1} = \left(\frac{1}{2}\right)^{x-3}$ or $x - 3 = \log_{\frac{1}{2}} 2$ $x - 3 = -1$ $x = 2$	✓ $0 = \left(\frac{1}{2}\right)^{x-3} - 2$ ✓ same basis/logs ✓ answer (3)
4.4	$y = -2$	✓ answer (1)
4.5		✓ y-intercept ✓ shape ✓ x-intercept ✓ asymptote (4) **[11]**

QUESTION 5

5.1	The other x-intercept: $(-4\ ;\ 0)$	✓ x-intercept
	$f(x) = -\frac{1}{2}(x-2)(x+4)$	✓ substitution
	$= -\frac{1}{2}(x^2 + 2x - 8)$	
	$= -\frac{1}{2}x^2 - x + 4$	(2)
	OR	
	$f(x) = -\frac{1}{2}x^2 + bx + c$	
	Turning point: $x = \frac{-b}{2a}$ or $f'(x) = -x + b$	
	$-1 = \frac{-b}{2\left(-\frac{1}{2}\right)}$ $\quad 0 = -(-1) + b$	✓ substitution into turning point formula
	$b = -1$	
	$0 = -\frac{1}{2}(2)^2 - (2) + c$	✓ substitution: B(2; 0)
	$c = 4$	
	$\therefore f(x) = -\frac{1}{2}x^2 - x + 4$	(2)
	OR	
	$f(x) = -\frac{1}{2}(x+1)^2 + q$	✓ substitution of p
	$0 = -\frac{1}{2}(2+1)^2 + q$	✓ substitution: B(2; 0)
	$q = \frac{9}{2}$	
	$f(x) = -\frac{1}{2}(x+1)^2 + \frac{9}{2}$	
	$= -\frac{1}{2}(x^2 + 2x + 1) + \frac{9}{2}$	
	$= -\frac{1}{2}x^2 - x - \frac{1}{2} + \frac{9}{2}$	
	$\therefore f(x) = -\frac{1}{2}x^2 - x + 4$	(2)

5.2	$(0\ ;\ 4)$	✓ $x = 0$ ✓ $y = 4$ (2)
5.3	$f(x) = -\frac{1}{2}(-1)^2 - (-1) + 4$ $= 4{,}5$ $\therefore (-1\ ;\ 4{,}5)$	✓ substitution ✓ answer (2)
5.4	$h(x) = -x + c$ $0 = -(2) + c$ $c = 2$ $h(x) = -x + 2$	✓ $m = -1$ ✓ substitution ✓ answer (3)
5.5	$h(x) = -x + 2$ $q = -(-1) + 2$ $q = 3$ $g(x) = \frac{a}{x+1} + 3$ $4 = \frac{a}{0+1} + 3$ $a = 1$ $g(x) = \frac{1}{x+1} + 3$	✓ $q = 3$ ✓ substitution p and q ✓ substitution $(0\ ;\ 4)$ ✓ answer (4)
5.6	$0 = \frac{1}{x+1} + 3$ $-3 = \frac{1}{x+1}$ $-3x - 3 = 1$ $-3x = 4$ $x = -\frac{4}{3}$	✓ $y = 0$ ✓ simplify ✓ answer (3)
5.7	$x \in \left[-\frac{4}{3}\ ;\ -1\right) \cup (-1\ ;\ \infty)$ **OR** $x \in \left[-\frac{4}{3}\ ;\ \infty\right);\ x \neq -1$	✓✓ $\left[-\frac{4}{3}\ ;\ -1\right)$ ✓ $(-1\ ;\ \infty)$ ✓✓ $\left[-\frac{4}{3}\ ;\ \infty\right)$ ✓ $x \neq -1$ (3)

