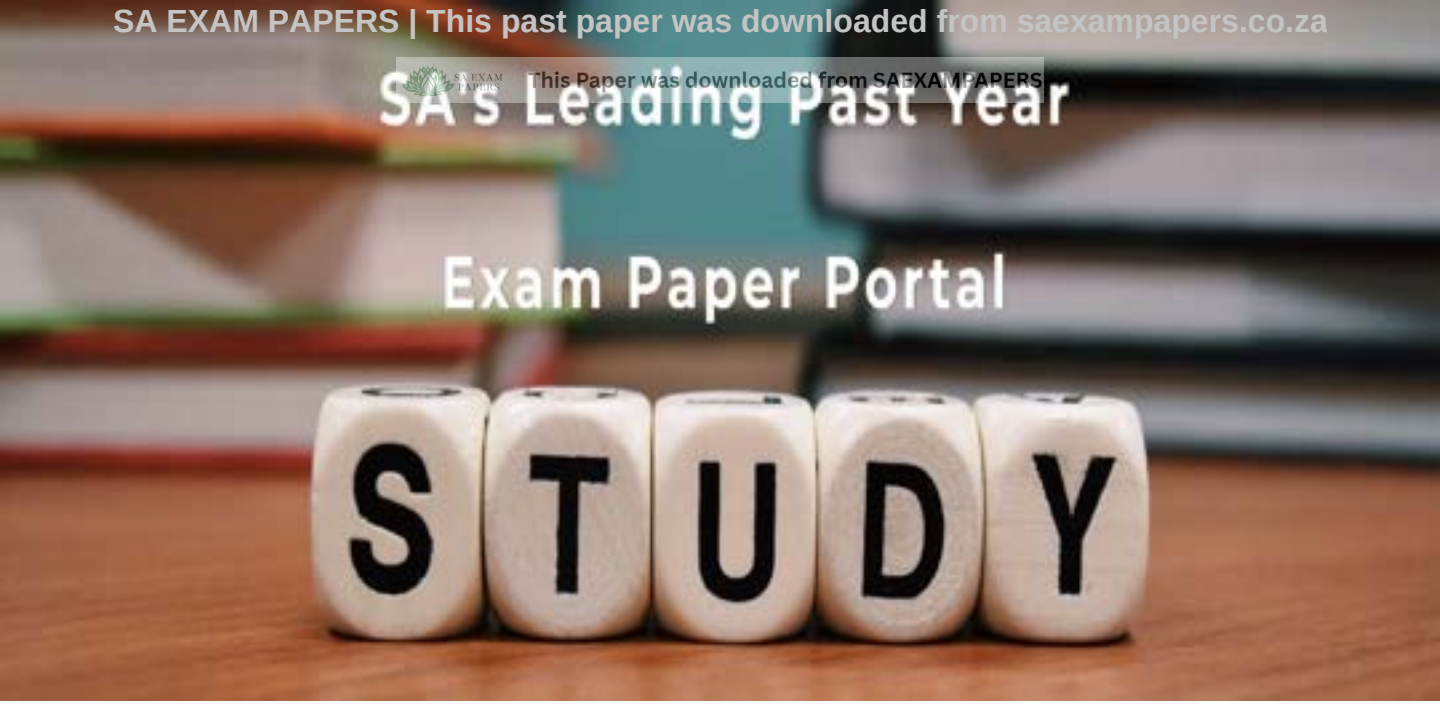


education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

SEPTEMBER 2025

MARKING GUIDELINES

MARKS: 150

These marking guidelines consist of 18 pages.

NOTE:

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

QUESTION 1

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

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

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

QUESTION 2

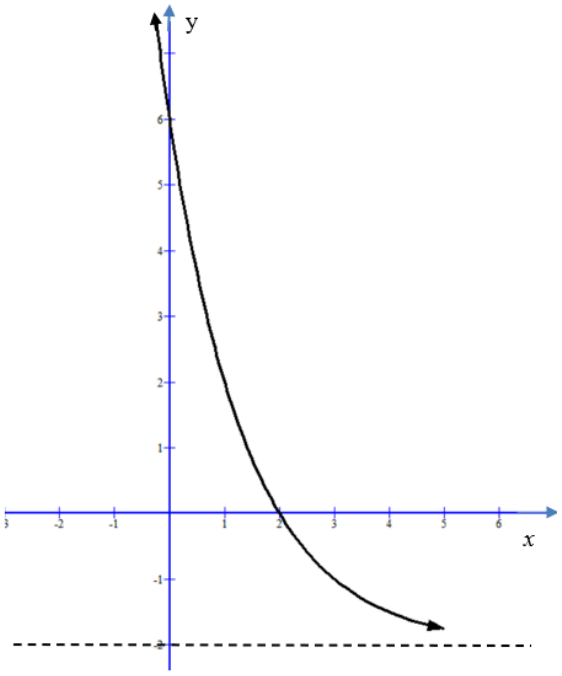
2.1.1	$r = \frac{63}{21} = 3$ $p = \frac{21}{3} = 7$ **OR** $\frac{21}{p} = \frac{63}{21}$ $p = \frac{(21)(21)}{63} = 7$	✓ $r = 3$ ✓ answer (2) ✓ ratio ✓ answer (2)
2.1.2	$T_n = ar^{n-1}$ $137\ 781 = 7(3)^{n-1}$ $19\ 683 = 3^{n-1}$ $n - 1 = \log_3 19\ 683$ or $3^{n-1} = 3^9$ $n - 1 = 9$ $n = 10$ $\therefore$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

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

QUESTION 3

3.1	10 21 38 11 17 6 $2a = 6$ $a = 3$ $T_2 - T_1 = 3a + b$ $11 = 3(3) + b$ $b = 2$ $T_1 = a + b + c$ $10 = 3 + 2 + c$ $c = 5$ $\therefore T_n = 3n^2 + 2n + 5$	✓ $a = 3$ ✓ $b = 2$ ✓ $c = 5$ ✓ answer (4)
3.2	$T_n = 3n^2 + 2n + 5$ $T_{10} = 3(10)^2 + 2(10) + 5$ $= 325$	✓ substitution ✓ answer (2)
3.3	$T_n = a + (n-1)d$ $95 = 11 + (n-1)(6)$ $84 = (n-1)(6)$ $14 = n - 1$ $n = 15$ Term 15 and 16 differ with 95. **OR** $T_{n+1} - T_n = 95$ $3(n+1)^2 + 2(n+1) + 5 - (3n^2 + 2n + 5) = 95$ $3(n^2 + 2n + 1) + 2n + 2 + 5 - 3n^2 - 2n - 5 = 95$ $3n^2 + 6n + 3 + 2n + 2 + 5 - 3n^2 - 2n - 5 = 95$ $6n = 90$ $n = 15$ Term 15 and 16 differ with 95.	✓ substitution ✓ value of n ✓ answer (3) ✓ substitution ✓ value of n ✓ answer (3) **[9]**

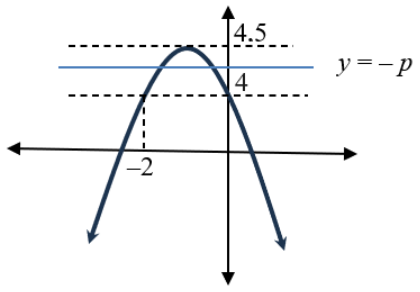
QUESTION 4

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

QUESTION 5

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

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

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

QUESTION 6

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

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

QUESTION 7

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

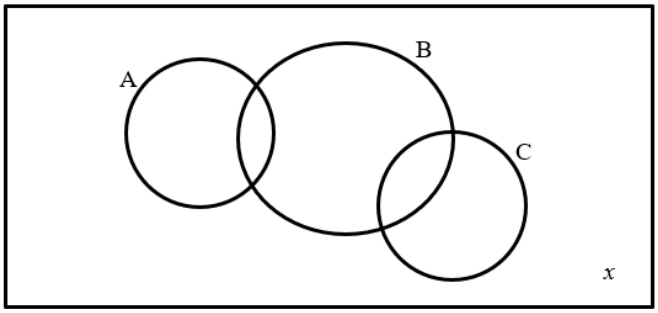
QUESTION 8

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

QUESTION 9

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

QUESTION 10

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

QUESTION 11

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