NOTE:

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

LET WEL:

- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.*
- *Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.*

QUESTION/*VRAAG* 1

1.1.1	$(x-2)(4+x)=0$ $x=2$ or $x=-4$	✓$x=2$ ✓$x=-4$ (2)
1.1.2	$3x^2-2x-14=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{2\pm\sqrt{(-2)^2-4(3)(-14)}}{2(3)}$ $=\frac{2\pm\sqrt{172}}{6}$ $x=2{,}52$ or/*of* $x=-1{,}85$ **OR/*OF*** $x^2-\frac{2}{3}x+\frac{1}{9}=\frac{14}{3}+\frac{1}{9}$ $\left(x-\frac{1}{3}\right)^2=\frac{43}{9}$ $x-\frac{1}{3}=\pm\frac{\sqrt{43}}{3}$ $\therefore x=\frac{1\pm\sqrt{43}}{3}$ $x=2{,}52$ or/*of* $x=-1{,}85$	✓ standard form/*standaardvorm* ✓ substitution into correct formula/ *substitusie in korrekte formule* ✓✓ answers/ *antwoorde* (4) ✓for adding $\frac{1}{9}$ on both sides/*tel* $\frac{1}{9}$ *by aan beide kante* ✓$x=\frac{1\pm\sqrt{43}}{3}$ ✓✓answers (4)

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1.1.3	$2^{x+2}+2^x=20$ $2^x(2^2+1)=20$ $2^x=\frac{20}{5}$ $2^x=2^2$ $\therefore x=2$ **OR/*OF*** $2^x.2^2+2^x=2^2.5$ $2^x(2^2+1)=2^2.5$ $2^x.5=2^2.5$ $\therefore x=2$ **OR/*OF*** $4.2^x+2^x=20$ $5.2^x=20$ $2^x=4=2^2$ $\therefore x=2$	✓common factor/*gemeen. faktor* ✓ simplification/ *vereenvoudiging* ✓ answer/*antwoord* (3) ✓ common factor/*gemeen. faktor* ✓ simplification/ *vereenvoudiging* ✓ answer/*antwoord* (3) ✓$5.2^x=20$ ✓$2^x=4$ ✓answer/*antwoord* (3)
1.2	$x=2y+3$ .....(1) $3x^2-5xy=24+16y$ .....(2) (1) in (2) : $3(2y+3)^2-5(2y+3)y=24+16y$ $3(4y^2+12y+9)-10y^2-15y=24+16y$ $12y^2+36y+27-10y^2-15y-24-16y=0$ $2y^2+5y+3=0$ $(2y+3)(y+1)=0$ $y=-\frac{3}{2}$ or $y=-1$ $\therefore x=2\left(-\frac{3}{2}\right)+3$ *or* $x=2(-1)+3$ $x=0$ *or* $x=1$ $(0;-\frac{3}{2})$ $(1;-1)$ **OR/*OF***	✓ substitution/*substitusie* ✓ simplification/ *vereenvoudiging* ✓standard form/ *standaardvorm* ✓factorisation/*faktorisering* ✓*y*-values/*y-waardes* ✓*x*-values/*x-waardes* (6)

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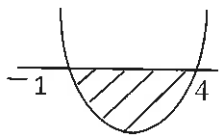
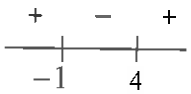
	$y=\frac{x-3}{2}$ $3x^2-5x\left(\frac{x-3}{2}\right)=24+16\left(\frac{x-3}{2}\right)$ $3x^2-\frac{5x^2-15x}{2}=24+\frac{16x-48}{2}$ $\times 2: 6x^2-5x^2+15x=48+16x-48$ $x^2-x=0$ $x(x-1)=0$ $x=0 \text{ or } x=1$ $y=-\frac{3}{2} \text{ or } y=-1$	✓substitution/*substitusie* ✓simplification/ *vereenvoudiging* ✓standard form / *standard vorm* ✓ factors/*faktore* ✓*x*- values/*x- waardes* ✓ *y*-values/*y*-waardes (6)
1.3	$(x-1)(x-2)<6$ $x^2-3x+2<6$ $x^2-3x-4<0$ $(x+1)(x-4)<0$  **OR/** ***OF***  $-1<x<4 \quad \text{or} \quad x\in(-1;4)$	✓ standard form/ *standaardvorm* ✓factorisation/*faktorisering* ✓critical values in the context of inequality / *kritiese waardes in die konteks van die ongelykheid* ✓notation/*notasie* (4)
1.4	$-k-4\geq 0$ $k\leq -4$	✓ $-k-4\geq 0$ ✓ answer/*antwoord* (2) **[21]**

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QUESTION/*VRAAG* 2

2.1	$T_4 = 23$	✓23 (1)
2.2	$T_{251} = a+(n-1)d$ $= 2+(251-1)(7)$ $= 1752$	✓$a = 2$ and $d = 7$ ✓subst. into correct formula /*subt. in korrekte formule* ✓1752 (3)
2.3	$\sum_{n=1}^{251}(7n-5)$ **OR/*OF*** $\sum_{p=0}^{250}(7p+2)$	✓ general term/ *algemene term* ✓ complete answer /*volledige antwoord* (2) ✓ general term/ *algemene term* ✓ complete answer / *volledige antwoord* (2)
2.4	$S_n = \frac{n}{2}[a+l]$ $S_n = \frac{251}{2}[2+1752]$ $= 220127$ **OR/*OF*** $S_n = \frac{n}{2}[2a+(n-1)d]$ $= \frac{251}{2}[2(2)+(251-1)(7)]$ $= 220127$	✓substitution/*substitusie* ✓220127 (2) ✓substitution/*substitusie* ✓220127 (2)
2.5	The new series/*Die nuwe reeks* is 16 + 44 + 72 + …+1 752 $16+28(n-1) = 1752$ $1736 = 28(n-1)$ $62 = n-1$ $n = 63$ **OR/*OF*** $2+9+\underline{16}+23+30+37+\underline{44}+51+\ldots+\underline{1752}$ T_3 is divisible by /is deelbaar deur 4 Then $T_7, T_{11}, T_{15}, \ldots, T_{251}$ are divisible by 4, thus each 4th term is divisible by 4. Daarna is $T_7, T_{11}, T_{15}, \ldots, T_{251}$ deelbaar deur 4, d.w.s. elke 4de term is deelbaar deur 4. ∴number of terms divisible by 4 will be $= \frac{251-3}{4}+1 = 63$ ∴aantal terme deelbaar deur 4 sal wees $= \frac{251-3}{4}+1 = 63$	✓✓generating new series divisible by 4/ *vorming van nuwe reeks deelbaar deur 4* ✓ $T_n = 1752$ ✓ 63 (4) ✓T_3 is divisible by 4/ *is deelbaar deur 4* ✓identifying terms divisible by 4/ *identifiseer terme deelbaar deur 4* ✓ reasoning/*redenering* ✓63 (4)

