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education

MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

MATHEMATICS GRADE 12 REVISION PACK

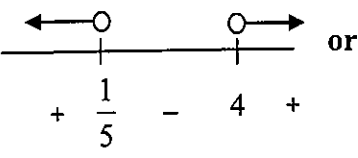
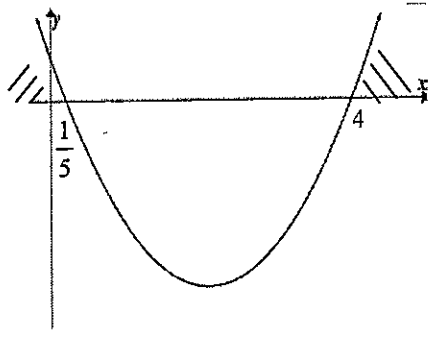
Paper 1

EASY TO SCORE QUESTIONS

Memorandum

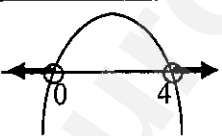
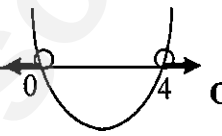
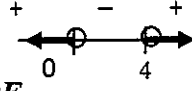
QUESTION/VRAAG 1

1.1.1	$(x+4)(x-5)=0$ $\therefore x=-4$ or $x=5$	✓ factors/faktore ✓ answers/antwoorde (2)
1.1.2	$2x^2 - 11x + 7 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-11) \pm \sqrt{(-11)^2 - 4(2)(7)}}{2(2)}$ $= 4,77 \text{ or } 0,73$ OR/OF $2x^2 - 11x + 7 = 0$ $x^2 - \frac{11}{2}x + \frac{7}{2} = 0$ $x^2 - \frac{11}{2}x + \left(\frac{1}{2} \cdot \frac{11}{2}\right)^2 + \frac{7}{2} - \left(\frac{1}{2} \cdot \frac{11}{2}\right)^2 = 0$ $\left(x - \frac{11}{4}\right)^2 + \frac{7}{2} - \frac{121}{16} = 0$ $\left(x - \frac{11}{4}\right)^2 = \frac{121 - 56}{16}$ $x - \frac{11}{4} = \pm \sqrt{\frac{65}{16}}$ $\therefore x = \frac{11}{4} + \frac{\sqrt{65}}{4} \quad \text{or} \quad x = \frac{11}{4} - \frac{\sqrt{65}}{4}$ $x = 4,77 \quad \quad \quad x = 0,73$	✓ substitution into correct formula/substitusie in korrekte formule ✓ 4,77 ✓ 0,73 ✓ correct completion of the square/korrekte voltooiing van die vierkant ✓ 4,77 ✓ 0,73 (3)

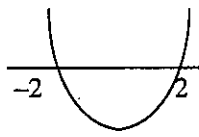
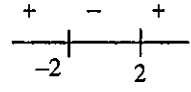
1.1.3	$5x^2 - 21x + 4 > 0$ $(5x - 1)(x - 4) > 0$ $x < \frac{1}{5}$ or/of $x > 4$  or 	✓ standard form/ <i>standaardvorm</i> ✓ factors/ <i>faktore</i> ✓ $x < \frac{1}{5}$ ✓ $x > 4$ ✓ of (5)
1.1.4	$2^{2x} - 6 \cdot 2^x = 16$ $2^{2x} - 6 \cdot 2^x - 16 = 0$ $(2^x - 8)(2^x + 2) = 0$ $2^x = 2^3$ or/of $2^x = -2$ $x = 3$ or/of No Solution or $2^x \neq -2$	✓ factors/ <i>faktore</i> ✓ no solution to/ <i>geen oplossing</i> $2^x = -2$ ✓ $2^x = 2^3$ ✓ answer/ <i>antw.</i> (4)

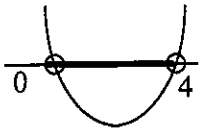
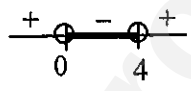
1.2	$y = 2x - 1$ $x^2 - x(2x - 1) + (2x - 1)^2 = 7$ $x^2 - 2x^2 + x + 4x^2 - 4x + 1 = 7$ $3x^2 - 3x - 6 = 0$ $x^2 - x - 2 = 0$ $(x - 2)(x + 1) = 0$ $x = 2$ or/of $x = -1$ $y = 3$ or/of $y = -3$ OR/OF $x = \frac{y}{2} + \frac{1}{2}$ $\left(\frac{y}{2} + \frac{1}{2}\right)^2 - \left(\frac{y}{2} + \frac{1}{2}\right)y + y^2 = 7$ $\frac{y^2}{4} + \frac{y}{2} + \frac{1}{4} - \frac{y^2}{2} - \frac{y}{2} + y^2 = 7$ $\times 4: y^2 + 2y + 1 - 2y^2 - 2y + 4y^2 - 28 = 0$ $3y^2 - 27 = 0$ $y^2 - 9 = 0$ $(y - 3)(y + 3) = 0$ $\therefore y = 3$ or $y = -3$ $\therefore x = \frac{3}{2} + \frac{1}{2}$ $x = \frac{-3}{2} + \frac{1}{2}$ $x = 2$ $x = -1$	✓ the subject/ die onderwerp ✓ substitution/substitusie ✓ simplification/vereenv. ✓ factors/faktore ✓ x-values/waardes ✓ y-values/waardes (6)
1.3.1	$k = -2$ or/of $k = 2$	✓✓ answer/antw. (2)
1.3.2	$k = -3$	✓ -3 (1)

1.4	$\sqrt{\frac{7^{2014} - 7^{2012}}{12}}$ $= \sqrt{\frac{7^{2012}(7^2 - 1)}{12}}$ $= \sqrt{\frac{7^{2012} \cdot 48}{12}}$ $= \sqrt{7^{2012} \cdot 4}$ $= 2 \cdot 7^{1006}$ $a = 2; b = 1006$	$\checkmark \frac{7^{2012}(7^2 - 1)}{12}$ $\checkmark \sqrt{7^{2012} \cdot 4}$ $\checkmark 2 \cdot 7^{1006} \checkmark$ OR/OF $\checkmark a = 2$ $\checkmark b = 1006$ (4) [27]
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1.1.1	$x^2 - x - 12 = 0$ $(x - 4)(x + 3) = 0$ $x = 4 \text{ or } x = -3$ OR/OF $x^2 - x - 12 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-12)}}{2(1)}$ $= 4 \text{ or } -3$	✓ factors ✓✓ answers (3) ✓ substitution into formula ✓✓ answers (3)
1.1.2	$x(x + 3) - 1 = 0$ $x^2 + 3x - 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-3 \pm \sqrt{3^2 - 4(1)(-1)}}{2(1)}$ $= \frac{-3 \pm \sqrt{13}}{2}$	✓ standard form ✓ substitution into correct formula ✓ answer (3)
1.1.3	$x(4 - x) < 0$ $x < 0 \text{ or } x > 4$ OR/OF $x(4 - x) < 0$ $x(x - 4) > 0$ $x < 0 \text{ or } x > 4$  OR/OF  	✓ $x < 0$ ✓ $x > 4$ ✓ or (3) ✓ $x < 0$ ✓ $x > 4$ ✓ or (3)

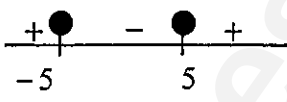
1.1.4	$x = \frac{a^2 + a - 2}{a - 1}$ $= \frac{(a+2)(a-1)}{a-1}$ $= a+2$ $= 888888888890$	$\checkmark (a+2)(a-1)$ $\checkmark$ answer (check ten eights written)/tien agtstes geskryf (2)
1.2	$y+7=2x$ $y=2x-7 \dots\dots\dots(1)$ $x^2 - xy + 3y^2 = 15$ substitute (1) in (2): $x^2 - x(2x-7) + 3(2x-7)^2 = 15$ $x^2 - 2x^2 + 7x + 3(4x^2 - 28x + 49) = 15$ $x^2 - 2x^2 + 7x + 12x^2 - 84x + 147 - 15 = 0$ $11x^2 - 77x + 132 = 0$ $x^2 - 7x + 12 = 0$ $(x-3)(x-4) = 0$ $x=3 \quad \text{or} \quad x=4$ $y=2(3)-7 \quad y=2(4)-7$ $y=-1 \quad y=1$ OR/OF $y+7=2x$ $x = \frac{y+7}{2} \dots\dots\dots(1)$ $x^2 - xy + 3y^2 = 15 \dots\dots\dots(2)$ substitute (1) in (2): $\left(\frac{y+7}{2}\right)^2 - \left(\frac{y+7}{2}\right)y + 3y^2 = 15$ $\frac{y^2 + 14y + 49}{4} - \frac{y^2 + 7y}{2} + 3y^2 = 15$ $y^2 + 14y + 49 - 2y^2 - 14y + 12y^2 - 60 = 0$ $11y^2 - 11 = 0$ $y^2 - 1 = 0$ $(y-1)(y+1) = 0$ $y = -1 \quad y = 1$ $x = \frac{-1+7}{2} \quad x = \frac{1+7}{2}$ $x = 3 \quad x = 4$	$\checkmark y=2x-7$ $\checkmark$ substitution $\checkmark$ standard form $\checkmark$ factorisation $\checkmark$ x-values $\checkmark$ y-values (6) $\checkmark x = \frac{y+7}{2}$ $\checkmark$ substitution $\checkmark$ standard form $\checkmark$ factorisation $\checkmark$ y-values $\checkmark$ x-values (6)

1.3	$y = x + \frac{1}{x}$ $xy = x^2 + 1$ $x^2 - xy + 1 = 0$ Since x is real, this equation has real roots. / <i>Omdat x reëel is, het die vergelyking reële wortels.</i> $\Delta \geq 0$ $y^2 - 4 \geq 0$ $(y-2)(y+2) \geq 0$  OR/ OF  $y \leq -2 \text{ or } y \geq 2$	$\checkmark x^2 - xy + 1 = 0$ $\checkmark \Delta \geq 0$ $\checkmark y^2 - 4$ $\checkmark$ factors $\checkmark y \leq -2$ $\checkmark y \geq 2$ (6) [23]
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1.1.1	$(x-3)(x+1) = 0$ $x = 3$ or $x = -1$	✓ answer ✓ answer (2)
1.1.2	$\sqrt{x^3} = 512$ $x^{\frac{3}{2}} = 512$ $\left(x^{\frac{3}{2}}\right)^{\frac{2}{3}} = (512)^{\frac{2}{3}}$ $x = 64$ OR $\sqrt{x^3} = 512$ $x^3 = 262144$ $x^3 = 2^{18}$ $x = 2^6$ $x = 64$	✓ $x^{\frac{3}{2}}$ ✓ $(8^3)^{\frac{2}{3}}$ ✓ answer (3) ✓ squaring both sides ✓ $x^3 = 2^{18}$ ✓ answer (3)
1.1.3	$x(x-4) < 0$  OR / OF  $0 < x < 4$ OR / OF $x \in (0; 4)$	✓ critical values ✓ inequality or interval (2)

1.2.1	$x^2 - 5x + 2 = 0$ $x = \frac{5 \pm \sqrt{(-5)^2 - 4(1)(2)}}{2(1)}$ $x = \frac{5 \pm \sqrt{17}}{2}$ $x = 0,44$ or $x = 4,56$ OR $x^2 - 5x + 2 = 0$ $x^2 - 5x = -2$ $x^2 - 5x + \left(-\frac{5}{2}\right)^2 = -2 + \left(-\frac{5}{2}\right)^2$ $\left(x - \frac{5}{2}\right)^2 = \frac{17}{4}$ $x = \frac{5 + \sqrt{17}}{2}$ or $x = \frac{5 - \sqrt{17}}{2}$ $x = 0,44$ or $x = 4,56$	✓ subst correct formula ✓ answer ✓ answer (3) ✓ $\left(x - \frac{5}{2}\right)^2 = \frac{17}{4}$ ✓ answer ✓ answer (3)
1.2.2	$f(x) = x^2 - 5x + 2$ $x^2 - 5x + 2 = c$ $x^2 - 5x + 2 - c = 0$ $b^2 - 4ac < 0$ $(-5)^2 - 4(1)(2 - c) < 0$ $25 - 8 + 4c < 0$ $4c < -17$ $c < -\frac{17}{4}$	✓ standard form ✓ $b^2 - 4ac < 0$ ✓ substitution ✓ answer (4)
1.3	$x = 2y + 2$ $x^2 - 2xy + 3y^2 = 4$ $(2y + 2)^2 - 2y(2y + 2) + 3y^2 = 4$ $4y^2 + 8y + 4 - 4y^2 - 4y + 3y^2 = 4$ $3y^2 + 4y = 0$ $y(3y + 4) = 0$ $y = 0$ or $y = -\frac{4}{3}$ $x = 2$ $x = -\frac{2}{3}$	✓ substitution ✓ simplification ✓ standard form ✓ factors ✓ $y = 0$; $y = -\frac{4}{3}$ ✓ x-values (ca on both x-values) (6)

