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**PROVINCIAL PREPARATORY EXAMINATION/
PROVINSIALE VOORBEREIDINGSEKSAMEN**

GRADE/GRAAD 12

**MATHEMATICS P1/WISKUNDE V1
MARKING GUIDELINES/NASIENRIGLYNE
SEPTEMBER 2021**

MARKS/PUNTE: 150

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

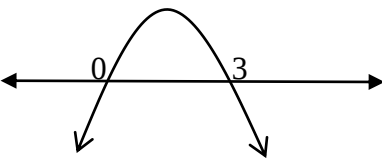
NOTE:

- If a candidate answered a question TWICE, mark only the FIRST attempt.
- If a candidate has crossed out an attempt to answer a question and did not redo it, mark the crossed-out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum. Stop marking at the second calculation error.
- (A) is an accuracy mark.
- Assuming answers/values in order to solve a problem is NOT acceptable.

LET WEL:

- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord het, sien slegs die EERSTE poging na.*
- *As 'n kandidaat 'n poging om 'n vraag te beantwoord, doodgetrek en nie oorgedoen het nie, sien die dood getrekte poging na.*
- *Volgehoue akkuraatheid is op ALLE aspekte van die memorandum van toepassing. Staak nasien by die tweede berekeningsfout.*
- *Om antwoorde/waardesom 'n probleem op te los, te veronderstel, word NIE toegelaat NIE.*

QUESTION/VRAAG 1

ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDERING
1.1.1	$x^2 - x - 6 = 0$ $(x-3)(x+2) = 0$ $x = 3$ or $x = -2$	✓ factors ✓ ✓ answers (3)
1.1.2	$x(x+6)+1=0$ $x^2 + 6x + 1 = 0$ $x = \frac{-6 \pm \sqrt{(6)^2 - 4(1)(1)}}{2(1)}$ $x = -0,17$ or $x = -5,83$ Penalise 1 mark for incorrect rounding	✓ standard form ✓ substitution into formula ✓ $x = -0,17$ ✓ $x = -5,83$ (4)
1.1.3	$6x - 2x^2 \leq 0$ $-2x(-3+x) = 0$ $x = 0$ or $x = 3$  $x \leq 0$ or $x \geq 3$ If 'and' instead of 'or' penalise 1 mark	✓ critical value(s) ✓ method ✓ answer (3)
1.1.4	$(\sqrt{\sqrt{2}-x})(\sqrt{\sqrt{2}+x}) = x$ $\sqrt{2-x^2} = x$ $(\sqrt{2-x^2})^2 = x^2$ $2-x^2 = x^2$ $2x^2 - 2 = 0$ $x^2 - 1 = 0$ $(x+1)(x-1) = 0$ $x = -1$ or $x = 1$ $\therefore x = 1$	✓ $\sqrt{2-x^2}$ ✓ squaring both sides ✓ standard form ✓ factors ✓ selection (5)

ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDING
1.2	$x - y = 3 \text{ and } x^2 - 3y^2 = 13$ $x = 3 + y$ $(3 + y)^2 - 3y^2 = 13$ $9 + 6y + y^2 - 3y^2 - 13 = 0$ $-2y^2 + 6y - 4 = 0$ $y^2 - 3y + 2 = 0$ $(y - 1)(y - 2) = 0$ $y = 1 \text{ or } y = 2$ $\therefore x = 3 + 1 \text{ or } x = 3 + 2$ $x = 4 \text{ or } x = 5$ OR/OF $x - y = 3 \text{ and } x^2 - 3y^2 = 13$ $y = x - 3$ $x^2 - 3(x - 3)^2 = 13$ $x^2 - 3(x^2 - 6x + 9) - 13 = 0$ $x^2 - 3x^2 + 18x - 27 - 13 = 0$ $-2x^2 + 18x - 40 = 0$ $x^2 - 9x + 20 = 0$ $(x - 4)(x - 5)$ $x = 4 \text{ or } x = 5$ $y = 4 - 3 \text{ or } y = 5 - 3$ $y = 1 \text{ or } y = 2$	$\checkmark x = 3 + y$ $\checkmark$ substitution $\checkmark$ standard form $\checkmark$ factors $\checkmark$ y-values $\checkmark$ x-values OR/OF $\checkmark y = x - 3$ $\checkmark$ substitution $\checkmark$ standard form $\checkmark$ factors $\checkmark$ x-values $\checkmark$ y-values (6)
1.3	$x^2 = 7$ $x = \sqrt{7}$ $x^5 = x^2 \cdot x^2 \cdot x$ $x^5 = 7 \cdot 7 \cdot \sqrt{7}$ $x^5 = 49\sqrt{7}$	$\checkmark x = \sqrt{7}$ $\checkmark x^5 = x^2 \cdot x^2 \cdot x$ $\checkmark$ answer (3)
		[24]