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	OR/OF Position of terms divisible by 4: 3 ; 7 ; 11 ; …; 247; 251 $T_n = 4n - 1 = 251$ $4n = 252$ $n = 63$	✓✓ generating sequence involving position of terms/*vorming van reeks i.t.v. posisie van terme* ✓ $T_n = 251$ ✓ 63 (4) **[12]**

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QUESTION/*VRAAG 3*

3.1.1	$-1 \;;\; -7 \;;\; -11 \;;\; p \;;\; \ldots$ $-6 \quad -4 \quad p+11$ $2 \quad 2$ $p+11-(-4)=2$ $p+15=2$ $p=-13$ **OR/*OF*** $-1 \;;\; -7 \;;\; -11 \;;\; p \;;\; \ldots$ $-6 \quad -4 \quad p+11$ $2 \quad 2$ $p+11=-2$ $p=-13$	✓$p+15=2$ ✓$p=-13$ (2) ✓first differences/*eerste verskille* ✓$p=-13$ (2)
3.1.2	$2a=2$ $a=1$ $3a+b=-6$ $3(1)+b=-6$ $b=-9$ $a+b+c=-1$ $1-9+c=-1$ $c=7$ $T_n=n^2-9n+7$ **OR/*OF*** $T_n=T_1+(n-1)d_1+\frac{(n-1)(n-2)d_2}{2}$ $=-1+(n-1)(-6)+\frac{(n-1)(n-2)(2)}{2}$ $=-1-6n+6+\frac{2n^2-6n+4}{2}$ $=n^2-9n+7$ **OR/*OF***	✓$a=1$ ✓$b=-9$ ✓$c=7$ ✓answer/*antwoord* (4) ✓formula/*formule* ✓substitution of first and second differences/*substitusie van eerste en tweede verskille* ✓simplification/*vereenvoudiging* ✓answer/*antwoord* (4)

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	$7; -1 \;;\; -7 \;;\; -11 \;;\; p \;;\ldots$ $-8 \quad -6 \quad -4 \quad p+11$ $2 \quad 2 \quad 2$	
	$T_0 = 7 = c$	✓*c*-value/*c-waarde*
	$2a = 2 \quad \therefore a = 1$	✓*a*-value/*a-waarde*
	$3a + b = -6 \quad \therefore b = -9$	✓*b*-value/*b-waarde*
	$T_n = n^2 - 9n + 7$	✓answer/*antwoord* (4)
	OR/OF	
	$a = \frac{1}{2}(2) = 1$	✓*a*-value/*a-waarde*
	$\therefore T_n = n^2 + bn + c$	
	$T_1 = -1 \;\therefore 1 + b + c = -1 \quad \ldots\ldots(1)$	
	$T_2 = -7 \;\therefore 4 + 2b + c = -7 \ldots\ldots(2)$	
	$(2) - (1): \quad 3 + b = -6$	
	$\therefore b = -9$	✓*b*-value/*b-waarde*
	sub in $(1): c = 7$	✓*c*-value/*c-waarde*
	$\therefore T_n = n^2 - 9n + 7$	✓answer/*antwoord* (4)

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3.1.3	The sequence of first differences is/*Die reeks van eerste verskille is*: $-6\ ;-4\ ;-2\ ;0\ ;\ldots$	
	$-6+(n-1)(2)=96$ $n=52$	✓$-6+(n-1)(2)=96$ ✓52
	∴two terms are/*twee terme is*: $T_{52}=52^2-9(52)+7=2243$	
	$T_{53}=53^2-9(53)+7=2339$	✓2 243 ✓2 339 (4)
	OR/OF	
	The sequence of first differences is/*Die reeks van eerste verskille is*: $-6\ ;-4\ ;-2\ ;0\ ;\ldots$ The formula for the sequence of first differences/*Die formule vir die reeks van eerste verskille* is $T_n=2n-8$	
	1st difference/*1ste verskil*: $2n-8=96$	✓$2n-8=96$
	$2n=104$ $n=52$	✓52
	∴two terms are/*twee terme is*: $T_{52}=52^2-9(52)+7=2243$	✓2 243
	$T_{53}=53^2-9(53)+7=2339$	✓2 339 (4)
	OR/*OF*	
	$T_n-T_{n-1}=96$	✓$T_n-T_{n-1}=96$
	$(n^2-9n+7)-[(n-1)^2-9(n-1)+7]=96$ $n^2-9n+7-n^2+2n-1+9n-9-7=96$	
	$2n=106$	
	$n=53$	✓53
	$T_{52}=52^2-9(52)+7=2243$	✓2 243
	$T_{53}=53^2-9(53)+7=2339$	✓2 339 (4)
	OR/OF	
	$T_{n+1}-T_n=96$	✓$T_{n+1}-T_n=96$
	$[(n+1)^2-9(n+1)+7]-[n^2-9n+7]=96$ $n^2+2n+1-9n-9+7-n^2+9n-7=96$	
	$2n=104$	
	$n=52$	✓52
	$T_{52}=52^2-9(52)+7=2243$	✓2 243
	$T_{53}=53^2-9(53)+7=2339$	✓2 339 (4)

