SA-STUDENT

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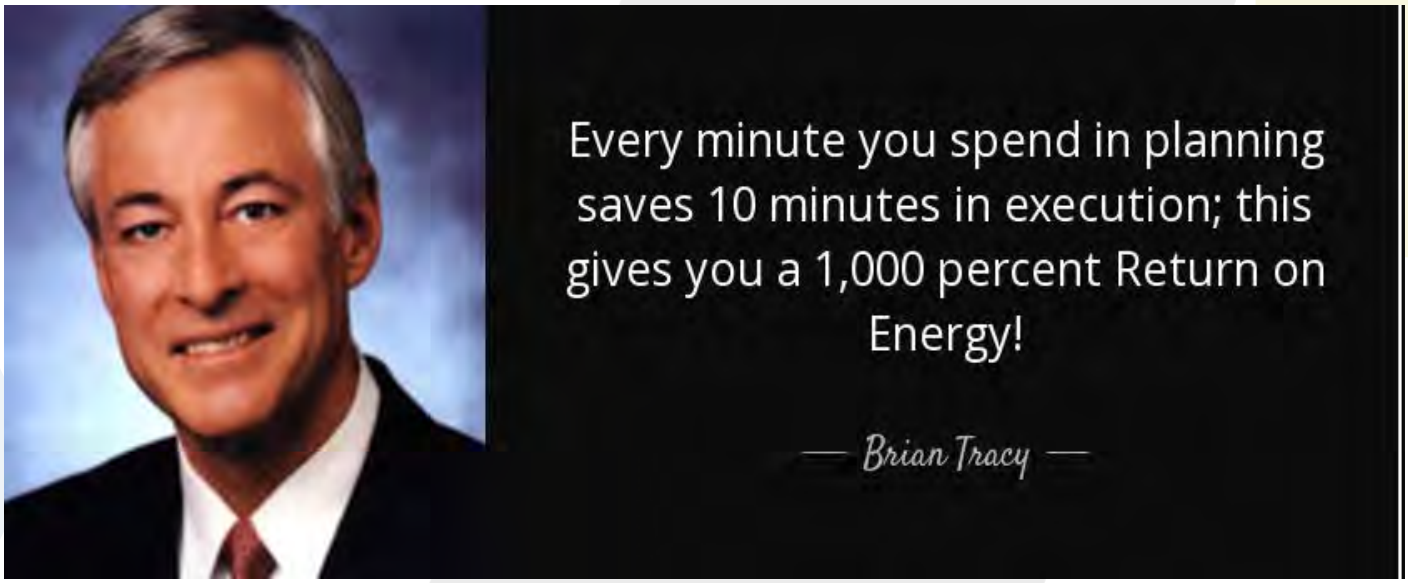

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LET WEL:
- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.*
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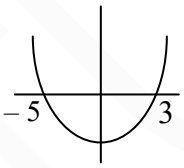
QUESTION 1/*VRAAG* 1

1.1.1	$x^2-7x+12=0$ $(x-4)(x-3)=0$ $x=4$ or $x=3$ Answer only: Full Marks	✓ factors ✓ $x=4$ ✓ $x=3$ (3)
1.1.2	$3x^2+5x-1=0$ $x=\frac{-5\pm\sqrt{5^2-4(3)(-1)}}{2(3)}=\frac{-5\pm\sqrt{37}}{6}$ $\therefore x=0{,}18$ or $x=-1{,}85$	✓standard form ✓substitution into the correct formula ✓ $x=0{,}18$ ✓ $x=-1{,}85$ (4)
1.1.3	$x^2+2x-15<0$ $(x-3)(x+5)<0$ $x=3$ or $x=-5$ $-5<x<3$ 	✓standard form ✓ critical values ✓✓answer (4)
1.1.4	$\sqrt{2(1-x)}=x-1$ $\left(\sqrt{2(1-x)}\right)^2=(x-1)^2$ $2-2x=x^2-2x+1$ $x^2-1=0$ $\therefore x=1$ and $x\neq-1$	✓squaring both sides ✓simplification ✓standard form ✓ answer with selection (4)

1.2	$3^{x+y}=27$	
	$x^2+y^2=17$	
	$3^{x+y}=3^3$	✓ $3^{x+y}=3^3$
	$x+y=3$ …….(1)	✓ $x+y=3$
	$y=3-x$	
	$x^2+(3-x)^2=17$	✓substitution
	$2x^2-6x-8=0$	
	$x^2-3x-4=0$	✓standard form
	$(x-4)(x+1)=0$	
	$x=4$ or $x=-1$	✓x-values
	$y=-1$ or $y=4$	✓y-values (6)
	OR/*OF*	**OR/*OF***
	$3^{x+y}=27$	
	$x^2+y^2=17$	
	$3^{x+y}=3^3$	✓ $3^{x+y}=3^3$
	$x+y=3$ …….(1)	✓ $x+y=3$
	$x=3-y$	
	$(3-y)^2+y^2=17$	✓substitution
	$9-6y+y^2+y^2-17=0$	
	$2y^2-6y-8=0$	✓standard form
	$y^2-3y-4=0$	
	$(y-4)(y+1)=0$	
	$y=-1$ or $y=4$	✓y-values
	$x=4$ or $x=-1$	✓x-values (6)

1.3	$\frac{1}{\sqrt{1}+\sqrt{2}}+\frac{1}{\sqrt{2}+\sqrt{3}}+\frac{1}{\sqrt{3}+\sqrt{4}}+\ldots+\frac{1}{\sqrt{99}+\sqrt{100}}$ $=\frac{1}{\sqrt{1}+\sqrt{2}}\times\frac{\sqrt{1}-\sqrt{2}}{\sqrt{1}-\sqrt{2}}+\ldots$ $+\frac{1}{\sqrt{99}+\sqrt{100}}\times\frac{\sqrt{99}-\sqrt{100}}{\sqrt{99}-\sqrt{100}}$ $=-1+\sqrt{2}-\sqrt{2}+\sqrt{3}-\sqrt{3}+2\ldots-\sqrt{99}+10$ $=-1+10$ $=9$	✓rationalisation ✓ simplification ✓ answer (3)
		[24]

QUESTION 2/*VRAAG* 2

2.1.1	$\frac{1}{5}+\frac{1}{15}+\frac{1}{45}+\ldots$ $r=\frac{\frac{1}{15}}{\frac{1}{5}}=\frac{1}{3}$ $-1<\frac{1}{3}<1$ $\therefore$ the series is convergent.	✓ $r=\frac{1}{3}$ ✓ answer (any indicator of convergence) (2)
2.1.2	$S_\infty=\frac{a}{1-r}$ $=\frac{\frac{1}{5}}{1-\frac{1}{3}}$ $=\frac{3}{10}$	✓ substitution ✓ answer (2)
2.2.1	$4x\ ;\ \frac{1}{81}$	✓ $4x$ ✓ $\frac{1}{81}$ (2)
2.2.2	$T_n=x+(n-1)x$ $=x+xn-x$ $=xn$ Answer only: Full Marks	✓ substitution ✓ answer (2)
2.2.3	$T_n=ar^{n-1}$ $T_{13}=\frac{1}{3}\left(\frac{1}{3}\right)^{13-1}$ $T_{13}=\left(\frac{1}{3}\right)^{13}$ or $\frac{1}{1\,594\,323}$ or $6{,}27\times10^{-7}$ or 3^{-13}	✓ $n=13$ ✓ $r=\frac{1}{3}$ ✓ answer (3)
2.2.4	$\sum_{n=1}^{21}P_n=S_{11}+S_{10}$ $=\frac{11}{2}[2x+10x]+\frac{\frac{1}{3}\left[1-\left(\frac{1}{3}\right)^{10}\right]}{1-\frac{1}{3}}$ $=66x+0{,}5$ $33{,}5=66x+0{,}5$ $\therefore x=\frac{1}{2}$	✓ S_{11} ✓ $+S_{10}$ ✓ arithmetic sum ✓ geometric sum ✓ $66x+0{,}5$ (A) ✓ answer (6)
		[17]

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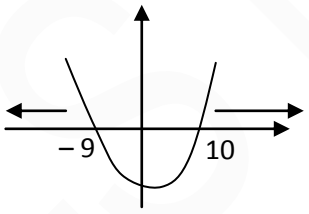
QUESTION1/*VRAAG* 1

1.1.1	$(3x-6)(x+2)=0$ $x=2$ or $x=-2$	✓ $x=2$ ✓ $x=-2$ (2)
1.1.2	$2x^2-6x+1=0$ $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\dfrac{6\pm\sqrt{(-6)^2-4(2)(1)}}{2(2)}$ $x=2{,}82$ or $x=0{,}18$	✓ correct substitution into correct formula ✓ 2,82 ✓ 0,18 (3)
1.1.3	$x^2-90>x$ $x^2-x-90>0$ $(x+9)(x-10)>0$ CV: $x=-9$ or $x=10$  $x<-9$ or $x>10$ **OR/OF** $(-\infty;-9)$ or $(10;\infty)$	✓ standard form ✓ critical values ✓✓ $x<-9$ or $x>10$ (4)

1.1.4	$x-7\sqrt{x}=-12$ $x+12=7\sqrt{x}$ $(x+12)^2=\left(7\sqrt{x}\right)^2$ $x^2+24x+144=49x$ $x^2-25x+144=0$ $(x-16)(x-9)=0$ $x=16$ or $x=9$ **OR/*OF*** $x-7\sqrt{x}+12=0$ $\left(\sqrt{x}-3\right)\left(\sqrt{x}-4\right)=0$ or let $\sqrt{x}=k$ $\sqrt{x}=3$ or $\sqrt{x}=4$ $x=9$ or $x=16$	✓ isolating the root ✓ squaring both sides ✓ standard form ✓ both answers (4) **OR/*OF*** ✓ standard form ✓ factors ✓ answers ✓ both answers for x (4)
1.2	$2x-y=2$ $y=2x-2$ .....(1) $xy=4$ .....(2) (1) in (2): $x(2x-2)=4$ $2x^2-2x-4=0$ $x^2-x-2=0$ $(x-2)(x+1)=0$ $x=2$ or $x=-1$ $y=2$ $y=-4$	✓ eq 1 ✓ substitution ✓ standard form ✓ x-values ✓ y-values (5)

	OR/*OF*	**OR/*OF***
	$2x-y=2$	
	$x=\frac{1}{2}y+1$ .....(1)	✓ eq 1
	$xy=4$ .....(2)	
	(1) in (2):	
	$y\left(\frac{1}{2}y+1\right)=4$	✓ substitution
	$\frac{1}{2}y^2+y-4=0$	✓ standard form
	$y^2+2y-8=0$	
	$(y+4)(y-2)=0$	
	$y=-4$ or $y=2$	✓ y-values
	$x=-1$ $x=2$	✓ x-values (5)
	OR/OF	**OR/OF**
	$2x-y=2$ .....(1)	
	$y=\frac{4}{x}$ .....(2)	✓ eq 2
	(2) in (1):	
	$2x-\frac{4}{x}=2$	✓ substitution
	$2x^2-2x-4=0$ $x^2-x-2=0$	✓ standard form
	$(x-2)(x+1)=0$	
	$x=2$ or $x=-1$ $y=2$ $y=-4$	✓ x-values ✓ y-values (5)

	OR/OF $2x-y=2$ ……(1) $x=\frac{4}{y}$ ……(2) (2)in (1): $2\left(\frac{4}{y}\right)-y=2$ $8-y^2-2y=0$ $y^2+2y-8=0$ $(y+4)(y-2)=0$ $y=-4$ or $y=2$ $x=-1$ $x=2$	**OR/OF** ✓ eq 2 ✓ substitution ✓ standard form ✓ *y*-values ✓ *x*-values (5)
1.3	$2.5^n-5^{n+1}+5^{n+2}=2.5^n-5^n.5^1+5^n.5^2$ $=5^n(2-5+25)$ $=5^n(22)$ $2\left(5^n(11)\right)$ **OR/OF** Any integer multiplied by an even number will be even	✓ exp law ✓common factor ✓answer/explanation (3)
1.4	$\frac{3^{y+1}}{32}=\sqrt{96^x}$ $\frac{3^{y+1}}{2^5}=(96)^{\frac{x}{2}}$ $3^{y+1}.2^{-5}=2^{\frac{5x}{2}}.3^{\frac{x}{2}}$ $-5=\frac{5x}{2}$ $\therefore x=-2$ $y+1=\frac{x}{2}$ $y+1=\frac{-2}{2}$ $\therefore y=-2$	✓ $\frac{3^{y+1}}{2^5}=(96)^{\frac{x}{2}}$ ✓ $3^{y+1}.2^{-5}=2^{\frac{5x}{2}}.3^{\frac{x}{2}}$ ✓ $x=-2$ ✓ $y=-2$ (4)

	OR/OF $\frac{3^{y+1}}{32} = \sqrt{96^x}$ $\left(\frac{3^{y+1}}{2^5}\right)^2 = \left(\sqrt{(96)^x}\right)^2$ $\frac{3^{2y+2}}{2^{10}} = 2^{5x}.3^x$ $3^{2y+2}.2^{-10} = 2^{5x}.3^x$ $-10 = 5x$ $\therefore x = -2$ $2y + 2 = -2$ $\therefore y = -2$	**OR/OF** ✓ $\left(\frac{3^{y+1}}{2^5}\right)^2 = \left(\sqrt{(96)^x}\right)^2$ ✓ $3^{2y+2}.2^{-10} = 2^{5x}.3^x$ ✓ $x = -2$ ✓ $y = -2$ (4)
		[25]

QUESTION 2/*VRAAG* 2

2.1.1	$a=14$ $T_6=14r^5=448$ $r^5=32$ $\therefore r=2$ Answer only: full marks	✓ $T_6=14r^5=448$ ✓ $r=2$ (2)
2.1.2	$T_n=14(2)^{n-1}$ $S_n=\frac{14(2^6-1)}{2-1}$ $S_6=882$ $114\,674-882=113\,792$ $113\,792=896\left(2^n-1\right)$ $128=2^n$ $n=7$ **OR/OF** $S_n=\frac{a(r^n-1)}{r-1}$ $114\,674=\frac{14(2^n-1)}{2-1}$ $8\,191=2^n-1$ $2^n=8\,192$ $n=\log_2 8\,192$ $n=13$ $\therefore$ 7 more terms must be added to the first 6 terms.	✓ substitution into correct formula ✓ $S_6=882$ ✓ $128=2^n$ ✓ 7 (4) **OR/OF** ✓ substitution into correct formula ✓ $2^n=8\,192$ ✓ $n=13$ ✓ 7 (4)
2.1.3	$r=\frac{1}{2}$ OR $448r^5=14$ $\therefore r=\frac{1}{2}$ $S_\infty=\frac{a}{1-r}$ $S_\infty=\frac{448}{1-\frac{1}{2}}$ $S_\infty=896$	✓ $r=\frac{1}{2}$ ✓ substitution ✓ answer (3)

2.2	$\sum_{p=0}^{k}\left(\frac{1}{3}p+\frac{1}{6}\right)=20\frac{1}{6}$	
	$T_1=\frac{1}{6}\qquad T_2=\frac{1}{3}+\frac{1}{6}=\frac{3}{6}$	✓ $T_1=\frac{1}{6}$
	$d=\frac{3}{6}-\frac{1}{6}=\frac{1}{3}$	✓ d
	$\frac{121}{6}=\frac{n}{2}\left[2\left(\frac{1}{6}\right)+(n-1)\left(\frac{1}{3}\right)\right]$	✓ substitution
	$\frac{121}{3}=n\left[\frac{1}{3}+\frac{1}{3}n-\frac{1}{3}\right]$	
	$\frac{121}{3}=\frac{1}{3}n^2$ $121=n^2$	
	$n=11$ $\therefore k=10$	✓ value of n ✓ value of k (5)
	OR/*OF*	**OR/*OF***
	$\sum_{p=0}^{k}\left(\frac{1}{3}p+\frac{1}{6}\right)=20\frac{1}{6}$	
	$a=\frac{1}{6}$	✓ $a=\frac{1}{6}$
	$l=\frac{1}{3}k+\frac{1}{6}$	✓ l
	$n=k+1$	✓ $n=k+1$
	$S_n=\frac{n}{2}[a+l]$	
	$\frac{121}{6}=\frac{k+1}{2}\left[\frac{1}{6}+\frac{1}{3}k+\frac{1}{6}\right]$	
	$\frac{121}{6}=\frac{k+1}{2}\left[\frac{1}{3}k+\frac{1}{3}\right]$	
	$\frac{121}{6}=\frac{k+1}{2}\left[\frac{k+1}{3}\right]$	
	$\frac{121}{6}=\frac{(k+1)^2}{6}$	✓ $\frac{121}{6}=\frac{(k+1)^2}{6}$
	$k+1=\pm\sqrt{121}$ $k+1=11$ $k=10$	✓ value of k (5)
		[14]

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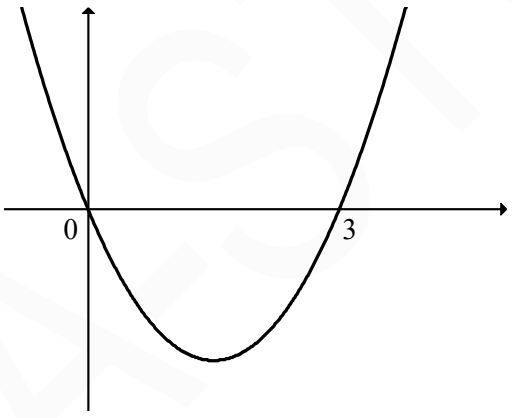
QUESTION/*VRAAG* 1

1.1.1	$x^2+2x-15=0$ $(x+5)(x-3)=0$ $x=-5$ or $x=3$	✓ factors ✓ $x=-5$ ✓ $x=3$ (3)
1.1.2	$5x^2-x-9=0$ $x=\frac{-(-1)\pm\sqrt{(-1)^2-4(5)(-9)}}{2(5)}$ $x=\frac{1\pm\sqrt{181}}{10}$ $x=1{,}45$ or $x=-1{,}25$	✓substitution into the correct formula ✓ $x=1{,}45$ ✓ $x=-1{,}25$ (3)
1.1.3	$x^2\le 3x$ $x^2-3x\le 0$ $x(x-3)\le 0$  $0\le x\le 3$ OR $x\in[0;3]$	✓ standard form ✓ factors ✓✓ answer (4)
1.2.1	$a+\frac{64}{a}=16$ $a^2-16a+64=0$ $(a-8)^2=0$ $a=8$	✓ standard form ✓ factors ✓ answer (3)

1.2.2	$2^x + 2^{6-x} = 16$ $2^x + \frac{64}{2^x} = 16$ $2^x = 8$ (from 1.2.1) $2^x = 2^3$ $x = 3$	✓ exp law ✓ $2^x = 8$ ✓ answer (3)
1.3	$\sqrt{\frac{2^{1002}(1+2^4)}{17(2)^{998}}}$ $= \sqrt{\frac{2^4(17)}{17}}$ $= \sqrt{2^4}$ $= 2^2$ $= 4$	✓common factor ✓second factor ✓simplification ✓answer (4)
1.4	$2x - y = 2 \quad \ldots(1)$ $\frac{1}{x} - 3y = 1 \quad \ldots(2)$ $y = 2x - 2$ $\frac{1}{x} - 3(2x-2) = 1$ $\frac{1}{x} - 6x + 6 - 1 = 0$ $1 - 6x^2 + 6x - x = 0$ $-6x^2 + 5x + 1 = 0$ $6x^2 - 5x - 1 = 0$ $(6x+1)(x-1) = 0$ $x = -\frac{1}{6}$ or $x = 1$ $y = 2\left(-\frac{1}{6}\right) - 2$ or $y = 2(1) - 2$ $y = -\frac{7}{3}$ or $y = 0$	✓ $y = 2x - 2$ ✓substitution ✓simplification ✓standard form ✓x-values ✓y-values (6)

OR/*OF*

$x = \frac{2+y}{2} \quad \ldots(1)$

$\frac{1}{x} - 3y = 1 \quad \ldots(2)$

$\frac{1}{\frac{2+y}{2}} - 3y = 1$

$\frac{2}{2+y} - 3y = 1$

$\frac{2-6y-3y^2}{2+y} = 1$

$2 - 6y - 3y^2 = 2 + y$

$-3y^2 - 7y = 0$

$-y(3y+7) = 0$

$y = 0 \quad \text{or} \quad y = -\frac{7}{3}$

$x = 1 \quad \text{or} \quad x = -\frac{1}{6}$

OR/*OF*

✓ $x = \frac{2+y}{2}$

✓substitution

✓simplification

✓standard form

✓*y*-values

✓*x*-values

(6)
[26]

QUESTION/*VRAAG* 2

2.1.1	$a+6d=35$ $-1+6d=35$ $6d=36$ $d=6$ **OR/OF** $\frac{35-(-1)}{7-1}=6$ ANSWER ONLY: FULL MARKS	✓ substitution ✓answer (2) **OR/OF** ✓ substitution ✓answer (2)
2.1.2	$T_n=a+(n-1)d$ $473=-1+(n-1)(6)$ $79=n-1$ $\therefore n=80$ ANSWER ONLY: FULL MARKS	✓substitution into the correct formula ✓ equating to 473 ✓ answer (3)
2.1.3	$S_n=\frac{n}{2}[2a+(n-1)d]$ $S_{40}=\frac{40}{2}[2(-1)+(40-1)(6)]$ $\therefore S_{40}=4\,640$ **OR/*OF*** $T_{40}=6(40)-7$ $=233$ $S_n=\frac{n}{2}(a+l)$ $=\frac{40}{2}(-1+233)$ $=4\,640$	✓ substitution ✓answer (2) **OR/*OF*** ✓ substitution ✓answer (2)
2.2.1	75 53 35 21 –22 –18 –14 4 4 $T_5=11$	✓answer (A) (1)
2.2.2	$T_n=an^2+bn+c$ $2a=4$ $a=2$ $3a+b=-22$ $6+b=-22$ $b=-28$ $a+b+c=75$ $2-28+c=75$ $c=101$ $\therefore T_n=2n^2-28n+101$	✓ $T_n=an^2+bn+c$ ✓ $a=2$ ✓ $b=-28$ ✓ $c=101$ (4)

2.2.3 Minimum value of T_n

$n = -\frac{b}{2a} = -\frac{(-28)}{2(2)}$

$n = 7$ ✓ $n = 7$

Minimum value of $T_n = 2(7)^2 - 28(7) + 101 = 3$ ✓ min value = 3

Each term in the new pattern is $-\frac{1}{5}$ the value of the terms in the old pattern. ✓ $-\frac{1}{5}$ value of term of old pattern

Maximum value of new pattern $= -\frac{3}{5}$ ✓ max value $= -\frac{3}{5}$ (4)

OR/*OF*

OR/*OF*

$T_n' = 4n - 28$

$4n - 28 = 0$

$4n = 28$

$n = 7$ ✓$n = 7$

Minimum value of $T_n = 2(7)^2 - 28(7) + 101 = 3$ ✓ min value = 3

Each term in the new pattern is $-\frac{1}{5}$ the value of the terms in the old pattern. ✓ $-\frac{1}{5}$ value of term of old pattern

Maximum value of new pattern $= -\frac{3}{5}$ ✓ max value $= -\frac{3}{5}$ (4)

OR/OF

OR/OF

$T_n = -\frac{2}{5}n^2 + \frac{28}{5}n - \frac{101}{5}$ ✓✓ $T_n \div (-5)$

$n = -\frac{b}{2a} = \frac{-\frac{28}{5}}{2\left(\frac{-2}{5}\right)}$

$= 7$ ✓$n = 7$

$T_7 = -\frac{3}{5}$ ✓ max value $= -\frac{3}{5}$ (4)

OR/OF

OR/OF

$T_n = -\frac{2}{5}n^2 + \frac{28}{5}n - \frac{101}{5}$

$T'_n = -\frac{4}{5}n + \frac{28}{5}$ ✓✓ $T_n \div (-5)$

$-\frac{4}{5}n + \frac{28}{5} = 0$

$-4n = -28$

$n = 7$ ✓$n = 7$

Minimum value of $T_n = 2(7)^2 - 28(7) + 101 = 3$

Each term in the new pattern is $-\frac{1}{5}$ the value of the terms in the old pattern.