QUESTION/VRAAG 2

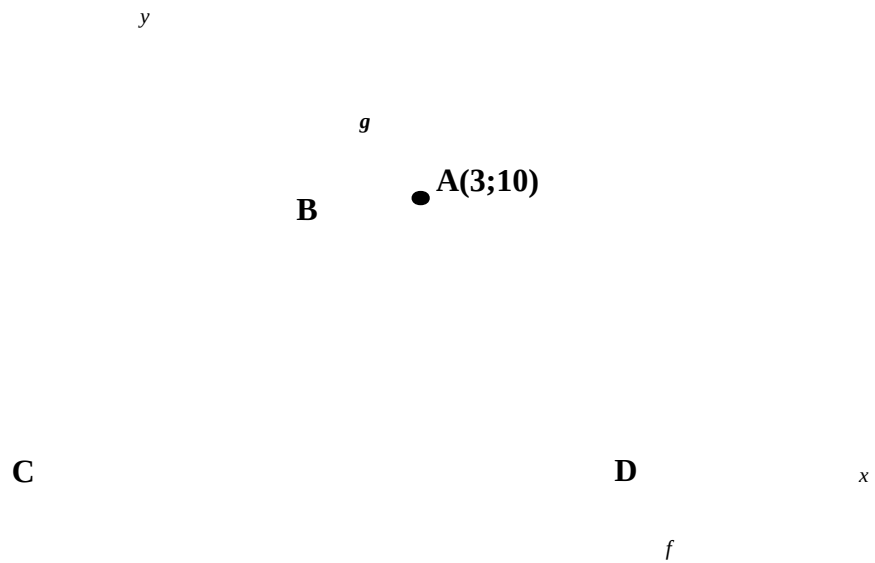
ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDING
2.1.1	$2^{nd} \text{ diff} = -6$	✓✓ answer (2)
2.1.2	$2a = -6$ $a = -3$ $3a + b = 111$ $3(-3) + b = 111$ $b = 111 + 9$ $b = 120$ $-3 + 120 + c = 171$ $c = 171 - 117$ $c = 54$ $T_n = -3n^2 + 120n + 54$	✓ $a = -3$ ✓ $b = 120$ ✓ $c = 54$ ✓ answer (4)
2.1.3	$T_n = -3n^2 + 120n + 54$ and $P_n = -60n + 2754$ $-3n^2 + 120n + 54 = -60n + 2754$ $3n^2 - 180n + 2700 = 0$ $n^2 - 60n + 900 = 0$ $(n - 30)^2 = 0$ $n = 30$	✓ equating the equations ✓ standard form ✓ factors ✓ answer (4)
2.2.1	$\frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \dots$ $a = \frac{1}{8}$ $r = \frac{1}{2}$ $S_{16} = \frac{\frac{1}{8} \left(\left(\frac{1}{2} \right)^{16} - 1 \right)}{\frac{1}{2} - 1}$ $S_{16} = 0.2499$ or 0.25 or 0.250 or 0.2500	✓ value of a and r ✓ substitution ✓ answer (3)

ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDING
2.2.2	$S_{\infty} - T_n = \frac{1023}{4096}$ $\frac{\frac{1}{8}}{1 - \frac{1}{2}} - \frac{1}{8} \left(\frac{1}{2} \right)^{n-1} = \frac{1023}{4096}$ $\frac{1}{4} - \frac{1}{8} \left(\frac{1}{2} \right)^{n-1} = \frac{1023}{4096}$ $-\frac{1}{8} \left(\frac{1}{2} \right)^{n-1} = \frac{1023}{4096} - \frac{1}{4}$ $\left(\frac{1}{2} \right)^{n-1} = \frac{1}{512}$ $\left(\frac{1}{2} \right)^{n-1} = \left(\frac{1}{2} \right)^9 \text{ or } n-1 = \log_{\frac{1}{2}} \left(\frac{1}{512} \right)$ $n-1=9$ $n=10$	✓ substitution ✓ $S_{\infty} = \frac{1}{4}$ ✓ $\left(\frac{1}{2} \right)^{n-1} = \frac{1}{512}$ ✓ $\left(\frac{1}{2} \right)^{n-1} = \left(\frac{1}{2} \right)^9$ or $n-1 = \log_{\frac{1}{2}} \left(\frac{1}{512} \right)$ ✓ $n=10$ (5)
		[18]

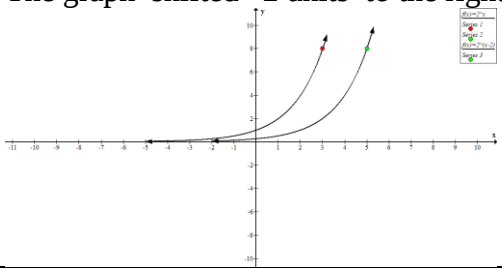
QUESTION/VRAAG 3

ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDING
3.1	$\sum_{k=1}^n 6k + 13$ $19 + 25 + 31 + \dots 6n + 13$ $a = 19 \quad d = 6$ $S_n = \frac{n}{2}(19 + 6n + 13)$ $S_n = \frac{n}{2}(6n + 32)$ $S_n = 3n^2 + 16n$ OR/OF $\sum_{k=1}^n 6k + 13$ $19 + 25 + 31 + \dots 6n + 13$ $a = 19 \quad d = 6$ $S_n = \frac{n}{2}(2(19) + (n-1)6)$ $S_n = \frac{n}{2}(38 + 6n - 6)$ $S_n = \frac{n}{2}(6n + 32)$ $S_n = 3n^2 + 16n$	$\checkmark 19 + 25 + 31 + \dots$ $\checkmark a \text{ and } d$ $\checkmark$ substitution into correct formula (3)
3.2	$S_n = 3n^2 + 16n$ $S_{34} - S_{33} = 3(34)^2 + 16(34) - (3(33)^2 + 16(33))$ $= 4012 - 3795$ $= 217$	$\checkmark$ correct substitution $\checkmark$ answer (2)
3.3	$T_1 ; T_2 ; T_3 ; T_4 ; 120 \quad T_k = 6k + 13$ $19 \quad 25 \quad 31 \quad 37$ $T_4 = 120 - 37$ $T_4 = 83$ $T_3 = 83 - 31$ $T_3 = 52$	$\checkmark$ sequence of first differences. $\checkmark T_4 = 83$ $\checkmark T_3 = 52$
		[8]

QUESTION/VRAAG 4



ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDERING
4.1	$f(x) = -x^2 + 4x + 5$ $x = \frac{-4}{2(-1)} \quad \text{OR} \quad f'(x) = -2x + 4$ $x = 2 \quad \quad \quad 0 = -2x + 4$ $\quad \quad \quad x = 2$ $y = -(2)^2 + 4(2) + 5$ $y = 9$ $B(2;9)$	$\checkmark$ substitution/derivative $\checkmark$ x-value $\checkmark$ $y = 8$ (3)
4.2	$p = -2 \text{ and } q = 9$	$\checkmark$ $p = -2$ $\checkmark$ $q = 9$ (2)

5.5	$h(x) = \frac{1}{4} f(x)$ $= 2^{-2}(2^x)$ $= 2^{x-2}$ The graph shifted 2 units to the right 	✓ 2^{x-2} ✓ 2nits ✓ right (3) [13]
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QUESTION/VRAAG 6

ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDING
6.1.1	$F = \frac{x[(1+i)^n - 1]}{i}$ $F = \frac{4100 \left[\left(1 + \frac{0.06}{4} \right)^{4 \times 20} - 1 \right]}{\frac{0.06}{4}}$ $F = 626\,114,50$	✓ substitution into correct formula ✓ 80 ✓ answer (3)
6.1.2	$A = 626114,50 \left(1 + \frac{0.062}{2} \right)^{2 \times 5}$ $= 849\,650,68$	✓ substitution ✓ answer (2)
6.2.1	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $660\,000 = \frac{x \left[1 - \left(1 + \frac{0.11}{12} \right)^{-180} \right]}{\frac{0.11}{12}}$ $x = \frac{660000 \left(\frac{0.11}{12} \right)}{1 - \left(1 + \frac{0.11}{12} \right)^{-180}}$ $x = 7\,501,54$	✓ substitution into correct formula ✓ $\frac{0.11}{12}$ ✓ answer (3)

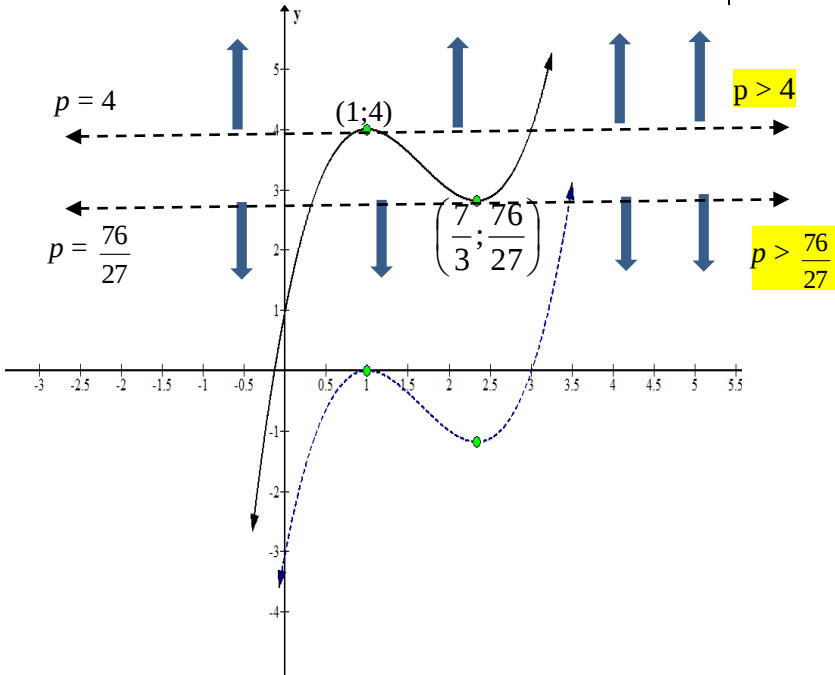
6.2.2	Outstanding balance after the 84th payment $P = \frac{7\,501,54 \left[1 - \left(1 + \frac{0.11}{12} \right)^{-96} \right]}{\frac{0.11}{12}}$ Outstanding Balance = 477 548,81 OR/OF $\text{Outstanding Balance} = 660\,000 \left(1 + \frac{0.11}{12} \right)^{84} - \frac{7\,501,54 \left(\left(1 + \frac{0.11}{12} \right)^{84} - 1 \right)}{\frac{0.11}{12}}$ $= R\,477\,548,77$	✓ -96 ✓ substitution into correct formula ✓ 477 548,81 (3) OR/OF ✓ substitution (A) ✓ answer (3)
6.2.3	$\therefore 477\,548,81 = \frac{10\,000 \left[1 - \left(1 + \frac{0.11}{12} \right)^{-n} \right]}{\frac{0.11}{12}}$ $\frac{477\,548,81 \left(\frac{0.11}{12} \right)}{10\,000} - 1 = - \left(1 + \frac{0.11}{12} \right)^{-n}$ $-0.5622469242 = - \left(1 + \frac{0.11}{12} \right)^{-n}$ $-n = \log_{\left(1 + \frac{0.11}{12} \right)} (0.5622469242)$ $-n = -63,10$ $n = 64 \text{ payments}$ $\therefore 96 - 64 = 32 \text{ payments sooner}$	✓ substitution (A) ✓ application of logs ✓ 64 payments ✓ 32 payments sooner (4)
		[15]