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Please turn over/*Blaai om asseblief*

3.2.1	$T_{12} = 16\left(\frac{1}{4}\right)^{12-1}$ $= \frac{1}{4^9}$ or 4^{-9} or $\frac{1}{2^{18}}$ or 2^{-18}	✓ $a = 16$ and $r = \frac{1}{4}$ ✓subst. into correct formula/ *subt in korrekte formule* ✓ answer/*antwoord* (3)
3.2.2	$S_{10} = \frac{16\left(1-\left(\frac{1}{4}\right)^{10}\right)}{1-\frac{1}{4}}$ $= 21{,}33$ **OR/OF** $S_{10} = \frac{16\left(\left(\frac{1}{4}\right)^{10}-1\right)}{\frac{1}{4}-1}$ $= 21{,}33$	✓ substitution into correct formula /*substitusie in korrekte formule* ✓ answer/*antwoord* (2) ✓ substitution into correct formula /*substitusie in korrekte formule* ✓ answer/*antwoord* (2)
3.3	$\left(1+\frac{1}{2}\right)\left(1+\frac{1}{3}\right)\left(1+\frac{1}{4}\right)\ldots\left(1+\frac{1}{99}\right)$ $= \left(\frac{3}{2}\right)\left(\frac{4}{3}\right)\left(\frac{5}{4}\right)\left(\frac{6}{5}\right)\ldots\left(\frac{100}{99}\right)$ $= \left(\frac{100}{2}\right)$ $= 50$ **OR/OF** $\left(1+\frac{1}{2}\right)\left(1+\frac{1}{3}\right)\left(1+\frac{1}{4}\right)\ldots\left(1+\frac{1}{99}\right)$ $T_1 = \left(1+\frac{1}{2}\right) = \frac{3}{2}$ $T_2 = \frac{3}{2}\left(1+\frac{1}{3}\right) = \frac{3}{2}\times\frac{4}{3} = 2$ $T_3 = 2\left(1+\frac{1}{4}\right) = 2\times\frac{5}{4} = \frac{5}{2}$ $\frac{3}{2}, 2, \frac{5}{2}\ldots$ is an arithmetic sequence with $a = \frac{3}{2}$ and $d = \frac{1}{2}$ $\therefore T_{98} = \frac{3}{2} + (98-1)\frac{1}{2}$ $= \frac{100}{2} = 50$	✓ improper fractions/ *onegte breuke* ✓ $\left(1+\frac{1}{99}\right)$ or $\left(\frac{100}{99}\right)$ ✓✓ answer/*antwoord* (4) ✓$\left(1+\frac{1}{99}\right)$ ✓ giving the first three terms / *gee die eerste drie terme* ✓✓answer /*antwoord* (4) **[19]**

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QUESTION/*VRAAG 4*

4.1	$p=1$ $q=1$	✓p value /*waarde* ✓q value /*waarde* (2)
4.2	$0=\frac{2}{x+1}+1$ $-x-1=2$ $x=-3$ **OR/*OF*** Reflect (0 ; 3) across $y=-x$ to get T(–3 ; 0) $x=-3$ *Reflekteer* (0 ; 3) *om* $y=-1$ *om* T(–3 ; 0) *te kry* $x=-3$	✓$0=\frac{2}{x+1}+1$ ✓$x=-3$ (2) ✓ reflect across/*reflekteer om* $y=-x$ ✓ $x=-3$ (2)
4.3	Shifting g five units to the left shifts (– 1 ; 0) five units to the left. $x=-6$	✓ answer/*antwoord* (1)
4.4	$\frac{2}{x+1}+1=x$ $2+x+1=x^2+x$ $x^2=3$ $\therefore x=\sqrt{3}$ since at S, $x>0$ $y=\sqrt{3}=1{,}73...$ $OS^2=x^2+y^2=3+3=6$ $\therefore OS=\sqrt{6}=2{,}45$ units/*eenhede* **OR/*OF***	✓ equating both graphs/*stel grafieke gelyk* ✓$x^2=3$ ✓$x=\sqrt{3}$ and $y=\sqrt{3}$ ✓$OS^2=6$ ✓ answer/*antwoord* (5)

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	Translate g one unit down and one unit to the right/*Transleer g een eenheid af en een eenheid na regs* The new equation/*Die nuwe vergelyking* : $p(x)=\frac{2}{x}$ Therefore the image of S is $S'(\sqrt{2};\sqrt{2})$/ *Daarom is die beeld van S nou* $S'(\sqrt{2};\sqrt{2})$ Now translate p back to *g/Transleer p terug na g*: $S(\sqrt{2}-1;\sqrt{2}+1)$ $OS^2=(\sqrt{2}-1)^2+(\sqrt{2}+1)^2=2-2\sqrt{2}+1+2+2\sqrt{2}+1$ $\therefore OS=\sqrt{6}=2{,}45$ units/*eenhede*	✓ $p(x)=\frac{2}{x}$ ✓✓coord. of/*koörd. van* S' ✓coord. of/*koörd. van* S ✓answer/*antwoord* (5)
4.5	$k<3$ will give roots with opposite signs/ $k<3$ *sal wortels met teenoorgestelde tekens gee*	✓$k<3$ (1) **[11]**