	OR / OF $x = 2y + 2$ $y = \frac{1}{2}x - 1$ $x^2 - 2xy + 3y^2 = 4$ $x^2 - 2x\left(\frac{1}{2}x - 1\right) + 3\left(\frac{1}{2}x - 1\right)^2 = 4$ $x^2 - x^2 + 2x + 3\left(\frac{1}{4}x^2 - x + 1\right) = 4$ $2x + \frac{3}{4}x^2 - 3x + 3 = 4$ $3x^2 - 4x - 4 = 0$ $(3x + 2)(x - 2) = 0$ $x = 2 \quad \text{or} \quad x = -\frac{2}{3}$ $y = 0 \quad \quad y = -\frac{4}{3}$	✓ substitution ✓ simplification ✓ standard form ✓ factors ✓ $x = 2 ; x = -\frac{2}{3}$ ✓ y-values (ca on both y-values) (6)
1.4	$S = \frac{6}{x^2 + 2}$ For S to be a maximum the denominator needs to be at a minimum. <i>Vir S om 'n maksimum waarde te hê, moet die deler 'n minimum waarde h</i> Minimum of $x^2 + 2$ is 2 Maximum of $S = \frac{6}{x^2 + 2}$ $= \frac{6}{2}$ $= 3$	✓ Minimum of $x^2 + 2$ is 2 ✓ 3 (2)
[22]		

1.1.1	$x^2 - 6x - 16 = 0$ $(x-8)(x+2) = 0$ $x = -2$ or $x = 8$	✓ factors ✓ $x = -2$ ✓ $x = 8$ (3)
1.1.2	$2x^2 + 7x - 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(7) \pm \sqrt{(7)^2 - 4(2)(-1)}}{2(2)}$ $= \frac{-7 \pm \sqrt{57}}{4}$ $x = 0,14$ or $x = -3,64$ OR/OF $x^2 + \frac{7}{2}x + \frac{49}{16} = \frac{1}{2} + \frac{49}{16}$ $\left(x + \frac{7}{4}\right)^2 = \frac{57}{16}$ $x + \frac{7}{4} = \pm \frac{\sqrt{57}}{4}$ $x = \frac{-7 \pm \sqrt{57}}{4}$ $x = 0,14$ or $x = -3,64$ NOTE: Penalise 1 mark if the rounding to TWO decimal places is incorrect.	✓ subs into correct formula ✓ $\frac{-7 \pm \sqrt{57}}{4}$ ✓ $x = 0,14$ ✓ $x = -3,64$ OR/OF ✓ for adding $\frac{49}{16}$ on both sides ✓ $\frac{-7 \pm \sqrt{57}}{4}$ ✓ $x = 0,14$ ✓ $x = -3,64$ (4)
1.2	$x^2 - 25 < 0$ $(x-5)(x+5) < 0$  $-5 < x < 5$ $x = \{-4; -3; -2; -1; 0; 1; 2; 3; 4\}$ NOTE: Final answer only 2 / 2	✓ factors ✓ ✓ inequality ✓ answer (4)

1.3	$x = 2y - 1$ $(2y - 1)^2 - 7 - y^2 = -y$ $4y^2 - 4y + 1 - 7 - y^2 = -y$ $3y^2 - 3y - 6 = 0$ $y^2 - y - 2 = 0$ $(y - 2)(y + 1) = 0$ $y = 2 \text{ or } y = -1$ $x = 2(2) - 1 \text{ or } x = 2(-1) - 1$ $x = 3 \text{ or } x = -3$ OR/OF $y = \frac{x+1}{2}$ $x^2 - 7 - y^2 = -y$ $x^2 - 7 - \left(\frac{x+1}{2}\right)^2 = -\left(\frac{x+1}{2}\right)$ $x^2 - 7 - \left(\frac{x^2 + 2x + 1}{4}\right) = \frac{-x-1}{2}$ $4x^2 - 28 - x^2 - 2x - 1 = -2x - 2$ $3x^2 - 27 = 0$ $x^2 - 9 = 0$ $(x - 3)(x + 3) = 0$ $x = -3 \text{ or } x = 3$ $y = \frac{-3+1}{2} \text{ or } y = \frac{3+1}{2}$ $y = -1 \text{ or } y = 2$	$\checkmark x = 2y - 1$ $\checkmark$ substitution $\checkmark$ correct standard form $\checkmark$ factors $\checkmark$ y - values $\checkmark$ x - values OR/OF $\checkmark y = \frac{x+1}{2}$ $\checkmark$ substitution $\checkmark$ correct standard form $\checkmark$ factors $\checkmark$ x - values $\checkmark$ y - values (6)
1.4	$\frac{3^{2018} + 3^{2016}}{3^{2017}}$ $= \frac{3^{2017}(3^1 + 3^{-1})}{3^{2017}}$ $= 3 + \frac{1}{3}$ $= 3\frac{1}{3} \text{ or } \frac{10}{3}$ OR/OF	$\checkmark$ common factor 3^{2017} $\checkmark$ answer OR/OF

	$\frac{3^{2018} + 3^{2016}}{3^{2017}}$ $= \frac{3^{2016}(3^2 + 1)}{3^{2017}}$ $= \frac{10}{3}$ OR/OF $\frac{3^{2018} + 3^{2016}}{3^{2017}}$ $= \frac{3^{2018}}{3^{2017}} + \frac{3^{2016}}{3^{2017}}$ $= 3 + \frac{1}{3}$ $= 3\frac{1}{3} \text{ or } \frac{10}{3}$	✓ common factor 3^{2016} ✓ answer OR/OF ✓ dividing by 3^{2017} ✓ answer (2)
1.5.1	$3x - 5 \geq 0 \text{ and } x \neq 3$ $x \geq \frac{5}{3} \text{ and } x \neq 3$	✓ $3x - 5 \geq 0$ ✓ $x \geq \frac{5}{3}$ ✓ $x \neq 3$ (3)
1.5.2	$\frac{\sqrt{3x-5}}{x-3} = 1$ $\sqrt{3x-5} = x-3$ $3x-5 = (x-3)^2$ $3x-5 = x^2 - 6x + 9$ $x^2 - 9x + 14 = 0$ $(x-7)(x-2) = 0$ $x \neq 2 \text{ or } x = 7$ NOTE: If $x = 2$ is not rejected, then maximum 3 / 4 marks	✓ $\sqrt{3x-5} = x-3$ ✓ $3x-5 = (x-3)^2$ ✓ factors ✓ $x = 7$ (4) [26]

NOTE:

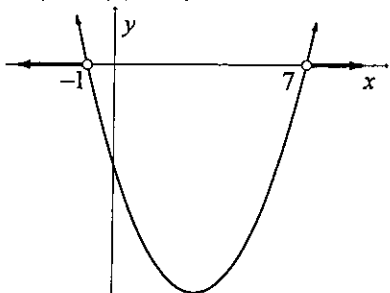
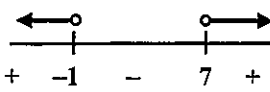
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking guidelines.

LET WEL:

- Indien 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

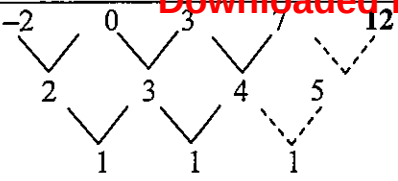
QUESTION/VRAAG 1

1.1.1	$(3x-1)(x+4)=0$ $x = \frac{1}{3} \text{ or } x = -4$	$\checkmark x = \frac{1}{3}$ $\checkmark x = -4$ (2)
1.1.2	$2x^2 + 9x - 14 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-9 \pm \sqrt{9^2 - 4(2)(-14)}}{2(2)}$ $= \frac{-9 \pm \sqrt{193}}{4}$ $x = 1,22 \text{ or } x = -5,72$ OR/OF $x^2 + \frac{9}{2}x + \frac{81}{16} = 7 + \frac{81}{16}$ $\left(x + \frac{9}{4}\right)^2 = \frac{193}{16}$ $x + \frac{9}{4} = \pm \frac{\sqrt{193}}{4}$ $x = \frac{-9 \pm \sqrt{193}}{4}$ $x = 1,22 \text{ or } x = -5,72$	$\checkmark$ substitution into correct formula $\checkmark$ simplification $\checkmark x = 1,22$ $\checkmark x = -5,72$ OR/OF $\checkmark$ for adding $\frac{81}{16}$ on both sides $\checkmark$ simplification $\checkmark x = 1,22$ $\checkmark x = -5,72$ (4)
1.1.3	$\sqrt{3-26x} = 3x$ $3-26x = 9x^2$ $9x^2 + 26x - 3 = 0$ $(9x-1)(x+3) = 0$ $x = \frac{1}{9} \text{ or } x = -3$ N/A	$\checkmark 3-26x = 9x^2$ $\checkmark$ standard form $\checkmark$ factors $\checkmark$ answer with selection (4)

1.1.4	$(x-1)(x-4) > x+11$ $x^2 - 5x + 4 > x + 11$ $x^2 - 6x - 7 > 0$ $(x-7)(x+1) > 0$  OR  $x < -1$ or $x > 7$	$\checkmark x^2 - 5x + 4$ $\checkmark$ standard form $\checkmark$ factors $\checkmark\checkmark x < -1$ or $x > 7$ (5)
1.2	$\frac{4\sqrt{x^7} - 5\sqrt{x^7}}{\sqrt{x}}$ $= \frac{-\sqrt{x^7}}{\sqrt{x}}$ $= \frac{-x^{\frac{7}{2}}}{x^{\frac{1}{2}}}$ $= -x^3$ OR/OF $\frac{\sqrt{x^7}(4-5)}{\sqrt{x}}$ $= \sqrt{x^6}(-1)$ $= -x^3$ OR/OF $\frac{(16x^7)^{\frac{1}{2}} - (25x^7)^{\frac{1}{2}}}{x^{\frac{1}{2}}}$ $= \frac{4x^{\frac{7}{2}} - 5x^{\frac{7}{2}}}{x^{\frac{1}{2}}}$ $= \frac{-x^{\frac{7}{2}}}{x^{\frac{1}{2}}}$ $= -x^3$	$\checkmark 4\sqrt{x^7} - 5\sqrt{x^7}$ $\checkmark -\sqrt{x^7}$ $\checkmark -x^3$ (3) OR/OF $\checkmark \sqrt{x^7}(4-5)$ $\checkmark \sqrt{x^6}(-1)$ $\checkmark -x^3$ (3) OR/OF $\checkmark \frac{4x^{\frac{7}{2}} - 5x^{\frac{7}{2}}}{x^{\frac{1}{2}}}$ $\checkmark -x^{\frac{7}{2}}$ $\checkmark -x^3$ (3)

