DBE

MATHEMATICS

PAST PAPER BOOKLET 2020

Past Paper Memos
By Topic

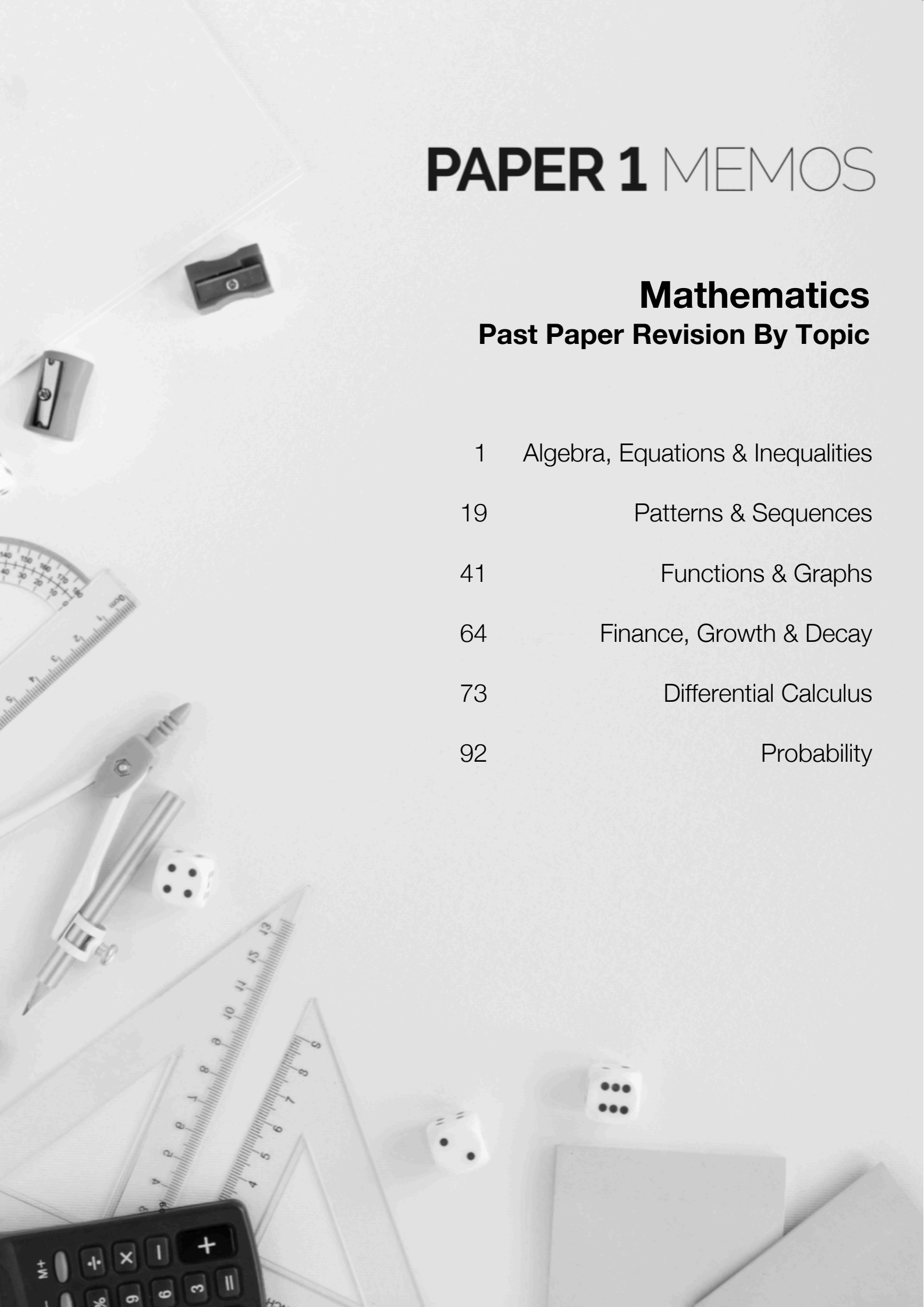
PAPER 1

AngloAmerican PLATINUM

XLEducation

PAPER 1 MEMOS

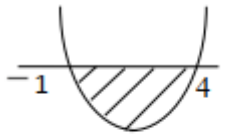
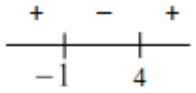
Mathematics
Past Paper Revision By Topic



Question 1 **November 2014**

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

0	$4.2^x + 2^x = 20$ $5.2^x = 20$ $2^x = 4 = 2^2$ $\therefore x = 2$	✓ $5.2^x = 20$ ✓ $2^x = 4$ ✓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)
	$y = \frac{x-3}{2}$ $3x^2 - 5x\left(\frac{x-3}{2}\right) = 24 + 16\left(\frac{x-3}{2}\right)$ $3x^2 - \frac{5x^2 - 15x}{2} = 24 + \frac{16x - 48}{2}$ $\times 2 : 6x^2 - 5x^2 + 15x = 48 + 16x - 48$ $x^2 - x = 0$ $x(x-1) = 0$ $x = 0$ *or* $x = 1$ $y = -\frac{3}{2}$ *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***  $-1<x<4$ or $x\in(-1;4)$	✓ 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 1 **Feb March 2015**

1.1.1	$(x+4)(x-5)=0$ $\therefore x=-4$ or $x=5$	✓ factors/*faktore* ✓answers/*antwoorde* (2)
1.1.2	$2x^2-11x+7=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-(-11)\pm\sqrt{(-11)^2-4(2)(7)}}{2(2)}$ $=$ 4,77 or 0,73 **OR/*OF***	✓ substitution into correct formula/*substitusie* in korrekte formule ✓4,77 ✓0,73 (3)

$2x^2 - 11x + 7 = 0$

$x^2 - \frac{11}{2}x + \frac{7}{2} = 0$

$x^2 - \frac{11}{2}x + \left(\frac{1}{2}.\frac{11}{2}\right)^2 + \frac{7}{2} - \left(\frac{1}{2}.\frac{11}{2}\right)^2 = 0$

✓ correct completion of the square/*korrekte voltooiing van die vierkant*

$\left(x - \frac{11}{4}\right)^2 + \frac{7}{2} - \frac{121}{16} = 0$

$\left(x - \frac{11}{4}\right)^2 = \frac{121 - 56}{16}$

$x - \frac{11}{4} = \pm\sqrt{\frac{65}{16}}$

$\therefore x = \frac{11}{4} + \frac{\sqrt{65}}{4}$ or $x = \frac{11}{4} - \frac{\sqrt{65}}{4}$

$x = 4{,}77$ $x = 0{,}73$

✓4,77
✓0,73

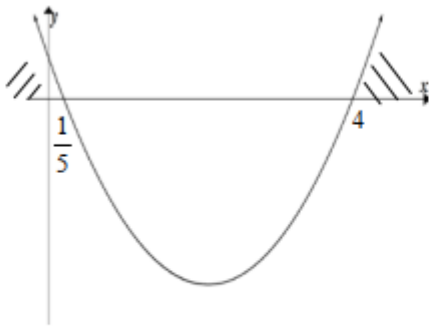
(3)

1.1.3

$5x^2 - 21x + 4 > 0$

$(5x - 1)(x - 4) > 0$

$x < \frac{1}{5}$ or/*of* $x > 4$



✓ 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.*

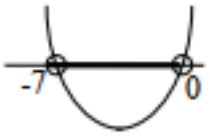
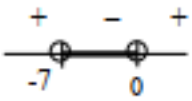
(4)

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 1 **November 2015**

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)

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

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

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

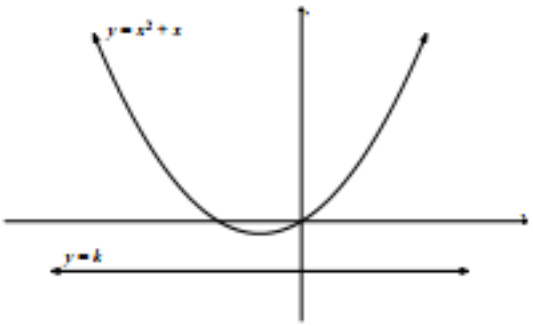
$$k < \frac{-1}{4}$$

✓$k + \frac{1}{4} < 0$
✓$k < \frac{-1}{4}$

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 $\left(\frac{-1}{2}; \frac{-1}{4}\right)$

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

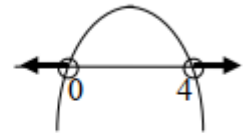
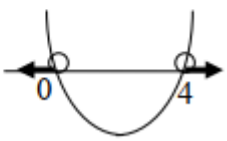
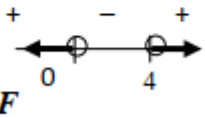
$x^2 + x = k$ does not have real roots when the line $y = k$ does not intersect $y = x^2 + x$.
$x^2 + x = k$ *het geen reële wortels as die lyn* $y = k$ *nie met* $y = x^2 + x$ *sny nie.*

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

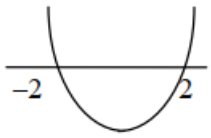
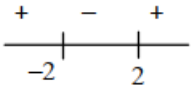
✓$k < \frac{-1}{4}$

(4)
[26]

Question 1 — Feb March 2016

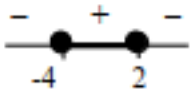
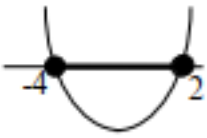
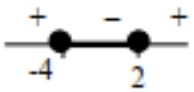
1.1.1	$x^2 - x - 12 = 0$ $(x-4)(x+3) = 0$ $x = 4$ or $x = -3$ **OR/*OF*** $x^2 - x - 12 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-12)}}{2(1)}$ $= 4$ or -3	✓factors ✓✓answers (3) ✓ substitution into formula ✓✓answers (3)
1.1.2	$x(x+3) - 1 = 0$ $x^2 + 3x - 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-3 \pm \sqrt{3^2 - 4(1)(-1)}}{2(1)}$ $= \frac{-3 \pm \sqrt{13}}{2}$	✓standard form ✓substitution into correct formula ✓answer (3)
1.1.3	$x(4-x) < 0$ $x < 0$ or $x > 4$ **OR/*OF*** $x(4-x) < 0$ $x(x-4) > 0$ $x < 0$ or $x > 4$   **OR/*OF***  	✓ $x < 0$ ✓ $x > 4$ ✓or (3) ✓ $x < 0$ ✓ $x > 4$ ✓or (3)
1.1.4	$x = \frac{a^2 + a - 2}{a - 1}$ $= \frac{(a+2)(a-1)}{a-1}$ $= a + 2$ $= 888\,888\,888\,890$	✓ $(a+2)(a-1)$ ✓answer (check ten eights written)/*tien agtstes geskryf* (2)

1.2	$y+7=2x$ $y=2x-7$ .....(1) $x^2-xy+3y^2=15$ substitute (1) in (2) : $x^2-x(2x-7)+3(2x-7)^2=15$ $x^2-2x^2+7x+3(4x^2-28x+49)=15$ $x^2-2x^2+7x+12x^2-84x+147-15=0$ $11x^2-77x+132=0$ $x^2-7x+12=0$ $(x-3)(x-4)=0$ $x=3$ or $x=4$ $y=2(3)-7$ $y=2(4)-7$ $y=-1$ $y=1$	✓ $y=2x-7$ ✓ substitution ✓standard form ✓factorisation ✓x-values ✓y-values (6)
	OR/*OF*	
	$y+7=2x$ $x=\frac{y+7}{2}$ .....(1) $x^2-xy+3y^2=15$ .....(2) substitute (1) in (2) : $\left(\frac{y+7}{2}\right)^2-\left(\frac{y+7}{2}\right)y+3y^2=15$ $\frac{y^2+14y+49}{4}-\frac{y^2+7y}{2}+3y^2=15$ $y^2+14y+49-2y^2-14y+12y^2-60=0$ $11y^2-11=0$ $y^2-1=0$ $(y-1)(y+1)=0$ $y=-1$ $y=1$ $x=\frac{-1+7}{2}$ $x=\frac{1+7}{2}$ $x=3$ $x=4$	✓ $x=\frac{y+7}{2}$ ✓ substitution ✓standard form ✓factorisation ✓y-values ✓x-values (6)

1.3	$y = x + \frac{1}{x}$ $xy = x^2 + 1$ $x^2 - xy + 1 = 0$ Since x is real, this equation has real roots./*Omdat x reëel is, het die vergelyking reële wortels.* $\Delta \geq 0$ $y^2 - 4 \geq 0$ $(y-2)(y+2) \geq 0$  **OR/** ***OF***  $y \leq -2$ or $y \geq 2$	✓ $x^2 - xy + 1 = 0$ ✓ $\Delta \geq 0$ ✓ $y^2 - 4$ ✓factors ✓ $y \leq -2$ ✓ $y \geq 2$ (6) **[23]**

Question 1 **May June 2016**

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***	✓ correct substitution into correct formula ✓ answer ✓ answer (3)

	$x^2-5x+\frac{25}{4}=2+\frac{25}{4}$ $\left(x-\frac{5}{2}\right)^2=\frac{33}{4}$ $x-\frac{5}{2}=\pm\frac{\sqrt{33}}{2}$ $x=\frac{5\pm\sqrt{33}}{2}$ $x=-0,37 \quad \text{or} \quad x=5,37$	✓ 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	$x-3x^{\frac{1}{2}}-4=0$ $\left(x^{\frac{1}{2}}-4\right)\left(x^{\frac{1}{2}}+1\right)=0$ $x^{\frac{1}{2}}=4 \quad \text{or} \quad x^{\frac{1}{2}}=-1$ $x=16 \qquad \text{N/A}$ **OR/OF** $x-3x^{\frac{1}{2}}-4=0$ Let $x^{\frac{1}{2}}=k$ $k^2-3k-4=0$ $(k-4)(k+1)=0$ $x^{\frac{1}{2}}=4 \quad \text{or} \quad x^{\frac{1}{2}}=-1$ $x=16 \qquad \text{N/A}$ **OR/OF**	✓ 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)

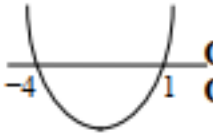
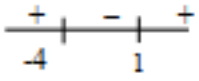
	$x-3x^{\frac{1}{2}}=4$ $x-4=3\sqrt{x}$ Restrictions/*Beperkings*: $9x=x^2-8x+16$ $x\geq 4$ and $x\geq 0$ $x^2-17x+16=0$ $(x-1)(x-16)=0$ $x=1$ or $x=16$ N/A	✓ isolating $3\sqrt{x}$ or $3x^{\frac{1}{2}}$ ✓ standard form ✓ factors ✓ answers ✓ selection (5)
1.2	$y=2x+1$ $x^2-3x-4-(2x+1)=(2x+1)^2$ $x^2-3x-4-2x-1=4x^2+4x+1$ $3x^2+9x+6=0$ $x^2+3x+2=0$ $(x+2)(x+1)=0$ $x=-2$ or $x=-1$ If $x=-2$, then $y=-3$ If $x=-1$, then $y=-1$ **OR/OF** $x=\frac{y-1}{2}$ $\left(\frac{y-1}{2}\right)^2-3\left(\frac{y-1}{2}\right)-4-y=y^2$ $\frac{y^2-2y+1}{4}-3\left(\frac{y-1}{2}\right)-4-y=y^2$ $y^2-2y+1-6y+6-16-4y=4y^2$ $3y^2+12y+9=0$ $y^2+4y+3=0$ $(y+3)(y+1)=0$ $y=-3$ or $y=-1$ 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 1 **November 2016**

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 2 **November 2014**

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

Question 3 **November 2014**

3.1.1	$-1 \;;\; -7 \;;\; -11 \;;\; p \;;\ldots$ $-6 \quad -4 \quad p+11$ $2 \quad 2$ $p+11-(-4)=2$ $p+15=2$ $p=-13$ **OR/*OF*** $-1 \;;\; -7 \;;\; -11 \;;\; p \;;\ldots$ $-6 \quad -4 \quad p+11$ $2 \quad 2$ $p+11=-2$ $p=-13$	✓$p+15=2$ ✓$p=-13$ (2) ✓first differences/ *eerste verskille* ✓$p=-13$ (2)
3.1.2	$2a=2$ $a=1$ $3a+b=-6$ $3(1)+b=-6$ $b=-9$ $a+b+c=-1$ $1-9+c=-1$ $c=7$ $T_n=n^2-9n+7$ **OR/*OF***	✓$a=1$ ✓$b=-9$ ✓$c=7$ ✓answer/*antwoord* (4)

	$T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)d_2}{2}$ $= -1 + (n-1)(-6) + \frac{(n-1)(n-2)(2)}{2}$ $= -1 - 6n + 6 + \frac{2n^2 - 6n + 4}{2}$ $= n^2 - 9n + 7$	✓formula/*formule* ✓substitution of first and second differences/*substitusie van eerste en tweede verskille* ✓simplification/*vereenvoudiging* ✓answer/*antwoord* (4)
	OR/*OF*	
	$7; -1 \;;\; -7 \;;\; -11 \;;\; p \;;\; \ldots$ $-8 \quad -6 \quad -4 \quad p+11$ $2 \quad 2 \quad 2$ $T_0 = 7 = c$ $2a = 2 \quad \therefore a = 1$ $3a + b = -6 \quad \therefore b = -9$ $T_n = n^2 - 9n + 7$	✓*c*-value/*c-waarde* ✓*a*-value/*a-waarde* ✓*b*-value/*b-waarde* ✓answer/*antwoord* (4)
	OR/OF	
	$a = \frac{1}{2}(2) = 1$ $\therefore T_n = n^2 + bn + c$ $T_1 = -1 \;\therefore 1 + b + c = -1$ .....(1) $T_2 = -7 \;\therefore 4 + 2b + c = -7$ .....(2) $(2) - (1): \quad 3 + b = -6$ $\therefore b = -9$ sub in (1) : $c = 7$ $\therefore T_n = n^2 - 9n + 7$	✓*a*-value/*a-waarde* ✓*b*-value/*b-waarde* ✓*c*-value/*c-waarde* ✓answer/*antwoord* (4)
3.1.3	The sequence of first differences is/*Die reeks van eerste verskille is*: $-6 \;;\; -4 \;;\; -2 \;;\; 0 \;;\; \ldots$ $-6 + (n-1)(2) = 96$ $n = 52$ $\therefore$ two terms are/*twee terme is*: $T_{52} = 52^2 - 9(52) + 7 = 2243$ $T_{53} = 53^2 - 9(53) + 7 = 2339$	✓$-6 + (n-1)(2) = 96$ ✓52 ✓2 243 ✓2 339 (4)
	OR/OF	

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

3.2.1	$T_{12}=16\left(\frac{1}{4}\right)^{12-1}$ $=\frac{1}{4^9}$ or 4^{-9} or $\frac{1}{2^{18}}$ or 2^{-18}	✓ $a=16$ and $r=\frac{1}{4}$ ✓subst. into correct formula/ *subt in korrekte formule* ✓ answer/*antwoord* (3)