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QUESTION 5

5.1	$y = \log_a x$ $-1 = \log_a \frac{1}{3}$ $a^{-1} = \frac{1}{3}$ $a = \left(\frac{1}{3}\right)^{-1}$ $\therefore a = 3$	✓subt. $\left(\frac{1}{3};-1\right)$ ✓ $a^{-1} = \frac{1}{3}$ or $a = \left(\frac{1}{3}\right)^{-1}$ (2)
5.2	$h: \quad x = \log_3 y$ $\therefore \quad y = 3^x$	✓swop x and y/*ruil x en y* ✓ answer/*antwoord* (2)
5.3	$g(x) = -\log_3 x$ **OR/*OF*** $g(x) = \log_3 \frac{1}{x}$ **OR/*OF*** $g(x) = \log_{\frac{1}{3}} x$ **OR/OF** $x = 3^{-y}$ **OR/OF** $x = \left(\frac{1}{3}\right)^{y}$	✓answer/*antwoord* (1) ✓answer/*antwoord* (1) ✓answer/*antwoord* (1) ✓answer/*antwoord* (1) ✓answer/*antwoord* (1)
5.4	$x > 0$ **OR/*OF*** $(0;\infty)$	✓ answer/*antwoord* (1) ✓ answer/*antwoord* (1)
5.5	$\log_3 x = -3$ $x = 3^{-3}$ $x = \frac{1}{27}$ $x \geq \frac{1}{27}$	✓ exponential form/*eksponensiële vorm* ✓simplification/vereenvoudiging ✓answer/*antwoord* (3) **[9]**

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QUESTION/*VRAAG 6*

6.1	$4x^2 - 6 = 0$ $x^2 = \frac{3}{2}$ $x = 1{,}22$ (x - coordinate of S is positive)	✓$y = 0$ ✓1,22 (2)
6.2	$(0 ; -6)$	✓ 0 ✓ -6 (2)
6.3.1	$QT = f(x) - g(x)$ $= 2\sqrt{x} - (4x^2 - 6)$ or $= 2\sqrt{x} - 4x^2 + 6$	✓✓ correct formula/ *korrekte formule* ✓substitution/*substitusie* (3)
6.3.2	$QT = 2x^{\frac{1}{2}} - 4x^2 + 6$ Deravitive of $QT = x^{\frac{-1}{2}} - 8x = 0$ $\frac{1}{\sqrt{x}} = 8x$ $x^{\frac{3}{2}} = \frac{1}{8}$ or $\frac{1}{x} = 64x^2$ $x = \left(\frac{1}{8}\right)^{\frac{2}{3}}$ $x = \left(\frac{1}{2}\right)^2$ or $x^3 = \frac{1}{64}$ $x = \frac{1}{4} = 0{,}25$ Max/*Maks* $QT = 2\left(\frac{1}{4}\right)^{\frac{1}{2}} - 4\left(\frac{1}{4}\right)^2 + 6$ $= 6\frac{3}{4} = 6.75$ units/*eenhede*	✓derivative/*afgeleide* ✓derivative equal to 0/ *afgeleide gelyk aan 0* ✓ $x^{\frac{3}{2}} = \frac{1}{8}$ ✓x-value/x-*waarde* ✓ substitution/*substitusie* ✓answer/*antwoord* (6) **[13]**

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QUESTION/*VRAAG* 7

7.1

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

$$72\,500 = 145\,000(1-i)^5$$

$$i = 1 - \sqrt[5]{\frac{72500}{145000}}$$

$$= 0{,}1294\ldots$$

∴ Rate of interest/*Rentekoers* is 12,94 % p.a./*p.j.*

✓substitution/*substitusie*

✓writing in terms of i *herskryf in terme van i*

✓answer/*antwoord* (3)

OR/*OF*

$$(1-i)^5 = \frac{1}{2}$$

$$\therefore i = 1 - \left(\frac{1}{2}\right)^{\frac{1}{5}}$$

$$i = 0{,}1294$$

∴ Rate of interest/*Rentekoers* is 12,94 % p.a./*p.j.*

✓substitution/*substitusie*

✓writing i.t.o i

✓answer (3)

7.2.1

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

$$500\,000 = \frac{x\left[1-\left(1+\frac{0{,}12}{12}\right)^{-240}\right]}{\frac{0{,}12}{12}}$$

$$x = \frac{500000 \times \frac{0{,}12}{12}}{\left[1-\left(1+\frac{0{,}12}{12}\right)^{-240}\right]}$$

x = R5505,43

✓ $i = \frac{0{,}12}{12}$

✓ n =240

✓substitution into correct formula

✓answer/*antwoord* (4)

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7.2.2	$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $500000 = \frac{6000\left[1-\left(1+\frac{0.12}{12}\right)^{-n}\right]}{\frac{0.12}{12}}$ $\frac{500000}{6000} \times 0{,}01 = 1-(1{,}01)^{-n}$ $(1{,}01)^{-n} = 1-\frac{5}{6}$ $-n = \frac{\log\frac{1}{6}}{\log 1{,}01}$ $n = 180{,}07$ $\therefore$ Melissa settles the loan in 181 months	✓6000 ✓substitute into correct formula/*substitusie in korrekte formule* ✓ use of logs/*gebruik van logs* ✓answer/*antwoord* (4)
7.2.3	Samuel He is paying off his loan over a longer period thus more interest will be paid./*Hy betaal sy lening oor 'n langer tydperk af, dus sal hy meer rente betaal.* **OR/*OF*** Samuel He will pay/*Hy betaal* R5505,43 × 240 – R500 000 = R821 303,20 She will pay between/*Sy sal tussen* R580 000 and/*en* R586 000,00 *betaal.*	✓Samuel ✓reason/*rede* (2) ✓Samuel ✓reason/*rede* (2) **[13]**

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QUESTION/*VRAAG* 8

8.1

$$f(x+h)=(x+h)^3=(x^3+2xh+h^2)(x+h)$$
$$=x^3+x^2h+2x^2h+2xh^2+h^2x+h^3$$
$$=x^3+3x^2h+3xh^2+h^3$$
$$f(x+h)-f(x)=x^3+3x^2h+3xh^2+h^3-x^3$$
$$=3x^2h+3xh^2+h^3$$