1.3	$x - 2y - 3 = 0$ $x = 2y + 3 \dots\dots\dots(1)$ $xy = 9 \dots\dots\dots(2)$ Substitute (1) into (2) $(2y + 3)y = 9$ $2y^2 + 3y = 9$ $2y^2 + 3y - 9 = 0$ $(2y - 3)(y + 3) = 0$ $y = \frac{3}{2}$ or $y = -3$ $x = 6$ or $x = -3$ OR/OF $y = \frac{x - 3}{2} \dots\dots\dots(1)$ $xy = 9 \dots\dots\dots(2)$ Substitute (1) into (2) $x\left(\frac{x - 3}{2}\right) = 9$ $x^2 - 3x = 18$ $x^2 - 3x - 18 = 0$ $(x - 6)(x + 3) = 0$ $x = 6$ or $x = -3$ $y = \frac{3}{2}$ or $y = -3$ OR/OF $x - 2y - 3 = 0$ $x = 2y + 3 \dots\dots\dots(1)$ $y = \frac{9}{x} \dots\dots\dots(2)$ Substitute (2) into (1) $x = 2\left(\frac{9}{x}\right) + 3$ $x^2 - 2(9) - 3x = 0$ $x^2 - 3x - 18 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-3 \pm \sqrt{(-3)^2 - 4(1)(-18)}}{2(1)}$ $= \frac{-3 \pm \sqrt{81}}{2}$ $x = 6$ or $x = -3$ $y = \frac{9}{6} = 1,5$ or $y = \frac{9}{-3} = -3$	$\checkmark x = 2y + 3$ $\checkmark$ substitution $\checkmark$ standard form $\checkmark$ y-values $\checkmark$ x-values (5) OR/OF $\checkmark y = \frac{x - 3}{2}$ $\checkmark$ substitution $\checkmark$ standard form $\checkmark$ x-values $\checkmark$ y-values (5) OR/OF $\checkmark y = \frac{9}{x}$ $\checkmark$ substitution $\checkmark$ standard form $\checkmark$ x-values $\checkmark$ y-values (5)
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1.4	$x^2 + 2xy + 2y^2$ $= x^2 + 2xy + y^2 + y^2$ $= (x + y)^2 + y^2$ $(x + y)^2 \geq 0$ and $y^2 \geq 0$ Therefore $(x + y)^2 + y^2 \geq 0$	$\checkmark x^2 + 2xy + y^2 + y^2$ $\checkmark (x + y)^2$ $\checkmark (x + y)^2 \geq 0$ and $y^2 \geq 0$ $\checkmark (x + y)^2 + y^2 \geq 0$ (4) [27]
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2.1.1	 The next term of the sequence is 12./Die volgende term in die ry is 12.	✓ answer (1)
2.1.2	$2a = 1$ $a = \frac{1}{2}$ $3a + b = T_2 - T_1$ $3\left(\frac{1}{2}\right) + b = 2$ $b = \frac{1}{2}$ $a + b + c = T_1$ $\frac{1}{2} + \frac{1}{2} + c = -2$ $c = -3$ $\therefore T_n = \frac{1}{2}n^2 + \frac{1}{2}n - 3$ OR/OF	✓ value of a $3\left(\frac{1}{2}\right) + b = 2$ ✓ value of b $\frac{1}{2} + \frac{1}{2} + c = -2$ ✓ value of c (5)

$2a = 1$ $a = \frac{1}{2}$ $T_n = an^2 + bn + c$ $-2 = \frac{1}{2} + b + c \dots \dots \dots T_1$ $b + c = -\frac{5}{2} \dots \dots \dots \text{line 1}$ $0 = 2 + 2b + c \dots \dots \dots T_2$ $2b + c = -2 \dots \dots \dots \text{line 2}$ $\text{line 2} - \text{line 1}:$ $b = \frac{1}{2}$ $\text{substitute in line 1} \quad \quad \quad \text{or} \quad \quad \quad \text{substitute in line 2}$ $\frac{1}{2} + c = -\frac{5}{2}$ $c = -3$ $\therefore T_n = \frac{1}{2}n^2 + \frac{1}{2}n - 3$ OR/OF $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)}{2}d_2$ $= -2 + (n-1)(2) + \frac{(n-1)(n-2)}{2}(1)$ $= -2 + 2n - 2 + (n^2 - 3n + 2)(\frac{1}{2})$ $= -2 + 2n - 2 + \frac{1}{2}n^2 - \frac{3}{2}n + 1$ $= \frac{1}{2}n^2 + \frac{1}{2}n - 3$ OR/OF $2a = 1$ $a = \frac{1}{2}$ $3a + b = T_2 - T_1$ $3\left(\frac{1}{2}\right) + b = 2$ $b = \frac{1}{2}$ $T_0 = c = -3$ $\therefore T_n = \frac{1}{2}n^2 + \frac{1}{2}n - 3$ OR/OF	✓ value of a ✓ $-2 = \frac{1}{2} + b + c$ ✓ $0 = 2 + 2b + c$ ✓ value of b ✓ value of c (5) ✓ formula ✓ substitution ✓ value of a ✓ value of b ✓ value of c (5) ✓ value of a ✓ $3\left(\frac{1}{2}\right) + b = 2$ ✓ value of b ✓ $T_0 = c$ ✓ value of c (5)
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	Since $T_2 = 0$, $(n-2)$ is factor of T_n $T_n = an^2 + bn + c$ $= a(n-2)(n-k)$ $T_1 = -2 = a(1-2)(1-k)$ $-2 = -a(1-k)$ $a = \frac{2}{1-k}$ $T_3 = 3 = a(3-2)(3-k)$ $3 = a(3-k)$ $a = \frac{3}{3-k}$ $\frac{2}{1-k} = \frac{3}{3-k}$ $2(3-k) = 3(1-k)$ $6-2k = 3-3k$ $k = -3$ $a = \frac{1}{2}$ $T_n = \frac{1}{2}(n-2)(n+3)$ $= \frac{1}{2}n^2 + \frac{1}{2}n - 3$	✓ $T_n = a(n-2)(n-k)$ ✓ $-2 = a(1-2)(1-k)$ ✓ $3 = a(3-2)(3-k)$ ✓ value of k ✓ value of a (5)
2.1.3	$\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322$ $n^2 + n - 6 = 644$ $n^2 + n - 650 = 0$ $n = \frac{-1 \pm \sqrt{1^2 - 4(1)(-650)}}{2}$ $n = 25 \text{ or } n = -26$ The 25th term has a value of 322. / Die 25^{ste} term se waarde is 322. OR/OF $\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322$ $n^2 + n - 6 = 644$ $n^2 + n - 650 = 0$ $(n-25)(n+26) = 0$ $n = 25 \text{ or } n = -26$ The 25th term has a value of 322. / Die 25^{ste} term se waarde is 322. OR/OF	✓ $\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322$ ✓ standard form ✓ substitution into quadratic formula ✓ answer (4) ✓ $\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322$ ✓ standard form ✓ factors ✓ answer (4)

	$\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322$ $n^2 + n - 6 = 644$ $(n+3)(n-2) = 23 \times 28$ $n-2 = 23$ $n = 25$	$\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322$ $\checkmark (n+3)(n-2)$ $\checkmark 23 \times 28$ $\checkmark \text{ answer}$
2.2.1	$T_2 : a + d = 8$ $T_5 : a + 4d = 10$ $T_5 - T_2 : 3d = 2$ $d = \frac{2}{3}$	$\checkmark a + d = 8$ $\checkmark a + 4d = 10$ $\checkmark \text{ answer}$
2.2.2	$T_1 = T_2 - d$ $= 8 - \frac{2}{3}$ $= \frac{22}{3}$ $T_n = a + (n-1)d$ $= \frac{22}{3} + (n-1)\frac{2}{3}$ $= \frac{2n+20}{3}$ $S_{50} = \sum_{n=1}^{50} \left(\frac{22}{3} + (n-1)\frac{2}{3} \right)$ OR/OF $S_{50} = \sum_{n=1}^{50} \left(\frac{2n+20}{3} \right)$	$\checkmark T_1 = \frac{22}{3}$ $\checkmark \text{ answer}$
2.2.3	$S_n = \frac{n}{2} [2a + (n-1)d]$ $S_{50} = \frac{50}{2} \left[2 \left(\frac{22}{3} \right) + (50-1) \left(\frac{2}{3} \right) \right]$ $= \frac{3550}{3}$	$\checkmark \text{ correct substitution into correct formula}$ $\checkmark \checkmark \text{ answer}$

2.1	For geometric: $-\frac{1}{4}; b; -1; \dots$ $\frac{b}{-\frac{1}{4}} = -\frac{1}{b}$ $b^2 = \frac{1}{4}$ $b = \pm \frac{1}{2}$ OR $b = \pm \sqrt{\left(-\frac{1}{4}\right)(-1)}$ $b = \pm \frac{1}{2}$	$\checkmark \frac{b}{-\frac{1}{4}} = -\frac{1}{b}$ $\checkmark b = \frac{1}{2}$ $\checkmark b = -\frac{1}{2}$ (3) $\checkmark b = \pm \sqrt{\left(-\frac{1}{4}\right)(-1)}$ $\checkmark b = \frac{1}{2}$ $\checkmark b = -\frac{1}{2}$ (3)
2.2	$-\frac{1}{4}; \frac{1}{2}; -1; \dots$ $r = -2$ $T_{19} = ar^{18}$ $= \left(-\frac{1}{4}\right)(-2)^{18}$ $= \left(-\frac{2^{18}}{2^2}\right)$ $= -2^{16}$ $= -65536$ OR / OF $T_{19} = ar^{18}$ $= \left(-\frac{1}{4}\right)(-2)^{18}$ $= (-2^{-2})(2^{18})$ $= -2^{16}$ $= -65536$	$\checkmark r = -2$ $\checkmark$ subst. into correct formula $\checkmark -65536 / -2^{16}$ (3) $\checkmark r = -2$ $\checkmark$ subst. into correct formula $\checkmark -65536 / -2^{16}$ (3)

2.3	The series is: $-\frac{1}{4}; \frac{1}{2}; -1; 2; -4; 8; \dots$ The new positive term series: $\frac{1}{2}; 2; 8; 32; 128; \dots$ $a = \frac{1}{2} \quad r = 4$ $\sum_{n=1}^{20} \left(\frac{1}{2}\right)(4)^{n-1}$ OR/OF $\sum_{p=0}^{19} \left(\frac{1}{2}\right)(4)^p$ etc.	$\checkmark a = \frac{1}{2}$ $\checkmark r = 4$ $\checkmark \sum_{n=1}^{20}$ or $\sum_{p=0}^{19}$ $\checkmark$ correct formula (4)
2.4	No, the series is not convergent / <i>Nee, die reeks konvergeer nie</i> $r = 4$ and for convergence $-1 < r < 1$ $r = 4$ en vir konvergering $-1 < r < 1$	$\checkmark$ no $\checkmark$ reason (2)
		[12]

2.1	$S_n = a + (a + d) + (a + 2d) + \dots + a + (n-1)d$ $S_n = a + (n-1)d + a + (n-2)d + a + (n-3)d + \dots + a$ $2S_n = n(2a + (n-1)d)$ $S_n = \frac{n}{2}[2a + (n-1)d]$	✓ first series/eerste reeks ✓ series reversed/reeks omgekeer ✓ sum/som ✓ division/deling	(4)
2.2	$\sum_{k=1}^{50} (100 - 3k) = 97 + 94 + 91 + \dots$ $T_1 = a = 97$ $d = -3$ $n = 50 - 1 + 1 = 50$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $= \frac{50}{2}[2(97) + 49(-3)]$ $= 1175$ OR/OF $T_1 = a = 97$ $l = 100 - 3(50) = -50$ $n = 50 - 1 + 1 = 50$ $S_n = \frac{n}{2}[a + l]$ $= \frac{50}{2}[97 - 50]$ $= 1175$	✓ $a = 97$ ✓ $d = -3$ ✓ $n = 50$ ✓ answer/antwoord ✓ $a = 97$ ✓ $l = -50$ ✓ $n = 50$ ✓ answer/antwoord	(4)

2.3.1 (a)	$T_5 - T_4 = 25$	✓ answer/antwoord (1)
2.3.1 (b)	$T_{70} - T_{69} = 7 + (69-1)(6)$ $= 415$	✓ $n = 69$ ✓ $7 + (69-1)(6)$ ✓ answer/antw. (3)
2.3.2	$T_{89} - T_{69} = (T_{70} - T_{69}) + (T_{71} - T_{70}) + \dots + (T_{89} - T_{88})$ $= 415 + 421 + \dots \text{to 20 terms}$ $= \frac{20}{2} [2(415) + 19(6)]$ $= 9440$ $T_{69} = T_{89} - (\text{sum of the differences from/som van die verskille van } T_{69} \text{ to } T_{89})$ $T_{69} = 23594 - 9440$ $= 14154$ OR/OF $\begin{array}{ccc} 7 & 13 & 19 & 25 \\ & \swarrow \searrow & \swarrow \searrow & \swarrow \searrow \\ & 6 & 6 & 6 \end{array}$ $\therefore 2a = 6$ $a = 3$ $3a + b = 7$ $b = -2$ $T_{89} = 3(89)^2 - 2(89) + c = 23594$ $\therefore c = 9$ $\therefore T_n = 3n^2 - 2n + 9$ $\therefore T_{69} = 3(69)^2 - 2(69) + 9$ $\therefore T_{69} = 14154$	✓ expansion/uitbreiding ✓ $n = 20$ ✓ method/metode ✓ $a = 415$ ✓ answer/antwoord (5) ✓ a and/en b ✓ T_{89} (subst $n = 89$) ✓ T_n ✓ substitution/substitusie ✓ answer/antwoord (5)

