education

MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

MATHEMATICS GRADE 12
REVISION PACK

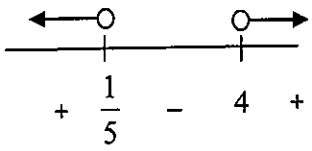
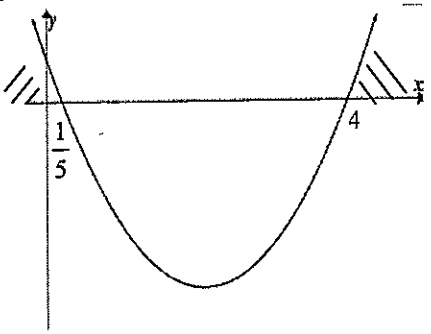
Paper 1

EASY TO SCORE QUESTIONS

Memorandum

QUESTION/*VRAAG* 1

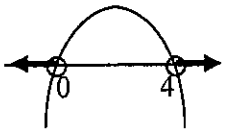
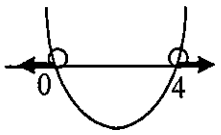
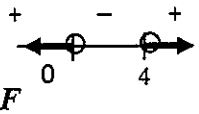
1.1.1	$(x+4)(x-5)=0$ $\therefore x=-4$ or $x=5$	✓ factors/*faktore* ✓ answers/*antwoorde* (2)
1.1.2	$2x^2-11x+7=0$ $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\dfrac{-(-11)\pm\sqrt{(-11)^2-4(2)(7)}}{2(2)}$ = 4,77 or 0,73 **OR/*OF*** $2x^2-11x+7=0$ $x^2-\dfrac{11}{2}x+\dfrac{7}{2}=0$ $x^2-\dfrac{11}{2}x+\left(\dfrac{1}{2}.\dfrac{11}{2}\right)^2+\dfrac{7}{2}-\left(\dfrac{1}{2}.\dfrac{11}{2}\right)^2=0$ $\left(x-\dfrac{11}{4}\right)^2+\dfrac{7}{2}-\dfrac{121}{16}=0$ $\left(x-\dfrac{11}{4}\right)^2=\dfrac{121-56}{16}$ $x-\dfrac{11}{4}=\pm\sqrt{\dfrac{65}{16}}$ $\therefore x=\dfrac{11}{4}+\dfrac{\sqrt{65}}{4}$ or $x=\dfrac{11}{4}-\dfrac{\sqrt{65}}{4}$ $x=4,77$ $x=0,73$	✓ substitution into correct formula/*substitusie* in korrekte formule ✓4,77 ✓0;73 (3) ✓ 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** + $\frac{1}{5}$ − 4 +  	✓ standard form/ *standaardvorm* ✓ factors/*faktore* ✓ $x < \frac{1}{5}$ ✓ $x > 4$ ✓ of (5)
1.1.4	$2^{2x} - 6.2^x = 16$ $2^{2x} - 6.2^x - 16 = 0$ $(2^x - 8)(2^x + 2) = 0$ $2^x = 2^3$ or/*of* $2^x = -2$ $x = 3$ or/*of* No Solution or $2^x \neq -2$	✓ factors/*faktore* ✓no solution to/ *geen oplossing* $2^x = -2$ ✓ $2^x = 2^3$ ✓ answer/*antw.* (4)

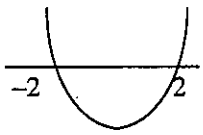
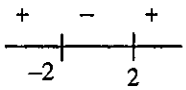
1.2	$y = 2x - 1$ $x^2 - x(2x-1) + (2x-1)^2 = 7$ $x^2 - 2x^2 + x + 4x^2 - 4x + 1 = 7$ $3x^2 - 3x - 6 = 0$ $x^2 - x - 2 = 0$ $(x-2)(x+1) = 0$ $x = 2$ or/*of* $x = -1$ $y = 3$ or/*of* $y = -3$ **OR/*OF*** $x = \frac{y}{2} + \frac{1}{2}$ $\left(\frac{y}{2} + \frac{1}{2}\right)^2 - \left(\frac{y}{2} + \frac{1}{2}\right)y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

1.4	$\sqrt{\frac{7^{2014}-7^{2012}}{12}}$ $=\sqrt{\frac{7^{2012}\left(7^2-1\right)}{12}}$ $=\sqrt{\frac{7^{2012}.48}{12}}$ $=\sqrt{7^{2012}.4}$ $=2.7^{1006}$ $a = 2;\ b = 1006$	✓$\frac{7^{2012}\left(7^2-1\right)}{12}$ ✓$\sqrt{7^{2012}.4}$ ✓2.7^{1006} ✓ **OR/*OF*** ✓$a = 2$ ✓$b = 1006$ (4) **[27]**

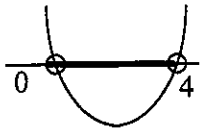
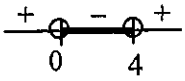
QUESTION/*VRAAG* 1

1.1.1	$x^2 - x - 12 = 0$ $(x-4)(x+3) = 0$ $x = 4$ or $x = -3$ **OR/*OF*** $x^2 - x - 12 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-12)}}{2(1)}$ $= 4$ 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	$x(4-x) < 0$ $x < 0$ or $x > 4$ **OR/*OF*** $x(4-x) < 0$ $x(x-4) > 0$ $x < 0$ or $x > 4$	  **OR/*OF***  	✓ $x < 0$ ✓ $x > 4$ ✓or (3) ✓ $x < 0$ ✓ $x > 4$ ✓or (3)

1.1.4	$x=\frac{a^2+a-2}{a-1}$ $=\frac{(a+2)(a-1)}{a-1}$ $=a+2$ $=888\,888\,888\,890$	✓$(a+2)(a-1)$ ✓answer (check ten eights written)/*tien agtstes geskryf* (2)
1.2	$y+7=2x$ $y=2x-7$ .....(1) $x^2-xy+3y^2=15$ substitute (1) in (2) : $x^2-x(2x-7)+3(2x-7)^2=15$ $x^2-2x^2+7x+3(4x^2-28x+49)=15$ $x^2-2x^2+7x+12x^2-84x+147-15=0$ $11x^2-77x+132=0$ $x^2-7x+12=0$ $(x-3)(x-4)=0$ $x=3$ or $x=4$ $y=2(3)-7$ $y=2(4)-7$ $y=-1$ $y=1$	✓$y=2x-7$ ✓ substitution ✓standard form ✓factorisation ✓x-values ✓y-values (6)
	OR/*OF*	
	$y+7=2x$ $x=\frac{y+7}{2}$ .....(1) $x^2-xy+3y^2=15$ .....(2) substitute (1) in (2) : $\left(\frac{y+7}{2}\right)^2-\left(\frac{y+7}{2}\right)y+3y^2=15$ $\frac{y^2+14y+49}{4}-\frac{y^2+7y}{2}+3y^2=15$ $y^2+14y+49-2y^2-14y+12y^2-60=0$ $11y^2-11=0$ $y^2-1=0$ $(y-1)(y+1)=0$ $y=-1$ $y=1$ $x=\frac{-1+7}{2}$ $x=\frac{1+7}{2}$ $x=3$ $x=4$	✓$x=\frac{y+7}{2}$ ✓ substitution ✓standard form ✓factorisation ✓y-values ✓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./*Omdat x reëel is, het die vergelyking reële wortels.* $\Delta \geq 0$ $y^2 - 4 \geq 0$ $(y-2)(y+2) \geq 0$  **OR/** ***OF***  $y \leq -2$ or $y \geq 2$	✓ $x^2 - xy + 1 = 0$ ✓ $\Delta \geq 0$ ✓ $y^2 - 4$ ✓factors ✓ $y \leq -2$ ✓ $y \geq 2$ (6) **[23]**