✓simplifying/*vereenvouding*

$$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$
$$=\lim_{h\to 0}\frac{3x^2h+3xh^2+h^3}{h}$$
$$=\lim_{h\to 0}\frac{h(3x^2+3xh+h^2)}{h}$$
$$=\lim_{h\to 0}(3x^2+3xh+h^2)$$
$$=3x^2$$

✓formula/*formule*

✓subst. into formula/*subst. in formule*

✓factorization/*faktorisering*

✓answer/*antwoord*

(5)

OR/OF

$$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$
$$=\lim_{h\to 0}\frac{(x+h)^3-x^3}{h}$$
$$=\lim_{h\to 0}\frac{(x+h)(x+h)^2-x^3}{h}$$
$$=\lim_{h\to 0}\frac{(x+h)(x^2+2xh+h^2)-x^3}{h}$$
$$=\lim_{h\to 0}\frac{x^3+3x^2h+3xh^2+h^3-x^3}{h}$$
$$=\lim_{h\to 0}\frac{h(3x^2+3xh+h^2)}{h}$$
$$=\lim_{h\to 0}(3x^2+3xh+h^2)$$
$$=3x^2$$

✓formula/*formule*

✓subst. into formula/*subst. in formule*

✓simplifying/*vereenvoudiging*

✓factorization/*faktorisering*

✓answer/*antwoord*

(5)

OR

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	$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{(x+h)^3-x^3}{h}$ $=\lim_{h\to 0}\frac{(x+h-x)(x^2+2xh+h^2+x^2+xh+x^2)}{h}$ $=\lim_{h\to 0}\frac{h(3x^2+3xh+h^2)}{h}$ $=\lim_{h\to 0}(3x^2+3xh+h^2)$ $=3x^2$	✓formula/*formule* ✓subst. into formula/*subst. in formule* ✓factorization/*faktorisering* ✓simplifying/*vereenvoudiging* ✓answer/*antwoord* (5)
8.2	$f'(x)=4x+2x^3$	✓$4x$ ✓$2x^3$ (2)
8.3	$y=x^{12}-2x^6+1$ $\frac{dy}{dx}=12x^{11}-12x^5$ $=12x^5(x^6-1)$ $=12x^5\sqrt{y}$	✓simplification/*vereenvoudiging* ✓derivative/*afgeleide* ✓factors/*faktore* (3)
8.4	$f(x)=2x^3-2x^2+4x-1$ $f'(x)=6x^2-4x+4$ $f''(x)=12x-4$ f is concave up when/*is konkaaf op as* $f''(x)>0$ $\therefore 12x-4>0$ $12x>4$ $x>\frac{1}{3}$	✓first derivative/*eerste afgeleide* ✓ second derivative/*tweede afgeleide* ✓ $f''(x)>0$ ✓ $x>\frac{1}{3}$ (4) **[14]**

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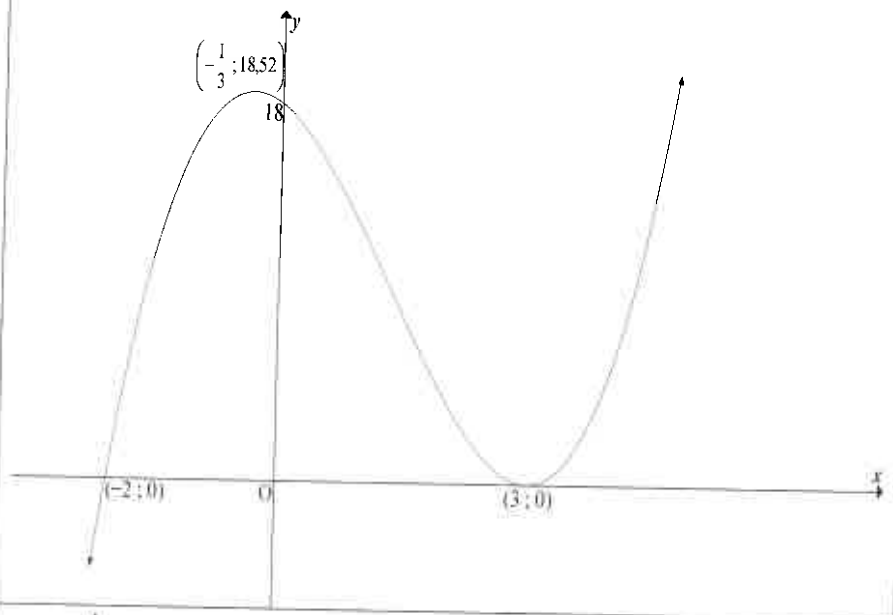
QUESTION/*VRAAG* 9

9.1	$f'(x) = 3x^2 - 8x - 3 = 0$ $(3x+1)(x-3) = 0$ $x = -\frac{1}{3}$ or $x = 3$ $y = \frac{500}{27}$ $\left(\text{or } y = 18\frac{14}{27} \text{ or } 18{,}52\right)$ $y = 0$ Turning points are/*Draaipunte is* $\left(-\frac{1}{3}; \frac{500}{27}\right)$ and $(3;0)$	✓derivative/*afgeleide* ✓derivative/*afgeleide* = 0 ✓factors/*faktore* ✓x-values/*waardes* ✓✓each y-values/*elke y-waarde* (6)
9.2		✓x-intercepts/*afsnitte* ✓y-intercept/*afsnit* ✓turning points/*draaipunte* ✓shape/*vorm* (4)
9.3	$x < \frac{-1}{3}$ or $0 < x < 3$ **OR** $(-\infty; -\frac{1}{3}) \cup (0;3)$	✓$x < \frac{-1}{3}$ ✓both critical points/*beide kritieke-punte* ✓notation/*notasie* (3)