OR/OF

$$\begin{array}{ccc} 7 & 13 & 19 & 25 \\ \swarrow & \swarrow & \swarrow & \\ 6 & 6 & 6 & \end{array}$$

$$\therefore 2a = 6$$

$$a = 3$$

$$7 - 6 = 1$$

$$T_1 - T_0 = 1$$

$$a + b + c - c = 1$$

$$3 + b = 1$$

$$b = -2$$

$$T_{89} = 3(89)^2 - 2(89) + c = 23594$$

$$\therefore c = 9$$

$$\therefore T_n = 3n^2 - 2n + 9$$

$$\therefore T_{69} = 3(69)^2 - 2(69) + 9$$

$$\therefore T_{69} = 14154$$

✓ *a and/en b*✓ T_{89} (subst $n = 89$)✓ T_n

✓ substitution/substitutie

✓ answer/antwoord

(5)
[17]**OR/OF**

$$T_{n+1} - T_n = 7 + 6(n-1)$$

$$\therefore T_{89} - T_1 = \sum_{n=1}^{88} (T_{n+1} - T_n)$$

$$= \frac{n}{2} [2a + (n-1)d]$$

$$= \frac{88}{2} [14 + 87 \times 6]$$

$$= 23584$$

$$\therefore T_1 = 23594 - 23584 = 10$$

$$\therefore T_{69} - 10 = \sum_{n=1}^{68} (T_{n+1} - T_n)$$

$$= 34(15 + 67 \times 6) = 14144$$

$$\therefore T_{69} = 14154$$

✓ formula/formule

✓ value of/waarde van S_{88} ✓ first term value/
eerste term waarde

✓ substitution/substitutie

✓ answer/antwoord

(5)
[17]

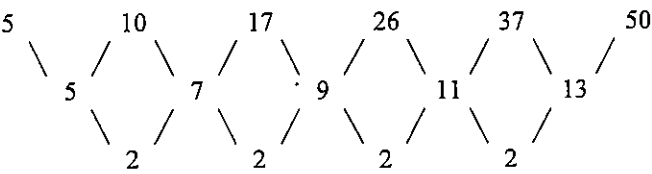
QUESTION 3

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3.1	$r = \frac{40,5}{45} = 0,9$ $T_{12} = 45(0,9)^{12-1}$ $= 14,12147682...$ $= 14,12$	$\checkmark r = 0,9$ $\checkmark$ substitution into correct formula/substitusie in korrekte formule $\checkmark$ answer/antwoord (3)
3.2	$r = 0,9$ $-1 < 0,9 < 1$	$\checkmark$ answer/antwoord (1)
3.3	$S_{\infty} = \frac{45}{1-0,9}$ $S_{\infty} = 450$	$\checkmark$ substitution/substitusie $\checkmark$ 450 (2)
3.4	$S_{\infty} - S_n < 1$ $S_{\infty} - S_n = 450 - \frac{45(1 - (0,9)^n)}{1 - 0,9}$ $S_{\infty} - S_n = 450 - 450(1 - (0,9)^n)$ $450(0,9)^n < 1$ $(0,9)^n < \frac{1}{450}$ $\log(0,9)^n < \log \frac{1}{450}$ $n \cdot \log(0,9) < \log \frac{1}{450}$ $n > \frac{\log \frac{1}{450}}{\log(0,9)}$ $n > 57,98...$ Smallest value/Kleinste waarde: $n = 58$	$\checkmark 450 - \frac{45(1 - (0,9)^n)}{1 - 0,9}$ $\checkmark (0,9)^n = \frac{1}{450}$ $\checkmark$ introducing/gebruik logs $\checkmark$ making n the subject/maak n die onderwerp $\checkmark n = 58$ (5) [11]

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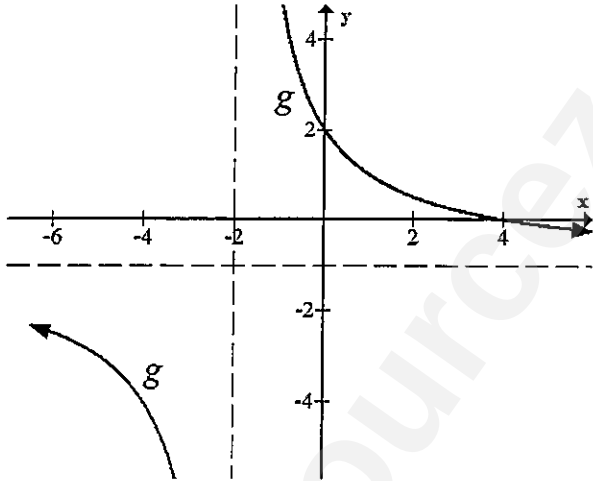
2.1.1	$30; 10; \frac{10}{3} \dots\dots$ $a = 30 \quad r = \frac{1}{3}$ $T_n = ar^{n-1}$ $\frac{10}{729} = 30\left(\frac{1}{3}\right)^{n-1}$ $\frac{1}{2187} = 3^{1-n}$ $3^{-7} = 3^{1-n}$ $-7 = 1-n$ $n = 8$ OR/OF $\frac{1}{2187} = \left(\frac{1}{3}\right)^{n-1}$ $\left(\frac{1}{3}\right)^7 = \left(\frac{1}{3}\right)^{n-1}$ $7 = n-1$ $n = 8$	$\checkmark r = \frac{1}{3}$ $\checkmark$ substitution into correct formula $\checkmark 3^{-7} = 3^{1-n}$ or $\left(\frac{1}{3}\right)^7 = \left(\frac{1}{3}\right)^{n-1}$ or use of logs $\checkmark n = 8$ (4)
2.1.2	$S_\infty = \frac{a}{1-r}$ $= \frac{30}{1-\frac{1}{3}}$ $= 45$	$\checkmark$ substitution into correct formula $\checkmark$ answer (2)
2.2	$S_n = a + (a+d) + \dots + (a+(n-2)d) + (a+(n-1)d) \quad (1)$ $S_n = (a+(n-1)d) + (a+(n-2)d) + \dots + (a+d) + a \quad (2)$ Adding both equations/Tel die twee vergelykings bymekaar: $2S_n = 2a + (n-1)d + 2a + (n-1)d + 2a + (n-1)d + \dots$ $= n[2a + (n-1)d]$ $S_n = \frac{n}{2}[2a + (n-1)d]$ OR/OF $S_n = a + (a+d) + \dots + (a+(n-2)d) + T_n \quad (1)$ $S_n = T_n + (T_n - d) + (T_n - 2d) + \dots + a \quad (2)$ Adding both equations/Tel die twee vergelykings bymekaar: $2S_n = (a+T_n) + (a+T_n) + (a+T_n) + \dots + (a+T_n)$ $S_n = \frac{n}{2}(a+T_n)$ but $T_n = a + (n-1)d$ $S_n = \frac{n}{2}[2a + (n-1)d]$	$\checkmark$ expanding S_n $\checkmark$ reverse writing $\checkmark 2S_n = n[2a + (n-1)d]$ $\checkmark S_n = \frac{n}{2}[2a + (n-1)d]$ (4) $\checkmark$ expanding S_n $\checkmark$ reverse writing $\checkmark 2S_n = n(a+T_n)$ $\checkmark S_n = \frac{n}{2}[2a + (n-1)d]$ (4) [10]

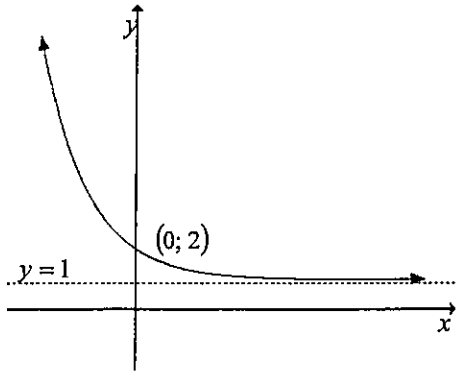
2.1.1	 37; 50	✓ 37 ✓ 50 (2)
2.1.2	$a = \frac{\text{second difference}}{2} = \frac{2}{2} = 1$ $3a + b = 5$ $3 + b = 5$ $b = 2$ $a + b + c = 5$ $1 + 2 + c = 5$ $c = 2$ $T_n = an^2 + bn + c$ $= n^2 + 2n + 2$	✓ second difference of 2 ✓ $a = 1$ ✓ $b = 2$ ✓ $c = 2$ (4)
2.1.3	$n^2 + 2n + 2 = 1765$ $n^2 + 2n - 1763 = 0$ $(n + 43)(n - 41) = 0$ $n = -43 \text{ or } n = 41$ N/A OR/OF $n^2 + 2n + 2 = 1765$ $n^2 + 2n - 1763 = 0$ $n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-2 \pm \sqrt{2^2 - 4(1)(-1763)}}{2(1)}$ $= \frac{-2 \pm \sqrt{7056}}{2}$ $n = -43 \text{ or } n = 41$ N/A	✓ equating T_n to 1765 ✓ standard form ✓ factors ✓ answer with rejection (4) OR/OF ✓ equating T_n to 1765 ✓ standard form ✓ subt in correct formula ✓ answer with rejection (4)

2.2	Sum of multiples of 7 from 35 to 196: <i>Som van meervoudde van 7 vanaf 35 tot by 196:</i> $a = 35; d = 7$ $S_n = \frac{n}{2}[a + \ell]$ $= \frac{24}{2}[35 + 196]$ $= 12[231]$ $= 2772$ Sum of all natural numbers from 35 to 196: <i>Som van alle natuurlike getalle vanaf 35 tot by 196:</i> $a = 35; d = 1; n = 162$ $S_n = \frac{n}{2}[a + \ell]$ $= \frac{162}{2}[35 + 196]$ $= 81[231]$ $= 18\,711$ Sum of numbers not divisible by 7/ <i>Som van getalle nie deelbaar deur 7</i> $= 18\,711 - 2772$ $= 15\,939$	✓ correct a, d and n substitution into correct formula ✓ answer ✓ 162 ✓ answer ✓ answer (5) [15]
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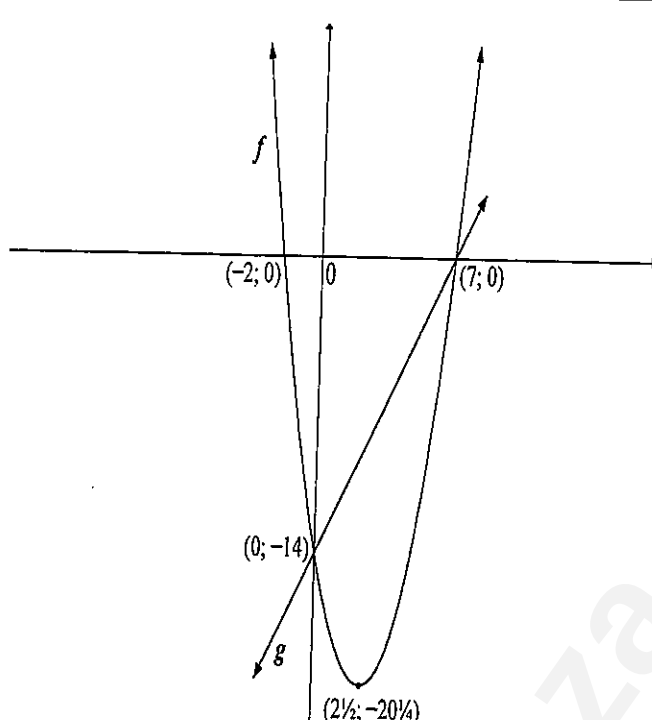
3.1.1	24	✓ 24 (1)
3.1.2	$2a = 3$ $3a + b = 0$ $a + b + c = 6$ $a = \frac{3}{2}$ $b = -\frac{9}{2}$ $c = 9$ $T_n = \frac{3}{2}n^2 - \frac{9}{2}n + 9$ OR/OF $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)d_2}{2}$ $= 6 + (n-1)(0) + \frac{(n-1)(n-2)(3)}{2}$ $= 6 + \frac{n^2 - 3n + 2}{1} \left(\frac{3}{2}\right)$ $= 6 + \frac{3}{2}n^2 - \frac{9}{2}n + 3$ $= \frac{3}{2}n^2 - \frac{9}{2}n + 9$	$\checkmark a = \frac{3}{2}$ $\checkmark b = -\frac{9}{2}$ $\checkmark c = 9$ $\checkmark T_n = \frac{3}{2}n^2 - \frac{9}{2}n + 9$ (4) $\checkmark$ formula $\checkmark$ substitution $\checkmark$ simplifying $\checkmark T_n = \frac{3}{2}n^2 - \frac{9}{2}n + 9$ (4)
3.1.3	$\frac{3}{2}n^2 - \frac{9}{2}n + 9 = 3249$ $3n^2 - 9n + 18 = 6498$ $3n^2 - 9n - 6480 = 0$ $n^2 - 3n - 2160 = 0$ $(n + 45)(n - 48) = 0$ $n \neq -45$ or $n = 48$	$\checkmark$ equating general term to 3249 $\checkmark$ standard form $\checkmark$ factors $\checkmark n \neq -45$ or $n = 48$ (4)

