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**PREPARATORY EXAMINATION
*VOORBEREIDENDE EKSAMEN***

GRADE/*GRAAD* 12

**MATHEMATICS P1
*WISKUNDE V1***

SEPTEMBER 2023

MARKS/*PUNTE*: 150

**MARKING GUIDELINES
*NASIENRIGLYNE***

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

NOTE:

- Constant accuracy applies in the whole marking guideline.
- If a learner answers a question twice, mark only the first attempt.
- If a learner cancels a question, but does not redo it, mark that attempt.

NOTA:

- *Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas.*
- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, sien die doodgetrekte poging na.*

QUESTION/VRAAG 1

1.1		
1.1.1	$(x - 1)(2x + 1) = 0$ $x = 1$ or/of $x = -\frac{1}{2}$	$\checkmark x = 1$ $\checkmark x = -\frac{1}{2}$ (2)
1.1.2	$(x - 1)(2x + 1) = 4$ $2x^2 - x - 5 = 0$ $\therefore x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(2)(-5)}}{2(2)}$ $x = \frac{1 \pm \sqrt{41}}{4}$ $x = 1,85$ or/of $x = -1,35$	\checkmark standard form \checkmark correct substitution in correct formula \checkmark 1,85 \checkmark -1,35 Penalise/mark -1 for incorrect rounding (4)
1.1.3	$x + \sqrt{x - 2} = 4$ $\sqrt{x - 2} = 4 - x$ $(\sqrt{x - 2})^2 = (4 - x)^2$ $x - 2 = 16 - 8x + x^2$ $0 = x^2 - 9x + 18$ $0 = (x - 6)(x - 3)$ $x = 6$ or/of $x = 3$ Not applicable/ <i>Nie van toepassing nie</i>	\checkmark isolate the surd \checkmark squaring both sides \checkmark standard form \checkmark factors \checkmark answer with choice (5)
1.1.4	$3x^2 + x \leq 0$ $x(3x + 1) \leq 0$ Critical values: 0 and/en $-\frac{1}{3}$ $x \in \left[-\frac{1}{3}; 0\right]$ Or $-\frac{1}{3} \leq x \leq 0$	\checkmark factors \checkmark critical values \checkmark answer (3)

<p>1.2</p>	$2x + y = 17$ $\therefore y = 17 - 2x$ <p>Substitute in/verv. in $xy = 8$</p> $x(17 - 2x) = 8$ $0 = 2x^2 - 17x + 8$ $0 = (2x - 1)(x - 8)$ $\therefore x = \frac{1}{2} \text{ or } x = 8$ $y = 17 - 2\left(\frac{1}{2}\right) \quad \text{or/of} \quad y = 17 - 2(8)$ $y = 16 \quad \quad \quad y = 1$ <p>OR/OF</p> $x = \frac{17 - y}{2}$ <p>Substitute in/verv. in $xy = 8$</p> $\left(\frac{17 - y}{2}\right)y = 8$ $17y - y^2 = 16$ $0 = y^2 - 17y + 16$ $0 = (y - 16)(y - 1)$ $\therefore y = 16 \text{ or/of } y = 1$ $x = \frac{17 - 16}{2} \quad \text{or/of} \quad x = \frac{17 - 1}{2}$ $x = \frac{1}{2} \quad \quad \quad x = 8$	<p>✓ $y = 17 - 2x$</p> <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ both answers for x</p> <p>✓ both answers for y</p> <p>OR</p> $x = \frac{17 - y}{2}$ <p>✓ substitution</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ both answers for x</p> <p>✓ both answers for y</p> <p>(6)</p>
<p>1.3</p>	$\sqrt{\sqrt{21x^2} - \sqrt{5x^2}} \times \sqrt{\sqrt{21x^2} + \sqrt{5x^2}}$ $= \sqrt{(\sqrt{21x^2} - \sqrt{5x^2})(\sqrt{21x^2} + \sqrt{5x^2})}$ $= \sqrt{21x^2 - 5x^2}$ $= \sqrt{16x^2}$ $= 4x$	<p>✓ one square root</p> <p>✓ difference between squares</p> <p>✓ answer</p> <p>(3)</p>
		<p>[23]</p>

QUESTION/VRAAG 2

2.1.1	$S_n = a + (a + d) + (a + 2d) + \dots + a + (n - 1)d$ $S_n = a + (n - 1)d + a + (n - 2)d + \dots + a$ $\therefore 2S_n = n(2a + (n - 1)d)$ $S_n = \frac{n}{2}(2a + (n - 1)d)$	$\checkmark T_n = a + (n - 1)d$ \checkmark reverse \checkmark add (3)
2.1.2	$2^x + 2 \cdot 2^x + 3 \cdot 2^x + \dots$ $\therefore a = 2^x$ $d = 2^x$ $1680 = \frac{20}{2}(2(2^x) + (19)(2^x))$ $168 = 21 \cdot 2^x$ $8 = 2^x$ $x = 3$	$\left. \begin{array}{l} \text{value } a \\ \text{value } d \end{array} \right\} \checkmark$ \checkmark substitution in correct formula \checkmark Simplification ($8 = 2^x$) \checkmark answer (4)
2.2	$S_n = \frac{n^2 + n}{4}$ $\therefore T_8 = S_8 - S_7$ $= \frac{8^2 + 8}{4} - \frac{7^2 + 7}{4}$ $= 18 - 14$ $= 4$	\checkmark correct method \checkmark substitution \checkmark answer (3)
2.3	$S_n = \frac{a(1 - r^n)}{1 - r}$ $S_{10} = \frac{32 \left(1 - \left(-\frac{1}{2} \right)^{10} \right)}{1 - \left(-\frac{1}{2} \right)}$ $S_{10} = \frac{341}{16} \text{ or/of } 21,31$	\checkmark values of a and r \checkmark substitution into correct formula \checkmark answer (3)
		[13]

QUESTION/VRAAG 3

3.1	-4 ; -6 ; -10 ; -16 ; ... given/gegee	
3.1.1	<p>First difference/<i>eerste verskil</i> : -2 ; -4 ; -6 Second differences/<i>tweede verskil</i> -2 ; -2</p> $2a = -2 \quad 3(-1) + b = -2$ $a = -1 \quad b = 1$ $-1 + 1 + c = -4$ $c = -4$ $T_n = -n^2 + n - 4$	<p>✓ value of a ✓ value of b ✓ value of c ✓ $T_n = -n^2 + n - 4$</p> <p>(4) ANSWER ONLY FULL MARKS</p>
3.1.2	$T_n = -2 + (n-1)(-2)$ $T_n = -2n$ $-100 = -2n$ $\therefore n = 50$ <p>Between/<i>tussen</i> T_{50} and/<i>en</i> T_{51}</p> <p style="text-align: center;">OR/OF</p> $T_{n+1} - T_n = -100$ $-(n+1)^2 + (n+1) - 4 - [-n^2 + n - 4] = -100$ $-n^2 - 2n - 1 + n + 1 - 4 + n^2 - n + 4 = -100$ $-2n = -100$ $n = 50$ <p>Between/<i>tussen</i> T_{50} and/<i>en</i> T_{51}</p>	<p>✓ $d = -2$ ✓ $T_n = -2n$ ✓ 50 ✓ answer</p> <p>OR</p> <p>✓ $T_{n+1} - T_n = -100$ ✓ substitution ✓ 50 ✓ answer</p> <p>(4)</p>

3.2	$a = k - \frac{3}{2}$ $r = k - \frac{3}{2}$ $\therefore S_{\infty} = \frac{a}{1-r}$ $-\frac{5}{3} = \frac{k - \frac{3}{2}}{1 - \left(k - \frac{3}{2}\right)}$ $-\frac{5}{3} + \frac{5}{3}k - \frac{5}{2} = k - \frac{3}{2}$ $-10 + 10k - 15 = 6k - 9$ $4k = 16$ $k = 4$	<p>✓ value of a and r</p> <p>✓ substitution in correct formula</p> <p>✓ simplification shown</p> <p>✓ answer</p> <p>(4)</p>
		[12]

QUESTION/VRAAG 4

	Given/gegee $h(x) = -\frac{2}{x-2} + 2$	
4.1	$x = 2$ $y = 2$	✓ $x = 2$ ✓ $y = 2$ (2)
4.2	$0 = -\frac{2}{x-2} + 2$ $-2(x-2) = -2$ $x-2 = 1$ $x = 3$	✓ $y = 0$ ✓ $x = 3$ (2)
4.3		✓ BOTH asymptotes ✓ x- intercept ✓ y- intercept ✓ shape (4)
4.4	$y - 2 = -1(x - 2)$ $y = -x + 4$	✓ gradient -1 ✓ substitute (2; 2) ✓ equation (3)

4.5	$-h(x)+1$ $= \frac{2}{x-2} - 2 + 1$ $= \frac{2}{x-2} - 1$ $\therefore y \in R; y \neq -1$	✓ new equation ✓ answer (2) ANSWER ONLY FULL MARKS
4.6	$h(x) \leq 0$ $\therefore x \in (2;3]$ OR/OR $2 < x \leq 3$	✓ critical values ✓ notation (2)
		[15]

QUESTION/VRAAG 5

	<p>Given/gegee $f(x) = -\frac{1}{2}x^2 + 2x + 6$ $g(x) = -x - 2$</p>	
5.1.1	$x = \frac{-2}{2\left(-\frac{1}{2}\right)}$ $f'(x) = 0$ $0 = -x + 2$ $x = 2$ <p>OR/OF</p> $y = -\frac{1}{2}(x^2 - 4x) + 6$ $x = 2$ $y = -\frac{1}{2}(x - 2)^2 + 8$ <p>$\therefore D(2;8)$ $\therefore D(2;8)$</p>	<p>✓ method for turning point</p> <p>✓ x-value ✓ y-value</p> <p>(3)</p>
5.1.2	<p>$D(2;8)$ $\therefore F(2;-4)$ DF = 12 units/eenhede</p>	<p>✓✓ coordinates F ✓ answer</p> <p>(3)</p>
5.2	<p>$6 < k < 8$</p>	<p>✓✓ answer</p> <p>(2)</p>
5.3	<p>$h'(x) = f(x)$ $0 = -\frac{1}{2}x^2 + 2x + 6$ $0 = x^2 - 4x - 12$ $0 = (x - 6)(x + 2)$ $A(-2;0)$ $B(6;0)$ $\therefore x = -2$ $x = 6$</p> <p>for turning points of/vir draaipunte van h</p>	<p>✓ $f(x) = h'(x) = 0$</p> <p>✓ Factors ✓ both x values</p> <p>(3)</p>
5.4	<p>$f'(x) \times g(x) \leq 0$ $\therefore x \in [-2;2]$</p>	<p>✓ critical values ✓ notation</p> <p>(2)</p>
		[13]

QUESTION/VRAAG 6

6.1	$T(0; 1)$	✓ answer (1)
6.2	$\frac{27}{8} = a^3$ $\therefore a = \frac{3}{2}$	✓ substitute B ✓ answer (2)
6.3	$g(x) = \left(\frac{2}{3}\right)^x$ OR/OFF $g(x) = \left(\frac{3}{2}\right)^{-x}$	✓ base ✓ exponent (2)
6.4	$f^{-1} : x = \left(\frac{3}{2}\right)^y$ $\therefore y = \log_{\frac{3}{2}} x$	✓ swop x and y ✓ answer (2)
6.5	$\log_{\frac{3}{2}} x = 1$ $\therefore x = \frac{3}{2}$ $f^{-1}(x) \leq 1$ $\therefore x \in (0; \frac{3}{2}]$	✓ $x = \frac{3}{2}$ ✓ critical values ✓ notation (3)
		[10]

QUESTION/VRAAG 7

7.1	$A = P(1+i)^n$ $3x = x(1 + 0,098)^n$ $3 = 1,098^n$ $n = \log_{1,098} 3$ $n = 11,751$ <p>It will take 12 years to triple the money/<i>Dit sal 12 jaar neem om die geld te verdriedubbel.</i></p>	<p>✓ correct substitution in correct formula</p> <p>✓ use of logs (independent mark)</p> <p>✓ 12 also accept 11,75</p> <p>(3)</p>
7.2		
7.2.1	$F_v = \frac{x[(1+i)^n - 1]}{i}$ $64000 = \frac{x \left[\left(1 + \frac{0,085}{12} \right)^{120} - 1 \right]}{\frac{0,085}{12}}$ $x = 340,18$	<p>✓ $i = \frac{0,085}{12}$</p> <p>$n = 120$ both i and n</p> <p>✓ substitution in correct formula</p> <p>✓ answer</p> <p>(3)</p>
7.2.2	$F_v = \frac{340,18 \left[\left(1 + \frac{0,085}{12} \right)^{96} - 1 \right]}{\frac{0,085}{12}} \left(1 + \frac{0,085}{12} \right)^{24}$ $= 55135,69$	<p>✓ $96 = n$</p> <p>✓ compound interest 24 months</p> <p>✓ answer</p> <p>(3)</p>
7.3		
7.3.1	$P_v = \frac{4396,83 \left[1 - \left(1 + \frac{0,104}{12} \right)^{-72} \right]}{\frac{0,104}{12}}$ $= R234770,75$	<p>✓ $72 = n$ and $i = \frac{0,104}{12}$</p> <p>✓ substitution into correct formula</p> <p>✓ answer</p>

	<p>ALTERNATIVE method <i>ALTERNATIEWE metode</i></p> $400000 \left(1 + \frac{0,104}{12} \right)^{108}$ $- \frac{4396,83 \left[\left(1 + \frac{0,104}{12} \right)^{108} - 1 \right]}{\frac{0,104}{12}}$ <p>= R234770,77</p>	<p>✓ loan with n = 108</p> <p>✓ F_v with n = 108</p> <p>✓ answer</p> <p>(3)</p>
7.3.2	<p>During 9 years, she paid R474 857,64. Her payment on the loan however is only R165 229,25. She paid interest of R309 628,39 over the 9 years. / <i>Gedurende 9 jaar het sy R474 857,64 betaal. Haar betaling op die lening is egter slegs R165 229,25. Sy het rente van R309 628,39 oor die 9 jaar betaal</i></p>	<p>✓ R474 857,64</p> <p>✓ R165 229,25 or R165 229,23</p> <p>✓ R309 628,39 or R306 628,41</p> <p>(3)</p>
		[15]

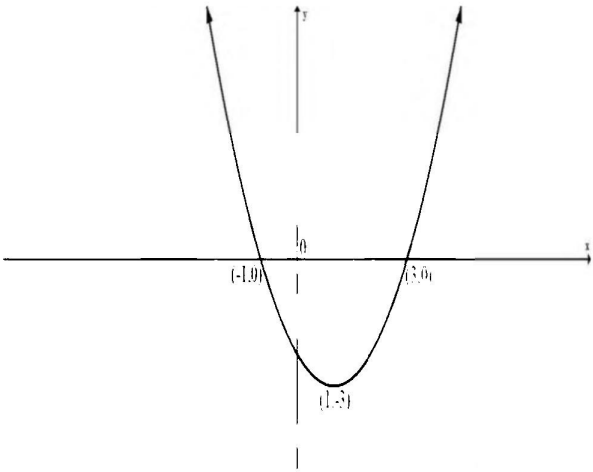
QUESTION/VRAAG 8

Penalise 1 mark for incorrect notation in question 8 only/Penaliseer slegs 1 punt vir verkeerde notasie in vraag 8.

<p>8.1</p>	$f(x) = 3 - x^2$ $f(x+h) = 3 - (x+h)^2$ $= 3 - x^2 - 2xh - h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{3 - x^2 - 2xh - h^2 - (3 - x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \rightarrow 0} (-2x - h)$ $= -2x$	$\checkmark = 3 - x^2 - 2xh - h^2$ \checkmark substitution in correct formula \checkmark simplify \checkmark factors \checkmark answer <p style="text-align: right;">(5)</p>
<p>8.2</p>		
<p>8.2.1</p>	$D_x \left[\frac{2}{x} - \sqrt{x} \right]$ $= D_x \left[2x^{-1} - x^{\frac{1}{2}} \right]$ $= -2x^{-2} - \frac{1}{2}x^{-\frac{1}{2}}$	$\checkmark 2x^{-1}$ $\checkmark x^{\frac{1}{2}}$ $\checkmark -2x^{-2}$ $\checkmark -\frac{1}{2}x^{-\frac{1}{2}}$ <p style="text-align: right;">(4)</p>
<p>8.2.2</p>	$y = (x^3 - 1)^2$ $y = x^6 - 2x^3 + 1$ $\therefore \frac{dy}{dx} = 6x^5 - 6x^2$	$\checkmark x^6 - 2x^3 + 1$ $\checkmark 6x^5$ $\checkmark -6x^2$ <p style="text-align: right;">(3)</p>

8.3	$f(x) = x^3 - 12x - 16$	
8.3.1(a)	$f'(x) = 3x^2 - 12$ $0 = 3(x-2)(x+2)$ $x = 2$ $x = -2$ $\therefore (2; -32)$ $(-2; 0)$	$\checkmark 3x^2 - 12$ $\checkmark = 0$ \checkmark factors $\checkmark (2; -32)$ $\checkmark (-2; 0)$ (5)
8.3.1(b)	$x^3 - 12x - 16 = 0$ $(x+2)(x+2)(x-4) = 0$ $x = -2$ $x = 4$	$\checkmark y = 0$ \checkmark factors \checkmark BOTH answers (3)
8.3.2	$15 = 3x^2 - 12$ $0 = 3x^2 - 27$ $x^2 = 9$ $x = \pm 3$	\checkmark derivative = 15 \checkmark standard form $\checkmark x = 3$ $\checkmark x = -3$ (4)
8.3.3	$f''(x) = 6x$ $0 = 6x$ $x = 0$ Concave up/ <i>konkaaf op</i> : $x \in (0; \infty)$ or written/ <i>of geskryf</i> as $x > 0$	$\checkmark 6x = 0$ \checkmark values \checkmark notation (3)
		[27]

QUESTION/VRAAG 9

9.1		<ul style="list-style-type: none"> ✓ turning point ✓ shape ✓ x- intercepts <p>(3)</p>
9.2	$T(t) = 60 + 27t - t^3$	
9.2.1	<p>Average change/ $= \frac{T(6) - T(3)}{3}$</p> <p><i>Gemid. verandering</i> $= \frac{6 - 114}{3}$</p> <p>$= -36$</p>	<ul style="list-style-type: none"> ✓ correct formula ✓ substitution ✓ answer <p>(3)</p>
9.2.2	$0 = 27 - 3t^2$ $\therefore t^2 = 9$ $t = 3$	<ul style="list-style-type: none"> ✓ $27 - 3t^2$ ✓ $= 0$ ✓ answer <p>(3)</p>
		<p>[9]</p>

QUESTION/VRAAG 10

10.1	$P(A) = 0,4$ $P(B) = 0,5$	
10.1.1	$P(A \text{ or/of } B) = P(A) + P(B)$ $\quad - P(A \text{ and/en } B)$ $= 0,4 + 0,5 - 0$ $= 0,9$	$\checkmark P(A \text{ and } B) = 0$ \checkmark answer (2)
10.1.2	$P(A \text{ or/of } B) = P(A) + P(B)$ $\quad - P(A \text{ and/en } B)$ $= 0,4 + 0,5 - (0,4 \times 0,5)$ $= 0.7$	\checkmark rule $\checkmark P(A) \times P(B) = P(A \text{ and } B)$ \checkmark answer (3)
10.2		
10.2.1	$5 \times 5 \times 10 \times 9$ $= 2250$	$\checkmark 5$ $\checkmark 5$ $\checkmark 10$ $\checkmark 9$ (4)
10.2.2	$\frac{1 \times 5 \times 9 \times 5}{2250}$ $= \frac{1}{10}$ $= 0,1$	\checkmark denominator 2250 $\checkmark 1 \times 5$ $\checkmark 9 \times 5$ \checkmark answer (4)
		[13]

TOTAL/TOTAAL: 150

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GRADE 12

**MATHEMATICS P1
SEPTEMBER 2023
MARKING GUIDELINES**

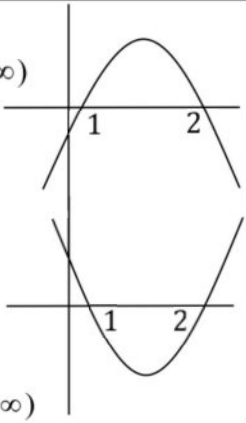
MARKS: 150

These marking guidelines consists of 16 pages.