Maximum value of new pattern $= -\frac{3}{5}$

✓ max value $= -\frac{3}{5}$

(4)

[16]

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QUESTION/VRAAG 1

1.1.1	$x^2-2x-24=0$ $(x-6)(x+4)=0$ $x=6$ or $x=-4$	✓factors ✓$x=6$ ✓$x=-4$ (3)
1.1.2	$2x^2-3x-3=0$ $x=\dfrac{3\pm\sqrt{(-3)^2-4(2)(-3)}}{2(2)}$ $x=\dfrac{3\pm\sqrt{33}}{4}$ $x=2{,}19$ or $x=-0{,}69$	✓substitution into the correct formula ✓$x=2{,}19$ ✓$x=-0{,}69$ (3)
1.1.3	$x^2+5x\le -4$ $x^2+5x+4\le 0$ $(x+4)(x+1)\le 0$ Critical values: $x=-4$ or $x=-1$  $-4\le x\le -1$ **OR/*OF*** $x\in[-4\,;-1]$	✓ standard form ✓ critical values ✓✓answer (4)
1.1.4	$\sqrt{x+28}=2-x$ $\left(\sqrt{x+28}\right)^2=(2-x)^2$ $x+28=4-4x+x^2$ $x^2-5x-24=0$ $(x-8)(x+3)=0$ $x\neq 8$ or $x=-3$	✓ squaring both sides ✓ standard form ✓ factors ✓ answers with selection (4)

1.2	$2y = 3 + x$ $x = 2y - 3$ **...** (1) $2xy + 7 = x^2 + 4y^2$ ... (2) $2y(2y-3) + 7 = (2y-3)^2 + 4y^2$ $4y^2 - 6y + 7 = 4y^2 - 12y + 9 + 4y^2$ $4y^2 - 6y + 2 = 0$ $2y^2 - 3y + 1 = 0$ $(2y-1)(y-1) = 0$ $y = \frac{1}{2}$ or $y = 1$ $x = -2$ or $x = -1$ **OR/*OF*** $2y = 3 + x$ $y = \frac{3}{2} + \frac{x}{2}$ ...(1) $2xy + 7 = x^2 + 4y^2$ ... (2) $2x\left(\frac{3}{2} + \frac{x}{2}\right) + 7 = x^2 + 4\left(\frac{3}{2} + \frac{x}{2}\right)^2$ $3x + x^2 + 7 = x^2 + 9 + 6x + x^2$ $x^2 + 3x + 2 = 0$ $(x+2)(x+1) = 0$ $x = -2$ or $x = -1$ $y = \frac{1}{2}$ or $y = 1$	✓equation 1 ✓substitution ✓simplification ✓standard form ✓y – values ✓x – values (6) **OR/*OF*** ✓equation 1 ✓substitution ✓simplification ✓standard form ✓x – values ✓y – values (6)
1.3	$\frac{n}{m} = \frac{p}{n}$ $n^2 = mp$ $\Delta = b^2 - 4ac$ $\Delta = n^2 - 4mp$, but $n^2 = mp$ $\Delta = n^2 - 4n^2$ **OR/*OF*** $\Delta = mp - 4mp$ $\Delta = -3n^2$ $\Delta = -3mp$ $n^2 > 0$ $mp > 0$ $\therefore -3n^2 < 0$ $\therefore -3mp < 0$ $\therefore \Delta < 0 \Rightarrow x$ is a non-real number	✓$\frac{n}{m} = \frac{p}{n}$ ✓$n^2 = mp$ ✓$\Delta = -3n^2$ or $-3mp$ ✓$\Delta < 0$ (4)
		[24]

QUESTION/VRAAG 2

2.1	$\frac{90}{x}=\frac{81}{90}$ $81x=8\,100$ $x=100$ **OR/OF** $x=90\times\frac{10}{9}$ $x=100$	✓ $\frac{90}{x}=\frac{81}{90}$ ✓ answer (2) **OR/OF** ✓ $\frac{10}{9}$ ✓ answer (2)
2.2	$S_n=\frac{a\left(1-r^n\right)}{1-r}$ $S_n=\frac{100\left(1-(0{,}9)^n\right)}{1-0{,}9}$ $S_n=\frac{100\left(1-(0{,}9)^n\right)}{0{,}1}$ $\therefore S_n=1\,000\left(1-(0{,}9)^n\right)$	✓$r=0{,}9$ ✓substitution into correct formula (2)
2.3	$S_\infty=\frac{a}{1-r}$ $S_\infty=\frac{100}{1-\frac{9}{10}}$ $S_\infty=1000$ **OR/OF** $S_\infty=\lim_{n\to\infty}\left[1\,000\left(1-(0{,}9)^n\right)\right]$ $S_\infty=1000$	✓ substitution ✓ answer (2) **OR/OF** ✓ $S_\infty=\lim_{n\to\infty}\left[1\,000\left(1-(0{,}9)^n\right)\right]$ ✓ answer (2)
		[6]

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QUESTION/*VRAAG* 1

1.1.1	$x^2 - x - 20 = 0$ $(x-5)(x+4) = 0$ $x = 5$ or $x = -4$	✓factors ✓ $x = 5$ ✓ $x = -4$ (3)
1.1.2	$3x^2 - 2x - 6 = 0$ $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-6)}}{2(3)}$ $x = \frac{1 \pm \sqrt{19}}{3}$ $x = -1{,}12$ or $x = 1{,}79$	✓substitution ✓simplification ✓ $x = -1{,}12$ ✓ $x = 1{,}79$ (4)
1.1.3	$(x-1)^2 > 9$ $x^2 - 2x - 8 > 0$ $(x-4)(x+2) > 0$ Critical values: $x = 4$ or $x = -2$  $x < -2$ or $x > 4$ **OR/OF** $(-\infty;-2)$ or $(4;\infty)$ **OR/OF** $x - 1 > 3$ or $x - 1 < -3$ $x > 4$ or $x < -2$	✓standard form ✓critical values ✓✓ $x < -2$ or $x > 4$ (4) **OR/OF** ✓✓ $(-\infty;-2)$ or $(4;\infty)$ **OR/OF** ✓ $x - 1 > 3$ ✓ $x - 1 < -3$ ✓✓ $x > 4$ or $x < -2$ (4)

1.1.4	$2\sqrt{x+6}+2=x$ $2\sqrt{x+6}=x-2$ $4(x+6)=(x-2)^2$ $4x+24=x^2-4x+4$ $x^2-8x-20=0$ $(x-10)(x+2)=0$ $x=10$ or $x\neq -2$	✓ isolating the surd ✓ $4x+24=x^2-4x+4$ ✓ $x=10$ ✓ $x\neq -2$ (4)
1.2	$4x=2-y$ . . . (1) $4x+y^2=8$ . . . (2) $\therefore 2-y+y^2=8$ $y^2-y-6=0$ $(y-3)(y+2)=0$ $y=3$ or $y=-2$ $x=-\frac{1}{4}$ or $x=1$ **OR/OF** $y=-4x+2$ . . . (1) $4x+y^2=8$ . . . (2) $4x+(-4x+2)^2=8$ $4x+16x^2-16x+4-8=0$ $16x^2-12x-4=0$ $4x^2-3x-1=0$ $(4x+1)(x-1)=0$ $x=-\frac{1}{4}$ or $x=1$ $y=3$ or $y=-2$	✓ $4x=2-y$ ✓substitution ✓standard form ✓y-values ✓x-values (5) **OR/OF** ✓ $y=-4x+2$ ✓substitution ✓standard form ✓x-values ✓y-values (5)
1.3	$2^x\times 3^y=(2^3\times 3)^6$ $2^x\times 3^y=2^{18}\times 3^6$ $2^x=2^{18}$ and $3^y=3^6$ $x=18$ and $y=6$ $\therefore x-y=18-6$ $\therefore x-y=12$	✓ $2^3\times 3$ ✓ 2^{18} or 3^6 ✓ $x=18$ or $y=6$ ✓ answer (A) (4)
		[24]

QUESTION/*VRAAG* 2

2.1.1	72 ; 100 ; 120 ; 132 ; … 28 20 12 −8 − 8 $2a = -8$ $a = -4$ $3a + b = 28$ $b = 40$ $a + b + c = 72$ $c = 36$ $T_n = -4n^2 + 40n + 36$	✓ second differences = – 8 ✓ $a = -4$ ✓ $b = 40$ ✓ $c = 36$ (4)
2.1.2	$T_{12} = 36 - 8n = 36 - 8(12) = -60$ $-4n^2 + 40n + 36 = -60$ $n^2 - 10n - 24 = 0$ $(n-12)(n+2) = 0$ $\therefore n = 12$	✓ $36 - 8n$ ✓ -60 ✓ standard form ✓factors ✓ $n = 12$ (5)
2.1.3	$T_n^{/} = -8n + 40 = 0$ $n = 5$ $T_n = -4(5)^2 + 40(5) + 36 = 136$ **OR/OF** $\frac{-b}{2a} = \frac{40}{8} = 5$ $T_n = -4(5)^2 + 40(5) + 36$ $= 136$	✓ $-8n + 40$ ✓ $n = 5$ ✓136 (3) **OR/OF** ✓substitution ✓ $n = 5$ ✓136 (3)
2.1.4	Maximum value = 41	✓value (1)
2.2	$2\sin 3x - (-11) = 15 - 2\sin 3x$ $4\sin 3x = 4$ $\sin 3x = 1$ $3x = 90^\circ$ $\therefore x = 30^\circ$	✓equating ✓ $4\sin 3x = 4$ ✓ $\sin 3x = 1$ ✓answer (4)
		[17]

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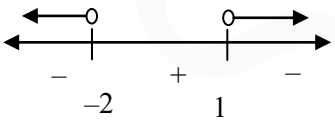
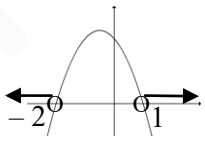
REMEMBER: (A) next o the description of a tick implies accuracy mark
ONTHOU: (A) langs die beskrywing van `n regmerk impliseer akkuraatheids-punt
QUESTION/*VRAAG* 1

1.1.1	$x^2 - 6x = 0$ $x(x-6) = 0$ $x = 0$ or $x = 6$	✓ common factor ✓ both answers (2)
1.1.2	$x^2 + 10x + 8 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-10 \pm \sqrt{10^2 - 4(1)(8)}}{2(1)}$ $= \frac{-10 \pm \sqrt{68}}{2}$ $x = -0{,}88$ or $x = -9{,}12$	✓ substitution into the correct formula ✓ – 0,88 ✓ –9,12 (3)
1.1.3	$(1-x)(x+2) < 0$ Critical values: $x = 1$ or $x = -2$  or  $x < -2$ or $x > 1$	✓ critical values ✓ correct method ✓ answer (3)
1.1.4	$\sqrt{x+18} = x - 2$ $x + 18 = x^2 - 4x + 4$ $0 = x^2 - 5x - 14$ $(x-7)(x+2) = 0$ $x = 7$ or $x \neq -2$	✓ squaring both sides (m) ✓ standard form ✓ factors ✓ both answers ✓ rejection of $x = -2$ (5)

1.2	$x+y=3$ $y=3-x$ …….. (1) $2x^2+4xy-y=15$ …….. (2) Substitute (1) into (2): $2x^2+4x(3-x)-(3-x)=15$ $2x^2+12x-4x^2-3+x-15=0$ $-2x^2+13x-18=0$ $2x^2-13x+18=0$ $(2x-9)(x-2)=0$ $x=\frac{9}{2}$ or $x=2$ $y=-\frac{3}{2}$ or $y=1$ **OR** $x+y=3$ $x=3-y$ …….. (1) $2x^2+4xy-y=15$ …….. (2) Substitute (1) into (2): $2(3-y)^2+4(3-y)y-y=15$ $2y^2-12y+18-4y^2+12y-y-15=0$ $-2y^2-y+3=0$ $2y^2+y-3=0$ $(2y+3)(y-1)=0$ $y=-\frac{3}{2}$ or $y=1$ $x=\frac{9}{2}$ or $x=2$	✓ y subject of the formula ✓ substitution ✓ standard form ✓ factors ✓ x-values ✓ y-values (6) **OR** ✓ x subject of the formula ✓ substitution ✓ standard form ✓ factors ✓ y-values ✓ x-values (6)
1.3	$n^{200}<5^{300}$ $(n^2)^{100}<(5^3)^{100}$ $(n^2)^{100}<(125)^{100}$ $n^2<125$ Maximum value of n is 11. **OR** $200\log n<300\log 5$ $n<10^{\frac{3}{2}\log 5}$ $n<11{,}18$ $\therefore n=11$ **OR**	✓ $(n^2)^{100}<(5^3)^{100}$ ✓ $n^2<125$ ✓ 11 (3) **OR** ✓ use of logs ✓ $n<11{,}18$ ✓11 (3) **OR**

	$n^{200} < 5^{300}$ $(n^2)^{100} < (5^3)^{100}$ $\sqrt{n^2} < \sqrt{5^3}$ $n < 5^{\frac{3}{2}}$ $n < 11{,}18$ $\therefore n = 11$ **OR** $n^{200} < 5^{300}$ $n < 5^{\frac{300}{200}}$ $n < 11{,}18$ $\therefore n = 11$	✓ $(n^2)^{100} < (5^3)^{100}$ ✓ $n < 11{,}18$ ✓ 11 (3) **OR** ✓ $n < 5^{\frac{300}{200}}$ ✓ $n < 11{,}18$ ✓ $n = 11$ (3)
		[22]

QUESTION/*VRAAG* 2

2.1	$7\ ;\ x\ ;\ y\ ;\ -11\ ;\ \ldots$ $a = 7$ $a + 3d = -11$ $7 + 3d = -11$ $d = -6$ $x = a + d = 7 + (-6) = 1$ $y = a + 2d = 7 + 2(-6) = -5$ **OR** $a + 3d = -11$ $3d = -11 - 7$ $3d = -18$ $d = -6$ $x = 1$ $y = -5$ **OR** $x - 7 = y - x$ and $y - x = -11 - y$ $2x - 7 = y$ ....(1) $2y = -11 + x$...(2) (1) into (2) $2(2x - 7) = -11 + x$ $4x - 14 = -11 + x$ $3x = 3$ $x = 1$ $y = 2(1) - 7 = -5$	✓ $7 + 3d = -11$ ✓ $d = -6$ ✓ value of x ✓ value of y (4) **OR** ✓ $3d = -11 - 7$ ✓ $d = -6$ ✓ $x = 1$ ✓ $y = -5$ (4) **OR** ✓ 2 equations ✓ substitution ✓ value of x ✓ value of y (4)
2.2.1	$-3\ ;\ 6\ ;\ 27\ ;\ 60\ ;\ \ldots$ $-3 \quad 6 \quad 27 \quad 60$ $9 \quad 21 \quad 33$ $12 \quad 12$ $2a = 12$ $a = 6$ $3a + b = 9$ $3(6) + b = 9$ $b = -9$ $a + b + c = -3$ $6 - 9 + c = -3$ $c = 0$ $T_n = 6n^2 - 9n$	✓ second difference ✓ $a = 6$ ✓ $b = -9$ ✓ $c = 0$ (4)

2.2.2	$T_{50} = 6(50)^2 - 9(50)$ $= 14\ 550$	**Answer Only: Full Marks**	✓ substitute 50 ✓ answer (2)
2.2.3	9 ; 21 ; 33 ; … $a = 9$ $d = 12$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_n = \frac{n}{2}[2(9) + (n-1)(12)]$ $= \frac{n}{2}[18 + 12n - 12]$ $= \frac{n}{2}[12n + 6]$ $= 6n^2 + 3n$		✓ a and d ✓ substitution into the correct formula ✓ $\frac{n}{2}[12n + 6]$ (3)
2.2.4	$-3 + S_n = 21060$ $S_n = 21063$ $6n^2 + 3n = 21063$ $6n^2 + 3n - 21063 = 0$ $2n^2 + n - 7021 = 0$ $n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $n = \frac{-1 \pm \sqrt{(1)^2 - 4(1)(-7021)}}{2(2)}$ $n = 59$ *or* $n \neq \frac{-119}{2}$ $\therefore\ n = 59$ **OR** $T_n = 21060$ $6n^2 - 9n - 21060 = 0$ $2n^2 - 3n - 7020 = 0$ $n = 60$ $\therefore 59$ first differences must be added.		✓ $-3 + S_n = 21060$ ✓ equation ✓standard form ✓ answer (4) ✓ equation ✓ standard form ✓✓ answer (4)
			[17]

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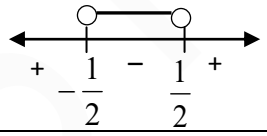
QUESTION/*VRAAG* 1

1.1.1	$x^2+5x-6=0$ $(x+6)(x-1)=0$ $x=-6$ or $x=1$	✓factors ✓ $x=-6$ ✓ $x=1$ (3)
1.1.2	$4x^2+3x-5=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-3\pm\sqrt{(3)^2-4(4)(-5)}}{2(4)}$ $x=\frac{-3\pm\sqrt{89}}{8}$ $x=-1{,}55$ or $x=0{,}8$	✓substitution into the correct formula ✓ $x=-1{,}55$ ✓ $x=0{,}8$ (3)
1.1.3	$4x^2-1<0$ $(2x+1)(2x-1)<0$ $\frac{-1}{2}<x<\frac{1}{2}$ 	✓factors ✓method ✓answer (3)
1.1.4	$\left(\sqrt{\sqrt{32}+x}\right)\left(\sqrt{\sqrt{32}-x}\right)=x$ $\sqrt{32-x^2}=x$ $32-x^2=x^2$ $-2x^2=-32$ $x^2=16$ $x=\pm4$ $\therefore x=4$	✓ $\sqrt{32-x^2}$ ✓ squaring both sides ✓ $x^2=16$ ✓ $x=4$ (selection) (4)

1.2	$y+x=12$ $y=-x+12$.....(1) $xy=14-3x$.....(2) Sub (1) into (2) $x(-x+12)=14-3x$ $-x^2+12x-14+3x=0$ $-x^2+15x-14=0$ $x^2-15x+14=0$ $(x-14)(x-1)=0$ $x=14$ or $x=1$ $y=-2$ or $y=11$ **OR/OF** $y+x=12$ $x=-y+12$.....(1) $xy=14-3x$.....(2) Sub (1) into (2) $y(-y+12)=14-3(-y+12)$ $12y-y^2-14+36-3y=0$ $-y^2+9y+22=0$ $y^2-9y-22=0$ $(y+2)(y-11)=0$ $y=-2$ or $y=11$ $x=14$ or $x=1$	✓y subject of the formula ✓ substitution ✓simplification ✓both values of x ✓both values of y (5) **OR/OF** ✓x subject of the formula ✓substitution ✓simplification ✓both values of y ✓both values of x (5)
1.3	3 6 9 12 15 18 21 24 27 30 3 3 3^2 3 3 3^2 3 3 3^3 3 $\therefore k=14$	✓identifying multiples of 3 ✓ten multiples of 3 ✓ powers of 3 ✓ answer (4)
		[22]

QUESTION/*VRAAG* 2

2.1.1	209 ; 186	✓209 ✓186 (2)
2.1.2	321 ; 290 ; 261 ; 234 1*st diff* −31 −29 −27 2*nd diff* 2 2 $2a = 2$ $3a + b = -31$ $a + b + c = 321$ $a = 1$ $3(1) + b = -31$ $1 + (-34) + c = 321$ $b = -34$ $c = 354$ $T_n = n^2 - 34n + 354$	✓ 2nd diff = 2 ✓ $a = 1$ ✓ $b = -34$ ✓ $c = 354$ (4)
2.1.3	$n^2 - 34n + 354 = 74$ $n^2 - 34n + 280 = 0$ $(n-14)(n-20) = 0$ $n = 14$ or $n = 20$	✓equating T_n to 74 ✓standard form ✓14 ✓ 20 (4)
2.1.4	$f'(n) = 0$ $2n - 34 = 0$ $2n = 34$ $n = 17$ Term 17 will have the smallest value **OR/OF** $n = \frac{-b}{2a}$ $n = \frac{34}{2}$ $n = 17$ Term 17 will have the smallest value **OR/OF** $n = \frac{14 + 20}{2} = 17$ Term 17 will have the smallest value	✓ $2n - 34 = 0$ ✓answer (2) **OR/OF** ✓substitution ✓answer (2) **OR/OF** ✓substitution ✓answer (2)

2.2.1	$a=\frac{5}{8}\quad;\quad r=\frac{1}{2}\quad;\quad n=21$ $S_n=\frac{a(1-r^n)}{1-r}$ $S_{21}=\frac{\frac{5}{8}\left(1-\left(\frac{1}{2}\right)^{21}\right)}{1-\frac{1}{2}}$ $=1{,}2499...$ $=1{,}25$	✓ r ✓ substitution into the correct formula ✓ answer (3)
2.2.2	$T_n>\frac{5}{8192}$ $ar^{n-1}>\frac{5}{8192}$ $\frac{5}{8}\left(\frac{1}{2}\right)^{n-1}>\frac{5}{8192}$ $\left(\frac{1}{2}\right)^{n-1}>\frac{1}{1024}$ $\left(\frac{1}{2}\right)^{n-1}>\left(\frac{1}{2}\right)^{10}$ *or* $2^{-n+1}>2^{-10}$ $\therefore n-1<10$ $\quad -n+1>-10$ $n<11$ $\quad n<11$ $\therefore n=10$ $\quad \therefore n=10$ **OR/OF** 8 ; 16 ; 32 ; … ; 8192 $8.2^{n-1}<8192$ $2^{n-1}<1024$ $2^{n-1}<2^{10}$ $n-1<10$ $n<11$ $\therefore n=10$	✓ substitution into the correct formula ✓ method /same base or log ✓calculating n ✓ answer (4) **OR/OF** ✓ substitution into the correct formula ✓ method ✓calculating n ✓ answer (4)
		[19]

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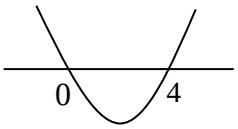
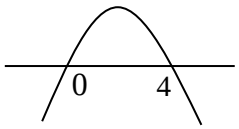
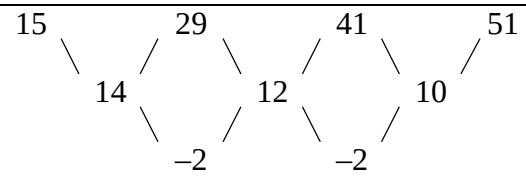
QUESTION/*VRAAG* 1

1.1.1	$x^2-5x-6=0$ $(x-6)(x+1)=0$ $x=6$ or $x=-1$ **OR/*OF*** $x^2-5x-6=0$ $x=\frac{5\pm\sqrt{(-5)^2-4(1)(-6)}}{2(1)}$ $x=\frac{5\pm\sqrt{49}}{2}$ $x=6$ or $x=-1$	✓ factors ✓ both answers (2) **OR/*OF*** ✓ correct subst into correct formula ✓ both answers (2)
1.1.2	$(3x-1)(x-4)=16$ $3x^2-13x-12=0$ $x=\frac{13\pm\sqrt{(-13)^2-4(3)(-12)}}{2(3)}$ $x=\frac{13\pm\sqrt{313}}{6}$ $x=5{,}12$ or $x=-0{,}78$ **OR/*OF*** $3x^2-13x-12=0$ $x^2-\frac{13}{3}x=4$ $x^2-\frac{13}{3}x+\left(-\frac{13}{6}\right)^2=4+\left(-\frac{13}{6}\right)^2$ $\left(x-\frac{13}{6}\right)^2=\frac{313}{36}$ $x=\frac{13\pm\sqrt{313}}{6}$ $x=5{,}12$ or $x=-0{,}78$	✓ standard form ✓ correct subst into correct formula ✓✓ answers (4) **OR/*OF*** ✓ standard form ✓ adding $\left(-\frac{13}{6}\right)^2$ both sides ✓✓ answers (4)