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

Question 2 **Feb March 2015**

2.1	$S_n = a + (a+d) + (a+2d) + \ldots + a + (n-1)d$ $S_n = a + (n-1)d + a + (n-2)d + a + (n-3)d + \ldots + a$ $2S_n = n(2a + (n-1)d)$ $S_n = \frac{n}{2}[2a + (n-1)d]$	✓ first series/*eerste reeks* ✓series reversed/*reeks omgekeer* ✓ sum/*som* ✓ division/*deling* (4)
2.2	$\sum_{k=1}^{50}(100-3k) = 97 + 94 + 91 + \ldots$ $T_1 = a = 97$ $d = -3$ $n = 50 - 1 + 1 = 50$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $= \frac{50}{2}[2(97) + 49(-3)]$ $= 1175$ **OR/*OF*** $T_1 = a = 97$ $l = 100 - 3(50) = -50$ $n = 50 - 1 + 1 = 50$ $S_n = \frac{n}{2}[a + l]$ $= \frac{50}{2}[97 - 50]$ $= 1175$	✓$a = 97$ ✓$d = -3$ ✓$n = 50$ ✓ answer/*antwoord* (4) ✓$a = 97$ ✓$l = -50$ ✓$n = 50$ ✓ answer/*antwoord* (4)
2.3.1 (a)	$T_5 - T_4 = 25$	✓ answer/*antwoord* (1)
2.3.1 (b)	$T_{70} - T_{69} = 7 + (69-1)(6)$ $= 415$	✓$n = 69$ ✓$7 + (69-1)(6)$ ✓ answer/*antw.* (3)
2.3.2	$T_{89} - T_{69} = (T_{70} - T_{69}) + (T_{71} - T_{70}) + \ldots + (T_{89} - T_{88})$ $= 415 + 421 + \ldots$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***	✓ expansion/*uitbreiding* ✓$n = 20$ ✓ method/*metode* ✓$a = 415$ ✓ answer/*antwoord* (5)

	7 13 19 25 6 6 6 $\therefore 2a = 6$ $a = 3$ $3a + b = 7$ $b = -2$ $T_{89} = 3(89)^2 - 2(89) + c = 23594$ $\therefore c = 9$ $\therefore T_n = 3n^2 - 2n + 9$ $\therefore T_{69} = 3(69)^2 - 2(69) + 9$ $\therefore T_{69} = 14154$	✓ a and/*en* b ✓ T_{89} (subst $n = 89$) ✓ T_n ✓substitution/*substitusie* ✓ answer/*antwoord* (5)
	OR/*OF* 7 13 19 25 6 6 6 $\therefore 2a = 6$ $a = 3$ $7 - 6 = 1$ $T_1 - T_0 = 1$ $a + b + c - c = 1$ $3 + b = 1$ $b = -2$ $T_{89} = 3(89)^2 - 2(89) + c = 23594$ $\therefore c = 9$ $\therefore T_n = 3n^2 - 2n + 9$ $\therefore T_{69} = 3(69)^2 - 2(69) + 9$ $\therefore T_{69} = 14154$	✓ a and/*en* b ✓ T_{89} (subst $n = 89$) ✓ T_n ✓substitution/*substitusie* ✓ answer/*antwoord* (5) **[17]**

	OR/*OF* $T_{n+1} - T_n = 7 + 6(n-1)$ $\therefore T_{89} - T_1 = \sum_{n=1}^{88} (T_{n+1} - T_n)$ $= \frac{n}{2}[2a + (n-1)d]$ $= \frac{88}{2}[14 + 87 \times 6]$ $= 23584$ $\therefore T_1 = 23594 - 23584 = 10$ $\therefore T_{69} - 10 = \sum_{n=1}^{68} (T_{n+1} - T_n)$ $= 34(15 + 67 \times 6) = 14144$ $\therefore T_{69} = 14154$	✓formula/*formule* ✓value of/*waarde van* S_{88} ✓first term value/ *eerste term waarde* ✓substitution/*substitusie* ✓answer/*antwoord* (5) **[17]**

Question 3 **Feb March 2015**

3.1	$r = \frac{40,5}{45} = 0,9$ $T_{12} = 45(0,9)^{12-1}$ $= 14,12147682...$ $= 14,12$	✓$r = 0,9$ ✓ substitution into correct formula/*substitusie in korrekte formule* ✓ answer/*antwoord* (3)
3.2	$r = 0,9$ $-1 < 0,9 < 1$	✓answer/*antwoord* (1)
3.3	$S_\infty = \frac{45}{1-0,9}$ $S_\infty = 450$	✓ substitution/*substitusie* ✓ 450 (2)

3.4	$S_\infty - S_n < 1$ $S_\infty - S_n = 450 - \frac{45\left(1-(0,9)^n\right)}{1-0,9}$ $S_\infty - S_n = 450 - 450\left(1-(0,9)^n\right)$ $450(0,9)^n < 1$ $(0,9)^n < \frac{1}{450}$ $\log(0,9)^n < \log\frac{1}{450}$ $n.\log(0,9) < \log\frac{1}{450}$ $n > \frac{\log\frac{1}{450}}{\log(0,9)}$ $n > 57,98...$ Smallest value/*Kleinste waarde*: $n = 58$	✓ $450 - \frac{45\left(1-(0,9)^n\right)}{1-0,9}$ ✓ $(0,9)^n = \frac{1}{450}$ ✓ introducing/*gebruik* logs ✓making n the subject/*maak n die onderwerp* ✓ $n = 58$ (5) **[11]**

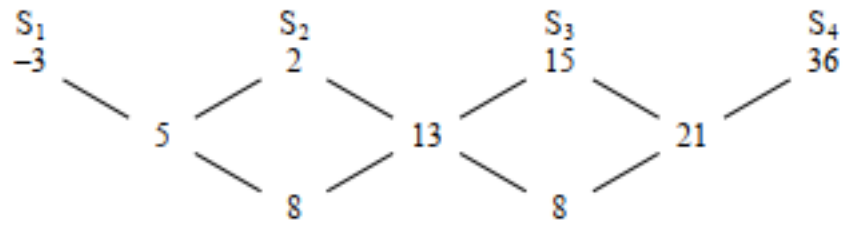
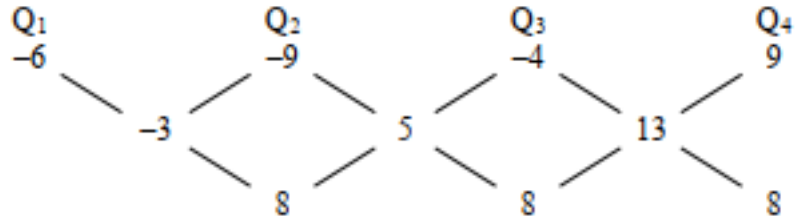
Question 2 **November 2015**

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)

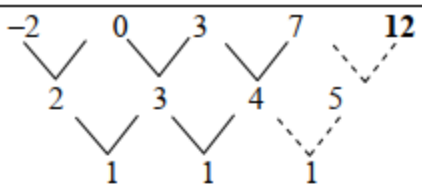
2.4	$S_\infty - S_n = \frac{a}{1-r} - \frac{a(1-r^n)}{1-r}$ $= \frac{10}{1-\frac{1}{2}} - \frac{10\left(1-\frac{1}{2}^n\right)}{1-\frac{1}{2}}$ $= 20 - 20\left(1-\frac{1}{2}^n\right)$ $= 20 - 20 + 20\left(\frac{1}{2}\right)^n$ $= 20\left(\frac{1}{2}\right)^n$ **OR/*OF***	✓ $\frac{10}{1-\frac{1}{2}}$ ✓ $\frac{10\left(1-\frac{1}{2}^n\right)}{1-\frac{1}{2}}$ ✓ $20\left(1-\frac{1}{2}^n\right)$ ✓answer (4) ✓constructing the series
	$S_\infty - S_n = T_{n+1} + T_{n+2} + T_{n+3} + \ldots$ $= 10\left(\frac{1}{2}\right)^n\left[1+\frac{1}{2}+\frac{1}{4}+\ldots\right]$ $= 10\left(\frac{1}{2}\right)^n\left[\frac{1}{1-\frac{1}{2}}\right]$ $= 20\left(\frac{1}{2}\right)^n$ **OR/*OF*** $S_\infty - S_n = \frac{a}{1-r} - \frac{a(1-r^n)}{1-r}$ $= \frac{a-a+ar^n}{1-r}$ $= \frac{ar^n}{1-r}$ $= \frac{10\left(\frac{1}{2}\right)^n}{\frac{1}{2}}$ $= 20\left(\frac{1}{2}\right)^n$	✓ $10\left(\frac{1}{2}\right)^n\left[1+\frac{1}{2}+\frac{1}{4}+\ldots\right]$ ✓ $\frac{1}{1-\frac{1}{2}}$ ✓answer (4) ✓ $\frac{a-a+ar^n}{1-r}$ ✓ $\frac{ar^n}{1-r}$ ✓ $\frac{10\left(\frac{1}{2}\right)^n}{\frac{1}{2}}$ ✓answer (4) **[10]**

Question 3 **November 2015**

3.1	$d = 8$ $T_k = a + (k-1)d$ $= -3 + (k-1)(8)$ $= -3 + 8k - 8$ $= 8k - 11$	✓ d value ✓answer (2)
3.2	$\sum_{k=1}^{n}(8k-11)$ **OR/*OF*** $\sum_{k=0}^{n-1}(8(k+1)-11) = \sum_{k=0}^{n-1}(8k-3)$	✓for general term ✓lower and upper values in sigma notation (2)
3.3	$S_n = \frac{n}{2}[2a + (n-1)d]$ $= \frac{n}{2}[2(-3) + (n-1)(8)]$ $= \frac{n}{2}[-6 + 8n - 8]$ $= \frac{n}{2}[8n - 14]$ $= n(4n - 7)$ $= 4n^2 - 7n$ **OR/*OF*** $S_n = \frac{n}{2}[2a + (n-1)d]$ $= \frac{n}{2}[2(-3) + (n-1)(8)]$ $= \frac{n}{2}[-6 + 8n - 8]$ $= \frac{n}{2}[8n - 14]$ $= 4n^2 - 7n$ **OR/*OF*** $S_n = \frac{n}{2}[a + l]$ $= \frac{n}{2}[-3 + 8n - 11]$ $= \frac{n}{2}[8n - 14]$ $= 4n^2 - 7n$	✓formula ✓substitution ✓ $\frac{n}{2}[8n-14]$ (3) ✓formula ✓substitution ✓ $\frac{n}{2}[8n-14]$ (3) ✓formula ✓substitution ✓ $\frac{n}{2}[8n-14]$ (3)

	OR/*OF*  $S_n = an^2 + bn + c$ $a = \frac{8}{2}$ $a = 4$ $S_1 = 4 + b + c = -3$ $b + c = -7$ .....(1) $S_2 = 16 + 2b + c = 2$ $2b + c = -14$.....(2) $b = -7$.....(2)−(1) $c = 0$ Hence $S_n = 4n^2 - 7n$	$S_2 = -3 + 5 = 2$ $S_3 = 2 + 13 = 15$ $S_4 = 15 + 21$ ✓calculates S_1, S_2, S_3 and S_4, ✓ $a = 4$ ✓solves simultaneously for b and c. (3)
3.4.1	$Q_6 = -6 - 3 + 5 + 13 + 21 + 29$	✓✓ answer (2)
3.4.2	$Q_{129} = -6 + S_{128}$ $= -6 + 4(128)^2 - 7(128)$ $= 64634$ **OR/*OF***  $Q_n = an^2 + bn + c$ $a = 4$ $Q_1 = 4 + b + c = -6$ $b + c = -10$ .....(1) $Q_2 = 16 + 2b + c = -9$ $2b + c = -25$.....(2) $b = -15$.....(2)−(1) $c = 5$ Hence $Q_n = 4n^2 - 15n + 5$ $Q_{129} = 4(129)^2 - 15(129) + 5$ $= 64\,634$	✓✓ $-6 + 4(128)^2 - 7(128)$ ✓answer (3) ✓ $a = 4$ ✓ $Q_n = 4n^2 - 15n + 5$ ✓answer (3) **[12]**

Question 2 **Feb March 2016**

2.1.1	 The next term of the sequence is 12./*Die volgende term in die ry is 12.*	✓answer (1)
2.1.2	$2a=1$ $a=\frac{1}{2}$ $3a+b=T_2-T_1$ $3\left(\frac{1}{2}\right)+b=2$ $b=\frac{1}{2}$ $a+b+c=T_1$ $\frac{1}{2}+\frac{1}{2}+c=-2$ $c=-3$ $\therefore T_n=\frac{1}{2}n^2+\frac{1}{2}n-3$ **OR/*OF***	✓value of a ✓$3\left(\frac{1}{2}\right)+b=2$ ✓value of b ✓$\frac{1}{2}+\frac{1}{2}+c=-2$ ✓ value of c (5)
	$2a=1$ $a=\frac{1}{2}$ $T_n=an^2+bn+c$ $-2=\frac{1}{2}+b+c\ldots\ldots\ldots\ldots T_1$ $b+c=-\frac{5}{2}\ldots\ldots\ldots\ldots$line 1 $0=2+2b+c\ldots\ldots\ldots\ldots T_2$ $2b+c=-2\ldots\ldots\ldots\ldots$line 2 line 2 − line 1: $b=\frac{1}{2}$ substitute in line 1 or substitute in line 2 $\frac{1}{2}+c=-\frac{5}{2}$ $2\left(\frac{1}{2}\right)+c=-2$ $c=-3$ $\therefore T_n=\frac{1}{2}n^2+\frac{1}{2}n-3$ **OR/*OF***	✓value of a ✓$-2=\frac{1}{2}+b+c$ ✓ $0=2+2b+c$ ✓value of b ✓ value of c (5)

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

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

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

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

$= \frac{1}{2}n^2 + \frac{1}{2}n - 3$ ✓ value of a ✓value of b ✓ value of c (5)

OR/*OF*

$2a = 1$

$a = \frac{1}{2}$ ✓value of a

$3a + b = T_2 - T_1$

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

$b = \frac{1}{2}$ ✓value of b

$T_0 = c = -3$ ✓$T_0 = c$

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

OR/*OF*

Since $T_2 = 0, (n-2)$ is a factor of T_n

$T_n = an^2 + bn + c$

$= a(n-2)(n-k)$

$T_1 = -2 = a(1-2)(1-k)$

$-2 = -a(1-k)$ ✓$T_n = a(n-2)(n-k)$

$a = \frac{2}{1-k}$ ✓ $-2 = a(1-2)(1-k)$

$T_3 = 3 = a(3-2)(3-k)$

$3 = a(3-k)$ ✓$3 = a(3-2)(3-k)$

$a = \frac{3}{3-k}$

$\frac{2}{1-k} = \frac{3}{3-k}$

$2(3-k) = 3(1-k)$

$6 - 2k = 3 - 3k$

$k = -3$ ✓value of k

$a = \frac{1}{2}$

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

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

2.1.3	$\frac{1}{2}n^2+\frac{1}{2}n-3=322$ $n^2+n-6=644$ $n^2+n-650=0$ $n=\frac{-1\pm\sqrt{1^2-4(1)(650)}}{2}$ $n=25 \quad \text{or} \quad n=-26$ The 25th term has a value of 322./*Die 25ste term se waarde is 322.* **OR/*OF*** $\frac{1}{2}n^2+\frac{1}{2}n-3=322$ $n^2+n-6=644$ $n^2+n-650=0$ $(n-25)(n+26)=0$ $n=25 \quad \text{or} \quad n=-26$ 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)
	$\frac{1}{2}n^2+\frac{1}{2}n-3=322$ $n^2+n-6=644$ $(n+3)(n-2)=23\times28$ $n-2=23$ $n=25$	✓$\frac{1}{2}n^2+\frac{1}{2}n-3=322$ ✓$(n+3)(n-2)$ ✓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	$T_1=T_2-d$ $=8-\frac{2}{3}$ $=\frac{22}{3}$ $T_n=a+(n-1)d$ $=\frac{22}{3}+(n-1)\frac{2}{3}$ $=\frac{2n+20}{3}$ $S_{50}=\sum_{n=1}^{50}\left(\frac{22}{3}+(n-1)\frac{2}{3}\right)$	✓$T_1=\frac{22}{3}$ ✓answer (2)

	OR/*OF* $S_{50}=\sum_{n=1}^{50}\left(\frac{2n+20}{3}\right)$	(2)
2.2.3	$S_n=\frac{n}{2}[2a+(n-1)d]$ $S_{50}=\frac{50}{2}\left[2\left(\frac{22}{3}\right)+(50-1)\left(\frac{2}{3}\right)\right]$ $=\frac{3550}{3}$	✓correct substitution into correct formula ✓✓answer (3) **[18]**

Question 3 **Feb March 2016**

3.1	$r=\frac{70}{100}$ $=\frac{7}{10}$	✓value of r
	$T_n=ar^{n-1}$ $11,76=100\left(\frac{7}{10}\right)^{n-1}$	✓substitution in formula for T_n
	$\left(\frac{7}{10}\right)^{n-1}=\frac{11,76}{100}$ $n-1=\log_{\frac{7}{10}}\left(\frac{11,76}{100}\right)$	✓use of logarithms
	$n-1=6$ $n=7$ During the 7th year/*In die 7de jaar*	✓answer (4)
	OR/*OF* $r=\frac{70}{100}$ $=\frac{7}{10}$	✓value of r
	$T_n=ar^{n-1}$ $11,76=100(0,7)^{n-1}$ $0,7^{n-1}=\frac{11,76}{100}$ $=0,1176$	✓substitution in formula for T_n
	$(n-1)\log 0,7=\log 0,1176$ $n-1=\frac{\log 0,1176}{\log 0,7}$ $n-1=6$ $n=7$ During the 7th year/*In die 7de jaar*	✓use of logarithms ✓answer (4)

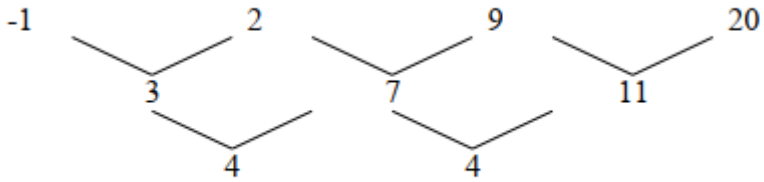
3.2	$h(n) = 130 + (100 + 70 + 49 + ...\text{to } n \text{ terms})$ $= 130 + \frac{100\left(1-(0,7)^n\right)}{1-0,7}$ $= 130 + \frac{100\left(1-(0,7)^n\right)}{0,3}$	✓130 ✓ $100 + 70 + 49 + ...\text{to } n \text{ terms}$ ✓answer (3)
3.3	Eventual height of the tree/*Uiteindelike hoogte van die boom* $= 130 + \frac{100}{1-0,7}$ $= 463,33 \text{ mm} \quad \text{OR} \quad \frac{1390}{3} \text{ mm}$	✓✓$130 + \frac{100}{1-0,7}$ ✓answer (3) **[10]**