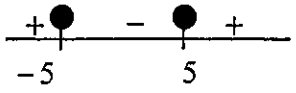
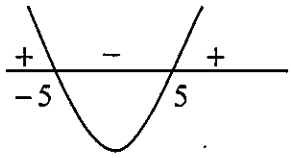
QUESTION/*VRAAG* 1

1.1.1	$(x-3)(x+1)=0$ $x=3$ or $x=-1$	✓ answer ✓ answer (2)
1.1.2	$\sqrt{x^3}=512$ $x^{\frac{3}{2}}=512$ $\left(x^{\frac{3}{2}}\right)^{\frac{2}{3}}=\left(8^3\right)^{\frac{2}{3}}$ $x=64$ **OR** $\sqrt{x^3}=512$ $x^3=262144$ $x^3=2^{18}$ $x=2^6$ $x=64$	✓ $x^{\frac{3}{2}}$ ✓ $\left(8^3\right)^{\frac{2}{3}}$ ✓ 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** $x^2-5x+2=0$ $x^2-5x=-2$ $x^2-5x+\left(-\frac{5}{2}\right)^2=-2+\left(-\frac{5}{4}\right)^2$ $\left(x-\frac{5}{2}\right)^2=\frac{17}{4}$ $x=\frac{5+\sqrt{17}}{2}$ 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 $x = 2y + 2$ $y = \frac{1}{2}x - 1$ $x^2 - 2xy + 3y^2 = 4$ $x^2 - 2x\left(\frac{1}{2}x - 1\right) + 3\left(\frac{1}{2}x - 1\right)^2 = 4$ $x^2 - x^2 + 2x + 3\left(\frac{1}{4}x^2 - x + 1\right) = 4$ $2x + \frac{3}{4}x^2 - 3x + 3 = 4$ $3x^2 - 4x - 4 = 0$ $(3x + 2)(x - 2) = 0$ $x = 2 \quad \text{or} \quad x = -\frac{2}{3}$ $y = 0 \qquad y = -\frac{4}{3}$	✓ 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. *Vir* S *om 'n maksimum waarde te hê, moet die deler 'n minimum waarde h* 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]

QUESTION/*VRAAG* 1

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 $x=-3{,}64$ NOTE: Penalise 1 mark if the rounding to TWO decimal places is incorrect. **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 $x=-3{,}64$	✓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	$x = 2y - 1$ $(2y-1)^2 - 7 - y^2 = -y$ $4y^2 - 4y + 1 - 7 - y^2 = -y$ $3y^2 - 3y - 6 = 0$ $y^2 - y - 2 = 0$ $(y-2)(y+1) = 0$ $y = 2$ or $y = -1$ $x = 2(2) - 1$ or $x = 2(-1) - 1$ $x = 3$ or $x = -3$ **OR/*OF*** $y = \frac{x+1}{2}$ $x^2 - 7 - y^2 = -y$ $x^2 - 7 - \left(\frac{x+1}{2}\right)^2 = -\left(\frac{x+1}{2}\right)$ $x^2 - 7 - \left(\frac{x^2+2x+1}{4}\right) = \frac{-x-1}{2}$ $4x^2 - 28 - x^2 - 2x - 1 = -2x - 2$ $3x^2 - 27 = 0$ $x^2 - 9 = 0$ $(x-3)(x+3) = 0$ $x = -3$ or $x = 3$ $y = \frac{-3+1}{2}$ or $y = \frac{3+1}{2}$ $y = -1$ or $y = 2$	✓ $x = 2y - 1$ ✓ substitution ✓ correct standard form ✓ factors ✓ y – values ✓ x – values **OR/*OF*** ✓ $y = \frac{x+1}{2}$ ✓ substitution ✓ correct standard form ✓ factors ✓ x – values ✓ y – values (6)
1.4	$\frac{3^{2018} + 3^{2016}}{3^{2017}}$ $= \frac{3^{2017}(3^1 + 3^{-1})}{3^{2017}}$ $= 3 + \frac{1}{3}$ $= 3\frac{1}{3}$ or $\frac{10}{3}$ **OR/*OF***	✓ common factor 3^{2017} ✓ answer **OR/*OF***

	$\frac{3^{2018}+3^{2016}}{3^{2017}}$ $=\frac{3^{2016}(3^2+1)}{3^{2017}}$ $=\frac{10}{3}$ **OR/*OF*** $\frac{3^{2018}+3^{2016}}{3^{2017}}$ $=\frac{3^{2018}}{3^{2017}}+\frac{3^{2016}}{3^{2017}}$ $=3+\frac{1}{3}$ $=3\frac{1}{3}$ or $\frac{10}{3}$	✓ common factor 3^{2016} ✓ answer **OR/*OF*** ✓ dividing by 3^{2017} ✓ answer (2)
1.5.1	$3x-5\geq 0$ and $x\neq 3$ $x\geq\frac{5}{3}$ and $x\neq 3$	✓ $3x-5\geq 0$ ✓ $x\geq\frac{5}{3}$ ✓ $x\neq 3$ (3)
1.5.2	$\frac{\sqrt{3x-5}}{x-3}=1$ $\sqrt{3x-5}=x-3$ $3x-5=(x-3)^2$ $3x-5=x^2-6x+9$ $x^2-9x+14=0$ $(x-7)(x-2)=0$ $x\neq 2$ 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:

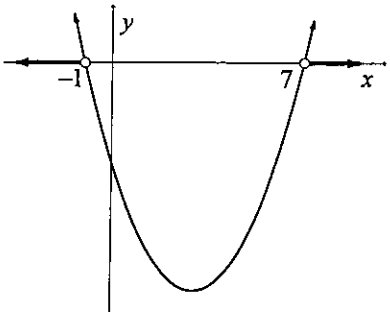
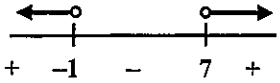
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking guidelines.