1.1.3	$x(4-x)\geq 0$ $-x(x-4)\geq 0$ or $-x(x-4)\geq 0$ $x(x-4)\leq 0$   $0\leq x\leq 4$ or $x\in[0\,;4]$	✓ factorisation ✓✓ $0\leq x\leq 4$ (3)
1.1.4	$\frac{5^{2x}-1}{5^x+1}=4$ $\frac{(5^x+1)(5^x-1)}{5^x+1}=4$ $5^x-1=4$ $5^x=5$ $x=1$ **OR/*OF*** $\frac{5^{2x}-1}{5^x+1}=4$ $5^{2x}-1=4.5^x+4$ $5^{2x}-4.5^x-5=0$ $(5^x-5)(5^x+1)=0$ $5^x=5$ or $5^x\neq -1$ $x=1$	✓ factors in numerator ✓ $5^x-1=4$ ✓ answer (3) **OR/*OF*** ✓ standard form ✓ factors ✓ answer (3)
1.2	$x=2-3y$ ……..……..(1) $x^2+4xy-5=0$ ……(2) Substitute (1) in (2): $(2-3y)^2+4y(2-3y)-5=0$ $4-12y+9y^2+8y-12y^2-5=0$ $-3y^2-4y-1=0$ $3y^2+4y+1=0$ $(3y+1)(y+1)=0$ $y=-\frac{1}{3}$ or $y=-1$ $x=3$ or $x=5$ **OR/*OF***	✓ $x=2-3y$ ✓ correct subst into correct formula ✓ either standard form ✓ y – values ✓ x – values (5) **OR/*OF***

	$y=\frac{2}{3}-\frac{x}{3}$ ……..……..(1) $x^2+4xy-5=0$ ……(2) Substitute (1) in (2): $x^2+4x\left(\frac{2}{3}-\frac{x}{3}\right)-5=0$ $3x^2+8x-4x^2-15=0$ $-x^2+8x-15=0$ $x^2-8x+15=0$ $(x-5)(x-3)=0$ $x=3$ or $x=5$ $y=-\frac{1}{3}$ or $y=-1$	✓ $y=\frac{2}{3}-\frac{x}{3}$ ✓ correct subst into correct formula ✓ either standard form ✓ x – values ✓ y – values (5)
1.3	$ab=2\sqrt{10}$ $bc=3\sqrt{2}$ $ac=6\sqrt{5}$ $ab.bc.ac=2\sqrt{10}.6\sqrt{5}.3\sqrt{2}$ $(abc)^2=36\sqrt{100}$ $abc=\sqrt{360}=6\sqrt{10}$ **OR/*OF*** $ac=6\sqrt{5}\quad\therefore a=\frac{6\sqrt{5}}{c}$ $bc=3\sqrt{2}\quad\therefore b=\frac{3\sqrt{2}}{c}$ $ab=2\sqrt{10}$ $\left(\frac{6\sqrt{5}}{c}\right)\left(\frac{3\sqrt{2}}{c}\right)=2\sqrt{10}$ $18\sqrt{10}=2\sqrt{10}.c^2$ $c^2=9$ $c=3$ Volume $=abc=2\sqrt{10}.3=\sqrt{360}=6\sqrt{10}$	✓ volume = abc ✓✓ $ab.bc.ac=2\sqrt{10}.6\sqrt{5}.3\sqrt{2}$ ✓ $(abc)^2=36\sqrt{100}$ ✓ answer (5) **OR/*OF*** ✓ $a=\frac{6\sqrt{5}}{c}$ ✓ $b=\frac{3\sqrt{2}}{c}$ ✓ value of c ✓ Volume = abc ✓ answer (5) **[22]**

QUESTION/*VRAAG* 2

2.1.1	59	✓ answer (1)
2.1.2	 $2a=-2$ $a=-1$ $3(-1)+b=14$ $b=17$ $(-1)+(17)+c=15$ $c=-1$ $T_n=-n^2+17n-1$	✓second difference of – 2 ✓ a ✓ b ✓ c (4)
2.1.3	$T_{27}=-(27)^2+17(27)-1$ $=-271$	✓ substitution ✓ answer (2)
2.2.1	$r=\frac{-18}{36}=-\frac{1}{2}$	✓ answer (1)
2.2.2	$T_n=36\left(-\frac{1}{2}\right)^{n-1}$ $\frac{9}{4096}=36\left(-\frac{1}{2}\right)^{n-1}$ $\frac{1}{16384}=\left(-\frac{1}{2}\right)^{n-1}$ $\left(-\frac{1}{2}\right)^{14}=\left(-\frac{1}{2}\right)^{n-1}$ $14=n-1$ $n=15$ **OR/*OF*** $36\ ;\ -18\ ;\ 9\ ;\ \frac{-9}{2}\ ;\ \frac{9}{4}\ ;\ \frac{-9}{8}\ ;\ \ldots\ ;\ \frac{9}{4096}$ If you look only at the denominator: 2 ; 4 ; 8 ; … ; 4096 $2^k=4096$ $2^k=2^{12}$ $k=12$ $\therefore n=15$ terms	✓ $T_n=36\left(-\frac{1}{2}\right)^{n-1}$ ✓ $\frac{1}{16384}=\left(-\frac{1}{2}\right)^{n-1}$ ✓ answer (3) **OR/*OF*** ✓ $2^k=4096$ ✓ $k=12$ ✓ answer (3)

2.2.3	$S_\infty = \frac{a}{1-r}$ $= \frac{36}{1-\left(-\frac{1}{2}\right)}$ $= 24$	✓ correct subst into correct formula with $-1 < r < 1$ ✓ answer if $-1 < r < 1$ (2)
2.2.4	$S_{250\,\text{even}} = \frac{-18\left(\left(\frac{1}{4}\right)^{250} - 1\right)}{\frac{1}{4} - 1}$ $= -24$ $S_{250\ \text{odd}} = \frac{36\left(\left(\frac{1}{4}\right)^{250} - 1\right)}{\frac{1}{4} - 1}$ $= 48$ $\frac{S_{odd}}{S_{even}} = \frac{48}{-24}$ $= -2$ **OR/*OF*** $\frac{T_1 + T_3 + T_5 + T_7 + ... + T_{499}}{T_2 + T_4 + T_6 + T_8 + ... + T_{500}}$ $= \frac{a + ar^2 + ar^4 + ... + ar^{498}}{ar + ar^3 + ar^5 + ... + ar^{499}}$ $= \frac{a + ar^2 + ar^4 + ... + ar^{498}}{r\left(a + ar^2 + ar^4 + ... + ar^{498}\right)}$ $= \frac{1}{r}$ $= -2$	✓ $r = \frac{1}{4}$ and $n = 250$ ✓ $S_{250\,\text{even}} = -24$ ✓ $S_{250\,\text{odd}} = 48$ ✓ answer (4) **OR/*OF*** ✓ $a + ar^2 + ar^4 + ... + ar^{498}$ ✓ $ar + ar^3 + ar^5 + ... + ar^{499}$ ✓ $r\left(a + ar^2 + ar^4 + ... + ar^{498}\right)$ ✓ answer (4) **[17]**

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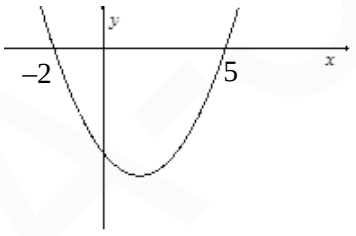
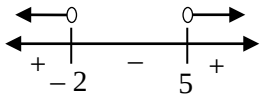
QUESTION/*VRAAG* 1

1.1.1	$x^2-4x+3=0$ $(x-3)(x-1)=0$ $x=3$ or $x=1$	✓factors/correct subt in formula ✓ $x=3$ ✓ $x=1$ (3)
1.1.2	$5x^2-5x+1=0$ $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\dfrac{5\pm\sqrt{25-4(5)(1)}}{2(5)}$ $=\dfrac{5\pm\sqrt{5}}{10}$ $x=0{,}72$ or $x=0{,}28$	✓substitution into the correct formula ✓$x=0{,}72$ ✓$x=0{,}28$ (3)
1.1.3	$x^2-3x-10>0$ $(x-5)(x+2)>0$ **OR/OF**   $x<-2$ or $x>5$	✓factors/ critical values ✓✓ $x<-2$ or $x>5$ (3)
1.1.4	$3\sqrt{x}=x-4$ $9x=x^2-8x+16$ $x^2-17x+16=0$ $(x-16)(x-1)=0$ $x=16$ or $x=1$ NA	✓ squaring both sides ✓ $x^2-17x+16=0$ ✓ factors ✓ answer with selection (4)

	OR/OF $3x^{\frac{1}{2}} = x - 4$ $x - 3x^{\frac{1}{2}} - 4 = 0$ $\left(x^{\frac{1}{2}} - 4\right)\left(x^{\frac{1}{2}} + 1\right) = 0$ $x^{\frac{1}{2}} = 4$ or $x^{\frac{1}{2}} = -1$ $x = 16$ NA	**OR/OF** ✓ standard form ✓ recognize $x = \left(x^{\frac{1}{2}}\right)^2$ ✓ factors ✓ answer with selection (4)
1.2	$2y + 9x^2 = -1$.....(1) $3x - y = 2$ ..... (2) $y = 3x - 2$ .....(3) $2(3x - 2) + 9x^2 = -1$ $6x - 4 + 9x^2 = -1$ $9x^2 + 6x - 3 = 0$ $3x^2 + 2x - 1 = 0$ $(3x - 1)(x + 1) = 0$ $x = \frac{1}{3}$ or $x = -1$ $y = -1$ or $y = -5$	✓ $y = 3x - 2$ ✓substitution ✓ standard form ✓factors ✓both x values ✓both y values (6)
	OR/OF $2y + 9x^2 = -1$.....(1) $3x - y = 2$ ..... (2) $x = \frac{y+2}{3}$ $2y + 9\left(\frac{y+2}{3}\right)^2 = -1$ $2y + 9\left(\frac{y^2+4y+4}{9}\right) = -1$ $2y + y^2 + 4y + 4 + 1 = 0$ $y^2 + 6y + 5 = 0$ $(y + 5)(y + 1) = 0$ $y = -1$ or $y = -5$ $x = \frac{1}{3}$ or $x = -1$	**OR/OF** ✓ $x = \frac{y+2}{3}$ ✓substitution ✓ standard form ✓factors ✓both y values ✓both x values (6)

1.3	$3^{9x} = 64$ $\left(3^{3x}\right)^3 = (4)^3$ $3^{3x} = 4$	✓ $3^{3x} = 4$
	$5^{\sqrt{p}} = 64$ $\sqrt{5}^{\sqrt{p}} = \sqrt{64}$ $\sqrt{5}^{\sqrt{p}} = 8$	✓ $\sqrt{5}^{\sqrt{p}} = 8$
	$\frac{\left[3^{x-1}\right]^3}{\sqrt{5}^{\sqrt{p}}} = \frac{3^{3x-3}}{\sqrt{5}^{\sqrt{p}}}$ **OR/OF** $= \frac{3^{3x}.3^{-3}}{5^{\frac{\sqrt{p}}{2}}}$	✓ 3^{3x-3} or $3^{3x}.3^{-3}$
	$= \frac{3^{3x}}{27 \times \sqrt{5}^{\sqrt{p}}}$ $= \frac{\sqrt[3]{64}.3^{-3}}{\sqrt{64}}$ $= \frac{4}{27 \times 8}$ $= \frac{1}{54}$	✓answer (4)
	OR/OF	**OR/OF**
	$\frac{\left(3^{x-1}\right)^3}{\sqrt{5}^{\sqrt{p}}} = \frac{3^{3x}.3^{-3}}{\left(5^{0.5}\right)^{\sqrt{p}}}$	✓ 3^{3x-3} or $3^{3x}.3^{-3}$
	$= \frac{3^{3x}.3^{-3}}{\left(5^{\sqrt{p}}\right)^{0.5}}$	✓ $3^{3x} = 4$ ✓ $\sqrt{5}^{\sqrt{p}} = 8$
	$= \frac{4.3^{-3}}{\sqrt{64}}$ $= \frac{4.\frac{1}{27}}{8} = \frac{1}{54}$	✓answer (4)
		[23]

QUESTION/*VRAAG* 2

2.1.1	42	✓answer (1)
2.1.2	$2a = 6$ $3a + b = 1$ $a + b + c = 2$ $a = 3$ $3(3) + b = 1$ $(3) + (-8) + c = 2$ $b = -8$ $c = 7$ $T_n = 3n^2 - 8n + 7$ **OR/OF** $2a = 6$ $a = 3$ $T_n = 3n^2 + bn + c$ $T_1 : 3 + b + c = 2$ $b + c = -1$ .....(1) $T_2 : 12 + 2b + c = 3$ $2b + c = -9$ .....(2) $T_2 - T_1 : b = -8$ Subst. in (1): $-8 + c = -1$ $c = 7$ $T_n = 3n^2 - 8n + 7$	✓ $a = 3$ ✓ $b = -8$ ✓ $c = 7$ ✓ $T_n = an^2 + bn + c$ (4) **OR/OF** ✓ $a = 3$ ✓ $b = -8$ ✓ $c = 7$ ✓ $T_n = an^2 + bn + c$ (4)
2.1.3	$T_{20} = 3(20)^2 - 8(20) + 7$ $= 1047$	✓substitution ✓answer (2)
2.2	$T_n = -7n + 42$ $-7n + 42 = -140$ $-7n = -182$ $n = 26$	✓ $T_n = -7n + 42$ ✓ $-7n + 42 = -140$ ✓ $n = 26$ (3)
2.3	$S_n = \frac{n}{2}(a + l)$ **OR/OF** $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_n = \frac{n}{2}(35 - 7n + 42)$ $S_n = \frac{n}{2}(70 - 7n + 7)$ $S_n = \frac{n}{2}(-7n + 77)$ $S_n = -\frac{7}{2}n^2 + \frac{77}{2}n$ $-\frac{7}{2}n^2 + \frac{77}{2}n = 3n^2 - 8n + 7$ $13n^2 - 93n + 14 = 0$ $(n - 7)(13n - 2) = 0$ $n = 7$ *or* $n = \frac{2}{13}$ NA $\therefore n = 7$	✓ $S_n = \frac{n}{2}(35 - 7n + 42)$ or $S_n = \frac{n}{2}(70 - 7n + 7)$ ✓simplification of S_n ✓equating ✓standard form ✓factors ✓answer with selection (6)
		[16]

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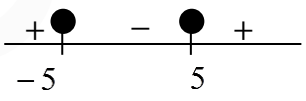
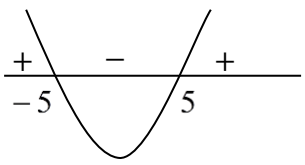
QUESTION/*VRAAG* 1

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***

	$\frac{3^{2018}+3^{2016}}{3^{2017}}$ $=\frac{3^{2016}\left(3^2+1\right)}{3^{2017}}$ $=\frac{10}{3}$ **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]**

QUESTION/*VRAAG* 2

2.1.1	$30\ ;\ 10\ ;\ \frac{10}{3}\ldots\ldots$ $a=30 \qquad r=\frac{1}{3}$ $T_n = ar^{n-1}$ $\frac{10}{729}=30\left(\frac{1}{3}\right)^{n-1}$ $\frac{1}{2187}=3^{1-n}$ $3^{-7}=3^{1-n}$ $-7=1-n$ $n=8$ **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	$S_n = a+(a+d)+.....+(a+(n-2)d)+(a+(n-1)d) \quad (1)$ $S_n = (a+(n-1)d)+(a+(n-2)d)+.....+(a+d)+a \quad (2)$ Adding both equations/*Tel die twee vergelykings bymekaar:* $2S_n = 2a+(n-1)d+2a+(n-1)d+2a+(n-1)d+.....$ $= n[2a+(n-1)d]$ $S_n = \frac{n}{2}[2a+(n-1)d]$ **OR/OF** $S_n = a+(a+d)+.....+(a+(n-2)d)+T_n \quad (1)$ $S_n = T_n+(T_n-d)+(T_n-2d)+.....+a \quad (2)$ Adding both equations/*Tel die twee vergelykings bymekaar:* $2S_n = (a+T_n)+(a+T_n)+(a+T_n)+.....+(a+T_n)$ $S_n = \frac{n}{2}(a+T_n)$ 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]**

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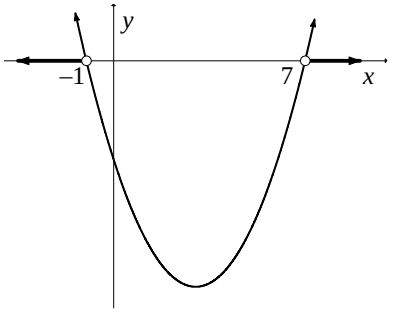
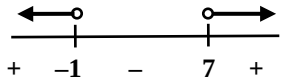
QUESTION/*VRAAG* 1

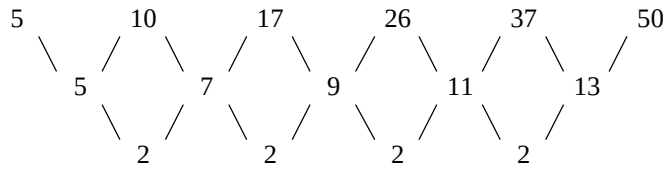
1.1.1	$(3x-1)(x+4)=0$ $x=\frac{1}{3}$ or $x=-4$	✓ $x=\frac{1}{3}$ ✓ $x=-4$ (2)
1.1.2	$2x^2+9x-14=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-9\pm\sqrt{9^2-4(2)(-14)}}{2(2)}$ $=\frac{-9\pm\sqrt{193}}{4}$ $x=1{,}22$ or $x=-5{,}72$ **OR/*OF*** $x^2+\frac{9}{2}x+\frac{81}{16}=7+\frac{81}{16}$ $\left(x+\frac{9}{4}\right)^2=\frac{193}{16}$ $x+\frac{9}{4}=\pm\frac{\sqrt{193}}{4}$ $x=\frac{-9\pm\sqrt{193}}{4}$ $x=1{,}22$ 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*** $\frac{\left(16x^7\right)^{\frac{1}{2}}-\left(25x^7\right)^{\frac{1}{2}}}{x^{\frac{1}{2}}}$ $=\frac{4x^{\frac{7}{2}}-5x^{\frac{7}{2}}}{x^{\frac{1}{2}}}$ $=\frac{-x^{\frac{7}{2}}}{x^{\frac{1}{2}}}$ $=-x^3$	✓ $4\sqrt{x^7}-5\sqrt{x^7}$ ✓ $-\sqrt{x^7}$ ✓ $-x^3$ (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) $xy=9$.....(2) Substitute (1) into (2)	✓ $x=2y+3$
	$(2y+3)y=9$	✓ 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) $xy=9$.....(2) Substitute (1) into (2)	✓ $y=\frac{x-3}{2}$
	$x\left(\frac{x-3}{2}\right)=9$	✓ 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	 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]**

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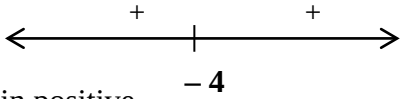
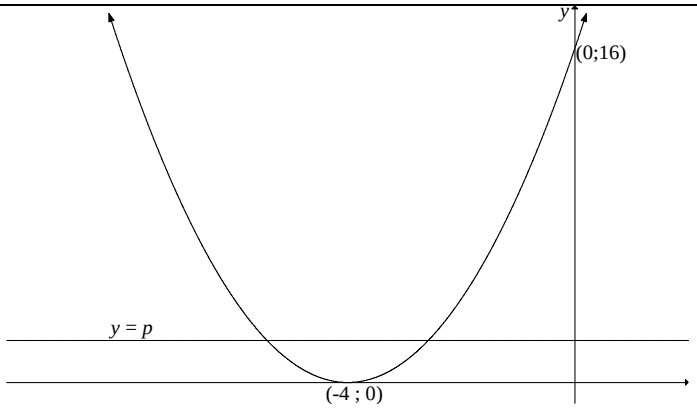
QUESTION/*VRAAG* 1

1.1.1	$x^2+9x+14=0$ $(x+7)(x+2)=0$ $x=-7$ or $x=-2$	✓ factors ✓ $x=-7$ ✓ $x=-2$ (3)
1.1.2	$4x^2+9x-3=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-9\pm\sqrt{9^2-4(4)(-3)}}{2(4)}$ $=\frac{-9\pm\sqrt{129}}{8}$ $x=0{,}29$ or $x=-2{,}54$ **OR/*OF*** $x^2+\frac{9}{4}x+\frac{81}{64}=\frac{3}{4}+\frac{81}{64}$ $\left(x+\frac{9}{8}\right)^2=\frac{129}{64}$ $x+\frac{9}{8}=\pm\frac{\sqrt{129}}{8}$ $x=\frac{-9\pm\sqrt{129}}{8}$ $x=0{,}29$ or $x=-2{,}54$	✓ substitution ✓ simplification ✓ $x=0{,}29$ ✓ $x=-2{,}54$ **OR/*OF*** ✓ for adding $\frac{81}{64}$ on both sides ✓ simplification ✓ $x=0{,}29$ ✓ $x=-2{,}54$ (4)
1.1.3	$\sqrt{x^2-5}=2\sqrt{x}$ $x^2-5=4x$ $x^2-4x-5=0$ $(x-5)(x+1)=0$ $x=5$ or $x=-1$ $x=5$	✓ $x^2-5=4x$ ✓ standard form ✓ both answers ✓ select $x=5$ (4)

1.2	$3x-y=4$ $y=3x-4$ $x^2+2xy-y^2=-2$ $x^2+2x(3x-4)-(3x-4)^2=-2$ $x^2+6x^2-8x-(9x^2-24x+16)=-2$ $7x^2-8x-9x^2+24x-16=-2$ $-2x^2+16x-14=0$ $x^2-8x+7=0$ $(x-7)(x-1)=0$ $x=1$ or $x=7$ $y=3(1)-4$ $y=3(7)-4$ $y=-1$ or $y=17$ **OR/*OF*** $3x-y=4$ $x=\frac{y+4}{3}$ $x^2+2xy-y^2=-2$ $x^2+2xy-y^2=-2$ $\left(\frac{y+4}{3}\right)^2+2\left(\frac{y+4}{3}\right)y-y^2=-2$ $y^2+8y+16+6y^2+24y-9y^2=-18$ $-2y^2+32y+34=0$ $y^2-16y-17=0$ $(y-17)(y+1)=0$ $y=-1$ or $y=17$ $x=\frac{-1+4}{3}$ $x=\frac{17+4}{3}$ $x=1$ or $x=7$	✓ y subject of formula ✓ substitution ✓ correct standard form ✓ factors ✓x-values ✓y-values **OR/*OF*** ✓x subject of formula ✓ substitution ✓ correct standard form ✓ factors ✓y-values ✓x-values (6)
1.3.1	$x^2+8x+16>0$ $(x+4)(x+4)>0$ $x\in R,\ x\neq -4$ **or** $x\in(-\infty;-4)$ or $x\in(-4;\infty)$ **or** $x<-4$ or $x>-4$ **OR/*OF*** $x^2+8x+16>0$ $(x+4)(x+4)>0$  The function values remain positive $x\in R,\ x\neq -4$	✓ $(x+4)(x+4)$ ✓✓ any one of the solutions **OR/*OF*** ✓ $(x+4)(x+4)$ ✓✓ any one of the solutions (3)

1.3.2



For two negative unequal roots:

$0 < p < 16$

✓ 0
✓ 16

✓ ✓ $0 < p < 16$ (4)

OR/*OF*

$x^2 + 8x + 16 = p$

$x^2 + 8x + 16 - p = 0$

$0 < 16 - p < 16$

$-16 < -p < 0$

$0 < p < 16$

✓ 0
✓ 16

✓ ✓ $0 < p < 16$ (4)

OR/*OF*

$x^2 + 8x + 16 - p = 0$

$x = \dfrac{-8 \pm \sqrt{64 - 4(16 - p)}}{2}$

$0 < 64 - 4(16 - p) < 64$

$0 < 4p < 64$

$0 < p < 16$

✓ 0
✓ 16

✓ ✓ $0 < p < 16$ (4)

OR/*OF*

$x^2 + 8x + 16 = p$

$x^2 + 8x + 16 - p = 0$

Roots are real and unequal:

$8^2 - 4(16 - p) > 0$

$4p > 0$

$p > 0$

Roots are: $\dfrac{-8 \pm \sqrt{4p}}{2}$

For both roots to be negative:

$\sqrt{4p} < 8$

$4p < 64$

$p < 16$

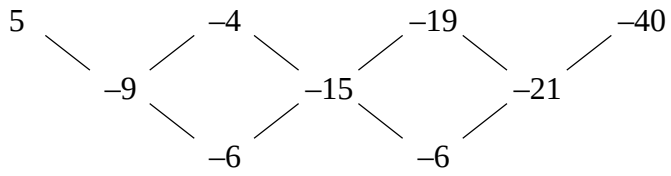
$0 < p < 16$

✓ 0
✓ 16

✓ ✓ $0 < p < 16$ (4)

[24]