Question 2 **May June 2016**

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	$a = 6 \quad d = 7$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{20} = \frac{20}{2}[2(6) + (20-1)(7)]$ $= 1450$ **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	$\left(-\frac{7}{2}\right)+\left(-\frac{7}{4}\right)+\left(-\frac{7}{8}\right)+\ldots\ldots$ $S_\infty = \frac{a}{1-r}$ $= \frac{-\frac{7}{2}}{1-\frac{1}{2}}$ $= -7$ **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]**

Question 3 **May June 2016**

3.1	 $2a = 4$ $a = 2$ $3a + b = 3$ $b = -3$ $a + b + c = -1$ $c = 0$ $T_n = 2n^2 - 3n$ **OR/OF** $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)}{2}d_2$ $= (-1) + (n-1)(3) + \frac{(n-1)(n-2)}{2}(4)$ $= -1 + 3n - 3 + 2n^2 - 6n + 4$ $= 2n^2 - 3n$	✓ 2nd difference = 4 ✓ $a = 2$ ✓ $b = -3$ ✓ $T_n = 2n^2 - 3n$ (4) ✓ formula ✓ 2nd difference = 4 ✓ simplifying ✓ $T_n = 2n^2 - 3n$ (4)
3.2	$T_n = 2n^2 - 3n$ $T_{48} = 2(48)^2 - 3(48)$ $= 4464$	✓ substitution ✓ answer (2)
3.3	$3 + 7 + 11.....$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $= \frac{n}{2}[2(3) + (n-1)4]$ $= \frac{n}{2}[6 + 4n - 4]$ $= 2n^2 + n$	✓ $a = 3$ ✓ $d = 4$ ✓ substitution into correct formula (3)
3.4	$S_{69} = 9591$ and $T_1 = -1$ (of the original sequence/*van die oorspronklike ry*) $9591 + (-1) = 9590$ $S_{69} + T_1 = 9590$ The 70th term of the original sequence will have a value of 9590 **OR/OF**	✓ $(9591) + (-1)$ ✓ 70 (2)

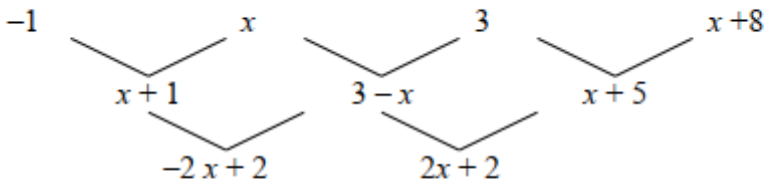
	$2n^2 - 3n = 9590$ $2n^2 - 3n - 9590 = 0$ $(n-70)(2n+137) = 0$ $n = 70$ $T_{70} = 9590$	✓ $2n^2 - 3n - 9590 = 0$ ✓70 (2) **[11]**

Question 2 **November 2016**

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** $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{22} = \frac{22}{2}[2(-3) + (22-1)(-4)]$ $= -990$ **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.* **OR/OF** Sum $= S_{24} - (5+1)$ $= \frac{24}{2}[5 - 87] - 6$ $= -990$	✓ $n = 22$ ✓ $a = -3$ ✓ answer (3) ✓ $n = 22$ ✓ $a = -3$ ✓ answer (3) ✓ $a = -3$ ✓✓ answer (3) ✓ $\frac{24}{2}[5 - 87]$ ✓ –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:* $-4187+4(3)$ $=-4175$ $T_n=-20n+25$ $-4175=-20n+25$ $20n=4200$ $n=210$ 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**	✓ $d=-20$ ✓ $T_n=-20n+25$ ✓ $-4175=-20n+25$ ✓ $n=210$ (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.* $T_1;T_6;T_{11};T_{16}$ ... are divisible by 5./*is deelbaar deur* 5. The largest integer value of k such that $5k-4\le 1049$ $5k\le 1053$ $k\le 210{,}6$ $k=210$ **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 $=\frac{1046-1}{5}+1$ $=210$	✓ $-4n+9=-4187$ ✓ $n=1049$ ✓ $5k-4\le 1049$ ✓ $k=210$ (4) ✓ $d=-4$ ✓ $-4175=-4n+9$ ✓ 1046 ✓ $n=210$ (4) **[11]**

Question 3 **November 2016**

3.1.1	$-1 \;;\; x \;;\; 3 \;;\; x+8 \;;\; \ldots$  $-2x+2=2x+2$ $4x=0$ $x=0$	✓ $x+1;3-x$ and $x+5$ ✓ calculating second differences ✓ $-2x+2=2x+2$ ✓ $x=0$ (4)
3.1.2	First differences/*Eerste verskille*: 1 ; 3 ; 5 ; …… $S_n=\frac{n}{2}[2(1)+(n-1)(2)]$ $=n^2$ $250<n^2$ $n>\sqrt{250}$ $\therefore n>15{,}8$ The sum of the 16 first differences will be greater than 250. Therefore the 17th term of the quadratic number pattern is the first satisfying this condition./*Die som van* 16 *eerste verskille sal groter as* 250 *wees. Gevolglik sal die* 17^{de} *term van die kwadratiese getalpatroon die eerste wees wat aan die voorwaarde voldoen.*	✓ $S_n=n^2$ ✓ $S_n>250$ ✓ $n>15{,}8$ ✓ $n=17$ (4)
3.2.1	$21+21(0{,}85)+21(0{,}85)^2+\ldots\ldots$ $T_n=ar^{n-1}$ $T_{10}=(21)(0{,}85)^9$ $=4{,}86$ cm	✓ $n=10$; $r=0{,}85$ or $\frac{17}{20}$ ✓ substitution into correct formula ✓ answer (3)
3.2.2	$S_n=\frac{a(1-r^n)}{1-r}$ $S_{15}=\frac{21(1-(0{,}85)^{15})}{1-0{,}85}$ $=127{,}77$ Area of the page = 30 x 21 = 630 Percentage of paper covered in grey ink: $=\frac{127{,}77}{630}\times 100\%$ $=20{,}28\%$	✓ $n=15$ ✓ 127,77 ✓ 630 ✓ 20,28 (4) **[15]**

Question 4 **November 2014**

4.1	$p = 1$ $q = 1$	✓p value /*waarde* ✓q value /*waarde* (2)
4.2	$0 = \frac{2}{x+1} + 1$ $-x - 1 = 2$ $x = -3$ **OR/*OF*** Reflect (0 ; 3) across $y = -x$ to get T(–3 ; 0) $x = -3$ *Reflekteer* (0 ; 3) *om* $y = -1$ *om* T(–3 ; 0) *te kry* $x = -3$	✓ $0 = \frac{2}{x+1} + 1$ ✓ $x = -3$ (2) ✓ reflect across/*reflekteer om* $y = -x$ ✓ $x = -3$ (2)
4.3	Shifting g five units to the left shifts (– 1 ; 0) five units to the left. $x = -6$	✓ answer/*antwoord* (1)
4.4	$\frac{2}{x+1} + 1 = x$ $2 + x + 1 = x^2 + x$ $x^2 = 3$ $\therefore x = \sqrt{3}$ since at S, $x > 0$ $y = \sqrt{3} = 1{,}73...$ $OS^2 = x^2 + y^2 = 3 + 3 = 6$ $\therefore OS = \sqrt{6} = 2{,}45$ units/*eenhede* **OR/*OF*** Translate g one unit down and one unit to the right/*Transleer g een eenheid af en een eenheid na regs* The new equation/*Die nuwe vergelyking* : $p(x) = \frac{2}{x}$ Therefore the image of S is $S'(\sqrt{2};\sqrt{2})$/ *Daarom is die beeld van S nou* $S'(\sqrt{2};\sqrt{2})$ Now translate p back to g/*Transleer p terug na g*: $S(\sqrt{2}-1;\sqrt{2}+1)$ $OS^2 = (\sqrt{2}-1)^2 + (\sqrt{2}+1)^2 = 2 - 2\sqrt{2} + 1 + 2 + 2\sqrt{2} + 1$ $\therefore OS = \sqrt{6} = 2{,}45$ units/*eenhede*	✓ equating both graphs/*stel grafieke gelyk* ✓ $x^2 = 3$ ✓ $x = \sqrt{3}$ and $y = \sqrt{3}$ ✓ $OS^2 = 6$ ✓ answer/*antwoord* (5) ✓ $p(x) = \frac{2}{x}$ ✓✓coord. of/*koörd. van* S' ✓coord. of/*koörd. van* S ✓answer/*antwoord* (5)
4.5	$k < 3$ will give roots with opposite signs/ $k < 3$ *sal wortels met teenoorgestelde tekens gee*	✓$k < 3$ (1) **[11]**

Question 5 **November 2014**

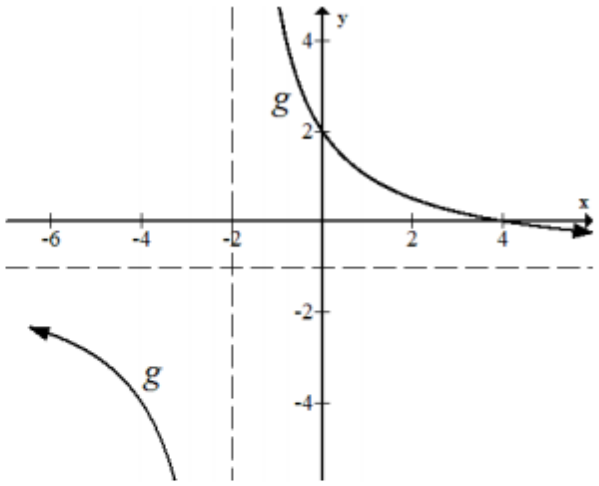
5.1	$y = \log_a x$ $-1 = \log_a \frac{1}{3}$ $a^{-1} = \frac{1}{3}$ $a = \left(\frac{1}{3}\right)^{-1}$ $\therefore a = 3$	✓subt. $\left(\frac{1}{3};-1\right)$ ✓ $a^{-1} = \frac{1}{3}$ or $a = \left(\frac{1}{3}\right)^{-1}$ (2)
5.2	$h: \quad x = \log_3 y$ $\therefore \quad y = 3^x$	✓swop x and y/*ruil*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

Question 6 **November 2014**

6.1	$4x^2 - 6 = 0$ $x^2 = \frac{3}{2}$ $x = 1{,}22$ (x - coordinate of S is positive)	✓$y = 0$ ✓1,22 (2)
6.2	$(0\ ;-6)$	✓ 0 ✓-6 (2)
6.3.1	$QT = f(x) - g(x)$ $= 2\sqrt{x} - (4x^2 - 6)$ or $= 2\sqrt{x} - 4x^2 + 6$	✓✓ correct formula/ *korrekte formule* ✓substitution/*substitusie* (3)
6.3.2	$QT = 2x^{\frac{1}{2}} - 4x^2 + 6$ Deravitive of $QT = x^{\frac{-1}{2}} - 8x = 0$ $\frac{1}{\sqrt{x}} = 8x$ $x^{\frac{3}{2}} = \frac{1}{8}$ or $\frac{1}{x} = 64x^2$ $x = \left(\frac{1}{8}\right)^{\frac{2}{3}}$ $x = \left(\frac{1}{2}\right)^2$ or $x^3 = \frac{1}{64}$ $x = \frac{1}{4} = 0{,}25$ Max/*Maks* $QT = 2\left(\frac{1}{4}\right)^{\frac{1}{2}} - 4\left(\frac{1}{4}\right)^2 + 6$ $= 6\frac{3}{4} = 6{,}75$units/*eenhede*	✓derivative/*afgeleide* ✓derivative equal to 0/ *afgeleide gelyk aan 0* ✓ $x^{\frac{3}{2}} = \frac{1}{8}$ ✓x-value/x-*waarde* ✓ substitution/*substitusie* ✓answer/*antwoord* (6) **[13]**

Question 4 **Feb March 2015**

4.1	$x = -2$ $y = -1$	✓ $x = -2$ ✓ $y = -1$ (2)
4.2.1	$g(0) = \frac{6}{0+2} - 1$ $= 2$ y-intercept/*afsnit* $(0\ ;\ 2)$	 ✓ answer/*antwoord* (1)
4.2.2	$0 = \frac{6}{x+2} - 1$ $1 = \frac{6}{x+2}$ $x + 2 = 6$ $x = 4$ x-intercept/*afsnit* $(4\ ;\ 0)$	✓ equating to/*stel gelyk aan* 0 ✓ answer/*antwoord* (2)

4.3		✓ asymptotes/*asimptote* ✓ intercepts/*afsnitte* ✓ shape/*vorm* (3)
4.4	$y+1=-(x+2)$ $y=-x-3$ **OR/*OF*** Using general formula/*Gebruik algemene formule*: $y=-(x+p)+q$ $y=-(x+2)-1$ $y=-x-3$	✓$m=-1$ ✓substitution of $(-2\,;-1)$ ✓answer (3) ✓formula/*formule* ✓substitution of p and q values/*substitusie van p- en q-waardes* ✓answer/*antwoord* (3)
4.5	$x>-2$	✓✓ answer (2) **[13]**

Question 5 **Feb March 2015**

5.1	$9=a^2$ $a=3$ **OR/*OF*** $f^{-1}(x)=\log_a x$ $2=\log_a 9$ $a^2=9=3^2$ $\therefore a=3$	✓$9=a^2$ ✓$a=3$ (2) ✓$9=a^2$ ✓$a=3$ (2)
5.2	$g(x)=3^{-x}$ **OR/*OF*** $g(x)=\left(\frac{1}{3}\right)^x$	✓ answer/*antwoord* (1) ✓ answer/*antwoord* (1)

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

Question 6 **Feb March 2015**

6.1	$-3 \leq x \leq 2$	✓ critical values/ *kritiese waardes* ✓ notation/*notasie* (2)
6.2	$f: \quad y = a(x - x_1)(x - x_2)$ $y = a(x+3)(x-2)$ $-8 = a(1+3)(1-2)$ $-8 = -4a$ $2 = a$ $y = 2(x+3)(x-2)$ $y = 2x^2 + 2x - 12$ $b = 2$ and/*en* $c = -12$ **OR/*OF***	✓ $y = a(x+3)(x-2)$ ✓ substitute/*vervang* $(1 ; -8)$ ✓ $a = 2$ ✓ $b = 2$ and/*en* ✓ $c = -12$ (5)

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

$0 = a\left(2 + \frac{1}{2}\right)^2 + q \quad \rightarrow \quad 0 = \frac{25}{4}a + q \quad \ldots.(1)$

$-8 = a\left(1 + \frac{1}{2}\right)^2 + q \quad \rightarrow \quad -8 = \frac{9}{4}a + q \quad \ldots..(2)$

✓equation/*vergelyking* 1

✓equation/*vergelyking* 2

$(1) - (2): 8 = 4a$

$a = 2$

✓$a = 2$

$q = 0 - \frac{25}{4}(2) = -\frac{25}{2} = -12{,}5$

$y = 2\left(x + \frac{1}{2}\right)^2 - 12\frac{1}{2}$

$y = 2\left(x^2 + x + \frac{1}{4}\right) - 12\frac{1}{2}$

$y = 2x^2 + 2x + \frac{1}{2} - 12\frac{1}{2}$

$y = 2x^2 + 2x - 12$

✓ substitution/*substitusie*

$\therefore b = 2$ and $c = -12$

✓$b = 2$ and/*en*
✓$c = -12$

(5)

OR/*OF*

$f'(x) = 2ax + b$

$f'\left(-\frac{1}{2}\right) = 2a\left(-\frac{1}{2}\right) + b = 0$

$\therefore a = b$

$(-3;0): 9a - 3b + c = 0$

$\therefore 6a + c = 0 \ldots\ldots\ldots\ldots(1)$

✓equation/*vergelyking* 1

$(1;-8): a + b + c = -8$

$\therefore 2a + c = -8 \ldots\ldots\ldots\ldots(2)$

✓equation/*vergelyking* 2

$(1) - (2): \quad 4a = 8$

$\therefore a = 2$

$\Rightarrow b = 2$

$\therefore c = -12$

✓$a = 2$

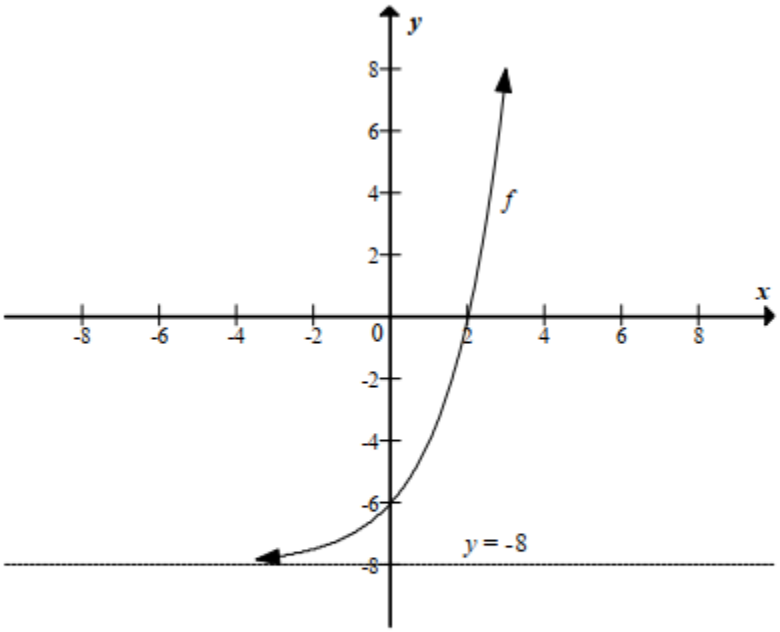
✓$b = 2$
✓$c = -12$

(5)