NOTE:

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

QUESTION 1

1.1.1	$x^2 = 5x$ $x^2 - 5x = 0$ $x(x - 5) = 0$ $x = 0$ or $x = 5$	✓ standard form ✓ factors ✓ x-values (3)
1.1.2	$x^2 - 2x - 13 = 0$ $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-13)}}{2(1)}$ $x = 4,74$ or $x = -2,74$	✓ substitution into the correct formula ✓ $x = 4,74$ ✓ $x = -2,74$ (3)
1.1.3	$(x - 2)(1 - x) \leq 0$ $x \leq 1$ or $x \geq 2$ / $x \in (-\infty; 1] \text{ or } [2; \infty)$ OR $(x - 2)(x - 1) \geq 0$ $x \leq 1$ or $x \geq 2$ / $x \in (-\infty; 1] \text{ or } [2; \infty)$	 ✓ critical values ✓ $x \leq 1$ ✓ $x \geq 2$ (3)
1.1.4	$2\sqrt{2x - 1} = x - 11$ $4(2x - 1) = x^2 - 22x + 121$ $8x - 4 = x^2 - 22x + 121$ $x^2 - 30x + 125 = 0$ $(x - 25)(x - 5) = 0$ $x = 25$ or $x \neq 5$ OR $2\sqrt{2x - 1} = x - 11$ $\sqrt{2x - 1} = \frac{x - 11}{2}$ $2x - 1 = \frac{x^2 - 22x + 121}{4}$ $8x - 4 = x^2 - 22x + 121$ $x^2 - 30x + 125 = 0$ $(x - 25)(x - 5) = 0$ $x = 25$ or $x \neq 5$	✓ square on both sides ✓ standard form ✓ factors/formula ✓ both answers ✓ reject $x = 5$ (5) ✓ square on both sides ✓ standard form ✓ factors/formula ✓ both answers ✓ reject $x = 5$ (5)

1.2	$3x - y = 4$ $y = 3x - 4$ $x^2 + xy = 24$ $x^2 + x(3x - 4) = 24$ $x^2 + 3x^2 - 4x = 24$ $4x^2 - 4x - 24 = 0$ $x^2 - x - 6 = 0$ $(x - 3)(x + 2) = 0$ $x = 3 \text{ or } x = -2$ $y = 3(3) - 4 \text{ or } y = 3(-2) - 4$ $y = 5 \quad y = -10$ OR $3x = y + 4$ $x = \frac{y + 4}{3}$ $x^2 + xy = 24$ $\left(\frac{y + 4}{3}\right)^2 + y\left(\frac{y + 4}{3}\right) = 24$ $\frac{y^2 + 8y + 16}{9} + \frac{y^2 + 4y}{3} = 24$ $y^2 + 8y + 16 + 3y^2 + 12y = 216$ $4y^2 + 20y - 200 = 0$ $y^2 + 5y - 50 = 0$ $(y + 10)(y - 5) = 0$ $y = -10 \text{ or } y = 5$ $x = \frac{(-10) + 4}{3} \text{ or } x = \frac{(5) + 4}{3}$ $x = -2 \quad x = 3$	$\checkmark y = 3x - 4$ \checkmark substitution \checkmark standard form \checkmark factors/formula \checkmark both x -values \checkmark both y -values (6) $\checkmark x = \frac{y + 4}{3}$ \checkmark substitution \checkmark standard form \checkmark factors/formula \checkmark both y -values \checkmark both x -values (6)
1.3	$S = \left(1 + \frac{1}{7}\right)\left(1 + \frac{1}{8}\right)\left(1 + \frac{1}{9}\right)\dots\left(1 + \frac{1}{m}\right)$ $S = \left(\frac{8}{7}\right)\left(\frac{9}{8}\right)\left(\frac{10}{9}\right)\dots\left(\frac{m+1}{m}\right)$ $S = \frac{m+1}{7}$ <p>For S to be a natural number, $m+1$ must be a multiple of 7</p> $m+1 = 14 \text{ or } m+1 = 21 \text{ or } m+1 = 28$ $m = 13 \quad m = 20 \quad m = 27$	$\checkmark \left(\frac{8}{7}\right)\left(\frac{9}{8}\right)\left(\frac{10}{9}\right)\dots$ $\checkmark \frac{m+1}{m}$ $\checkmark S = \frac{m+1}{7}$ \checkmark multiples 14,21,28 \checkmark answer (5)
[25]		

QUESTION 2

<p>2.1.1</p>	$\begin{array}{cccc} -120 & -99 & -80 & -63 \\ & \swarrow & \swarrow & \swarrow \\ & 21 & 19 & 17 \\ & \swarrow & \swarrow & \swarrow \\ & -2 & -2 & -2 \end{array}$ <p>The next TWO terms: -48 ; -35</p>	<p>✓ -48 ✓ -35 (2)</p>
<p>2.1.2</p>	$\begin{array}{l} 2a = -2 \quad 3a + b = 21 \quad a + b + c = -120 \\ a = -1 \quad 3(-1) + b = 21 \quad (-1) + (24) + c = -120 \\ \qquad \qquad \qquad b = 24 \quad c = -143 \\ T_n = -n^2 + 24n - 143 \end{array}$	<p>✓ 2nd diff = -2 ✓ a = -1 ✓ b = 24 ✓ c = -143 (4)</p>
<p>2.1.3</p>	<p>$T_n n = -2n + 24 = 0$ $n = 12$</p> <p>$T_n = -(12)^2 + 24(12) - 143$ $T_n = 1$ A maximum of 1 Add -1 to T_n</p> <p>OR</p> <p>$n = \frac{-(24)}{2(-1)} = 12$</p> <p>$T_n = -(12)^2 + 24(12) - 143$ $T_n = 1$ A maximum of 1 Add -1 to T_n</p> <p>OR</p> <p>$T_n = -n^2 + 24n - 143 + k$ $\Delta = (24)^2 - 4(-1)(k - 143)$ $= 576 + 4k - 572$ $= 4k + 4$ but $\Delta = 0$ $4k + 4 = 0$ $k = -1$</p>	<p>✓ method ✓ n = 12</p> <p>✓ maximum 1 ✓ -1 (4)</p> <p>✓ method ✓ n = 12</p> <p>✓ maximum 1 ✓ -1 (4)</p> <p>✓ method</p> <p>✓ $\Delta = 4k + 4$ ✓ $\Delta = 0$</p> <p>✓ -1 (4)</p>
<p>2.2.1</p>	<p>9 + 14 + 19 + ... + 124</p> <p>$T_n = (9) + (n - 1)(5)$ $T_n = 5n + 4$</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Answer only: full marks</p> </div>	<p>✓ substitution into the correct formula ✓ $T_n = 5n + 4$ (2)</p>

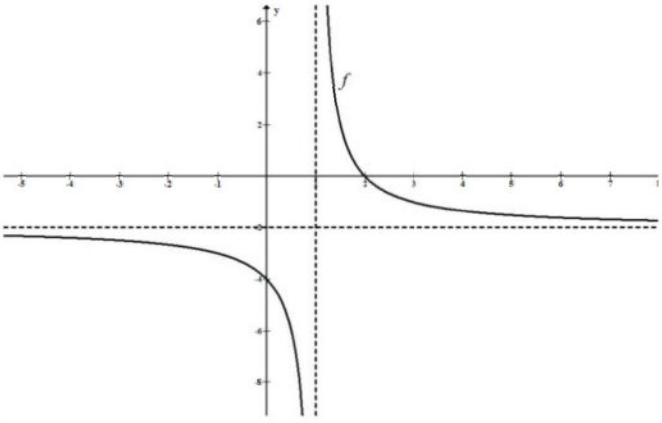
2.2.2	$T_n = 5n + 4 = 124$ $5n = 120$ $n = 24$ $\sum_{n=1}^{24} (5n + 4)$	✓ =124 ✓ $n = 24$ ✓ answer (3)
2.3	$2^x + 2 \cdot 2^x + 3 \cdot 2^x + 4 \cdot 2^x \dots$ $a = 2^x$ $d = 2^x$ $S_{30} = \frac{30}{2} [2(2^x) + 29(2^x)]$ $3720 = 15(31 \cdot 2^x)$ $248 = 31 \cdot 2^x$ $8 = 2^x$ $2^3 = 2^x$ $x = 3$	✓ $a = 2^x$ and $d = 2^x$ ✓ substitution into the correct formula ✓ $2^x = 8$ ✓ $x = 3$ (4)
		[19]

QUESTION 3

3.1.1	$5; 10; 20; \dots$ $T_n = a \cdot r^{n-1}$ $T_n = (5)(2)^{n-1}$	✓ answer (1)
3.1.2	$S_n = \frac{a(r^n - 1)}{r - 1}$ $S_{18} = \frac{5[(2)^{18} - 1]}{2 - 1}$ $S_{18} = 1310715$	✓ substitution into the correct formula ✓ answer (2)
3.2	$r = \frac{(2x+4)(2x-4)}{2x-4} = 2x+4$ Converge: $-1 < r < 1$ $-1 < 2x+4 < 1$ $-5 < 2x < -3$ $-\frac{5}{2} < x < -\frac{3}{2}$	✓ $r = 2x+4$ ✓ $-1 < r < 1$ ✓ substitution ✓ answer (4)

3.3	$\frac{S_{\infty}}{S_2} = \frac{\frac{2}{1 - \frac{1}{\sqrt{2}}}}{2 \left(1 - \left(\frac{1}{\sqrt{2}} \right)^2 \right)}$ $= \frac{1}{1 - \frac{1}{2}}$ $= 2$	✓ S_{∞} ✓ S_2 ✓ dividing ✓ answer (3)
		[10]

QUESTION 4

4.1	$x = 1$ $y = -2$	✓ $x = 1$ ✓ $y = -2$ (2)
4.2		✓ x-asymptote and y-asymptote ✓ x-intercept ✓ y-intercept ✓ form-decreasing (4)
4.3	$y = -x + c$ $-2 = -(1) + c$ $-1 = c$ $y = -x - 1$	✓ method ✓ answer (2)
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> Answer only: full marks </div>		
4.4	$0 \leq x < 1$ OR $x \in [0 ; 1)$	✓ 0 and 1 ✓ inequalities (2) ✓ 0 and 1 ✓ brackets (2)
		[10]

QUESTION 5

5.1	$y = a\left(\frac{1}{5}\right)^x - 5$ $-4 = a\left(\frac{1}{5}\right)^{-2} - 5$ $1 = a(25)$ $\frac{1}{25} = a$	✓ substitution ✓ simplification (2)
5.2	$0 = \frac{1}{25}\left(\frac{1}{5}\right)^x - 5$ $5 = \frac{1}{25}\left(\frac{1}{5}\right)^x$ $125 = \left(\frac{1}{5}\right)^x$ $5^3 = 5^{-x}$ $x = -3 \quad (-3; 0)$	✓ $y = 0$ ✓ simplifying ✓ answer (3)
5.3.1	$h: y = \left(\frac{1}{5}\right)^x$ $x = \left(\frac{1}{5}\right)^y$ $y = \log_{\frac{1}{5}} x \text{ or } y = -\log_5 x$	<div style="border: 1px solid black; padding: 5px; display: inline-block; margin-right: 20px;"> Answer only: full marks </div> ✓ swop x and y ✓ answer (2)
5.3.2	$g: y = \left(\frac{1}{5}\right)^2 \cdot \left(\frac{1}{5}\right)^x - 5$ $g(x) = \left(\frac{1}{5}\right)^{x+2} - 5$ 2 units right and 5 units up	✓ rewriting g ✓ 2 units right and 5 units up (2)
		[9]

QUESTION 6

6.1	$y = \frac{1}{2}x + 2$ $0 = \frac{1}{2}x + 2$ $x = -4$ $B(-4; 0)$	✓ $y = 0$ ✓ answer (2)
6.2	$y = a(x - x_1)(x - x_2)$ $y = a(x + 2)(x + 6)$ $-12 = a(0 + 2)(0 + 6)$ $-12 = 12a$ $a = -1$ $y = -(x^2 + 8x + 12)$ $y = -x^2 - 8x - 12$ <p>OR</p> $(-2; 0): 0 = a(-2)^2 + b(-2) - 12$ $12 = 4a - 2b$ $6 = 2a - b \dots\dots(1)$ <p>and $\frac{-b}{2a} = -4$</p> $-b = -8a$ $b = 8a \dots\dots(2)$ $6 = 2a - 8a$ $6 = -6a$ $a = -1$ $b = 8(-1) = -8$ $y = -x^2 - 8x - 12$	✓ coordinates of A(-6; 0) ✓ substitution ✓ $a = -1$ ✓ answer (4) ✓ substitution ✓ substitution ✓ $a = -1$ ✓ answer (4)

6.3	$FH = -x^2 - 8x - 12 - \left(\frac{1}{2}x + 2\right)$ $= -x^2 - 8x - 12 - \frac{1}{2}x - 2$ $= -x^2 - \frac{17}{2}x - 14$ $\frac{dFH}{dx} = -2x - \frac{17}{2} = 0 \quad \text{or} \quad x = -\frac{b}{2a}$ $-2x = \frac{17}{2} \quad x = -\frac{(-8,5)}{2(-1)}$ $x = -\frac{17}{4} \quad x = -\frac{17}{4}$ $G\left(-\frac{17}{4}; 0\right)$	✓ $f(x) - g(x)$ ✓ FH ito x ✓ method ✓ answer (4)
6.4	$-4 < x < 0$ <p>OR</p> $x \in (-4; 0)$	✓ answer ✓ inequality (2) ✓ -4 and 0 ✓ inequality (2)
		[12]

QUESTION 7

7.1	$1 + i_{eff} = \left(1 + \frac{i^m}{m}\right)^m$ $1 + 0,113 = \left(1 + \frac{i^4}{4}\right)^4$ $1,027... = 1 + \frac{i^4}{4}$ $0,027... = \frac{i^4}{4}$ $0,1085.. = i^4$ $r = 10,85\%$	✓ substitution ✓ 4 th root ✓ answer (3)
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7.2	$A = 10\,000 \left(1 + \frac{0,053}{12}\right)^{60}$ $A = 13\,026,71$ $F = \frac{500 \left[\left(1 + \frac{0,053}{12}\right)^{58} - 1 \right]}{\frac{0,053}{12}}$ $F = R32\,970,51$ $\text{Total} = 13\,026,71 + 32\,970,51$ $= R45\,997,22$ <p>OR</p> $= 10\,000 \left(1 + \frac{0,053}{12}\right)^{60} + \frac{500 \left[\left(1 + \frac{0,053}{12}\right)^{58} - 1 \right]}{\frac{0,053}{12}}$ $= R45\,997,22$	<ul style="list-style-type: none"> ✓ substitution into the correct formula ✓ $n = 60$ and $i = \frac{0,053}{12}$ ✓ substitution into the F formula ✓ $n = 58$ ✓ answer (5) ✓ substitution into the correct formula ✓ $n = 60$ and $i = \frac{0,053}{12}$ ✓ substitution into the F formula ✓ $n = 58$ ✓ answer (5)
7.3.1	$860\,000 = \frac{7\,200 \left[1 - \left(1 + \frac{0,095}{12}\right)^{-n} \right]}{\frac{0,095}{12}}$ $0,945\dots = 1 - \left(1 + \frac{0,095}{12}\right)^{-n}$ $-0,054\dots = -\left(1 + \frac{0,095}{12}\right)^{-n}$ $0,054\dots = \left(1 + \frac{0,095}{12}\right)^{-n}$ $-n = \log_{(1,007\dots)} 0,054\dots$ $-n = -369,212\dots$ <p>Sam will have 370 installments</p>	<ul style="list-style-type: none"> ✓ substitution into the correct formula ✓ $i = \frac{0,095}{12}$ ✓ correct use of log ✓ answer (4)

7.3.2	$A = 860\,000 \left(1 + \frac{0,095}{12}\right)^{369}$ $A = R15\,782\,859,31$ $F = \frac{7\,200 \left[\left(1 + \frac{0,095}{12}\right)^{369} - 1 \right]}{\frac{0,095}{12}}$ $F = R15\,781\,334,69$ <p>Balance = R1524,62 (after 369 installments)</p> $\text{Last installment} = 1524,62 \left(1 + \frac{0,095}{12}\right)^1$ $= R1536,69$ <p>OR</p> $P = \frac{7\,200 \left(1 - \left(1 + \frac{0,095}{12}\right)^{-0,2127679\dots}\right)}{\frac{0,095}{12}}$ $P = R1524,62 \text{ (after 369 installments)}$ $\text{Last installment} = 1524,62 \left(1 + \frac{0,095}{12}\right)^1$ $= R1536,69$	<p>✓ loan and interest ✓ $n = 369$</p> <p>✓ payment and interest</p> <p>✓ method</p> <p>✓ answer (5)</p> <p>✓ method ✓ $n = -0,2127679\dots$</p> <p>✓ balance</p> <p>✓ method ✓ answer (5)</p> <p style="text-align: right;">[17]</p>
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QUESTION 8

8.1	$f(x) = 1 - x^2$ $f(x+h) = 1 - (x+h)^2$ $= 1 - (x^2 + 2xh + h^2)$ $= 1 - x^2 - 2xh - h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{1 - x^2 - 2xh - h^2 - (1 - x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \rightarrow 0} (-2x - h)$ $f'(x) = -2x$	<p>✓ $= 1 - x^2 - 2xh - h^2$</p> <p>✓ substitution</p> <p>✓ $\frac{-2xh - h^2}{h}$</p> <p>✓ $-2x - h$</p> <p>✓ $-2x$ (5)</p>
8.2.1	$D_x \left[3x^2 - \frac{2}{x} \right]$ $D_x [3x^2 - 2x^{-1}]$ $= 6x + 2x^{-2}$	<p>✓ $-2x^{-1}$</p> <p>✓ $6x$</p> <p>✓ $2x^{-2}$ (3)</p>
8.2.2	$y = \sqrt{x} (\sqrt[3]{x} - 5x)$ $y = x^{\frac{1}{2}} (x^{\frac{1}{3}} - 5x)$ $y = x^{\frac{5}{6}} - 5x^{\frac{3}{2}}$ $\frac{dy}{dx} = \frac{5}{6} x^{-\frac{1}{6}} - \frac{15}{2} x^{\frac{1}{2}}$	<p>✓ change from surd to exponential form</p> <p>✓ $x^{\frac{5}{6}}$ and $-5x^{\frac{3}{2}}$</p> <p>✓ $\frac{5}{6} x^{-\frac{1}{6}}$</p> <p>✓ $-\frac{15}{2} x^{\frac{1}{2}}$ (4)</p>
		[12]

QUESTION 9

9.1	$f(x) = ax^3 + bx^2$ $-\frac{1}{3} = a(2)^3 + b(2)^2$ $-\frac{1}{3} = 8a + 4b \dots (1)$ $f'(x) = 3ax^2 + 2bx$ $f'(2) = 3a(2)^2 + 2b(2) = 0$ $12a + 4b = 0$ $4b = -12a$ $b = -3a \dots (2)$ $-\frac{1}{3} = 8a + 4(-3a)$ $-\frac{1}{3} = 8a - 12a$ $-\frac{1}{3} = -4a$ $a = \frac{1}{12}$ $b = -\frac{1}{4}$	<p>✓ substitution $\left(2; -\frac{1}{3}\right)$</p> <p>✓ $f'(x) = 0$ ✓ substitution $x = 2$</p> <p>✓ solve simultaneously</p> <p style="text-align: right;">(4)</p>
9.2	$f''(x) = \frac{1}{2}x - \frac{1}{2}$ $\frac{1}{2}x - \frac{1}{2} < 0$ $x < 1 \quad / \quad x \in (-\infty; 1)$	<p>✓ $f''(x)$</p> <p>✓ $f''(x) < 0$</p> <p>✓ answer (3)</p>

9.3	$f(x) = \frac{1}{12}x^3 - \frac{1}{4}x^2$ $f(-2) = \frac{1}{12}(-2)^3 - \frac{1}{4}(-2)^2 = -\frac{5}{3}$ $\left(-2; -\frac{5}{3}\right)$ $m = f'(x) = \frac{1}{4}x^2 - \frac{1}{2}x$ $f'(-2) = \frac{1}{4}(-2)^2 - \frac{1}{2}(-2)$ $m = 2$ $y = 2x + c$ $-\frac{5}{3} = 2(-2) + c$ $c = \frac{7}{3}$ $y = 2x + \frac{7}{3}$	<p>✓ $y = -\frac{5}{3}$</p> <p>✓ gradient</p> <p>✓ substitution of x, y and m</p> <p>✓ answer (4)</p>
9.4	$-\frac{1}{3} < k < 0 \quad / \quad k \in \left(-\frac{1}{3}; 0\right)$	<p>✓✓ answer (2)</p>
[13]		

QUESTION 10

10.1	$\tan 60^\circ = \frac{DF}{x} = \sqrt{3}$ $DF = \sqrt{3}x$ $\therefore \text{Area rectangle} = DF \times DE$ $= \sqrt{3}x(m - 2x)$	<p>✓ $\tan 60^\circ = \sqrt{3}$</p> <p>✓ $DF = \sqrt{3}x$</p> <p>✓ $DE = (m - 2x)$</p> <p>(3)</p>
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10.2	$\text{Area} = \sqrt{3}mx - 2\sqrt{3}x^2$ $\frac{dA}{dx} = \sqrt{3}m - 4\sqrt{3}x = 0$ $x = \frac{m}{4}$ $\text{Max Area} = \sqrt{3}x(m - 2x)$ $= \sqrt{3}\left(\frac{m}{4}\right)\left(m - 2\left(\frac{m}{4}\right)\right)$ $= \frac{\sqrt{3}}{8}m^2$ <p>OR</p> $\frac{dA}{dx} = \sqrt{3}m - 4\sqrt{3}x = 0$ $x = \frac{m}{4}$ $\sqrt{3}mx - 2\sqrt{3}(x^2)$ $= \sqrt{3}m\left(\frac{m}{4}\right) - 2\sqrt{3}\left(\frac{m}{4}\right)^2$ $= \frac{\sqrt{3}m^2}{4} - \frac{\sqrt{3}m^2}{8}$ $= \frac{2\sqrt{3}m^2 - 8\sqrt{3}m^2}{8}$ $= \frac{\sqrt{3}m^2}{8}$	<p>✓ $f'(x) = 0$</p> <p>✓ $x = \frac{m}{4}$</p> <p>✓ substitution</p> <p>✓ $\frac{\sqrt{3}}{8}m^2$ (4)</p> <p>✓ $f'(x) = 0$</p> <p>✓ $x = \frac{m}{4}$</p> <p>✓ substitution</p> <p>✓ $\frac{\sqrt{3}}{8}m^2$ (4)</p>
		[7]

QUESTION 11

11.1.1	$P(A \text{ and } C) = 0$	✓ answer (1)
11.1.2	$P(A \text{ and } B) = P(A) \times P(B)$ $P(A \text{ and } B) = 0,3 \times 0,43$ $P(A \text{ and } B) = 0,129$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $P(A \text{ or } B) = 0,3 + 0,43 - 0,129$ $P(A \text{ or } B) = 0,6$	✓ $P(A \text{ and } B) = 0,129$ ✓ substitution ✓ answer (3)
11.2.1	$P(G \text{ and } T) = \frac{105}{250} = \frac{21}{50} = 42\%$	✓ answer (1)
11.2.2	Independent: $P(T \text{ and } G) = P(T) \times P(G)$ $P(T) \times P(G)$ $P(G \text{ and } T)$ $= \frac{173}{250} \times \frac{130}{250}$ $= \frac{105}{250}$ $= 0,36$ $= 0,42$ $P(G \text{ and } T) \neq P(G) \times P(T)$ Events are not independent.	✓ $P(T) = \frac{173}{250}$ ✓ $P(G) = \frac{130}{250}$ ✓ $P(T) \times P(G) = 0,36$ ✓ answer (4)
11.3.1	12!	✓ answer (1)
11.3.2	Pieter and John next to one another = 10!2! $11! - 10!2!$ $= 32\,659\,200$	✓ 10!2! ✓ $11! - 10!2!$ ✓ answer (3)
11.3.3	$\frac{11!2!}{12!}$ $= \frac{1}{6}$	✓ 11!2! ✓ 12! ✓ answer (3)
		[16]
		TOTAL: 150

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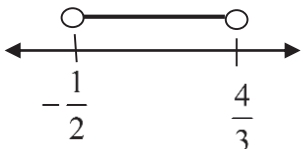
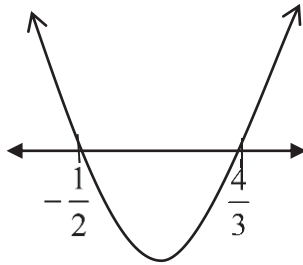
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**MATHEMATICS PAPER 1
SEPTEMBER 2023
MARKING GUIDELINES**

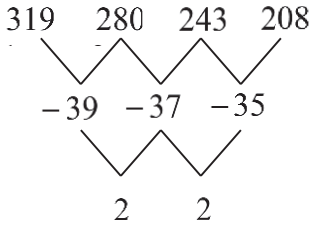
MARKS: 150

This marking guideline consists of 13 pages.