QUESTION/*VRAAG* 2

2.1.1	 first differences: –9; –15; –21 second difference = – 6	✓ first differences ✓ – 6 (2)
2.1.2	$T_n = an^2 + bn + c$ $a = \frac{\text{second difference}}{2} = -3$ $3a + b = -9$ $3(-3) + b = -9$ $b = 0$ $a + b + c = 5$ $-3 + 0 + c = 5$ $c = 8$ $T_n = -3n^2 + 8$ **OR/*OF*** $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)d_2}{2}$ $= 5 + (n-1)(-9) + \frac{(n-1)(n-2)(-6)}{2}$ $= 5 - 9n + 9 - 3n^2 + 9n - 6$ $T_n = -3n^2 + 8$	✓ $a = -3$ ✓ $b = 0$ ✓ $c = 8$ ✓ $T_n = -3n^2 + 8$ **OR/*OF*** ✓ $a = -3$ ✓ $b = 0$ ✓ $c = 8$ ✓ $T_n = -3n^2 + 8$ (4)
2.1.3	$-3n^2 + 8 = -25\,939$ $-3n^2 = -25947$ $n^2 = 8649$ $n = -93 \text{ or } n = 93$ The 93rd term has a value of –25 939	✓ $T_n = -25\,939$ ✓ $n^2 = 8649$ ✓ answer (3)

2.2.1	$2k-7\ ;\ k+8$ and $2k-1$ $k+8-(2k-7)=2k-1-(k+8)$ $-k+15=k-9$ $2k=24$ $k=12$ $2k-7;k+8$ and $2k-1$ $17\ ;20\ ;23.....$ $d=3$ $T_{15}=17+14(3)$ $=59$	✓ $k+8-(2k-7)=2k-1-(k+8)$ ✓$k=12$ ✓17 ✓ $d=3$ ✓$T_{15}=59$ (5)
2.2.2	Sequence is 17 ; 20 ; 23 ; 26 ; 29 ; 32 ……. Every alternate term of the sequence will be even / *Elke tweede term van die ry sal ewe wees* $20+26+32+.....$ $S_{30}=\frac{30}{2}[2(20)+(29)(6)]$ $=15[40+174]$ $=3210$ **OR/*OF*** $T_{30}=20+29(6)$ $=94$ $S_{30}=\frac{30}{2}(20+194)$ $=3210$	✓ $20+26+32+.....$ ✓$a=20\ \ d=6$ ✓subst into correct formula ✓ answer (4) ✓ $a=20\ \ d=6$ ✓ $T_{30}=94$ ✓ $S_{30}=\frac{30}{2}(20+194)$ ✓ answer (4) **[18]**

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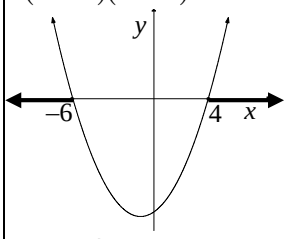
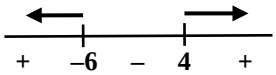
- *Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.*

QUESTION/*VRAAG* 1

1.1.1	$3x^2+10x+6=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-10\pm\sqrt{(10)^2-4(3)(6)}}{2(3)}$ $x=-2{,}55 \quad \text{or} \quad x=-0{,}78$ **OR/OF** $x^2+\frac{10}{3}x+\frac{100}{36}=-2+\frac{100}{36}$ $\left(x+\frac{5}{3}\right)^2=\frac{7}{9}$ $x+\frac{5}{3}=\pm\frac{\sqrt{7}}{3}$ $x=\frac{-5\pm\sqrt{7}}{3}$ $x=-0{,}78 \quad \text{or} \quad x=-2{,}55$	✓ substitution into correct formula ✓ $x=-2{,}55$ ✓ $x=-0{,}78$ (3) ✓for adding $\frac{100}{36}$ on both sides ✓ $x=-2{,}55$ ✓ $x=-0{,}78$ (3)
1.1.2	$\sqrt{6x^2-15}=x+1$ $6x^2-15=(x+1)^2$ $6x^2-15=x^2+2x+1$ $5x^2-2x-16=0$ $(5x+8)(x-2)=0$ $x=-\frac{8}{5} \text{ or } x=2$ $\therefore x=2$	✓ concept of squaring both sides ✓ standard form (accurate) ✓ factors ✓ both answers ✓ correct selection (5)

1.1.3	$x^2+2x-24\geq 0$ $(x+6)(x-4)\geq 0$  **OR**  $x\leq -6$ or $x\geq 4$	✓ factors ✓✓ $x\leq -6$ or $x\geq 4$ (3)
1.2	$y=-5x+3$ $3x^2-2x(-5x+3)=(-5x+3)^2-105$ $3x^2+10x^2-6x=25x^2-30x+9-105$ $-12x^2+24x+96=0$ $x^2-2x-8=0$ $(x-4)(x+2)=0$ $x=-2$ or $x=4$ $y=13$ or $y=-17$ **OR/*OF*** $x=\frac{3-y}{5}$ $3\left(\frac{3-y}{5}\right)^2-2y\left(\frac{3-y}{5}\right)=y^2-105$ $3\left(\frac{9-6y+y^2}{25}\right)-2y\left(\frac{3-y}{5}\right)=y^2-105$ $27-18y+3y^2-30y+10y^2=25y^2-2625$ $12y^2+48y-2652=0$ $y^2+4y-221=0$ $(y-13)(y+17)=0$ $y=-17$ or $y=13$ $x=\frac{3+17}{5}$ or $x=\frac{3-13}{5}$ $x=4$ or $x=-2$	✓ y subject of formula ✓ substitution ✓ simplification ✓ factors ✓ values of x ✓ values of y (6) ✓ x subject of formula ✓ substitution ✓ simplification ✓ factors ✓ values of y ✓ values of x (6)
1.3.1	$p^2-48p-49=0$ $(p-49)(p+1)=0$ $p=-1$ or $p=49$	✓ factors ✓ $p=-1$ ✓ $p=49$ (3)
1.3.2	$7^x=-1$ or $7^x=49$ no solution $x=2$	✓ $7^x=-1$ or $7^x=49$ ✓ no solution ✓ $x=2$ (3) **[23]**

QUESTION/*VRAAG* 2

2.1.1	3; 2; k; ... $r = \frac{2}{3}$	✓ $r = \frac{2}{3}$ / 0,67 (1)
2.1.2	$r = \frac{T_3}{T_2}$ $T_3 = r \times T_2$ $= \frac{2}{3} \times 2$ $= \frac{4}{3}$ Thus $k = \frac{4}{3}$	✓ $\frac{2}{3} \times 2$ ✓ $\frac{4}{3}$ / 1,34 (2)
2.1.3	$T_n = a.r^{n-1}$ $\frac{128}{729} = 3 \times \left(\frac{2}{3}\right)^{n-1}$ $\left(\frac{2}{3}\right)^{n-1} = \frac{128}{2187}$ $\left(\frac{2}{3}\right)^{n-1} = \left(\frac{2}{3}\right)^{7}$ $n-1 = 7$ $n = 8$ **OR / OF** $T_n = a.r^{n-1}$ $\frac{128}{729} = 3 \times \left(\frac{2}{3}\right)^{n-1}$ $\left(\frac{2}{3}\right)^{n-1} = \frac{128}{2187}$ $n-1 = \log_{\frac{2}{3}} \frac{128}{2189}$ $n-1 = 7$ $n = 8$	✓ $\frac{128}{729} = 3 \times \left(\frac{2}{3}\right)^{n-1}$ ✓ $\left(\frac{2}{3}\right)^{n-1} = \frac{128}{2187}$ ✓ $\left(\frac{2}{3}\right)^{7}$ ✓answer **OR / OF** ✓ $\frac{128}{729} = 3 \times \left(\frac{2}{3}\right)^{n-1}$ ✓ $\left(\frac{2}{3}\right)^{n-1} = \frac{128}{2187}$ ✓ $n-1 = \log_{\frac{2}{3}} \frac{128}{2189}$ ✓answer (4)
2.2.1	$T_n = a + (n-1)d$ $T_{18} = 100 + (18-1)(150)$ $=$ R 2 650	✓ substitution of n, a and d into AS ✓ 2 650 (2)

2.2.2	$S_n = \frac{n}{2}[2a + (n-1)d]$ $30\,500 = \frac{n}{2}[2(100) + (n-1)(150)]$ $61\,000 = n(150n + 50)$ $61\,000 = 150n^2 + 50n$ $3n^2 + n - 1\,220 = 0$ $(3n + 61)(n - 20) = 0$ $n = -\frac{61}{3}$ or $n = 20$ N/A $x = 100 + (20-1)(150)$ $= \text{R } 2\,950$	✓substitute 30 500, a and d into sum formula for AS ✓ simplification ✓ factors or quad formula ✓ $n = 20$ ✓ substitution T_n of AS ✓ 2 950 (6) **[15]**

QUESTION/*VRAAG* 3

3.1	First differences: 17; 15 Second difference: –2 $T_n = an^2 + bn + c$ $a = \frac{\text{second difference}}{2} = \frac{-2}{2} = -1$ $3a + b = 17$ $3(-1) + b = 17$ $b = 20$ $a + b + c = 0$ $-1 + 20 + c = 0$ $c = -19$ $T_n = -n^2 + 20n - 19$ **OR / OF** First differences: 17; 15 $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)}{2}d_2$ $= (0) + (n-1)(17) + \frac{(n-1)(n-2)}{2}(-2)$ $= 17n - 17 - n^2 + 3n - 2$ $= -n^2 + 20n - 19$	✓17; 15 ✓value of a ✓ value of b ✓value of c ✓17; 15 ✓value of a ✓ value of b ✓value of c (4)

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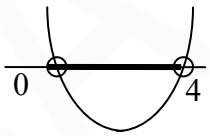
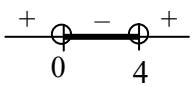
QUESTION/*VRAAG* 1

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 $\text{Maximum of } S = \frac{6}{x^2 + 2}$ $= \frac{6}{2}$ $= 3$	✓ Minimum of $x^2 + 2$ is 2 ✓3 (2)
		[22]

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: $\frac{1}{2};\ 2\ ;\ 8\ ;\ 32\ ;\ 128\ ;$ …… $a=\frac{1}{2}\qquad r=4$ $\sum_{n=1}^{20}\left(\frac{1}{2}\right)(4)^{n-1}$ **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]

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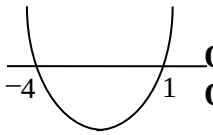
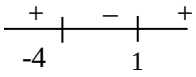
QUESTION/*VRAAG* 1

1.1.1	$x(x-7)=0$ $x=0$ or $x=7$	✓ $x=0$ ✓ $x=7$ (2)
1.1.2	$x^2-6x+2=0$ $x=\frac{6\pm\sqrt{(-6)^2-4(1)(2)}}{2(1)}$ $x=\frac{6\pm\sqrt{28}}{2}$ $x=0{,}35$ or $x=5{,}65$ **OR/OF** $x^2-6x+2=0$ $x^2-6x+9=-2+9$ $(x-3)^2=7$ $x-3=\pm\sqrt{7}$ $x=3\pm\sqrt{7}$ $x=0{,}35$ or $x=5{,}65$	✓correct substitution into correct formula ✓ $x=0{,}35$ ✓ $x=5{,}65$ (3) ✓ $(x-3)^2=7$ ✓ $x=0{,}35$ ✓ $x=5{,}65$ (3)
1.1.3	$\sqrt{x-1}+1=x$ $\sqrt{x-1}=x-1$ $x-1=x^2-2x+1$ $x^2-3x+2=0$ $(x-2)(x-1)=0$ $x=2$ or $x=1$ Both answers are valid **OR/OF**	✓ isolate $\sqrt{x-1}$ ✓ x^2-2x+1 ✓ standard form ✓ factors ✓ both answers (5)

	$\sqrt{x-1}+1=x$ $\sqrt{x-1}=x-1$ Let $x-1=k$ $\sqrt{k}=k \quad k\geq 0$ $k=k^2$ $k^2-k=0$ $k(k-1)=0$ $(x-1)(x-2)=0$ $x=2$ or $x=1$; $x\geq 1$ Both answers are valid **OR/OF** $\sqrt{x-1}+1=x$ $\sqrt{x-1}=x-1$ By inspection : $x-1=0$ or $x-1=1$ $x=2$ or $x=1$	✓ isolate $\sqrt{x-1}$ ✓ k^2 ✓ standard form ✓ factors ✓ both answers (5) ✓ isolate $\sqrt{x-1}$ ✓ $x-1=0$ ✓ $x-1=1$ ✓ $x=2$ ✓ $x=1$ (5)
1.1.4	$3^{x+3}-3^{x+2}=486$ $3^x3^3-3^x3^2=486$ $3^x(3^3-3^2)=486$ $3^x=27$ $3^x=3^3$ $x=3$ **OR/OF** $3^{x+3}-3^{x+2}=486$ $3^{x+2}(3^1-1)=486$ $3^{x+2}=243$ $3^{x+2}=3^5$ $x+2=5$ $x=3$	✓ expansion ✓ common factor ✓ $3^x=27$ ✓ $x=3$ (4) ✓ common factor ✓ (3^1-1) ✓ $3^{x+2}=243$ ✓ $x=3$ (4)
1.2.1	$f(x)=x^2+3x-4$ $0=(x+4)(x-1)$ $x=-4$ or $x=1$	✓ factors ✓ both answers (2)

1.2.2	$x^2+3x-4<0$ $(x+4)(x-1)<0$  **OR/ OF**  $-4<x<1$ **OR/*OF*** $x\in(-4\,;1)$	✓ ✓ $-4<x<1$ (2)
1.2.3	$2x+3\geq 0$ $x\geq -\frac{3}{2}$ $f'(x)\geq 0$ when f is increasing The turning point occurs at $x=\frac{-4+1}{2}$ $x\geq -\frac{3}{2}$	✓ $2x+3$ ✓ $x\geq -\frac{3}{2}$ (2) ✓ $x=\frac{-4+1}{2}$ ✓ $x\geq -\frac{3}{2}$ (2)
1.3	$x=2y$ and $x^2-5xy=-24$ $(2y)^2-5(2y)(y)=-24$ $4y^2-10y^2=-24$ $-6y^2=-24$ $y^2=4$ $y=-2$ or $y=2$ $x=-4$ or $x=4$ **OR/OF** $x=2y$ and $x^2-5xy=-24$ $y=\frac{x}{2}$ $x^2-5(x)\left(\frac{x}{2}\right)=-24$ $x^2-\frac{5}{2}x^2=-24$ $-\frac{3}{2}x^2=-24$ $x^2=16$ $x=-4$ or $x=4$ $y=-2$ or $y=2$ **OR/OF**	✓ substitution of $2y$ ✓ $-6y^2=-24$ ✓ both y – values ✓ both x– values (4) ✓ substitution of $\frac{x}{2}$ ✓ $-\frac{3}{2}x^2=-24$ ✓ both x – values ✓ both y – values (4)

	$x = 2y$ and $x^2 - 5xy = -24$ $y = \frac{x}{2}$ $y = \frac{-x^2 - 24}{-5x}$ $\frac{x}{2} = \frac{x^2 + 24}{5x}$ $5x^2 = 2x^2 + 48$ $3x^2 = 48$ $x^2 = 16$ $x = -4$ or $x = 4$ $y = -2$ or $y = 2$	✓ equating $\frac{x}{2} = \frac{x^2 + 24}{5x}$ ✓ $3x^2 = 48$ ✓ both x – values ✓ both y – values (4)
		[24]

QUESTION/*VRAAG* 2

2.1	$T_4 = -7$	✓ –7 (1)
2.2	$T_n = a + (n-1)d$ $-87 = 5 + (n-1)(-4)$ $-87 = 5 - 4n + 4$ $4n = 96$ $n = 24$ **OR/OF** $-4n + 9 = -87$ $-4n = -96$ $n = 24$	✓ $a = 5$ and $d = -4$ ✓ $-87 = 5 + (n-1)(-4)$ ✓ $n = 24$ (3) ✓ $-4n + 9$ ✓ $-4n + 9 = -87$ ✓ $n = 24$ (3)
2.3	$-3; -7; .....; -87$ $S_n = \frac{n}{2}[a + T_n]$ $S_{22} = \frac{22}{2}[-3 - 87]$ $= -990$ **OR/OF**	✓ $n = 22$ ✓ $a = -3$ ✓ answer (3)

	$-3;-7;.....;-87$ $S_n = \frac{n}{2}[2a+(n-1)d]$ $S_{22} = \frac{22}{2}[2(-3)+(22-1)(-4)]$ $= -990$	✓ $n = 22$ ✓ $a = -3$ ✓ answer (3)
	OR/OF All negative terms can be written down and added to get the answer of –990./*Alle negatiewe terme kan neergeskryf word en dan bymekaar getel word om –990 te kry.*	✓$a = -3$ ✓✓ answer (3)
	OR/OF Sum $= S_{24} - (5+1)$ $= \frac{24}{2}[5-87]-6$ $= -990$	✓ $\frac{24}{2}[5-87]$ ✓ –6 ✓ answer (3)
2.4	$5;-15;-35.....$ $d = -20$ $T_n = -20n+25$ Last term in the sequence divisible by 5 is:/*Laaste term in die ry deelbaar deur* 5 *is:* $-4187+4(3)$ $= -4175$	✓ $d = -20$ ✓ $T_n = -20n+25$
	$T_n = -20n+25$ $-4175 = -20n+25$ $20n = 4200$ $n = 210$ There will be 210 terms in the sequence that is divisible by 5./*Daar is* 210 *terme in die ry deelbaar deur* 5. **OR/OF**	✓ $-4175 = -20n+25$ ✓ $n = 210$ (4)

	5 ; 1 ; –3 ; ... ; –83 ; –87; ……; – 4187 $T_n = -4n + 9$ $-4187 = -4n + 9$ $4n = 4196$ $n = 1049$ There are 1049 terms in the sequence./*Daar is* 1049 *terme in die ry.*	✓ $-4n + 9 = -4187$ ✓ $n = 1049$
	T_1 ; T_6 ; T_{11} ; T_{16} ... are divisible by 5./*is deelbaar deur* 5. The largest integer value of k such that $5k - 4 \le 1049$ $5k \le 1053$ $k \le 210{,}6$ $k = 210$	✓ $5k - 4 \le 1049$ ✓ $k = 210$ (4)
	OR/*OF*	
	5 ; 1 –3 ; –7 ; … ; **–4175**; –4179 ;–4183 ; –4187 $T_n = a + (n-1)d$ $-4175 = 5 + (n-1)(-4)$ $-4180 = -4(n-1)$ $n = 1046$ Number of terms divisible by 5 $= \frac{1046 - 1}{5} + 1$ $= 210$	✓ $d = -4$ ✓ $-4175 = -4n + 9$ ✓ 1046 ✓ $n = 210$ (4) **[11]**

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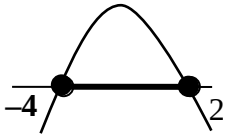
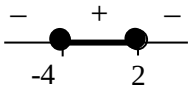
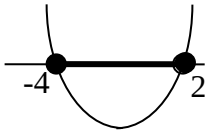
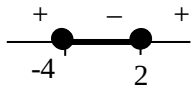
QUESTION/*VRAAG 1*

1.1.1	$4x^2-25=0$ $(2x-5)(2x+5)=0$ $x=\frac{5}{2}$ or/of $x=-\frac{5}{2}$ **OR/*OF*** $4x^2=25$ $x^2=\frac{25}{4}$ $x=\pm\sqrt{\frac{25}{4}}$ $x=\frac{5}{2}$ or/of $x=-\frac{5}{2}$	✓✓ factors ✓ answers (3) ✓ $x^2=\frac{25}{4}$ ✓ $x=\pm\sqrt{\frac{25}{4}}$ ✓ answer (3)
1.1.2	$x^2-5x-2=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-(-5)\pm\sqrt{(-5)^2-4(1)(-2)}}{2(1)}$ $=\frac{5\pm\sqrt{33}}{2}$ $x=5{,}37$ or/of $x=-0{,}37$ **OR/*OF*** $x^2-5x+\frac{25}{4}=2+\frac{25}{4}$ $\left(x-\frac{5}{2}\right)^2=\frac{33}{4}$ $x-\frac{5}{2}=\pm\frac{\sqrt{33}}{2}$ $x=\frac{5\pm\sqrt{33}}{2}$ $x=-0{,}37$ or $x=5{,}37$	✓ correct substitution into correct formula ✓ answer ✓ answer (3) ✓ for adding $\frac{25}{4}$ on both sides ✓answer ✓answer (3)

1.1.3	$(2-x)(x+4) \geq 0$  **OR / OF**  $-4 \leq x \leq 2$ **OR / OF** $x \in [-4; 2]$ **OR / OF** $(2-x)(x+4) \geq 0$ $(x-2)(x+4) \leq 0$  ***OR / OF***  $-4 \leq x \leq 2$ **OR / OF** $x \in [-4; 2]$	✓method ✓critical values in context of inequality ✓inequality or interval (3) ✓change of inequality ✓critical values in context of inequality ✓inequality or interval (3)
1.1.4	$x - 3x^{\frac{1}{2}} - 4 = 0$ $\left(x^{\frac{1}{2}} - 4\right)\left(x^{\frac{1}{2}} + 1\right) = 0$ $x^{\frac{1}{2}} = 4$ or $x^{\frac{1}{2}} = -1$ $x = 16$ N/A **OR/OF** $x - 3x^{\frac{1}{2}} - 4 = 0$ Let $x^{\frac{1}{2}} = k$ $k^2 - 3k - 4 = 0$ $(k-4)(k+1) = 0$ $x^{\frac{1}{2}} = 4$ or $x^{\frac{1}{2}} = -1$ $x = 16$ N/A **OR/OF** $x - 3x^{\frac{1}{2}} = 4$ $x - 4 = 3\sqrt{x}$ Restrictions/*Beperkings*: $9x = x^2 - 8x + 16$ $x \geq 4$ and $x \geq 0$ $x^2 - 17x + 16 = 0$ $(x-1)(x-16) = 0$ $x = 1$ or $x = 16$ N/A	✓ standard form ✓ factors ✓ $x^{\frac{1}{2}} = 4$ ✓ $x^{\frac{1}{2}} = -1$ ✓ answer (5) ✓ standard form ✓ factors ✓ $x^{\frac{1}{2}} = 4$ ✓ $x^{\frac{1}{2}} = -1$ ✓ answer (5) ✓ isolating $3\sqrt{x}$ or $3x^{\frac{1}{2}}$ ✓ standard form ✓ factors ✓ answers ✓ selection (5)

1.2	$y = 2x+1$ $x^2-3x-4-(2x+1)=(2x+1)^2$ $x^2-3x-4-2x-1=4x^2+4x+1$ $3x^2+9x+6=0$ $x^2+3x+2=0$ $(x+2)(x+1)=0$ $x=-2 \quad \text{or} \quad x=-1$ If $x=-2$, then $y=-3$ If $x=-1$, then $y=-1$ **OR/OF** $x=\frac{y-1}{2}$ $\left(\frac{y-1}{2}\right)^2-3\left(\frac{y-1}{2}\right)-4-y=y^2$ $\frac{y^2-2y+1}{4}-3\left(\frac{y-1}{2}\right)-4-y=y^2$ $y^2-2y+1-6y+6-16-4y=4y^2$ $3y^2+12y+9=0$ $y^2+4y+3=0$ $(y+3)(y+1)=0$ $y=-3 \quad \text{or} \quad y=-1$ If $y=-3$, then $x=-2$ If $y=-1$, then $x=-1$	✓ y subject of formula ✓ substitution ✓ standard form ✓ factors ✓ values of x ✓ values of y (6) ✓ x subject of formula ✓ substitution ✓ standard form ✓ factors ✓ values of y ✓ values of x (6)
1.3.1	$2x+1\geq 0$ $x\geq -\frac{1}{2}$ **OR/OF** $\left[-\frac{1}{2};\infty\right)$	✓ answer (1) ✓ answer (1)

1.3.2	$f(x)=2x-1$ $\sqrt{2x+1}=2x-1$ Restrictions/*Beperkings*: $2x+1=4x^2-4x+1$ $x\geq -\frac{1}{2}$ and $x\geq \frac{1}{2}$ $4x^2-6x=0$ $x(4x-6)=0$ $x=\frac{3}{2}$ or $x=0$ $\therefore x=\frac{3}{2}$	✓ $\sqrt{2x+1}=2x-1$ ✓ standard form ✓ factors ✓ answers ✓ correct selection (5) **[26]**