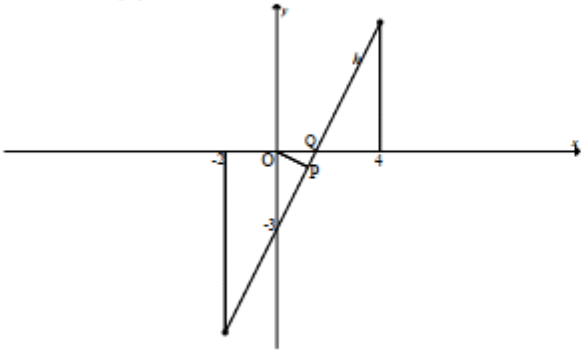
6.3	$x=-\frac{b}{2a}$ $x=-\frac{2}{2(2)}=-\frac{1}{2}$ $y=\frac{1}{2}-1-12$ $y=-12\frac{1}{2}$ $\text{TP}\left(-\frac{1}{2};-12\frac{1}{2}\right)$ **OR/*OF***	✓ $x=-\frac{1}{2}$ ✓substitution/*substitusie* ✓*y*-value/*waarde* (3)
	$y=2[x^2+x-6]$ $y=2\left[x^2+x+\left(\frac{1}{2}.1\right)^2-6-\left(\frac{1}{2}.1\right)^2\right]$ $=2\left[\left(x+\frac{1}{2}\right)^2-6,25\right]$ $=2\left(x+\frac{1}{2}\right)^2-12,5$ $\text{TP}\left(-\frac{1}{2};-12,5\right)$ **OR/*OF***	✓ method/*metode* ✓*x*-value/*waarde* ✓*y*-value/*waarde* (3)
	$x=\frac{-3+2}{2}=-\frac{1}{2}$ $y=2\left(-\frac{1}{2}\right)+2\left(-\frac{1}{2}\right)-12$ $y=-12\frac{1}{2}$ $\text{TP}\left(-\frac{1}{2};-12,5\right)$ **OR/*OF***	✓ method/*metode* ✓*x*-value/*waarde* ✓*y*-value/*waarde* (3)
	$f(x)=y=2x^2+2x-12$ $f'(x)=4x+2$ $4x+2=0$ $4x=-2$ $x=-\frac{1}{2}$ $\therefore y=2\left(-\frac{1}{2}\right)^2+2\left(-\frac{1}{2}\right)-12=-\frac{25}{2}$ $\text{TP}\left(-\frac{1}{2};-\frac{25}{2}\right)$	✓ method/*metode* ✓*x*-value/*waarde* ✓*y*-value/*waarde* (3)

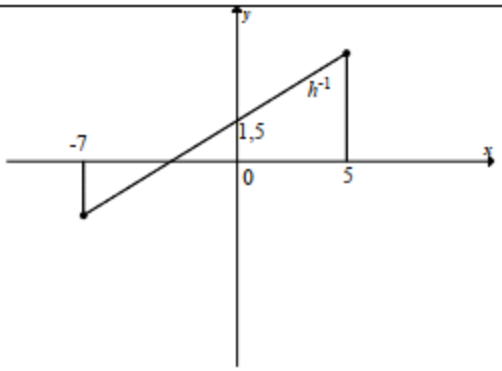
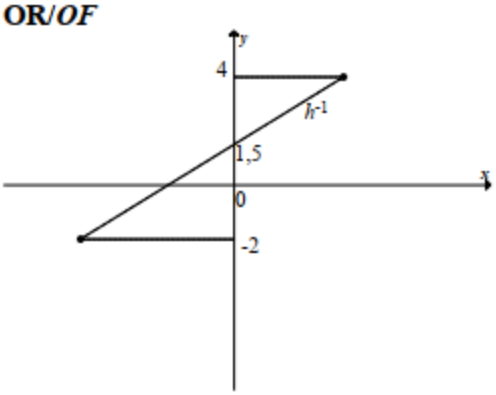
6.4	$x=\frac{13}{2}$	✓✓ answer/i (2)
6.5	$f'(x)=4x+2$ $m=f'(1)=4(1)+2$ $m=6$	✓ $y'=4x+2$ ✓ subst. $x=1$ ✓ answer/*antwoord* (3) **[15]**

Question 4 **November 2015**

Given: $f(x)=2^{x+1}-8$		
4.1	$y=-8$	✓ $y=-8$ (1)
4.2		✓x-intercept ✓y-intercept ✓shape ✓asymptote (only if the graph does not cut the asymptote) (4)
4.3	$g(x)=2^{-x+1}-8$ **OR/*OF*** $g(x)=\left(\frac{1}{2}\right)^{x-1}-8$	✓answer (1) ✓answer (1) **[6]**

Question 5 **November 2015**

Given $h(x)=2x-3$ for $-2\le x\le 4$. 	

5.1	For x-intercepts, $y = 0$ $2x - 3 = 0$ $x = 1{,}5$ $Q(1{,}5\,;\,0)$	✓ $x = 1{,}5$ ✓ $y = 0$ (2)
5.2	h: $x = -2$: $y = 2(-2) - 3 = -7$ $x = 4$: $y = 2(4) - 3 = 5$ Domain of h^{-1}: $-7 \le x \le 5$ **OR/*OF*** $[-7; 5]$	✓ $h(-2) = -7$ ✓ $h(4) = 5$ ✓ $-7 \le x \le 5$ (3)
5.3	 **OR/*OF***  	✓ y-intercept on a straight line ✓ line segment ✓ accurate endpoints (x or y or both) (3)
5.4	$h(x) = 2x - 3$ For the inverse of h, $x = 2y - 3$ $y = \frac{x+3}{2}$ $h^{-1}(x) = \frac{x+3}{2}$ $h(x) = h^{-1}(x)$ $2x - 3 = \frac{x+3}{2}$ $4x - 6 = x + 3$ $x = 3$ **OR/*OF***	✓ $y = \frac{x+3}{2}$ ✓ $2x - 3 = \frac{x+3}{2}$ ✓ $x = 3$ (3)

$h(x)=2x-3$

h and h^{-1} intersect when $y=x$

$h(x)=x$ ✓ $h(x)=x$

$2x-3=x$ ✓ $2x-3=x$

$x=3$ ✓ $x=3$

(3)

OR/*OF*

$h(x)=2x-3$

For the inverse of h, ✓ $y=\frac{x+3}{2}$

$x=2y-3$

$y=\frac{x+3}{2}$

$h^{-1}(x)=x$ ✓ $\frac{x+3}{2}=x$

$\frac{x+3}{2}=x$

$x+3=2x$ ✓ $x=3$

$x=3$

(3)

5.5 $OP^2=(x-0)^2+(y-0)^2$ ✓ $OP^2=x^2+y^2$

$=x^2+(2x-3)^2$ ✓ substitute $y=2x-3$

$=x^2+4x^2-12x+9$

$=5x^2-12x+9$ ✓ $5x^2-12x+9$

For OP to be at its minimum, OP^2 has to be a minimum

Vir OP om minimum te wees, moet OP^2 'n minimum wees

$\frac{d(OP^2)}{dx}=0$ **OR / *OF*** $x=-\frac{b}{2a}$

$10x-12=0$ $=-\frac{-12}{2(5)}$

$\therefore x=\frac{6}{5}$ ✓ x-value

Minimum length of OP $=\sqrt{5\left(\frac{6}{5}\right)^2-12\left(\frac{6}{5}\right)+9}=\sqrt{\frac{9}{5}}$ or $\frac{3}{\sqrt{5}}$ or 1,34 units ✓ answer

(5)

OR/*OF*

For minimum distance OP $\perp$ the line

$m_h=2$ (given)

$m_{OP}=\frac{-1}{2}$

$\therefore$ OP has equation $y=\frac{-1}{2}x$

$$\frac{-1}{2}x = 2x - 3$$
$$-x = 4x - 6$$
$$5x = 6$$
$$x_P = 1{,}2$$
$$y_P = -\frac{1}{2}(1{,}2) = -0{,}6$$
$$OP = \sqrt{(1{,}2-0)^2 + (-0{,}6-0)^2}$$
$$= 1{,}34 \text{ or } \sqrt{1{,}8} \text{ units}$$

✓ $m_{OP} = \frac{-1}{2}$
✓equation of OP
✓ $\frac{-1}{2}x = 2x - 3$
✓x-value
✓answer
(5)

OR/*OF*

For minimum distance OP ⊥ the line

$O(0;0) \quad P(x;\ 2x-3) \quad Q\left(\frac{3}{2};0\right)$

$$OP^2 + PQ^2 = OQ^2 \quad \text{(pythag)}$$
$$(x-0)^2 + (2x-3-0)^2 + \left(x-\frac{3}{2}\right)^2 + (2x-3-0)^2 = \left(\frac{3}{2}\right)^2$$
$$x^2 + 4x^2 - 12x + 9 + x^2 - 3x + \frac{9}{4} + 4x^2 - 12x + 9 = \frac{9}{4}$$
$$10x^2 - 27x + 18 = 0$$
$$(5x-6)(2x-3) = 0$$
$$x = \frac{6}{5} \text{ or } \frac{3}{2}$$

Hence, $x = \frac{6}{5}$ at P

$$OP^2 = x^2 + (2x-3)^2$$
$$= \left(\frac{6}{5}\right)^2 + \left(2\left(\frac{6}{5}\right) - 3\right)^2$$
$$= \frac{36}{25} + \frac{9}{25}$$
$$= \frac{9}{5}$$
$$OP = 1{,}34$$

✓ $OP^2 = x^2 + y^2$
✓substitute $y = 2x - 3$
✓ $10x^2 - 27x + 18$
✓x-value
✓answer
(5)

OR/*OF*

For minimum distance OP ⊥ the line

$$\tan \hat{Q} = 2$$
$$\hat{Q} = 63{,}43^\circ$$
$$\sin 63{,}43^\circ = \frac{OP}{1{,}5}$$
$$OP = 1{,}34$$

✓ $\tan \hat{Q} = 2$
✓ $\hat{Q} = 63{,}43^\circ$
✓ $\sin 63{,}43^\circ$
✓ $\frac{OP}{1{,}5}$
✓ answer
(5)

OR/*OF*

$$OP = \sqrt{(x-0)^2 + (y-0)^2}$$
$$= \sqrt{(x-0)^2 + (2x-3-0)^2}$$
$$= \sqrt{x^2 + 4x^2 - 12x + 9}$$
$$= \sqrt{5x^2 - 12x + 9}$$

✓ $OP = \sqrt{(x-0)^2 + (y-0)^2}$

✓substitute $y = 2x - 3$

✓ $5x^2 - 12x + 9$

By using the chain rule (which is not in the CAPS):

$$\frac{dOP}{dx} = \frac{1}{2}\left(5x^2 - 12x + 9\right)^{\frac{-1}{2}} \cdot (10x - 12)$$
$$0 = \frac{1}{2}\left(5x^2 - 12x + 9\right)^{\frac{-1}{2}} \cdot (10x - 12)$$
$$0 = \frac{1}{2}(10x - 12)$$
$$0 = 5x - 6$$
$$x = \frac{6}{5}$$

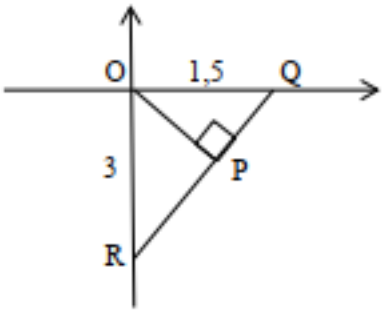
✓x-value

$$OP = \sqrt{5\left(\frac{5}{6}\right)^2 - 12\left(\frac{6}{5}\right) + 9}$$
$$= 1{,}34$$

✓answer (5)

OR/*OF*

For minimum distance OP ⊥ the line
Let the y-intercept be R
OR = 3 units



$OQ = \frac{3}{2}$ units

$RQ = \frac{3}{2}\sqrt{5}$ (Pythagoras)

✓ $RQ = \frac{3}{2}\sqrt{5}$

Area OQR $= \frac{1}{2} \times$ base $\times \perp$height

$$\frac{1}{2}.OR.OQ = \frac{1}{2}\left(\frac{3}{2}\sqrt{5}\right).OP$$
$$\frac{1}{2}.3\left(\frac{3}{2}\right) = \frac{1}{2}\left(\frac{3}{2}\sqrt{5}\right).OP$$
$$OP = \frac{3}{\sqrt{5}} = 1{,}34$$

✓ $\frac{1}{2}\left(\frac{3}{2}\sqrt{5}\right)OP$

✓ $\frac{1}{2}.3\left(\frac{3}{2}\right)$

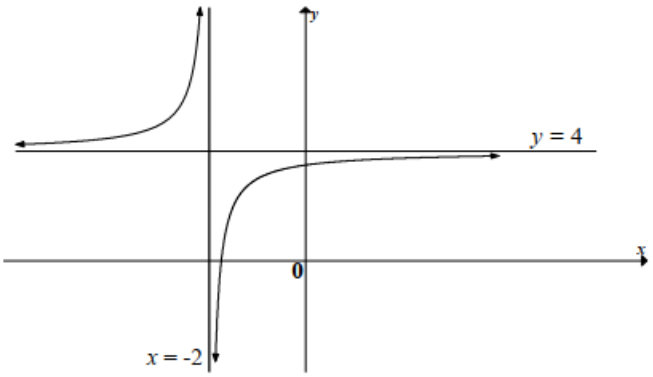
✓ equating

✓ answer (5)

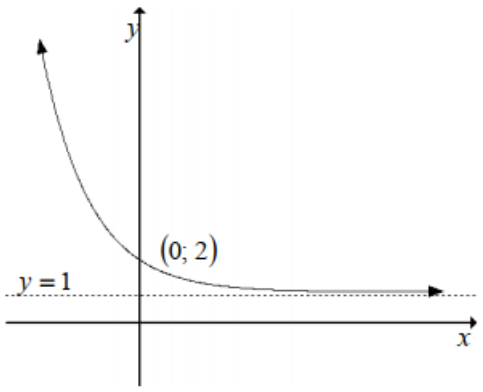
5.6.1	$f'(x)=2x-3$ Turning point at $x=\frac{3}{2}$ $f''(x)=2>0$ or $f''\left(\frac{3}{2}\right)>0$ f has a local minimum at $x=\frac{3}{2}$ *f het 'n lokale minimum by* $x=\frac{3}{2}$ **OR/*OF*** $h(x)=f'(x)<0$ for $x\in(-2\ ;\ 1{,}5)\Rightarrow f$ is decreasing on the left of Q / *f is dalend links van Q.* $h(x)=f'(x)>0$ for $x\in(1{,}5\ ;\ 4)\Rightarrow f$ is increasing on the right of Q / *f is stygend regs van Q.* $\therefore f(x)$ has a local minimum when $x=\frac{3}{2}$ / *$\therefore f(x)$ het 'n lokael minimum by* $x=\frac{3}{2}$ **OR/*OF*** $f(x)=x^2-3x+c$ f has a minimum value since $a>0$ *f het 'n minimum waarde omdat $a>0$*	✓ Turning point at $x=\frac{3}{2}$ ✓ $f''(x)=2>0$ (2) ✓decreasing left of Q ✓increasing right of Q (2) ✓ $f(x)=x^2-3x+c$ ✓ explanation (2)
5.6.2	$m=f'(4)=h(4)=5$	✓answer (1) **[19]**

Question 6 **November 2015**

6.1.1	$T(0;18)$	✓ $(0;18)$ (1)
6.1.2	$-2x^2+18=0$ $(x-3)(x+3)=0$ Q(3 ; 0) **OR/*OF*** $-2x^2+18=0$ $x^2=9$ Q(3 ; 0)	✓$y=0$ ✓factors ✓$x=3$ (3) ✓ $y=0$ ✓ $x^2=9$ ✓ $x=3$ (3)

6.1.3	x-coordinate of S is 4,5/*x-koördinaat van S is 4,5* By symmetry about the line $x = 4{,}5$/*Deur simmetrie om die lyn x = 4,5:* R = (4,5 + 4,5–3 ; 0) = (6 ; 0)	✓ $x = 6$ ✓ $y = 0$ (2)
6.1.4	For all $x \in \mathbf{R}$ **OR/*OF*** $(-\infty;\infty)$	✓✓answer (2)
6.2	If C $(x;y)$ is the centre of the hyperbola/*As C $(x;y)$ die middelpunt is van die hiperbool* $y = x + 6$ and $x = -2$ $\therefore y = -2 + 6 = 4$  	✓✓ asymptote $y = 4$ ✓asymptote $x = -2$ ✓shape (increasing hyperbolic function) (4) **[12]**

Question 4 **Feb March 2016**

4.1	$(0\ ;2)$	✓answer (1)
4.2	 	✓shape ✓$(0;2)$ ✓asymptote (3)
4.3	$f(-2) = 5$ $f(1) = 2^{-1} + 1 = \frac{3}{2}$ Average gradient $= \frac{f(1) - f(-2)}{1 - (-2)}$ $= \frac{\frac{3}{2} - 5}{3}$ $= -\frac{7}{6}$	✓ $f(-2) = 5$ ✓ $f(1) = \frac{3}{2}$ ✓ answer (3)

4.4	Since the asymptote of f is $y=1$, the asymptote of $h(x)=3f(x)$ will be $y=3$. *Omdat die asimptoot van f $y=1$ is,* *sal die asimptoot van $h(x)=3f(x)$ $y=3$ wees.*	✓answer (1) **[8]**

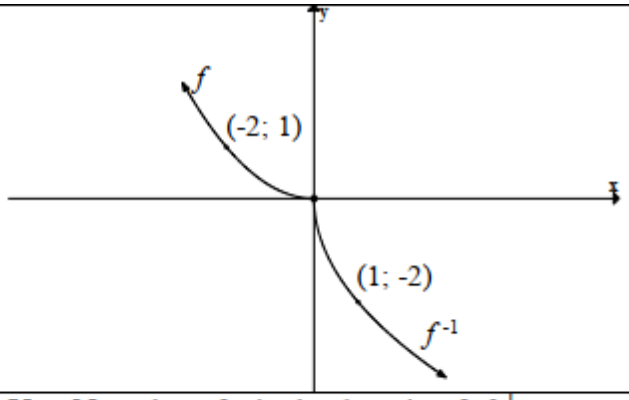
Question 5 **Feb March 2016**

5.1	$y=a(x+p)^2+q$ Turning point $(1;-8)$: $y=a(x-1)^2-8$ Substitute $(0;-4)$: $-4=a(0-1)^2-8$ $-4=a-8$ $a=4 \quad p=-1 \quad q=-8$ $y=4(x-1)^2-8$	✓ $y=a(x-1)^2-8$ ✓substitute $(0;-4)$ ✓ $a=4$ ✓ p and q values (4)
5.2	Asymptote is $y=-2 \quad \Rightarrow \quad d=-2$ Substitute $(1;-8)$: $-8=\frac{k}{1+r}-2$ $k=-6(1+r)$ $k=-6-6r$ .....line 1 Substitute $(0;-4)$: $-4=\frac{k}{r}-2$ $\frac{k}{r}=-2$ $k=-2r$ .....line 2 Equating lines 1 and 2: $-6-6r=-2r$ $-4r=6$ $r=-\frac{3}{2}$ Substituting into line 2 or line 1: $k=(-2)\left(-\frac{3}{2}\right)=3$ $\quad$ $k=-6-6\left(-\frac{3}{2}\right)=3$	✓ $d=-2$ ✓ $k=-6-6r$ ✓ $k=-2r$ ✓ $-6-6r=-2r$ ✓ value of r ✓ value of k (6)
5.3	$g(x)\geq f(x)$ $\therefore 0\leq x\leq 1$	✓ $0\leq x$ ✓ $x\leq 1$ (2)
5.4	The line $y=k$ must pass through f twice on the positive side of the x-axis./*Die lyn $y=k$ moet twee keer deur f aan die positiewe kant van die x-as sny.* $-8<k<-4$	✓ $-8<k$ ✓ $k<-4$ (2)