QUESTION 1 / VRAAG 1		
1.1.1	$(3 - x)(2 - x) = 0$ $x = 3 \text{ or } x = 2$	✓ ✓ answers (2)
1.1.2	$2x^2 + 7x = 2$ $2x^2 + 7x - 2 = 0$ $x = \frac{-(7) \pm \sqrt{7^2 - 4(2)(-2)}}{2(2)}$ $x = \frac{-7 \pm \sqrt{65}}{4}$ $x = 0,27 \text{ or } x = -3,77$	✓ standard form ✓ substitution into correct formula ✓ ✓ answers (4)
1.1.3	$4 + 5x > 6x^2$ $6x^2 - 5x - 4 < 0$ $(3x - 4)(2x + 1) < 0$  <p style="text-align: center;">OR</p>  $-\frac{1}{2} < x < \frac{4}{3}$ OR $x \in \left(-\frac{1}{2}; \frac{4}{3}\right)$	✓ factors ✓ critical values ✓ ✓ answer (4)
1.1.4	$9^x + 9 = 10 \cdot 3^x$ $3^{2x} - 10 \cdot 3^x + 9 = 0$ $(3^x - 9)(3^x - 1) = 0$ $3^x = 3^2 \text{ or } 3^x = 3^0$ $x = 2 \text{ or } x = 0$	✓ 3^{2x} ✓ factors ✓ exponential law ✓ answer (4)

<p>1.2</p>	$y - 2x = -1$ $y = 2x - 1 \dots (1)$ $y^2 - 3xy = -2 \dots (2)$ $(2x - 1)^2 - 3x(2x - 1) = -2$ $4x^2 - 4x + 1 - 6x^2 + 3x = -2$ $-2x^2 - x + 3 = 0$ $2x^2 + x - 3 = 0$ $(2x + 3)(x - 1) = 0$ $x = -\frac{3}{2} \text{ or } x = 1$ $y = 2\left(-\frac{3}{2}\right) - 1 \text{ or } y = 2(1) - 1$ $y = -4 \text{ or } y = 1$ <p style="text-align: center;">OR</p> $y - 2x = -1$ $x = \frac{y + 1}{2} \dots (1)$ $y^2 - 3xy = -2 \dots (2)$ $y^2 - 3\left(\frac{y + 1}{2}\right)y = -2$ $2y^2 - 3y^2 - 3y + 4 = 0$ $-y^2 - 3y + 4 = 0$ $y^2 + 3y - 4 = 0$ $(y + 4)(y - 1) = 0$ $y = -4 \text{ or } y = 1$ $x = -\frac{3}{2} \text{ or } x = 1$	<ul style="list-style-type: none"> ✓ equation 1 ✓ substitution ✓ standard form ✓ factors ✓ x-values ✓ y-values <p style="text-align: right;">(6)</p> <ul style="list-style-type: none"> ✓ equation 1 ✓ substitution ✓ standard form ✓ factors ✓ y-values ✓ x-values <p style="text-align: right;">(6)</p>
<p>1.3</p>	<p>Multiply every term by LCD $4xy$</p> $4x^2 + 4y^2 = 17xy$ $4x^2 - 17xy + 4y^2 = 0$ $(4x - y)(x - 4y) = 0$ $4x - y = 0$ $\frac{x}{y} = \frac{1}{4}$ $x - 4y = 0$ $\frac{x}{y} = 4$	<ul style="list-style-type: none"> ✓ multiply by LCD ✓ standard form ✓ factors ✓ answer ✓ answer <p style="text-align: right;">(5)</p>

	<p>OR</p> $\frac{x}{y} + \frac{y}{x} = \frac{17}{4}$ $\frac{x}{y} + \frac{1}{\frac{x}{y}} = \frac{17}{4}$ $\frac{x^2}{y^2} - \frac{17x}{4y} + 1 = 0$ $\frac{x}{y} = \frac{\frac{17}{4} \pm \sqrt{\left(\frac{17}{4}\right)^2 - 4(1)(1)}}{2(1)}$ $= \frac{\frac{17}{4} \pm \sqrt{\frac{225}{16}}}{2}$ $\frac{x}{y} = 4 \quad \text{or} \quad \frac{x}{y} = \frac{1}{4}$	<p>✓ fraction</p> <p>✓ standard form</p> <p>✓ substitution into correct formula</p> <p>✓ simplification</p> <p>✓ answers (5)</p>
		[25]

QUESTION 2 / VRAAG 2		
2.1	319 ; 280 ; 243 ; 208 ; 175 ; 144 ;	
2.1.1	 <p> $2a = 2$ $3a + b = -39$ $a + b + c = 319$ $a = 1$ $3(1) + b = -39$ $1 - 42 + c = 319$ $b = -42$ $c = 360$ </p> $T_n = n^2 - 42n + 360$	<p>✓ First differences</p> <p>✓ $2a = 2$</p> <p>✓ $3(1) + b = -39$</p>

		✓ $1 - 42 + c = 319$ (4)
2.1.2	$n^2 - 42n + 360 = 0$ $(n - 12)(n - 30) = 0$ $n = 12$ or $n = 30$	✓ $T_n = 0$ ✓ factors ✓ answer (3)
2.1.3	$2n - 42 = 0$ OR $n = \frac{-(-42)}{2(1)}$ $n = 21$ $n = 21$ T_{21} is lowest	✓ derivative = 0 ✓ answer (2) OR ✓ substitution into $x = \frac{-b}{2a}$ ✓ answer (2)
2.2	$3t ; 4t - 1 ; 23$	
2.2.1	$3t ; 4t - 1 ; 23$ $4t - 1 - 3t = 23 - (4t - 1)$ $4t - 1 - 3t = 23 - 4t + 1$ $5t = 25$ $t = 5$	✓ subtraction ✓ simplification (2)
2.2.2	$15 ; 19 ; 23$ $a = 15$ $d = 4$ $S_{50} = \frac{50}{2}[2(15) + (49)4]$ $= 5650$	✓ $a = 15$ ✓ value of d ✓ substitution into correct formula ✓ answer (4)
		[15]

QUESTION 3

3.1	$x = 4 + 12 + 36 + \dots$ to 15 terms	
3.1.1	$T_n = a.r^{n-1}$ $T_n = 4.3^{n-1}$ $\sum_{n=1}^{15} (4.3^{n-1})$	✓ $T_n = 4.3^{n-1}$ ✓ answer (2)
3.1.2	$S_n = \frac{a(r^n - 1)}{r - 1}$ $S_n = \frac{4(3^{15} - 1)}{3 - 1}$ $= 28697812$	✓ substitution into the correct formula ✓ answer (2)
3.1.3	$r = 3$ and not between -1 and 1 \therefore not converging	✓ $r = 3$ not in $-1 < r < 1$ ✓ answer (2)
3.2.1	$S_\infty = \frac{a}{1 - r} = 13,5$ $a = 13,5(1 - r)$ $S_\infty = \frac{ar^2}{1 - r} = 1,5$ $ar^2 = 1,5(1 - r)$ $a = \frac{1,5(1 - r)}{r^2}$ $13,5(1 - r) = \frac{1,5(1 - r)}{r^2}$ $r^2 = \frac{1,5}{13,5}$ $= \frac{1}{9}$ $r = \pm \frac{1}{3}$ But $r > 0$ $\therefore r = \frac{1}{3}$	✓ substitution into correct formula ✓ $a = 13,5(1 - r)$ ✓ equating ✓ $r = \frac{1}{3}$ (4)

3.2.2	$\frac{a}{1 - \frac{1}{3}} = 13,5$ $a = 9$ $9 + 3 + 1 + \dots$	✓ value of a ✓ answer (2)
		[12]
QUESTION 4		
4.1	$0 = \frac{a}{-2+1} + 2$ $a = 2$	✓ substitution ✓ answer (2)
4.2	$\text{Average gradient} = \frac{h(-2) - h(-4)}{-2 - (-4)}$ $= \frac{\frac{2}{-2+1} + 2 - \left(\frac{2}{-4+1} + 2 \right)}{2}$ $= -\frac{2}{3}$	✓ $h(-4)$ and $h(-2)$ ✓ substitution ✓ answer (3)
4.3	$-1 < x < 0$	✓ critical values ✓ answers (2)
4.4	$y = x + 1 + 2$ $y = x + 3$ <p>OR</p> $y = x + c$ $2 = -1 + c$ $c = 3$ $y = x + 3$	✓ gradient ✓ answer (2) <p>OR</p> ✓ value of c ✓ answer (2)
4.5	$g(x) = \frac{-2}{x+1} - 2$ $x = -1$ $y = -2$	✓ horizontal asymptote ✓ vertical asymptotes (2)
		[11]

QUESTION 5		
	$h(x) = q^x \quad f(x) = -\frac{1}{2}x^2 + \frac{1}{2}x + k \quad g(x) = mx + c$	
5.1	$h(x) = q^0$ $= 1 \quad D(0 ; 1)$	✓ answer (1)
5.2	$k = 1$	✓ answer (1)
5.3	$f(x) = -\frac{1}{2}x^2 + \frac{1}{2}x + 1$ $x^2 - x - 2 = 0$ $(x - 2)(x + 1) = 0$ $x = 2 \text{ or } x = -1$ BC = 3units	✓ $f(x) = 0$ ✓ factors ✓ both x values ✓ answer (4)
5.4	$f(-2) = -\frac{1}{2}(-2)^2 + \frac{1}{2}(-2) + 1$ $= -2$ PR = 2 units	✓ substitution of -2 ✓ answer (2)
5.5.1	$h(x) = q^x$ $\frac{1}{4} = q^2$ $q = \frac{1}{2}$	✓ $A\left(2; \frac{1}{4}\right)$ ✓ substitution of $\left(2; \frac{1}{4}\right)$ ✓ value of q (3)
5.5.2	$h(x) = \left(\frac{1}{2}\right)^x$ $h^{-1}(x) = \log_{\frac{1}{2}} x$	✓ equation of h ✓ equation of h^{-1} (2)
5.6	$y > 0$	✓ answer (1)
5.7	$f'(x) = -x + \frac{1}{2}$ $f'(-1) = -(-1) + \frac{1}{2} = \frac{3}{2}$ $y - y_1 = m(x - x_1)$ B(-1 ; 0) $y - 0 = \frac{3}{2}(x - (-1))$ $y = \frac{3}{2}x + \frac{3}{2}$	✓ derivative ✓ derivative $x = -1$ ✓ $f'(-1) = \frac{3}{2}$ ✓ substitution of B ✓ tangent (5)
5.8	$x < -1 \text{ or } x > 2$ OR $x \in (-\infty ; 1) \cup (2; \infty)$	✓✓ answer (2)
		[21]

QUESTION 6		
6.1	$A = P(1 + i)^n$ $2x = x(1 + 0,054)^n$ $2 = (1,054)^n$ $\log(2) = n \log(1,054)$ $n = \frac{\log 2}{\log(1,054)}$ $n = 13,18$	✓ substitution into correct formula ✓ correct use of logs ✓ answer (3)
6.2	$P = \frac{x [1 - (1 + i)^{-n}]}{i}$ $P = \frac{3300 \left[1 - \left(1 + \frac{0,12}{12} \right)^{-60} \right]}{\frac{0,12}{12}}$ $= R148351,63$	✓ value of i ✓ value of n ✓ substitution into correct formula ✓ answer (4)
6.3	$i_{eff} = \left(1 + \frac{0,05}{4} \right)^4 - 1$ $= 0,05094533691$ Rate = 5,09%	✓ value of n ✓ substitution into correct formula ✓ rate (3)
6.4	$10\,000\,000 = \frac{x \left[\left(1 + \frac{0,15}{12} \right)^{384} - 1 \right]}{\frac{0,15}{12}}$ $125000 = x(116,9484518)$ $x = R1068,85$	✓ value of n ✓ substitution into correct formula ✓ answer (3)
		[13]

QUESTION 7		Penalty for notation error in 7.1 only.
7.1	$f(x) = -2x^2 + 1$ $f(x+h) = -2(x+h)^2 + 1$ $f(x+h) = -2x^2 - 4xh - 2h^2 + 1$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 + 1 - (-2x^2 + 1)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 + 1 + 2x^2 - 1}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-4xh - 2h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(-4x - 2h)}{h}$ $= -4x$	<p>✓ $-2x^2 - 4xh - 2h^2 + 1$</p> <p>✓ correct substitution into formula</p> <p>✓ simplification</p> <p>✓ common factor</p> <p>✓ answer (5)</p>
7.2.1	$f(x) = \frac{1}{2}x^2 - 5x^{-1}$ $f'(x) = x + 5x^{-2}$	<p>✓ $-5x^{-1}$</p> <p>✓ x</p> <p>✓ $5x^{-2}$ (3)</p>
7.2.2	$D_x \left[\frac{-2x^2 + \sqrt[4]{x}}{x^2} \right]$ $= D_x \left[-\frac{2x^2}{x^2} + \frac{x^{\frac{1}{4}}}{x^2} \right]$ $= D_x \left[-2 + x^{-\frac{7}{4}} \right]$ $= -\frac{7}{4}x^{-\frac{11}{4}}$	<p>✓ $\sqrt[4]{x} = x^{\frac{1}{4}}$</p> <p>✓ $-2 + x^{-\frac{7}{4}}$</p> <p>✓ derivative (3)</p>
		[11]

QUESTION 8																	
8.1	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>1</td> <td>-1</td> <td>5</td> <td>8</td> <td>-12</td> </tr> <tr> <td></td> <td>0</td> <td>-1</td> <td>4</td> <td>12</td> </tr> <tr> <td></td> <td>-1</td> <td>4</td> <td>12</td> <td>0</td> </tr> </table> <p> $(x-1)(-x^2 + 4x + 12) = 0$ $(x-1)(x^2 - 4x - 12) = 0$ $(x-1)(x-6)(x+2) = 0$ $x = 1 \text{ or } x = 6 \text{ or } x = -2$ $\therefore C(6; 0)$ </p>	1	-1	5	8	-12		0	-1	4	12		-1	4	12	0	<ul style="list-style-type: none"> ✓ quadratic factor ✓ factors ✓ x-values ✓ answer <p style="text-align: right;">(4)</p>
1	-1	5	8	-12													
	0	-1	4	12													
	-1	4	12	0													
8.2	<p> $-3x^2 + 10x + 8 = 0$ $3x^2 - 10x - 8 = 0$ $(3x + 2)(x - 4) = 0$ $x = -\frac{2}{3} \text{ or } x = 4$ $f(4) = -(4)^3 + 5(4)^2 + 8(4) - 12$ $= 36$ </p>	<ul style="list-style-type: none"> ✓ derivative ✓ $f'(x) = 0$ ✓ factors ✓ x-values ✓ answer <p style="text-align: right;">(5)</p>															
8.3	<p> $-6x + 10 > 0$ $x < \frac{5}{3}$ </p>	<ul style="list-style-type: none"> ✓ inequality ✓ answer <p style="text-align: right;">(2)</p>															
8.4	<p> $f'(x) = -3x^2 + 10x + 8$ $f'(0) = 8$ $-3x^2 + 10x + 8 = 8$ $-3x^2 + 10x = 0$ $x(-3x + 10) = 0$ $x = 0 \text{ or } x = \frac{10}{3}$ $\therefore OG = \frac{10}{3}$ </p>	<ul style="list-style-type: none"> ✓ $f'(0) = 8$ ✓ equating ✓ factors ✓ x-values ✓ value of OG <p style="text-align: right;">(5)</p>															
8.5	<p> $f'(x) = -3x^2 + 10x + 8$ $f'(5) = -3(5)^2 + 10(5) + 8$ $= -17$ $m = \frac{1}{17}$ </p>	<ul style="list-style-type: none"> ✓ substitution ✓ $f'(5) = -17$ ✓ answer <p style="text-align: right;">(3)</p>															
[19]																	

QUESTION 9		
9.1	$m_{mn} = -\frac{b}{a}$ $y = -\frac{b}{a}x + b$	✓ m_{mn} ✓ answer (2)
9.2	Area of PTOR = TP x PR $= x\left(-\frac{b}{a}x + b\right)$ $= -\frac{b}{a}x^2 + bx$ $\text{Max: } -\frac{2b}{a}x + b = 0$ $x = b\left(\frac{a}{2b}\right)$ $x = \frac{a}{2}$ $y = -\frac{b}{a}\left(\frac{a}{2}\right) + b = \frac{b}{2}$ $\text{Midpoint of MN: } \left(\frac{0+a}{2}; \frac{0+b}{2}\right) = \left(\frac{a}{2}; \frac{b}{2}\right)$ $\therefore \text{Max at midpoint}$	✓ substitution into area formula ✓ simplification ✓ derivative = 0 ✓ value of x ✓ value of y ✓ midpoint (6)
		[8]

QUESTION 10		
10.1.1	$45 - 38 = 7$	✓ answer (1)
10.1.2	<p>$S = 45$</p>	✓ 8 ✓ 6 ✓ $11 - x$ ✓ $7 - x$ (4)
10.1.3	$3 + 8 + 6 + 5 + 11 - x + x + 7 - x + 7 = 45$ $x = 2$	✓ calculation ✓ answer (2)
10.1.4	$P(2\text{languages}) = \frac{6 + 8 + 2}{45}$ $= \frac{16}{45}$	✓ 16 ✓ $\frac{16}{45}$ (2)
10.2.1	$8! = 40320$	✓ $8!$ (1)
10.2.2	$3! \times 5! \times 6 = 4320$ OR $3! \times 6! = 4320$	✓ $3!$ ✓ $5!$ ✓ $3! \times 5! \times 6$ (3)
10.2.3	$\frac{5!}{8!} = \frac{1}{336}$	✓ $5!$ ✓ $\frac{5!}{8!}$ OR $\frac{1}{336}$ (2)
		[15]

TOTAL: 150

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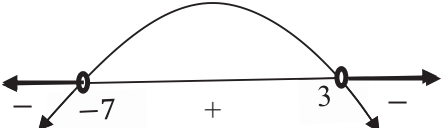
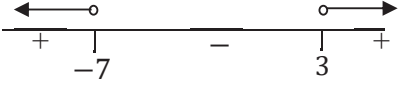
GRADE/*GRAAD* 12

MATHEMATICS P1/*WISKUNDE VI*
SEPTEMBER 2023
MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 21 pages/*Hierdie nasienriglyne bestaan uit 21 bladsye.*

QUESTION/VRAAG 1

1.1	1.1.1	$x(7-x)=0$ $x=0$ or/of $x=7$	✓ $x=0$ ✓ $x=7$	(2)
	1.1.2	$3x^2 - 2x - 6 = 0$ $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-6)}}{2(3)}$ $x = -1,12$ or/of $x = 1,79$	✓ subst in correct formula/vervang in korrekte formule ✓ $x = -1,12$, ✓ $x = 1,79$ N.B. (-1 mark for incorrect rounding/-1 vir verkeerde afronding)	(3)
	1.1.3	$(3-x)(x+7) < 0$ CV: $x=3$ or/of $x=-7$  $\therefore x < -7$ or/of $x > 3$ OR/OF $(-\infty; -7)$ or/of $(3; \infty)$ OR/OF $(3-x)(x+7) < 0$ $-(x-3)(x+7) < 0$ $(x-3)(x+7) > 0$ CV: $x = -7$ or/of $x = 3$  $\therefore x < -7$ or/of $x > 3$ OR/OF $(-\infty; -7)$ or/of $(3; \infty)$	✓ critical values/ kritieke waardes ✓ ✓ answer/antwoord OR/OF ✓ critical values/ kritieke waardes ✓ ✓ answer/antwoord	(3)

1.1.4	$\sqrt[3]{32} = 8^{3x} \cdot 2^{6x}$ $32^{\frac{1}{3}} = 8^{3x} \cdot 4^{3x}$ $32^{\frac{1}{3}} = (8 \times 4)^{3x}$ $32^{\frac{1}{3}} = 32^{3x}$ $3x = \frac{1}{3}$ $x = \frac{1}{9}$ <p>OR / OF</p> $\sqrt[3]{32} = 8^{3x} \cdot 2^{6x}$ $2^{\frac{5}{3}} = (2^3)^{3x} \cdot 2^{6x}$ $2^{\frac{5}{3}} = 2^{9x} \cdot 2^{6x}$ $2^{\frac{5}{3}} = 2^{15x}$ $15x = \frac{5}{3}$ $x = \frac{1}{9}$	$\checkmark 32^{\frac{1}{3}} = 8^{3x} \cdot 4^{3x}$ $\checkmark 32^{\frac{1}{3}} = 32^{3x}$ $\checkmark 3x = \frac{1}{3}$ $\checkmark x = \frac{1}{9}$ <p>OR/OF</p> $\checkmark 2^{\frac{5}{3}} = 2^{9x} \cdot 2^{6x}$ $\checkmark 2^{\frac{5}{3}} = 2^{15x}$ $\checkmark 15x = \frac{5}{3}$ $\checkmark x = \frac{1}{9}$	(4)
1.1.5	$x - 4 - 2\sqrt{x-1} = 0$ $x - 4 = 2\sqrt{x-1}$ $(x-4)^2 = (2\sqrt{x-1})^2$ $x^2 - 8x + 16 = 4(x-1)$ $x^2 - 12x + 20 = 0$ $(x-10)(x-2) = 0$ $x = 10 \text{ or/of } x \neq 2$	$\checkmark \text{isolating the square root/isoleer vierkants wortel}$ $\checkmark \text{squaring both sides/kwadreer beide kante}$ $\checkmark \text{standard form/vorm}$ $\checkmark x = 10 \text{ or/of } x \neq 2$	(4)

<p>1.2</p>	<p> $x - 2y = 1$ $x = 1 + 2y$.....(1) $x^2 - xy + 2y^2 = 2$.....(2) subst (1) into (2) $(1 + 2y)^2 - y(1 + 2y) + 2y^2 = 2$ $4y^2 + 4y + 1 - y - 2y^2 + 2y^2 - 2 = 0$ $4y^2 + 3y - 1 = 0$ $(4y - 1)(y + 1) = 0$ $y = \frac{1}{4}$ or/of $y = -1$ $x = \frac{3}{2}$ or/of $x = -1$ OR/OF $y = \frac{x - 1}{2}$.....(1) $x^2 - xy + 2y^2 = 2$.....(2) Subst. (1) into (2) $x^2 - x\left(\frac{x - 1}{2}\right) + 2\left(\frac{x - 1}{2}\right)^2 = 2$ $x^2 - \frac{x^2 - x}{2} + \frac{2x^2 - 4x + 2}{4} = 2$ $4x^2 - 2x^2 + 2x + 2x^2 - 4x + 2 - 8 = 0$ $4x^2 - 2x - 6 = 0$ $2x^2 - x - 3 = 0$ $(2x - 3)(x + 1) = 0$ $x = \frac{3}{2}$ or/of $x = -1$ $y = \frac{1}{4}$ or/of $y = -1$ </p>	<p> ✓ equation/vgl 1 ✓ substitution/vervang ✓ simpl/vereenv ✓ standard form/vorm ✓ y-values/waardes ✓ x-values/waardes OR/OF ✓ equation/vgl 1 ✓ substitution/vervang ✓ simpl/vereenv ✓ standard form/vorm ✓ x-values/waardes ✓ y-values/waardes </p>	<p>(6)</p> <p>(6)</p>
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1.3	1.3.1	<p>Then the amount that should be paid by each friend = $\frac{3500}{x}$</p> <p>\therefore The amount paid by each friend less four friends = $\frac{3500}{x-4}$</p> <p>Extra amount paid = 43,75</p> <p>$\rightarrow \frac{3500}{x-4} - \frac{3500}{x} = 43,75$</p> <p>$43,75x^2 - 175x - 14000 = 0$</p> <p>$x^2 - 4x - 320 = 0$</p> <p>$(x-20)(x+16) = 0$</p> <p>$x = 20$ or $x \neq -16$</p> <p>$\rightarrow 20$ friends are going on the trip.</p> <p>OR/OF</p> <p>Let the cost per person be y</p> <p>$y = \frac{3\ 500}{x}$</p> <p>$xy = 3\ 500$</p> <p>$(x-4)(y+43,75) = 3\ 500$</p> <p>$xy - 4y + 43,75x - 175 = 3\ 500$</p> <p>$3\ 500 - 4\left(\frac{3\ 500}{x}\right) + 43,75x - 175 = 3\ 500$</p> <p>$43,75x^2 - 175x - 14\ 000 = 0$</p> <p>$x^2 - 4x - 320 = 0$</p> <p>$(x-20)(x+16) = 0$</p> <p>$\therefore x = 20$ or $x \neq -16$</p>	<p>$\checkmark \frac{3500}{x}$</p> <p>$\checkmark \frac{3500}{x-4}$</p> <p>$\checkmark$ equation/vgl</p> <p>\checkmark standard form/vorm</p> <p>\checkmark values with selection/ waardes net seleksie</p> <p>OR/OF</p> <p>$\checkmark y = \frac{3\ 500}{x}$</p> <p>$\checkmark$ equation/vgl</p> <p>\checkmark simplification/ vereenvoudig</p> <p>\checkmark standard form/vorm</p> <p>\checkmark values with selection/ waardes met seleksie</p>	(5)
	1.3.2	<p>Each friend pays:</p> <p>$\frac{3500}{16} = R218,75$</p> <p>OR/OF</p> <p>Cost = $175 + 43,75$</p> <p>$= R218,75$</p>	<p>\checkmark answer/antwoord</p> <p>OR/OF</p> <p>$\checkmark R218,75$</p>	(1)
				[28]