QUESTION/*VRAAG 2*

2.1.1	$27-b=b-13$ $b=\frac{27+13}{2}$ $b=20$ $27-20=13-a$ $a=6$ **OR/OF** $27-13=2d$ $d=7$ $b=13+7=20$ $a=13-7=6$	✓ $27-b=b-13$ ✓ $27-20=13-a$ (2) ✓ $d=7$ or $27-13=2d$ ✓ $b=13+7$ $a=13-7$ (2)
2.1.2	$a=6$ $d=7$ $S_n=\frac{n}{2}[2a+(n-1)d]$ $S_{20}=\frac{20}{2}[2(6)+(20-1)(7)]$ $=1450$ **OR/OF** $T_{20}=a+19(d)$ $=6+19(7)$ $=139$ $S_n=\frac{n}{2}[a+T_n]$ $S_{20}=\frac{20}{2}[6+139]$ $=1450$	✓ $d=7$ ✓ correct substitution into correct formula ✓ answer (3) ✓ $d=7$ ✓ $T_{20}=139$ ✓ answer (3)

2.1.3	$T_n = 6+(n-1)(7)$ $= 7n-1$ $\sum_{n=1}^{20}(6+7(n-1))$ $=\sum_{n=1}^{20}(7n-1)$	✓ $T_n = 6+(n-1)(7)$ or $7n-1$ ✓ $\sum_{n=1}^{20}$ (2)
2.2.1	$r=\frac{(x-2)(x+2)}{x-2}$ or $r=\frac{(x^2-4)(x+2)}{x^2-4}$ $=x+2$ For convergence/Om te konvergeer: $-1<r<1$ $-1<x+2<1$ $-3<x<-1$	✓ $\frac{(x^2-4)}{x-2}$ or $\frac{(x-2)(x+2)}{x-2}$ or $\frac{(x^2-4)(x+2)}{x^2-4}$ ✓ $r=x+2$ ✓ $-1<r<1$ ✓ answer (4)
2.2.2	$\left(-\frac{7}{2}\right)+\left(-\frac{7}{4}\right)+\left(-\frac{7}{8}\right)+.....$ $S_\infty=\frac{a}{1-r}$ $=\frac{-\frac{7}{2}}{1-\frac{1}{2}}$ $=-7$ **OR/OF** $S_\infty=\frac{a}{1-r}$ $=\frac{(x-2)}{1-(x+2)}$ $=\frac{x-2}{-x-1}$ $=\frac{-\frac{3}{2}-2}{\frac{3}{2}-1}$ $=\frac{-\frac{7}{2}}{\frac{1}{2}}$ $=-7$	✓ $a=-\frac{7}{2}$ ✓ substitution into correct formula ✓ answer (3) ✓ substitution into correct formula ✓ substitution of $x=-\frac{3}{2}$ ✓answer (3) **[14]**

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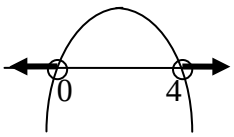
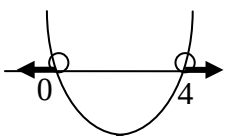
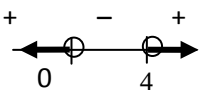
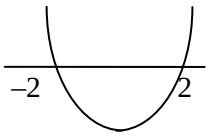
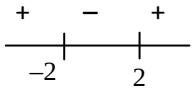
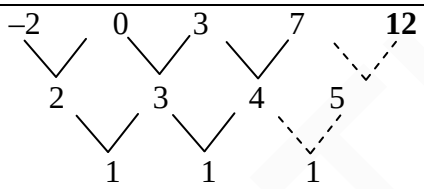
QUESTION/*VRAAG* 1

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 $x > 4$	 ✓ $x < 0$ ✓ $x > 4$ ✓or (3)  **OR/*OF***  ✓ $x < 0$ ✓ $x > 4$ ✓or (3)

1.1.4	$x = \dfrac{a^2 + a - 2}{a - 1}$ $= \dfrac{(a+2)(a-1)}{a-1}$ $= a + 2$ $= 888\,888\,888\,890$	✓ $(a+2)(a-1)$ ✓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* $y + 7 = 2x$ $x = \dfrac{y+7}{2}$ .....(1) $x^2 - xy + 3y^2 = 15$ .....(2) substitute (1) in (2) : $\left(\dfrac{y+7}{2}\right)^2 - \left(\dfrac{y+7}{2}\right)y + 3y^2 = 15$ $\dfrac{y^2 + 14y + 49}{4} - \dfrac{y^2 + 7y}{2} + 3y^2 = 15$ $y^2 + 14y + 49 - 2y^2 - 14y + 12y^2 - 60 = 0$ $11y^2 - 11 = 0$ $y^2 - 1 = 0$ $(y-1)(y+1) = 0$ $y = -1$ $y = 1$ $x = \dfrac{-1+7}{2}$ $x = \dfrac{1+7}{2}$ $x = 3$ $x = 4$	✓ $x = \dfrac{y+7}{2}$ ✓ 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* 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
	$T_n = an^2+bn+c$ $-2=\frac{1}{2}+b+c.....T_1$	✓ $-2=\frac{1}{2}+b+c$
	$b+c=-\frac{5}{2}$.....line 1 $0=2+2b+c.....T_2$	✓ $0=2+2b+c$
	$2b+c=-2$.....line 2 line 2 – line 1: $b=\frac{1}{2}$	✓value of b
	substitute in line 1 or substitute in line 2 $\frac{1}{2}+c=-\frac{5}{2}$ $2\left(\frac{1}{2}\right)+c=-2$ $c=-3$ $\therefore T_n=\frac{1}{2}n^2+\frac{1}{2}n-3$	✓ value of c (5)
	OR/*OF* $T_n = T_1+(n-1)d_1+\frac{(n-1)(n-2)}{2}d_2$ $=-2+(n-1)(2)+\frac{(n-1)(n-2)}{2}(1)$ $=-2+2n-2+(n^2-3n+2)(\frac{1}{2})$ $=-2+2n-2+\frac{1}{2}n^2-\frac{3}{2}n+1$ $=\frac{1}{2}n^2+\frac{1}{2}n-3$	✓formula ✓substitution ✓ value of a ✓value of b ✓ value of c (5)
	OR/*OF* $2a=1$ $a=\frac{1}{2}$ $3a+b=T_2-T_1$ $3\left(\frac{1}{2}\right)+b=2$ $b=\frac{1}{2}$ $T_0=c=-3$ $\therefore T_n=\frac{1}{2}n^2+\frac{1}{2}n-3$	✓value of a ✓ $3\left(\frac{1}{2}\right)+b=2$ ✓value of b ✓ $T_0=c$ ✓ value of c (5)
	OR/*OF*	

	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]**

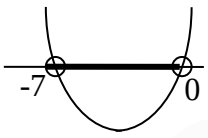
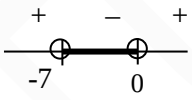
NOTE:
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking memorandum.

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

QUESTION/*VRAAG* 1

1.1.1	$x^2 - 9x + 20 = 0$ $(x-4)(x-5) = 0$ $x = 4$ or $x = 5$	✓factors ✓ $x = 4$ ✓ $x = 5$ (3)
1.1.2	$3x^2 + 5x - 4 = 0$ $x = \frac{-5 \pm \sqrt{(5)^2 - 4(3)(-4)}}{2(3)}$ $x = \frac{-5 \pm \sqrt{73}}{6}$ $x = -2{,}26$ or $x = 0{,}59$ **OR/*OF*** $x^2 + \frac{5}{3}x + \frac{25}{36} = \frac{4}{3} + \frac{25}{36}$ $\left(x + \frac{5}{6}\right)^2 = \frac{73}{36}$ $x + \frac{5}{6} = \pm\frac{\sqrt{73}}{6}$ $x = \frac{-5 \pm \sqrt{73}}{6}$ $x = -2{,}26$ or $x = 0{,}59$	✓standard form ✓substitution into correct formula ✓✓answers (4) ✓for adding $\frac{25}{36}$ on both sides ✓ $x = \frac{-5 \pm \sqrt{73}}{6}$ ✓✓answers (4)
1.1.3	$2x^{\frac{-5}{3}} = 64$ $x^{\frac{-5}{3}} = 32$ $x = \left(2^5\right)^{\frac{-3}{5}}$ $x = 2^{-3}$ or $\frac{1}{8}$ or $0{,}125$ **OR/*OF***	✓dividing both sides by 2 ✓$32 = 2^5$ or $64 = 2^6$ ✓raising RHS to $\frac{-3}{5}$ ✓answer (4)

	$2x^{\frac{-5}{3}} = 64$ $x^{\frac{-5}{3}} = 32$ $x = (32)^{\frac{-3}{5}}$ $x = \sqrt[5]{32^{-3}}$ $x = 2^{-3}$ or $\frac{1}{8}$ or 0,125 **OR/*OF*** $\left(2x^{\frac{-5}{3}}\right)^{\frac{-3}{5}} = 64^{\frac{-3}{5}}$ $0{,}659x = 0{,}0825$ $x = 0{,}125$ **OR/*OF*** $x^{\frac{-5}{3}} = 32$ $\frac{-5}{3}\log x = \log 32$ $\log x = \frac{3}{-5}\log 32$ $\log x = -0{,}903$ $x = 10^{-0{,}903}$ $= 0{,}125$ or $\frac{1}{8}$	✓dividing both sides by 2 ✓raising RHS to $\frac{-3}{5}$ ✓$\sqrt[5]{32^{-3}}$ ✓answer (4) ✓raising both sides to $\frac{-3}{5}$ ✓0,659 and 0,0825 ✓dividing both sides by 0,659 ✓answer (4) ✓dividing both sides by 2 ✓logs on both sides ✓ $\log x = -0{,}903$ ✓answer (4)
1.1.4	$\sqrt{2-x} = x-2$ $2-x = (x-2)^2$ $2-x = x^2-4x+4$ $x^2-3x+2=0$ $(x-1)(x-2)=0$ $x=1$ or $x=2$ if $x=1$, $\sqrt{2-x}=1$ and $x-2=-1$ $x=2$ only **OR/*OF***	✓squaring both sides ✓factors ✓ $x=1$ or $x=2$ ✓ $x=2$ only (4)

	$\sqrt{2-x} = x-2$ $2-x = (x-2)^2$ $2-x = (2-x)^2$ $2-x = 1$ or $2-x = 0$ $x = 1$ or $x = 2$ if $x = 1$, $\sqrt{2-x} = 1$ and $x-2 = -1$ $\therefore x = 2$ only **OR/*OF*** $\sqrt{2-x} = x-2$ $2-x \geq 0$ and $x-2 \geq 0$ $x \leq 2$ and $x \geq 2$ $\therefore x = 2$ only	✓squaring both sides ✓ $2-x = 1$ or $2-x = 0$ ✓ $x = 1$ or $x = 2$ ✓ $x = 2$ only (4) ✓ $2-x \geq 0$ ✓ $x-2 \geq 0$ ✓ $x \leq 2$ and $x \geq 2$ ✓ $x = 2$ (4)
1.1.5	$x^2 + 7x < 0$ $x(x+7) < 0$  **OR/*OF***  $-7 < x < 0$ **OR/*OF*** $x \in (-7; 0)$	✓factors ✓✓inequality or interval (3)

1.2	The square of any number is always positive or zero So for the sum of two squares to be zero, both squares must be zero, i.e. *Die kwadraat van enige getal is altyd positief of nul. Vir die som van twee kwadrate om nul te wees, moet beide die kwadrate nul wees, d.i.* $(3x-y)^2 = 0$ and/*en* $(x-5)^2 = 0$ $3x-y = 0$ and/*en* $x-5 = 0$ $x = 5$ $3(5)-y = 0$ $y = 15$	✓ $3x-y = 0$ ✓ $x-5 = 0$ ✓ $x = 5$ ✓ $y = 15$ (4)

1.3

$x^2 + x = k$

$x^2 + x - k = 0$

$\Delta < 0$

$b^2 - 4ac < 0$

$1^2 - 4(1)(-k) < 0$

$1 + 4k < 0$

$k < \frac{-1}{4}$

✓standard form
✓ $\Delta < 0$
✓ $1^2 - 4(1)(-k)$
✓ $k < \frac{-1}{4}$

OR/*OF*

(4)

$x^2 + x = k$

$x^2 + x + \frac{1}{4} = k + \frac{1}{4}$

$\left(x + \frac{1}{2}\right)^2 = k + \frac{1}{4}$

for nonreal roots $k + \frac{1}{4} < 0$

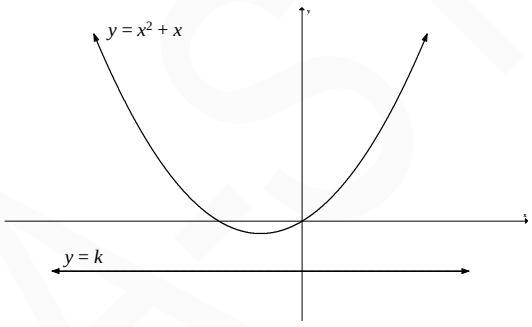
$k < \frac{-1}{4}$

✓adds $\frac{1}{4}$ to both sides
✓ $\left(x + \frac{1}{2}\right)^2 = k + \frac{1}{4}$
✓ $k + \frac{1}{4} < 0$
✓ $k < \frac{-1}{4}$

OR/*OF*

(4)

Consider the functions $y = x^2 + x$ and $y = k$
Beskou die funksies $y = x^2 + x$ *en* $y = k$



✓sketch or explanation

Turning point of/*Draaipunt van* $y = x^2 + x$ is $\left(\frac{-1}{2}; \frac{-1}{4}\right)$

✓ $x = -\frac{1}{2}$
✓ $y = -\frac{1}{4}$

$x^2 + x = k$ does not have real roots when the line $y = k$ does not intersect $y = x^2 + x$.
$x^2 + x = k$ *het geen reële wortels as die lyn* $y = k$ *nie met* $y = x^2 + x$ *sny nie.*

Therefore $k < \frac{-1}{4}$

✓ $k < \frac{-1}{4}$

(4)
[26]

QUESTION/*VRAAG* 2

2.1	$r=\frac{T_2}{T_1}$ $=\frac{5}{10}$ $=\frac{1}{2}$ $T_5=1{,}25\left(\frac{1}{2}\right)$ $=\frac{5}{8}$ or 0,625 **OR/*OF*** $T_5=10\left(\frac{1}{2}\right)^4$ $=\frac{5}{8}$ or 0,625	✓ $r=\frac{1}{2}$ ✓answer (2)
2.2	$T_n=10\left(\frac{1}{2}\right)^{n-1}$	✓substitutes $a=10$ into GP formula ✓substitutes $r=\frac{1}{2}$ into GP formula (2)
2.3	For convergence/*Om te konvergeer* $-1<r<1$ Since/*Aangesien* $r=\frac{1}{2}$ and/*en* $-1<\frac{1}{2}<1$ the sequence converges/*die ry konvergeer*	✓ $-1<r<1$ ✓ show that $r=\frac{1}{2}$ is $-1<r<1$ (2)
2.4	$S_\infty - S_n=\frac{a}{1-r}-\frac{a\left(1-r^n\right)}{1-r}$ $=\frac{10}{1-\frac{1}{2}}-\frac{10\left(1-\frac{1}{2}^n\right)}{1-\frac{1}{2}}$ $=20-20\left(1-\frac{1}{2}^n\right)$ $=20-20+20\left(\frac{1}{2}\right)^n$ $=20\left(\frac{1}{2}\right)^n$ **OR/*OF*** ✓constructing the series	✓ $\frac{10}{1-\frac{1}{2}}$ ✓ $\frac{10\left(1-\frac{1}{2}^n\right)}{1-\frac{1}{2}}$ ✓ $20\left(1-\frac{1}{2}^n\right)$ ✓answer (4)

	$S_\infty - S_n = T_{n+1} + T_{n+2} + T_{n+3} + \ldots$ $= 10\left(\frac{1}{2}\right)^n\left[1+\frac{1}{2}+\frac{1}{4}+\ldots\right]$ $= 10\left(\frac{1}{2}\right)^n\left[\frac{1}{1-\frac{1}{2}}\right]$ $= 20\left(\frac{1}{2}\right)^n$	✓ $10\left(\frac{1}{2}\right)^n\left[1+\frac{1}{2}+\frac{1}{4}+\ldots\right]$ ✓ $\frac{1}{1-\frac{1}{2}}$ ✓answer (4)
	OR/*OF*	
	$S_\infty - S_n = \frac{a}{1-r} - \frac{a\left(1-r^n\right)}{1-r}$ $= \frac{a-a+ar^n}{1-r}$ $= \frac{ar^n}{1-r}$ $= \frac{10\left(\frac{1}{2}\right)^n}{\frac{1}{2}}$ $= 20\left(\frac{1}{2}\right)^n$	✓ $\frac{a-a+ar^n}{1-r}$ ✓ $\frac{ar^n}{1-r}$ ✓ $\frac{10\left(\frac{1}{2}\right)^n}{\frac{1}{2}}$ ✓answer (4) **[10]**

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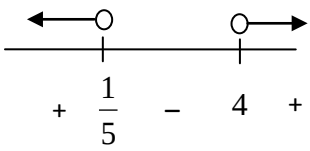
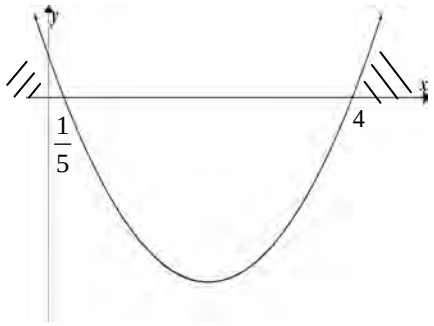
- *Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.*

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**  	✓ 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* 2

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

NOTE:

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

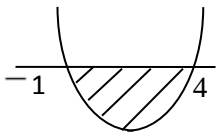
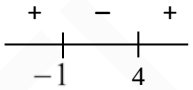
LET WEL:

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

QUESTION/*VRAAG* 1

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

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

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

QUESTION/*VRAAG* 2

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

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

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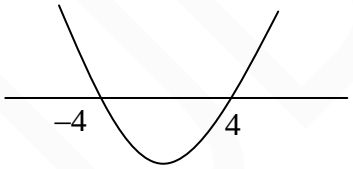
LET WEL:
- *As 'n kandidaat 'n vraag TWEE keer beantwoord het, merk slegs die eerste poging.*
- *As 'n kandidaat 'n antwoord deurgehaal en nie oorgedoen het nie, merk die deurgehaalde antwoord.*
- *Volgehoue akkuraatheid is DEURGAANS in ALLE aspekte van die memorandum van toepassing.*
- *Aanvaarding van waardes/antwoorde om 'n problem op te los, is onaanvaarbaar.*

QUESTION/*VRAAG* 1

1.1.1	$x^2 - 2x - 35 = 0$ $(x-7)(x+5) = 0$ $x = 7$ or $x = -5$	✓factors ✓answer ✓ answer (3)
1.1.2	$x^2 - 16 \geq 0$ $(x-4)(x+4) \geq 0$ + 0 − 0 + (–4, 4) or  $x \leq -4$ or $x \geq 4$ **OR** $x \in (-\infty ; -4]$ or $x \in [4 ; \infty)$ **OR** $x \in (-\infty ; -4] \cup [4 ; \infty)$	✓ factors ✓ critical values ✓ $x \leq -4$ ✓ $x \geq 4$ (4)
1.1.3	$9.2^{x-1} = 2.3^x$ $3^2.2^{x-1} = 2.3^x$ $2^{x-2} = 3^{x-2}$ $\left(\frac{2}{3}\right)^{x-2} = 1$ $\left(\frac{2}{3}\right)^{x-2} = \left(\frac{2}{3}\right)^0$ $x - 2 = 0$ $x = 2$ **OR**	✓ $2^{x-2} = 3^{x-2}$ ✓ $x - 2 = 0$ ✓answer (3)

	$9.2^{x-1} = 2.3^x$ $\frac{9.2^x}{2} = 2.3^x$ $9.2^x = 4.3^x$ $\frac{2^x}{3^x} = \frac{4}{9}$ $\left(\frac{2}{3}\right)^x = \frac{4}{9}$ $\left(\frac{2}{3}\right)^x = \left(\frac{2}{3}\right)^2$ $x = 2$	✓ $\frac{9.2^x}{2}$ ✓ $\left(\frac{2}{3}\right)^x = \frac{4}{9}$ ✓answer (3)
1.2	$f(x) = x^2 - 5x + c$ $x = \frac{5 \pm \sqrt{25 - 4(1)(c)}}{2}$ $25 - 4c = 41$ $-4c = 16$ $c = -4$ **OR** $x = \frac{5 \pm \sqrt{41}}{2}$ $2x - 5 = \pm\sqrt{41}$ $(2x-5)^2 = 41$ $4x^2 - 20x + 25 = 41$ $4x^2 - 20x - 16 = 0$ $x^2 - 5x - 4 = 0$ $\therefore c = -4$	✓substitution into correct formula ✓ $25 - 4c = 41$ ✓ $c = -4$ (3) ✓squaring both sides ✓ $4x^2 - 20x - 16 = 0$ ✓ $c = -4$ (3)
1.3	$3^{x-10} = 3^{3x}$ $x - 10 = 3x$ $2x = -10$ $x = -5$ $y^2 + x = 20$ $y^2 - 5 = 20$ $y^2 = 25$ $y = -5$ or $y = 5$	✓ equating of exponents ✓ x-value ✓ $20 = y^2 - 5$ ✓✓ y-values (5) **[18]**

QUESTION 2/*VRAAG* 2

2.1.1	$T_3 = 20$ and $T_4 = 40$ $r = \frac{T_4}{T_3} = 2$	✓ answer (1)
2.1.2	$T_n = ar^{n-1}$ $20 = a.2^{3-1}$ $a = 5$ $T_n = 5.2^{n-1}$ **OR** $40 = a.2^{4-1}$ $a = 5$ $T_n = 5.2^{n-1}$	✓subs into correct formula ✓ $a = 5$ ✓answer (3) ✓subs into correct formula ✓ $a = 5$ ✓answer (3)
2.2.1	$\frac{-7}{125}$	✓ answer (1)
2.2.2	$T_n = \frac{2+(n-1)(-3)}{(1).5^{n-1}}$ $T_n = \frac{5-3n}{5^{n-1}}$	✓ 5 ✓ 5^{n-1} ✓ $-3n$ (3)
2.2.3	$T_n = \frac{5-3n}{5^{n-1}}$ $T_{500} = \frac{5-3(500)}{5^{499}}$ $= \frac{-1495}{5^{499}}$	✓ numerator ✓ denominator (2)
2.2.4	$5-3n < -59$ $-3n < -64$ $n > 21{,}333...$ $n = 22$	✓ $5-3n < -59$ ✓ $n > 21{,}333...$ ✓ $n = 22$ (3) **[13]**

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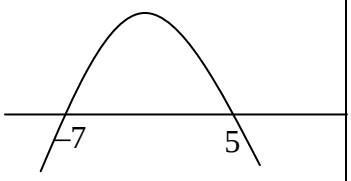
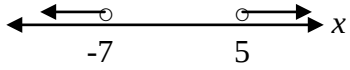
- *Aanvaarding van waardes/antwoorde om 'n problem op te los, is onaanvaarbaar.*

QUESTION/*VRAAG* 1

1.1.1	$x^2 - x - 12 = 0$ $(x-4)(x+3) = 0$ $x = 4$ or $x = -3$ **NOTE:** Answer only: max 2/3 marks **OR** $x^2 - x - 12 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-12)}}{2(1)}$ $= \frac{1 \pm \sqrt{49}}{2}$ $= 4$ or -3	✓ factors ✓ answer ✓ answer (3) ✓ substitution into the correct formula ✓ answer ✓ answer (3)
1.1.2 (a)	$2x^2 - 5x - 11 = 0$ **NOTE:** Wrong formula: 0/4 marks $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-11)}}{2(2)}$ $= \frac{5 \pm \sqrt{113}}{4}$ $= 3{,}91$ or $-1{,}41$ **OR** **NOTE:** • Answer only: max 2/4 marks • If the answer is left as $\frac{5 \pm \sqrt{113}}{4}$: 4/4 marks • If candidate continues after correct surd but then has incorrect answers: max 4/4 marks	✓ correct substitution of *b* into correct formula ✓ correct substitution of *a* and *c* into correct formula ✓✓ $\frac{5 \pm \sqrt{113}}{4}$ OR decimal answers (4)