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QUESTION/*VRAAG* 10

10.1	$l+2h=40$ $l=40-2h$	✓answer (1)
10.2	$2b+2h=100$ $b=50-h$ $V=lbh$ $V=h(40-2h)(50-h)$	✓ $2b+2h=100$ ✓ $b=50-h$ ✓volume formula (3)
10.3	$V=(50h-h^2)(40-2h)$ $V=2h^3-140h^2+2000h$ $V'=6h^2-280h+2000=0$ $h=\frac{280\pm\sqrt{(-280)^2-4(6)(2000)}}{2(6)}$ $h\neq 37{,}86$ or $h=8{,}80$ ∴ for a box as large as possible, $h=8{,}80$ cm *vir die grootste moontlike boks = 8,80 cm*	✓simplifying/*vereenvoudig* ✓derivative / *afgeleide* ✓✓*h*-values in any form / *h-waardes in enige vorm* ✓answer/*antwoord* (5) **[9]**

QUESTION/*VRAAG* 11

11.1.1	P(male/*manlik*) $=\frac{83}{180}$ or 0,46 or 46,11%	✓answer/*antwoord* (1)
11.1.2	P(not game park/*nie wildreservaat*) = 1 – P(game park/*wildreservaat*) $=1-\frac{62}{180}$ $=\frac{59}{90}$ or 0,66 or 65,56% **OR/*OF*** P(not game park/*nie wildreservaat*) $=\frac{98}{180}+\frac{20}{180}$ $=\frac{118}{180}$ $=\frac{59}{90}$ or 0,66 or 65,56%	✓ $1-\frac{62}{180}$ ✓answer/*antwoord* (2) ✓ $\frac{98}{180}+\frac{20}{180}$ ✓answer/*antwoord* (2)

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11.2

Events are independent if /*Gebeure is onafhanklike indien*
P(male) × P(home) = P(male and home)
P(*manlik*) × P(*huis*) = P(*manlik en huis*)

P(male/*manlik*) = $\frac{83}{180}$

and/*en* P(home/*huis*) = $\frac{20}{180}$ or 0,11 or 11,11%

P(male/*manlik*) × P(home/*huis*)
$= \frac{83}{180} \times \frac{20}{180}$
$= \frac{83}{1620}$
= 0,05123 or 5,12%

✓P(*m*) × P(*h*) and their values/*en hulle waardes*

✓answer of product

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P(male and home/*manlik en huis*)
$= \frac{13}{180}$
= 0,07222… or 7,22%

✓P(*m* and/*en h*) value/*waarde*

Therefore P(male) × P(home) ≠ P(male and home)
Dus P(*manlik*) × P(*huis*) ≠ P(*manlik en huis*)
Thus the events are not independent./*Dus is die gebeure nie onafhanklik nie*

✓conclusion/*afleiding* (4)

OR/*OF*

	Home/*Huis*	Not Home/ *Nie huis*	
M	13	70	83
F	7	90	97
	20	160	180

P(female/*vroulik*) × P(not home/nie *huis*)
$= \frac{97}{180} \times \frac{160}{180}$
$= \frac{194}{405}$
= 0,479012345… or 47,90%

✓P(*f*) × P(not *h*) and their values/*en hulle waardes*

✓answer of product

P(female and not home/*vroulik en nie-huis*)
$= \frac{90}{180}$
= 0,5 or 50%

✓P(*f* and/*en* not *h*) value/*waarde*

Therefore P(female) × P(not home) ≠ P(female and not home)
Thus the events are not independent.
Dus P(*vroulik*) × P(nie-*huis*) ≠ P(*vroulik en nie-huis*)
Dus is die gebeure nie onafhanklik nie.

✓conclusion/*afleiding* (4)

[7]

QUESTION/*VRAAG* 12

12.1.1	$26\times25\times24\times23\times22$ $= 7\ 893\ 600$ **OR/*OF*** $^{26}P_5 = \frac{26!}{(26-5)!} = \frac{26!}{21!} = 7\ 893\ 600$	✓$26\times25\times24\times23\times22$ ✓7 893 600 (2) ✓formula/*formule* ✓answer/*antwoord* (2)
12.1.2	$24\times23\times22$ $= 12\ 144$	✓$24\times23\times22$ ✓12 144 (2)
12.2.1	~~7×6×5×4×3×2×1~~ $= 5\ 040$	✓product/*produk* ✓5 040 (2)
12.2.2	(~~3×2×1~~)(~~5×4×3×2×1~~) $= 720$ **OR/*OF*** The five 'units' can be parked in ~~5×4×3×2×1~~ ways./*Die vyf 'eenhede' kan op 5×4×3×2×1 maniere geparkeer word.* The three silver cars can be parked in ~~3×2×1~~ ways./*Die drie silwer motors kan op 3×2×1 maniere parkeer word.* So there are (~~3×2×1~~)(~~5×4×3×2×1~~) = 720 ways to park the cars./*Dus is daar (3×2×1)(5×4×3×2×1) = 720 maniere om die motors te parkeer.* **OR/*OF*** Suppose for the moment the 3 silver cars are at one end./*Veronderstel die drie silwer motors is op die punt.* The 3 cars can be arranged in ~~3×2×1~~ = 6 ways./*Die 3 motors kan op 3×2×1 = 6 maniere gerangskik word.* For each of them the remaining four cars can be arranged in ~~4×3×2×1~~ = 24 ways./*Die 4 oorblywende motors kan op 4×3×2×1 = 24 maniere rangskik word.* So 6×24 = 144 ways if all 3 cars at one end./*Dus is daar 6 × 24 = 144 maniere as die 3 motors op die punt is.* Together, the silver cars can only occupy 5 different positions amongst the 7 positions. ./*Saam kan die silwer motors slegs 5 verskillende posisies hê tussen die 7 moontlike posisies.* ∴ Total ways/*Totale getal maniere* = 5×144 = 720	✓3×2×1 ✓5×4×3×2×1 ✓720 (3) ✓5×4×3×2×1 ✓3×2×1 ✓720 (3) ✓6×24 = 144 ✓5×144 ✓720 (3) [9]

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TOTAL/*TOTAAL*: 150

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ANNEXURE A : MATHEMATICS PAPER 1 NOVEMBER 2014
MEMORANDUM NOTES TO MARKERS

- **Continued Accuracy – when the second mistake is made: stop marking; 1st one is regarded as a slip; the second one is regarded as they do not know what they are doing – stop marking**

- **Incorrect formula: 0 marks**

QUESTION 1

Question 1.1.2

- **Only** place where there will be a penalty for rounding
- If the substitution is not shown but everything else is correct – max 3 / 4 marks
- This is the place where we penalise the candidate for not SHOWING how they get to the answer.