	<p>OR/OF</p> $21 + (n - 2)(14) + 21 + (n - 1)(14) = 308$ $21 + 14n - 28 + 21 + 14n - 14 = 308$ $28n = 308$ $n = 11$ $T_{11} = 21 + 10(14) = 161$ $T_{10} = 21 + 9(14) = 147$	<p>OR/OF</p> <p>✓ $d = 14$</p> <p>✓ method/metode</p> <p>✓ $n = 11$</p> <p>✓ $T_{10} = 147$</p>	<p>(4)</p>
<p>2.2</p>	<p> $2a = 8$ $a = 4$ $5a + b = 21$ $5(4) + b = 21$ $b = 1$ $16a + 4b + c = 68$ $16(4) + 4(1) + c = 68$ $c = 0$ $\therefore T_n = 4n^2 + n$ </p>	<p>✓ 2nd difference/ 2^e verskil</p> <p>✓ $2a = 8$</p> <p>✓ $5a + b = 21$</p> <p>✓ $16a + 4b + c = 68$</p>	<p>(4)</p>
			<p>[13]</p>

QUESTION/VRAAG 3

3.1	3.1.1	$T_1 = a^2$ $T_2 = (ar)^2$ OR / OF $T_2 = a^2r^2$	✓ answer/antwoord	(1)
	3.1.2	$\frac{a}{1-r} = 6 \dots\dots\dots(1)$ $\frac{a^2}{1-r^2} = 6 \dots\dots\dots(2)$ $\frac{a^2}{1-r^2} = \left(\frac{a}{1-r}\right)\left(\frac{a}{1+r}\right)$ $6 = 6\left(\frac{a}{1+r}\right)$ $a = 1+r \dots\dots\dots(3)$ subst. into (1) $\frac{1+r}{1-r} = 6$ $1+r = 6-6r$ $r = \frac{5}{7}$ $a = \frac{12}{7}$	✓ both equations/ beide vergelykings ✓ $6 = 6\left(\frac{a}{1+r}\right)$ ✓ equation/vgl (3) ✓ substitution/ vervanging ✓ value/waarde $r = \frac{5}{7}$ ✓ value/waarde $a = \frac{12}{7}$	(6)

	<p>OR/OF</p> $\frac{a}{1-r} = 6$ $a = 6(1-r) \dots\dots\dots(1)$ $\frac{a^2}{1-r^2} = 6$ $a^2 = 6(1-r^2) \dots\dots\dots(2)$ <p>From equation (1)</p> $a^2 = 36(1-r)^2$ $\therefore 36(1-r)^2 = 6(1-r^2)$ $36 - 72r + 36r^2 = 6 - 6r^2$ $42r^2 - 72r + 30 = 0$ $7r^2 - 12r + 5 = 0$ $(7r - 5)(r - 1) = 0$ $r = \frac{5}{7} \text{ or } r \neq 1$ $a = 6\left(1 - \frac{5}{7}\right)$ $= \frac{12}{7}$	<p>OR/OF</p> $\checkmark a = 6(1-r)$ $\checkmark a^2 = 6(1-r^2)$ $\checkmark 36(1-r)^2 = 6(1-r^2)$ $\checkmark 42r^2 - 72r + 30 = 0$ $\checkmark r = \frac{5}{7} \text{ or / of } r \neq 1$ $\checkmark a = \frac{12}{7}$	<p>(6)</p>
<p>3.1.3</p>	<p>$T_6 = a^2 r^{10}$</p> $= \left(\frac{12}{7}\right)^2 \left(\frac{5}{7}\right)^{10}$ $= 0,10$ <p>OR/OF</p> $T_6 = (ar^5)^2$ $= \left[\frac{12}{7} \left(\frac{5}{7}\right)^5\right]^2$ $= \left(\frac{12}{7}\right)^2 \left(\frac{5}{7}\right)^{10}$ $= 0,10$	$\checkmark \left(\frac{12}{7}\right)^2 \left(\frac{5}{7}\right)^{10}$ <p>\checkmark answer/antwoord</p> <p>OR/OF</p> $\checkmark \left(\frac{12}{7}\right)^2 \left(\frac{5}{7}\right)^{10}$ <p>OR/OF</p> $\left[\frac{12}{7} \left(\frac{5}{7}\right)^5\right]^2$ <p>\checkmark answer/antwoord</p>	<p>(2)</p> <p>(2)</p>

<p>3.2</p>	<p>water left after 1 hour = $\frac{99}{100} \times 50$ $\therefore a = 50(0,99), \quad r = 0,99$ $T_n = ar^{n-1}$ $T_8 = 50(0,99)(0,99)^7$ $= 50(0,99)^8$ $= 46,14$ 46,14 litres of water will be left after eight hours</p> <p>OR/OF</p> <p>water evaporated after an hour = 1% of 50 = 0,5 water evaporated after 2 hours = 1% of 49,5 = 0,495 water evaporated after 3 hours = 1% of 49,005 = 0,49005 $a = 0,5 \quad r = 0,99$ $S_n = \frac{a(r^n - 1)}{r - 1}$ $S_8 = \frac{0,5(0,99^8 - 1)}{0,99 - 1}$ $= 3,86$ \therefore water that will be left after eight hours = $50 - 3,86$ $= 46,14$ liters</p> <p>OR/OF</p> <p>$T_0 = 50$ $T_1 = 50(0,99)$ $T_2 = 50(0,99)(0,99)$ $T_8 = 50(0,99)(0,99)^7$ $= 50(0,99)^8$ $= 46,14$ litres</p>	<p>$\checkmark a = 50(0,99)$</p> <p>\checkmark subst in correct formula/<i>vervang in korrekte formule</i> $\checkmark 46,14$ litres</p> <p>OR/OF</p> <p>$\checkmark a = 0,5$</p> <p>\checkmark subst in correct formula/<i>vervang in korrekte formule</i></p> <p>$\checkmark 46,14$ litres</p> <p>OR/OF</p> <p>$\checkmark T_1 = 50(0,99)$</p> <p>$\checkmark$ substitution/<i>vervanging</i></p> <p>\checkmark answer/<i>antwoord</i></p>	<p>(3)</p> <p>(3)</p> <p>(3)</p>
			<p>[12]</p>

QUESTION/VRAAG 4

4.1	4.1.1	$p = -1$ $q = -3$	✓ value/waarde p ✓ value/waarde q	(2)
	4.1.2	$f(x) = \frac{a}{x-1} - 3$ subs (0 ; -5) $-5 = \frac{a}{0-1} - 3$ $-5 = -a - 3$ $a = 2$	✓ subst. p and q / verv. p en q ✓ subst/verv (0 ; -5) ✓ value/waarde a	(3)
	4.1.3	f is translated 6 units up and 2 units to the right to form g .	✓ 6 units up/ eenhede op ✓ 2 units to the right/ eenhede na regs	(2)
	4.1.4	$y = 3$	✓ answer/antwoord	(1)
4.2	4.2.1	$x > 0$	✓ answer/antwoord	(1)
	4.2.2	$y = \log_b x$ $b^y = x$ $b^{-2} = 25$ $b = \frac{1}{5}$ $f(x) = \log_{\frac{1}{5}} x$	✓ subst/verv (25 ; -2) ✓ answer/antwoord	(2)
	4.2.3	$y = \log_{\frac{1}{5}} x$ $x = \log_{\frac{1}{5}} y$ $y = \left(\frac{1}{5}\right)^x$	✓ swop x and y /ruil x en y ✓ answer/antwoord	(2)
	4.2.4	$x > -5$	✓✓ answer/antwoord	(2)
				[15]

QUESTION/VRAAG 5

5.1		$y = a(x+1)(x+5)$ $5 = a(1)(5)$ $a = 1$ $y = (x+1)(x+5)$ $y = x^2 + 6x + 5$	✓ subst/verv $(-5 ; 0)$ & $(-1 ; 0)$ ✓ subst/verv $(0 ; 5)$ ✓ value/waarde a	(3)
5.2		$x^2 + 6x + 5 = 2x + 10$ $x^2 + 4x - 5 = 0$ $(x+5)(x-1) = 0$ $x \neq -5$ or $x = 1$ $\therefore y = 2(1) + 10 = 12$ OR $y = (1)^2 + 6 + 5 = 12$ Q(1 ; 12)	✓ equating/gelykstel ✓ standard form/vorm ✓ x -values with selection/ x -waardes met seleksie ✓ y -value/waarde	(4)
5.3		For turning point: $f'(x) = 2x + 6 = 0$ $x = -3$ Then $f(-3) = (-3)^2 + 6(-3) + 5 = -4$ -4 is minimum value. Therefore, $f(x) \neq -5$ for all value of x OR/OF Axis of symmetry: $x = -\frac{b}{2a} = -\frac{6}{2} = -3$ $y = (-3)^2 + 6(-3) + 5 = -4$ $f(x) = -4$ is minimum at $x = -3$ $-5 < -4$, therefore, $(x) \neq -5$ for all x	✓ $x = -3$ ✓ value/waarde y ✓ conclusion/gevolgtrekking OR/OF ✓ x -value//waardes ✓ value/waarde y ✓ conclusion/gevolgtrekking	(3)
5.4	5.4.1	$SR = 2x + 10 - (x^2 + 6x + 5)$ $= -x^2 - 4x + 5$ $\frac{dSR}{dx} = -2x - 4 = 0$ $x = -2$ $f'(x) = 2x + 6$ $\therefore f'(-2) = 2$	✓ SR ✓ value/waarde x ✓ $f'(x)$ ✓ $f'(-2)$	(4)

		<p>OR / OF</p> $SR = 2x + 10 - (x^2 + 6x + 5)$ $= -x^2 - 4x + 5$ $\text{max SR at } x = \frac{-(-4)}{2(-1)}$ $= -2$ $f'(x) = 2x + 6$ $\therefore f'(-2) = 2$	<p>OR/OF</p> $\checkmark -x^2 - 4x + 5$ $\checkmark x = -2$ $\checkmark f'(x) = 2x + 6$ $\checkmark f'(-2) = 2$	(4)
	5.4.2	<p>When $x = -2$</p> $y = x^2 + 6x + 5$ $y = (-2)^2 + 6(-2) + 5 = -3$ <p>$R(-2; -3)$ and $m = 2$</p> $y = mx + c$ $-3 = 2(-2) + c$ $c = 1$ $y = 2x + 1$ <p>OR / OF</p> <p>When $x = -2$</p> $y = x^2 + 6x + 5$ $y = (-2)^2 + 6(-2) + 5 = -3$ <p>$R(-2; -3)$ and $m = 2$</p> $y - (-3) = 2[x - (-2)]$ $y + 3 = 2x + 4$ $y = 2x + 1$	<p>\checkmark y-value/waarde</p> <p>\checkmark substitution/ vervanging</p> <p>\checkmark answer/antwoord</p> <p>OR/OF</p> <p>\checkmark y-value//waarde</p> <p>\checkmark substitution/ vervanging</p> <p>\checkmark answer/antwoord</p>	(3)
	5.5	$g(x) = 2x + 10$ $g^{-1}(x) = \frac{x}{2} - \frac{10}{2}$ $g(x) - g^{-1}(x) = 15 \text{ for } x = 15$ $\therefore g(x) - g^{-1}(x) > 15 \text{ for } x > 0$	$\checkmark g^{-1}(x)$ $\checkmark \checkmark x > 0$	(3)
				[20]

QUESTION/VRAAG 6

6.1		$1 + i_{eff} = 1 + i_{nom}$ $1 + i_{eff} = \left(1 + \frac{0,05}{12}\right)^{12}$ $i_{eff} = 0,05116\dots$ $= 5,12\%$	✓ substitution/ vervanging ✓ answer/antwoord	(2)
6.2	6.2.1	$P = \frac{x \left[1 - (1+i)^{-n}\right]}{i}$ $800\,000 = \frac{x \left[1 - \left(1 + \frac{0,1075}{12}\right)^{-300}\right]}{0,1075}$ $x = 7\,696,74$ <p>Matome's monthly payments = R7 696,74</p>	✓ value/waarde n ✓ value/waardes i ✓ subst in correct formula/vervang in korrekte formule ✓ answer/antwoord	(4)
	6.2.2	<p>Balance after 240th payment:</p> $\text{Balance} = x(1+i)^n - \frac{x \left[(1+i)^n - 1\right]}{i}$ $= 800\,000 \left(1 + \frac{0,1075}{12}\right)^{240} - \frac{7\,696,74 \left[\left(1 + \frac{0,1075}{12}\right)^{240} - 1\right]}{0,1075}$ $= 356\,036,20$ <p>OR/OF</p> $P = \frac{x \left[1 - (1+i)^{-n}\right]}{i}$ $= \frac{7\,696,74 \left[1 - \left(1 + \frac{0,1075}{12}\right)^{-60}\right]}{0,1075}$ $= 356\,034,62$ <p>Balance was R356 034, 62</p>	✓✓ Tick for each term/ merk elke term ✓ answer/antwoord OR/OF ✓ $n = -60$ ✓ subst in correct formula/vervang in korrekte formule ✓ answer/antwoord	(3)

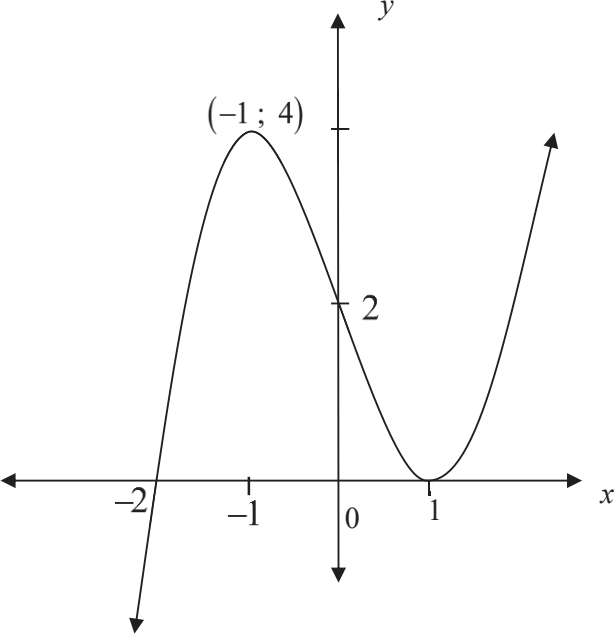
	<p>6.2.3 The balance after missing 6 instalments:</p> $A = P(1+i)^n$ $= 356\,034,62 \left(1 + \frac{0,1075}{12}\right)^6$ $= 375\,605,22$ <p>The number of payments:</p> $375\,605,22 = \frac{9\,000 \left[1 - \left(1 + \frac{0,1075}{12}\right)^{-n}\right]}{\frac{0,1075}{12}}$ $-n = \log_{\left(1 + \frac{0,1075}{12}\right)} \left[1 - \frac{375\,605,22 \left(\frac{0,1075}{12}\right)}{9\,000}\right]$ $n = 52,5$ <p>Yes, Matome was able to settle the loan in time. He settled the loan in 53 months instead of 54 months.</p> <p>OR/OR</p> $A = P(1+i)^n$ $= 356\,034,62 \left(1 + \frac{0,1075}{12}\right)^6$ $= 375\,605,2205$ $P = \frac{x \left[1 - (1+i)^{-n}\right]}{i}$ $375\,605,2205 = \frac{x \left[1 - \left(1 + \frac{0,1075}{12}\right)^{-54}\right]}{\frac{0,1075}{12}}$ $x = 8\,803,68$ <p>Yes, Matome paid more than the required amount.</p>	<p>✓ subst in correct formula/vervang in korrekte formule ✓ answer/antwoord</p> <p>✓ subst in correct formula/vervang in korrekte formule</p> <p>✓ value/waarde n ✓ conclusion/</p> <p>OR/OF</p> <p>✓ subst in correct formula/vervang in korrekte formule ✓ answer/antwoord</p> <p>✓ subst in correct formula/vervang in korrekte formule ✓ answer/antwoord ✓ conclusion/gevolgtrekking gevolgtrekking</p>	<p>(5)</p> <p>(5)</p> <p>[14]</p>
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QUESTION/VRAAG 7

7.1		$f(x) = 4x^2 - x$ $f(x+h) = 4(x+h)^2 - (x+h)$ $= 4x^2 + 8xh + 4h^2 - x - h$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{4x^2 + 8xh + 4h^2 - x - h - (4x^2 - x)}{h}$ $= \lim_{h \rightarrow 0} \frac{8xh + 4h^2 - h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(8x + 4h - 1)}{h}$ $= \lim_{h \rightarrow 0} (8x + 4h - 1)$ $= 8x - 1$ <p>OR/OF</p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{4(x+h)^2 - (x+h) - (4x^2 - x)}{h}$ $= \lim_{h \rightarrow 0} \frac{4x^2 + 8xh + 4h^2 - x - h - 4x^2 + x}{h}$ $= \lim_{h \rightarrow 0} \frac{8xh + 4h^2 - h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(8x + 4h - 1)}{h}$ $= \lim_{h \rightarrow 0} (8x + 4h - 1)$ $= 8x - 1$	<p>✓ expansion/uitbrei</p> <p>✓ correct substitution/ korrekte vervanging</p> <p>✓ simplification/ vereenvoudig</p> <p>✓ common factor/ gemeensk faktor</p> <p>✓ answer/antwoord</p> <p>OR/OF</p> <p>✓ correct substitution</p> <p>✓ expansion</p> <p>✓ simplification/ vereenvoudig</p> <p>✓ common factor</p> <p>✓ answer/antwoord</p>	(5)
7.2	7.2.1	$y = -x^3 - 16x^2 + 6x$ $\frac{dy}{dx} = -3x^2 - 32x + 6$	<p>✓ $-3x^2$</p> <p>✓ $-32x$</p> <p>✓ 6</p>	(3)

7.2.2	$f(x) = \frac{4}{5x^{-3}} - \frac{3}{\sqrt[3]{x^2}}$ $= \frac{4}{5}x^3 - 3x^{-\frac{2}{3}}$ $f'(x) = \frac{12}{5}x^2 + 2x^{-\frac{5}{3}}$	✓ $\frac{4}{5}x^3$ ✓ $-3x^{-\frac{2}{3}}$ ✓ $\frac{12}{5}x^2$ ✓ $2x^{-\frac{5}{3}}$	(4)
			[12]

QUESTION/VRAAG 8

8.1		✓ x-intercepts/afsnitte ✓ y- intercept/afsnit ✓ turning points/DP ✓ shape/vorm	(4)
8.2	$y = a(x-1)^2(x+2)$ $2 = a(-1)^2(2)$ $2 = 2a$ $a = 1$ $f(x) = (x^2 + x - 2)(x - 1)$ $= x^3 - 3x + 2$	✓ subst in correct formula/vervang in korrekte formule ✓ subst/verv (0 ; 2) ✓ a = 1 ✓ b = 0 ✓ c = -3 & d = 2	(5)

8.3	(1 ; 0) and/en (4 ; 0)	✓ (1 ; 0) ✓ (4 ; 0)	(2)
8.4	$p > 4$ or/of $p < 0$	✓✓ answer/antwoord	(2)
			[13]

QUESTION/VRAAG 9

9.1	<p>The area of the square = x^2 and the area of the circle = πr^2 Total area (A) = $x^2 + \pi r^2$.....(1) Perimeter of the square + circumference of the circle = 12 $4x + 2\pi r = 12$ $r = \frac{6 - 2x}{\pi}$.....(2) subst. (2) into (1) $A = x^2 + \pi \left(\frac{6 - 2x}{\pi} \right)^2$ $A = x^2 + \frac{4x^2 - 24x + 36}{\pi}$ $A = \frac{4x^2 + \pi x^2 - 24x + 36}{\pi}$ $A = \frac{(4 + \pi)x^2 - 24x + 36}{\pi}$</p>	<p>✓ $A = x^2 + \pi r^2$ ✓ $4x + 2\pi r$ ✓ equating to 12 ✓ $r = \frac{6 - 2x}{\pi}$ ✓ substitution/ vervangings ✓ simplification/ vereenvoudig</p>	(6)
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	<p>OR/OF</p> <p>The area of the square = x^2 remaining wire = $12 - 4x$ $2\pi r = 12 - 4x$ $r = \frac{12 - 4x}{2\pi}$ area of the circle = $\pi \left(\frac{12 - 4x}{2\pi} \right)^2$ $= \pi \left(\frac{6 - 2x}{\pi} \right)^2$ $= \frac{36 - 24x + 4x^2}{\pi}$ Total area = area of a square + area of a circle Total area (A) = $x^2 + \frac{36 - 24x + 4x^2}{\pi}$ $= \frac{\pi x^2 + 36 - 24x + 4x^2}{\pi}$ $= \frac{(\pi + 4)x^2 - 24x + 36}{\pi}$</p>	<p>OR/OF</p> <p>✓ x^2 ✓ $12 - 4x$ ✓ $r = \frac{12 - 4x}{2\pi}$ ✓ $\frac{36 - 24x + 4x^2}{\pi}$ ✓ $x^2 + \frac{36 - 24x + 4x^2}{\pi}$ ✓ $\frac{\pi x^2 + 36 - 24x + 4x^2}{\pi}$</p>	(6)
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9.2		<p>Area is minimum when:</p> $x = \frac{\frac{24}{\pi}}{2\left(\frac{\pi+4}{\pi}\right)}$ $x = 1,68$ <p>OR/OF</p> <p>For minimum area:</p> $A(x) = \frac{(4+\pi)}{\pi}x^2 - \frac{24}{\pi}x + \frac{36}{\pi}$ $A'(x) = 2\left(\frac{4+\pi}{\pi}\right)x - \frac{24}{\pi} = 0$ $2\left(\frac{4+\pi}{\pi}\right)x = \frac{24}{\pi}$ $x = 1,68 \text{ m}$ <p>For minimum area, the side of the square should be 1,68 m</p>	<p>✓ method/metode</p> <p>✓ answer/antwoord</p> <p>OR/OF</p> <p>✓ method/metode</p> <p>✓ answer/antwoord</p>	<p>(2)</p> <p>(2)</p>
				[8]