3.1	$-1; 2; 5$ $T_n = -1 + (n-1)(3)$ $= 3n - 4$	$\checkmark 3n$ $\checkmark -4$ (2)
3.2	$T_{43} = 3(43) - 4$ $= 125$ OR/OF $T_{43} = -1 + (43-1)(3)$ $= 125$	$\checkmark$ subs of 43 $\checkmark$ answer (2)
3.3	$T_n = 3n - 4$ $S_n = \sum_{k=1}^n T_k = -1 + 2 + 5 + \dots + 3n - 4$ $S_n = \frac{n}{2}[-1 + 3n - 4]$ or $S_n = \frac{n}{2}[-2 + (n-1)3]$ $= \frac{n}{2}[3n - 5]$ $= \frac{3n^2 - 5n}{2}$ OR/OF $T_n = 3n - 4$ $\sum_{k=1}^n T_k = 3(1) - 4 + 3(2) - 4 + 3(3) - 4 + \dots + 3n - 4$ $= 3(1 + 2 + 3 + \dots + n) - 4n$ $= \frac{3n(n+1)}{2} - 4n$ $= \frac{3n^2 - 5n}{2}$	$\checkmark S_n = \sum_{k=1}^n T_k$ $\checkmark$ substitution into correct formula $\checkmark \frac{n}{2}[3n - 5]$ or $\frac{3n^2 - 5n}{2}$ OR/OF $\checkmark (1) - 4 + 3(2) - 4 + 3(3) - 4 + \dots + 3n - 4$ $\checkmark 3(1 + 2 + 3 + \dots + n) - 4n$ $\checkmark \frac{3n^2 - 5n}{2}$ (3)

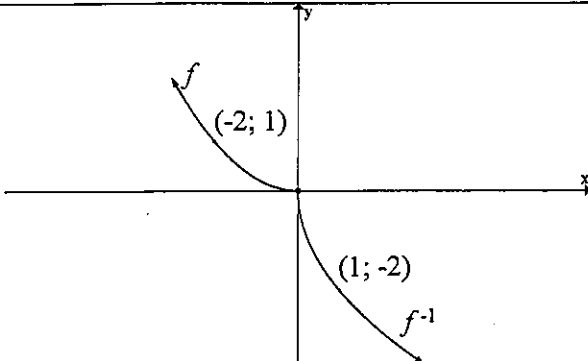
4.1	$x = -2$ $y = -1$	$\checkmark x = -2$ $\checkmark y = -1$ (2)
4.2.1	$g(0) = \frac{6}{0+2} - 1$ $= 2$ y -intercept/afsnit (0 ; 2)	$\checkmark$ answer/antwoord (1)
4.2.2	$0 = \frac{6}{x+2} - 1$ $1 = \frac{6}{x+2}$ $x+2 = 6$ $x = 4$ x -intercept/afsnit (4 ; 0)	$\checkmark$ equating to/stel gelyk aan 0 $\checkmark$ answer/antwoord (2)
4.3		$\checkmark$ asymptotes/asimptote $\checkmark$ intercepts/afsnitte $\checkmark$ shape/vorm (3)
4.4	$y + 1 = -(x + 2)$ $y = -x - 3$ OR/OF Using general formula/Gebruik algemene formule: $y = -(x + p) + q$ $y = -(x + 2) - 1$ $y = -x - 3$	$\checkmark m = -1$ $\checkmark$ substitution of (-2 ; -1) $\checkmark$ answer (3) $\checkmark$ formula/formule $\checkmark$ substitution of p and q values/substitusie van p - en q -waardes $\checkmark$ answer/antwoord (3)
4.5	$x > -2$	$\checkmark\checkmark$ answer (2)

4.1	(0 ; 2)	✓ answer (1)
4.2		✓ shape ✓ (0; 2) ✓ asymptote (3)
4.3	$f(-2) = 5$ $f(1) = 2^{-1} + 1 = \frac{3}{2}$ Average gradient = $\frac{f(1) - f(-2)}{1 - (-2)}$ $= \frac{\frac{3}{2} - 5}{3}$ $= -\frac{7}{6}$	✓ $f(-2) = 5$ ✓ $f(1) = \frac{3}{2}$ ✓ answer (3)
4.4	Since the asymptote of f is $y = 1$, the asymptote of $h(x) = 3f(x)$ will be $y = 3$. <i>Omdat die asimptoot van f $y = 1$ is, sal die asimptoot van $h(x) = 3f(x)$ $y = 3$ wees.</i>	✓ answer (1) [8]

QUESTION/VRAAG 5

5.1		f: ✓ x-intercepts ✓ y-intercept ✓ shape ✓ TP g: ✓ x-intercept and y-intercept ✓ shape (6)
5.2	$y = -20\frac{1}{4}$	✓✓ $y = -20\frac{1}{4} / -\frac{81}{4}$ (2)

5.1	$9 = a^2$ $a = 3$ OR/OF $f^{-1}(x) = \log_a x$ $2 = \log_a 9$ $a^2 = 9 = 3^2$ $\therefore a = 3$	$\checkmark 9 = a^2$ $\checkmark a = 3$ (2)
5.2	$g(x) = 3^{-x}$ OR/OF $g(x) = \left(\frac{1}{3}\right)^x$	$\checkmark$ answer/antwoord (1) $\checkmark$ answer/antwoord (1)
5.3	$x \geq 9$ OR/OF $f^{-1}(x) = \log_3 x$ $\log_3 x = 2$ $x = 3^2 = 9$ $\therefore x \geq 9$ OR/OF $\log_3 x \geq 2$ $x \geq 3^2$ $\therefore x \geq 9$	$\checkmark\checkmark$ answer/antwoord (2) $\checkmark\checkmark$ answer/antwoord (2) $\checkmark\checkmark$ answer/antwoord (2)
5.4	Yes/Ja. For every y -value there is only one x such that/Vir elke y -waarde is daar slegs een x sodanig dat $y = f(x)$. OR/OF Yes/Ja. f is a one-to-one relation/is 'n een-tot-een-relasie.	$\checkmark$ Yes/Ja $\checkmark$ Reason/Rede (2) $\checkmark$ Yes/Ja $\checkmark$ Reason/Rede (2) [7]

6.1	$f: y = \frac{1}{4}x^2$ $f^{-1}: x = \frac{1}{4}y^2$ $y^2 = 4x$ $y = \pm\sqrt{4x}$ $f^{-1}(x) = -\sqrt{4x}$ OR/OF $f^{-1}(x) = -2\sqrt{x}$	✓interchanging x and y ✓ $y^2 = 4x$ ✓ answer (3)
6.2		✓ both graphs pass through (0 ; 0) ✓ shape for both ✓ one additional point on both graphs (3)
6.3	Yes. No value of x in the domain of f^{-1} maps onto more than one y-value. <i>Ja. Geen waarde van x in die definisieversameling van f^{-1} assosieer met meer as een y-waarde nie.</i> OR/OF Yes. One to one function./Ja. Een-tot-een-funksie. OR/OF Yes. Vertical line test holds./Ja. Die vertikale lyntoets werk.	✓ yes ✓ reason (2) ✓ yes ✓ reason (2) ✓ yes ✓ reason (2) [8]

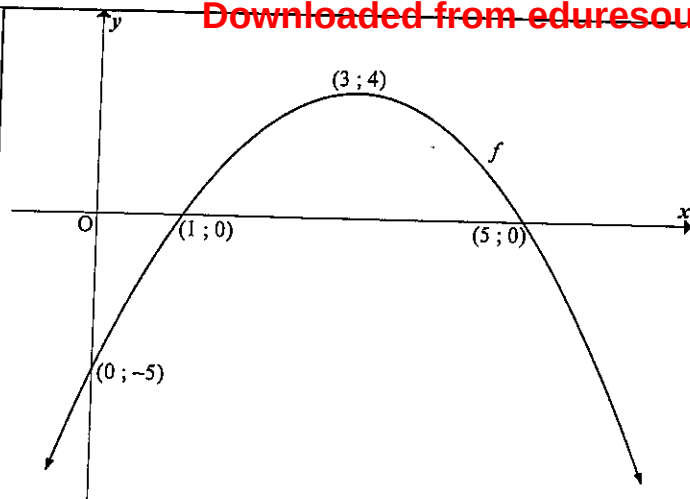
4.1	E(4 ; -9)	$\checkmark x = 4$ $\checkmark y = -9$ (2)
4.2	$f(x) = (x-4)^2 - 9$ $(x-4)^2 - 9 = 0$ $(x-4)^2 = 9$ $x-4 = \pm 3$ $x = 7$ or $x = 1$ A(1 ; 0) OR/OF $f(x) = (x-4)^2 - 9$ $0 = x^2 - 8x + 16 - 9$ $0 = x^2 - 8x + 7$ $(x-7)(x-1) = 0$ $x = 7$ or $x = 1$ A(1 ; 0)	$\checkmark y = 0$ $\checkmark x - 4 = \pm 3$ $\checkmark A(1 ; 0)$ OR/OF $\checkmark y = 0$ $\checkmark (x-7)(x-1)$ $\checkmark A(1 ; 0)$ (3)
4.3	C(0 ; 7) M(8 ; 7) NOTE: Answer only 3 / 3	$\checkmark C(0 ; 7)$ $\checkmark x = 8$ $\checkmark y = 7$ (3)
4.4	C(0 ; 7) D(4 ; 0) $m = \frac{7-0}{0-4}$ or $m = \frac{0-7}{4-0}$ or $0 = 4m + 7$ $m = -\frac{7}{4}$ $m = -\frac{7}{4}$ $m = -\frac{7}{4}$ $y - 0 = -\frac{7}{4}(x - 4)$ $y = -\frac{7}{4}x + 7$	$\checkmark D(4 ; 0)$ $\checkmark m = -\frac{7}{4}$ $\checkmark y = -\frac{7}{4}x + 7$ (3)
4.5	$g : y = -\frac{7}{4}x + 7$ $g^{-1} : x = -\frac{7}{4}y + 7$ $4x = -7y + 28$ $7y = -4x + 28$ $y = -\frac{4}{7}x + 4$	$\checkmark$ interchange x and y $\checkmark$ simplification $\checkmark y = -\frac{4}{7}x + 4$