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

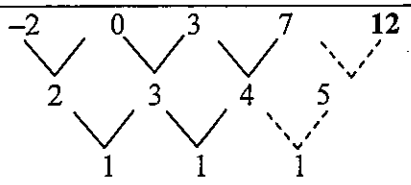
1.1.1	$(3x-1)(x+4)=0$ $x=\frac{1}{3}$ or $x=-4$	✓ $x=\frac{1}{3}$ ✓ $x=-4$ (2)
1.1.2	$2x^2+9x-14=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-9\pm\sqrt{9^2-4(2)(-14)}}{2(2)}$ $=\frac{-9\pm\sqrt{193}}{4}$ $x=1{,}22$ or $x=-5{,}72$ **OR/*OF*** $x^2+\frac{9}{2}x+\frac{81}{16}=7+\frac{81}{16}$ $\left(x+\frac{9}{4}\right)^2=\frac{193}{16}$ $x+\frac{9}{4}=\pm\frac{\sqrt{193}}{4}$ $x=\frac{-9\pm\sqrt{193}}{4}$ $x=1{,}22$ or $x=-5{,}72$	✓ substitution into correct formula ✓ simplification ✓ $x=1{,}22$ ✓ $x=-5{,}72$ (4) **OR/*OF*** ✓for adding $\frac{81}{16}$ on both sides ✓ simplification ✓ $x=1{,}22$ ✓ $x=-5{,}72$ (4)
1.1.3	$\sqrt{3-26x}=3x$ $3-26x=9x^2$ $9x^2+26x-3=0$ $(9x-1)(x+3)=0$ $x=\frac{1}{9}$ or $x=-3$ N/A	✓ $3-26x=9x^2$ ✓ standard form ✓ factors ✓ 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 $x>7$	✓ x^2-5x+4 ✓ standard form ✓ factors ✓✓ $x<-1$ 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*** $\frac{(16x^7)^{\frac{1}{2}}-(25x^7)^{\frac{1}{2}}}{x^{\frac{1}{2}}}$ $=\frac{4x^{\frac{7}{2}}-5x^{\frac{7}{2}}}{x^{\frac{1}{2}}}$ $=\frac{-x^{\frac{7}{2}}}{x^{\frac{1}{2}}}$ $=-x^3$	✓ $4\sqrt{x^7}-5\sqrt{x^7}$ ✓ $-\sqrt{x^7}$ ✓ $-x^3$ (3) **OR/*OF*** ✓ $\sqrt{x^7}(4-5)$ ✓ $\sqrt{x^6}(-1)$ ✓ $-x^3$ (3) **OR/OF** ✓ $\frac{4x^{\frac{7}{2}}-5x^{\frac{7}{2}}}{x^{\frac{1}{2}}}$ ✓ $-x^{\frac{7}{2}}$ ✓ $-x^3$ (3)

1.3	$x-2y-3=0$	
	$x=2y+3$.....(1)	✓ $x=2y+3$
	$xy=9$.....(2)	
	Substitute (1) into (2)	
	$(2y+3)y=9$	✓ substitution
	$2y^2+3y=9$	
	$2y^2+3y-9=0$	✓ standard form
	$(2y-3)(y+3)=0$	
	$y=\frac{3}{2}$ or $y=-3$	✓ y-values
	$x=6$ or $x=-3$	✓ x-values (5)
	OR/*OF*	**OR/*OF***
	$y=\frac{x-3}{2}$.....(1)	✓ $y=\frac{x-3}{2}$
	$xy=9$.....(2)	
	Substitute (1) into (2)	
	$x\left(\frac{x-3}{2}\right)=9$	✓ substitution
	$x^2-3x=18$	
	$x^2-3x-18=0$	✓ standard form
	$(x-6)(x+3)=0$	
	$x=6$ or $x=-3$	✓ x-values
	$y=\frac{3}{2}$ or $y=-3$	✓ y-values (5)
	OR/OF	**OR/OF**
	$x-2y-3=0$	
	$x=2y+3$.....(1)	
	$y=\frac{9}{x}$.....(2)	✓ $y=\frac{9}{x}$
	Substitute (2) into (1)	
	$x=2\left(\frac{9}{x}\right)+3$	✓ substitution
	$x^2-2(9)-3x=0$	
	$x^2-3x-18=0$	✓ standard form
	$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$	
	$=\frac{-3\pm\sqrt{(-3)^2-4(1)(-18)}}{2(1)}$	
	$=\frac{-3\pm\sqrt{81}}{2}$	
	$x=6$ or $x=-3$	✓ x-values
	$y=\frac{9}{6}=1,5$ or $y=\frac{9}{-3}=-3$	✓ y-values (5)

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 $(x+y)^2 + y^2 \geq 0$	✓ $x^2 + 2xy + y^2 + y^2$ ✓ $(x+y)^2$ ✓ $(x+y)^2 \geq 0$ and $y^2 \geq 0$ ✓ $(x+y)^2 + y^2 \geq 0$ (4) **[27]**

QUESTION/*VRAAG* 2

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)

$2a = 1$

$a = \frac{1}{2}$ ✓value of a

$T_n = an^2 + bn + c$

$-2 = \frac{1}{2} + b + c \ldots\ldots\ldots\ldots T_1$ ✓$-2 = \frac{1}{2} + b + c$

$b + c = -\frac{5}{2} \ldots\ldots\ldots\ldots$line 1

$0 = 2 + 2b + c \ldots\ldots\ldots\ldots T_2$ ✓ $0 = 2 + 2b + c$

$2b + c = -2 \ldots\ldots\ldots\ldots$line 2

line 2 – line 1:

$b = \frac{1}{2}$ ✓value of b

substitute in line 1 or substitute in line 2

$\frac{1}{2} + c = -\frac{5}{2}$ $2\left(\frac{1}{2}\right) + c = -2$

$c = -3$ ✓ value of c

$\therefore T_n = \frac{1}{2}n^2 + \frac{1}{2}n - 3$ (5)

OR/*OF*

$T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)}{2}d_2$

$= -2 + (n-1)(2) + \frac{(n-1)(n-2)}{2}(1)$ ✓formula

$= -2 + 2n - 2 + (n^2 - 3n + 2)(\frac{1}{2})$ ✓substitution

$= -2 + 2n - 2 + \frac{1}{2}n^2 - \frac{3}{2}n + 1$ ✓ value of a

$= \frac{1}{2}n^2 + \frac{1}{2}n - 3$ ✓value of b
✓ value of c

OR/*OF* (5)

$2a = 1$

$a = \frac{1}{2}$ ✓value of a

$3a + b = T_2 - T_1$

$3\left(\frac{1}{2}\right) + b = 2$ ✓$3\left(\frac{1}{2}\right) + b = 2$

$b = \frac{1}{2}$ ✓value of b

$T_0 = c = -3$ ✓$T_0 = c$

$\therefore T_n = \frac{1}{2}n^2 + \frac{1}{2}n - 3$ ✓ value of c

OR/*OF* (5)

	Since $T_2 = 0, (n-2)$ is a 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	$\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322$ $n^2 + n - 6 = 644$ $n^2 + n - 650 = 0$ $n = \frac{-1 \pm \sqrt{1^2 - 4(1)(650)}}{2}$ $n = 25$ or $n = -26$ The 25th term has a value of 322./*Die 25ste term se waarde is 322.* **OR/*OF*** $\frac{1}{2}n^2 + \frac{1}{2}n - 3 = 322$ $n^2 + n - 6 = 644$ $n^2 + n - 650 = 0$ $(n-25)(n+26) = 0$ $n = 25$ or $n = -26$ The 25th term has a value of 322./*Die 25ste 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)

	$\frac{1}{2}n^2+\frac{1}{2}n-3=322$ $n^2+n-6=644$ $(n+3)(n-2)=23\times 28$ $n-2=23$ $n=25$	✓$\frac{1}{2}n^2+\frac{1}{2}n-3=322$ ✓$(n+3)(n-2)$ ✓23×28 ✓answer (4)
2.2.1	$T_2: \quad a+d=8$ $T_5: \quad a+4d=10$ $T_5-T_2: \quad 3d=2$ $d=\frac{2}{3}$	✓$a+d=8$ ✓$a+4d=10$ ✓answer (3)
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*** $S_{50}=\sum_{n=1}^{50}\left(\frac{2n+20}{3}\right)$	✓$T_1=\frac{22}{3}$ ✓answer (2) (2)
2.2.3	$S_n=\frac{n}{2}[2a+(n-1)d]$ $S_{50}=\frac{50}{2}\left[2\left(\frac{22}{3}\right)+(50-1)\left(\frac{2}{3}\right)\right]$ $=\frac{3550}{3}$	✓correct substitution into correct formula ✓✓answer (3) **[18]**