5.5	$y=-x+c$ Substitute the intersection point of the asymptotes, i.e. $\left(\frac{3}{2};-2\right)$: *Vervang die snypunt van die asimptote, m.a.w.* $\left(\frac{3}{2};-2\right)$: $-2=-\frac{3}{2}+c$ $c=-\frac{1}{2}$ $y=-x-\frac{1}{2}$ **OR/*OF*** $y=-x$ is translated $\frac{3}{2}$ units right and 2 units down/ $y=-x$ *transleer* $\frac{3}{2}$ *eenhede na regs en 2 eenhede na onder* $\Rightarrow$ $y=-\left(x-\frac{3}{2}\right)-2$ $y=-x-\frac{1}{2}$	✓ $y=-x+c$ ✓ $-2=-\frac{3}{2}+c$ ✓answer (3) ✓ $y=-x$ ✓ $y=-\left(x-\frac{3}{2}\right)-2$ ✓answer (3)
5.6	By symmetry, $Q=\left(\frac{3}{2}+8-2;-2+\frac{3}{2}-1\right)$ $=\left(\frac{15}{2};-\frac{3}{2}\right)$	✓ $x=\frac{15}{2}$ ✓ $y=-\frac{3}{2}$ (2) **[19]**

Question 6 **Feb March 2016**

6.1	$f:\ y=\frac{1}{4}x^2$ $f^{-1}:\ x=\frac{1}{4}y^2$ $y^2=4x$ $y=\pm\sqrt{4x}$ $f^{-1}(x)=-\sqrt{4x}$ **OR**/OF $f^{-1}(x)=-2\sqrt{x}$	✓interchanging x and y ✓ $y^2=4x$ ✓answer (3)

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

Question 4 **May June 2016**

4.1	(0 ; 3)	✓ (0 ; 3) (1)
4.2	$x = -\frac{b}{2a}$ or $-2x-2=0$ $= -\frac{(-2)}{2(-1)}$ $\therefore x=-1$ $=-1$ $y=-(-1)^2-2(-1)+3$ or $y=\frac{4ac-b^2}{4a}$ $=4$ $=\frac{4(-1)(3)-(-2)^2}{4(-1)}$ $C(-1;4)$	✓ $x=-\frac{(-2)}{2(-1)}$ or $-2x-2=0$ ✓ simplification ✓ in the context of a turning point $-(-1)^2-2(-1)+3$ $\frac{4(-1)(3)-(-2)^2}{4(-1)}$ (3)

4.3	B(1 ; 0) By symmetry/*Deur simmetrie* A(−3 ; 0) **OR/OF** $x^2+2x-3=0$ $(x+3)(x-1)=0$ $x=-3$ or $x=1$ A(−3 ; 0)	✓ A(−3 ; 0) (1) ✓ A(−3 ; 0) (1)
4.4	Equation of g: $m=\frac{4-0}{-1+3}$ $=2$ $y=2x+q$ **OR/OF** $y-0=2(x+3)$ $0=2(-3)+q$ or $4=2(-1)+q$ $y=2x+6$ $q=6$ or $y-4=2(x+1)$ $y=2x+6$ E(0 ;6) C(−1 ;4) $CE=\sqrt{(0+1)^2+(6-4)^2}$ $=\sqrt{5}$ units/2,24 units	✓ $m=2$ ✓subs of A(−3;0) or C (−1;4) ✓ $y=2x+6$ ✓ E(0 ;6) ✓substitution into distance formula ✓answer (6)
4.5	$f'(x)=-2x-2$. But $m_{tan}=2$ $-2x-2=2$ $x=-2$ $f(-2)=3$ $y=2x+k$ $3=2(-2)+k$ $k=7$ **OR/OF** $-x^2-2x+3=2x+k$ $-x^2-4x+3-k=0$ $x^2+4x-3+k=0$ For equal roots : $\Delta=b^2-4ac=0$ $(-4)^2-4(-1)(3-k)=0$ $(4)^2-4(1)(k-3)=0$ $16+12-4k=0$ or $16-4k+12=0$ $k=7$ $k=7$	✓ $-2x-2$ ✓ $-2x-2=2$ ✓ $x=-2$ ✓ $y=3$ ✓answer (5) ✓ $-x^2-2x+3=2x+k$ ✓standard form ✓ $b^2-4ac=0$ ✓substitution ✓answer (5)

4.6	g: $y=2x+6$ g^{-1}: $x=2y+6$ $2y=x-6$ $y=\frac{x-6}{2}$ or $y=\frac{x}{2}-3$	✓ $x=2y+6$ ✓ $y=\frac{x-6}{2}$ or $y=\frac{x}{2}-3$ (2)
4.7	$g(x)\geq g^{-1}(x)$ $2x+6\geq\frac{x-6}{2}$ $4x+12\geq x-6$ $3x\geq -18$ $x\geq -6$	✓ $2x+6\geq\frac{x-6}{2}$ ✓ $4x+12\geq x-6$ ✓ $x\geq -6$ (3) **[21]**

Question 5 **May June 2016**

5.1	$r=2$	✓$r=2$ (1)
5.2	$g(x)=2^x+2$ $g(0)=2^0+2=3$ B(0 ; 3) $3=\frac{3}{0-p}+2$ $p=-3$	✓ $g(0)=2^0+2$ ✓ $y=3$ ✓substitute B(0 ; 3) and $q=2$ ✓ $p=-3$ (4)
5.3	at A: $x=-3$ $y=2^{-3}+2=2\frac{1}{8}$ $A\left(-3;2\frac{1}{8}\right)$ or $A\left(-3;\frac{17}{8}\right)$ or $A(-3;2{,}125)$	✓ at A : $x=-3$ (p-value) ✓ substitute $x=-3$ into exponential eqution ✓ y-value (3)
5.4	$-3<x\leq 0$ **OR/ OF** $(-3;0]$	✓$-3<x$ ✓$x\leq 0$ (2)
5.5	$f(x)=\frac{3}{x+3}+2$ $f(x-2)=\frac{3}{x-2+3}+2$ $h(x)=\frac{3}{x+1}+2$	✓substitution of $x-2$ ✓ $h(x)=\frac{3}{x+1}+2$ (2) **[12]**

Question 4 **May June 2016**

4.1	$y = 0$	✓ $y = 0$ (1)
4.2	R(0 ; 1)	✓ answer (1)
4.3	$y = a^x$ $9 = a^2$ $\therefore a = 3$	✓ substitution ✓ $a = 3$ (2)
4.4	DP = $2 - b$ $y = 3^x$ $\frac{1}{81} = 3^b$ $3^{-4} = 3^b$ $b = -4$ DP = $2 - (-4)$ = 6 units	✓ $\frac{1}{81} = 3^b$ ✓ 3^{-4} or use of logs ✓ $b = -4$ ✓ DP = 6 units (4)
4.5	$h(x+2) + k = 0$ $h(x+2) = -k$ $0 < -k < \frac{1}{81}$ $-\frac{1}{81} < k < 0$	✓✓ $-k < \frac{1}{81}$ or $k > -\frac{1}{81}$ ✓ $-\frac{1}{81} < k < 0$ (3)
		[11]

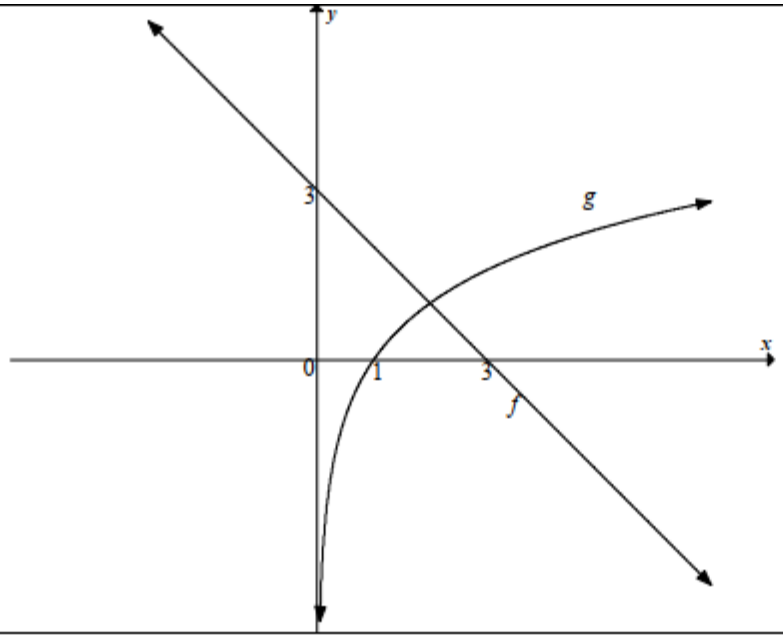
Question 5 **May June 2016**

5.1	$f(x) = -x^2 + 4x - 3$ $f'(x) = 0$ or $x = -\frac{4}{2(-1)}$ $-2x + 4 = 0$ $x = 2$ $x = 2$ $y = -(2)^2 + 4(2) - 3$ $= 1$ B(2 ; 1) **OR/OF**	✓ $-2x + 4 = 0$ or $x = -\frac{4}{2(-1)}$ ✓ $y = -(2)^2 + 4(2) - 3$ (2)

	$-x^2+4x-3=0$ $x^2-4x+3=0$ $(x-3)(x-1)=0$ $x=3$ or $x=1$ $x=\frac{3+1}{2}$ $x=2$ $y=-(2)^2+4(2)-3$ $=1$ B(2 ; 1)	✓ $x=\frac{3+1}{2}$ ✓ $y=-(2)^2+4(2)-3$ (2)
5.2	Range/*Waardeversameling* : $y\leq 1$ **OR/OF** Range/*Waardeversameling* : $y\in(-\infty\,;1]$	✓ $y\leq 1$ (1) ✓ $(-\infty\,;1]$ (1)
5.3	$x\leq -1$ or $x>2$ **OR/OF** $(-\infty\,;-1]\cup(2\,;\infty)$	✓ critical values ✓ $x\leq -1$ or $x>2$ (2) ✓ critical values ✓ $x\leq -1$ or $x>2$ (2)
5.4	$(x-p)(y+t)=3$ Vertical asymptote of h(x) */vertikale asimptoot* at $x=2$ Translation 4 units to the left / *Translasie 4 eenhede links* $x=2-4=-2$ is the equation of the vertical asymptote of h($x+4$) $x=2-4=-2$ *is die vergelyking van die vertikale asimptoot* **OR/OF** $h(x)=\frac{3}{x-2+4}+1$ $=\frac{3}{x+2}+1$ $x=-2$ is the equation of the vertical asymptote / *is die vergelyking van die vertikale asimptoot*	✓ $x=-2$ (1) ✓ $x=-2$ (1)

5.5	$(x-p)(y+t)=3$ $(y+t)=\frac{3}{(x-p)}$ $y=\frac{3}{x-p}-t$ $B(2;1)$ Point of intersection of the asymptotes *Snypunt van die asimptote* $p=2$ $-t=1$ $t=-1$	✓ $\frac{3}{x-p}$ ✓ $-t$ ✓ $p=2$ ✓ $t=-1$ (4)
5.6	x-intercepts of f / *x-afsnitte van* f: $x^2-4x+3=0$ $(x-3)(x-1)=0$ $x=1$ or $x=3$ $g'(x)<0$ for $x\in R;\ x\neq 2$ Hence $f(x)<0$ $x\leq 1$ or $x\geq 3$ **OR/OF** $(-\infty;1]\cup[3;\infty)$	✓ both critical values ✓ $x\leq 1$ ✓ or ✓ $x\geq 3$ (4) **[14]**

Question 6 **May June 2016**

6.1		*g*: ✓shape: increasing curve ✓(1 ; 0): only on log graph *f*: ✓(3 ; 0) ✓(0 ; 3) (4)

6.2	$y = \log_2 x$ $g^{-1}: \ x = \log_2 y$ $y = 2^x$	✓ interchange x and y ✓ $y = 2^x$ (2)
6.3	$\log_2(3-x) = x$ $2^x = 3 - x$ $2^x = -x + 3$ Reflect the graph of g about the line $y = x$ to obtain g^{-1} and determine the point of intersection of f and g^{-1} / *Reflekteer die grafiek van g om die lyn* $y = x$ *en bepaal die snypunt van* f and g^{-1}	✓✓ $2^x = -x + 3$ ✓ point of intersection of f and g^{-1} (3)
6.4	$x = 1$	✓ answer (1) **[10]**

Question 7 **November 2014**

7.1	$A = P(1-i)^n$ $72\,500 = 145\,000(1-i)^5$ $i = 1-\sqrt[5]{\frac{72500}{145000}}$ $= 0{,}1294\ldots$ ∴ Rate of interest/*Rentekoers* is 12,94 % p.a./*p.j.* **OR/*OF*** $(1-i)^5 = \frac{1}{2}$ $\therefore i = 1-\left(\frac{1}{2}\right)^{\frac{1}{5}}$ $i = 0{,}1294$ ∴ Rate of interest/*Rentekoers* is 12,94 % p.a./*p.j.*	✓substitution/*substitusie* ✓writing in terms of i *herskryf in terme van i* ✓answer/*antwoord* (3) ✓substitution/*substitusie* ✓writing i.t.o i ✓answer (3)
7.2.1	$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $500\,000 = \frac{x\left[1-\left(1+\frac{0{,}12}{12}\right)^{-240}\right]}{\frac{0{,}12}{12}}$ $x = \frac{500000\times\frac{0{,}12}{12}}{\left[1-\left(1+\frac{0{,}12}{12}\right)^{-240}\right]}$ $x = \text{R}5505{,}43$	✓ $i = \frac{0{,}12}{12}$ ✓ $n = 240$ ✓substitution into correct formula ✓answer/*antwoord* (4)
7.2.2	$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $500000 = \frac{6000\left[1-\left(1+\frac{0{,}12}{12}\right)^{-n}\right]}{\frac{0{,}12}{12}}$ $\frac{500000}{6000}\times 0{,}01 = 1-(1{,}01)^{-n}$ $(1{,}01)^{-n} = 1-\frac{5}{6}$ $-n = \frac{\log\frac{1}{6}}{\log 1{,}01}$ $n = 180{,}07$ ∴ Melissa settles the loan in 181 months	✓6000 ✓substitute into correct formula/*substitusie in korrekte formule* ✓ use of logs/*gebruik van logs* ✓answer/*antwoord* (4)

7.2.3	Samuel He is paying off his loan over a longer period thus more interest will be paid./*Hy betaal sy lening oor 'n langer tydperk af, dus sal hy meer rente betaal.* **OR/*OF*** Samuel He will pay/*Hy betaal* R5505,43 × 240 – R500 000 = R821 303,20 She will pay between/*Sy sal tussen* R580 000 and/*en* R586 000,00 *betaal.*	✓Samuel ✓reason/*rede* (2) ✓Samuel ✓reason/*rede* (2) **[13]**

Question 7 **Feb March 2015**

7.1.1	$R400\times(44\times12)$ $=R211200$	✓$R400\times(44\times12)$ ✓R211200 (2)
7.1.2	$F=\frac{x\left[(1+i)^n-1\right]}{i}$ $=\frac{400\left[\left(1+\frac{0,08}{12}\right)^{528}-1\right]}{\frac{0,08}{12}}$ $=$R1 943 524,42	✓$x=400$ ✓$n=528$ ✓$i=\frac{0,08}{12}$ ✓ substitution into correct formula/*substitusie in korrekte formule* ✓answer/*antwoord* (5)
7.1.3	$P=\frac{x[1-(1+i)^{-n}]}{i}$ $2000000=\frac{x\left[1-\left(1+\frac{0,1}{12}\right)^{-300}\right]}{\frac{0,1}{12}}$ $x=$R18 174,01 **OR/*OF*** $2000000\left(1+\frac{0,1}{12}\right)^{300}=\frac{x\left(\left(1+\frac{0,1}{12}\right)^{300}-1\right)}{\frac{0,1}{12}}$ $x=$R18174,01	✓ P = 2000000 ✓$n=300$ and/*en* $i=\frac{0,1}{12}$ ✓ substituting into correct formula/*substitusie in korrekte formule* ✓ answer/*antwoord* (4) ✓P = 2000000 ✓$n=300$ and/*en* $i=\frac{0,1}{12}$ ✓equating/stel gelyk ✓ answer/*antwoord* (4)

7.2	Let P_X and P_Y be the populations of the two towns at the beginning of 2010./*Laat* P_X *en* P_Y *die bevolkings wees van die twee dorpe aan die begin van 2010.* $A_X = A_Y$ $P_X(1-0{,}08)^3 = P_Y(1+0{,}12)^3$ $\frac{P_X}{P_Y} = \frac{(1+0{,}12)^3}{(1-0{,}08)^3}$ $= \frac{1{,}404...}{0{,}778...}$ $= 1{,}8:1$	✓ equating/*stel gelyk* ✓ $A_X = P_X(1-0{,}08)^3$ ✓ $A_Y = P_Y(1+0{,}12)^3$ ✓ answer/*antwoord* (4) **[15]**

Question 7 **November 2015**

7.1	R450 000	✓answer (1)
7.2	$A = P(1-i)^n$ $f(x) = 450000(1-i)^x$ $243\ 736{,}90 = 450000(1-i)^4$ $i = 1 - \sqrt[4]{\frac{243\ 736{,}90}{450000}}$ $i = 0{,}1421$ The rate of depreciation is 14,21% p.a. *Die waardeverminderingskoers is 14,21% p.j.*	✓substitution of 450 000 into correct formula ✓substitution of $(4;\ 243\ 736{,}90)$ into correct formula ✓making i the subject ✓answer (4)
7.3	At T : $A = P(1+i)^n$ $g(x) = 450000(1+i)^x$ $a = 450000(1+0{,}081)^4$ $= R614490{,}66$	✓$i = 0{,}081$ & $n = 4$ ✓correct substitution into formula ✓answer (3)

7.4	Future Value $= R614\,490,66 - R243\,736,90$ $= R370\,753,76$ Let x be the value of monthly payment $F_v = \frac{x\left[(1+i)^n - 1\right]}{i}$ $370753,76 = \frac{x\left[\left(1+\frac{0.062}{12}\right)^{36} - 1\right]}{\frac{0.062}{12}}$ $x = R9397,11$	✓R370 753,76 ✓$i = \frac{0,062}{12}$ ✓$n = 36$ ✓substitution into correct formula ✓answer (5) **[13]**