QUESTION/VRAAG 10

10.1	10.1.1	$P(G) = \frac{50}{100} = \frac{1}{2} = 0,5$	✓ answer/antwoord	(1)
	10.1.2	$P(S) = \frac{35}{100} = \frac{7}{20} = 0,35$	✓ answer/antwoord	(1)
	10.1.3	$P(G \text{ and } S) = \frac{15}{100} = 0,15$ $P(S) \times P(G) = \frac{1}{2} \times \frac{7}{20} = \frac{7}{40} = 0,175$ $P(G \text{ and } S) \neq P(G) \times P(S)$ Events G and S are not independent	✓ 0, 15 ✓ 0, 175 ✓ Conclusion/ gevolgtrekking	(3)
10.2		$4 \times 7 \times 7 \times 3$ $= 588$	✓ $4 \times 7 \times 7 \times 3$ ✓ answer/antwoord	(2)
10.3	10.3.1	$7! = 5\ 040$	✓ $7!$ or/of 5 040	(1)
	10.3.2	$3 \times 5! \times 4 = 1\ 440$	✓ 4 ✓ $3 \times 5!$ ✓ answer/antwoord	(3)
	10.3.3	The number of ways of arranging all the letters with all the three vowels following each other : $3! \times 5! = 720$ $\therefore P(\text{all vowels will not follow each other})$ $= 1 - \frac{720}{5\ 040} = \frac{6}{7}$	✓ $3!$ ✓ $3! \times 5!$ ✓ $1 - \frac{720}{5\ 040}$ ✓ $\frac{6}{7}$	(4)
				[15]

TOTAL/TOTAAL : 150

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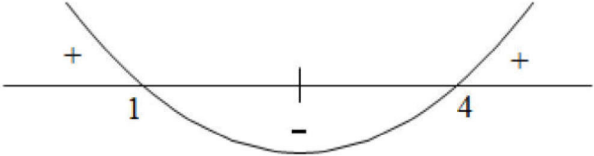

GRADE 12

MATHEMATICS P1

PREPARATORY EXAMINATION

SEPTEMBER 2023

Marking Guidelines

QUESTION 1			
1.1.1	$x=0$ or $x=4$	AA✓✓ answer	(2)
1.1.2	$2x^2 + 3x - 7 = 0$ $x = \frac{-3 \pm \sqrt{(3)^2 - 4(2)(-7)}}{2(2)}$ $x = 1,27$ or $x = -2,77$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> Penalise 1 mark for incorrect rounding off . </div>	A✓ standard form CA✓ substitution into formula CA✓ 1,27 CA✓ -2,77	(4)
1.1.3	$(x-1)(x-4) > 0$  $x < 1$ or $x > 4$ <p style="text-align: center;">OR</p> $(x-1)(x-4) > 0$  $x < 1$ or $x > 4$	A✓ factors CA✓ $x < 1$ CA✓ $x > 4$ <p style="text-align: center;">OR</p> A✓ factors CA✓ $x < 1$ CA✓ $x > 4$	(3)

1.1.4	$(3^x - 3)(3^x - 7) = 0$ $3^x = 3 \quad \text{or} \quad 3^x = 7$ $\log_3 7 = x$ $x = 1 \quad 1, 77 = x$ <p style="text-align: center;">OR</p> <p>Let $3^x = m \therefore 3^{2x} = m^2$</p> $m^2 - 10m + 21 = 0$ $(m - 3)(m - 7) = 0$ $m = 3 \quad \text{or} \quad m = 7$ $3^x = 3 \quad \text{or} \quad 3^x = 7$ $\log_3 7 = x$ $x = 1 \quad \text{or} \quad 1, 77 = x$	A✓ factors CA✓ $3^x = 3$ or $3^x = 7$ CA✓ using logs CA✓ $x = 1$ CA✓ $x = 1, 77$ <p style="text-align: center;">OR</p> A✓ $m = 3$ or $m = 7$ CA✓ $3^x = 3$ or $3^x = 7$ CA✓ using logs CA✓ $x = 1$ CA✓ $x = 1, 77$	(5)
1.2	$x = 2 - y \dots \dots (3)$ $(2 - y)^2 + y^2 + 6(2 - y) - 4y + 4 = 0$ $4 - 4y + y^2 + y^2 + 12 - 6y - 4y + 4 = 0$ $2y^2 - 14y + 20 = 0$ $y^2 - 7y + 10 = 0$ $(y - 2)(y - 5) = 0$ $y = 2 \quad \text{or} \quad y = 5$ $x = 2 - 2 = 0$ $x = 2 - 5 = -3$	A✓ equation (3) CA✓ substitution CA✓ standard form CA✓ factors CA✓ y values CA✓ x values	(6)

1.3	<p>For equal roots $\Delta = 0$</p> $25 - n^2 = 0$ $(5 - n)(5 + n) = 0$ $n = \pm 5$ <p style="text-align: center;">OR</p> <p>For equal roots $\Delta = 0$</p> $25 - n^2 = 0$ $25 = n^2$ $n = \pm 5$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 10px auto;">answer only = full marks</div>	$A \checkmark 25 - n^2 = 0$ $A \checkmark \text{ factors}$ $CA \checkmark \text{ answer}$ <p style="text-align: center;">OR</p> $A \checkmark 25 - n^2 = 0$ $A \checkmark 25 = n^2$ $CA \checkmark \text{ answer}$	(3)
			[23]

QUESTION 2			
2.1.1	<p>3 ; 7 ; 11 ;----- 399.</p> $a = 3$ $d = 4$ $n = 20$ $T_n = a + (n-1)d$ $T_{20} = 3 + (20-1)4$ $T_{20} = 79$ <p style="text-align: center;">OR</p> <p>3 ; 7 ; 11 ;----- 399.</p> <p>4; 4; 4;</p> $T_n = 4n - 1$ $T_{20} = 4n - 1$ $T_{20} = 4(20) - 1$ $T_{20} = 79$	<p>A✓ substitute into correct T_n formula</p> <p>CA✓ answer</p> <p style="text-align: center;">OR</p> <p>A✓ substitute into correct T_n formula</p> <p>CA✓ answer</p>	(2)
2.1.2	$T_n = 399$ $T_n = a + (n-1)d$ $399 = 3 + (n-1)4$ $396 = (n-1)4$ $99 = n - 1$ $100 = n$ <p style="text-align: center;">OR</p> $T_n = 399$ $T_n = 4n - 1$ $399 = 4n - 1$ $400 = 4n$ $100 = n$	<p>A✓ substitute into correct T_n formula</p> <p>CA✓ answer</p> <p style="text-align: center;">OR</p> <p>A✓ substitute into correct T_n formula</p>	

		CA✓ answer	(2)
2.2.1	$T_1 = a$ $T_{13} = a + 24$ $T_{13} = a + (13-1)d$ $a + 24 = a + 12d$ $24 = 12d$ $2 = d$	 A✓ $a + 24 = a + 12d$ A✓ $d = 2$	(2)
2.2.2	$S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{200} = \frac{200}{2}[2(a) + (200-1)2]$ $S_{200} = 100(2a + 398)$ $S_{200} = 200a + 39\ 800$ <p style="text-align: center;">OR</p> $T_n = a + (n-1)d$ $T_{200} = a + (200-1)(2)$ $= a + 398$ $S_n = \frac{n}{2}(a+l)$ $S_{200} = \frac{200}{2}[a + (a + 398)]$ $S_{200} = 100(2a + 398)$ $= 200a + 39\ 800$	 CA✓ substitute into the correct formula CA✓ answer <p style="text-align: center;">OR</p> CA✓ substitute into the correct formula CA✓ answer	(2)
			[8]

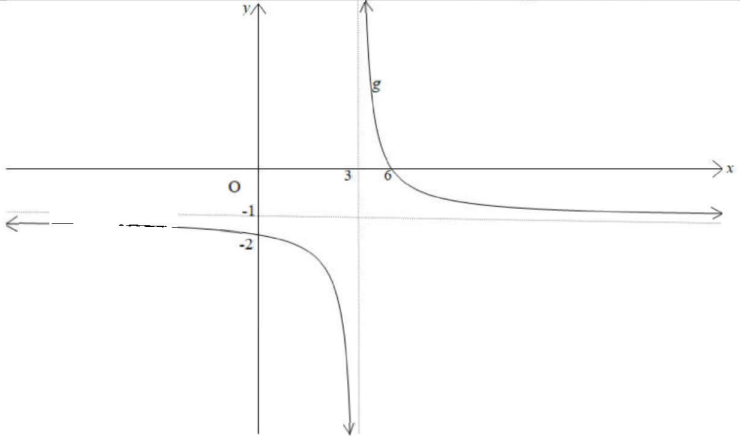
QUESTION 3			
3.1	<p>1 ; 11 ; 27 ; 49 ; 77 ; 111 ; 151 ;</p> <p>10 ; 16 ; 22 ; 28 ; 34 ; 40 ;</p> <p>6 ; 6 ; 6 ; 6 ; 6 ;</p> <p>The third term is 27</p>	A✓ answer	(1)
3.2	<p>Second difference is 6</p> <p>$2a = 6$</p> <p>$a = 3$</p> <p>$10 = 3a + b$</p> <p>$10 = 3(3) + b$</p> <p>$1 = b$</p> <p>$1 = 3 + 1 + c$</p> <p>$-3 = c$</p> <p>$T_n = 3n^2 + n - 3$</p> <p style="text-align: center;">OR</p> <p>- ; - ; 27 ; 49 ; 77 ; 111 ; 151 ;</p> <p>- ; 16 ; 22 ; 28 ; 34 ; 40 ;</p> <p>6 ; 6 ; 6 ; 6 ;</p> <p>$2a = 6$</p> <p>$a = 3$</p> <p>$T_n = an^2 + bn + c$</p> <p>$49 = 3(4)^2 + b(4) + c$</p> <p>$77 = 3(5)^2 + b(5) + c$</p> <p>$49 = 48 + 4b + c \dots\dots\dots(1)$</p> <p>$77 = 75 + 5b + c \dots\dots\dots(2)$</p> <p>$28 = 27 + b \dots\dots\dots(2) - (1)$</p> <p>$1 = b$</p> <p>$49 = 48 + 4(1) + c$</p> <p>$-3 = c$</p>	<p>A✓ $a = 3$</p> <p>CA✓ $b = 1$</p> <p>CA✓ $c = -3$</p> <p>CA✓ answer</p> <p style="text-align: center;">OR</p> <p>A✓ $a = 3$</p> <p>CA✓ $b = 1$</p> <p>CA✓ $c = -3$</p> <p>CA✓ answer</p>	(4)

	$T_n = 3n^2 + n - 3$		
3.3	<p>First difference 10; 16; 22; 28; 34; 40 ...</p> <p style="text-align: center;">6; 6; 6; 6; 6; ...</p> <p>$T_n = 6n + 4$</p> <p>$418 = 6n + 4$</p> <p>$414 = 6n$</p> <p>$69 = n$</p> <p>$70 = n + 1$</p> <p>\therefore between T_{69} and T_{70}</p> <p style="text-align: center;">OR</p> <p>$418 = T_{n+1} - T_n$</p> <p>$418 = 3(n+1)^2 + (n+1) - 3 - (3n^2 + n - 3)$</p> <p>$418 = 3(n^2 + 2n + 1) + n + 1 - 3 - 3n^2 - n + 3$</p> <p>$418 = 3n^2 + 6n + 3 + n - 2 - 3n^2 - n + 3$</p> <p>$418 = 6n + 4$</p> <p>$414 = 6n$</p> <p>$69 = n$</p> <p>$70 = n + 1$</p> <p>$\therefore$ between T_{69} and T_{70}</p>	<p>$A\checkmark T_n = 6n + 4$</p> <p>$CA\checkmark$ value of n</p> <p>$CA\checkmark$ between T_{69} and T_{70}</p> <p style="text-align: center;">OR</p> <p>$A\checkmark 418 = T_{n+1} - T_n$</p> <p>$CA\checkmark$ value of n</p> <p>$CA\checkmark$ between T_{69} and T_{70}</p>	(3)
			[8]

QUESTION 4			
4.1.1	$T_1 = x$ $T_2 = x + 1$ $r = \frac{T_2}{T_1}$ $r = \frac{x+1}{x}$	A✓ answer	(1)
4.1.2	$T_3 = T_2 \times r$ $T_3 = (x+1) \times \frac{x+1}{x}$ $T_3 = \frac{(x+1)^2}{x}$	CA✓ $(x+1) \times \frac{x+1}{x}$ CA✓ answer	(2)
4.1.3	$r = \frac{(2+1)}{2} = \frac{3}{2}$ ∴ no, since $r > 1$ OR No, for the series to converge: $-1 < r < 1$	CA✓ value of r CA✓ answer with motivation	(2)
4.2	For AP: $T_2 - T_1 = T_3 - T_2$ $a - 6 = b - a$ $2a - 6 = b \dots\dots\dots(1)$ For GP: $\frac{T_2}{T_1} = \frac{T_3}{T_2}$ $\frac{b}{a} = \frac{16}{b}$	A✓ equation (1)	

	$16a = b^2 \dots\dots\dots(2)$ $16a = (2a - 6)^2$ $16a = 4a^2 - 24a + 36$ $0 = 4a^2 - 40a + 36$ $0 = a^2 - 10a + 9$ $0 = (a - 1)(a - 9)$ $a = 1 \text{ or } 9$ $b = 2(9) - 6 = 12$ $b = 2(1) - 6 = -4$	A✓ equation (2) CA✓ standard form CA✓ values of a CA✓ values of b	 (5)
			[10]

QUESTION 5			
5.1	$x = 3$ $y = -1$	A✓ answer A✓ answer	(2)
5.2	$x - \text{intercept:}$ $0 = \frac{-3}{3-x} - 1$ $1 = \frac{-3}{3-x}$ $3-x = -3$ $x = 6$ $y - \text{intercept} = \frac{-3}{3-0} - 1 = -2$ <p style="text-align: center;">OR</p> $y = \frac{-3}{-(x-3)} - 1$ $y = \frac{3}{x-3} - 1$ $x - \text{intercept:}$ $0 = \frac{3}{x-3} - 1$ $1 = \frac{3}{x-3}$ $x-3 = 3$ $x = 6$ $y - \text{intercept} = \frac{3}{0-3} - 1 = -2$	A✓ sub $y = 0$ CA✓ $x = 6$ A✓ $y = -2$ <p style="text-align: center;">OR</p> A✓ sub $y = 0$ CA✓ $x = 6$ A✓ $y = -2$	(3)


5.3		A✓ shape CA✓ intercepts CA✓ asymptotes	(3)
5.4	$y = -x + c$ $-1 = -3 + c$ $2 = c$ $y = -x + 2$ <p style="text-align: center;">OR</p> $y = \frac{-3}{-3-x} - 1$ $y = (3-x) - 1$ $y = -x + 2$ <p style="text-align: center;">OR</p> $y = \frac{3}{x-3} - 1$ $y = -(x-3) - 1$ $y = -x + 3 - 1$ $y = -x + 2$	CA✓ sub (3; -1) CA✓ answer <p style="text-align: center;">OR</p> A✓ (3-x)-1 CA✓ answer <p style="text-align: center;">OR</p> A✓ -(x-3)-1 CA✓ answer	(2)
			[10]

QUESTION 6			
6.1	$m = \tan 135^\circ$ $m = -1$ $\therefore y = -x + 2$	A✓ $m = \tan 135^\circ$ A✓ $m = -1$	(2)
6.2	$0 = -x + 2$ $x = 2$ $\therefore S(2; 0)$	A✓ equating to zero A✓ answer	(2)
Answer only = full marks			
6.3	$y = a(x - x_1)(x - x_2)$ $y = a\left(x + \frac{1}{2}\right)(x - 2)$ $-12 = a\left(1 + \frac{1}{2}\right)(1 - 2)$ $-12 = \frac{-3a}{2}$ $8 = a$ $y = 8\left(x + \frac{1}{2}\right)(x - 2)$ $y = 8\left(x^2 - \frac{3}{2}x - 1\right)$ $y = 8x^2 - 12x - 8$	A✓ sub $x = -\frac{1}{2}$ and $x = 2$ A✓ sub (1; -12) A✓ $a = 8$ A✓ $y = 8\left(x^2 - \frac{3}{2}x - 1\right)$	(4)
Accept method of simultaneous equations			
6.4	$x = \frac{-b}{2a}$ $x = \frac{-(-12)}{2(8)} = \frac{3}{4}$ $y = 8\left(\frac{3}{4}\right)^2 - 12\left(\frac{3}{4}\right) - 8$ $y = \frac{-25}{2}$ $V\left(\frac{3}{4}; \frac{-25}{2}\right)$	A✓ x value CA✓ substitution CA✓ y value	

	<p style="text-align: center;">OR</p> $g'(x) = 16x - 12$ $0 = 16x - 12$ $12 = 16x$ $\frac{3}{4} = x$ $y = 8\left(\frac{3}{4}\right)^2 - 12\left(\frac{3}{4}\right) - 8$ $y = \frac{-25}{2}$ $V\left(\frac{3}{4}; \frac{-25}{2}\right)$ <p style="text-align: center;">OR</p> <p>x-intercepts S(2;0) and R$\left(-\frac{1}{2}; 0\right)$</p> $\text{midpoint } x = \frac{\frac{-1}{2} + 2}{2}$ $x = \frac{3}{4}$ $y = 8\left(\frac{3}{4}\right)^2 - 12\left(\frac{3}{4}\right) - 8$ $y = \frac{-25}{2}$ $V\left(\frac{3}{4}; \frac{-25}{2}\right)$ <p style="text-align: center;">OR</p> $y = 8\left[x^2 - \frac{12}{8}x - 1\right]$ $y = \left[\left(x^2 - \frac{3}{2}x + \frac{9}{16}\right) - 1 - \frac{9}{16}\right]$ $y = 8\left[\left(x - \frac{3}{4}\right)^2 - \frac{25}{16}\right]$	$A\checkmark 0 = 16x - 12$ $CA\checkmark x \text{ value}$ $CA\checkmark y \text{ value}$ <p style="text-align: center;">OR</p> $A\checkmark \text{ subst into correct midpoint formula}$ $CA\checkmark x \text{ value}$ $CA\checkmark y \text{ value}$ <p style="text-align: center;">OR</p> $A\checkmark \text{ completing the square}$	
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	$y = 8\left(x - \frac{3}{4}\right)^2 - \frac{25}{2}$ $V\left(\frac{3}{4}; -\frac{25}{2}\right)$	CA✓✓ x value and y value	(3)
6.5	$k > \frac{-25}{2}$	CA✓ answer	(1)
6.6	$x > \frac{3}{4}$ OR $(-1)(16x - 12) < 0$ $-16x < -12$ $x > \frac{3}{4}$	CA✓ answer OR A✓ answer	(1)
6.7	$T\left(-1; \frac{1}{2}\right)$	A✓ x - coordinate A✓ y - coordinate	(2)
			[15]

QUESTION 7			
7.1	$(4; -1)$	A✓ answer	(1)
7.2	$y = \log_a x$ $-1 = \log_a 4$ $a^{-1} = 4$ $a = \frac{1}{4}$	A✓ sub(4; -1) A✓ $a^{-1} = 4$	(2)
7.3	$y = \left(\frac{1}{4}\right)^x$	A✓ answer	(1)
7.4	A(-1; 4) and B(1; 0) $AB = \sqrt{(-1-1)^2 + (4-0)^2}$ $AB = \sqrt{4+16} = \sqrt{20}$ $AB = 2\sqrt{5} = 4,47$	A✓ B(1; 0) CA✓ sub points A and B CA✓ answer	(3)
7.5	$x > 4$	A✓ answer	(1)
			[8]

QUESTION 8			
8.1	$A = P(1-i)^n$ $10767,26 = 15800 \left(1 - \frac{12}{100}\right)^n$ $\frac{10767,26}{15800} = (0,88)^n$ $\log_{(0,88)} \left(\frac{10767,26}{15800}\right) = n$ $2,999998... = n$ $n = 3 \text{ years}$	<p>A✓ sub into correct formula</p> <p>CA✓ correct use of logs</p> <p>CA✓ answer</p>	(3)
8.2	$\left(1 + \frac{r}{100}\right) = \left(1 + \frac{i}{m}\right)^m$ $\left(1 + \frac{r}{100}\right) = \left(1 + \frac{7,64}{200}\right)^2$ $r = 100 \left[\left(1 + \frac{7,64}{200}\right)^2 - 1 \right]$ $r = 7,79\%$	<p>A✓ subst into correct formula</p> <p>CA✓ answer</p>	(2)
8.3.1	 $F = \frac{x \left[(1+i)^n - 1 \right]}{i}$		

	$F = \frac{500 \left[\left(1 + \frac{5,8}{1200} \right)^{24} - 1 \right]}{\frac{5,8}{1200}}$ $= R12\,691,25$	A✓ values of i & n CA✓ subst into correct CA✓ answer	(3)
8.3.2	$R368\,400 - R12\,691,25 = R355\,708,75$ $P = \frac{x \left[1 - (1+i)^{-n} \right]}{i}$ $355708,75 = \frac{x \left[1 - \left(1 + \frac{10,4}{1200} \right)^{-72} \right]}{\frac{10,4}{1200}}$ $R6661,78 = x$	CA✓ R355 708,75 A✓ $n = 72$ CA✓ sub into correct formula CA✓ answer	(4)
8.3.3	$\text{Balance Outstanding} = P(1+i)^n - \frac{x \left[(1+i)^n - 1 \right]}{i}$ $= 355708,75 \left(1 + \frac{10,4}{1200} \right)^{56} - \frac{6661,78 \left[\left(1 + \frac{10,4}{1200} \right)^{56} - 1 \right]}{\frac{10,4}{1200}}$ <p>Balance outstanding = R99 128,46</p> <p style="text-align: center;">OR</p> <p>Remaining instalments = $72 - 56 = 16$</p> $\text{Balance} = \frac{6661,78 \left[1 - \left(1 + \frac{10,4}{1200} \right)^{-16} \right]}{\frac{10,4}{1200}}$	CA✓ $355708,75 \left(1 + \frac{10,4}{1200} \right)^{56}$ CA✓ $\frac{6661,78 \left[\left(1 + \frac{10,4}{1200} \right)^{56} - 1 \right]}{\frac{10,4}{1200}}$ CA✓ R99 128,46 OR A✓ $n = 16$ CA✓ subst into correct formula	

	= R99128,52	CA✓ R99128,52	(3)
			[15]

QUESTION 9**Penalise ONCE for incorrect notation, either in 9.1 or 9.2.**

9.1	$f(x) = 2x^2 + 9$ $f(x+h) = 2(x+h)^2 + 9$ $= 2x^2 + 4xh + 2h^2 + 9$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{2x^2 + 4xh + 2h^2 + 9 - 2x^2 - 9}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{4xh + 2h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(4x + 2h)}{h}$ $f'(x) = \lim_{h \rightarrow 0} 4x + 2h$ $f'(x) = 4x$	<p>A✓ calculating $f(x+h)$</p> <p>CA✓ sub into formula</p> <p>CA✓ simplifying</p> <p>CA✓ factors</p> <p>CA✓ answer</p>	(5)
9.2.1	$y = 2x^2 + x$ $\frac{dy}{dx} = 4x + 1$	<p>A✓ product</p> <p>CA✓ answer</p>	(2)
9.2.2	$\sqrt{y+x} = x+3$ $(\sqrt{y+x})^2 = (x+3)^2$ $y+x = x^2 + 6x + 9$ $y = x^2 + 5x + 9$ $\frac{dy}{dx} = 2x + 5$	<p>A✓ squaring both sides</p> <p>A✓ correct product</p> <p>CA✓ answer</p>	(3)
9.2.3	$\frac{d}{dx} \left[4x^{-1} + \sqrt{3}x^{-\frac{1}{2}} \right]$ $= -4x^{-2} - \frac{\sqrt{3}}{2}x^{-\frac{3}{2}}$	<p>A✓ $4x^{-1} + \sqrt{3}x^{-\frac{1}{2}}$</p> <p>CA CA✓✓ each term</p>	(3)