QUESTION/*VRAAG* 2

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

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

QUESTION/*VRAAG* 2

2.1	$S_n = a + (a+d) + (a+2d) + \ldots + a + (n-1)d$ $S_n = a + (n-1)d + a + (n-2)d + a + (n-3)d + \ldots + a$ $2S_n = n(2a + (n-1)d)$ $S_n = \frac{n}{2}[2a + (n-1)d]$	✓ first series/*eerste reeks* ✓ series reversed/*reeks omgekeer* ✓ sum/*som* ✓ division/*deling* (4)
2.2	$\sum_{k=1}^{50}(100-3k) = 97 + 94 + 91 + \ldots$ $T_1 = a = 97$ $d = -3$ $n = 50 - 1 + 1 = 50$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $= \frac{50}{2}[2(97) + 49(-3)]$ $= 1175$ **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* (4) ✓$a = 97$ ✓$l = -50$ ✓$n = 50$ ✓ 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	$T_{89} - T_{69} = (T_{70} - T_{69}) + (T_{71} - T_{70}) + ... + (T_{89} - T_{88})$ $= 415 + 421 + ...$to 20 terms $= \frac{20}{2}[2(415) + 19(6)]$ $= 9440$ $T_{69} = T_{89}$ – (sum of the differences from/*som van die verskille van* T_{69} to T_{89}) $T_{69} = 23594 - 9440$ $= 14154$ **OR/*OF*** 7 13 19 25 6 6 6 $\therefore 2a = 6$ $a = 3$ $3a + b = 7$ $b = -2$ $T_{89} = 3(89)^2 - 2(89) + c = 23594$ $\therefore c = 9$ $\therefore T_n = 3n^2 - 2n + 9$ $\therefore T_{69} = 3(69)^2 - 2(69) + 9$ $\therefore T_{69} = 14154$	✓ 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*	
	7 13 19 25 6 6 6	
	$\therefore 2a = 6$ $a = 3$ $7 - 6 = 1$ $T_1 - T_0 = 1$ $a + b + c - c = 1$ $3 + b = 1$ $b = -2$ $T_{89} = 3(89)^2 - 2(89) + c = 23594$ $\therefore c = 9$ $\therefore T_n = 3n^2 - 2n + 9$ $\therefore T_{69} = 3(69)^2 - 2(69) + 9$ $\therefore T_{69} = 14154$	✓ *a* and/*en b* ✓ T_{89} (subst $n = 89$) ✓ T_n ✓substitution/*substitusie* ✓ 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/*substitusie* ✓answer/*antwoord* (5) **[17]**

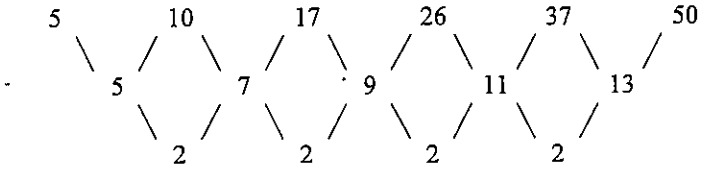
QUESTION 3

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

QUESTION/*VRAAG* 2

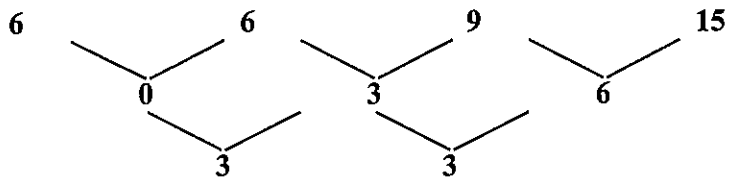
2.1.1	$30\ ;\ 10\ ;\ \frac{10}{3}\ldots\ldots$ $a=30 \quad r=\frac{1}{3}$ $T_n = ar^{n-1}$ $\frac{10}{729}=30\left(\frac{1}{3}\right)^{n-1}$ $\frac{1}{2187}=3^{1-n}$ $3^{-7}=3^{1-n}$ $-7=1-n$ $n=8$ **OR/*OF*** $\frac{1}{2187}=\left(\frac{1}{3}\right)^{n-1}$ $\left(\frac{1}{3}\right)^{7}=\left(\frac{1}{3}\right)^{n-1}$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

QUESTION/*VRAAG 2*

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	$n^2 + 2n + 2 = 1765$ $n^2 + 2n - 1763 = 0$ $(n + 43)(n - 41) = 0$ $n = -43$ or $n = 41$ N/A **OR/OF** $n^2 + 2n + 2 = 1765$ $n^2 + 2n - 1763 = 0$ $n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-2 \pm \sqrt{2^2 - 4(1)(-1763)}}{2(1)}$ $= \frac{-2 \pm \sqrt{7056}}{2}$ $n = -43$ or $n = 4$ 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: *Som van meervoude van* 7 *vanaf* 35 *tot by* 196: $a = 35;\ \ d = 7$ $S_n = \frac{n}{2}[a + \ell]$ $= \frac{24}{2}[35 + 196]$ $= 12[231]$ $= 2772$ Sum of all natural numbers from 35 to 196: *Som van alle natuurlike getalle vanaf* 35 *tot by* 196: $a = 35;\ d = 1;\ n = 162$ $S_n = \frac{n}{2}[a + \ell]$ $= \frac{162}{2}[35 + 196]$ $= 81[231]$ $= 18\ 711$ Sum of numbers not divisible by 7/ *Som van getalle nie deelbaar deur* 7 $= 18\ 711 - 2772$ $= 15\ 939$	✓ correct a, d and n substitution into correct formula ✓ answer ✓ 162 ✓ answer ✓ answer (5) **[15]**

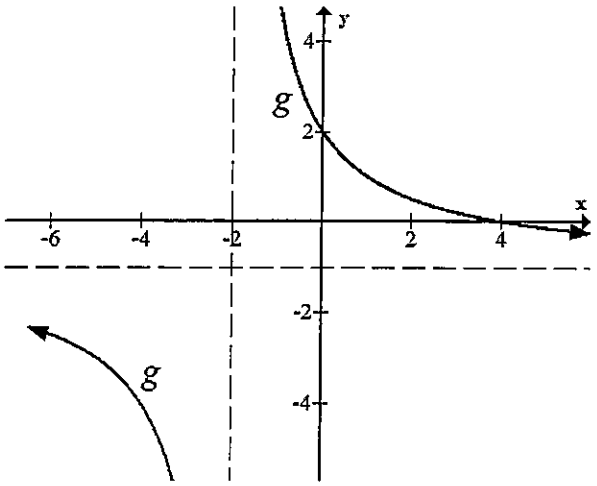
QUESTION/*VRAAG* 3

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** $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)d_2}{2}$ $= 6 + (n-1)(0) + \frac{(n-1)(n-2)(3)}{2}$ $= 6 + \frac{n^2 - 3n + 2}{1}\left(\frac{3}{2}\right)$ $= 6 + \frac{3}{2}n^2 - \frac{9}{2}n + 3$ $= \frac{3}{2}n^2 - \frac{9}{2}n + 9$	✓ $a = \frac{3}{2}$ ✓ $b = -\frac{9}{2}$ ✓ $c = 9$ ✓ $T_n = \frac{3}{2}n^2 - \frac{9}{2}n + 9$ (4) ✓formula ✓substitution ✓simplifying ✓ $T_n = \frac{3}{2}n^2 - \frac{9}{2}n + 9$ (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* $n = 48$	✓ equating general term to 3249 ✓ standard form ✓ factors ✓ $n \neq -45$ or $n = 48$ (4)