QUESTION/VRAAG 4

4.1	U(1; 0)	✓ (1; 0) (1)
4.2	$x = 1$ $y = 1$	✓ $x = 1$ ✓ $y = 1$ (2)
4.3	$\frac{2}{x-1} + 1 = 0$ $2 = -x + 1$ $x = -1$ T(-1; 0)	✓ $y = 0$ ✓ $x = -1$ (2)
4.4	$f(x) = \log_5 x$ $h: x = \log_5 y$ $y = 5^x$	✓ change x and y ✓ $y = 5^x$ (2)
4.5	$y = 0$	✓ answer (1)
4.6	$V(\sqrt{2} + 1; \sqrt{2} + 1)$ $V(2, 41; 2, 41)$ OR / OF $x = \frac{2}{x-1} + 1$ $x^2 - x = 2 + x - 1$ $x^2 - 2x - 1 = 0$ $x = \frac{2 \pm \sqrt{4 - 4(1)(-1)}}{2}$ $= \frac{2 \pm \sqrt{8}}{2}$ $= \frac{2 \pm 2\sqrt{2}}{2}$ $= 1 \pm \sqrt{2}$ $V(1 + \sqrt{2}; 1 + \sqrt{2})$ OR / OF $x - 1 = \frac{2}{x-1}$ $(x-1)^2 = 2$ $x = 1 \pm \sqrt{2}$ $V(1 + \sqrt{2}; 1 + \sqrt{2})$	✓ ✓ $\sqrt{2} + 1$ ✓ ✓ $\sqrt{2} + 1$ (4) ✓ $x = \frac{2}{x-1} + 1$ ✓ subs into correct formula ✓ $x = \sqrt{2} + 1$ ✓ $y = \sqrt{2} + 1$ (4) ✓ $x - 1 = \frac{2}{x-1}$ ✓ $(x-1)^2 = 2$ ✓ $x = \sqrt{2} + 1$ ✓ $y = \sqrt{2} + 1$ (4)
4.7	T'(3; 2)	✓ $x = 3$ ✓ $y = 2$ (2) [14]

5.1.1	$C(0; -3)$	✓ $C(0; -3)$ (1)
5.1.2	$f(x) = x^2 - 2x - 3$ $(x-3)(x+1) = 0$ $x = -1$ or $x = 3$ $AB = 3 - (-1)$ $AB = 4$ units	✓ factors ✓ x-value ✓ other x-value ✓ answer (4)
5.1.3	$x = \frac{2}{2(1)}$ or $2x - 2 = 0$ or $x = \frac{-1+3}{2}$ $= 1$ $y = (1)^2 - 2(1) - 3$ $= -4$ $D(1; -4)$	✓ $x = 1$ ✓ y value (2)
5.1.4	$C(0; -3)$ $D(1; -4)$ Average gradient / Gemiddelde gradiënt $= \frac{-4+3}{1-0}$ or $\frac{-3+4}{0-1}$ $= -1$	✓ $\frac{-4+3}{1-0}$ or $\frac{-3+4}{0-1}$ ✓ -1 (2)
5.1.5	$OC = OB = 3$ $\hat{OCB} = 45^\circ$ isosceles right angled triangle <i>Gelykbenige reghoekige driehoek</i> OR / OF $\tan \beta = m_g$ $\tan \beta = 1$ $\beta = 45^\circ$ $\hat{OBC} = 45^\circ$ $\hat{OCB} = 45^\circ$	✓ equal lengths ✓ 45° (2) ✓ $\tan \beta = 1$ ✓ 45° (2)
5.1.6	$-4 < k < -3$ OR $(-4; -3)$	✓ -4 ✓ -3 ✓ notation (3)
5.1.7	$f'(x) \cdot f''(x) > 0$ $(2x-2) \cdot 2 > 0$ $2x-2 > 0$ $x > 1$	✓ $2x-2$ ✓ 2 ✓ $x > 1$ (3)

5.2



$$f(x) = a(x-1)(x-5)$$

$$4 = a(3-1)(3-5)$$

$$4 = -4a$$

$$a = -1$$

$$f(x) = -x^2 + 6x - 5$$

TP

$$\checkmark x = 3$$

$$\checkmark y = 4$$

 $\checkmark x$ - intercepts

 $\checkmark y$ -intercept

 $\checkmark$ shape

(5)

[22]

5.1	$x \in R; x \neq -1$	$\checkmark x \in R$ $\checkmark x \neq -1$ (2)
5.2	x -intercept of f : $0 = \frac{2}{x+1} + 4$ $\frac{2}{x+1} = -4$ $2 = -4x - 4$ $4x = -6$ $x = -\frac{3}{2}$	$\checkmark$ equating to 0 $\checkmark$ answer (2)
5.3	$y = \frac{2}{x+1} + 4$ $\frac{14}{3} = \frac{2}{k+1} + 4$ $\frac{2}{k+1} = \frac{14}{3} - 4$ $\frac{2}{k+1} = \frac{2}{3}$ $2k+2=6$ $k+1=3$ $k=2$	$\checkmark$ substitution $\checkmark$ simplification $\checkmark$ answer (3)
5.4	$C(2;4)$	$\checkmark 2$ $\checkmark 4$ (2)
5.5	$y = a(x+p)^2 + q$ $= a(x-2)^2 + 4$ Substitute $(0; 0)$: $0 = a(0-2)^2 + 4$ $0 = 4a + 4$ $a = -1$ $y = -(x-2)^2 + 4$	$\checkmark a(x-2)^2 + 4$ $\checkmark$ Substitute $(0; 0)$ $\checkmark a = -1$ (3)
5.6	$x \leq -\frac{3}{2}$ or $-1 < x < 0$ or $x > 4$	$\checkmark x \leq -\frac{3}{2}$ $\checkmark\checkmark -1 < x < 0$ $\checkmark x > 4$ (4)

QUESTION/VR4AG5

5.1	$a^0 = 1$ $T(0; 1)$	✓ $x = 0$ ✓ $y = 1$ (2)
5.2	$g(x) = a^x$ $9 = a^2$ $a = 3$ $a > 0$	✓ substitution ✓ $a = 3$ (2)
5.3	$y = \left(\frac{1}{3}\right)^x$ or $y = 3^{-x}$	✓✓ $y = \left(\frac{1}{3}\right)^x$ (2)

6.1.1	$A = 150\,000(1 - 0,2)^2$ $= R96\,000$	$\checkmark n = 2$ $\checkmark 150\,000$ in correct formula $\checkmark 96\,000$ (3)
6.1.2	$150\,000(1 - 0,2)^n = 49\,152$ $(0,8)^n = \frac{1024}{3125}$ $n \log(0,8) = \log \frac{1024}{3125}$ $n = 5$ The machine will need to be replaced at the beginning of 2020 / <i>Masjien moet aan die begin van 2020 vervang word</i> OR / OF $150\,000(1 - 0,2)^n = 49\,152$ $(0,8)^n = \frac{1024}{3125}$ $n = \log_{0,8} \frac{1024}{3125}$ $n = 5$ The machine will need to be replaced at the beginning of 2020 / <i>Masjien moet aan die begin van 2020 vervang word</i>	$\checkmark 150\,000(1 - 0,2)^n = 49\,152$ $\checkmark n \log(0,8) = \log \frac{1024}{3125}$ $\checkmark n = 5$ $\checkmark 2020$ (4) $\checkmark 150\,000(1 - 0,2)^n = 49\,152$ $\checkmark n = \log_{0,8} \frac{1024}{3125}$ $\checkmark n = 5$ $\checkmark 2020$ (4)

QUESTION/VRAAG 6

6.1	$A = P(1-i)^n$ $0,5P = P(1-0,15)^n$ $(1-0,15)^n = 0,5$ $(0,85)^n = 0,5$ $n = \frac{\log 0,5}{\log 0,85} \text{ or } \log_{0,85} 0,5$ $= 4,27 \text{ years}$	✓ $A = 0,5P$ ✓ substitution into correct formula ✓ use of logs ✓ answer
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(4)

QUESTION/VRAAG 7

7.1	$A = P(1-i)^n$ $331527 = 500000(1-i)^3$ $(1-i)^3 = \frac{331527}{500000}$ $1-i = \sqrt[3]{\frac{331527}{500000}}$ $i = 0,12800\dots$ $= 12,8\%$	✓ substitution of A, P & n in correct formula ✓ $1-i = \sqrt[3]{\frac{331527}{500000}}$ or $1-i = \sqrt[3]{0,663054}$ ✓ answer
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(3)

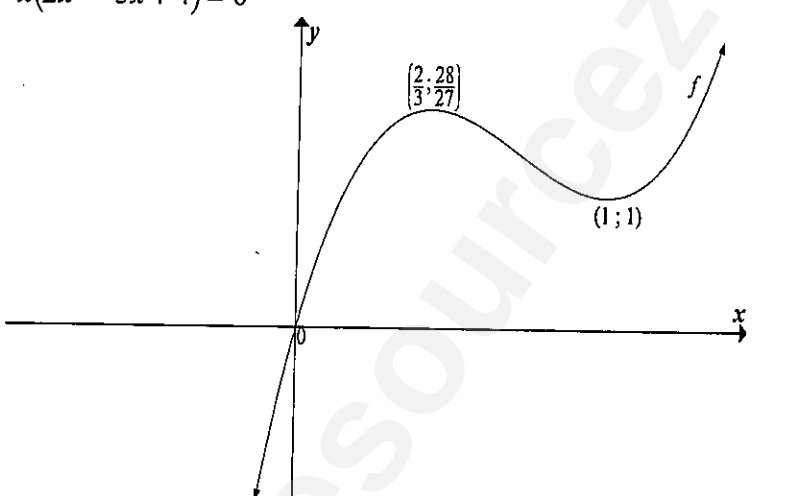
QUESTION/VRAAG 7

7.1.1	Quarterly interest rate/<i>Kwartaallikse rentekoers</i> $= \frac{10\%}{4}$ $= 2,5\%$	✓ answer
7.1.2	$A = P(1+i)^n$ $= 5000 \left(1 + \frac{2,5}{100}\right)^{2 \times 4}$ $= R6092,01$	✓ $n = 8$ ✓ $5000 \left(1 + \frac{2,5}{100}\right)^{2 \times 4}$ ✓ answer

(1)

(3)

ing points are $\left(\frac{2}{3}; \frac{28}{27}\right)$ and $(1; 1)$

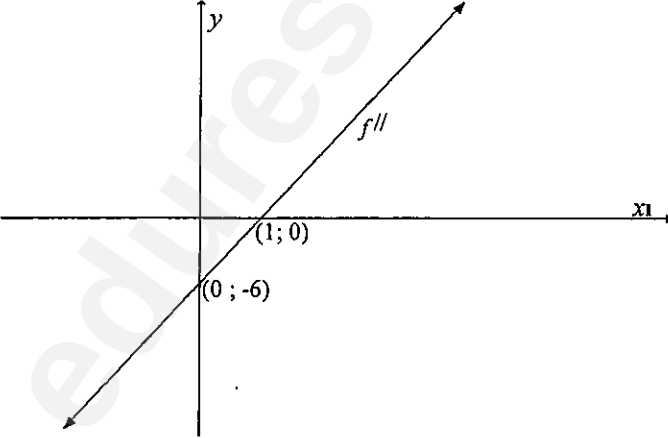
8.2	$2x^3 - 5x^2 + 4x = 0$ $x(2x^2 - 5x + 4) = 0$ $x = 0 \quad \text{or} \quad x = \frac{5 \pm \sqrt{25 - 4(2)(4)}}{4}$ $= \frac{5 \pm \sqrt{-7}}{4}$ No real roots / <i>Geen reële wortels</i> OR / OF $2x^3 - 5x^2 + 4x = 0$ $x(2x^2 - 5x + 4) = 0$ $x = 0 \quad \text{or} \quad b^2 - 4ac = 25 - 4(2)(4)$ $= -7 < 0$ No real roots / <i>Geen reële wortels</i>	$\checkmark x(2x^2 - 5x + 4) = 0$ $\checkmark x = 0$ $\checkmark \frac{5 \pm \sqrt{-7}}{4}$ (3) $\checkmark x(2x^2 - 5x + 4) = 0$ $\checkmark x = 0$ $\checkmark b^2 - 4ac < 0$ (3)
8.3	$f(x) = 2x^3 - 5x^2 + 4x$ $x(2x^2 - 5x + 4) = 0$ 	$\checkmark (0; 0)$ $\checkmark \text{turning points}$ $\checkmark \text{shape}$ (3)