QUESTION 10

<p>10.1</p>	$f(x) = ax^3 + bx^2$ $f(1) = a(1)^3 + b(1)^2 = a + b$ $f(2) = a(2)^3 + b(2)^2 = 8a + 4b$ $\text{Ave grad} = \frac{f(2) - f(1)}{2 - 1}$ $\text{Ave grad} = \frac{8a + 4b - a - b}{1}$ $5,5 = 7a + 3b \dots\dots\dots(1)$ $f'(x) = 3ax^2 + 2bx$ $f'(6) = 3a(6)^2 + 2b(6)$ $-18 = 108a + 12b \dots\dots\dots(2)$ $(1) \times 4: 22 = 28a + 12b \dots\dots\dots(3)$ $40 = -80a \dots\dots\dots(3) - (2)$ $\frac{-1}{2} = a$ $5,5 = 7\left(\frac{-1}{2}\right) + 3b$ $5,5 = -3,5 + 3b$ $9 = 3b$ $3 = b$	<p>A✓ subst $x = 1$ & $x = 2$</p> <p>A✓ correct subst into average gradient formula</p> <p>A✓ equation (1) A✓ equation (2)</p> <p>A✓ solving simultaneously</p>	<p>(5)</p>
<p>10.2</p>	$f'(x) = \frac{-3x^2}{2} + 6x$ $0 = \frac{-3x^2}{2} + 6x$ $0 = -3x^2 + 12x$ $0 = x^2 - 4x$ $0 = x(x - 4)$	<p>A✓ $f'(x)$</p> <p>CA✓ equating $f'(x) = 0$</p>	

	$x=0$ or $x=4$ $\therefore x=4$ At N $x=4 \therefore y = \frac{-1}{2}(4)^3 + 3(4)^2 = 16$ $N(4;16)$	CA✓ $x=4$ CA✓ $y=16$	(4)
10.3	$f''(x) = -3x + 6$ $-3x + 6 > 0$ $-3x > -6$ $x < 2$ $k = 2$ OR $f''(x) = -3x + 6$ $0 = -3x + 6$ $x = 2$ $\therefore k = 2$ OR $Midpt\ x = \frac{0+4}{2} = 2$ $x = 2$ $\therefore k = 2$	CA✓ $f''(x)$ CA✓ $-3x + 6 > 0$ CA✓ answer	(3)
			[12]

QUESTION 12			
12.1	$a = 4$ $b = 13$ $c = 5$ $d = 4$ $e = 6$	A✓ A✓ A✓ CA✓ CA✓	(5)
12.2	Greybound bus = 23 people	CA✓ answer	(1)
12.3	$P(\text{only one bus}) = \frac{6+4+2}{40} = \frac{12}{40} = \frac{3}{10}$	CA✓ adding CA✓ answer	(2)
			[8]

QUESTION 13			
13.1	$8! \text{ ways} = 40\,320 \text{ ways}$	A✓ $8!$ OR $40\,320$	(1)
13.2	$1 \times 6! \times 1 + 1 \times 6! \times 1 = 1440 \text{ ways}$ <p style="text-align: center;">OR</p> $2 \times 6! \times 1 = 1440 \text{ ways}$	A✓ $6!$ A✓ $1 \times 6! \times 1$ A✓ 1440	(3)
13.3	$1 - \left[\frac{(2! \times 5!)}{1440} + \frac{(2! \times 5!)}{1440} \right] = \frac{2}{3}$ OR $\frac{1440 - (2!5! + 2!5!)}{1440}$ $= \frac{2}{3}$	A✓ subtracting from 1 CA✓ denominator A✓ $2!5!$ CA✓ answer	(4)
			[8]

TOTAL MARKS: 150

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2023

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MATHEMATICS (PAPER 1) (10611)

18 pages

INSTRUCTIONS AND INFORMATION:

A – Accuracy

CA – Continued Accuracy

S – Statement

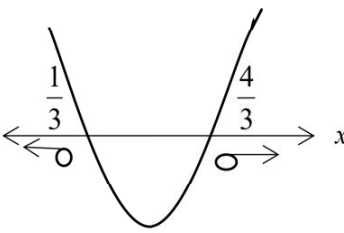
R – Reason

S and R – Statement and Reason

NOTE:

- If a candidate answered a question TWICE, mark only the FIRST attempt.
- If a candidate crossed OUT an answer and did not redo it, mark the crossed-out answer.
- Consistent accuracy applies to ALL aspects of the marking guidelines.
- It is UNACCEPTABLE to assume values/answers in order to solve a question.

QUESTION 1

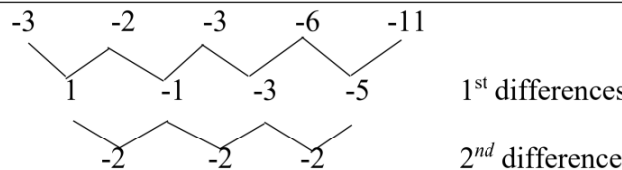
1.1	1.1.1	$(2x+1)^2 - 4 = 0$ $4x^2 + 4x + 1 - 4 = 0$ $4x^2 + 4x - 3 = 0$ $(2x+3)(2x-1) = 0$ $x = -\frac{3}{2} \dots or \dots x = \frac{1}{2}$	✓ standard form ✓ factors ✓ answers		
		OR			
		$(2x+1)^2 - 4 = 0$ $2x+1 = \pm\sqrt{4}$ $2x+1 = \pm 2$ $2x = \pm 2 - 1$ $2x = 2 - 1 \dots or \dots 2x = -2 - 1$ $2x = 1 \dots or \dots 2x = -3$ $x = \frac{1}{2} \dots or \dots x = -\frac{3}{2}$	✓ find root ✓ simplification ✓ answers		
		NOTE: In option 2, the simplification mark must only be awarded if the candidate states ± 2 or demonstrates it later in the solution.		(3)	
	1.1.2	$4x^2 - 11 = -12x$ $4x^2 + 12x - 11 = 0$ $x = \frac{-12 \pm \sqrt{(12)^2 - 4(4)(-11)}}{2(4)}$ $x = -3,74 \quad or \quad x = 0,74$	✓ correct substitution ✓✓ answers		
		NOTE: Penalise 1 mark for rounding in this question only. Candidate must show the substitution to obtain full marks.		(3)	
	1.1.3	$15x - 4 < 9x^2$ $\therefore -9x^2 + 15x - 4 < 0$ $\therefore 9x^2 - 15x + 4 > 0$ $(3x-1)(3x-4) > 0$ $\therefore x < \frac{1}{3} \dots or \dots x > \frac{4}{3}$		✓ standard form ✓ factors ✓✓ answers	
		NOTE: Penalise 1 mark for use of AND instead of OR		(4)	

1.1.4	$\sqrt{2x-2} - \sqrt{7-2x} = 1$ $(\sqrt{2x-2})^2 = (\sqrt{7-2x} + 1)^2$ $2x - 2 = 7 - 2x + 2\sqrt{7-2x} + 1$ $4x - 10 = 2\sqrt{7-2x}$ $(2x - 5)^2 = (\sqrt{7-2x})^2$ $4x^2 - 20x + 25 = 7 - 2x$ $4x^2 - 18x + 18 = 0$ $\therefore 2x^2 - 9x + 9 = 0$ $(x-3)(2x-3) = 0$ $\therefore x = 3 \dots \text{or} \dots x = \frac{3}{2}$ $\text{reject} \dots x \neq \frac{3}{2}$	<p>✓ isolate surd and square both sides</p> <p>✓ simplification</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ $x = 3$ and rejection</p>	(5)
1.2	$a^2b^2 - 2ab - 8 = 0 \quad \text{and} \quad \log_2(a+5) = 3$ $\log_2(a+5) = 3$ $2^3 = a+5$ $8 = a+5$ $a = 3$ $\therefore a^2b^2 - 2ab - 8 = 0$ $(3)^2b^2 - 2(3)b - 8 = 0$ $9b^2 - 6b - 8 = 0$ $(3b-4)(3b+2) = 0$ $b = \frac{4}{3} \quad \text{or} \quad b = -\frac{2}{3}$ <p style="text-align: center;">OR</p> $a^2b^2 - 2ab - 8 = 0 \quad \text{and} \quad \log_2(a+5) = 3$ $\log_2(a+5) = 3$ $2^3 = a+5$ $8 = a+5$ $a = 3$ $a^2b^2 - 2ab - 8 = 0$ $(ab-4)(ab+2) = 0$ $ab = 4 \quad \text{or} \quad ab = -2$ $\therefore 3b = 4 \quad 3b = -2$ $b = \frac{4}{3} \quad \text{or} \quad b = -\frac{2}{3}$	<p>✓ exponential form</p> <p>✓ value of a</p> <p>✓ substitution</p> <p>✓ factors</p> <p>✓ both answers for b</p> <p style="text-align: center;">OR</p> <p>✓ exponential form</p> <p>✓ value of a</p> <p>✓ factors</p> <p>✓ substitution</p> <p>✓ both answers for b</p>	(5)

1.3	$p = \frac{\sqrt{x+2}}{\sqrt{16-x^2}}$ $\therefore x+2 \geq 0$ $\therefore x \geq -2 \dots \dots \dots (1)$ $\therefore 16-x^2 > 0$ $(4+x)(4-x) > 0$ $\therefore -4 < x < 4 \dots \dots \dots (2)$ <p>From (1) and (2)</p> $-2 \leq x < 4$	<p>✓ equation (1)</p> <p>✓ factors ✓ equation (2)</p> <p>✓ answer</p>	(4)
			[24]

QUESTION 2

2.1	2.1.1	$1-p; 2p-3; p+5$ $d = T_2 - T_1 = T_3 - T_2$ $\therefore (2p-3) - (1-p) = (p+5) - (2p-3)$ $2p-3-1+p = p+5-2p+3$ $3p-4 = -p+8$ $4p = 12$ $\therefore p = 3$	<p>✓ substitution</p> <p>✓ answer</p>	(2)
	2.1.2	(a) $T_1 = 1-p$ $T_1 = 1-3$ $T_1 = -2$	<p>✓ answer</p>	(1)
		(b) $T_2 = 2p-3$ $T_2 = 2(3)-3$ $\therefore T_2 = 3$ $\therefore d = T_2 - T_1$ $d = 3 - (-2)$ $d = 5$	<p>✓ answer</p>	(1)
	2.1.3	$1-p; \dots 2p-3; \dots p+5; \dots$ $= 1-3; \dots 2(3)-3; \dots 3+5; \dots$ $= -2; \dots \dots 3; \dots \dots 8; \dots 13; \dots 18; \dots$ All the terms except T_1 end in either 3 or 8 while perfect squares end on 1; 4; 9; 6; 5; 0.	<p>✓ correct terms</p> <p>✓ explanation</p>	(2)

2.2	2.2.1	<p>-3; -2; -3; -6; -11; ...</p> <p>First differences: +1; -1; -3; -5</p> $T_n = a + (n-1)d$ $T_n = 1 + (n-1)(-2)$ $T_n = 1 - 2n + 2$ $T_n = -2n + 3$	<p>✓ first differences</p> <p>✓ substitution</p> <p>✓ answer</p>	(3)
	2.2.2	$T_n = -2n + 3$ $T_{35} = -2(35) + 3$ $\therefore T_{35} = -67$	<p>✓ answer</p>	(1)
	2.2.3	 <p>1st differences</p> <p>2nd differences</p> $T_n = an^2 + bn + c$ <p>but ... $2a = -2$</p> $\therefore a = -1$ $\therefore T_n = -n^2 + bn + c$ $T_1 = -(1)^2 + b(1) + c$ $-3 = -1 + b + c$ $\therefore -2 = b + c \dots \dots (1)$ $T_2 = -(2)^2 + b(2) + c$ $-2 = -4 + 2b + c$ $\therefore 2 = 2b + c \dots \dots (2)$ $(2-1) \dots \therefore b = 4$ <p>sub(1) ... $-2 = 4 + c$</p> $\therefore c = -6$ $\therefore T_n = -n^2 + 4n - 6$	<p>✓ second differences</p> <p>✓ $a = -1$</p> <p>✓ $b = 4$</p> <p>✓ $c = -6$</p>	(4)
	2.2.4	$T_n = -n^2 + 4n - 6$ $T_n = -[n^2 - 4n + 2^2 - 4 + 6]$ $T_n = -[(n-2)^2 + 2]$ $\therefore T_n = -(n-2)^2 - 2$ $\therefore T_n(\text{max}) = -2$ $\therefore \text{NO positive terms.}$	<p>✓ method</p> <p>✓ $T_n(\text{max})$</p>	(2)

[16]

QUESTION 3

3.1	$S_n = 4n^2 + 1$ $S_6 = 4(6)^2 + 1$ $\therefore S_6 = 145$ $S_5 = 4(5)^2 + 1$ $\therefore S_5 = 101$ $\therefore T_6 = S_6 - S_5$ $\therefore T_6 = 145 - 101$ $\therefore T_6 = 44$	<p>✓ value of S_6</p> <p>✓ value of S_5</p> <p>✓ answer</p>	(3)
3.2	$(4x-3) + (4x-3)^2 + (4x-3)^3$ $\therefore r = 4x-3$ $\therefore -1 < r < 1; \dots\dots\dots r \neq 0$ $-1 < 4x-3 < 1; \dots\dots\dots 4x-3 \neq 0$ $\therefore 2 < 4x < 4 \dots\dots\dots x \neq \frac{3}{4}$ $\therefore \frac{1}{2} < x < 1; \dots\dots\dots x \neq \frac{3}{4}$ <p>NOTE: No penalty if candidate does not state: $x \neq \frac{3}{4}$</p>	<p>✓ $r = 4x-3$</p> <p>✓ $-1 < r < 1$</p> <p>✓ answer</p>	(3)
3.3	$\sum_{k=3}^5 (-1)^k \cdot \frac{2}{k}$ $= (-1)^3 \cdot \frac{2}{3} + (-1)^4 \cdot \frac{2}{4} + (-1)^5 \cdot \frac{2}{5}$ $= -\frac{2}{3} + \frac{1}{2} - \frac{2}{5}$ $= -\frac{17}{30}$ <p>NOTE: Answer only, full marks.</p>	<p>✓ expansion</p> <p>✓ answer</p>	(2)
			[8]

QUESTION 4

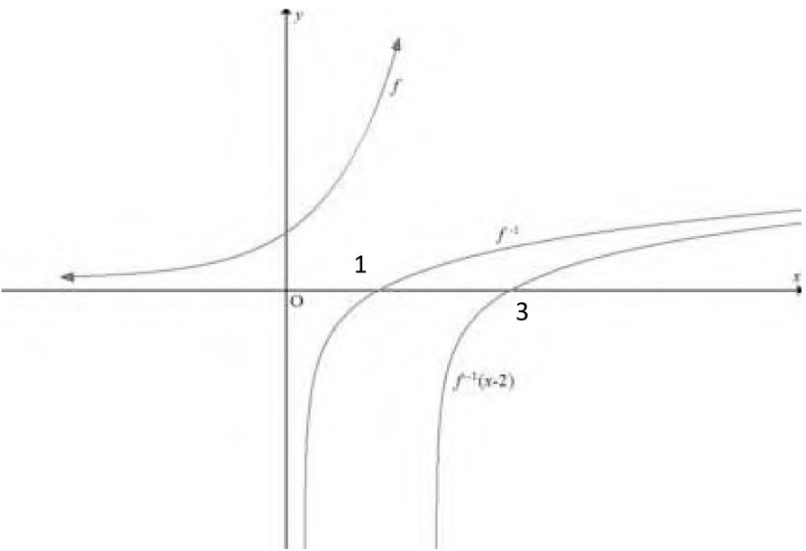
4.1	$x \in \mathbb{R}; x \neq -3$ NOTE: Both conditions must be stated.	✓ answer	(1)
4.2	$y \in \mathbb{R}; y \neq 2$ NOTE: Both conditions must be stated.	✓ answer	(1)
4.3	4.3.1 6 units right. NOTE: Accept 6 units, but not 6 units left.	✓ answer	(1)
	4.3.2 3,5 units upwards. NOTE: Accept 3,5 units, but not 3,5 units downwards.	✓ answer	(1)
4.4	$x = -3$ $y = -\frac{3}{2}$ NOTE: Do not accept any equating in terms of p and q.	✓ answer ✓ answer	(2)
4.5	$0 = \frac{6}{x+3} - 1,5$ $\frac{3}{2} = \frac{6}{x+3}$ $3(x+3) = 6(2)$ $3x+9 = 12$ $3x = 3$ $x = 1$ (1;0) NOTE: The answer does NOT need to be given in coordinate form.	✓ answer	(1)

4.6	<p>The graph shows a rational function with a vertical asymptote at $x = -3$ and a horizontal asymptote at $y = \frac{1}{2}$. The curve passes through the y-axis at $(0, 1)$ and the x-axis at $(3, 0)$. The branches are in the upper-right and lower-left regions relative to the asymptotes.</p>	<ul style="list-style-type: none"> ✓ asymptotes ✓ intercepts ✓ shape 	(3)
4.7	$y = -x + k$ $\therefore -\frac{3}{2} = -(-3) + k$ $-\frac{3}{2} = 3 + k$ $\therefore k = -\frac{9}{2}$	<ul style="list-style-type: none"> ✓ substitute point ✓ answer 	(2)
4.8	$x > -3$	✓ answer	(1)
4.9	$y = \frac{-6}{x+3} + \frac{3}{2}$ <p>OR</p> $y = \frac{6}{-x-3} + \frac{3}{2}$ <p>OR</p> $y = -\frac{6}{x+3} + \frac{3}{2}$	✓ answer	(1)
[14]			

QUESTION 5

5.1	$E\left(\frac{7}{2}; \frac{81}{4}\right)$	✓ answer	(1)
5.2	$f(x) = -\left(x - \frac{7}{2}\right)^2 + \frac{81}{4}$ $f(1) = -\left(1 - \frac{7}{2}\right)^2 + \frac{81}{4} = 14$ $f(5) = -\left(5 - \frac{7}{2}\right)^2 + \frac{81}{4} = 18$ $\therefore AG = \frac{f(5) - f(1)}{5 - 1}$ $= \frac{18 - 14}{4}$ $\therefore AG = 1$	✓ value of $f(1)$ ✓ value of $f(5)$ ✓ substitution ✓ answer	(4)
5.3	$f(x) = -\left(x - \frac{7}{2}\right)^2 + \frac{81}{4}$ $\therefore f(x) = -x^2 + 7x + 8$ $\because f(x) = g(x)$ $\therefore -x^2 + 7x + 8 = -3x + 24$ $-x^2 + 10x - 16 = 0$ $\therefore x^2 - 10x + 16 = 0$ $(x - 2)(x - 8) = 0$ $\therefore x = 2 \dots \text{or} \dots x = 8$ $\therefore x_D = 2$	✓ equating ✓ x-values ✓ answers/selection	(3)
5.4	$ST = f(x) - g(x)$ $ST = -x^2 + 7x + 8 - (-3x + 24)$ $ST = -x^2 + 7x + 8 + 3x - 24$ $ST = -x^2 + 10x - 16$	✓ method ✓ answer	(2)
5.5	For max: $\frac{d(ST)}{dx} = 0$ $\frac{d(ST)}{dx} = -2x + 10 = 0$ $2x = 10$ $\therefore x = 5$ $\text{max: } ST = -(5)^2 + 10(5) - 16$ $\therefore ST = 9$	✓ derivative = 0 ✓ value for x ✓ answer	(3)
			[13]

QUESTION 6

6.1	$y = 3^x$ Inverse $x = 3^y$ $\therefore y = \log_3 x$	✓ answer	(1)
6.2	$y = f^{-1}(x) = \log_3 x$ x-intercept: $\log_3 x = 0$ $\therefore x = 3^0$ $\therefore x = 1$ y-intercept: None $y = f^{-1}(x-2) = \log_3(x-2)$ x-intercept: $\log_3(x-2) = 0$ $\therefore x-2 = 3^0$ $\therefore x = 3$ y-intercept: None  <p>NOTE: If the candidate does not draw the graph but calculates both x-intercepts, award 2 marks.</p>	✓ x-intercept of $f^{-1}(x) = \log_3 x$ ✓ shape $f^{-1}(x) = \log_3 x$ ✓ x-intercept of $f^{-1}(x-2) = \log_3(x-2)$ ✓ shape $f^{-1}(x-2) = \log_3(x-2)$	(4)
6.3	$\log_3(x-2) < 1$ $\therefore 2 < x < 5$	✓ critical values ✓ correct notation	(2)
			[7]

QUESTION 7

7.1	$A = P(1+i)^n$ $6\,000\,000 = 5\,700\,000(1+i)^7$ $\frac{6\,000\,000}{5\,700\,000} = (1+i)^7$ $\sqrt[7]{1,0526\dots} = 1+i$ $\therefore i = 1,00735 - 1$ $\therefore i = 0,00735$ <p>rate: 0,74%</p>	<p>✓ substitution into correct formula</p> <p>✓ value of i</p> <p>✓ answer</p>	(3)
7.2	<p>7.2.1</p> $P_v = \frac{x[1-(1+i)^{-n}]}{i}$ $4\,000\,000 = \frac{30\,000 \left[1 - \left(1 + \frac{0,06}{12} \right)^{-n} \right]}{\frac{0,06}{12}}$ $\frac{4\,000\,000 \times \left(\frac{0,06}{12} \right)}{30\,000} = 1 - \left(1 + \frac{0,06}{12} \right)^{-n}$ $\frac{1}{3} = \left(1 + \frac{0,06}{12} \right)^{-n}$ $\log_{\left(1 + \frac{0,06}{12} \right)} \frac{1}{3} = -n$ $n = 220,27$ <p>\therefore she will make 220 withdrawals.</p>	<p>✓ substitution into correct formula</p> <p>✓ $i = \frac{0,06}{12}$</p> <p>✓ simplification</p> <p>✓ correct use of logs</p> <p>✓ answer of 220</p>	(5)