Question 7 **Feb March 2016**

7.1.1	Quarterly interest rate/*Kwartaallikse rentekoers* $= \frac{10\%}{4}$ $= 2,5\%$	✓answer (1)
7.1.2	$A = P(1+i)^n$ $= 5000\left(1+\frac{2,5}{100}\right)^{2\times4}$ $= R6092,01$	✓$n = 8$ ✓$5000\left(1+\frac{2,5}{100}\right)^{2\times4}$ ✓answer (3)
7.2.1	$P_v = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $800\,000 = \frac{10\,000\left[1-\left(1+\frac{0,14}{12}\right)^{-n}\right]}{\frac{0,14}{12}}$ $\frac{800\,000}{10\,000}\times\frac{0,14}{12} = 1-\left(1+\frac{0,14}{12}\right)^{-n}$ $\left(1+\frac{0,14}{12}\right)^{-n} = 1-\frac{800\,000}{10\,000}\times\frac{0,14}{12}$ $-n = \frac{\log\left[1-\frac{800000\times\frac{0,14}{12}}{10000}\right]}{\log\left(1+\frac{0,14}{12}\right)}$ $n = 233,4699962$ Motloi can make 233 withdrawals of R10 000./*Motloi kan 233 onttrekkings van R10 000 maak.*	✓$i = \frac{0,14}{12}$ ✓substitute into present value formula ✓$\left(1+\frac{0,14}{12}\right)^{-n} = 1-\frac{800\,000}{10\,000}\times\frac{0,14}{12}$ ✓ use of logs ✓233 (5)

7.2.2 (a)	$A\text{-}F_v = 800\,000\left(1+\frac{0,14}{12}\right)^{48} - \frac{10\,000\left[\left(1+\frac{0,14}{12}\right)^{48}-1\right]}{\frac{0,14}{12}}$ $= 1\ 396\ 005,54 - 638\ 577,36$ $= R757\,428$ **OR/*OF***	✓$n = 48$ in both formulae ✓$i = \frac{0,14}{12}$ in both formulae ✓ substitution into both formulae ✓answer (4)
	$P_v = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $= \frac{10000\left[1-\left(1+\frac{0,14}{12}\right)^{-185,4699962\ldots}\right]}{\frac{0,14}{12}}$ $= R757\,428$	✓$n = -185,46996\ldots$ ✓$i = \frac{0,14}{12}$ ✓ $\frac{10000\left[1-\left(1+\frac{0,14}{12}\right)^{-185,4699962\ldots}\right]}{\frac{0,14}{12}}$ ✓answer (4)
7.2.2 (b)	Let the purchase price of the house be y./*Laat die koopprys van die huis y wees.* $\frac{757\,428}{y} = 30\%$ $757\,428 = 0,3y$ $y = \frac{757\,428}{0,3}$ $= R2\,524\,760$ **OR/*OF*** Let the purchase price of the house be y./*Laat die koopprys van die huis y wees.* $y = \frac{757\,428}{30} \times 100$ $= R2\,524\,760$	✓answer (1) ✓answer (1) **[14]**

Question 6 **May June 2016**

6.1	$A = P(1-i)^n$ $\frac{2}{3}P = P(1-0,047)^n$ $\frac{2}{3} = (1-0,047)^n$ $\log\frac{2}{3} = n\log(1-0,047)$ $n = \frac{\log\frac{2}{3}}{\log(1-0,047)}$ $n = 8,42$ years	✓ $A = \frac{2}{3}P$ ✓ substitution into correct formula ✓ logs ✓ answer (4)
6.2.1	The book value of the tractor after 5 years/*Die boekwaarde van die trekker na 5 jaar* Book value $= x(1-0,2)^5$ or $x(0,8)^5$ $= 0,32768x$	✓ $x(1-0,2)^5$ or $x(0,8)^5$ ✓ $0,32768x$ (2)
6.2.2	Price of new tractor after 5 years/*Prys van nuwe trekker na 5 jaar* Book value $= x(1+0,18)^5$ or $x(1,18)^5$ $= 2,28776x$	✓ $x(1+0,18)^5$ or $x(1,18)^5$ ✓ $2,28776x$ (2)
6.2.3	$F = \frac{x\left[(1+i)^n - 1\right]}{i}$ $= \frac{8000\left[\left(1+\frac{0,10}{12}\right)^{60} - 1\right]}{\frac{0,10}{12}}$ $=$ R619 496,58	✓ $i = \frac{0,10}{12}$ ✓ $n = 60$ ✓ subst. into future value formula ✓ answer (4)
6.2.4	Sinking fund = New tractor price – Scrap value *Delgingsfonds = Nuwe trekker se prys – boekwaarde* $619\,496,58 = x(1+0,18)^5 - x(1-0,2)^5$ $619\,496,58 = x\left[(1,18)^5 - (0,8)^5\right]$ $x = \frac{619\,496,58}{\left[(1,18)^5 - (0,8)^5\right]}$ $x =$ R 316 057,15 $x =$ R 316 000 **OR/OF**	✓ 619 496,58 ✓ $x(1+0,18)^5 - x(1-0,2)^5$ ✓ common factor x ✓ R 316 000 (4)

	$619\,496{,}58 = x(2{,}28776) - x(0{,}32768)$ $619\,496{,}58 = x[1{,}96008]$ $x = \frac{619\,496{,}58}{1{,}96008}$ $x = \text{R}316\ \ 056{,}78$ $x = \text{R}316\ \ 000$	✓ $619\,496{,}58$ ✓ $x(2{,}28776) - x(0{,}32768)$ ✓ simplification ✓ R 316 000 (4) **[16]**

Question 7 **November 2016**

7.1	$A = P(1+i)^n$ $= 250000\left(1+\frac{0{,}15}{12}\right)^2$ $= \text{R}256\ 289{,}06$	✓substituting i and n values in correct formula ✓ answer (2)
7.2	$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $256\ 289{,}06 = \frac{x\left[1-\left(1+\frac{0{,}15}{12}\right)^{-46}\right]}{\frac{0{,}15}{12}}$ $3203{,}6133 = x\left[1-\left(1+\frac{0{,}15}{12}\right)^{-46}\right]$ $x = \text{R}\ 7\ 359{,}79 \quad \text{per month}$ **OR/*OF*** $250000 = \frac{x\left(1+\frac{0{,}15}{12}\right)^{-2}\left[1-\left(1+\frac{0{,}15}{12}\right)^{-46}\right]}{\frac{0{,}15}{12}}$ $x = \text{R}\ 7\ 359{,}79$	✓ $i = \frac{0{,}15}{12}$ ✓ $n = 46$ ✓ substitution into correct formula ✓ answer (4) ✓ $i = \frac{0{,}15}{12}$ ✓ $n = 46$ ✓ substitution into correct formula ✓ answer (4)

7.3	$256\ 289{,}06 = \dfrac{9\ 000\left[1-\left(1+\dfrac{0{,}15}{12}\right)^{-n}\right]}{\dfrac{0{,}15}{12}}$ $\left(1+\dfrac{0{,}15}{12}\right)^{-n} = 0{,}6440429722$ $-n\log\left(1+\dfrac{0{,}15}{12}\right) = \log 0{,}6440429722$ $n = 35{,}41872568$ months/ *maande* $\therefore$ 36 payments are required $\therefore$ 36 *paaiemente moet betaal word* $\therefore$ Thabiso will pay his loan off 10 months sooner./Thabiso *los sy lening 10 maande vroeër af.* **OR/*OF***	✓ $x = 9\ 000$ ✓ substitute into correct formula ✓ use of logs ✓ n =35,42 ✓ 10 months (5)
	$256289{,}06\left(1+\dfrac{0{,}15}{12}\right)^{n} = \dfrac{9000\left[\left(1+\dfrac{0{,}15}{12}\right)^{n}-1\right]}{\dfrac{0{,}15}{12}}$ $3203{,}61325\left(1+\dfrac{0{,}15}{12}\right)^{n} = 9000\left(1+\dfrac{0{,}15}{12}\right)^{n} - 9000$ $9000 = 5796{,}38675\left(1+\dfrac{0{,}15}{12}\right)^{n}$ $n = \log_{\left(1+\frac{0{,}15}{12}\right)} 1{,}5523691425$ $n = 35{,}41872568$ $\therefore$ 36 payments are required $\therefore$ 36 *paaiemente moet betaal word* $\therefore$ Thabiso will pay his loan off 10 months sooner./Thabiso *los sy lening 10 maande vroeër af.*	✓ 9 000 ✓ substitute into correct formula ✓ use of logs ✓ n =35,42 ✓ 10 months (5)
7.4	The balance of his loan after the 35th payment was made: *Die balans van sy lening nadat die 35ste paaiement betaal is:* $\text{Balance} = 256289{,}06\left(1+\dfrac{0{,}15}{12}\right)^{35} - \dfrac{9000\left(\left(1+\dfrac{0{,}15}{12}\right)^{35}-1\right)}{\dfrac{0{,}15}{12}}$ $= \text{R } 3\ 735{,}45$ $\text{Final instalment} = 3\ 735{,}45\left(1+\dfrac{0{,}15}{12}\right)$ $= \text{R } 3\ 782{,}14$ **OR/OF**	✓ $256289{,}06\left(1+\dfrac{0{,}15}{12}\right)^{35}$ ✓ $\dfrac{9000\left(\left(1+\frac{0{,}15}{12}\right)^{35}-1\right)}{\frac{0{,}15}{12}}$ ✓ $3\ 735{,}45\left(1+\dfrac{0{,}15}{12}\right)$ ✓ answer (4)

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

Final instalment

$$= \frac{9\,000\left[1-\left(1+\frac{0,15}{12}\right)^{-0.41872568}\right]}{\frac{0,15}{12}}\left(1+\frac{0,15}{12}\right)$$

$$= \text{R}3\ 782,14$$

✓ 0,41872568
✓ $\frac{9\,000\left[1-\left(1+\frac{0,15}{12}\right)^{-0,41872568}\right]}{\frac{0,15}{12}}$
✓ $\times\left(1+\frac{0,15}{12}\right)$
✓ answer

(4)

OR/OF

$$\text{Balance} = 256289,06\left(1+\frac{0,15}{12}\right)^{36} - \frac{9000\left(\left(1+\frac{0,15}{12}\right)^{36}-1\right)}{\frac{0,15}{12}}$$

$$= \text{R}\ -5\ 217,86$$

$$\text{Final payment} = 9\,000 - 5217,86$$

$$= \text{R}3\ 782,14$$

✓ $256289,06\left(1+\frac{0,15}{12}\right)^{36}$
✓ $\frac{9000\left(\left(1+\frac{0,15}{12}\right)^{36}-1\right)}{\frac{0,15}{12}}$
✓ $9\,000 - 5217,86$
✓ answer

(4)

[15]

Question 8 **November 2014**

8.1

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

✓simplifying/*vereenvouding*

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

✓formula/*formule*

$$=\lim_{h\to 0}\frac{3x^2h+3xh^2+h^3}{h}$$

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

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

✓factorization/*faktorisering*

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

✓answer/*antwoord*

(5)

OR/OF

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

✓formula/*formule*

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

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

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

✓simplifying/*vereenvoudiging*

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

✓factorization/*faktorisering*

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

✓answer/*antwoord*

(5)

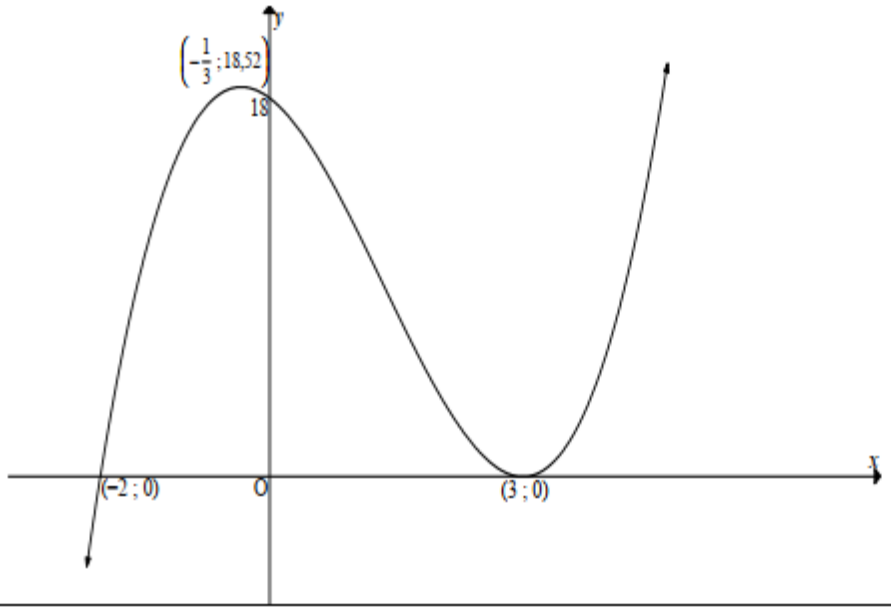
OR

	$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{(x+h)^3-x^3}{h}$ $=\lim_{h\to 0}\frac{(x+h-x)(x^2+2xh+h^2+x^2+xh+x^2)}{h}$ $=\lim_{h\to 0}\frac{h(3x^2+3xh+h^2)}{h}$ $=\lim_{h\to 0}(3x^2+3xh+h^2)$ $=3x^2$	✓formula/*formule* ✓subst. into formula/*subst. in formule* ✓factorization/*faktorisering* ✓simplifying/*vereenvoudiging* ✓answer/*antwoord* (5)

8.2	$f'(x)=4x+2x^3$	✓$4x$ ✓$2x^3$ (2)
8.3	$y=x^{12}-2x^6+1$ $\frac{dy}{dx}=12x^{11}-12x^5$ $=12x^5(x^6-1)$ $=12x^5\sqrt{y}$	✓simplification/*vereenvoudiging* ✓derivative/*afgeleide* ✓factors/*faktore* (3)
8.4	$f(x)=2x^3-2x^2+4x-1$ $f'(x)=6x^2-4x+4$ $f''(x)=12x-4$ f is concave up when/*is konkaaf op as* $f''(x)>0$ $\therefore 12x-4>0$ $12x>4$ $x>\frac{1}{3}$	✓first derivative/*eerste afgeleide* ✓ second derivative/*tweede afgeleide* ✓ $f''(x)>0$ ✓ $x>\frac{1}{3}$ (4) **[14]**

Question 9 **November 2014**

9.1	$f'(x)=3x^2-8x-3=0$ $(3x+1)(x-3)=0$ $x=-\frac{1}{3}$ or $x=3$ $y=\frac{500}{27}$ $\left(\text{or } y=18\frac{14}{27} \text{ or } 18{,}52\right)$ $y=0$ Turning points are/*Draaipunte is* $\left(-\frac{1}{3};\frac{500}{27}\right)$ and $(3;0)$	✓derivative/*afgeleide* ✓derivative/ *afgeleide* = 0 ✓factors/*faktore* ✓x-values/*waardes* ✓✓each y-values/*elke y-waarde* (6)

9.2		✓*x*-intercepts/*afsnitte* ✓*y*-intercept/*afsnit* ✓turning points/ *draaipunte* ✓shape/*vorm* (4)
9.3	$x < \frac{-1}{3}$ or $0 < x < 3$ **OR** $(-\infty ; -\frac{1}{3}) \cup (0;3)$	✓ $x < \frac{-1}{3}$ ✓both critical points/ *beide kritieke-punte* ✓notation/*notasie* (3)

Question 10 **November 2014**

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

Question 8 **Feb March 2015**

8.1	$f(x+h)=2(x+h)^2+4$ $=2x^2+4xh+2h^2+4$ $f(x+h)-f(x)=2x^2+4xh+2h^2+4-2x^2-4$ $=4xh+2h^2$ $f'(x)=\lim_{h\to 0}\frac{4xh+2h^2}{h}$ $=\lim_{h\to 0}\frac{h(4x+2h)}{h}$ $=\lim_{h\to 0}(4x+2h)$ $=4x$	✓ $2x^2+4xh+2h^2+4$ ✓ $4xh+2h^2$ ✓ $\lim_{h\to 0}\frac{h(4x+2h)}{h}$ ✓ $4x$ (4)
8.2.1	$f(x)=-3x^2+5\sqrt{x}$ $f(x)=-3x^2+5x^{\frac{1}{2}}$ $f'(x)=-6x+\frac{5}{2}x^{-\frac{1}{2}}$	✓ $5x^{\frac{1}{2}}$ ✓ $-6x$ ✓ $\frac{5}{2}x^{-\frac{1}{2}}$ (3)
8.2.2	$p(x)=\left(\frac{1}{x^3}+4x\right)^2$ $=\frac{1}{x^6}+\frac{8}{x^2}+16x^2$ $=x^{-6}+8x^{-2}+16x^2$ $p'(x)=-6x^{-7}-16x^{-3}+32x$ **OR/*OF*** $p(x)=(x^{-3}+4x)^2$ by making use of the chain rule : $p'(x)=2(x^{-3}+4x)(-3x^{-4}+4)$ $p'(x)=-6x^{-7}-16x^{-3}+32x$	✓ $\frac{1}{x^6}+\frac{8}{x^2}+16x^2$ ✓ $x^{-6}+8x^{-2}+16x^2$ ✓✓ answer/*antwoord* (4) ✓✓ $2(x^{-3}+4x)$ ✓✓ $(-3x^{-4}+4)$ (4)
8.3.1	$h'(x)=3x^2-14x+14$	✓ finding/*kry* $h'(x)$ (1)
8.3.2	At/*By* B: $h'(x)=0$ $3x^2-14x+14=0$ $x=\frac{14\pm\sqrt{(-14)^2-4(3)(14)}}{2(3)}$ $=1{,}45$ or $3{,}22$ *n / a*	✓ derivative equal to/ *afgeleide gelyk aan* 0 ✓ substitution into correct formula/*substitusie in korrekte formule* ✓ x-value of/*x-waarde van* 1,45 (3)

8.3.3	$x^3-7x^2+14x-8=(x-1)(x^2-6x+8)$ $=(x-1)(x-2)(x-4)$ $C(4;0)$ **OR/*OF*** $x_c>3{,}22$ $h(4)=(4)^3-7(4)^2+14(4)-8=0$ $\therefore x_c=4$	✓$(x-1)$ ✓x^2-6x+8 ✓$(x-2)(x-4)$ ✓coordinates of/*koördinate van* C (4) ✓$x_c>3{,}22$ ✓substitution of/ *substitusie van* 4 ✓ $h(4)=0$ ✓ x_c (4)
8.3.4	$h'(x)=3x^2-14x+14$ $h''(x)=6x-14$ $6x-14<0$ $6x<14$ $\therefore x<\frac{7}{3}$ $\therefore k=\frac{7}{3}$	✓$h''(x)=6x-14$ ✓$6x-14<0$ ✓$k=\frac{7}{3}$ (3) **[22]**

Question 9 **Feb March 2015**

9.1	$\pi r^2 h=6$ $h=\frac{6}{\pi r^2}$	✓$h=\frac{6}{\pi r^2}$ (1)