QUESTION/*VRAAG* 3

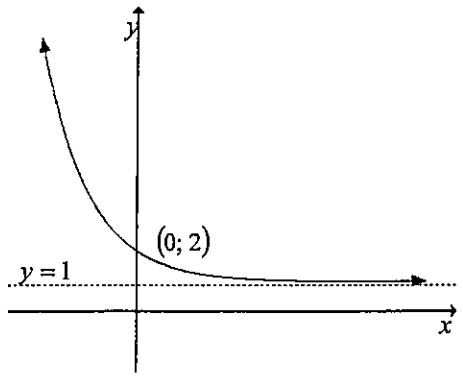
3.1	$-1\ ;\ 2\ ;\ 5$ $T_n = -1+(n-1)(3)$ $= 3n-4$	✓ $3n$ ✓ -4 (2)
3.2	$T_{43} = 3(43)-4$ $= 125$ **OR/ OF** $T_{43} = -1+(43-1)(3)$ $= 125$ NOTE: Answer only 2 / 2	✓ subs of 43 ✓ answer (2)
3.3	$T_n = 3n-4$ $S_n = \sum_{k=1}^{n} T_k = -1+2+5+\ldots\ldots\ldots+3n-4$ $S_n = \frac{n}{2}[-1+3n-4]$ or $S_n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

QUESTION/*VRAAG* 4

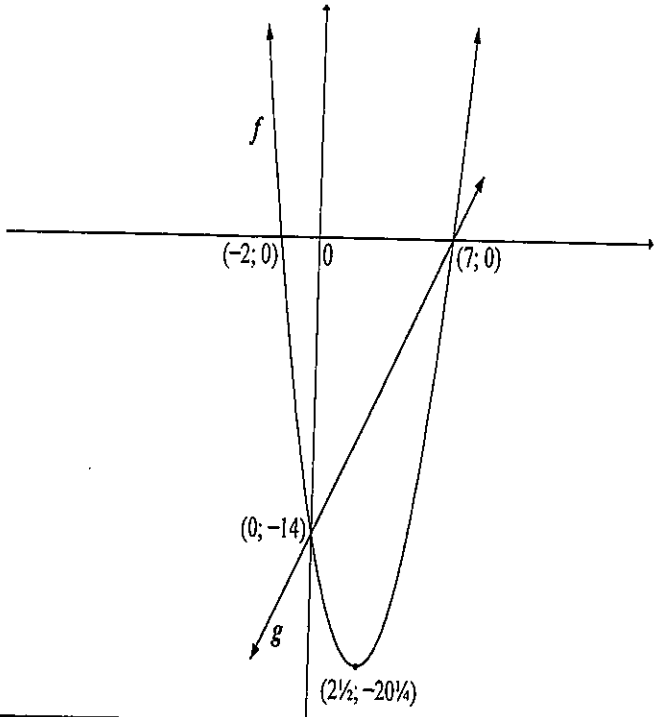
4.1	$x=-2$ $y=-1$	✓ $x=-2$ ✓ $y=-1$ (2)
4.2.1	$g(0)=\frac{6}{0+2}-1$ $=2$ *y*-intercept/*afsnit* (0 ; 2)	✓ answer/*antwoord* (1)
4.2.2	$0=\frac{6}{x+2}-1$ $1=\frac{6}{x+2}$ $x+2=6$ $x=4$ *x*-intercept/*afsnit* (4 ; 0)	✓ equating to/*stel gelyk aan* 0 ✓ answer/*antwoord* (2)
4.3		✓ asymptotes/*asimptote*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

[13]

QUESTION/*VRAAG* 4

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 $y=3$. *Omdat die asimptoot van* f $y=1$ *is,* *sal die asimptoot van* $h(x)=3f(x)$ $y=3$ *wees.*	✓answer (1) **[8]**

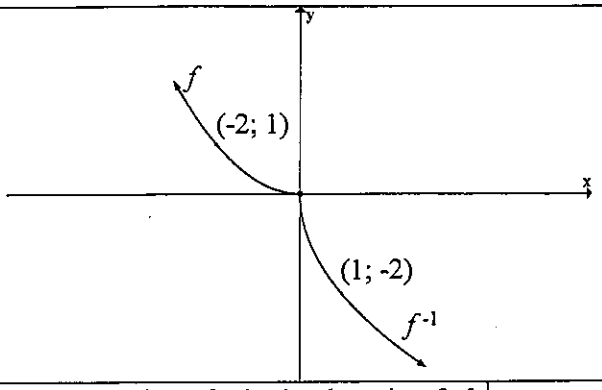
QUESTION/*VRAAG* 5

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)

QUESTION/*VRAAG* 5

5.1	$9 = a^2$ $a = 3$ **OR/*OF*** $f^{-1}(x) = \log_a x$ $2 = \log_a 9$ $a^2 = 9 = 3^2$ $\therefore a = 3$	✓ $9 = a^2$ ✓ $a = 3$ (2) ✓ $9 = a^2$ ✓ $a = 3$ (2)
5.2	$g(x) = 3^{-x}$ **OR/*OF*** $g(x) = \left(\frac{1}{3}\right)^x$	✓ answer/*antwoord* (1) ✓ 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*** $\log_3 x \geq 2$ $x \geq 3^2$ $\therefore x \geq 9$	✓✓ answer/*antwoord* (2) ✓✓ answer/*antwoord* (2) ✓✓ 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.*	✓ Yes/*Ja* ✓ Reason/*Rede* (2) ✓ Yes/*Ja* ✓ Reason/*Rede* (2) **[7]**

QUESTION/*VRAAG* 6

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. *Ja. Geen waarde van x in die definisieversameling van f^{-1} assosieer met meer as een y-waarde nie.* **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]**

QUESTION/*VRAAG* 4

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

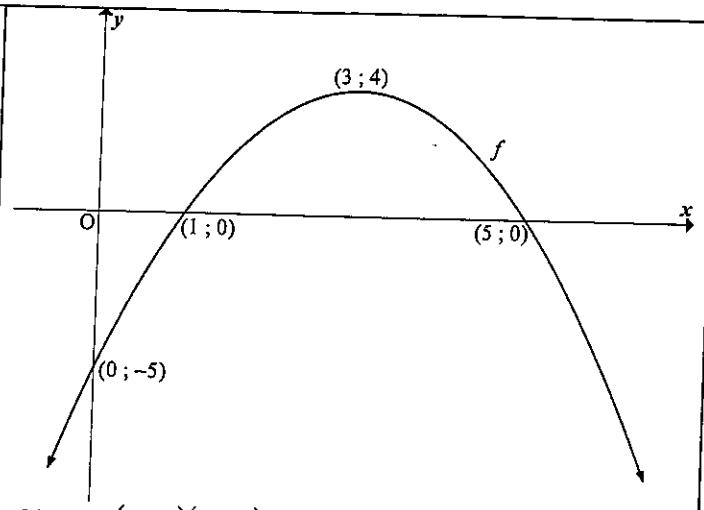
QUESTION/*VRAAG 4*

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]**

QUESTION 5

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 $O\hat{C}B = 45°$ isosceles right angled triangle *Gelykbenige reghoekige driehoek* **OR / OF** $\tan\beta = m_g$ $\tan\beta = 1$ $\beta = 45°$ $O\hat{B}C = 45°$ $O\hat{C}B = 45°$	✓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	$f'(x) \cdot f''(x) > 0$ $(2x-2).2 > 0$ $2x-2 > 0$ $x > 1$	✓ $2x-2$ ✓ 2 ✓ $x > 1$ (3)