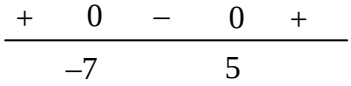
	$2x^2-5x-11=0$ $x^2-\frac{5}{2}x=\frac{11}{2}$ $\left(x-\frac{5}{4}\right)^2=\frac{11}{2}+\frac{25}{16}$ $\left(x-\frac{5}{4}\right)=\pm\sqrt{\frac{113}{16}}$ $x=\frac{5}{4}\pm\sqrt{\frac{113}{16}}$ $x=3{,}91 \quad \text{or} \quad x=-1{,}41$ **OR** $2x^2-5x-11=0$ $x^2-\frac{5x}{2}-\frac{11}{2}=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-\left(-\frac{5}{2}\right)\pm\sqrt{\left(-\frac{5}{2}\right)^2-4(1)\left(-\frac{11}{2}\right)}}{2(1)}$ $=\frac{\frac{5}{2}\pm\sqrt{\frac{113}{4}}}{2}$ $x=3{,}91 \quad \text{or} \quad x=-1{,}41$	✓ division by 2 ✓ $\left(x-\frac{5}{4}\right)=\pm\sqrt{\frac{113}{16}}$ ✓ $x=\frac{5}{4}\pm\sqrt{\frac{113}{16}}$ ✓answers (4) ✓ division by 2 ✓subs into correct formula ✓ $\frac{\frac{5}{2}\pm\sqrt{\frac{113}{4}}}{2}$ ✓ answer (4)
1.1.2 (b)	$2x^3-5x^2-11x=0$ $x(2x^2-5x-11)=0$ $x=0$ or $x=3{,}91$ or $x=-1{,}41$ **OR** $x=0 \quad \text{or} \quad x=\frac{5\pm\sqrt{113}}{4}$ **NOTE:** • Division by x: max 1/2 marks • Use quadratic formula to solve cubic: 0/2 marks • Answer only : 2/2 marks	✓ factors ✓ answers (2)
1.1.3	$-3(x+7)(x-5)<0$ – 0 + 0 – –7 5 OR  OR x | -7 | 5 $x+7$: + 0 – – – $x-5$: + + + 0 – $-3(x+7)(x-5)$: – 0 + 0 – $x<-7$ or $x>5$ OR $x\in(-\infty;-7)\cup(5;\infty)$	✓critical values ✓ $x<-7$ ✓ $x>5$ ✓or / $\cup$

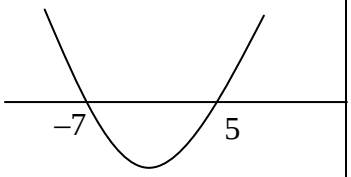
(4)

OR 

OR

$-3(x+7)(x-5)<0$
$(x+7)(x-5)>0$



OR 

✓critical values

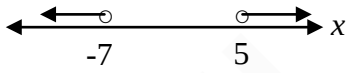
OR

x		-7		5	
$x+7$	–	0	+	+	+
$x-5$	–	–	–	0	+
$(x+7)(x-5)$	+	0	–	0	+

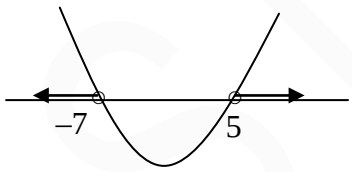
$x<-7$ or $x>5$ OR $x\in(-\infty;-7)\cup(5;\infty)$

✓ $x<-7$
✓ $x>5$
✓or / ∪

(4)

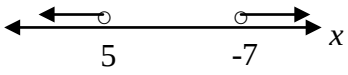
OR 

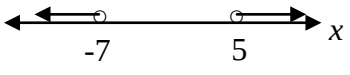
NOTE:
In this alternative, award max 3/4 marks since there is no conclusion



NOTE:
If $(x+7)(x-5)<0$ and get $-7<x<5$: max 2 / 4 marks

NOTE:
If the candidate gives the correct graphical answer but then concludes incorrectly: award max 2 / 4 marks

If the candidate writes $x<5$ or $x>-7$ **OR** $x\in(-\infty;5)\cup(-7;\infty)$ **OR** award maximum 1/4 marks 

If the candidate writes $x\le-7$ or $x\ge5$ **OR** $x\in(-\infty;-7]\cup[5;\infty)$ award maximum 3/4 marks 

If the candidate writes $x<-7$ or $x<5$ as a final answer, award maximum 2/4 marks

If the candidate writes $x<-7$ $x>5$ only (i.e. omits "or") award maximum 3/4 marks.

1.2	$y+2=x$ and $y=x^2-x-10$ $y+2=x$ $y=(y+2)^2-(y+2)-10$ $y=y^2+4y+4-y-2-10$ $0=y^2+2y-8$ $0=(y+4)(y-2)$ $y=-4$ or 2 $x=-4+2$ or $x=2+2$ $=-2$ $=4$ **OR** $y+2=x$ and $y=x^2-x-10$ $x^2-x-10+2=x$ $0=x^2-2x-8$ $0=x^2-2x-8$ $0=(x-4)(x+2)$ $x=4$ or -2 $y=4-2$ or $y=-2-2$ $=2$ $=-4$ **OR** $y+2=x$ and $y=x^2-x-10$ $y=x-2$ $x-2=x^2-x-10$ $0=x^2-2x-8$ $0=x^2-2x-8$ $0=(x-4)(x+2)$ $x=4$ or -2 $y=4-2$ or $y=-2-2$ $=2$ $=-4$ **Note:** If candidate makes a mistake which leads to both equations being LINEAR award maximum 2/6 marks ✓ substitution ✓ first unknown	✓ substitution ✓ $0=y^2+2y-8$ ✓ factors ✓ *y*-values ✓✓ *x*-values (6) ✓ substitution ✓ $0=x^2-2x-8$ ✓ factors ✓ *x*-values ✓✓ *y*-values (6) ✓ substitution ✓ $0=x^2-2x-8$ ✓ factors ✓ *x*-values ✓✓ *y*-values (6)
1.3	$\frac{3^{2015}+3^{2013}}{9^{1006}}$ $=\frac{3^{2013}(3^2+1)}{3^{2012}}$ $=3(10)$ $=30$ **OR**	✓ $3^{2013}(3^2+1)$ ✓ denominator ✓ answer (3)

	$\frac{3^{2015}+3^{2013}}{9^{1006}}$ $=\frac{3^{2012}\left(3^3+3\right)}{3^{2012}}$ $=27+3$ $=30$ **OR** Let $x=3^{2012}$ $\frac{3^{2015}+3^{2013}}{9^{1006}}$ $=\frac{3^{2012}.3^3+3^{2012}.3}{3^{2012}}$ $=\frac{27x+3x}{x}$ $=\frac{30x}{x}$ $=30$	✓ $3^{2012}\left(3^3+3\right)$ ✓ denominator ✓ answer (3) ✓ $3^{2012}.3^3+3^{2012}.3$ / $27x + 3x$ ✓ denominator ✓ answer (3) **[22]**

QUESTION/*VRAAG* 2

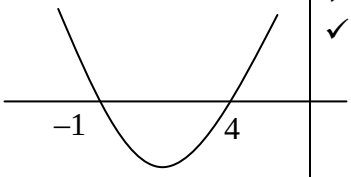
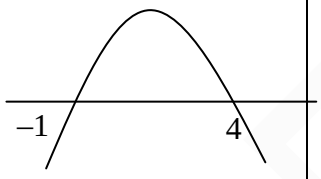
2.1	Given geometric sequence : 7 ; x ; 63 ... $\frac{T_2}{T_1}=\frac{T_3}{T_2}$ $\frac{x}{7}=\frac{63}{x}$ $x^2=441$ $x=\pm 21$ **OR** Given geometric sequence : 7 ; x ; 63 ... $\frac{T_2}{T_1}=\frac{T_3}{T_2}$ $\frac{x}{7}=\frac{63}{x}$ $x^2=441$ $x^2-441=0$ $(x-21)(x+21)=0$ $x=\pm 21$ **OR** $63=7r^2$ $r^2=9$ $r=\pm 3$ $x=\pm 21$	✓ $\frac{T_2}{T_1}=\frac{T_3}{T_2}$ / $\frac{x}{7}=\frac{63}{x}$ ✓ $x^2=441$ ✓ both answers (3) ✓ $\frac{T_2}{T_1}=\frac{T_3}{T_2}$ / $\frac{x}{7}=\frac{63}{x}$ ✓ $x^2=441$ ✓ both answers (3) ✓ $63=7r^2$ ✓ $r^2=9$ ✓ both answers (3)
2.2.1	$r=\frac{10}{15}=\frac{2}{3}$ $T_n=ar^{n-1}$ $T_{10}=15\left(\frac{2}{3}\right)^{10-1}$ $=\frac{2560}{6561}$ or 0,39 **NOTE:** If the candidate rounds off early and gets r = 0,67, then T_{10} = 0,41: 3/3 marks **OR** $r=\frac{10}{15}=\frac{2}{3}$ Expansion of the series $15+10+\frac{20}{3}+\frac{40}{9}+\frac{80}{27}+\frac{160}{81}+\frac{320}{243}+\frac{640}{729}+\frac{1280}{2187}+\frac{2560}{6561}$ $T_{10}=\frac{2560}{6561}$	✓ $r=\frac{2}{3}$ ✓ correct subs into correct formula ✓answer (3) ✓ $r=\frac{2}{3}$ ✓ expansion of the series ✓answer (3)

2.2.2	$S_n = \frac{a(r^n - 1)}{r - 1}$ $S_9 = \frac{15\left(\left(\frac{2}{3}\right)^9 - 1\right)}{\frac{2}{3} - 1}$ $= \frac{95855}{2187}$ $= 43{,}83$ **OR** $S_n = \frac{a(1 - r^n)}{1 - r}$ $S_9 = \frac{15\left(1 - \left(\frac{2}{3}\right)^9\right)}{1 - \left(\frac{2}{3}\right)}$ $= \frac{95855}{2187}$ $= 43{,}83$	✓ correct substitution into correct formula ✓answer (2) ✓ substitution into correct formula ✓answer (2)
2.3.1	$T_{191} = 0$	✓answer (1)
2.3.2	Since the sum of all odd-positioned terms will be zero, need only consider the sum of the even-positioned terms, which form an arithmetic sequence, i.e. the sum of 250 **even** terms: *Omdat die som van al die terme in onewe posisies nul is, slegs nodig om die som van die terme in ewe posisies te oorweeg, wat 'n rekenkundige ry vorm, m.a.w. die som van 250* ***ewe*** *terme:* $S_{500} = \frac{250}{2}\left[2\left(-\frac{1}{2}\right) + (250 - 1)(1)\right]$ $= 31000$ **NOTE:** Breakdown: If $n = 500$ with $a = -\frac{1}{2}$ and $d = 1$ then $S_n = 124\,500$: max 2/4 marks **OR** $S_{500} = \frac{125[2(-1) + 249(2)]}{2}$ $= 31000$ **OR**	✓$n = 250$ ✓$a = -\frac{1}{2}$ and $d = 1$ ✓ substitution into correct formula ✓ answer ✓$n = 125$ ✓$a = -1$ and $d = 2$ ✓ subs into correct formula ✓ answer (4)

	$\frac{3}{2}+\frac{5}{2}+...\text{to 248 terms}$ $=124\left[\frac{3}{2}+\frac{497}{2}\right]$ $=124\times 250$ $=31000$ **OR** $\frac{3}{2}+\frac{5}{2}+...\text{to 248 terms}$ $=124[3+247]$ $=124\times 250$ $=31000$ **OR** Sum = 0 + 4 + 8 +…to 125 terms $=\frac{125}{2}[0+(125-1)4]$ $=31000$	✓n = 248 ✓ subs into correct formula ✓ $\frac{3}{2}+\frac{247}{2}$ ✓ answer (4) ✓n = 248 ✓ subs into correct formula ✓ 3 + 247 ✓ answer (4) ✓n = 125 ✓a = 0 and d = 4 ✓ subs into correct formula ✓ answer (4)
2.4.1	$T_1=(4(1)-1)^2$ $=3^2$ $=9$ **NOTE:** If k = 1, T_1 = 3: max 1/2 mark	✓ subs x = 1 and k = 2 ✓ answer (2)
2.4.2	$r=4x-1$ $-1<r<1$ $-1<4x-1<1$ $0<4x<2$ $0<x<\frac{1}{2}$ **NOTE:** Incorrect r : max 1/3 marks If candidate only writes down $4x-1$ and does nothing else: 0/3 marks	✓ $r=4x-1$ ✓ $-1<4x-1<1$ ✓ answer (3) **[18]**

QUESTION 1

1.1.1	$(x^2-9)(2x+1)=0$ $(x-3)(x+3)(2x+1)=0$ $x=\pm 3 \quad \text{or} \quad x=-\frac{1}{2}$ **OR** $(x^2-9)(2x+1)=0$ $x=\pm 3 \quad \text{or} \quad x=-\frac{1}{2}$	✓ $(x-3)(x+3)$ ✓ ± 3 ✓ $-\frac{1}{2}$ (3) ✓ -3 ✓ 3 ✓ $-\frac{1}{2}$ (3)
1.1.2	$x^2+x-13=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-1\pm\sqrt{1-4(1)(-13)}}{2}$ $=\frac{-1\pm\sqrt{53}}{2}$ $x=3{,}14 \quad \text{or} \quad x=-4{,}14$	✓ subs into formula ✓ $\sqrt{53}$ ✓ answer ✓ answer (4)
1.1.3	$2\cdot 3^x=81-3^x$ $2\cdot 3^x+3^x=81$ $3^x(2+1)=81$ $3^x=27$ $3^x=3^3$ $x=3$ **OR** $2.3^x=81-3^x$ $2.3^x+3^x=81$ $3^x(2+1)=81$ $3^{x+1}=3^4$ $x+1=4$ $x=3$	✓ $2\cdot 3^x+3^x=81$ ✓ 3^x as common factor ✓ simplification ✓ answer (4) ✓ $2\cdot 3^x+3^x=81$ ✓ 3^x as common factor ✓ $3^{x+1}=3^4$ ✓ answer (4)

1.1.4	$(x+1)(4-x)>0$ $(x+1)(x-4)<0$ $+ \quad 0 \quad - \quad 0 \quad +$ $-1 \qquad 4$ or  $-1<x<4$ **OR** $(x+1)(4-x)>0$ $- \quad 0 \quad + \quad 0 \quad -$ $-1 \qquad 4$  $-1<x<4$	✓ change of sign ✓ both critical values ✓ correct inequality sign (3) ✓ method ✓ both critical values ✓ correct inequality sign (3)
1.2.1	$2^x + 2^{x+2} = -5y + 20$ $2^x(1+2^2) = -5y + 20$ $2^x = \frac{-5y+20}{5}$ **OR** $2^x = -y + 4$	✓ 2^x common factor ✓ answer (2)
1.2.2	If $y = -4$, $2^x + 2^{x+2} = -5y + 20$ $2^x + 2^{x+2} = 40$ $2^x(1+2^2) = 40$ $2^x = 8$ $2^x = 2^3$ $x = 3$	✓ substitution ✓ answer (2)
1.2.3	$-y + 4 > 0$ $y < 4$ Largest integer value of y is 3 $2^x = -3 + 4$ $2^x = 1$ $x = 0$	✓ $-y + 4 > 0$ ✓ $y = 3$ ✓ $x = 0$ (3) **[21]**

QUESTION 2

2.1.1	$r=-\frac{32}{64}=-\frac{1}{2}$ $p=256\left(-\frac{1}{2}\right)$ $p=-128$ **OR** $\frac{p}{256}=\frac{64}{p}$ $p^2=16384$ $p=\pm 128$ $p=-128$ **OR** $\frac{p}{256}=\frac{-32}{64}$ $64p=8192$ $p=-128$ **OR** $\frac{1}{r}=\frac{64}{-32}=-2$ $p=-2\times 64$ $p=-128$	✓ $-\frac{1}{2}$ ✓ substitution ✓ answer (3) ✓ $\frac{p}{256}=\frac{64}{p}$ ✓ $p=\pm 128$ ✓ answer (3) ✓ $\frac{p}{256}=\frac{-32}{64}$ ✓ simplification ✓ answer (3) ✓ $\frac{1}{r}=\frac{64}{-32}=-2$ ✓ simplification ✓ answer (3)
2.1.2	$S_n=\frac{a\left[1-r^n\right]}{1-r}$ $S_8=\frac{256\left[1-\left(-\frac{1}{2}\right)^8\right]}{1+\frac{1}{2}}$ $=\frac{512}{3}\left(\frac{255}{256}\right)$ $=170$ **OR**	✓ formula ✓ substitution ✓ answer (3)

	$S_n = \frac{a\left[1-r^n\right]}{1-r}$ $S_8 = \frac{2^8\left[1-\left(-\frac{1}{2}\right)^8\right]}{1+\frac{1}{2}}$ $= \frac{2^9}{3}\left(\frac{255}{2^8}\right)$ $= 170$	✓ formula ✓ substitution ✓ answer (3)
2.1.3	$-1 < r < 1$ **OR** The common ratio is $-\frac{1}{2}$ which is between – 1 and 1. **OR** $-1 < -\frac{1}{2} < 1$	✓ answer (1) ✓ answer (1) ✓ answer (1)
2.1.4	$S_\infty = \frac{a}{1-r}$ $= \frac{256}{1-\left(-\frac{1}{2}\right)}$ $= \frac{512}{3}$ $= 170{,}67$	✓ formula ✓ substitution ✓ answer (3)

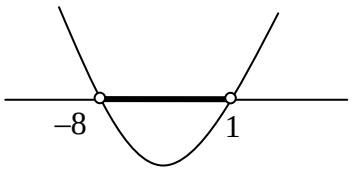
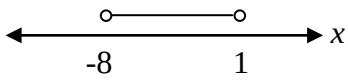
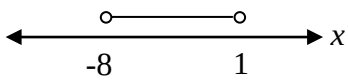
2.2.1	16	✓ answer (1)
2.2.2	$T_n = -8 + 6(n-1)$ $148 = 6n - 14$ $6n = 162$ $n = 27$	✓ substitution into equation ✓ $T_n = 148$ ✓ answer (3)
2.2.3	$S_n = \frac{n}{2}[2a + (n-1)d]$ $\frac{n}{2}[2(-8) + (n-1)(6)] > 10\,140$ $3n^2 - 11n > 10\,140$ $3n^2 - 11n - 10\,140 > 0$ $(3n + 169)(n - 60) > 0$ When $n = 60$, $S_n = 10\,140$ Smallest $n = 61$	✓ $\frac{n}{2}[2(-8) + (n-1)(6)]$ ✓ $3n^2 - 11n > 10\,140$ ✓ factors ✓ $n = 60$ ✓ answer (5)
2.3	$\sum_{k=1}^{30}(3k + 5)$ $a = 8 \quad n = 30 \quad d = 3$ $\sum_{k=1}^{30}(3k + 5) = \frac{30}{2}[2(8) + 29(3)]$ $= 15(103)$ $= 1545$	✓ $n = 30$ ✓ substitution into correct formula ✓ answer (3) **[22]**

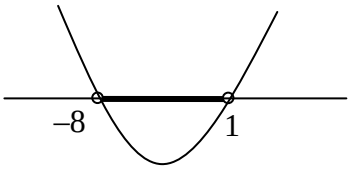
NOTE:

- If a candidate answered a question TWICE, mark the FIRST attempt ONLY.
- If a candidate crossed out an attempt of a question and did not redo the question, mark the crossed out question.
- Consistent accuracy applies in ALL aspects of the memorandum.

QUESTION 1

1.1.1	$(2x-1)(x+4)=0$ $x=\frac{1}{2}$ or -4	✓ answer ✓ answer (2)
1.1.2	$3x^2-x=5$ $3x^2-x-5=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-(-1)\pm\sqrt{(-1)^2-4(3)(-5)}}{2(3)}$ $=\frac{1\pm\sqrt{61}}{6}$ $=1{,}47$ or $-1{,}14$ **OR** $3x^2-x=5$ $x^2-\frac{1}{3}x=\frac{5}{3}$ $\left(x-\frac{1}{6}\right)^2=\frac{5}{3}+\frac{1}{36}$ $\left(x-\frac{1}{6}\right)=\pm\sqrt{\frac{61}{36}}$ $x=\frac{1}{6}\pm\sqrt{\frac{61}{36}}$ $=1{,}47$ or $-1{,}14$ **OR**	**Note:** if a candidate uses incorrect formula award max 1 mark (for standard form) **Note:** if a candidate has not rounded off correctly, penalise 1 mark ✓ standard form ✓subs into correct formula ✓✓answer (4) ✓ division by 3 ✓$\left(x-\frac{1}{6}\right)=\pm\sqrt{\frac{61}{36}}$ ✓✓answer (4)

	$3x^2 - x = 5$ $3x^2 - x - 5 = 0$ $x^2 - \frac{x}{3} - \frac{5}{3} = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-\left(-\frac{1}{3}\right) \pm \sqrt{\left(-\frac{1}{3}\right)^2 - 4(1)\left(-\frac{5}{3}\right)}}{2(1)}$ $= \frac{\frac{1}{3} \pm \sqrt{\frac{61}{9}}}{2}$ $= 1{,}47 \quad \text{or} \quad -1{,}14$	✓ standard form ✓subs into correct formula ✓✓answer (4)
1.1.3	$x^2 + 7x - 8 < 0$ $(x+8)(x-1) < 0$ + 0 − 0 + (–8, 1) **OR**  (–8, 1) **OR** x: -8, 1 $x+8$: – 0 + + + $x-1$: – – – 0 + $(x+8)(x-1)$: + 0 – 0 + Therefore the solution is: $-8 < x < 1$ **OR** $x \in (-8\,;1)$ **OR**  (-8, 1, x) **OR** $x^2 + 7x - 8 < 0$ $(x+8)(x-1) < 0$ $\therefore\ x+8 < 0$ and $x-1 > 0$ or $x+8 > 0$ and $x-1 < 0$ $x < -8$ and $x > 1$ $x > -8$ and $x < 1$ No solution Therefore the solution is: $-8 < x < 1$ **OR** $x \in (-8\,;1)$ **OR**  (-8, 1, x)	✓ factors ✓ – 8, 1 ✓✓ answer (4) ✓ factors ✓ – 8, 1 ✓✓ answer (4)

	NOTE: **In this alternative, award max 3/4 marks since there is no conclusion** $x^2 + 7x - 8 < 0$ $(x+8)(x-1) < 0$  	✓ factors ✓ – 8, 1 ✓ graph with bolded line
1.2.1	$4y - x = 4$ and $xy = 8$ $x = 4y - 4$ $(4y-4)y = 8$ $(y-1)y = 2$ $y^2 - y - 2 = 0$ $(y+1)(y-2) = 0$ $y = -1$ or $y = 2$ $x = -8$ or $x = 4$ $(x\ ;\ y) = (-8\ ;\ -1)$ or $(4\ ;\ 2)$ **Note:** If candidate makes a mistake which leads to both equations being LINEAR award maximum 2/6 marks **OR** $4y - x = 4$ and $xy = 8$ $x = 4y - 4$ $(4y-4)y = 8$ $(y-1)y = 2$ By inspection $y = -1$ or $y = 2$ $x = -8$ or $x = 4$ $(x\ ;\ y) = (-8\ ;\ -1)$ or $(4\ ;\ 2)$ **OR** $4y - x = 4$ and $xy = 8$ $x = 4y - 4$ $(4y-4)y = 8$ $(y-1)y = 2$ $y^2 - y - 2 = 0$ $y = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-2)}}{2(1)}$ $y = -1$ or $y = 2$ $x = -8$ or $x = 4$ $(x\ ;\ y) = (-8\ ;\ -1)$ or $(4\ ;\ 2)$	✓ $x = 4y - 4$ ✓ substitution ✓ factors ✓ y-values ✓✓ x-values (6) ✓ $x = 4y - 4$ ✓ substitution ✓✓ y-values ✓✓ x-values (6) ✓ $x = 4y - 4$ ✓ substitution ✓ subs into correct formula ✓ y-values ✓✓ x-values (6)