QUESTION/VRAAG 7: PENALISE -1 FOR NOTATION ONLY IN 7.1

ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDERING
7.1	$f(x) = 4x^2 - 3$ $f(x+h) = 4(x+h)^2 - 3$ $f(x+h) = 4x^2 + 8xh + 4h^2 - 3$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{4x^2 + 8xh + 4h^2 - 3 - (4x^2 - 3)}{h}$ $= \lim_{h \rightarrow 0} \frac{8xh + 4h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(8x + 4h)}{h}$ $= \lim_{h \rightarrow 0} (8x + 4h)$ $= 8x + 4(0)$ $= 8x$	$\checkmark 4x^2 + 8xh + 4h^2 - 3$ $\checkmark$ substitution $\checkmark$ simplification $\checkmark$ common factor $\checkmark$ answer (5)
7.2.1	$y = (3x - 4)(5x + 2)$ $= 15x^2 + 6x - 20x - 8$ $= 15x^2 - 14x - 8$ $\frac{dy}{dx} = 30x - 14$	$\checkmark 15x^2 - 14x - 8$ $\checkmark 30x - 14$ (2)
7.2.2	$\frac{d}{dx} \left(x\sqrt{x} - \frac{2}{x^2} \right)$ $\frac{d}{dx} \left(x^{\frac{3}{2}} - 2x^{-2} \right)$ $= \frac{3}{2}x^{\frac{1}{2}} + 4x^{-3}$ C.A only if exponent is a rational	$\checkmark x^{\frac{3}{2}}$ $\checkmark -2x^{-2}$ $\checkmark \frac{3}{2}x^{\frac{1}{2}}$ $\checkmark +4x^{-3}$ (4)
		[11]

QUESTION/VRAAG 8

ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDERING
8.1.1	$x^3 - 5x^2 + 7x - 3 = 0$ $f(1) = 0$ $(x-1)^2(x-3) = 0$ $A(1;0) \quad B(3;0)$ Does not have to be in a coordinate form. Accept $x=1$ or $x=3$	$\checkmark$ factors $\checkmark A(1;0)$ $\checkmark B(3;0)$ (3)
8.1.2	$h(x) = x^3 - 5x^2 + 7x - 3$ $h'(x) = 3x^2 - 10x + 7$ $0 = 3x^2 - 10x + 7$ $0 = (3x-7)(x-1)$ at C $x = \frac{7}{3}$ $f\left(\frac{7}{3}\right) = \left(\frac{7}{3}\right)^3 - 5\left(\frac{7}{3}\right)^2 + 7\left(\frac{7}{3}\right) - 3$ $= \frac{-32}{27}$ $C\left(\frac{7}{3}; -\frac{32}{27}\right)$	$\checkmark$ Derivative $\checkmark$ Equation derivation to 0. $\checkmark$ x-value $\checkmark$ y-value (4)
8.2.1	$x = \frac{1 + \frac{7}{3}}{2}$ $x = \frac{5}{3}$ $x < \frac{5}{3}$ OR $x < \frac{-b}{3a}$ $x < \frac{-(-5)}{3(1)}$ $x < \frac{5}{3}$ OR/OF $h(x) = x^3 - 5x^2 + 7x - 3$ $h'(x) = 3x^2 - 10x + 7$ $h''(x) = 6x - 10 < 0$ $6x - 10 < 0$ $\therefore x < \frac{5}{3}$	$\checkmark$ substitution $\checkmark$ x-value $\checkmark$ Answer (3) OR/OF $\checkmark \checkmark$ Second derivative < 0 $\checkmark$ answer (3)

ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDING
8.2.2	$h(x) > 0$ for $x > 3$ since $h(-x)$ is a reflection over y -axis $\therefore x < -3$	$\checkmark \checkmark$ answer (2)
8.3	$h(x) + 4 = p$ the turning points of $h(x) + 4$ are $A(1;4)$ and $\left(\frac{7}{3}; \frac{76}{27}\right)$ $p > 4$ or $p < \frac{76}{27}$ OR/OF	$\checkmark \checkmark p > 4$ $\checkmark p = 0$ $\checkmark p < \frac{76}{27}$ (4)
		
		[12]