Question 1.1.3

- Trial and error – try 1, didn't work; try 2, it works $\therefore x = 2$. 2/3 marks
- Breakdown: $2^{x+2} + 2^x = 2^2 + 2^4$
  $x + 2 + x = 2 + 4$
  $x = 2$
  This is a breakdown 0/3 marks
- Mathematics behind getting to $x = 2$ MUST be correct
- Answer only: 2/3 marks

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Question 1.2

- If the candidate says $x = -\frac{3}{2}$ or $x = -1$
  $y = -\frac{9}{4}$ or $y = -2$
  This then carries a maximum of 4/6 marks
- If the candidate does not show the factorisation but gets to the answer of y correct, then there is NO penalty.
- If the square is NOT put in in the substitution line, then the quadratic becomes the same – only lose substitution mark $\therefore$ 5/6 marks
- If the candidate simplifies the problem to a linear equation, the only mark they can get is for the substitution (including the squared) $\therefore$ max 1/6 mark

Question 1.3

- If they leave the answer as a correct sketch with the critical values on it: 3 / 4 marks
- If the candidate does $(x+1)(x-4) < 0$ then gets the answer $x < -1$ or $x < 4$: 2 / 4 marks
- If the candidate does a graphical solution but concludes incorrectly: 3 / 4 marks

- If the candidate leaves the answer as (including the open circles) or shades on the x-axis on the parabola 4 / 4 marks

- If the candidate changes the question to an equality, max 2 / 4 marks (✓ standard form ✓ factorisation)
- The critical value mark is awarded in the context of solving an inequality (i.e. in conjunction with the graphical solution or the table solution)

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Question 1.4

- Answer only: 2 / 2 marks
- If $k < -4$ then 1 / 2 marks
- If they don't get the first mark except in the instance above i.e. if the candidate answers $k = -4$: 0 / 2 marks

QUESTION 2

Question 2.2

- The mark for a and d is given independent of the formula.
- Incorrect formula but $a = 2$ and $d = 7$ is listed: 1 / 3 marks
- Incorrect formula: 0 / 3 marks
- Answer only: 3 / 3 marks

Question 2.3

- If $\sum_{n=1}^{251} = 7n - 5$ then 1 / 2 marks
- If $\sum_{n=1}^{251} T_n$ or $\sum_{n=1}^{251}(\text{wrong formula})$ then 1 / 2 marks

Question 2.4

T_n is a continued accuracy mark from 2.3

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Question 2.5

- Answer only: 1 / 4 marks
- If $\frac{251}{4} = 62{,}75 = 63$ then 1 / 4 marks
- If $\frac{252}{4} = 63$ only then 1 / 4 marks

QUESTION 3

Question 3.1

Answer only: 2 / 2 marks

Question 3.1.2

- If the candidate does the solution using regression analysis: $a = 7$; $b = -9$; $c = 1$ and $T_n = n^2 - 9n + 7$, 4./.4 marks
- If the answer is correct, then 4 / 4 marks
- If answer only: EVERYTHING must be correct to get 4 / 4 marks otherwise 0 / 4 marks

Question 3.1.3

If the candidate starts with $n = 52$ and gets $T_{52} = 2243$ and $T_{53} = 2339$: full marks

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Question 3.2.1

- Scientific notation is correct and will be awarded full marks: $3{,}81 \times 10^{-6}$
- If the candidate leaves the answer as $\frac{1}{262144}$: 2 / 3 marks

Question 3.2.2

- Answer only: 2 / 2 marks
- If answer is given as 21:1 / 2 marks

Question 3.3

Be aware of alternatives here.

QUESTION 4

Question 4.1

If the candidate writes down the function as $g(x) = \frac{2}{x+1} + 1$ then p and q values are implied and award 2 / 2 marks

Question 4.2

- Answer only: 2 / 2 marks
- If the candidate has $\frac{2}{x-1} + 1 = 0$ then $x = -1$ then 1 / 2 marks

Question 4.3

- Note that the answer can be done independently of Question 4.1
- Note that the answer can be done as a CA to the answer in Question 4.1: i.e. $x = -p - 5$ for the CA mark.

Question 4.4

- CA from 4.1 If candidate has $\frac{2}{x-1} + 1 = x$ then OS = 3,41
- If the candidate starts with S $\left(\sqrt{3}; \sqrt{3}\right)$ with no working and gets $OS^2 = 6$: 3 / 5 marks
- If the candidate assumes any other value for the point S, no CA marks

QUESTION 5

Question 5.1

If $\log_3 \frac{1}{3} = \log_3 3^{-1} = -\log_3 3 = -1$: 0 / 2 marks

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Question 5.2

- Answer only: 2 / 2 marks
- If the candidate states: $y = a^x$ then 2 / 2 marks

Question 5.3

Answers can be written in terms of a.

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Question 5.5

- Answer only: 3 / 3 marks
- The candidate can use the log inequality.
- If the candidate gives the answer in terms of a then 3 / 3 marks i.e. $x \geq \frac{1}{a^3}$
- If the candidate leaves the answer as $x \leq \frac{1}{27}$: 2 / 3 marks

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QUESTION 6

Question 6.1

- No penalty for rounding.
- Penalise for leaving in surd form as the question states to TWO decimal places.
- Penalise 1 if the candidate does not make a choice for x.
- The $y = 0$ can be implied.

Question 6.2

Both marks are accuracy marks.