5.2



TP
✓ $x = 3$
✓ $y = 4$

✓ x – intercepts
✓ y-intercept

✓ shape

(5)

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

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

$4 = -4a$

$a = -1$

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

[22]

QUESTION/*VRAAG* 5

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

QUESTION/*VRAAG* 5

5.1	$a^0 = 1$ T(0 ; 1)	✓ $x = 0$ ✓ $y = 1$ (2)
5.2	$g(x) = a^x$ $9 = a^2$ $a = 3$ $\quad a > 0$	✓ 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)

QUESTION/*VRAAG* 6

6.1.1	$A = 150\,000(1-0,2)^2$ $= R96\,000$	✓ $n = 2$ ✓ 150 000 in correct formula ✓ 96 000 (3)
6.1.2	$150\,000(1-0,2)^n = 49152$ $(0,8)^n = \frac{1024}{3125}$ $n\log(0,8) = \log\frac{1024}{3125}$ $n = 5$ The machine will need to be replaced at the beginning of 2020 / *Masjien moet aan die begin van 2020 vervang word* **OR / OF** $150\,000(1-0,2)^n = 49152$ $(0,8)^n = \frac{1024}{3125}$ $n = \log_{0,8}\frac{1024}{3125}$ $n = 5$ The machine will need to be replaced at the beginning of 2020 / *Masjien moet aan die begin van 2020 vervang word*	✓ $150\,000(1-0,2)^n = 49152$ ✓ $n\log(0,8) = \log\frac{1024}{3125}$ ✓ $n = 5$ ✓ 2020 (4) ✓ $150\,000(1-0,2)^n = 49152$ ✓ $n = \log_{0,8}\frac{1024}{3125}$ ✓ $n = 5$ ✓ 2020 (4)

QUESTION/*VRAAG 6*

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

QUESTION/*VRAAG 7*

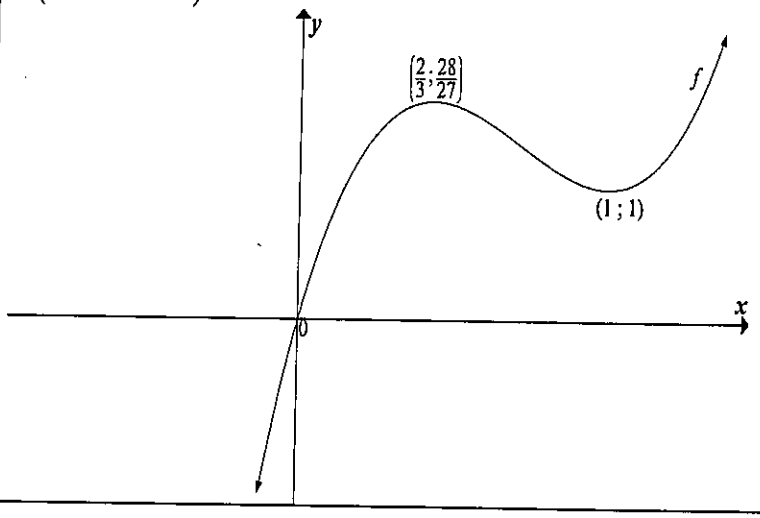
7.1	$A = P(1-i)^n$ $331527 = 500000(1-i)^3$ $(1-i)^3 = \frac{331527}{500000}$ $1-i = \sqrt[3]{\frac{331527}{500000}}$ $i = 0,12800...$ $= 12,8\%$	✓ substitution of A, P & n in correct formula ✓ $1-i = \sqrt[3]{\frac{331527}{500000}}$ or $1-i = \sqrt[3]{0,663054}$ ✓ answer (3)

QUESTION/*VRAAG 7*

7.1.1	Quarterly interest rate/*Kwartaallikse rentekoers* $= \frac{10\%}{4}$ $= 2,5\%$	✓answer (1)
7.1.2	$A = P(1+i)^n$ $= 5000\left(1+\frac{2,5}{100}\right)^{2\times4}$ $= R6092,01$	✓$n = 8$ ✓$5000\left(1+\frac{2,5}{100}\right)^{2\times4}$ ✓answer (3)

QUESTION/*VRAAG* 8

8.1	$f'(x)=0$ $6x^2-10x+4=0$ $3x^2-5x+2=0$ $(3x-2)(x-1)=0$ $x=\frac{2}{3}$ or $x=1$ $y=2\left(\frac{2}{3}\right)^3-5\left(\frac{2}{3}\right)^2+4\left(\frac{2}{3}\right)$ $y=2(1)^3-5(1)^2+4(1)$ $y=\frac{28}{27}$ or $y=1$ Turning points are $\left(\frac{2}{3};\frac{28}{27}\right)$ and $(1;1)$	✓ derivative ✓ derivative $=0$ ✓ factors ✓ x-values ✓ y-values (5)

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

8.4	$f(x)=2x^3-5x^2+4x$ $f'(x)=6x^2-10x+4$ $f''(x)=12x-10$ $f''(x)>0$ $12x-10>0$ $x>\frac{5}{6}$	✓ $12x-10$ ✓ $f''(x)>0$ ✓ answer (3)
	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 $a>0$	✓ $x=-\frac{(-5)}{3(2)}$ ✓ $x=\frac{5}{6}$ ✓ $f''(x)>0$ (3)
	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 $a>0$	✓ $x=\frac{\frac{2}{3}+1}{2}$ ✓ $x=\frac{5}{6}$ ✓ $f''(x)>0$ (3) **[14]**