OR

$4y - x = 4 \quad \text{and} \quad xy = 8$

$y = \frac{x}{4} + 1$ ✓ $y = \frac{x}{4} + 1$

$x\left(\frac{x}{4} + 1\right) = 8$ ✓ substitution

$\frac{x^2}{4} + x - 8 = 0$

$x^2 + 4x - 32 = 0$ ✓ factors

$(x + 8)(x - 4) = 0$

$x = -8 \quad \text{or} \quad x = 4$ ✓ x-values

$y = -1 \quad \text{or} \quad y = 2$ ✓✓ y-values

$(x\,;\,y) = (-8\,;\,-1) \text{ or } (4\,;\,2)$ (6)

OR

$4y - x = 4 \quad \text{and} \quad xy = 8$

$y = \frac{x}{4} + 1$ ✓ $y = \frac{x}{4} + 1$

$x\left(\frac{x}{4} + 1\right) = 8$ ✓ substitution

$\frac{x^2}{4} + x - 8 = 0$

$x^2 + 4x - 32 = 0$

$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(-32)}}{2(1)}$ ✓ subs into correct formula

$x = -8 \quad \text{or} \quad x = 4$ ✓ x-values

$y = -1 \quad \text{or} \quad y = 2$

$(x\,;\,y) = (-8\,;\,-1) \text{ or } (4\,;\,2)$ ✓✓ y-values (6)

OR

$xy = 8 \quad \text{and} \quad 4y - x = 4$

$x = \frac{8}{y}$ ✓ $x = \frac{8}{y}$

$4y - \frac{8}{y} = 4$ ✓ substitution

$4y^2 - 4y - 8 = 0$

$y^2 - y - 2 = 0$ ✓ factors

$(y - 2)(y + 1) = 0$

$y = -1 \quad \text{or} \quad y = 2$ ✓ y-values

$x = -8 \quad \text{or} \quad x = 4$

$(x\,;\,y) = (-8\,;\,-1) \text{ or } (4\,;\,2)$ ✓✓ x-values (6)

OR

$xy = 8 \quad \text{and} \quad 4y - x = 4$

$x = \frac{8}{y}$ ✓ $x = \frac{8}{y}$

$4y - \frac{8}{y} = 4$ ✓ substitution

$4y^2 - 4y - 8 = 0$

$y^2 - y - 2 = 0$

$y = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-2)}}{2(1)}$ ✓ subs into correct formula

$y = -1 \quad \text{or} \quad y = 2$ ✓ y-values

$x = -8 \quad \text{or} \quad x = 4$

$(x\,;\,y) = (-8\,;\,-1) \text{ or } (4\,;\,2)$ ✓✓ x-values (6)

OR

$xy = 8 \quad \text{and} \quad 4y - x = 4$

$y = \frac{8}{x}$ ✓ $y = \frac{8}{x}$

$4\left(\frac{8}{x}\right) - x = 4$ ✓ substitution

$0 = x^2 + 4x - 32$

$0 = (x+8)(x-4)$ ✓ factors

$x = -8 \quad \text{or} \quad x = 4$

$y = -1 \quad \text{or} \quad y = 2$ ✓ x-values

$(x\,;\,y) = (-8\,;\,-1) \text{ or } (4\,;\,2)$ ✓✓ y-values (6)

OR

$xy = 8 \quad \text{and} \quad 4y - x = 4$

$y = \frac{8}{x}$ ✓ $y = \frac{8}{x}$

$4\left(\frac{8}{x}\right) - x = 4$ ✓ substitution

$0 = x^2 + 4x - 32$

$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(-32)}}{2(1)}$ ✓ subs into correct formula

$x = -8 \quad \text{or} \quad x = 4$

$y = -1 \quad \text{or} \quad y = 2$ ✓ x-values

$(x\,;\,y) = (-8\,;\,-1) \text{ or } (4\,;\,2)$ ✓✓ y-values (6)

1.2.2	$4x - y = 4$ **OR** $y = 4x - 4$ **OR** $x = \frac{y+4}{4}$ **OR** $4x - y - 4 = 0$ **OR** $x = \frac{1}{4}y + 1$	✓✓ interchanges x and y (2)
1.3.1	$\sqrt{2p+5} = 0$ $2p + 5 = 0$ $2p = -5$ $p = -\frac{5}{2}$	✓ $2p + 5 = 0$ **or** $\sqrt{2p+5} = 0$ **or** $\frac{-2 \pm \sqrt{0}}{7}$ ✓ answer (2)
1.3.2	$2p + 5 < 0$ $p < -\frac{5}{2}$	✓ answer (1) **[21]**

QUESTION 2

2.1	$T_2 - T_1 = T_3 - T_2$ $2x - (3x+1) = (3x-7) - 2x$ $2x - 3x - 1 = 3x - 7 - 2x$ $-x - 1 = x - 7$ $-2x = -6$ $x = 3$ **OR** $T_2 = \frac{T_1 + T_3}{2}$ $2x = \frac{(3x+1)+(3x-7)}{2}$ $4x = 6x - 6$ $6 = 2x$ $x = 3$ **OR** $T_3 - T_1 = 2(T_2 - T_1)$ $(3x-7) - (3x+1) = 2(2x - (3x+1))$ $-8 = -2x - 2$ $2x = 6$ $x = 3$	✓ $T_2 - T_1 = T_3 - T_2$ or $2x - (3x+1) = (3x-7) - 2x$ ✓ answer (2) ✓ $T_2 = \frac{T_1 + T_3}{2}$ or $2x = \frac{(3x+1)+(3x-7)}{2}$ ✓ answer (2) ✓ $T_3 - T_1 = 2(T_2 - T_1)$ or $(3x-7) - (3x+1) = 2(2x - (3x+1))$ ✓ answer (2)
2.2.1	$T_n = a + (n-1)d$ $T_{11} = 10 + (11-1)(-4)$ $= -30$ **OR** 10; 6; 2; –2; –6; –10; –14; –18; –22; –26; –30 … $\therefore T_{11} = -30$	✓$d = -4$ ✓answer (2) ✓expands sequence ✓answer (2)

2.2.2

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

✓correct formula
✓substitution of a and d

$$-560 = \frac{n}{2}\left[2(10) + (n-1)(-4)\right]$$

✓subs $S_n = -560$

$$-1120 = -4n^2 + 24n$$

$$4n^2 - 24n - 1120 = 0$$

✓ $-4n^2 + 24n + 1120 = 0$ or $4n^2 - 24n - 1120 = 0$ or $n^2 - 6n - 280 = 0$

$$n^2 - 6n - 280 = 0$$

$$(n-20)(n+14) = 0$$

✓factors

$$n = 20 \quad \text{or} \quad -14$$

$\therefore n = 20$ only

✓ selects $n = 20$ only (6)

Note: if candidate substitutes into **incorrect formula**, award 0/6

OR

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

✓ correct formula

Note: if candidate writes **answer only**, award 1/6 marks

$$-560 = \frac{n}{2}\left[2(10) + (n-1)(-4)\right]$$

✓substitution of a and d
✓subs $S_n = -560$

$$-1120 = -4n^2 + 24n$$

$$4n^2 - 24n - 1120 = 0$$

✓ $4n^2 - 24n - 1120 = 0$ or $-4n^2 + 24n + 1120 = 0$ or $n^2 - 6n - 280 = 0$

$$n^2 - 6n - 280 = 0$$

$$n = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(-280)}}{2(1)}$$

✓subs into correct formula

$$n = 20 \quad \text{or} \quad -14$$

$\therefore n = 20$ only

✓ selects $n = 20$ only (6)

OR

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

✓ correct formula

$$-560 = \frac{n}{2}\left[2(10) + (n-1)(-4)\right]$$

✓substitution of a and d
✓subs $S_n = -560$

$$-560 = \frac{20n}{2} - \frac{4n^2}{2} + \frac{4n}{2}$$

$$2n^2 - 12n - 560 = 0$$

✓ $2n^2 - 12n - 560 = 0$ or $-2n^2 + 12n + 560 = 0$ or $n^2 - 6n - 280 = 0$

$$n^2 - 6n - 280 = 0$$

$$(n-20)(n+14) = 0$$

✓factors

$$n = 20 \quad \text{or} \quad -14$$

$\therefore n = 20$ only

✓ selects $n = 20$ only (6)

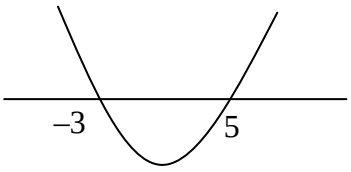
	OR $S_{11} = -110$ $\therefore n = 20$	✓ $S_{11} = -110$ ✓ sequence expanded ✓✓ series calculated ✓✓ answer (6) **[10]**

n	12	13	14	15	16	17	18	19	20
T_n	–34	–38	–42	–46	–50	–54	–58	–62	–66
S_n	–144	–182	–224	–270	–320	–374	–432	–494	–560

QUESTION 3

3.1.1	$T_n = ar^{n-1}$ $= 27\left(\frac{1}{3}\right)^{n-1}$ **Note:** The final answer can also be written as 3^{4-n} **or** $\left(\frac{1}{3}\right)^{n-4}$	✓ a = 27 and $r = \frac{1}{3}$ ✓ substitute into correct formula (2)
3.1.2	$-1 < r < 1$ or $\lvert r \rvert < 1$ **Note:** If candidate concludes series is not convergent, award 0 marks. **OR** The common ratio (r) is $\frac{1}{3}$ which is between –1 and 1. **OR** $-1 < \frac{1}{3} < 1$	✓ answer (1) ✓ answer (1) ✓ answer (1)
3.1.3	$S_\infty = \frac{a}{1-r}$ $= \frac{27}{1-\frac{1}{3}}$ $= \frac{81}{2}$ or 40,5 or 41 **Note:** If $r > 1$ or $r < -1$ is substituted then 0/2 marks.	✓ substitution ✓ answer (2)

QUESTION 1

1.1.1	$3x^2 - 5x = 2$ $3x^2 - 5x - 2 = 0$ $(3x+1)(x-2) = 0$ $x = -\frac{1}{3}$ or $x = 2$	✓ standard form ✓ factors ✓ both answers (3)
1.1.2	$x - \frac{2}{x} = 5$ $x^2 - 2 = 5x$ $x^2 - 5x - 2 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(-5) \pm \sqrt{25 - 4(1)(-2)}}{2(1)}$ $x = \frac{5 \pm \sqrt{33}}{2}$ $x = 5{,}37$ or $x = -0{,}37$	✓ standard form ✓ subs in correct formula ✓✓ answers (one for each answer) (4)
1.1.3	$(x+1)(x-3) > 12$ $x^2 - 2x - 3 > 12$ $x^2 - 2x - 15 > 0$ $(x-5)(x+3) > 0$ + 0 − 0 + (−3, 5) OR  $x < -3$ or $x > 5$	✓ multiplication ✓ factors ✓✓ answer (4)

1.2	$r + p = 2$ $r = 2 - p$ $6r + 5rp - 5p = 8$ $6(2 - p) + 5(2 - p)p - 5p = 8$ $12 - 6p + 10p - 5p^2 - 5p = 8$ $5p^2 + p - 4 = 0$ $(5p - 4)(p + 1) = 0$ $p = \frac{4}{5}$ *or* $p = -1$ $r = 2 - \left(\frac{4}{5}\right)$ *or* $r = 2 - (-1)$ $r = \frac{6}{5}$ $r = 3$ **OR** $r + p = 2$ $p = 2 - r$ $6r + 5rp - 5p = 8$ $6r + 5r(2 - r) - 5(2 - r) = 8$ $6r + 10r - 5r^2 - 10 + 5r = 8$ $5r^2 - 21r + 18 = 0$ $(5r - 6)(r - 3) = 0$ $r = \frac{6}{5}$ *or* $r = 3$ $p = 2 - \left(\frac{6}{5}\right)$ *or* $p = 2 - (3)$ $p = \frac{4}{5}$ $p = -1$	✓ $r = 2 - p$ ✓ substitution ✓ simplification ✓ factors ✓ *p*-answers ✓✓ *r*-answers (7) ✓ $p = 2 - r$ ✓ substitution ✓ standard form ✓ factors ✓ *r*-answers ✓✓ *p*-answers (7)
1.3	Let the shortest side be x Sides of the prism: x ; $2x$; $3x$ Volume = lbh $(x)(2x)(3x) = 3\,072$ $6x^3 = 3\,072$ $x^3 = 512$ $x = \sqrt[3]{512}$ $x = 8$	✓ let the shortest side be x ✓ x ; $2x$; $3x$ ✓ $(x)(2x)(3x) = 3\,072$ ✓ answer (4) **[22]**

QUESTION 2

2.1	$T_n = a + (n-1)d$ $173 = -7 + (n-1)(4)$ $173 = -7 + 4n - 4$ $4n = 184$ $n = 46$ **OR** $T_n = 4n - 11$ $173 = 4n - 11$ $4n = 184$ $n = 46$	✓ $d = 4$ ✓ $T_n = -7 + 4(n-1)$ ✓ answer (3) ✓✓ $T_n = 4n - 11$ ✓ answer (3)
2.2	$S_n = \frac{n}{2}[a + l]$ $= \frac{46}{2}[-7 + 173]$ $= 23[166]$ $= 3\,818$ **OR** $S_n = \frac{n}{2}[2a + (n-1)d]$ $= \frac{46}{2}[2(-7) + (45)(4)]$ $= 23[-14 + 180]$ $= 3\,818$	✓ subs of $n = 46$ ✓ subs of a and l into the correct formula ✓ answer (3) ✓ subs of $n = 46$ ✓ subs of a and d into the correct formula ✓ answer (3)
2.3	$\sum_{n=1}^{46}(4n - 11)$	✓ $n = 1$ ✓ top value = 46 ✓ $4n - 11$ (3) **[9]**

NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out version.
- Consistent Accuracy applies in all aspects of the marking memorandum.

QUESTION 1

1.1.1	$x(x+1)=6$ $x^2+x=6$ $x^2+x-6=0$ $(x+3)(x-2)=0$ $x=-3$ or 2 **OR** $x^2+x-6=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-1\pm\sqrt{1^2-4(1)(-6)}}{2(1)}$ $x=-3$ or 2	**Note:** Answers by inspection: award 3/3 marks **Note:** Answer only of $x=2$: award 1/3 marks **Note:** If candidate converts equation to linear: award 0/3 marks	✓ standard form ✓ factors ✓ answers (3) ✓ standard form ✓ substitution into correct formula ✓ answers (3)
1.1.2	$3x^2-4x=8$ $3x^2-4x-8=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-(-4)\pm\sqrt{(-4)^2-4(3)(-8)}}{2(3)}$ $=\frac{4\pm\sqrt{16+96}}{6}$ $=\frac{4\pm\sqrt{112}}{6}$ $=\frac{2\pm2\sqrt{7}}{3}$ $=2{,}43$ or $-1{,}10$	**Note:** If candidate uses incorrect formula: maximum 1/4 marks (for standard form) **Note:** Penalise 1 mark for inaccurate rounding off to ANY number of decimal places if candidate gives decimal answers. **Note:** If an error in subs and gets: $\frac{4\pm\sqrt{-80}}{6}$ and states "no solution": maximum 3/4 marks If doesn't conclude with "no solution": maximum 2/4 marks	✓ standard form ✓ substitution into correct formula ✓ $\sqrt{112}$ ✓ $\frac{4\pm\sqrt{112}}{6}$ or decimal answer (4)

OR

$3x^2 - 4x = 8$

$3x^2 - 4x - 8 = 0$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \dfrac{-(-4) \pm \sqrt{(-4)^2 - 4(3)(-8)}}{2(3)}$

$= 2{,}43 \text{ or } -1{,}10$

Note: Penalise 1 mark for inaccurate rounding off to ANY number of decimal places if candidate gives decimal answers

✓ standard form

✓ substitution into correct formula

✓ answer
✓ answer

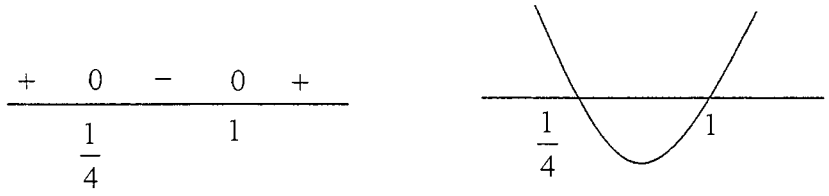
(4)

1.1.3

$4x^2 + 1 \geq 5x$

$4x^2 - 5x + 1 \geq 0$

$(4x - 1)(x - 1) \geq 0$



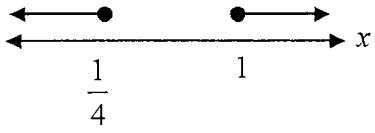
✓ factors

✓ both critical values of $\frac{1}{4}$ and 1

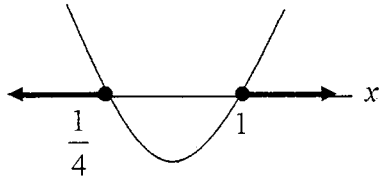
$x \leq \frac{1}{4}$ or $x \geq 1$ **OR** $\left(-\infty; \frac{1}{4}\right] \cup [1; \infty)$

✓ or **OR** ∪
✓ answer

OR



OR



Note: If candidate gives either of these correct graphical solutions but writes down the incorrect intervals or uses AND: max 3/4 marks

(4)

NOTES:

If a candidate gives an answer of $1 \leq x \leq \frac{1}{4}$ then max 3/4 marks.

If a candidate gives an answer of $\frac{1}{4} \leq x \leq 1$ then max 2/4 marks.

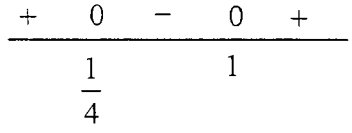
If a candidate gives an answer of $x \leq \frac{1}{4}$ **and** $x \geq 1$ then max 3/4 marks.

If the candidate leaves out the equality of the notation then penalty of 1 mark.

If a candidate gives an answer of $x \leq \frac{1}{4}$; $x \geq 1$ then max 3/4 marks.

If candidate gives $x \geq \frac{1}{4}$ and/or $x \geq 1$, BREAKDOWN: max 2/4 marks.

If candidate gives : award 3/4 marks



1.2.1

$x^2 + 5xy + 6y^2 = 0$

$(x+3y)(x+2y) = 0$

$x + 3y = 0 \qquad x + 2y = 0$

$x = -3y \quad \text{OR} \quad x = -2y$

$\frac{x}{y} = -3 \qquad \frac{x}{y} = -2$

Note:
If a candidate gives
$-\frac{x}{y} = 3$ or $-\frac{x}{y} = 2$
award 2/3 marks

✓ factors

✓✓ answers (3)

OR

Let $k = \frac{x}{y}$

$x^2 + 5xy + 6y^2 = 0$

$\left(\frac{x}{y}\right)^2 + 5\left(\frac{x}{y}\right) + 6 = 0$

✓ factors

$k^2 + 5k + 6 = 0$

$(k+3)(k+2) = 0$

$k = -3 \text{ or } k = -2$

$\frac{x}{y} = -3 \text{ or } \frac{x}{y} = -2$

✓✓ answers (3)

OR

$x^2 + 5xy + 6y^2 = 0$

$x = \frac{-5y \pm \sqrt{(5y)^2 - 4(1)(6y^2)}}{2(1)}$

$x = \frac{-5y \pm \sqrt{y^2}}{2}$

✓ substitutes correctly into correct formula

$x = \frac{-5y \pm y}{2}$

$x = -3y \qquad x = -2y$

$\frac{x}{y} = -3 \quad \text{or} \quad \frac{x}{y} = -2$

✓✓ answers (3)

OR

$x^2 + 5xy + 6y^2 = 0$

$x^2 + 5xy + \left(\frac{5}{2}y\right)^2 = -6y^2 + \left(\frac{5}{2}y\right)^2$

$\left(x + \frac{5}{2}y\right)^2 = \frac{1}{4}y^2$

✓ completing the square

$x + \frac{5}{2}y = \pm\frac{1}{2}y$

$x = -\frac{5}{2}y \pm \frac{1}{2}y$

	$x=-3y \quad x=-2y$ $\frac{x}{y}=-3$ or $\frac{x}{y}=-2$	✓✓ answers (3)
	OR	
	Let $k=\frac{x}{y}$ $x=ky$ $x^2+5xy+6y^2=0$ $(ky)^2+5y(ky)+6y^2=0$ $k^2y^2+5y^2k+6y^2=0$ $y^2(k^2+5k+6)=0$ $(k^2+5k+6)=0$ $(k+3)(k+2)=0$ $k=-3$ or $k=-2$ $\frac{x}{y}=-3$ or $\frac{x}{y}=-2$	✓ factors ✓✓ answers (3)
	Note: $(x;y) = (0;0)$ is also a solution, but in this case $\frac{x}{y}$ is undefined	
	OR	
	Let $y=1$, $x^2+5x+6=0$ $(x+2)(x+3)=0$ $x=-2$ or $x=-3$ $\frac{x}{y}=-2$ or $\frac{x}{y}=-3$	✓ factors ✓✓ answers (3)
1.2.2	$x+y=8 \quad x+y=8$ $-3y+y=8 \quad -2y+y=8$ $-2y=8$ OR $-y=8$ $y=-4 \quad y=-8$ $x=12 \quad x=16$	✓ substitution $x=-3y$ ✓ subs $x=-2y$ ✓✓ y values ✓ both x values correct (5)
	OR	
	$\frac{8-y}{y}=-3$ OR $\frac{8-y}{y}=-2$ $8-y=-3y \quad 8-y=-2y$ $8=-2y \quad 8=-y$ $y=-4 \quad y=-8$ $x=12 \quad x=16$	✓ $x=8-y$ ✓ substitution ✓✓ y values ✓ both correct x values (5)

OR

$x+y=8$

$y=8-x$

$\frac{x}{8-x}=-3$ OR $\frac{x}{8-x}=-2$

$x=-3(8-x)$ $x=-2(8-x)$

$x=-24+3x$ $x=-16+2x$

$-2x=-24$ $-x=-16$

$x=12$ $x=16$

$y=-4$ $y=-8$

✓ $y=8-x$

✓ substitution

✓✓ x values correct

✓ both y values correct

(5)

OR

$(x+2y)(x+3y)=0$

$x+y=8$

$x=8-y$

$(y+8)(2y+8)=0$

$y=-8$ or $y=-4$

$x=16$ $x=12$

✓ $x=8-y$

✓ substitution

✓✓ y values correct

✓ both x values correct

(5)

OR

$x=8-y$

$(8-y)^2+5(8-y)y+6y^2=0$

$64-16y+y^2+40y-5y^2+6y^2=0$

$2y^2+24y+64=0$

$y^2+12y+32=0$

$(y+8)(y+4)=0$

$y=-8$ or $y=-4$

$x=16$ $x=12$

✓ $x=8-y$

✓ substitution

✓factors

✓ both y values correct

✓ both x values correct

(5)

OR

OR

$x = 8 - y$

$(8-y)^2 + 5(8-y)y + 6y^2 = 0$

$64 - 16y + y^2 + 40y - 5y^2 + 6y^2 = 0$

$2y^2 + 24y + 64 = 0$

$y^2 + 12y + 32 = 0$

$y = \dfrac{-12 \pm \sqrt{12^2 - 4(1)(32)}}{2(1)}$

$= \dfrac{-12 \pm \sqrt{16}}{2}$

$y = -8$ or $y = -4$

$x = 16$ $\quad$ $x = 12$

Note:
If a candidate uses the formula and replaces x for y and then answers are swapped: maximum 4/5 marks

✓ $x = 8 - y$
✓ substitution

✓ substitutes into correct formula

✓ both y values correct
✓ both x values correct

(5)

OR

$y = 8 - x$

$x^2 + 5x(8-x) + 6(8-x)^2 = 0$

$x^2 + 40x - 5x^2 + 6(64 - 16x + x^2) = 0$

$2x^2 - 56x + 384 = 0$

$x^2 - 28x + 192 = 0$

$(x-16)(x-12) = 0$

$x = 12$ $\quad$ $x = 16$

$y = -4$ or $y = -8$

✓ $y = 8 - x$
✓ substitution

✓factors

✓ both x values correct
✓ both y values correct

(5)

OR

$y = 8 - x$

$x^2 + 5x(8-x) + 6(8-x)^2 = 0$

$x^2 + 40x - 5x^2 + 6(64 - 16x + x^2) = 0$

$2x^2 - 56x + 384 = 0$

$x^2 - 28x + 192 = 0$

$x = \dfrac{-(-28) \pm \sqrt{(-28)^2 - 4(1)(192)}}{2(1)}$

$= \dfrac{28 \pm \sqrt{416}}{2}$

$x = 12$ $\quad$ $x = 16$

$y = -4$ or $y = -8$

✓ $y = 8 - x$
✓ substitution

✓ substitutes into correct formula
✓ both x values correct
✓ both correct y values