QUESTION/VRAAG 9

ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDING
9.1	$S.A = 2l.w + 2l.h + 2w.h$ $= 2(x.5x + h.5x + x.h)$ $720 = 2(5x^2 + 6xh)$ $360 = 5x^2 + 6xh$ $360 - 5x^2 = 6xh$ $h = \frac{60}{x} - \frac{5}{6}x$ $V = 5x.x\left(\frac{60}{x} - \frac{5}{6}x\right)$ $V = 300x - \frac{25}{6}x^3$	✓ formula ✓ substitution ✓ simplification ✓ $h = \frac{60}{x} - \frac{5}{6}x$ ✓ substitution (5)
9.2	$V = 300x - \frac{25}{6}x^3$ $\frac{dV}{dx} = 300 - \frac{25}{2}x^2$ $0 = 300 - \frac{25}{2}x^2$ $\frac{25}{2}x^2 = 300$ $x^2 = 24$ $x = 2\sqrt{6} \quad \therefore v = 300(2\sqrt{6}) + \frac{25}{2}(2\sqrt{6})^3 = 2939,39$	✓ derivative ✓ equating the derivative to 0. ✓ x-value ✓ substitution ✓ Answer (5)
		[10]

QUESTION/VRAAG 10

Events A and B are given such that $P(A \text{ or } B) = \frac{3}{5}$ and $P(A) = \frac{2}{5}$.

ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDERING
10.1.1	$P(A \text{ OR } B) = P(A) + P(B)$ $\frac{3}{5} = \frac{2}{5} + P(B)$ $P(B) = \frac{3}{5} - \frac{2}{5}$ $P(B) = \frac{1}{5}$	✓ substitution ✓ answer (2)
10.1.2	$P(A \text{ or } B) = P(A) + P(B) - P(A).P(B)$ $\frac{3}{5} = \frac{2}{5} + P(B) - \frac{2}{5}P(B)$ $\frac{1}{5} = \frac{3}{5}P(B)$ $P(B) = \frac{1}{3}$	✓ substitution ✓ simplification ✓ answer (3)
10.2	$P(A \text{ or } B) = P(A) + P(B) - P(A).P(B)$ $0.84 = y + y - y.y$ $0.84 = 2y - y^2$ $y^2 - 2y + 0.84 = 0$ $y = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(0.84)}}{2(1)}$ $y = 1.4 \text{ OR } y = 0.6$ $\therefore y = 0,6$	✓ substitution ✓ standard form ✓ substitution into formula/factors ✓ answers ✓ selection (5)
		[10]

QUESTION/VRAAG 11

ITEM	SOLUTIONS/OPLOSSINGS	MARK CLARIFICATION/ PUNTEVERHELDING
11.1	$7 \times 7 \times 7 \times 7 = 2401$ codes OR 7^4 NOTE: Answer only award full marks Also if left as 7^4 or $7 \times 7 \times 7 \times 7$ award full marks	$\checkmark 7 \times 7 \times 7 \times 7$ $\checkmark 2401$ (2)
11.2	Case 1: The code must start with 2 and end with 0 $\begin{array}{ccc} \underline{2} & & \underline{0} \\ & 5 & 4 & 1 \text{ way} \end{array}$ Number of codes starting with 2 and ending with 0 is $1 \times 5 \times 4 \times 1 = 20$ Case 2: number of codes starting with 2 and ending with 4 $\begin{array}{ccc} \underline{2} & \underline{5} & \underline{4} & \underline{4} \\ 1 \text{ way} & & & 1 \text{ way} \end{array}$ $1 \times 5 \times 4 \times 1 = 20$ Case 3: number of codes starting with 2 and ending will 6 $1 \times 5 \times 4 \times 1 = 20$ Total number of codes = $20 + 20 + 20 = 60$ codes OR/OF $1 \times 5 \times 4 \times 1 \times 3 = 60$	$\checkmark 1 \times 5 \times 4 \times 1$ $\checkmark 1 \times 5 \times 4 \times 1$ $\checkmark 1 \times 5 \times 4 \times 1$ $\checkmark 60$ OR $\checkmark \checkmark 1 \times 5 \times 4 \times 1 \times 3$ $\checkmark \checkmark 60$ NOTE: Answer only 2 marks (4)
		[6]

TOTAL/TOTAAL: 150