QUESTION/*VRAAG* 8

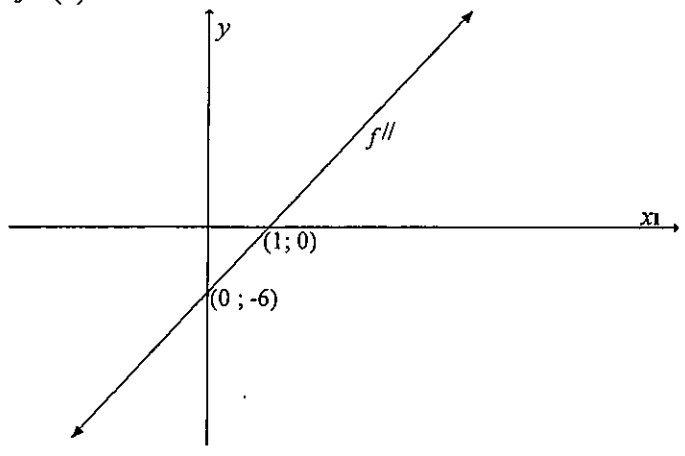
8.1	$f(x+h)=2(x+h)^2+4$ $=2x^2+4xh+2h^2+4$ $f(x+h)-f(x)=2x^2+4xh+2h^2+4-2x^2-4$ $=4xh+2h^2$ $f'(x)=\lim_{h\to 0}\frac{4xh+2h^2}{h}$ $=\lim_{h\to 0}\frac{h(4x+2h)}{h}$ $=\lim_{h\to 0}(4x+2h)$ $=4x$	✓ $2x^2+4xh+2h^2+4$ ✓ $4xh+2h^2$ ✓ $\lim_{h\to 0}\frac{h(4x+2h)}{h}$ ✓ $4x$ (4)
8.2.1	$f(x)=-3x^2+5\sqrt{x}$ $f(x)=-3x^2+5x^{\frac{1}{2}}$ $f'(x)=-6x+\frac{5}{2}x^{-\frac{1}{2}}$	✓ $5x^{\frac{1}{2}}$ ✓ $-6x$ ✓ $\frac{5}{2}x^{-\frac{1}{2}}$ (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: $p'(x)=2(x^{-3}+4x)(-3x^{-4}+4)$ $p'(x)=-6x^{-7}-16x^{-3}+32x$	✓ $\frac{1}{x^6}+\frac{8}{x^2}+16x^2$ ✓ $x^{-6}+8x^{-2}+16x^2$ ✓✓ answer/*antwoord* (4) ✓✓ $2(x^{-3}+4x)$ ✓✓ $(-3x^{-4}+4)$ (4)
8.3.1	$h'(x)=3x^2-14x+14$	✓ finding/*kry* $h'(x)$ (1)
8.3.2	At/*By* B: $h'(x)=0$ $3x^2-14x+14=0$ $x=\frac{14\pm\sqrt{(-14)^2-4(3)(14)}}{2(3)}$ $=1{,}45$ or $3{,}22$ n/a	✓ derivative equal to/ *afgeleide gelyk aan* 0 ✓ substitution into correct formula/*substitusie in korrekte formule* ✓ x-value of/*x-waarde van* 1,45 (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/*koördinate van* C (4) ✓ $x_c > 3{,}22$ ✓ substitution of/ *substitusie van* 4 ✓ $h(4) = 0$ ✓ x_c (4)

QUESTION/*VRAAG* 8

8.1	$f(x+h) = 4x^2$ $f(x+h)-f(x) = 4(x+h)^2 - 4x^2$ $= 4(x^2+2xh+h^2)-4x^2$ $= 4x^2+8xh+4h^2-4x^2$ $= 8xh+4h^2$ $f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $= \lim_{h\to 0}\left[\frac{8xh+4h^2}{h}\right]$ $= \lim_{h\to 0}\left[\frac{h(8x+4h)}{h}\right]$ $= 8x$ **OR/OF** $f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $= \lim_{h\to 0}\left[\frac{4(x+h)^2-4x^2}{h}\right]$ $= \lim_{h\to 0}\left[\frac{4x^2 8xh+4h^2-4x^2}{h}\right]$ $= \lim_{h\to 0}\left[\frac{8xh+4h^2}{h}\right]$ $\doteq \lim_{h\to 0}\left[\frac{h(8x+4h)}{h}\right]$ $= 8x$	✓ $4(x+h)^2$ ✓ $8xh+4h^2$ ✓ $\frac{f(x+h)-f(x)}{h}$ ✓ $\frac{h(8x+4h)}{h}$ ✓ $8x$ **OR/OF** ✓ $\frac{f(x+h)-f(x)}{h}$ ✓ $4(x+h)^2$ ✓ $8xh+4h^2$ ✓ $\frac{h(8x+4h)}{h}$ ✓ $8x$ (5)
8.2.1	$D_x\left[\frac{x^2-2x-3}{x-1}\right]$ $= D_x\left[\frac{(x-3)(x+1)}{x+1}\right]$ $= D_x(x-3)$ $= 1$	✓ $\frac{(x-3)(x+1)}{x+1}$ ✓ $(x-3)$ ✓ 1 (3)
8.2.2	$f(x) = \sqrt{x} = x^{\frac{1}{2}}$ $f'(x) = \frac{1}{2}x^{-\frac{1}{2}}$ $f''(x) = -\frac{1}{4}x^{-\frac{3}{2}}$	✓ $x^{\frac{1}{2}}$ ✓ $\frac{1}{2}x^{-\frac{1}{2}}$ ✓ $-\frac{1}{4}x^{-\frac{3}{2}}$ (3) **[11]**

QUESTION/*VRAAG* 9

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

9.5	f concave upwards $f''(x) > 0$ $6x - 6 > 0$ $x > 1$	NOTE: Answer only 2 / 2	✓ $f''(x) > 0$ ✓ $x > 1$ (2) **[17]**

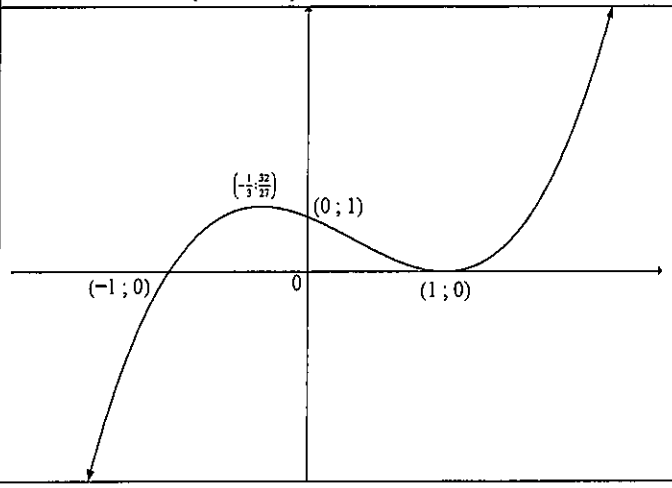
QUESTION/*VRAAG* 8

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). *Vir* $f(x)$, *sal buigpunt wees by* (0 ; 12) For $g(x)$, point of inflection will be at (0 ; –12). Vir $g(x)$, *sal buigpunt wees by* (0 ; –12). **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). *Vir* $f(x)$, *sal buigpunt wees by* (0 ; 12) For $g(x)$, point of inflection will be at (0 ; –12). Vir $g(x)$, *sal buigpunt wees by* (0 ; –12).	✓ $f'(x)=-3x^2+13$ ✓ $f''(x)=-6x$ ✓ 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 TPs ✓ $(0;-12)$ (4)

8.4	$f'(x) = -3x^2 + 13$ $-3x^2 + 13 = -14$ $-3x^2 = -27$ $x^2 = 9$ $x = 3$ or $x = -3$	✓ equating derivative to – 14 ✓ simplification ✓✓ answers (4) **[14]**