9.2	$S = 10\left(2\pi r^2 + 2\pi rh + 4\pi r^2\right)$ $= 10\left[2\pi rh + 6\pi r^2\right]$ $= 20\pi rh + 60\pi r^2$ $= 20\pi r\left(\frac{6}{\pi r^2}\right) + 60\pi r^2$ $= 60\pi r^2 + \frac{120}{r}$ **OR/*OF*** Area of/*van* 10 spheres/*sfere* $= 10 \times 4 \times \pi \times r^2 = 40\pi r^2$ Area of/*van* 10 cylinders/*silinders* $= 10(2\pi r^2 + 2\pi rh)$ $= 10(2\pi r^2 + 2\pi r\frac{6}{\pi r^2})$ $= 20\pi r^2 + \frac{120}{r}$ Total area/*Totale area* $= 40\pi r^2 + 20\pi r^2 + \frac{120}{r}$ $= 60\pi r^2 + \frac{120}{r}$	✓✓$10\left(2\pi r^2 + 2\pi rh + 4\pi r^2\right)$ ✓ $20\pi rh + 60\pi r^2$ ✓ substitution/*substitusie* (4) ✓area of 10 spheres/ *area van 10 sfere* ✓ area of 10 cylinders/ *area van 10 silinders* ✓ substitution/*substitusie* ✓simplification/*vereen-voudiging* (4)
9.3	$S' = 120\pi r - 120r^{-2} = 0$ $120\pi r - \frac{120}{r^2} = 0$ $120\pi r^3 - 120 = 0$ $r^3 = \frac{120}{120\pi}$ $\therefore r = \frac{1}{\pi^{\frac{1}{3}}} = 0{,}68$ cm	✓ $120\pi r - 120r^{-2}$ ✓ $= 0$ ✓ $r^3 = \frac{120}{120\pi}$ ✓answer/*antwoord* (4) **[9]**

Question 8 **November 2015**

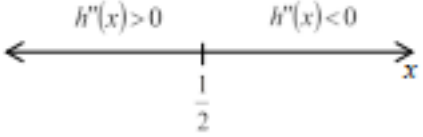
8.1	$f(x+h)=(x+h)^2-3(x+h)$ $=x^2+2xh+h^2-3x-3h$ $f(x+h)-f(x)=x^2+2xh+h^2-3x-3h-(x^2-3x)$ $=2xh+h^2-3h$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{2xh+h^2-3h}{h}$ $=\lim_{h\to 0}\frac{h(2x+h-3)}{h}$ $=\lim_{h\to 0}(2x+h-3)$ $=2x-3$ **OR/*OF*** $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{(x+h)^2-3(x+h)-(x^2-3x)}{h}$ $=\lim_{h\to 0}\frac{x^2+2xh+h^2-3x-3h-x^2+3x}{h}$ $=\lim_{h\to 0}\frac{2xh+h^2-3h}{h}$ $=\lim_{h\to 0}\frac{h(2x+h-3)}{h}$ $=\lim_{h\to 0}(2x+h-3)$ $=2x-3$	✓finding $f(x+h)$ ✓ $2xh+h^2-3h$ ✓formula ✓factorisation ✓answer (5) ✓formula ✓finding $f(x+h)$ ✓ $2xh+h^2-3h$ ✓factorisation ✓answer (5)
8.2.1	$y=\left(x^2-\frac{1}{x^2}\right)^2$ $y=x^4-2+\frac{1}{x^4}$ $=x^4-2+x^{-4}$ $\frac{dy}{dx}=4x^3-4x^{-5}$ **OR/*OF***	✓ $x^4-2+\frac{1}{x^4}$ ✓ $4x^3$ ✓ $-4x^{-5}$ (3)

	By using the chain rule (which is not part of CAPS): $y=(x^2-x^{-2})^2$ $\frac{dy}{dx}=2(x^2-x^{-2})(2x+2x^{-3})$ $=2(2x^3+2x^{-1}-2x^{-1}-2x^{-5})$ $=2(2x^3-2x^{-5})$ $=4x^3-4x^{-5}$	✓✓✓ $2(x^2-x^{-2})(2x+2x^{-3})$ (3)
8.2.2	$D_x\left[\frac{(x-1)(x^2+x+1)}{x-1}\right]$ $=D_x[x^2+x+1]$ $=2x+1$ **OR/*OF*** By using the quotient rule (with is not part of CAPS): $D_x\left[\frac{x^3-1}{x-1}\right]$ $=\frac{3x^2(x-1)-(x^3-1)}{(x-1)^2}$	✓factorisation ✓ x^2+x+1 ✓ $2x+1$ (3) ✓✓✓ $\frac{3x^2(x-1)-(x^3-1)}{(x-1)^2}$ (3) **[11]**

Question 9 **November 2015**

9.1	Substitute Q(2; 10) into $h(x)=-x^3+ax^2+bx$ $-2^3+a(2^2)+b(2)=10$ $-8+4a+2b=10$ $2a+b=9$ .....line 1 $h'(x)=-3x^2+2ax+b$ At Q: $h'(2)=0$ $-3(2)^2+2a(2)+b=0$ $-12+4a+b=0$ $4a+b=12$ .....line 2 line 2 – line 1: $2a=3$ $a=\frac{3}{2}$ Substitute in line 1: $b=6$	✓substitute Q into h ✓finding derivative ✓ $h'(2)$ ✓equating derivative to 0 ✓solving simultaneously for a and b (5)

9.2	$f(-1)=-(-1)^3+\frac{3}{2}(-1)^2+6(-1)$ $=-3,5$ Average gradient/*Gemiddelde gradiënt* $=\frac{f(x_Q)-f(x_P)}{x_Q-x_P}$ Average gradient/ *Gemiddelde gradiënt* $=\frac{10-(-3,5)}{2-(-1)}$ $=4,5$	✓ $f(-1)=-3,5$ ✓formula ✓substitution ✓answer (4)

9.3	$h'(x)=-3x^2+3x+6$ $h''(x)=-6x+3$ $=-3(2x-1)$  For $x<\frac{1}{2}$, h is concave up and for $x>\frac{1}{2}$, h is concave down *Vir* $x<\frac{1}{2}$,*is h konkaaf na bo en vir* $x>\frac{1}{2}$,*is h konkaaf na onder* $\therefore$ concavity changes at $x=\frac{1}{2}$/ $\therefore$ *konkwiteit verander by* $x=\frac{1}{2}$	✓ $h'(x)=-3x^2+3x+6$ ✓ $h''(x)=-6x+3$ ✓explanation using $h''(x)$ (3)
9.4	The graph of h has a point of inflection at $x=\frac{1}{2}$ / *Die grafiek van h het 'n buigpunt by* $x=\frac{1}{2}$. **OR/*OF*** The graph of h changes from concave up to concave down at $x=\frac{1}{2}$ / *Die grafiek van h verander by* $x=\frac{1}{2}$ *van konkaaf op na konkaaf af*	✓answer (1) ✓answer (1)

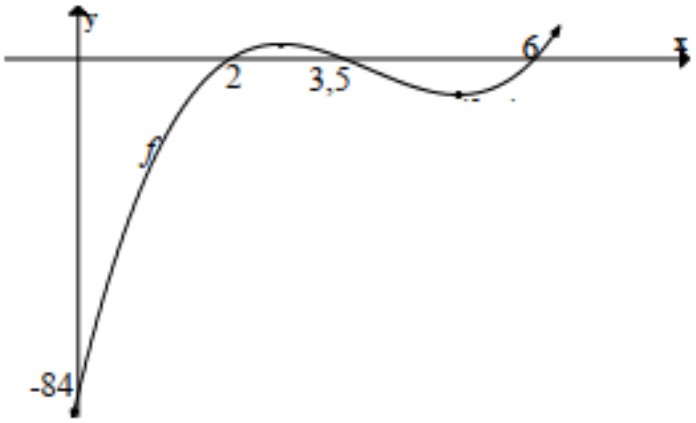
9.5	Gradient of g is -12/*Gradiënt van g is –12* Gradient of tangent is/*Gradiënt van die raaklyn is*: $h'(x) = -3x^2 + 3x + 6$ $h'(x) = -12$ $-3x^2 + 3x + 6 = -12$ $3x^2 - 3x + 18 = 0$ $x^2 - x + 6 = 0$ $(x-3)(x+2) = 0$ $x = -2$ only	✓ $h'(x) = -3x^2 + 3x + 6$ ✓ $h'(x) = -12$ ✓factors ✓selection of x-value (4) **[17]**

Question 10 **November 2015**

10.1	$\frac{h}{r} = \tan 60^0$ $r = \frac{h}{\tan 60^0}$ $\therefore r = \frac{h}{\sqrt{3}}$	✓ $\frac{h}{r} = \tan 60^0$ ✓answer (2)
10.2	$V_{cone} = \frac{1}{3}\pi r^2 h$ $= \frac{1}{3}\pi\left(\frac{h}{\sqrt{3}}\right)^2 h$ $= \frac{1}{9}\pi h^3$ $\frac{dV}{dh} = \frac{1}{3}\pi h^2$ $\left.\frac{dV}{dh}\right\|_{h=9} = \frac{1}{3}\pi(9)^2$ $= 27\pi$ or $84{,}82\ cm^3/cm$	✓formula ✓substitution of the value of r in terms of h ✓simplified volume answer ✓derivative ✓answer (5) **[7]**

Question 8 **Feb March 2016**

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

8.3.1	$f(2) = 2(2)^3 - 23(2)^2 + 80(2) - 84$ $= 0$ $\therefore (x-2)$ is a factor	✓substitution of 2 into f ✓value of 0 (2)
8.3.2	$f(x) = 2x^3 - 23x^2 + 80x - 84$ $= (x-2)(2x^2 - 19x + 42)$ $= (x-2)(2x-7)(x-6)$	✓ $2x^2 - 19x + 42$ ✓ $(x-2)(2x-7)(x-6)$ (2)
8.3.3	$f'(x) = 6x^2 - 46x + 80$ $6x^2 - 46x + 80 = 0$ $3x^2 - 23x + 40 = 0$ $(3x-8)(x-5) = 0$ $x = \frac{8}{3}$ or $x = 5$	✓ $f'(x) = 6x^2 - 46x + 80$ ✓ $f'(x) = 0$ ✓factors ✓x-values (4)
8.3.4		✓x-intercepts ✓y-intercept ✓shape (3)
8.3.5	$6x^2 - 46x + 80 = 40$ $6x^2 - 46x + 40 = 0$ $3x^2 - 23x + 20 = 0$ $(3x-20)(x-1) = 0$ $x = \frac{20}{3}$ or $x = 1$ But x must be an integer, so $x = 1$ at the point where tangent touches f *Ix moet heelgetal wees so x = 1 by punt waar die raaklyn f raak:* $y = f(1) = 2(1)^3 - 23(1)^2 + 80(1) - 84 = -25$ $y = mx + c$ $-25 = 40(1) + c$ $-65 = c$ $(0;-65)$	✓ $6x^2 - 46x + 80 = 40$ ✓factors ✓$x = 1$ ✓ y-value ✓ $-25 = 40(1) + c$ ✓answer (6) **[27]**

Question 9 **Feb March 2016**

9.1	$340 = \pi r^2 h$ $\therefore h = \frac{340}{\pi r^2}$	✓substitution into volume formula ✓answer (2)
9.2	$A = 2\pi r^2 + 2\pi rh$ $= 2\pi r^2 + 2\pi r\left(\frac{340}{\pi r^2}\right)$ $= 2\pi r^2 + 680r^{-1}$	✓formula ✓substitution of h (2)
9.3	$A(r) = 2\pi r^2 + 680r^{-1}$ $A'(r) = 4\pi r - 680r^{-2}$ $4\pi r - 680r^{-2} = 0$ $4\pi r = \frac{680}{r^2}$ $r^3 = \frac{680}{4\pi}$ $r = \sqrt[3]{\frac{680}{4\pi}}$ cm or 3,78 cm	✓$4\pi r$ ✓$-680r^{-2}$ ✓ $r^3 = \frac{680}{4\pi}$ ✓answer (4) **[8]**

Question 7 **May June 2016**

7.1	$f(x+h) = 3(x+h)^2 - 5 = 3(x^2 + 2xh + h^2) - 5$ $= 3x^2 + 6xh + 3h^2 - 5$ $f(x+h) - f(x) = 3x^2 + 6xh + 3h^2 - 5 - 3x^2 + 5$ $= 6xh + 3h^2$ $f'(x) = \lim_{h\to 0}\frac{f(x+h) - f(x)}{h}$ $= \lim_{h\to 0}\frac{6xh + 3h^2}{h}$ $= \lim_{h\to 0}\frac{h(6x + 3h)}{h}$ $= \lim_{h\to 0}(6x + 3h)$ $= 6x$ **OR/OF**	✓ $3x^2 + 6xh + 3h^2 - 5$ ✓ $6xh + 3h^2$ ✓ $\frac{f(x+h) - f(x)}{h}$ ✓ common factor/ $(6x + 3h)$ ✓ answer (5)

	$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{3(x+h)^2-5-(3x^2-5)}{h}$ $=\lim_{h\to 0}\frac{3x^2+6xh+3h^2-5-3x^2+5}{h}$ $=\lim_{h\to 0}\frac{6xh+3h^2}{h}$ $=\lim_{h\to 0}\frac{h(6x+3h)}{h}$ $=\lim_{h\to 0}(6x+3h)$ $=6x$	✓ $\frac{f(x+h)-f(x)}{h}$ ✓ $3x^2+6xh+3h^2-5$ ✓ $6xh+3h^2$ ✓ common factor/$(6x+3h)$ ✓ answer (5)
7.2.1	$y=2x^5+\frac{4}{x^3}$ $y=2x^5+4x^{-3}$ $\frac{dy}{dx}=10x^4-12x^{-4}$	✓ $2x^5+4x^{-3}$ ✓ $10x^4$ ✓ $-12x^{-4}$ (3)
7.2.2	$y=\left(\sqrt{x}-x^2\right)^2$ $y=\left(x^{\frac{1}{2}}-x^2\right)^2$ $=x-2x^{\frac{5}{2}}+x^4$ $\frac{dy}{dx}=1-5x^{\frac{3}{2}}+4x^3$	✓ $x-2x^{\frac{5}{2}}+x^4$ ✓1 ✓$-5x^{\frac{3}{2}}$ ✓$4x^3$ (4) **[12]**

Question 8 **May June 2016**

8.1	$y=12$	✓answer (1)

8.2	$12=(0-2)^2(0-k)$ $k=-3$ $(x-2)^2(x+3)=0$ $x=-3$ **OR/OF** $y=0$ $(x-2)^2(x-k)=0$ $(x^2-4x+4)(x-k)=0$ $x^3-kx^2-4x^2+4kx+4x-4k=0$ But $-4k$ is the y - intercept *Maar* $-4k$ *is die y-afsnit* $-4k=12$ $k=-3$ $x=-3$	✓ substituting (0;12) ✓ $k=-3$ ✓ $x=-3$ (3) ✓ $-4k$ ✓ $-4k=12$ or $k=-3$ ✓ $x=-3$ (3)
8.3	$f(x)=x^3+3x^2-4x^2-12x+4x+12$ $f(x)=x^3-x^2-8x+12$ $f'(x)=3x^2-2x-8$ $3x^2-2x-8=0$ $(3x+4)(x-2)=0$ $x=-\frac{4}{3}$ or $x=2$ $y=\frac{500}{27}$ or 18,52 or $18\frac{14}{27}$ $C\left(-\frac{4}{3};18{,}52\right)$	✓ $f(x)=x^3-x^2-8x+12$ ✓derivative ✓derivative equal to 0 ✓factors or formula ✓ $x=-\frac{4}{3}$ ✓ $y=\frac{500}{27}$ or 18,52 or $18\frac{14}{27}$ (6)
8.4	$f''(x)=6x-2$ $6x-2<0$ $x<\frac{1}{3}$ f is concave down when $x<\frac{1}{3}$ f *is konkaaf na onder vir* $x<\frac{1}{3}$ **OR/OF**	✓ $6x-2$ ✓✓ $x<\frac{1}{3}$ (3)

	$f''(x) = 6x - 2$ $6x - 2 = 0$ $x = \frac{1}{3}$ f is concave down when $x < \frac{1}{3}$ *f is konkaaf na onder vir* $x < \frac{1}{3}$	✓ $6x - 2$ ✓✓ $x < \frac{1}{3}$ (3)
	OR/OF $x = \frac{x_c + x_d}{2}$ $\quad x = -\frac{b}{3a}$ $= \frac{-\frac{4}{3} + 2}{2}$ or/of $= -\frac{-1}{3(1)}$ $= \frac{1}{3}$ $\quad = \frac{1}{3}$ f is concave down when $x < \frac{1}{3}$ *f is konkaaf na onder vir* $x < \frac{1}{3}$	✓ $\frac{-\frac{4}{3}+2}{2}$ or $-\frac{-1}{3(1)}$ ✓✓ $x < \frac{1}{3}$ (3) **[13]**

Question 9 **May June 2016**

9.1	$V = \pi r^2 h$ $\pi r^2 h = 340$ $h = \frac{340}{\pi r^2}$	✓formula ✓equating to 340 ✓ $h = \frac{340}{\pi r^2}$ (3)
9.2	$A = 2\pi r^2 + 2\pi rh$ $= 2\pi r^2 + 2\pi r\left(\frac{340}{\pi r^2}\right)$ $= 2\pi r^2 + \frac{680}{r}$ $A'(r) = 4\pi r - \frac{680}{r^2}$ $A'(r) = 0$ for minimum surface area/ *vir* min*imum buite-oppervlakte* $4\pi r - \frac{680}{r^2} = 0$ $r^3 = \frac{680}{4\pi} = \frac{170}{\pi}$ $= 54{,}11268$ $r = 3{,}78\,\text{cm}$	✓ $2\pi r^2 + 2\pi rh$ ✓substituting h ✓ $4\pi r - \frac{680}{r^2}$ ✓ $A'(r) = 0$ ✓ $r^3 = \frac{680}{4\pi}$ ✓answer (6) **[9]**

Question 8 **November 2016**

8.1	$f(x+h)=3(x+h)^2$ $=3(x^2+2xh+h^2)$ $=3x^2+6xh+3h^2$ $f(x+h)-f(x)=3x^2+6xh+3h^2-3x^2$ $=6xh+3h^2$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{6xh+3h^2}{h}$ $=\lim_{h\to 0}\frac{h(6x+3h)}{h}$ $=\lim_{h\to 0}(6x+3h)$ $=6x$ **OR/OF** $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{3(x+h)^2-3x^2}{h}$ $=\lim_{h\to 0}\frac{3x^2+6xh+3h^2-3x^2}{h}$ $=\lim_{h\to 0}\frac{6xh+3h^2}{h}$ $=\lim_{h\to 0}\frac{h(6x+3h)}{h}$ $=\lim_{h\to 0}(6x+3h)$ $=6x$	✓ $3(x+h)^2$ ✓ $6xh+3h^2$ ✓ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ ✓ $\lim_{h\to 0}(6x+3h)$ ✓$6x$ (5) ✓ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ ✓ $3(x+h)^2-3x^2$ ✓ $6xh+3h^2$ ✓ $\lim_{h\to 0}(6x+3h)$ ✓ $6x$ (5)
8.2	$\lim_{h\to 0}\frac{\sqrt{4+h}-2}{h}$ $g(x)=\sqrt{x}$ $a=4$	✓ answer ✓ answer (2)
8.3	$y=\sqrt{x^3}-\frac{5}{x^3}$ $y=x^{\frac{3}{2}}-5x^{-3}$ $\frac{dy}{dx}=\frac{3}{2}x^{\frac{1}{2}}+15x^{-4}$	✓ $x^{\frac{3}{2}}$ ✓ $-5x^{-3}$ ✓ $\frac{3}{2}x^{\frac{1}{2}}$ ✓ $15x^{-4}$ (4)