Question 6.3.1

- If the candidates swap the functions around then max 2 / 3 marks.
- If the candidate leaves the answer as $QT = 2\sqrt{x} - (4x^2 - 6)$ then 3 / 3 marks.
- If the candidate uses the distance formula with $(x\,;\,2\sqrt{x})$ and $(x\,;\,4x^2 - 6)$ and $\text{QT} = \sqrt{(2\sqrt{x} - 4x^2 + 6)^2 + (x - x)^2} = 2\sqrt{x} - 4x^2 + 6$ then 3 / 3 marks
- If the candidate uses the distance formula with $(x\,;\,2\sqrt{x})$ and $(x\,;\,4x^2 - 6)$ and $\text{QT} = \sqrt{(4x^2 - 6 - 2\sqrt{x})^2 + (x - x)^2} = 4x^2 - 6 - 2\sqrt{x}$ then 2 / 3 marks
- If the candidate provides the solution:

QKT = QK + KT	✓ QKT = QK + KT
$\text{QK} = 2\sqrt{x}$	
$\text{KT} = -(4x^2 - 6)$	✓ $-(4x^2 - 6)$
$\text{QKT} = 2\sqrt{x} + (-4x^2 + 6)$	✓ answer

Question 6.3.2

- CA must apply for the derivative from Question 6.3.1.
- If a candidate simplifies the equation by using their incorrect values then the CA cannot be applied.
- Be careful of the kinds of answers that the learner gives. The x value MUST be positive due to the position of K on the graph. If x is negative, then there is a breakdown.

QUESTION 7

Question 7.1

- If the candidate swaps A and P, the answer will be $i = -14{,}87\%$: max 1 / 3 marks
- If the candidate rounds off early and gets $i = 13\%$: max 2 / 3 marks
- If the candidate uses the incorrect formula: 0 / 3 marks
- If the candidate leaves the answer as 12,9%: 2 / 3 marks
- If the candidate leaves the answer to more than 2 decimal places then no penalty

Question 7.2.1

- The marks for n and i are independent of the formula.
- Early rounding: max 3 / 4 marks

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Question 7.2.2

- If the candidate uses the F_v formula: 1 / 4 marks for $x = 6000$.
- Accept $n = 180{,}07$
- Do not accept $n = 180$ 3./.4 marks

Question 7.2.3

- If the candidate answers Samuel only: 1 / 2 marks
- The totals can also be calculated: Melissa's total will be 6000 x 180,07 = R 1 080 420
  Samuel's total will be 5505,43 x 240 = R 1 321 303,20

QUESTION 8

There is a maximum penalty of 1 for incorrect notation in the WHOLE of question 8.

Question 8.1

- Mistakes in notation: max 4 / 5 marks
- Do not penalise if the candidate does not have the bracket in the second to last step.
- If the candidate uses rules of differentiation: 0 / 5 marks
- If the candidate simplifies the problem and does first principles on $3x^2$: 0 / 5 marks
- Markers need to be careful of the correct answer by incorrect methods.
- Ignore the substitution of $h = 0$.

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Question 8.2

If the candidate leaves the – 3 in the answer, then max 1 / 2 marks

Question 8.3

- The mark for the derivative is a CA mark
- The candidate can use the chain rule to solve this problem.

$$\frac{dy}{dx} = 2\left(x^6 - 1\right)6x^5$$
$$= 12x^5\left(x^6 - 1\right) \quad \checkmark 2\left(x^6 - 1\right) \quad \checkmark 6x^5 \quad \checkmark 12x^5$$
$$= 12x^5\sqrt{y}$$

- The candidate can square root first and then use implicit differentiation. An AP candidate may use this method.

$$y = \left(x^6 - 1\right)^2$$
$$y^{\frac{1}{2}} = x^6 - 1$$
$$\frac{1}{2}y^{-\frac{1}{2}}.\frac{dy}{dx} = 6x^5 \quad \checkmark \frac{1}{2}y^{-\frac{1}{2}} \quad \checkmark \frac{dy}{dx} \quad \checkmark 6x^5$$
$$\frac{dy}{dx} = 12x^5\sqrt{y}$$

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Question 8.4

- If the candidate works out $x = \frac{1}{3}$ and conclude $x > \frac{1}{3}$: full marks
- If the candidate stops at $x = \frac{1}{3}$ then 2 / 4 marks
- The mark for $f''(x) > 0$ can also be awarded for a "sketch" graph of f.

QUESTION 9

Question 9.1

= 0 must be stated and not implied.

If the candidate gets $x = 3$ by factorising the quadratic factor and concludes $x = 3$ and $y = 0$: 1 / 6 mark

Question 9.2

If the candidate draws a cubic graph passing through (0 ; 18) then the candidate can get 1 mark.

Question 9.3

If the candidate's answer is $-\frac{1}{3} < x < 3$: 0 / 3 marks

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QUESTION 10

Question 10.2

- If the candidate only writes V = *lbh*: 1 / 3 marks
- If the candidate only gets to $b = 50 - h$: 2 / 3 marks

Question 10.3

- = 0 can be implied.
- 5th mark is for rejection of one of the h's.
- If derivative incorrect:

  CA but the answer must make sense. Be careful that $0 < h < 20$.

  Do not CA if the candidate gets a quadratic that can be factorised. This has simplified the solution

QUESTION 11

Question 11.2

If the candidate just states not independent with no calculations: 0 / 4 marks

QUESTION 12

Question 12.1.1

There is NO CA for not knowing the number of letters in the alphabet. The candidate gets no marks if they do not start with 26 …

Question 12.1.2

The CA only continues if the number they start with is 2 less than the number they started with in 12.1.1

Question 12.2.2

- If the candidate only gives the answer as 3!: 1 / 3 marks
- If the candidate only gives the answer as 5!: 1 / 3 marks
- If the candidate only gives the answer as 3!.4! = 144: 1 / 3 marks

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