5.8	$k(x) = \dfrac{-1}{x-9} + 3$	✓ -1 ✓ $x-9$ ✓ answer (3)
5.9	$y = a(x - x_1)(x - x_2)$ $= -\dfrac{1}{2}(x+2)(x-0)$ $= -\dfrac{1}{2}(x^2 + 2x)$ $= -\dfrac{1}{2}x^2 - x$ Move downwards with more than the distance from the y-intercept of 4 to 0. Move downwards with less than the distance from the turning point of 4,5 to the x-axis. $\therefore -4{,}5 \leq p < -4$ **OR** $y = -\dfrac{1}{2}x^2 - x + 4 + p$ $0 = -\dfrac{1}{2}(-2)^2 - (-2) + 4 + p$ $p = -4$ The x-intercept must be greater than -2 $\therefore p < -4$ Move downwards with less than the distance from the turning point of 4,5 to the x-axis. $\therefore -4{,}5 \leq p < -4$ **OR** $f(-2) = -\dfrac{1}{2}(-2)^2 - (-2) + 4$ $= 4$  $4{,}5 \geq -p > 4$ $-4{,}5 \leq p < -4$	✓ substitution ✓ standard form ✓✓ answer (4) ✓ substitution (–2; 0) ✓ $p < -4$ ✓✓ answer (4) ✓ $f(-2) = 4$ ✓ $4{,}5 \geq -p > 4$ ✓✓ answer (4) **[26]**

QUESTION 6

6.1	$\text{Deposit} = 0{,}15(\text{cost})$ $R202\,500 = 0{,}15(\text{cost})$ $\text{cost} = R1\,350\,000$	✓ substitution ✓ answer (2)
6.2	$\text{Loan} = R1\,350\,000 - R202\,500$ $= R1\,147\,500$ $P = \dfrac{x\left[1-(1+i)^{-n}\right]}{i}$ $1\,147\,500 = \dfrac{20\,000\left[1-\left(1+\frac{0{,}098}{12}\right)^{-n}\right]}{\frac{0{,}098}{12}}$ $\dfrac{7\,497}{16\,000} = 1-\left(1+\dfrac{0{,}098}{12}\right)^{-n}$ $\left(1+\dfrac{0{,}098}{12}\right)^{-n} = \dfrac{8\,503}{16\,000}$ $-n = \log_{\left(1+\frac{0{,}098}{12}\right)}\dfrac{8\,503}{16\,000}$ $-n = -77{,}72418859$ $\therefore$ 78 monthly instalments	✓ loan ✓ i ✓ substitution ✓ simplification ✓ use of logs ✓ answer (6)
6.3	$A = 1\,147\,500\left(1+\dfrac{0{,}098}{12}\right)^{24}$ $= R1\,394\,853{,}88$ $F = \dfrac{x\left[(1+i)^{n}-1\right]}{i}$ $= \dfrac{20\,000\left[\left(1+\frac{0{,}098}{12}\right)^{24}-1\right]}{\frac{0{,}098}{12}}$ $x = R527\,899{,}43$ Outstanding balance $= R1\,394\,853{,}88 - R527\,899{,}43$ $= R866\,954{,}45$ **OR**	✓ substitution into A formula ✓ substitution into F formula ✓ answer (3)

	$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $= \frac{20\,000\left[1-\left(1+\frac{0,098}{12}\right)^{-53,72418859}\right]}{\frac{0,098}{12}}$ $= R866\,954,45$	✓ substitution into P formula ✓ $n = -53,72418859$ ✓ answer (3)
6.4	Total cost = R202 500 + (24)(20 000) + R866 954,45 = R1 549 454,45	✓ R202 500 + R866 954,45 ✓ (24)(20 000) ✓ answer (3) **[14]**