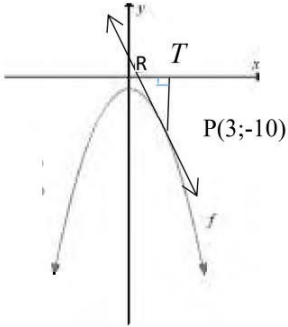
7.2.2	$4\,000\,000 = \frac{20\,000 \left[1 - \left(1 + \frac{0,06}{12} \right)^{-n} \right]}{\frac{0,06}{12}}$ $0 = \left(1 + \frac{0,06}{12} \right)^{-n}$ <p>She can make any number (an infinite number) of withdrawals.</p> <p>Her interest earned equals her withdrawal amount. She will only be drawing the interest amount.</p> <p style="text-align: center;">OR</p> $A = P(1+i)^n$ $A = 4\,000\,000 \left(1 + \frac{0,06}{12} \right)^1$ $A = R4\,020\,000$ <p>She can make any number (an infinite number) of withdrawals.</p> <p>Her interest earned equals her withdrawal amount. She will only be drawing the interest amount.</p>	<p>✓ valid method</p> <p>✓ simplification</p> <p>✓ explanation</p> <p style="text-align: center;">OR</p> <p>✓ valid method</p> <p>✓ answer</p> <p>✓ explanation</p>	(3)
7.3	$A = P(1+i)^n$ $A = 1\,000 \left(1 + \frac{0,15}{12} \right)^{18}$ $A = R1\,250,58$ $F_v = \frac{x[(1+i)^n - 1]}{i}$ $F_v = \frac{700 \left[\left(1 + \frac{0,15}{12} \right)^{18} - 1 \right]}{\frac{0,15}{12}}$ $F_v = R14\,032,33$ <p>Amount = R1 250,58 + R14 032,33</p> <p>∴ Amount = R15 282,91</p>	<p>✓ value of A</p> <p>✓ substitution in correct formula</p> <p>✓ value for F_v</p> <p>✓ answer</p>	(4)
[15]			

QUESTION 8

8.1	$f(x) = 3x^2 - 6$ $f(x+h) = 3(x+h)^2 - 6$ $f(x+h) = 3(x^2 + 2xh + h^2) - 6$ $f(x+h) = 3x^2 + 6xh + 3h^2 - 6$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 - 6 - 3x^2 + 6}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h}$ $f'(x) = \lim_{h \rightarrow 0} 6x + 3h$ $f'(x) = 6x$ <p>NOTE: Penalise 1 mark for notation error in this question only.</p>	<p>✓ $f(x+h)$</p> <p>✓ substitution</p> <p>✓ factorisation</p> <p>✓ answer</p>	(4)
8.2	$f(x) = (2\sqrt{x} - \frac{1}{x})^2$ $f(x) = 4x - 4 \cdot \frac{1}{\sqrt{x}} + \frac{1}{x^2}$ $f(x) = 4x - 4x^{\frac{1}{2}} + x^{-2}$ $\frac{d_y}{d_x} = 4 + 2x^{-\frac{3}{2}} - 2x^{-3}$ <p style="text-align: center;">OR</p> $\frac{d_y}{d_x} = 4 + \frac{2}{\sqrt{x^3}} - \frac{2}{x^3}$	<p>✓ simplification</p> <p>✓ $f(x) = 4x - 4x^{\frac{1}{2}} + x^{-2}$</p> <p>✓ 4</p> <p>✓ $2x^{-\frac{3}{2}}$ or $\frac{2}{\sqrt{x^3}}$</p> <p>✓ $-2x^{-3}$ or $\frac{2}{x^3}$</p>	(5)
8.3	$f(x) = 3x^3 - 3x^2 + 6x - 2$ $f'(x) = 9x^2 - 6x + 6$ $f''(x) = 18x - 6$ <p>for concave up</p> $18x - 6 > 0$ $\therefore x > \frac{1}{3}$	<p>✓ $f'(x)$</p> <p>✓ $f''(x)$</p> <p>✓ correct condition of concavity</p> <p>✓ answer</p>	(4)
[13]			

QUESTION 9

9.1	9.1.1	$f'(x) = -6x^2 - 6x + 12$ y-intercept $x = 0$ $\therefore f'(0) = 12$ $\therefore A(0 ; 12)$ NOTE: Does not have to be in coordinate form.	✓ answer	(1)
	9.1.2	x-intercepts $y = f'(x) = 0$ $-6x^2 - 6x + 12 = 0$ $\therefore x^2 + x - 2 = 0$ $(x + 2)(x - 1) = 0$ $\therefore x = -2 \dots \text{or} \dots x = 1$ $\therefore B(-2 ; 0) \quad ; \quad C(1 ; 0)$ NOTE: Must be in coordinate form.	✓ factors ✓ coordinates of B ✓ coordinates of C	(3)
	9.1.3	Turning points	✓ answer	(1)
	9.1.4	$f(x)$ increases where: $m = f'(x) > 0$ $\therefore -2 < x < 1$ OR $m = f'(x) > 0$ $\therefore x \in (-2 ; 1)$	✓ $m = f'(x) > 0$ ✓✓ answers OR ✓ $m = f'(x) > 0$ ✓✓ answers	(3)
	9.1.5	Point of inflection: $f''(x) = 0$ $\therefore -12x - 6 = 0$ $-12x = 6$ $\therefore x = -\frac{1}{2}$ $f(x) = -2x^3 - 3x^2 + 12x + 20$ $\therefore f(-\frac{1}{2}) = -2(-\frac{1}{2})^3 - 3(-\frac{1}{2})^2 + 12(-\frac{1}{2}) + 20$ $\therefore f(-\frac{1}{2}) = 13,5$	✓ $f''(x) = 0$ ✓ value for x ✓ substitution ✓ value for $f(-\frac{1}{2})$	(4)

9.2	$y = -x^2 - 1$ $\frac{d_y}{d_x} = -2x$ $\frac{d_y}{d_x} = -2(3)$ $\therefore \frac{d_y}{d_x} = -6$ $\therefore m_{PR} = -6$ $\therefore \frac{PT}{RT} = -6$ $\therefore \frac{-10}{RT} = -6$ $-6RT = -10$ $\therefore RT = \frac{5}{3}$ 	<p>✓ derivative</p> <p>✓ $\frac{d_y}{d_x} = -6$</p> <p>✓ $m_{PR} = -6$</p> <p>✓ substitution</p> <p>✓ answer</p>	(5)
[17]			

QUESTION 10

10.	$W(x) = -\frac{x^3}{150} + 3x^2 - 250x - 2700$ $\therefore \text{max :}$ $W'(x) = -\frac{3x^2}{150} + 6x - 250 = 0$ $-x^2 + 300x - 12500 = 0$ $\therefore x^2 - 300x + 12500 = 0$ $(x - 250)(x - 50) = 0$ $\therefore x = 250 \cdots \text{or} \cdots x = 50$ $W''(x) = -\frac{6x}{150} + 6$ $W''(x) = -\frac{x}{25} + 6$ $\therefore W''(50) = -\frac{50}{25} + 6 > 0$ $\therefore W''(250) = -\frac{250}{25} + 6 < 0$ $\therefore \text{Maximum profit: 250 bicycles weekly.}$	<p>✓ $W'(x)$</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ values of x</p> <p>✓ $W''(x)$</p> <p>✓ $W''(50) > 0$</p> <p>✓ $W''(250) < 0$</p> <p>✓ conclusion</p>	
[8]			

QUESTION 11

NOTE: Candidates can present solutions either in decimal or fraction form. Do not penalise for rounding-off.

11.1	11.1.1	For independent events: $P(A) \times P(B) = P(A \text{ en } B)$ $\therefore (x + 0,1) \times (0,4) = (0,1)$ $\therefore (x + 0,1) = 0,25$ $\therefore x = 0,15$ $x + 0,1 + 0,3 + y = 1$ $0,15 + 0,1 + 0,3 + y = 1$ $\therefore y = 0,45$	✓ correct substitution ✓ value for x ✓ method ✓ value for y	(4)
	11.1.2	$0,15 + 0,3$ $= 0,45$ NOTE: Answer only, full marks.	✓ answer	(1)
11.2	<p>F (unsuccessful)/P (pass/succeed)</p>			
	11.2.1	$\frac{4}{7} \times \frac{3}{5} = \frac{12}{35}$ NOTE: Answer only, full marks.	✓ method ✓ answer	(2)
	11.2.2	$\frac{4}{7} \times \frac{2}{5} \times \frac{3}{5} = \frac{24}{175}$ NOTE: Answer only, full marks.	✓ method ✓ answer	(2)
[9]				

QUESTION 12

12.1	12.1.1	1 NOTE: Accept 2.	✓ answer	(1)
	12.1.2	$7! - (2! \times 6!) = 3\,600$ NOTE: Accept answer as 3 600 or $7! - (2! \times 6!)$ No CA if method is meaningless.	✓ 7! ✓ $-(2! \times 6!)$ ✓ answer	(3)
12.2	P(win) $= 0,7 \times 0,9 + 0,3 \times 0,45$ $= 0,765$ $= 76,5\%$ NOTE: No CA if method is meaningless.		method answer	(2)
				[6]
TOTAL:				150

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SEPTEMBER EXAM PAPER 1

25 AUGUST 2023

MARKS: 150

This marking guideline consists of 14 pages.

QUESTION 1

1.1.1	$x(x + 2) = 0$ $x = 0$ OR/OF $x = -2$	$\checkmark x = 0$ $\checkmark x = -2$ (2)
1.1.2	$x^2 + 2x \geq 0$ $x(x + 2) \geq 0$  $\therefore x > 0$	$\checkmark x^2 + 2x \geq 0$ \checkmark graph/grafiek/ critical pts $\checkmark x > 0$ If $x \geq 0$ only 1 mark Indien $x \geq 0$ slegs 1 punt (3)
1.2	$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-7)}}{2(2)}$ $= \frac{3 \pm \sqrt{65}}{4}$ $x = 2,77$ OR/OF $x = -1,27$	\checkmark substitution into correct formula/ <i>substitusie in korrekte formule</i> \checkmark simplify $\checkmark 2,77$ $\checkmark -1,27$ If left in surd form only 2 marks. Indien in wortelvorm, slegs 2 punte. (4)
1.3.1	$k^2 + 5k - 14 = 0$ $(k - 2)(k + 7) = 0$ $k = 2$ or $k = -7$	\checkmark multiplying \checkmark factorising \checkmark both solutions (3)
1.3.2	$\sqrt{x+5} = 2$ or $\sqrt{x+5} = -7$ $x+5 = 4$ or invalid/ no solution $x = -1$	\checkmark substitution \checkmark identifying invalid \checkmark value of x
1.4	$x - 2y - 3 = 0$ (1) $4x^2 - 5xy + y^2 = 0$ (2) From eq (1): $x = 2y + 3$... (3) Subst. (3) into (2): $\therefore 4(2y + 3)^2 - 5y(2y + 3) + y^2 = 0$ $\therefore 4(4y^2 + 12y + 9) - 5y(2y + 3) + y^2 = 0$ $\therefore 16y^2 + 48y + 36 - 10y^2 - 15y + y^2 = 0$ $\therefore 7y^2 + 33y + 36 = 0$ $\therefore (7y + 12)(y + 3) = 0$ $\therefore y = \frac{-12}{7}$ or $y = -3$ $\therefore x = \frac{-3}{7}$ or $x = -3$	\checkmark equation (3) \checkmark substitution \checkmark simplification \checkmark standard form \checkmark factors \checkmark both y values \checkmark both x-values (7)

1.5	For real roots : $4 - 20k \geq 0$ $\therefore -20k \geq -4$ $\therefore k \leq \frac{1}{5}$	$\checkmark 4 - 20k \geq 0$ \checkmark Answer (2)
[24]		

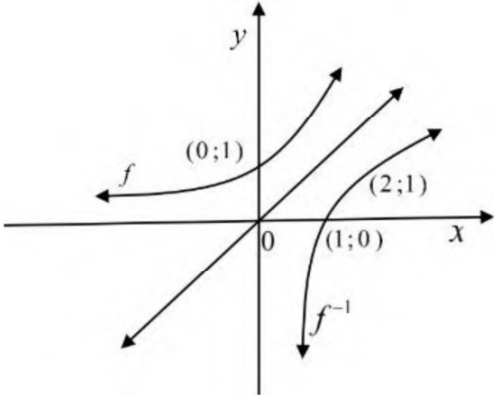
QUESTION 2

2.1.1	$1; -5; -13; -23$ $-6 \quad -8 \quad -10$ $-2 \quad -2$ $2a = -2 \quad 3a + b = -6 \quad a + b + c = 1$ $a = -1 \quad 3(-1) + b = 5 \quad -1 - 3 + c = 1$ $b = -3 \quad c = 5$ $T_n = -n^2 - 3n + 5$	\checkmark Value of a \checkmark Value of b \checkmark Value of c \checkmark General term (3)
2.1.2	$-n^2 - 3n + 5 = -643$ $n^2 + 3n - 648 = 0$ $(n + 27)(n - 24) = 0$ $n = -27$ or $n = 24$ $\therefore T_{24} = -643$	\checkmark equating \checkmark factors \checkmark answer (3)
2.2.1	$3k - (2k + 1) = 5k - 5 - 3k$ $k - 1 = 2k - 5$ $k = 4$	\checkmark Difference \checkmark answer (2)
2.2.2	$9, 12, 15$ $T_n = 3n + 6$ $\sum_{n=1}^{20} (3n + 6)$	\checkmark Sequence \checkmark General term \checkmark Sigma Notation (3)

2.3.1	$r = \frac{4x^4}{8x^3}$ $r = \frac{x}{2}$ $-1 < r < 1$ $-1 < \frac{x}{2} < 1$ $-2 < x < 2$	<ul style="list-style-type: none"> ✓ value of r ✓ Condition for converging series ✓ answer (3)
2.3.2	$S_{\infty} = \frac{a}{1-r}$ $S_{\infty} = \frac{8x^2}{1-\frac{x}{2}}$ $\frac{8}{3}\left(1-\frac{x}{2}\right) = 8x^2$ $\frac{8}{3} - \frac{8x}{6} = 8x^2$ $16 - 8x = 48x^2$ $48x^2 + 8x - 16 = 0$ $6x^2 + x - 2 = 0$ $(3x+2)(2x-1) = 0$ $x = -\frac{2}{3} \text{ or } x = \frac{1}{2}$	<ul style="list-style-type: none"> ✓ Substitution into the correct formula ✓ Standard form ✓ Factors ✓ Answers (4)
2.4.1	$a+2d=ar$ $1+2d=1r$ $d = \frac{r-1}{2} \longrightarrow 1+12\left(\frac{r-1}{2}\right) = r^2$ $1+6r-6 = r^2$ $r^2 - 6r + 5 = 0$ $(r-1)(r-5) = 0$ $r = 1 \text{ or } r = 5$ <p>1; 5; 25 OR</p> $r = 1 + 2d \longrightarrow 1 + 12d = r^2$ $1 + 12d = (1 + 2d)^2$ $= 1 + 4d + 4d^2$ $4d^2 - 8d = 0$ $4d(d-2) = 0$ $d = 0 \text{ or } d = 2$ $r = 1 + 2(0) = 1 \quad r = 1 + 2(2) = 5$ <p>1; 5; 25</p>	<ul style="list-style-type: none"> ✓ $a+2d=ar$ ✓ $a+12d=ar^2$ ✓ values of d ✓ standard form ✓ factors ✓ values of r ✓ sequence ✓ $a+2d=ar$ ✓ $a+12d=ar^2$ ✓ values of r ✓ standard form ✓ factors ✓ values of d ✓ sequence (6)

2.4.2	$S_n = \frac{a(r^n - 1)}{r - 1}$ $S_7 = \frac{1(5^7 - 1)}{5 - 1}$ $= 19531$	✓ substitute in correct formula ✓ answer (2)
		[27]

QUESTION 3

3.1	$y = 2^x$ $x = 0$ $\therefore f(0) = 2^0 = 1$ $\therefore C(0;1)$ y - intercept: $g(x) = -(x-1)^2 + q$ $C(0;1)$ $1 = -(0-1)^2 + q$ $1 = -1 + q$ $\therefore q = 2$	✓ substitute $x = 0$ and $y = 0$ into correct formula ✓ $x = -4$ ✓ $y = -2$ ✓ Symmetry $E(4; 0)$ (4)
3.2	$g(x) = -(x-1)^2 + 2$ $D(1; 2)$	✓✓ answer /antwoord (2)
3.3	$t = 2$	✓ answer/antwoord (1)
3.4	$f^{-1} : x = 2^y$ $\therefore y = \log_2 x$	✓✓ answer/antwoord (2)
3.5		✓ form of the graph /vorm van die grafiek ✓ x - intercept/afsnit ✓ any other coordinate on the graph /enige ander koördinaat op die grafiek (3)
3.6	$g(x) = -(x-1)^2 + 2$ $g(x+1) - 2 = -(x-1+1)^2 + 2 - 2$ $\therefore h(x) = -x^2$	✓ +1 and - 2 ✓ answer:antwoord (2)
3.7	Domain: $x \geq 0$ or $x \leq 0$	✓ Answer (1)
		[08]

QUESTION 4

4		
4.1	$f(x) = \frac{2+x}{x-1}$ $f(x) = \frac{x-1+3}{x-1}$ $f(x) = \frac{x-1}{x-1} + \frac{3}{x-1}$ $f(x) = \frac{3}{x-1} + 1$	$\checkmark \frac{x-1+3}{x-1}$ $\checkmark \frac{x-1}{x-1} + \frac{3}{x-1}$ $\checkmark f(x) = \frac{3}{x-1} + 1 \quad (3)$
4.2	$x = 1$ $y = 1$	$\checkmark x = 1$ $\checkmark y = 1(2)$
4.3	$0 = \frac{2+x}{x-1}$ $0 = 2+x$ $x = -2$ $A(-2; 0)$	$\checkmark y = 0$ $\checkmark x = -2 \quad (2)$
		[07]

QUESTION 5

5.1.1	$x = \left(\frac{1}{3}\right)^y$ $f^{-1}(x) = \log_{\frac{1}{3}} x$ OF $f^{-1}(x) = -\log_3 x$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Slegs Antwoord: Volpunte</div>	$\checkmark x = \left(\frac{1}{3}\right)^y$ $\checkmark \checkmark$ antwoord (3)
5.1.2		$f(x) = \left(\frac{1}{3}\right)^x :$ \checkmark vorm \checkmark y-afsnit $f^{-1}(x) = \log_{\frac{1}{3}} x:$ \checkmark vorm \checkmark x-afsnit (4)
5.2	$p(-3) = 10$ en $p'(x) = -2$ $p(x) = -2x + c$ $10 = -2(-3) + c$ $\therefore c = 16$ $p(x) = y = -2x + 16$ $x = -2y + 16$ $p^{-1}(x) = -\frac{1}{2}x + 8$	$\checkmark m = -2$ $\checkmark c = 16$ \checkmark omruil van x en y $(x = -2y + 16)$ \checkmark antwoord (4)
		[10]

QUESTION 6

6.1	$F = \frac{x[(1+i)^n - 1]}{i}$ $= \frac{2500 \left[\left(1 + \frac{0,06}{12}\right)^{60} - 1 \right]}{\frac{0,06}{12}}$ $= R174\,425,08$	<ul style="list-style-type: none"> ✓ $n = 60$ and $i = \frac{0,06}{12} / 0,005$ ✓ correct substitution into correct formula ✓ answer <p style="text-align: right;">(3)</p>
6.2.1	<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"> ✓ $n = 11$ ✓ correct substitution into correct formula ✓ answer <p style="text-align: right;">(3)</p>
6.2.2	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $94\,006,79 = \frac{3\,200 \left[1 - \left(1 + \frac{0,15}{12}\right)^{-n} \right]}{\frac{0,15}{12}}$ $\frac{94\,006,79}{3\,200} \times \frac{0,15}{12} = 1 - \left(1 + \frac{0,15}{12}\right)^{-n}$ $\left(1 + \frac{0,15}{12}\right)^{-n} = 1 - 0,3672147\dots$ $-n \log \left(1 + \frac{0,15}{12}\right) = \log 0,6327852\dots$ $-n = -36,8382\dots$ $n = 36,84$ <p>Genevieve will have to pay 36 installments of R3 200</p>	<ul style="list-style-type: none"> ✓ 94006,79 ✓ substitute into correct formula ✓ correct use of logs (logs to be defined) ✓ $n = 36,84$ ✓ 36 installments <p style="text-align: right;">(5)</p>

6.2.3

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

$$= \frac{3200 \left[1 - \left(1 + \frac{0,15}{12} \right)^{-0,83826912} \right]}{\frac{0,15}{12}}$$

$$P = 2652$$

Outstanding balance after 36 installments is R2 652

Final payment will be:

$$A = 2652,00 \left(1 + \frac{0,15}{12} \right)^1$$

$$= R\ 2685,00$$

OR/OF

$$\text{Balance : } 94006,79 \left(1 + \frac{0,15}{12} \right)^{36} - \frac{3\ 200 \left[\left(1 + \frac{0,15}{12} \right)^{36} - 1 \right]}{\frac{0,15}{12}}$$

$$= R2\ 651,72$$

Final payment will be:

$$A = 2651,72 \left(1 + \frac{0,15}{12} \right)^1$$

$$= R\ 2\ 685,00$$

$$\checkmark n = -083826912$$

✓ substitute into correct formula

✓ answer

$$\checkmark 2\ 652,00 \left(1 + \frac{0,15}{12} \right)^1$$

✓ answer

OR/OF

$$\checkmark 94006,79 \left(1 + \frac{0,15}{12} \right)^{36}$$

$$\checkmark \frac{3\ 200 \left[\left(1 + \frac{0,15}{12} \right)^{36} - 1 \right]}{\frac{0,15}{12}}$$

✓ 2 651,72

$$\checkmark 2651,72 \left(1 + \frac{0,15}{12} \right)^1$$

✓ answer

(5)

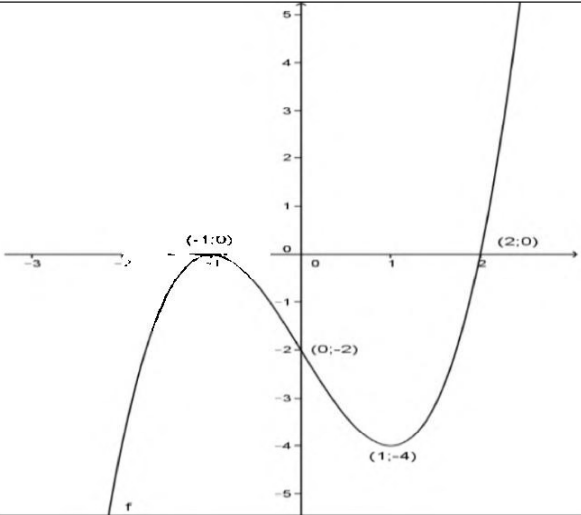
[16]

QUESTION 7

7.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2(x+h)^2 - (-2x^2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 + 2x^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2h(4x+h)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-4x-h}{1}$ $f'(x) = -4x$	<ul style="list-style-type: none"> ✓ Substitution into correct formula ✓ Expansion ✓ Factoring ✓ Applying limits ✓ Answer
7.2.1	$y = \frac{2x^2}{x^{\frac{1}{2}}} - \frac{1}{x^{\frac{1}{2}}}$ $y = 2x^{\frac{3}{2}} - x^{-\frac{1}{2}} \checkmark$ $\frac{dy}{dx} = 3x^{\frac{1}{2}} + \frac{1}{2}x^{-\frac{3}{2}}$	<ul style="list-style-type: none"> ✓ Simplified to binomial. ✓ $3x^{\frac{1}{2}}$ ✓ $+\frac{1}{2}x^{-\frac{3}{2}}$ (3)
7.2.2	$D_x[9x^2 - 12x + 4]$ $= 18x - 12$	<ul style="list-style-type: none"> ✓ $9x^2 - 12x + 4$ ✓ $18x$ ✓ -12 (3)
7.3	$y = x^{-2}$ $\frac{dy}{dx} = -2x^{-3} = -\frac{2}{x^3}$ <p>Therefore $\frac{dy}{dx} < 0$ for $x > 0$</p>	<ul style="list-style-type: none"> ✓ $-2x^{-3}$ ✓ $-\frac{2}{x^3}$ ✓ $\frac{dy}{dx} < 0$ for $x > 0$ (3)
[14]		