(5)
[19]

QUESTION 2

2.1.1	$x-4=32-x$ $2x=36$ $x=18$ **OR** $a=4$ $a+2d=32$ $2d=28$ $d=14$ $x=14+4$ $x=18$ **OR** $x=\frac{4+32}{2}=18$	**Note:** If answer only: award 2/2 marks **Note:** If candidate writes $x-4 \quad 32-x$ only (i.e. omits equality) : 0/2 marks	✓ $T_2-T_1=T_3-T_2$ ✓ answer (2) ✓ $a+2d=32$ and $a=4$ ✓ answer (2) ✓ substitutes correctly into arithmetic mean formula i.e. $\frac{4+32}{2}$ ✓ answers (2)
2.1.2	$\frac{x}{4}=\frac{32}{x}$ $x^2=128$ $x=\pm\sqrt{128}$ $x=\pm 8\sqrt{2}$ OR $x=\pm 11{,}31$ OR $x=\pm 2^{\frac{7}{2}}$ **OR** $a=4$ $r=\frac{x}{4}$ $ar^2=4\left(\frac{x}{4}\right)^2$ $32=4\left(\frac{x}{4}\right)^2$ $x^2=128$ $x=\pm\sqrt{128}$ $x=\pm 8\sqrt{2}$ or $x=\pm 11{,}31$ or $x=\pm 2^{\frac{7}{2}}$ **OR** $x=\pm\sqrt{4\times 32}$ $x=\pm\sqrt{128}$ or $x=\pm 8\sqrt{2}$ or $x=\pm 11{,}31$ or $x=\pm 2^{\frac{7}{2}}$	**Note:** If candidate writes $\frac{x}{4} \quad \frac{32}{x}$ only (i.e. omits equality) : 0/2 marks **Note:** If only $x=\sqrt{128}$ then penalty 1 mark	✓ $\frac{T_2}{T_1}=\frac{T_3}{T_2}$ ✓ $x^2=128$ ✓ both answers (surd or decimal or exponential form) (3) ✓ $32=4\left(\frac{x}{4}\right)^2$ ✓ $x^2=128$ ✓ both answers (surd or decimal or exponential form) (3) ✓✓ substitutes correctly into geometric mean formula i.e. $\pm\sqrt{4\times 32}$ ✓ both answers (surd or decimal or exponential form) (3)

2.2

$$P=\sum_{k=1}^{13}3^{k-5}$$
$$=3^{1-5}+3^{2-5}+3^{3-5}+\ldots+3^{13-5}$$
$$=3^{-4}+3^{-3}+3^{-2}+\ldots+3^{8}$$
$$=\frac{3^{-4}\left(3^{13}-1\right)}{3-1}$$
$$=9841{,}49 \quad \text{or} \quad 9841\frac{40}{81} \quad \text{or} \quad \frac{797161}{81}$$

Note:
Correct answer only:
1/4 marks only

✓ $a=3^{-4}$ or $\frac{1}{81}$
✓ $r=3$
✓ subs into correct formula
✓ answer
(4)

OR

$$P=\sum_{k=1}^{13}3^{k-5}$$
$$=3^{1-5}+3^{2-5}+3^{3-5}+\ldots+3^{13-5}$$
$$=3^{-4}+3^{-3}+3^{-2}+\ldots+3^{8}$$
$$=\frac{1}{81}+\frac{1}{27}+\frac{1}{9}+\ldots+6561$$
$$=9841{,}49 \quad \text{or} \quad 9841\frac{40}{81} \quad \text{or} \quad \frac{797161}{81}$$

Note: If the candidate rounds off and gets 9841,46 (i.e. correct to one decimal place): DO NOT penalise for the rounding off.

✓✓ expand the sum
✓ 13 terms in expansion
✓ answer
(4)

2.3

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

✓writing out S_n
✓ "reversing" S_n
✓expressing $2S_n$
✓ grouping to get $2S_n=n[2a+(n-1)d]$
(4)

OR

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

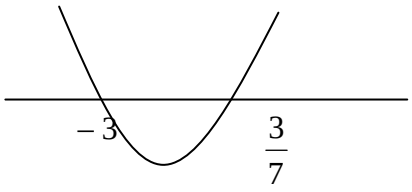
Note:
If a candidate uses a circular argument (eg $S_{n+1}=S_n+T_n$):
max 1/4 marks
(for writing out S_n)

✓writing out S_n
✓ "reversing" S_n
✓expressing $2S_n$
✓ grouping to get $2S_n=n[a+a+(n-1)d]$
(4)

Note: If a candidate uses a specific linear sequence, then NO marks.

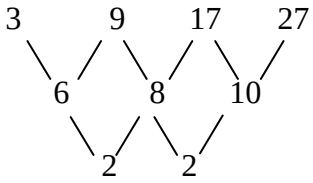
[13]

QUESTION 1

1.1.1	$x^2 - x = 12$ $x^2 - x - 12 = 0$ $(x-4)(x+3) = 0$ $x = 4$ or $x = -3$ **OR** $x(x-1) = 12$ $4(3) = 12$ $(-3)(-4) = 12$ By inspection $x = 4$ or $x = -3$	✓ standard form ✓ factors ✓ answers (3) ✓ factors ✓✓ answers (3)
1.1.2	$2x^2 + 3x - 7 = 0$ $x = \frac{-3 \pm \sqrt{(3)^2 - 4(2)(-7)}}{2(2)}$ $= \frac{-3 \pm \sqrt{65}}{4}$ $x = 1{,}27$ or $x = -2{,}77$	✓ substitution into correct formula ✓ 65 ✓✓ answers (4)
1.1.3	$7x^2 + 18x - 9 > 0$ $(7x-3)(x+3) > 0$ + 0 − 0 + -3 $\frac{3}{7}$  $x < -3$ or $x > \frac{3}{7}$ **OR** $x \in (-\infty ; -3) \cup \left(\frac{3}{7} ; \infty\right)$	✓ factors ✓ $\frac{3}{7}$ *and* -3 ✓ correct intervals (4)
1.2	$2x - y = 7$ $y = 2x - 7$ Substitute $y = 2x - 7$ into $x^2 + xy = 21 - y^2$ $x^2 + x(2x-7) = 21 - (2x-7)^2$ $x^2 + 2x^2 - 7x = 21 - 4x^2 + 28x - 49$ $7x^2 - 35x + 28 = 0$ $x^2 - 5x + 4 = 0$ $(x-4)(x-1) = 0$ $x = 4$ or $x = 1$ $y = 1$ or $y = -5$	✓ $y = 2x - 7$ ✓ substitution ✓ multiplication ✓standard form ✓ factors ✓ x-answers ✓ y-answers (7)

	OR $2x - y = 7$ $x = \frac{7+y}{2}$ Substitute $x = \frac{7+y}{2}$ into $x^2 + xy = 21 - y^2$ $\left(\frac{7+y}{2}\right)^2 + \left(\frac{7+y}{2}\right)y = 21 - y^2$ $\frac{49+14y+y^2}{4} + \frac{7y+y^2}{2} = 21 - y^2$ $49 + 14y + y^2 + 2(7y + y^2) = 84 - 4y^2$ $49 + 14y + y^2 + 14y + 2y^2 = 84 - 4y^2$ $7y^2 + 28y - 35 = 0$ $y^2 + 4y - 5 = 0$ $(y + 5)(y - 1) = 0$ $y = -5$ or $y = 1$ $x = 1$ $x = 4$	✓ $x = \frac{7+y}{2}$ ✓ substitution ✓ multiplication ✓standard form ✓ factors ✓ x-answers ✓ y-answers (7)
1.3	$\left(\sqrt[5]{\sqrt{35} + \sqrt{3}}\right)\left(\sqrt[5]{\sqrt{35} - \sqrt{3}}\right)$ $= \sqrt[5]{(\sqrt{35} + \sqrt{3})(\sqrt{35} - \sqrt{3})}$ $= \sqrt[5]{35 - 3}$ $= \sqrt[5]{32}$ $= 2$	✓ $\sqrt[5]{(\sqrt{35} + \sqrt{3})(\sqrt{35} - \sqrt{3})}$ ✓ $\sqrt[5]{35 - 3}$ ✓ answer (3) **[21]**

QUESTION 2

2.1	39	✓ answer (1)
2.2	 Let $T_n = an^2 + bn + c$ Then $2a = 2$ $a = 1$ $3a + b = 6$ $3(1) + b = 6$ $b = 3$ $a + b + c = 3$ $1 + 3 + c = 3$ $c = -1$ $T_n = n^2 + 3n - 1$ **OR** $2a = 2$ $a = 1$ $c = 3 - 4 = -1$ $T_n = n^2 + bn - 1$ $3 = (1)^2 + b(1) - 1$ (using $T_1 = 3$) $b = 3$ $T_n = n^2 + 3n - 1$	✓ formula ✓ $a = 1$ ✓ $b = 3$ ✓ $c = -1$ (4) ✓ $a = 1$ ✓ $c = -1$ ✓ formula ✓ $b = 3$ (4)
2.3	$n^2 + 3n - 1 > 269$ $n^2 + 3n - 270 > 0$ $(n + 18)(n - 15) > 0$ The first value of n is 16 The term is $16^2 + 3(16) - 1 = 303$	✓ $n^2 + 3n - 1 > 269$ ✓ factors ✓ $n = 16$ ✓ answer (4) **[9]**

- Consistent Accuracy will apply as a general rule.
- If a candidate does a question twice and does not delete either, mark the FIRST attempt.
- If a candidate does a question, crosses it out and does not re-do it, mark the deleted attempt.

QUESTION 1

1.1.1

$x(x-1)=30$

$x^2-x=30$

$x^2-x-30=0$

$(x-6)(x+5)=0$

$x=6$ or $x=-5$

If implied as equation : No penalty

If there is no equals sign or the equation is not = 0: No penalty

If x = 6 is answer by inspection : 1 / 3

Both correct answers no calculation : 1 / 3

✓ simplification (multiplying out brackets)

✓ factors

✓ both answers

(3)

OR

$x(x-1)=30$

$x^2-x=30$

$x^2-x-30=0$

$$x=\frac{-(-1)\pm\sqrt{(-1)^2-4(1)(-30)}}{2(1)}$$

$$=\frac{1\pm\sqrt{121}}{2}$$

$$=\frac{1\pm 11}{2}$$

$x=6$ or $x=-5$

✓ simplification (multiplying out brackets)

✓ substitution into formula

✓ both answers *(ca)*

(3)

1.1.2

$3x^2-5x+1=0$

$a=3 \quad b=-5 \quad c=1$

$$x=\frac{-(-5)\pm\sqrt{25-4(3)(1)}}{2(3)}$$

$$=\frac{5\pm\sqrt{13}}{6}$$

$x=1{,}4$ or $x=0{,}2$

NOTE:
Penalty 1 for incorrect rounding off in either answer

Using calculator incorrectly: Max: 2 / 4
Answers will be x = 5,6 or 4,4

Incorrect formula: max 1 / 4

If $x=\frac{5\pm\sqrt{37}}{6}$ then CA applies
x = 1,8 and – 0,2 : Max 3 / 4

Correct answer only: 2 / 4

If factorising: 0 / 4

✓ substitution into correct formula

✓ $\sqrt{13}$

✓✓ values of x
(CA with formula)

(4)

OR

If $x=\frac{5\pm\sqrt{13}}{6}$ only, then 2 / 4

If $x=5\pm\frac{\sqrt{13}}{6}$ only, then 1 / 4

- Consistent Accuracy will apply as a general rule.
- If a candidate does a question twice and does not delete either, mark the FIRST attempt.
- If a candidate does a question, crosses it out and does not re-do it, mark the deleted attempt.

1.1.2 contd

$3x^2 - 5x + 1 = 0$

$x^2 - \frac{5}{3}x = -\frac{1}{3}$

$x^2 - \frac{5}{3}x + \frac{25}{36} = -\frac{1}{3} + \frac{25}{36}$

$\left(x - \frac{5}{6}\right)^2 = \frac{13}{36}$

$x - \frac{5}{6} = \frac{\pm\sqrt{13}}{6}$

$x = \frac{5 \pm \sqrt{13}}{6}$

$x = 1{,}4 \quad \text{or} \quad x = 0{,}2$

✓ correct method of completing the square

✓ $\sqrt{13}$

✓✓ values of x
(CA with formula)

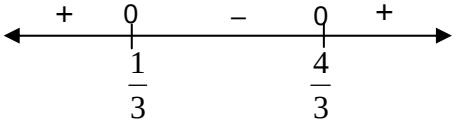
(4)

1.1.3

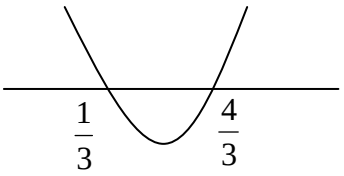
$-9x^2 + 15x - 4 < 0$

$9x^2 - 15x + 4 > 0$

$(3x - 4)(3x - 1) > 0$



OR



$x < \frac{1}{3}$ or $x > \frac{4}{3}$

Answer can be given as: $x \in \left(-\infty ; \frac{1}{3}\right) \cup \left(\frac{4}{3} ; \infty\right)$

✓ factors
✓ correct inequality sign

✓ $\frac{1}{3}$; $\frac{4}{3}$
✓ answer

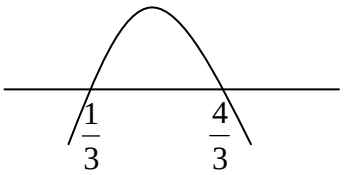
(4)

OR

$-9x^2 + 15x - 4 < 0$

$(-3x + 4)(3x - 1) < 0$

$x < \frac{1}{3}$ or $x > \frac{4}{3}$



✓ factors
✓ correct inequality sign

✓ $\frac{1}{3}$; $\frac{4}{3}$
✓ answer

(4)

NOTE:

If stop at factorisation: 2 / 4

If incorrect factors: CA applies 3 / 4

If answer : $\frac{1}{3} < x < \frac{4}{3}$ then 3 / 4

If $x < \frac{1}{3}$ AND $x > \frac{4}{3}$ then 3 / 4

- Consistent Accuracy will apply as a general rule.
- If a candidate does a question twice and does not delete either, mark the FIRST attempt.
- If a candidate does a question, crosses it out and does not re-do it, mark the deleted attempt.

1.2	Substitute $x = y + 3$ in $x^2 - xy - 2y^2 - 7 = 0$ $(y+3)^2 - y(y+3) - 2y^2 - 7 = 0$ $y^2 + 6y + 9 - y^2 - 3y - 2y^2 - 7 = 0$ $2y^2 - 3y - 2 = 0$ $(2y+1)(y-2) = 0$ $y = -\frac{1}{2}$ or $y = 2$ $x = 2\frac{1}{2}$ or $x = 5$ **OR** $y = x - 3$ $x^2 - x(x-3) - 2(x-3)^2 - 7 = 0$ $x^2 - x^2 + 3x - 2(x^2 - 6x + 9) - 7 = 0$ $0 = 2x^2 - 15x + 25$ $0 = (2x-5)(x-5)$ $x = 2\frac{1}{2}$ or $x = 5$ $y = -\frac{1}{2}$ or $y = 2$ **NOTE:** If the equation is changed to a linear equation, then max 2 / 5 There are no penalties for not putting = 0.	✓ substitution ✓ standard form ✓ factors ✓ both y-values ✓ both x-values (5) ✓ substitution ✓ standard form ✓ factors ✓ both x-values ✓ both y-values (5)
1.3	$\frac{10^{\frac{2009}{2}}}{10^{\frac{2011}{2}} - 10^{\frac{2007}{2}}}$ $= \frac{10^{\frac{2009}{2}}}{10^{\frac{2007}{2}}(100-1)}$ $= \frac{10}{99}$ **OR**	✓ convert to indices ✓ common factor ✓ answer (3)

- Consistent Accuracy will apply as a general rule.
- If a candidate does a question twice and does not delete either, mark the FIRST attempt.
- If a candidate does a question, crosses it out and does not re-do it, mark the deleted attempt.

1.3 contd	$\frac{10^{1004}\sqrt{10}}{10^{1005}\sqrt{10}-10^{1003}\sqrt{10}}$ $=\frac{10^{1004}\sqrt{10}}{\sqrt{10}(10^{1005}-10^{1003})}$ $=\frac{10^{1004}}{10^{1003}(100-1)}$ $=\frac{10}{99}$	✓ convert to indices ✓ common factor ✓ answer (3)
	OR	
	$\frac{\sqrt{10^{2009}}}{\sqrt{10^{2009}.10^{2}}-\sqrt{10^{2009}.10^{-2}}}$ $=\frac{\sqrt{10^{2009}}}{\sqrt{10^{2009}}(10-10^{-1})}$ $=\frac{1}{10-\frac{1}{10}}$ $=\frac{1}{\frac{99}{10}}$ $=\frac{10}{99}$	✓ convert to indices ✓ common factor ✓ answer (3)
	OR	
	$\frac{\sqrt{10^{2000}}\sqrt{10^{9}}}{\sqrt{10^{2000}.10^{11}}-\sqrt{10^{2000}.10^{7}}}$ $=\frac{\sqrt{10^{2000}}\sqrt{10^{9}}}{\sqrt{10^{2000}}\left(\sqrt{10^{11}}-\sqrt{10^{7}}\right)}$ $=\frac{\sqrt{10^{9}}}{\sqrt{10^{11}}-\sqrt{10^{7}}}$ $=\frac{10\sqrt{10^{7}}}{100\sqrt{10^{7}}-\sqrt{10^{7}}}$ $=\frac{10\sqrt{10^{7}}}{\sqrt{10^{7}}(100-1)}$ $=\frac{10}{99}$	✓ convert to indices ✓ common factor ✓ answer (3)
	OR	

- Consistent Accuracy will apply as a general rule.
- If a candidate does a question twice and does not delete either, mark the FIRST attempt.
- If a candidate does a question, crosses it out and does not re-do it, mark the deleted attempt.

	$\frac{\sqrt{10^{2007}}.\sqrt{10^2}}{\sqrt{10^{2007}.10^4}-\sqrt{10^{2007}}}$ $=\frac{10\sqrt{10^{2007}}}{\sqrt{10^{2007}}(\sqrt{10^4}-1)}$ $=\frac{10}{100-1}$ $=\frac{10}{99}$ **OR** Let $x = 2009$ $\frac{\sqrt{10^x}}{\sqrt{10^{x+2}}-\sqrt{10^{x-2}}}$ $=\frac{10^{\frac{x}{2}}}{10^{\frac{x}{2}}.10-10^{\frac{x}{2}}.10^{-1}}$ $=\frac{10^{\frac{x}{2}}}{10^{\frac{x}{2}}\left(10-10^{-1}\right)}$ $=\frac{1}{10-\frac{1}{10}}$ $=\frac{1}{\frac{99}{10}}$ $=\frac{10}{99}$	✓ convert to indices ✓ common factor ✓ answer (3) ✓ convert to indices ✓ common factor ✓ answer (3)
1.4	$\left(1+\sqrt{2x^2}\right)^2-\sqrt{8x^2}$ $=1+2\sqrt{2x^2}+2x^2-\sqrt{4}.\sqrt{2x^2}$ $=1+2\sqrt{2x^2}+2x^2-2\sqrt{2x^2}$ $=1+2x^2$ **OR** $\left(1+\sqrt{2x^2}\right)^2-\sqrt{8x^2}$ $=1+\sqrt{8x^2}+2x^2-\sqrt{8x^2}$ $=1+2\sqrt{2x^2}+2x^2-2\sqrt{2x^2}$ $=1+2x^2$	✓ expansion / multiplication $1+2\sqrt{2x^2}+2x^2$ ✓ $\sqrt{8x^2}=2\sqrt{2x^2}$ ✓ answer (3) ✓ expansion / multiplication $1+\sqrt{8x^2}+2x^2$ ✓ $\sqrt{8x^2}=2\sqrt{2x^2}$ ✓ answer (3)

- Consistent Accuracy will apply as a general rule.
- If a candidate does a question twice and does not delete either, mark the FIRST attempt.
- If a candidate does a question, crosses it out and does not re-do it, mark the deleted attempt.

1.4 contd	**OR** $\left(1+\sqrt{2x^2}\right)^2-\sqrt{8x^2}$ $=1+2\sqrt{2}x+2x^2-2\sqrt{2}x \quad \text{or} \quad =1-2\sqrt{2}x+2x^2+2\sqrt{2}x$ $=1+2x^2$ **Note**: $\sqrt{x^2}=x$ if $x>0$ and $-x$ if $x<0$	✓expansion / multiplication ✓simplification ✓ answer (3)
	OR $\left(1+\sqrt{2x^2}\right)^2-\sqrt{8x^2}$ $=\left(1+(2x^2)^{\frac{1}{2}}\right)^2-8^{\frac{1}{2}}x$ $=1+2.(2x^2)^{\frac{1}{2}}+2x^2-8^{\frac{1}{2}}x$ $=1+2.2^{\frac{1}{2}}x+2x^2-8^{\frac{1}{2}}x$ $=1+8^{\frac{1}{2}}x+2x^2-8^{\frac{1}{2}}x$ $=1+2x^2$ **Note:** $\sqrt{x^2}=x$ if $x>0$ and $-x$ if $x<0$	✓expansion / multiplication $1+2.(2x^2)^{\frac{1}{2}}+2x^2$ ✓simplification ✓ answer (3)
	OR Let $2x^2=y$ $\left(1+\sqrt{2x^2}\right)^2-\sqrt{8x^2}$ $=(1+\sqrt{y})^2-\sqrt{4y}$ $=1+2\sqrt{y}+y-2\sqrt{y}$ $=1+y$ $=1+2x^2$	**[22]**

- Consistent Accuracy will apply as a general rule.
- If a candidate does a question twice and does not delete either, mark the FIRST attempt.
- If a candidate does a question, crosses it out and does not re-do it, mark the deleted attempt.

QUESTION 2

2.1.1	$T_n = 4n+1$ **OR** $T_n = 5+(n-1)(4)$ $= 4n+1$ **NOTE**: If $T_n = 5+(n-1)(4)$ then full marks	✓✓✓ Answer only (3) ✓ $d = 4$ ✓ substitution ✓ answer (3)
2.1.2	$T_n = 5(25)^{n-1}$	✓ $r = 25$ ✓ answer (2)
2.2	The sequence is 1 ; 1 + d ; 1 + 2d ; 1 + 3d; …. (AP) and 1 ; r ; r^2 ; r^3 ; …. (GP) $\therefore 1+d = r$ and $d = r-1$ But $1+2d = r^2$ $1+2(r-1) = r^2$ $r^2-2r+1 = 0$ $(r-1)^2 = 0$ $r = 1$ OR $r^2 = 1+2d$ $(1+d)^2 = 1+2d$ $1+2d+d^2 = 1+2d$ $d^2 = 0$ $d = 0$ $r = 1$ $\therefore d = 0$ $\therefore$ the one and only such sequence is 1 ; 1; 1 ; ….. Nomsa is correct. **OR** $T_1 = 1$ Let the sequence be 1 ; a ; b ; ... Geometric: $r = \frac{a}{1} = \frac{b}{a}$ $a^2 = b$ Arithmetic: $d = a-1 = b-a$ $2a-1 = b$ $2a-1 = a^2$ $0 = a^2-2a+1$ $0 = (a-1)^2$ $a = 1$ $b = 1$ Sequence is 1 ; 1 ; 1 ; ... Nomsa is correct If: Sequence is 1 ; 1 ; 1 ; 1 ; 1 ; 1 ; ... Then $d = 0$ $r = 1$ Therefore only one sequence exists. Nomsa is correct Max 3 / 5 If the candidate only gives Sequence is 1 ; 1 ; 1 ; 1 ; 1 ; 1 ; ... then 2 / 5 If $ar^{n-1} = a + (n-1)d$ only then 1 / 5	✓ $1+d = r$ ✓ $1+2d = r^2$ ✓ $r = 1$ ✓ $d = 0$ ✓reason (5) ✓ Setting up sequence ✓ $a^2 = b$ ✓ $b = 2a-1$ ✓ $a = 1$ ✓$b = 1$ (5) **[10]**