QUESTION 7

7.1	$f(x) = x^2 - x + 3$ $f(x+h) = (x+h)^2 - (x+h) + 3$ $= x^2 + 2xh + h^2 - x - h + 3$ $f(x+h) - f(x) = (x^2 + 2xh + h^2 - x - h + 3)$ $- (x^2 - x + 3)$ $= 2xh + h^2 - h$ $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \to 0} \frac{2xh + h^2 - h}{h}$ $= \lim_{h \to 0} \frac{h(2x + h - 1)}{h}$ $= \lim_{h \to 0} (2x + h - 1)$ $= 2x - 1$	✓ substitution of $(x+h)$ ✓ simplify $f(x+h)$ ✓ simplification ✓ factors ✓ answer (5)
	OR $f(x) = x^2 - x + 3$ $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \to 0} \frac{[(x+h)^2 - (x+h) + 3] - (x^2 - x + 3)}{h}$ $= \lim_{h \to 0} \frac{x^2 + 2xh + h^2 - x - h + 3 - x^2 + x - 3}{h}$ $f'(x) = \lim_{h \to 0} \frac{2xh + h^2 - h}{h}$ $= \lim_{h \to 0} \frac{h(2x + h - 1)}{h}$ $= \lim_{h \to 0} (2x + h - 1)$ $= 2x - 1$	✓ substitution of $(x+h)$ ✓ simplify $f(x+h)$ ✓ simplification ✓ factors ✓ answer (5)
7.2.1	$f(x) = 5x^3 - 7x + 2$ $f'(x) = 15x^2 - 7$	✓ $15x^2$ ✓ -7 (2)
7.2.2	$f(x) = \frac{2x+1}{\sqrt[3]{x}}$ $= 2x^{\frac{2}{3}} + x^{-\frac{1}{3}}$ $f'(x) = \frac{4}{3}x^{-\frac{1}{3}} - \frac{1}{3}x^{-\frac{4}{3}}$	✓ $2x^{\frac{2}{3}}$ ✓ $x^{-\frac{1}{3}}$ ✓ $\frac{4}{3}x^{-\frac{1}{3}}$ ✓ $-\frac{1}{3}x^{-\frac{4}{3}}$ (4) **[11]**

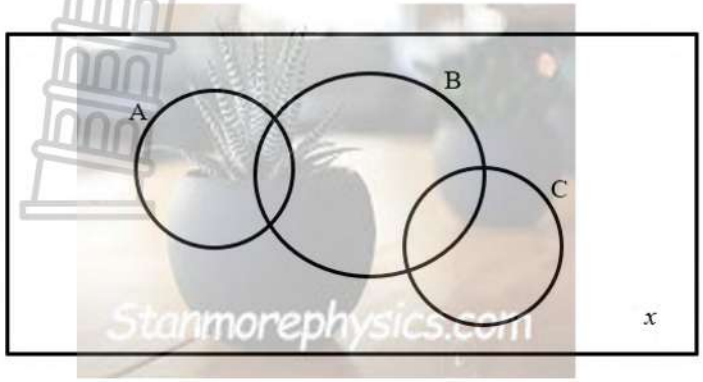
QUESTION 8

8.1	$f(x) = x^3 + bx^2 + cx + d$ $f'(x) = 3x^2 + 2bx + c$ $f''(x) = 6x + 2b$ $0 = 6(2) + 2b$ $2b = -12$ $b = -6$ $f'(1) = 3(1)^2 + 2(-6)(1) + c$ $0 = 3 - 12 + c$ $c = 9$ $f(x) = x^3 - 6x^2 + 9x + d$ $20 = (1)^3 - 6(1)^2 + 9(1) + d$ $d = 16$	✓ $f'(x) = 3x^2 + 2bx + c$ ✓ $f''(x) = 6x + 2b$ ✓ $f''(2) = 0$ ✓ $f'(1) = 0$ ✓ $f(1) = 20$ (5)
8.2	$\frac{x_B + 1}{2} = 2$ $x_B + 1 = 4$ $x_B = 3$ $\therefore 1 < x < 3$ **OR** $f'(x) = 3x^2 - 12x + 9$ $0 = 3x^2 - 12x + 9$ $0 = x^2 - 4x + 3$ $0 = (x - 3)(x - 1)$ $x = 3$ or $x = 1$ $\therefore 1 < x < 3$	✓ $x = 3$ ✓ answer (2) ✓ $x = 3$ ✓ answer (2)
8.3	$m = f'(x)$ $= 3x^2 - 12x + 9$ $mx - 16 = x^3 - 6x^2 + 9x + 16$ $(3x^2 - 12x + 9)x - 16 = x^3 - 6x^2 + 9x + 16$ $3x^3 - 12x^2 + 9x - 16 = x^3 - 6x^2 + 9x + 16$ $2x^3 - 6x^2 - 32 = 0$ $\therefore x = 4$ $f'(4) = 3(4)^2 - 12(4) + 9$ $\therefore m = 9$	✓ $m = f'(x)$ ✓ $f = g$ ✓ substitution ✓ standard form ✓ $x = 4$ ✓ answer (6) **[13]**