QUESTION 8

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8.1		<ul style="list-style-type: none"> ✓ (-1; 0) ✓ (2; 0) ✓ (0; -2) ✓ (1; -4) ✓ shape <p style="text-align: right;">(5)</p>
8.2	$-1 < x < 1$	(2)
8.3	Pt. of inflection: "halfway" between turning points(x-values) $\therefore x = \frac{-1+1}{2}$ $\therefore x = 0$	<ul style="list-style-type: none"> ✓ $x = \frac{-1+1}{2}$ ✓ $x = 0$ (2)
8.4	$f''(x) > 0$ $\therefore x > 0$	<ul style="list-style-type: none"> ✓ $f''(x) > 0$ ✓ $x > 0$ (2)
		[11]

QUESTION 9

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9.1	<p>There are four horizontal bars and three vertical bars.</p> $\Rightarrow 4y + 3h = 12$ $4y = 12 - 3h$ $y = \frac{1}{4}(12 - 3h)$	<p>✓ $4y + 3h$</p> <p>✓ $4y + 3h = 12$ (2)</p>
9.2	$\text{Area} = lb$ $= yh$ $= \frac{1}{4}(12 - 3h)h$ $= 3h - \frac{3}{4}h^2$	<p>✓ $A=yh$</p> <p>✓ Subst of y</p> <p>✓ simplification</p> <p>(3)</p>
9.3	$\text{Area} = 3h - \frac{3}{4}h^2$ $\frac{dA}{dh} = 3 - \frac{3}{2}h$ $\frac{dA}{dh} = 0$ $3 - \frac{3}{2}h = 0$ $h = 2$ $y = \frac{1}{4}(12 - 3(2))$ $= \frac{3}{2}$	<p>✓ derivative</p> <p>✓ equating to 0</p> <p>✓ $h = 2$</p> <p>✓ subst of h</p> <p>✓ value of y</p> <p>(5)</p>
		[10]

QUESTION 10

10.1	$\frac{10!}{2.2.2} = 453600$	$\checkmark \frac{10!}{2! \cdot 2! \cdot 2!}$ \checkmark Answer (2)
10.2	$\frac{8!}{4} = 10080$	$\checkmark \frac{8!}{4}$ \checkmark Answer (2)
10.3	Same letters are together in 2.2.2.7! ways = $\text{Probability} = \frac{8 \cdot 7!}{10!} = \frac{4}{45}$ $\frac{8}{8}$ So required probability is $\frac{41}{45}$ OR Same letters not together is 41380 ways Probability required is $\frac{41}{45}$	\checkmark Same letters together \checkmark Probability of same letters together \checkmark Answer OR \checkmark Same letter together \checkmark Same letter not together \checkmark Answer (3)
		[07]

QUESTION 11

11.1.1	$P(A \text{ or } B) = P(A) + P(B)$ $0.88 = 0.5 + x$ $x = 0.38$	\checkmark subst into correct formula \checkmark answer (2)
11.1.2	$P(A \text{ or } B) = P(A) + P(B) - P(A) \cdot P(B)$ $0.88 = 0.5 + x - 0.5x$ $0.38 = 0.5x$ $x = 0,76$	\checkmark subst into correct formula \checkmark 0.5x \checkmark answer (3)

11.2.1		<ul style="list-style-type: none"> ✓ 25% for C ✓ Correct outcomes to represent win/lose ✓ Correct diagram (3)
11.2.2	<p>Probability of winning</p> $P(W) = P(R \text{ and } W) \text{ or } P(S \text{ and } L) \text{ or } P(C \text{ and } W)$ $= 30\% \times 24\% + 45\% \times 65\% + 25\% \times 67\%$ $= \frac{1889}{2000}$ $= 0.9445 \text{ OR } \frac{1889}{2000}$	<ul style="list-style-type: none"> ✓ $30\% \times 24\% + 45\% \times 65\% + 25\% \times 67\%$ ✓ . ✓ answer <p>(3)</p>
[11]		

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MOCK EXAM


SEPTEMBER EXAM PAPER 1

25 AUGUST 2023

MARKS: 150

This marking guideline consists of 14 pages.

QUESTION 1

1.1.1	$x(x + 2) = 0$ $x = 0$ OR/OF $x = -2$	$\checkmark x = 0$ $\checkmark x = -2$ (2)
1.1.2	$x^2 + 2x \geq 0$ $x(x + 2) \geq 0$  $\therefore x > 0$	$\checkmark x^2 + 2x \geq 0$ \checkmark graph/grafiek/ critical pts $\checkmark x > 0$ If $x \geq 0$ only 1 mark Indien $x \geq 0$ slegs 1 punt (3)
1.2	$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-7)}}{2(2)}$ $= \frac{3 \pm \sqrt{65}}{4}$ $x = 2,77$ OR/OF $x = -1,27$	\checkmark substitution into correct formula/ <i>substitusie in korrekte formule</i> \checkmark simplify $\checkmark 2,77$ $\checkmark -1,27$ If left in surd form only 2 marks. Indien in wortelvorm, slegs 2 punte. (4)
1.3.1	$k^2 + 5k - 14 = 0$ $(k - 2)(k + 7) = 0$ $k = 2$ or $k = -7$	\checkmark multiplying \checkmark factorising \checkmark both solutions (3)
1.3.2	$\sqrt{x+5} = 2$ or $\sqrt{x+5} = -7$ $x+5 = 4$ or invalid/ no solution $x = -1$	\checkmark substitution \checkmark identifying invalid \checkmark value of x
1.4	$x - 2y - 3 = 0$ (1) $4x^2 - 5xy + y^2 = 0$ (2) From eq (1): $x = 2y + 3$...(3) Subst. (3) into (2): $\therefore 4(2y + 3)^2 - 5y(2y + 3) + y^2 = 0$ $\therefore 4(4y^2 + 12y + 9) - 5y(2y + 3) + y^2 = 0$ $\therefore 16y^2 + 48y + 36 - 10y^2 - 15y + y^2 = 0$ $\therefore 7y^2 + 33y + 36 = 0$ $\therefore (7y + 12)(y + 3) = 0$ $\therefore y = \frac{-12}{7}$ or $y = -3$ $\therefore x = \frac{-3}{7}$ or $x = -3$	\checkmark equation (3) \checkmark substitution \checkmark simplification \checkmark standard form \checkmark factors \checkmark both y values \checkmark both x-values (7)

1.5	For real roots : $4 - 20k \geq 0$ $\therefore -20k \geq -4$ $\therefore k \leq \frac{1}{5}$	$\checkmark 4 - 20k \geq 0$ \checkmark Answer (2)
[24]		

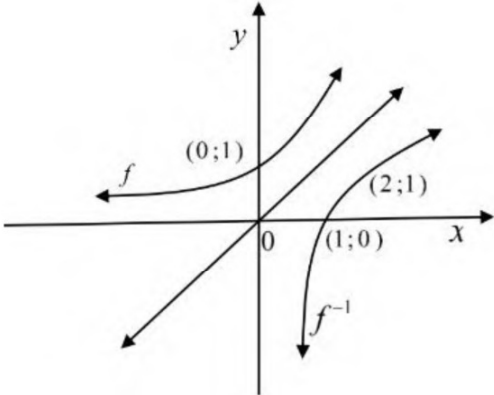
QUESTION 2

2.1.1	$1; -5; -13; -23$ $-6 \quad -8 \quad -10$ $-2 \quad -2$ $2a = -2 \quad 3a + b = -6 \quad a + b + c = 1$ $a = -1 \quad 3(-1) + b = 5 \quad -1 - 3 + c = 1$ $b = -3 \quad c = 5$ $T_n = -n^2 - 3n + 5$	\checkmark Value of a \checkmark Value of b \checkmark Value of c \checkmark General term (3)
2.1.2	$-n^2 - 3n + 5 = -643$ $n^2 + 3n - 648 = 0$ $(n + 27)(n - 24) = 0$ $n = -27$ or $n = 24$ $\therefore T_{24} = -643$	\checkmark equating \checkmark factors \checkmark answer (3)
2.2.1	$3k - (2k + 1) = 5k - 5 - 3k$ $k - 1 = 2k - 5$ $k = 4$	\checkmark Difference \checkmark answer (2)
2.2.2	$9, 12, 15$ $T_n = 3n + 6$ $\sum_{n=1}^{20} (3n + 6)$	\checkmark Sequence \checkmark General term \checkmark Sigma Notation (3)

2.3.1	$r = \frac{4x^4}{8x^3}$ $r = \frac{x}{2}$ $-1 < r < 1$ $-1 < \frac{x}{2} < 1$ $-2 < x < 2$	<ul style="list-style-type: none"> ✓ value of r ✓ Condition for converging series ✓ answer (3)
2.3.2	$S_{\infty} = \frac{a}{1-r}$ $S_{\infty} = \frac{8x^2}{1-\frac{x}{2}}$ $\frac{8}{3}\left(1-\frac{x}{2}\right) = 8x^2$ $\frac{8}{3} - \frac{8x}{6} = 8x^2$ $16 - 8x = 48x^2$ $48x^2 + 8x - 16 = 0$ $6x^2 + x - 2 = 0$ $(3x+2)(2x-1) = 0$ $x = -\frac{2}{3} \text{ or } x = \frac{1}{2}$	<ul style="list-style-type: none"> ✓ Substitution into the correct formula ✓ Standard form ✓ Factors ✓ Answers (4)
2.4.1	$a+2d=ar$ $1+2d=1r$ $d = \frac{r-1}{2} \longrightarrow 1+12\left(\frac{r-1}{2}\right) = r^2$ $1+6r-6 = r^2$ $r^2 - 6r + 5 = 0$ $(r-1)(r-5) = 0$ $r = 1 \text{ or } r = 5$ <p>1; 5; 25 OR</p> $r = 1 + 2d \longrightarrow 1 + 12d = r^2$ $1 + 12d = (1 + 2d)^2$ $= 1 + 4d + 4d^2$ $4d^2 - 8d = 0$ $4d(d-2) = 0$ $d = 0 \text{ or } d = 2$ $r = 1 + 2(0) \quad r = 1 + 2(2)$ $= 1 \quad = 5$ <p>1; 5; 25</p>	<ul style="list-style-type: none"> ✓ $a+2d=ar$ ✓ $a+12d=ar^2$ ✓ values of d ✓ standard form ✓ factors ✓ values of r ✓ sequence ✓ $a+2d=ar$ ✓ $a+12d=ar^2$ ✓ values of r ✓ standard form ✓ factors ✓ values of d ✓ sequence (6)

2.4.2	$S_n = \frac{a(r^n - 1)}{r - 1}$ $S_7 = \frac{1(5^7 - 1)}{5 - 1}$ $= 19531$	✓ substitute in correct formula ✓ answer (2)
		[27]

QUESTION 3

3.1	$y = 2^x$ $x = 0$ $\therefore f(0) = 2^0 = 1$ $\therefore C(0;1)$ y - intercept: $g(x) = -(x-1)^2 + q$ $C(0;1)$ $1 = -(0-1)^2 + q$ $1 = -1 + q$ $\therefore q = 2$	✓ substitute $x = 0$ and $y = 0$ into correct formula ✓ $x = -4$ ✓ $y = -2$ ✓ Symmetry $E(4; 0)$ (4)
3.2	$g(x) = -(x-1)^2 + 2$ $D(1; 2)$	✓✓ answer /antwoord (2)
3.3	$t = 2$	✓ answer/antwoord (1)
3.4	$f^{-1} : x = 2^y$ $\therefore y = \log_2 x$	✓✓ answer/antwoord (2)
3.5		✓ form of the graph /vorm van die grafiek ✓ x - intercept/afsnit ✓ any other coordinate on the graph /enige ander koördinaat op die grafiek (3)
3.6	$g(x) = -(x-1)^2 + 2$ $g(x+1) - 2 = -(x-1+1)^2 + 2 - 2$ $\therefore h(x) = -x^2$	✓ +1 and - 2 ✓ answer:antwoord (2)
3.7	Domain: $x \geq 0$ or $x \leq 0$	✓ Answer (1)
		[08]

QUESTION 4

4		
4.1	$f(x) = \frac{2+x}{x-1}$ $f(x) = \frac{x-1+3}{x-1}$ $f(x) = \frac{x-1}{x-1} + \frac{3}{x-1}$ $f(x) = \frac{3}{x-1} + 1$	$\checkmark \frac{x-1+3}{x-1}$ $\checkmark \frac{x-1}{x-1} + \frac{3}{x-1}$ $\checkmark f(x) = \frac{3}{x-1} + 1 \quad (3)$
4.2	$x = 1$ $y = 1$	$\checkmark x = 1$ $\checkmark y = 1(2)$
4.3	$0 = \frac{2+x}{x-1}$ $0 = 2+x$ $x = -2$ $A(-2; 0)$	$\checkmark y = 0$ $\checkmark x = -2 \quad (2)$
		[07]

QUESTION 5

5.1.1	$x = \left(\frac{1}{3}\right)^y$ $f^{-1}(x) = \log_{\frac{1}{3}} x$ OF $f^{-1}(x) = -\log_3 x$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Slegs Antwoord: Volpunte</div>	$\checkmark x = \left(\frac{1}{3}\right)^y$ $\checkmark \checkmark$ antwoord (3)
5.1.2		$f(x) = \left(\frac{1}{3}\right)^x$: \checkmark vorm \checkmark y-afsnit $f^{-1}(x) = \log_{\frac{1}{3}} x$: \checkmark vorm \checkmark x-afsnit (4)
5.2	$p(-3) = 10$ en $p'(x) = -2$ $p(x) = -2x + c$ $10 = -2(-3) + c$ $\therefore c = 16$ $p(x) = y = -2x + 16$ $x = -2y + 16$ $p^{-1}(x) = -\frac{1}{2}x + 8$	$\checkmark m = -2$ $\checkmark c = 16$ \checkmark omruil van x en y $(x = -2y + 16)$ \checkmark antwoord (4)
		[10]

QUESTION 6

6.1	$F = \frac{x[(1+i)^n - 1]}{i}$ $= \frac{2500 \left[\left(1 + \frac{0,06}{12}\right)^{60} - 1 \right]}{\frac{0,06}{12}}$ $= R174\,425,08$	<ul style="list-style-type: none"> ✓ $n = 60$ and $i = \frac{0,06}{12} / 0,005$ ✓ correct substitution into correct formula ✓ answer <p style="text-align: right;">(3)</p>
6.2.1	<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"> ✓ $n = 11$ ✓ correct substitution into correct formula ✓ answer <p style="text-align: right;">(3)</p>
6.2.2	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $94\,006,79 = \frac{3\,200 \left[1 - \left(1 + \frac{0,15}{12}\right)^{-n} \right]}{\frac{0,15}{12}}$ $\frac{94\,006,79}{3\,200} \times \frac{0,15}{12} = 1 - \left(1 + \frac{0,15}{12}\right)^{-n}$ $\left(1 + \frac{0,15}{12}\right)^{-n} = 1 - 0,3672147\dots$ $-n \log \left(1 + \frac{0,15}{12}\right) = \log 0,6327852\dots$ $-n = -36,8382\dots$ $n = 36,84$ <p>Genevieve will have to pay 36 installments of R3 200</p>	<ul style="list-style-type: none"> ✓ 94006,79 ✓ substitute into correct formula ✓ correct use of logs (logs to be defined) ✓ $n = 36,84$ ✓ 36 installments <p style="text-align: right;">(5)</p>

6.2.3

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

$$= \frac{3200 \left[1 - \left(1 + \frac{0,15}{12} \right)^{-0,83826912} \right]}{\frac{0,15}{12}}$$

$$P = 2652$$

Outstanding balance after 36 installments is R2 652

Final payment will be:

$$A = 2652,00 \left(1 + \frac{0,15}{12} \right)^1$$

$$= R\ 2685,00$$

OR/OF

$$\text{Balance : } 94006,79 \left(1 + \frac{0,15}{12} \right)^{36} - \frac{3\ 200 \left[\left(1 + \frac{0,15}{12} \right)^{36} - 1 \right]}{\frac{0,15}{12}}$$

$$= R2\ 651,72$$

Final payment will be:

$$A = 2651,72 \left(1 + \frac{0,15}{12} \right)^1$$

$$= R\ 2\ 685,00$$

$$\checkmark n = -083826912$$

✓ substitute into correct formula

✓ answer

$$\checkmark 2\ 652,00 \left(1 + \frac{0,15}{12} \right)^1$$

✓ answer

OR/OF

$$\checkmark 94006,79 \left(1 + \frac{0,15}{12} \right)^{36}$$

$$\checkmark \frac{3\ 200 \left[\left(1 + \frac{0,15}{12} \right)^{36} - 1 \right]}{\frac{0,15}{12}}$$

✓ 2 651,72

$$\checkmark 2\ 651,72 \left(1 + \frac{0,15}{12} \right)^1$$

✓ answer

(5)

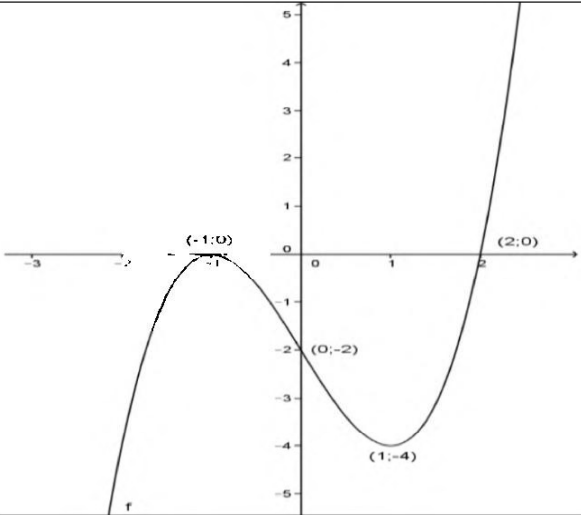
[16]

QUESTION 7

7.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2(x+h)^2 - (-2x^2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 + 2x^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2h(4x+h)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-4x-h}{1}$ $f'(x) = -4x$	<ul style="list-style-type: none"> ✓ Substitution into correct formula ✓ Expansion ✓ Factoring ✓ Applying limits ✓ Answer
7.2.1	$y = \frac{2x^2}{x^{\frac{1}{2}}} - \frac{1}{x^{\frac{1}{2}}}$ $y = 2x^{\frac{3}{2}} - x^{-\frac{1}{2}} \checkmark$ $\frac{dy}{dx} = 3x^{\frac{1}{2}} + \frac{1}{2}x^{-\frac{3}{2}}$	<ul style="list-style-type: none"> ✓ Simplified to binomial. ✓ $3x^{\frac{1}{2}}$ ✓ $+\frac{1}{2}x^{-\frac{3}{2}}$ (3)
7.2.2	$D_x[9x^2 - 12x + 4]$ $= 18x - 12$	<ul style="list-style-type: none"> ✓ $9x^2 - 12x + 4$ ✓ $18x$ ✓ -12 (3)
7.3	$y = x^{-2}$ $\frac{dy}{dx} = -2x^{-3} = -\frac{2}{x^3}$ <p>Therefore $\frac{dy}{dx} < 0$ for $x > 0$</p>	<ul style="list-style-type: none"> ✓ $-2x^{-3}$ ✓ $-\frac{2}{x^3}$ ✓ $\frac{dy}{dx} < 0$ for $x > 0$ (3)
[14]		

QUESTION 8

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8.1		<ul style="list-style-type: none"> ✓ (-1; 0) ✓ (2; 0) ✓ (0; -2) ✓ (1; -4) ✓ shape <p style="text-align: right;">(5)</p>
8.2	$-1 < x < 1$	(2)
8.3	Pt. of inflection: "halfway" between turning points(x-values) $\therefore x = \frac{-1+1}{2}$ $\therefore x = 0$	<ul style="list-style-type: none"> ✓ $x = \frac{-1+1}{2}$ ✓ $x = 0$ (2)
8.4	$f''(x) > 0$ $\therefore x > 0$	<ul style="list-style-type: none"> ✓ $f''(x) > 0$ ✓ $x > 0$ (2)
		[11]

QUESTION 9

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9.1	<p>There are four horizontal bars and three vertical bars.</p> $\Rightarrow 4y + 3h = 12$ $4y = 12 - 3h$ $y = \frac{1}{4}(12 - 3h)$	<p>✓ $4y + 3h$</p> <p>✓ $4y + 3h = 12$ (2)</p>
9.2	$\text{Area} = lb$ $= yh$ $= \frac{1}{4}(12 - 3h)h$ $= 3h - \frac{3}{4}h^2$	<p>✓ $A=yh$</p> <p>✓ Subst of y</p> <p>✓ simplification</p> <p>(3)</p>
9.3	$\text{Area} = 3h - \frac{3}{4}h^2$ $\frac{dA}{dh} = 3 - \frac{3}{2}h$ $\frac{dA}{dh} = 0$ $3 - \frac{3}{2}h = 0$ $h = 2$ $y = \frac{1}{4}(12 - 3(2))$ $= \frac{3}{2}$	<p>✓ derivative</p> <p>✓ equating to 0</p> <p>✓ $h = 2$</p> <p>✓ subst of h</p> <p>✓ value of y</p> <p>(5)</p>
		[10]

QUESTION 10

10.1	$\frac{10!}{2.2.2} = 453600$	$\checkmark \frac{10!}{2! \cdot 2! \cdot 2!}$ \checkmark Answer (2)
10.2	$\frac{8!}{4} = 10080$	$\checkmark \frac{8!}{4}$ \checkmark Answer (2)
10.3	Same letters are together in 2.2.2.7! ways = $\text{Probability} = \frac{8 \cdot 7!}{10!} = \frac{4}{45}$ $\frac{8}{8}$ So required probability is $\frac{41}{45}$ OR Same letters not together is 41380 ways Probability required is $\frac{41}{45}$	\checkmark Same letters together \checkmark Probability of same letters together \checkmark Answer OR \checkmark Same letter together \checkmark Same letter not together \checkmark Answer (3)
		[07]

QUESTION 11

11.1.1	$P(A \text{ or } B) = P(A) + P(B)$ $0.88 = 0.5 + x$ $x = 0.38$	\checkmark subst into correct formula \checkmark answer (2)
11.1.2	$P(A \text{ or } B) = P(A) + P(B) - P(A) \cdot P(B)$ $0.88 = 0.5 + x - 0.5x$ $0.38 = 0.5x$ $x = 0,76$	\checkmark subst into correct formula \checkmark 0.5x \checkmark answer (3)

11.2.1		<ul style="list-style-type: none"> ✓ 25% for C ✓ Correct outcomes to represent win/lose ✓ Correct diagram (3)
11.2.2	<p>Probability of winning</p> $P(W) = P(R \text{ and } W) \text{ or } P(S \text{ and } L) \text{ or } P(C \text{ and } W)$ $= 30\% \times 24\% + 45\% \times 65\% + 25\% \times 67\%$ $= \frac{1889}{2000}$ $= 0.9445 \text{ OR } \frac{1889}{2000}$	<ul style="list-style-type: none"> ✓ $30\% \times 24\% + 45\% \times 65\% + 25\% \times 67\%$ ✓ . ✓ answer <p>(3)</p>
[11]		