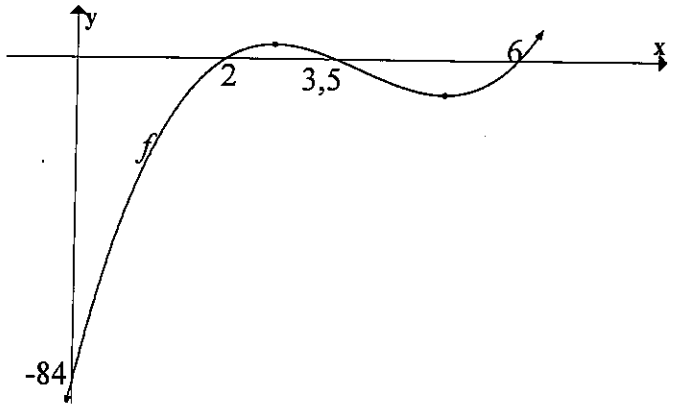
QUESTION/*VRAAG* 9

9.1	(0 ; 1)	✓ 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**	✓ $(x-1)$ ✓ (x^2-1) ✓ $(x-1)(x-1)(x+1)$ ✓(–1; 0) ✓(1; 0) (5) ✓ $(x-1)$ ✓ (x^2-1) ✓ $(x-1)(x-1)(x+1)$ ✓(–1; 0) ✓(1; 0) (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: $(-1;0)$; $(1;0)$	✓ $(x+1)$ ✓ (x^2-2x+1) ✓ $(x-1)(x-1)(x+1)$ ✓$(-1;0)$ ✓$(1;0)$ (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 $x=1$ $y=\frac{32}{27}$ $y=0$ $\left(-\frac{1}{3};\frac{32}{27}\right)$ $(1;0)$	✓ $f'(x)=3x^2-2x-1$ ✓ $f'(x)=0$ ✓factorisation ✓x value ✓x value ✓$y=\frac{32}{27}$ (6)
9.4		✓y– and x–intercepts ✓shape ✓turning points (3)
9.5	$f'(x)<0$ $-\frac{1}{3}<x<1$ **OR/*OF*** $(-\frac{1}{3}$; 1)	✓ $x>-\frac{1}{3}$ ✓ $x<1$ (2) ✓ $(-\frac{1}{3}$ ✓ 1) (2) **[17]**

QUESTION/*VRAAG* 8

8.1	$f(x+h)=-(x+h)^2+4=-(x^2+2xh+h^2)+4$ $=-x^2-2xh-h^2+4$ $f(x+h)-f(x)=-2xh-h^2$	✓ finding $f(x+h)$ ✓ $-2xh-h^2$
	$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{-2xh-h^2}{h}$ $=\lim_{h\to 0}\frac{h(-2x-h)}{h}$ $=\lim_{h\to 0}(-2x-h)$ $=-2x$	✓formula ✓factorisation ✓answer (5)
	OR/*OF*	
	$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{-(x+h)^2+4-\left(-x^2+4\right)}{h}$ $=\lim_{h\to 0}\frac{-x^2-2xh-h^2+4+x^2-4}{h}$ $=\lim_{h\to 0}\frac{-2xh-h^2}{h}$ $=\lim_{h\to 0}\frac{h(-2x-h))}{h}$ $=\lim_{h\to 0}(-2x-h)$ $=-2x$	✓formula ✓ finding $f(x+h)$ ✓ $-2xh-h^2$ ✓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)

QUESTION/*VRAAG* 10

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	$P(Male) \times P(Coffee) = P(Male\ and\ Coffee)$ $P(Manlik) \times P(Koffie) = P(Manlik\ en\ Koffie)$ $\frac{3}{8} \times \frac{80}{160} = \frac{b}{160}$ $\frac{3}{16} = \frac{b}{160}$ $16b = 480$ $b = 30$	✓formula ✓ $\frac{80}{160}$ ✓ $\frac{b}{160}$ ✓ answer (4)

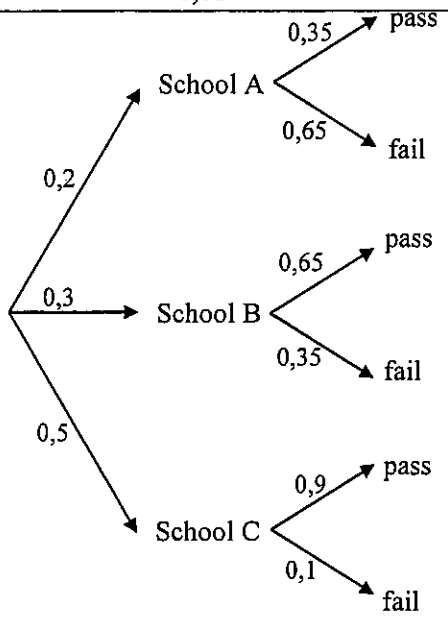
QUESTION/*VRAAG* 10

10.1.1	$P(S \text{ and } T) = P(S) \times P(T)$ $\frac{1}{6} = \left(\frac{1}{4}\right) \times P(T)$ $P(T) = \frac{2}{3}$	✓ $P(S \text{ and } T) = P(S) \times P(T)$ ✓ $P(T) = \frac{2}{3}$ (2)
10.1.2	$P(S \text{ or } T) = P(S) + P(T) - P(S \text{ and } T)$ $= \left(\frac{1}{4}\right) + \left(\frac{2}{3}\right) - \frac{1}{6}$ $= \frac{3}{4}$	✓ $\left(\frac{1}{4}\right) + \left(\frac{2}{3}\right) - \frac{1}{6}$ ✓ $\frac{3}{4}$ (2)
10.2.1	$5!$ $= 120$	✓ 5 ✓ 5! or 120 (2)
10.2.2	5^5 $= 3125$	✓ 5^5 or 3 125 (1)
10.3	$n(E) = 5! \times 2! \times 2!$ $n(S) = 7!$ $P(E) = \frac{5! \times 2! \times 2!}{7!}$ $= \frac{2}{21}$	✓ 5! ✓ $2! \times 2!$ ✓ $\frac{5! \times 2! \times 2!}{7!}$ ✓ $\frac{2}{21}$ (4)
		[11]

QUESTION/*VRAAG* 10

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

QUESTION/*VRAAG* 11

11.1	$8\times7\times6\times5\times4$ or $\frac{8!}{3!}$ $=6720$	✓$8\times7\times6\times5\times4$ / $\frac{8!}{3!}$ ✓6720 (2)
11.2	$P(A \text{ and } B)=P(A)\times P(B)$ $=0,4\times0,35$ $=0,14$ $P(A \text{ or } B)=P(A)+P(B)-P(A \text{ and } B)$ $=0,4+0,35-0,14$ $=0,61$	✓ $0,4\times0,35$ ✓ 0,14 ✓ substitution ✓ answer (4)
		

11.2.1	$6! = 720$	✓ $6!$ or 720 (2)
11.2.2	Number of arrangements $= 3! \times 3! \times 2$ $= 72$	✓ $3! \times 3!$ ✓ $\times 2$ ✓ answer (3)
11.2.3	$P(\text{hearts next to each other}) = \frac{3! \times 4!}{6!}$ $= \frac{144}{720}$ $= \frac{1}{5}$ or 0,2 or 20% **OR/*OF*** $P(\text{hearts next to each other}) = \frac{4 \times 3! \times 3!}{6!}$ $= \frac{144}{720}$ $= \frac{1}{5}$ or 0,2 or 20%	✓✓ $3! \times 4!$ ✓ $\frac{1}{5}$ or 0,2 or 20% **OR/*OF*** ✓✓ ✓ $\frac{1}{5}$ or 0,2 or 20% (3) **[15]**

TOTAL/*TOTAAL*: 150