8.4	$f(x) = 2x^3 - 5x^2 + 4x$ $f'(x) = 6x^2 - 10x + 4$ $f''(x) = 12x - 10$ $f''(x) > 0$ $12x - 10 > 0$ $x > \frac{5}{6}$ OR Point of inflection: $x = -\frac{b}{3a}$ $x = -\frac{(-5)}{3(2)}$ $x = \frac{5}{6}$ The function is concave up for $x > \frac{5}{6}$ since $a > 0$ OR Point of inflection: $x = \frac{\frac{2}{3} + 1}{2}$ $x = \frac{5}{6}$ The function is concave up for $x > \frac{5}{6}$ since $a > 0$	$\checkmark 12x - 10$ $\checkmark f''(x) > 0$ $\checkmark$ answer (3) $\checkmark x = -\frac{(-5)}{3(2)}$ $\checkmark x = \frac{5}{6}$ $\checkmark f''(x) > 0$ (3) $\checkmark x = \frac{\frac{2}{3} + 1}{2}$ $\checkmark x = \frac{5}{6}$ $\checkmark f''(x) > 0$ (3) [14]
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8.1	$f(x+h) = 2(x+h)^2 + 4$ $= 2x^2 + 4xh + 2h^2 + 4$ $f(x+h) - f(x) = 2x^2 + 4xh + 2h^2 + 4 - 2x^2 - 4$ $= 4xh + 2h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{4xh + 2h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(4x + 2h)}{h}$ $= \lim_{h \rightarrow 0} (4x + 2h)$ $= 4x$	$\checkmark 2x^2 + 4xh + 2h^2 + 4$ $\checkmark 4xh + 2h^2$ $\checkmark \lim_{h \rightarrow 0} \frac{h(4x + 2h)}{h}$ $\checkmark 4x \quad (4)$
8.2.1	$f(x) = -3x^2 + 5\sqrt{x}$ $f(x) = -3x^2 + 5x^{\frac{1}{2}}$ $f'(x) = -6x + \frac{5}{2}x^{-\frac{1}{2}}$	$\checkmark \frac{1}{2}$ $\checkmark 5x^{\frac{1}{2}}$ $\checkmark -6x$ $\checkmark \frac{5}{2}x^{-\frac{1}{2}}$ (3)
8.2.2	$p(x) = \left(\frac{1}{x^3} + 4x\right)^2$ $= \frac{1}{x^6} + \frac{8}{x^2} + 16x^2$ $= x^{-6} + 8x^{-2} + 16x^2$ $p'(x) = -6x^{-7} - 16x^{-3} + 32x$ OR/OF $p(x) = (x^{-3} + 4x)^2$ by making use of the chain rule: $p'(x) = 2(x^{-3} + 4x)(-3x^{-4} + 4)$ $p'(x) = -6x^{-7} - 16x^{-3} + 32x$	$\checkmark \frac{1}{x^6} + \frac{8}{x^2} + 16x^2$ $\checkmark x^{-6} + 8x^{-2} + 16x^2$ $\checkmark \checkmark \text{ answer/antwoord} \quad (4)$ $\checkmark \checkmark 2(x^{-3} + 4x)$ $\checkmark \checkmark (-3x^{-4} + 4)$ (4)
8.3.1	$h'(x) = 3x^2 - 14x + 14$	$\checkmark \text{ finding/kry } h'(x) \quad (1)$
8.3.2	At/By B: $h'(x) = 0$ $3x^2 - 14x + 14 = 0$ $x = \frac{14 \pm \sqrt{(-14)^2 - 4(3)(14)}}{2(3)}$ $= 1,45 \text{ or } 3,22$ n/a	$\checkmark \text{ derivative equal to/}$ $\text{afgeleide gelyk aan } 0$ $\checkmark \text{ substitution into}$ $\text{correct formula/substitusie}$ $\text{in korrekte formule}$ $\checkmark x\text{-value of/x-waarde}$ $\text{van } 1,45 \quad (3)$

8.3.3	$x^3 - 7x^2 + 14x - 8 = (x-1)(x^2 - 6x + 8)$ $= (x-1)(x-2)(x-4)$ $C(4;0)$ OR/OF $x_c > 3,22$ $h(4) = (4)^3 - 7(4)^2 + 14(4) - 8 = 0$ $\therefore x_c = 4$	✓ $(x-1)$ ✓ $x^2 - 6x + 8$ ✓ $(x-2)(x-4)$ ✓ coordinates of/<i>koördinate van C</i> (4) ✓ $x_c > 3,22$ ✓ substitution of/ <i>substitusie van 4</i> ✓ $h(4) = 0$ ✓ x_c (4)
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8.1	$f(x+h) = 4x^2$ $f(x+h) - f(x) = 4(x+h)^2 - 4x^2$ $= 4(x^2 + 2xh + h^2) - 4x^2$ $= 4x^2 + 8xh + 4h^2 - 4x^2$ $= 8xh + 4h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \left[\frac{8xh + 4h^2}{h} \right]$ $= \lim_{h \rightarrow 0} \left[\frac{h(8x + 4h)}{h} \right]$ $= 8x$ OR/OF $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \left[\frac{4(x+h)^2 - 4x^2}{h} \right]$ $= \lim_{h \rightarrow 0} \left[\frac{4x^2 + 8xh + 4h^2 - 4x^2}{h} \right]$ $= \lim_{h \rightarrow 0} \left[\frac{8xh + 4h^2}{h} \right]$ $= \lim_{h \rightarrow 0} \left[\frac{h(8x + 4h)}{h} \right]$ $= 8x$	$\checkmark 4(x+h)^2$ $\checkmark 8xh + 4h^2$ $\checkmark \frac{f(x+h) - f(x)}{h}$ $\checkmark \frac{h(8x + 4h)}{h}$ $\checkmark 8x$ OR/OF $\checkmark \frac{f(x+h) - f(x)}{h}$ $\checkmark 4(x+h)^2$ $\checkmark 8xh + 4h^2$ $\checkmark \frac{h(8x + 4h)}{h}$ $\checkmark 8x$ (5)
8.2.1	$D_x \left[\frac{x^2 - 2x - 3}{x - 1} \right]$ $= D_x \left[\frac{(x-3)(x+1)}{x+1} \right]$ $= D_x(x-3)$ $= 1$	$\checkmark \frac{(x-3)(x+1)}{x+1}$ $\checkmark (x-3)$ $\checkmark 1$ (3)
8.2.2	$f(x) = \sqrt{x} = x^{\frac{1}{2}}$ $f'(x) = \frac{1}{2} x^{-\frac{1}{2}}$ $f''(x) = -\frac{1}{4} x^{-\frac{3}{2}}$	$\checkmark x^{\frac{1}{2}}$ $\checkmark \frac{1}{2} x^{-\frac{1}{2}}$ $\checkmark -\frac{1}{4} x^{-\frac{3}{2}}$ (3)

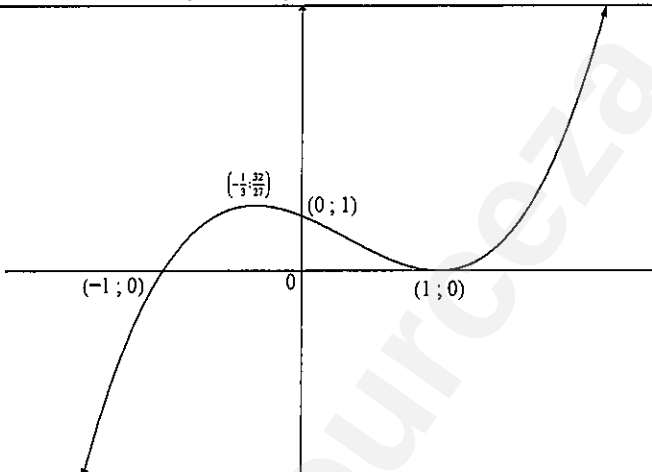
9.1	$f(x) = (x+2)(x-1)(x-4)$ $= (x^2 + x - 2)(x-4)$ $= x^3 + x^2 - 2x - 4x^2 - 4x + 8$ $= x^3 - 3x^2 - 6x + 8$ $b = -3 ; c = -6 ; d = 8$	$f(x) = (x+2)(x-1)(x-4)$ $\checkmark \text{ expansion}$ $\checkmark x^3 - 3x^2 - 6x + 8$ (4)
9.2	$f(x) = x^3 - 3x^2 - 6x + 8$ $f'(x) = 0$ $3x^2 - 6x - 6 = 0$ $x^2 - 2x - 2 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{2 \pm \sqrt{(2)^2 - 4(1)(-2)}}{2(1)}$ $= \frac{2 \pm \sqrt{12}}{2}$ $x = -0,73$	$\checkmark f'(x) = 0$ $\checkmark 3x^2 - 6x - 6$ $\checkmark \text{ substitution into correct formula}$ $\checkmark x = -0,73$ (4)
9.3	$f(x) = x^3 - 3x^2 - 6x + 8$ $f(-1) = (-1)^3 - 3(-1)^2 - 6(-1) + 8 \text{ or } f(-1) = (1)(-2)(-5)$ $= 10 \qquad \qquad \qquad = 10$ $f'(-1) = 3(-1)^2 - 6(-1) - 6$ $= 3$ $y - 10 = 3(x + 1)$ $y = 3x + 13$	$\checkmark f(-1) = 10$ $\checkmark f'(-1) = 3$ $\checkmark \text{ substitution}$ $\checkmark y = 3x + 13$ (4)
9.4	$f''(x) = 6x - 6$ 	$\checkmark f''(x) = 6x - 6$ $\checkmark x\text{- intercept}$ $\checkmark y\text{- intercept}$ (3)

9.5	f concave upwards $f''(x) > 0$ $6x - 6 > 0$ $x > 1$	NOTE: Answer only 2 / 2	$\checkmark f''(x) > 0$ $\checkmark x > 1$ (2) [17]
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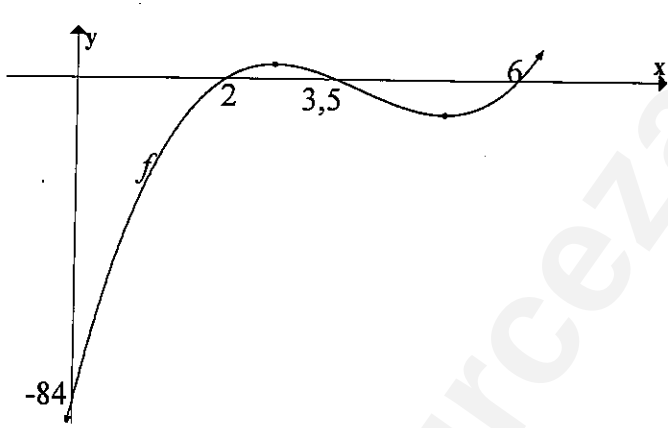
8.1	$C(0;12)$	✓ $C(0;12)$ (1)
8.2	$-x^3 + 13x + 12 = 0$ $x^3 - 13x - 12 = 0$ $(x+1)(x^2 - x - 12) = 0$ $(x+1)(x-4)(x+3) = 0$ $A(-3;0)$ $B(4;0)$	✓ $f(x) = 0$ ✓ $(x+1)$ ✓ $(x^2 - x - 12)$ ✓ $x = -3$ or 4 ✓ clearly indicating A and B (5)
8.3	$f'(x) = -3x^2 + 13$ $f''(x) = -6x$ $-6x = 0$ $x = 0$ For $f(x)$, point of inflection will be at $(0; 12)$. <i>Vir $f(x)$, sal buigpunt wees by $(0; 12)$</i> For $g(x)$, point of inflection will be at $(0; -12)$. <i>Vir $g(x)$, sal buigpunt wees by $(0; -12)$.</i> OR/OF $g(x) = x^3 - 13x - 12$ $g'(x) = 3x^2 - 13$ $g''(x) = 6x$ $6x = 0$ $x = 0$ $(0; -12)$ OR/OF $f'(x) = -3x^2 + 13$ TP's where $-3x^2 + 13 = 0$ $x^2 = \frac{13}{3}$ $x = \pm \sqrt{\frac{13}{3}}$ $= \pm 2,08$ x-value of point of inflection: $\frac{-2,08 + 2,08}{2} = 0$ For $f(x)$, point of inflection will be at $(0; 12)$. <i>Vir $f(x)$, sal buigpunt wees by $(0; 12)$</i> For $g(x)$, point of inflection will be at $(0; -12)$. <i>Vir $g(x)$, sal buigpunt wees by $(0; -12)$.</i>	✓ $f'(x) = -3x^2 + 13$ ✓ $f''(x) = -6x$ ✓ equating to zero ✓ $(0; -12)$ (4) OF/OR ✓ $g'(x) = 3x^2 - 13$ ✓ $g''(x) = 6x$ ✓ equating to zero ✓ $(0; -12)$ (4) OR/OF ✓ $f'(x) = -3x^2 + 13$ ✓ $-3x^2 + 13 = 0$ ✓ x-values of TP's ✓ $(0; -12)$ (4)