QUESTION 9

9.1	Chris	✓ Chris (1)
9.2	John	✓ John (1)
9.3	$k(x) = x^3 - 10,5x^2 + 37x$ $k'(x) = 3x^2 - 21x + 37$ $k''(x) = 6x - 21$ $0 = 6x - 21$ $6x = 21$ $x = \frac{21}{6} = 3,5\ hours$ $k(3,5) = (3,5)^3 - 10,5(3,5)^2 + 37(3,5)$ $= 43,75km$	✓ $k'(x) = 3x^2 - 21x + 37$ ✓ $k''(x) = 6x - 21$ ✓ $k''(x) = 0$ ✓ $x = 3,5$ ✓ answer (5)
9.4	$D(x) = k(x) - g(x)$ $= x^3 - 10,5x^2 + 37x - 2,6x^2$ $= x^3 - 13,1x^2 + 37x$ $D'(x) = 3x^2 - 26,2x + 37$ $0 = 3x^2 - 26,2x + 37$ $x = \frac{26,2 \pm \sqrt{(-26,2)^2 - 4(3)(37)}}{2(3)}$ $x = 6,96$ or $x = 1,77$ *n.a* ∴ After 1,77 hours ∴ After 1 hour and 46 min or 1 hour and 46,2 min	✓ $k(x) - g(x)$ ✓ $D'(x) = 0$ ✓ $x = 1,77$ ✓ answer (4) **[11]**

QUESTION 10

		
10.1	$P(A \text{ and } B) = P(A) \times P(B)$ $= 0,25 \times P(B)$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $0,55 = 0,25 + P(B) - 0,25P(B)$ $0,75P(B) = 0,3$ $P(B) = 0,4$	✓ $P(A \text{ and } B) = 0,25P(B)$ ✓ substitution ✓ $0,75P(B) = 0,3$ (3)
10.2	$P(A \text{ and } B) = P(A) \times P(B)$ $= 0,25 \times 0,4$ $= 0,1$	✓ substitution ✓ answer (2)
10.3	$P(\text{only A}) + P(B) + P(\text{only C}) + x = 1$ $0,15 + 0,4 + 0,25 + x = 1$ $x = 0,2$	✓ substitution ✓ answer (2)
10.4	$0,2 + P(\text{only B}) = 0,38$ $P(\text{only B}) = 0,18$	✓ substitution ✓ answer (2) **[9]**

QUESTION 11

11.1	(1) (1)(1) (1) $(10 \times 10 \times 10 \times 10)$ $(10 \times 10 \times 10 \times 10)$ $= 10^8 = 100\ 000\ 000$	✓✓ answer (2)
11.2	$(4 \times 8 \times 7 \times 3) + (3 \times 8 \times 7 \times 1) + (3 \times 8 \times 7 \times 1)$ $= 672 + 168 + 168$ $= 1\ 008$ $P = \frac{(1)(1)(1)(1)[1\ 008][10 \times 10 \times 10 \times 10]}{10^8}$ $= 0{,}1008 \approx 0.10$ **OR** $(4 \times 8 \times 7 \times 3) + (3 \times 8 \times 7 \times 1) + (3 \times 8 \times 7 \times 1)$ $= 672 + 168 + 168$ $= 1\ 008$ $P = \frac{1\ 008}{10 \times 10 \times 10 \times 10}$ $= 0{,}1008 \approx 0.10$	✓ $(4 \times 8 \times 7 \times 3)$ ✓ $(3 \times 8 \times 7 \times 1)$ ✓ $(3 \times 8 \times 7 \times 1)$ ✓ 10^8 in the denominator ✓ answer (A) (5) ✓ $(4 \times 8 \times 7 \times 3)$ ✓ $(3 \times 8 \times 7 \times 1)$ ✓ $(3 \times 8 \times 7 \times 1)$ ✓ 10^4 in the denominator ✓ answer (A) (5) **[7]**
		TOTAL: 150