8.4	$f'(x) = -3x^2 + 13$ $-3x^2 + 13 = -14$ $-3x^2 = -27$ $x^2 = 9$ $x = 3$ or $x = -3$	Downloaded from eduresourceza.com ✓ equating derivative to -14 ✓ simplification ✓✓ answers (4) [14]
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9.1	(0 ; 1)	Downloaded from eduresourceza.com	answer	(1)
9.2	$f(x) = x^3 - x^2 - x + 1$ $f(x) = x^2(x-1) - (x-1)$ $f(x) = (x-1)(x^2-1)$ $f(x) = (x-1)(x-1)(x+1)$ $f(x) = 0$ $(x-1)(x-1)(x+1) = 0$ x-intercepts: (-1; 0); (1; 0) OR $f(x) = x^3 - x^2 - x + 1$ $f(x) = (x-1)(x^2-1)$ $f(x) = (x-1)(x-1)(x+1)$ $f(x) = 0$ $(x-1)(x-1)(x+1) = 0$ x-intercepts: (-1; 0); (1; 0) OR	$\checkmark (x-1)$ $\checkmark (x^2-1)$ $\checkmark (x-1)(x-1)(x+1)$ $\checkmark (-1; 0)$ $\checkmark (1; 0)$ $\checkmark (x-1)$ $\checkmark (x^2-1)$ $\checkmark (x-1)(x-1)(x+1)$ $\checkmark (-1; 0)$ $\checkmark (1; 0)$	(5)	(5)

	$f(x) = x^3 - x^2 - x + 1$ $f(x) = (x+1)(x^2 - 2x + 1)$ $f(x) = (x+1)(x-1)(x-1)$ $f(x) = 0$ $(x-1)(x-1)(x+1) = 0$ x-intercepts: $(-1; 0); (1; 0)$	$\checkmark (x+1)$ $\checkmark (x^2 - 2x + 1)$ $\checkmark (x-1)(x-1)(x+1)$ $\checkmark (-1; 0)$ $\checkmark (1; 0)$ (5)
9.3	$f(x) = x^3 - x^2 - x + 1$ $f'(x) = 3x^2 - 2x - 1$ $f'(x) = 0$ $(3x+1)(x-1) = 0$ $x = -\frac{1}{3}$ or $x = 1$ $y = \frac{32}{27}$ $y = 0$ $(-\frac{1}{3}; \frac{32}{27})$ $(1; 0)$	$\checkmark f'(x) = 3x^2 - 2x - 1$ $\checkmark f'(x) = 0$ $\checkmark$ factorisation $\checkmark$ x value $\checkmark$ x value $\checkmark y = \frac{32}{27}$ (6)
9.4		$\checkmark$ y- and x-intercepts $\checkmark$ shape $\checkmark$ turning points (3)
9.5	$f'(x) < 0$ $-\frac{1}{3} < x < 1$ OR/OF $(-\frac{1}{3}; 1)$	$\checkmark x > -\frac{1}{3}$ $\checkmark x < 1$ (2) $\checkmark (-\frac{1}{3}; 1)$ $\checkmark 1)$ (2) [17]

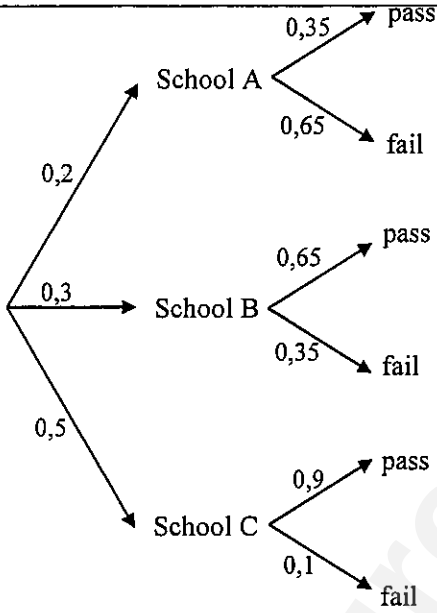
8.1	$f(x+h) = -(x+h)^2 + 4 = -(x^2 + 2xh + h^2) + 4$ $= -x^2 - 2xh - h^2 + 4$ $f(x+h) - f(x) = -2xh - h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \rightarrow 0} (-2x - h)$ $= -2x$ OR/OF $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-(x+h)^2 + 4 - (-x^2 + 4)}{h}$ $= \lim_{h \rightarrow 0} \frac{-x^2 - 2xh - h^2 + 4 + x^2 - 4}{h}$ $= \lim_{h \rightarrow 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \rightarrow 0} (-2x - h)$ $= -2x$	✓ finding $f(x+h)$ ✓ $-2xh - h^2$ ✓ formula ✓ factorisation ✓ answer (5)
8.2.1	$y = 3x^2 + 10x$ $\frac{dy}{dx} = 6x + 10$	✓ $6x$ ✓ 10 (2)
8.2.2	$f(x) = \left(x - \frac{3}{x}\right)^2$ $= x^2 - 6 + \frac{9}{x^2}$ $= x^2 - 6 + 9x^{-2}$ $f'(x) = 2x - 18x^{-3}$	✓ $x^2 - 6 + \frac{9}{x^2}$ ✓ $9x^{-2}$ ✓ $2x - 18x^{-3}$ (3)

8.3.1	$f(2) = 2(2)^3 - 23(2)^2 + 80(2) - 84$ $= 0$ $\therefore (x - 2)$ is a factor	substitution of 2 into f ✓ value of 0 (2)
8.3.2	$f(x) = 2x^3 - 23x^2 + 80x - 84$ $= (x - 2)(2x^2 - 19x + 42)$ $= (x - 2)(2x - 7)(x - 6)$	✓ $2x^2 - 19x + 42$ ✓ $(x - 2)(2x - 7)(x - 6)$ (2)
8.3.3	$f'(x) = 6x^2 - 46x + 80$ $6x^2 - 46x + 80 = 0$ $3x^2 - 23x + 40 = 0$ $(3x - 8)(x - 5) = 0$ $x = \frac{8}{3}$ or $x = 5$	✓ $f'(x) = 6x^2 - 46x + 80$ ✓ $f'(x) = 0$ ✓ factors ✓ x-values (4)
8.3.4		✓ x-intercepts ✓ y-intercept ✓ shape (3)

10.1.1	160	✓ answer (1)
10.1.2	$P(M) = \frac{60}{160}$ $= \frac{3}{8}$ $= 0,375$	✓ 60 ✓ answer (2)
10.1.3	$P(\text{Male}) \times P(\text{Coffee}) = P(\text{Male and Coffee})$ $P(\text{Manlik}) \times P(\text{Koffie}) = P(\text{Manlik en Koffie})$ $\frac{3}{8} \times \frac{80}{160} = \frac{b}{160}$ $\frac{3}{16} = \frac{b}{160}$ $16b = 480$ $b = 30$	✓ formula ✓ $\frac{80}{160}$ ✓ $\frac{b}{160}$ ✓ answer (4)

10.1.1	$P(S \text{ and } T) = P(S) \times P(T)$ $\frac{1}{6} = \left(\frac{1}{4}\right) \times P(T)$ $P(T) = \frac{2}{3}$	$\checkmark P(S \text{ and } T) = P(S) \times P(T)$ $\checkmark P(T) = \frac{2}{3}$ (2)
10.1.2	$P(S \text{ or } T) = P(S) + P(T) - P(S \text{ and } T)$ $= \left(\frac{1}{4}\right) + \left(\frac{2}{3}\right) - \frac{1}{6}$ $= \frac{3}{4}$	$\checkmark \left(\frac{1}{4}\right) + \left(\frac{2}{3}\right) - \frac{1}{6}$ $\checkmark \frac{3}{4}$ (2)
10.2.1	$5!$ $= 120$	$\checkmark 5$ $\checkmark 5! \text{ or } 120$ (2)
10.2.2	5^5 $= 3125$	$\checkmark 5^5 \text{ or } 3125$ (1)
10.3	$n(E) = 5! \times 2! \times 2!$ $n(S) = 7!$ $P(E) = \frac{5! \times 2! \times 2!}{7!}$ $= \frac{2}{21}$	$\checkmark 5!$ $\checkmark 2! \times 2!$ $\checkmark \frac{5! \times 2! \times 2!}{7!}$ $\checkmark \frac{2}{21}$ (4)
		[11]

10.1.1	$d = 5$ $e = 4$ $f = 7$ $g = 5$	$\checkmark d = 5$ $\checkmark e = 4$ $\checkmark f = 7$ $\checkmark g = 5$	(4)
10.1.2a	$P(A \text{ and/en } B \text{ and/en } C) = \frac{4}{54} = \frac{2}{27}$	$\checkmark \frac{4}{54} = \frac{2}{27}$	(1)
10.1.2b	$P(A \text{ or/of } B \text{ or/of } C) = \frac{48}{54} = \frac{8}{9}$	$\checkmark \frac{48}{54} = \frac{8}{9}$	(1)
10.1.2c	$P(\text{only/slegs } C) = \frac{7}{54}$	$\checkmark \frac{7}{54}$	(1)
10.1.2d	$P(\text{that a country uses exactly two methods/dat 'n land presies twee metodes gebruik}) = \frac{5+4+8}{54} = \frac{17}{54}$	$\checkmark \frac{17}{54}$	(1)
10.2.1	$P(\text{selects } Midnight \text{ as drama/kies } Midnight \text{ as drama}) = \frac{1}{5}$	$\checkmark \checkmark \text{ answer/antwoord}$	(2)
10.2.2	Number of different selections of drama, romance and comedy/Aantal verskillende keuses van drama, liefdesverhale en komedie $= 5 \times 4 \times 3 = 60$	$\checkmark \text{ product/produk}$ $\checkmark \text{ answer/antwoord}$	(2)
10.2.3	$P(\text{select } Last \text{ Hero and Laughing Dragon/kies } Last \text{ Hero en Laughing Dragon}) = \frac{1}{5} \times \frac{1}{3} = \frac{1}{15}$ OR/OF $P(\text{select } Last \text{ Hero and Laughing Dragon/kies } Last \text{ Hero en Laughing Dragon}) = \frac{1 \times 4 \times 1}{60} = \frac{1}{15}$	$\checkmark \text{ product/produk}$ $\checkmark \text{ answer/antwoord}$	(2)
TOTAL/TOTAAL:			[14] 150

11.1	$8 \times 7 \times 6 \times 5 \times 4$ or $\frac{8!}{3!}$ $= 6720$	$\checkmark 8 \times 7 \times 6 \times 5 \times 4 / \frac{8!}{3!}$ $\checkmark 6720$ (2)
11.2	$P(A \text{ and } B) = P(A) \times P(B)$ $= 0,4 \times 0,35$ $= 0,14$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $= 0,4 + 0,35 - 0,14$ $= 0,61$	$\checkmark 0,4 \times 0,35$ $\checkmark 0,14$ $\checkmark$ substitution $\checkmark$ answer (4)
		

11.2.1	$6! = 720$ Number of arrangements $= 3! \times 3! \times 2$ $= 72$	$\checkmark 6! \text{ or } 720$ $\checkmark 3! \times 3!$ $\checkmark \times 2$ $\checkmark \text{ answer}$
11.2.2	$P(\text{hearts next to each other}) = \frac{3! \times 4!}{6!}$ $= \frac{144}{720}$ $= \frac{1}{5} \text{ or } 0,2 \text{ or } 20\%$ OR/OF $P(\text{hearts next to each other}) = \frac{4 \times 3! \times 3!}{6!}$ $= \frac{144}{720}$ $= \frac{1}{5} \text{ or } 0,2 \text{ or } 20\%$	$\checkmark \checkmark 3! \times 4!$ $\checkmark \frac{1}{5} \text{ or } 0,2 \text{ or } 20\%$ OR/OF $\checkmark \checkmark$ $\checkmark \frac{1}{5} \text{ or } 0,2 \text{ or } 20\%$
11.2.3		

TOTAL/TOTAAL: 150