8.4	$f(x)=x^3+ax^2+bx+18$ $f'(x)=3x^2+2ax+b$ At $x=1$, $m_{tan}=-8$ $f'(1)=-8$ $3(1)^2+2a(1)+b=-8$ $3+2a+b=-8$ $2a+b=-11$ .....(1) $y=f(1)$ $=g(1)$ $=-8(1)+20$ $=12$ $1+a+b+18=12$ $a+b=-7$.....(2) $a=-4$ $b=-3$	✓ $3x^2+2ax+b$ ✓ $f'(1)=-8$ or $3(1)^2+2a(1)+b=-8$ ✓ $1+a+b+18=12$ ✓ $a=-4$ ✓ $b=-3$ (5) **[16]**

Question 9 **November 2016**

9.1	$f'(x)=3x^2+8x-3=0$ $(3x-1)(x+3)=0$ $x=\frac{1}{3}$ *or* $x=-3$	✓ equating derivative to zero ✓ factors ✓ $x-$ values (3)
9.2	$f''(x)=6x+8$ $6x+8<0$ $x<-\frac{4}{3}$ **OR** $x=\frac{\frac{1}{3}-3}{2}$ $=\frac{4}{3}$ $\therefore x<-\frac{4}{3}$	✓ $6x+8$ ✓✓ $x<-\frac{4}{3}$ (3) ✓ $\frac{\frac{1}{3}-3}{2}$ ✓✓ $x<-\frac{4}{3}$ (3)
9.3	$x\le-3$ or $x\ge\frac{1}{3}$ **OR/OF** $[-\infty;-3]\cup\left[\frac{1}{3};\infty\right]$	✓ $x\le-3$ ✓ $x\ge\frac{1}{3}$ (2) ✓ $[-\infty;-3]$ ✓ $\left[\frac{1}{3};\infty\right]$ (2)

9.4	$f(0)=-18$ $d=-18$ $f(x)=ax^3+bx^2+cx-18$ $f'(x)=3ax^2+2bx+c$ $f'(x)=3x^2+8x-3$ $3a=3 \qquad 2b=8$ $a=1 \qquad b=4 \qquad c=-3$ $f(x)=x^3+4x^2-3x-18$ **OR/OF** $f'(x)=3x^2+8x-3$ By integration/*Deur integrasie* $f(x)=x^3+4x^2-3x+d$ $f(0)=d=-18$ $a=1$ $b=4$ $c=-3$	✓ $d=-18$ ✓ $f'(x)=3ax^2+2bx+c$ ✓ $a=1$ ✓ $b=4$ ✓ $c=-3$ (5) ✓ $f(x)=x^3+4x^2-3x+d$ ✓ $d=-18$ ✓ $a=1$ ✓ $b=4$ ✓ $c=-3$ (5)
		[13]

Question 10 **November 2016**

10.1	$M(t)=-t^3+3t^2+72t$ $M(3)=-(3)^3+3(3)^2+72(3)$ $=216$ 216 molecules/*molekules*	✓ $M(3)=-(3)^3+3(3)^2+72(3)$ ✓ 216 (2)
10.2	$M(t)=-t^3+3t^2+72t$ $M'(t)=-3t^2+6t+72$ $M'(2)=-3(2)^2+6(2)+72$ $=72$ 72 molecules per hour/*molekules per uur*	✓ $M'(t)=-3t^2+6t+72$ ✓ $M'(2)$ ✓ 72 (3)
10.3	$M(t)=-t^3+3t^2+72t$ $M'(t)=-3t^2+6t+72$ $M''(t)=0$ $-6t+6=0$ $t=1$ Maximum rate of change of the number of molecules of the drug in the bloodstream is after 1 hour./*Maksimum tempo van verandering van die getal molekules in die bloedstroom is na 1 uur*	✓ $M''(t)$ ✓ $M''(t)=0$ ✓ answer (3) **[8]**

Question 11 **November 2014**

11.1.1	P(male/*manlik*) = $\frac{83}{180}$ or 0,46 or 46,11%	✓answer/*antwoord* (1)
11.1.2	P(not game park/*nie wildreservaat*) = 1 – P(game park/*wildreservaat*) = $1-\frac{62}{180}$ = $\frac{59}{90}$ or 0,66 or 65,56% **OR/*OF*** P(not game park/*nie wildreservaat*) = $\frac{98}{180}+\frac{20}{180}$ = $\frac{118}{180}$ = $\frac{59}{90}$ or 0,66 or 65,56%	✓$1-\frac{62}{180}$ ✓answer/*antwoord* (2) ✓$\frac{98}{180}+\frac{20}{180}$ ✓answer/*antwoord* (2)
11.2	Events are independent if /*Gebeure is onafhanklike indien* P(male) × P(home) = P(male and home) P(*manlik*) × P(*huis*) = P(*manlik en huis*) P(male/*manlik*) = $\frac{83}{180}$ and/*en* P(home/*huis*) = $\frac{20}{180}$ or 0,11 or 11,11% P(male/*manlik*) × P(home/*huis*) = $\frac{83}{180}\times\frac{20}{180}$ = $\frac{83}{1620}$ = 0,05123 or 5,12% P(male and home/*manlik en huis*) = $\frac{13}{180}$ = 0,07222… or 7,22% Therefore P(male) × P(home) ≠ P(male and home) Dus P(*manlik*) × P(*huis*) ≠ P(*manlik en huis*) Thus the events are not independent./*Dus is die gebeure nie onafhanklik nie* **OR/*OF***	✓P(*m*) × P(*h*) and their values/*en hulle waardes* ✓answer of product ✓P(*m* and/*en h*) value/*waarde* ✓conclusion/*afleiding* (4)

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

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

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

✓answer of product

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

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

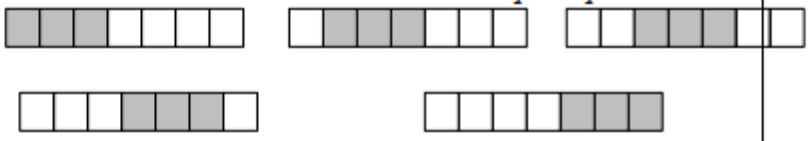
Therefore P(female) × P(not home) ≠ P(female and not home)
Thus the events are not independent.
Dus P(*vroulik*) × P(nie-*huis*) ≠ P(*vroulik en nie-huis*)
Dus is die gebeure nie onafhanklik nie.

✓conclusion/*afleiding* (4)

[7]

Question 12 **November 2014**

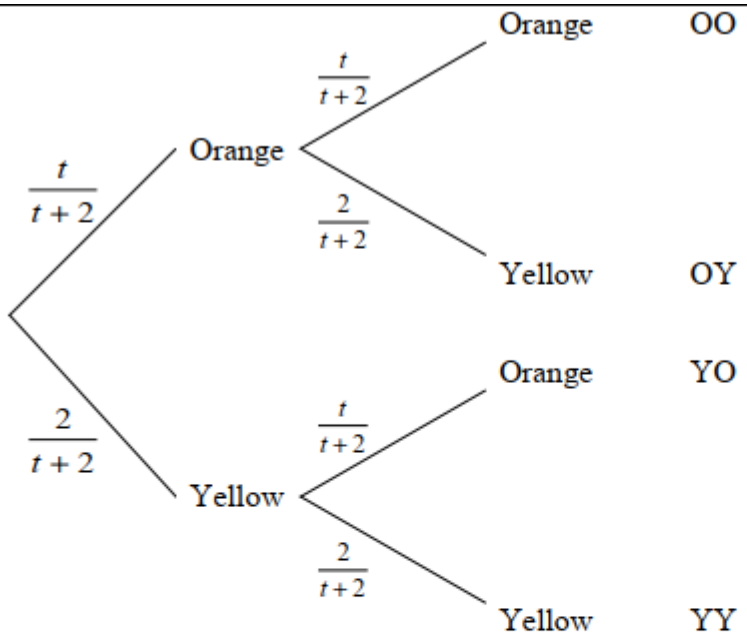
12.1.1	$26 \times 25 \times 24 \times 23 \times 22$ = 7 893 600 **OR/*OF*** $^{26}P_5 = \frac{26!}{(26-5)!} = \frac{26!}{21!} = 7\,893\,600$	✓$26 \times 25 \times 24 \times 23 \times 22$ ✓7 893 600 (2) ✓formula/*formule* ✓answer/*antwoord* (2)
12.1.2	$24 \times 23 \times 22$ = 12 144	✓$24 \times 23 \times 22$ ✓12 144 (2)
12.2.1	$7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$ = 5 040	✓product/*produk* ✓5 040 (2)
12.2.2	$(3 \times 2 \times 1)(5 \times 4 \times 3 \times 2 \times 1)$ = 720 **OR/*OF*** The five 'units' can be parked in $5 \times 4 \times 3 \times 2 \times 1$ ways./*Die vyf 'eenhede' kan op $5 \times 4 \times 3 \times 2 \times 1$ maniere geparkeer word.* The three silver cars can be parked in $3 \times 2 \times 1$ ways./*Die drie silwer motors kan op $3 \times 2 \times 1$ maniere parkeer word.* So there are $(3 \times 2 \times 1)(5 \times 4 \times 3 \times 2 \times 1) = 720$ ways to park the cars./*Dus is daar $(3 \times 2 \times 1)(5 \times 4 \times 3 \times 2 \times 1) = 720$ maniere om die motors te parkeer.* **OR/*OF***	✓$3 \times 2 \times 1$ ✓$5 \times 4 \times 3 \times 2 \times 1$ ✓720 (3) ✓$5 \times 4 \times 3 \times 2 \times 1$ ✓$3 \times 2 \times 1$ ✓720 (3)

	Suppose for the moment the 3 silver cars are at one end./*Veronderstel die drie silwer motors is op die punt.* The 3 cars can be arranged in 3×2×1 = 6 ways./*Die 3 motors kan op 3×2×1 = 6 maniere gerangskik word.* For each of them the remaining four cars can be arranged in 4×3×2×1 = 24 ways./*Die 4 oorblywende motors kan op 4×3×2×1 = 24 maniere rangskik word.* So 6 × 24 = 144 ways if all 3 cars at one end./*Dus is daar 6 × 24 = 144 maniere as die 3 motors op die punt is.*  Together, the silver cars can only occupy 5 different positions amongst the 7 positions. */Saam kan die silwer motors slegs 5 verskillende posisies hê tussen die 7 moontlike posisies.* ∴ Total ways/*Totale getal maniere* = 5 × 144 = 720	✓6 × 24 = 144 ✓5 × 144 ✓720 (3) **[9]**

Question 10 **Feb March 2015**

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

Question 11 **November 2015**

11.1	P(A) ×P(B) = 0,2×0,63 = 0,126 i.e. P(A) × P(B) = P(A and B) Therefore A and B are independent/*Dus is A en B onafhanklik*	✓0,2×0,63 ✓P(A)×P(B)=P(A and B) ✓conclusion (3)
11.2.1	$7^7 = 823\ 543$	✓✓7^7 (2)
11.2.2	7!=5040	✓✓7! (2)
11.2.3	There are 3 vowels $\Rightarrow$3 options for first position There are 4 consonants $\Rightarrow$4 options for last position The remaining 5 letters can be arranged in $5\times4\times3\times2\times1$ ways $3\times(5\times4\times3\times2\times1)\times4=1440$ *Daar is 3 klinkers $\Rightarrow$3 opsies vir die eerste posisie* *Daar is 4 konsonante $\Rightarrow$4 opsies vir die laaste posisie* *Die oorblywende 5 letters kan as volg gerangskik word* $5\times4\times3\times2\times1$ ways/*maniere* $3\times(5\times4\times3\times2\times1)\times4=1440$	✓×3 ✓×4 ✓$5\times4\times3\times2\times1$ ✓answer (4)
11.3	 $P(\text{Orange},\text{Orange})+P(\text{Yellow},\text{Yellow})=\frac{52}{100}$ $\left(\frac{t}{t+2}\right)\left(\frac{t}{t+2}\right)+\left(\frac{2}{t+2}\right)\left(\frac{2}{t+2}\right)=\frac{52}{100}$ $\frac{t^2}{t^2+4t+4}+\frac{4}{t^2+4t+4}=\frac{13}{25}$	✓$P(O)=\left(\frac{t}{t+2}\right)$ ✓$P(Y)=\left(\frac{2}{t+2}\right)$ ✓$P(O,O)=\left(\frac{t}{t+2}\right)^2$ ✓ $P(Y,Y)=\left(\frac{2}{t+2}\right)^2$ ✓ $\left(\frac{t}{t+2}\right)\left(\frac{t}{t+2}\right)+\left(\frac{2}{t+2}\right)\left(\frac{2}{t+2}\right)=\frac{52}{100}$

	$25(t^2+4)=13(t^2+4t+4)$ $3t^2-13t+12=0$ $(3t-4)(t-3)=0$ $t=3$ There are 3 orange balls in the bag/*Daar is 3 oranje balle in die sak*	✓ $t=3$ (no ca) (6) **[17]**

Question 10 **Feb March 2016**

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

10.2.1	$6!$ $=6\times5\times4\times3\times2\times1$ $=720$	✓$6!$ ✓answer (2)
10.2.2	number of ways Xoliswa sits next to Anees/ *getal maniere waarop Xoliswa langs Anees sit* $=5!\times2$ $=240$ **OR/*OF***	✓$5!\times2$ ✓answer (2)

	Regard Xoliswa and Anees as a single entity/*Beskou Xoliswa en Anees as een* Number of ways in which 5 passengers can be arranged = 5! *Getal maniere waarop 5 passasiers gerangskik kan word* = 5! So 5! different arrangements for XA and 5! different arrangements for AX *So 5! verskillende rangskikkings vir XA en 5! verskillende rangskikkings vir AX* number of ways Xoliswa sits next to Anees *getal maniere waarop Xoliswa langs Anees sit* $= 5! \times 2$ $= 240$	✓ 5!+ 5! ✓answer (2)
10.2.3	number of ways Mary is at an end of the row on the left $= 1 \times 5!$ number of ways Mary is at an end of the row on the right $= 5! \times 1$ total number of arrangements $= 6!$ $P(\text{Mary is at an end of the row}) = \frac{5! \times 1 + 1 \times 5!}{6!}$ $= \frac{1}{3}$ *getal maniere waarop Mary aan die einde van die ry links is* $= 1 \times 5!$ *getal maniere waarop Mary aan die einde van die ry regs is* $= 5! \times 1$ *totale getal rangskikkings* $= 6!$ $P(\text{Mary is aan einde van die ry}) = \frac{5! \times 1 + 1 \times 5!}{6!}$ $= \frac{1}{3}$	✓both LHS and RHS ways ✓6 ! ✓setting up probability ✓answer (4) **[15]**

Question 10 **May June 2016**

10.1.1 (a)	$\text{P(Female/Vroulik)} = \frac{70}{150} = \frac{7}{15} = 0{,}47$	✓ 70 ✓ answer (2)
10.1.1 (b)	$\text{P(Female playing tennis/Vroulik speel tennis)} = \frac{20}{150} = \frac{2}{15} = 0{,}13$	✓ answer (1)

10.1.2	$P(\text{Female/Vroulik}) = \frac{70}{150}$ $P(\text{Playing/Speel tennis}) = \frac{70}{150}$ $P(\text{Female playing tennis/Vrouliks speel tennis}) = \frac{20}{150} = 0,13$ $P(\text{Female/Vroulik}) \times P(\text{Playing/Speel tennis}) = \left(\frac{70}{150}\right)\left(\frac{70}{150}\right) = \frac{4900}{22500} = 0,22$ P(Female playing tennis/Vroulik speel tennis) ≠ P(Female/Vroulik) × P(Playing/Speel tennis) Therefore the event of playing tennis is not independent of gender./ Dus is die gebeurtenis om tennis te speel nie onafhanklik van geslag nie **OR/OF** $P(\text{Male/Manlik}) = \frac{80}{150}$ $P(\text{Playing/Speel tennis}) = \frac{70}{150}$ $P(\text{Male playing tennis/Manlik speel tennis}) = \frac{50}{150} = 0,33333$ $P(\text{Male/Manlik}) \times P(\text{Playing/Speel tennis}) = \left(\frac{80}{150}\right)\left(\frac{70}{150}\right) = \frac{5600}{22500} = 0,25$ P(Male playing tennis/Manlik speel tennis) ≠ P(Male/Manlik) × P(Playing/Speel tennis) Therefore the event of playing tennis is not independent of gender./ Dus is die gebeurtenis om tennis te speel nie onafhanklik van geslag nie. **OR/OF**	✓ $P(\text{Play ten}) = \frac{70}{150}$ ✓ $\left(\frac{70}{150}\right)\left(\frac{70}{150}\right) = \frac{4900}{22500}$ $= 0,22$ ✓ P(F play t) ≠ P(F) × P(Play t) Not independent (3) ✓ $P(\text{Play ten}) = \frac{70}{150}$ ✓ $\left(\frac{80}{150}\right)\left(\frac{70}{150}\right) = \frac{5600}{22500}$ $= 0,25$ ✓ P(M play t) ≠ P(M) × P(Play t) Not independent (3)
	$P(\text{Male}) = \frac{80}{150}$ $P(\text{Not playing tennis}) = \frac{80}{150}$ $P(\text{Male not playing tennis}) = \frac{80}{150} = 0,53333$ $P(\text{Male}) \times P(\text{Not playing tennis}) = \left(\frac{80}{150}\right)\left(\frac{80}{150}\right) = \frac{6400}{22500} = 0,28$ P(Male not playing tennis) ≠ P(Male) × P(Not playing tennis) Therefore the event of playing tennis in not independent of gender. **OR/OF**	✓ $P(\text{not play ten}) = \frac{80}{150}$ ✓ $\left(\frac{80}{150}\right)\left(\frac{80}{150}\right) = \frac{6400}{22500}$ $= 0,28$ ✓ P(M not play t) ≠ P(M) × P(Not play t) Not independent (3)

	$P(\text{Female}) = \frac{70}{150}$ $P(\text{Not playing tennis}) = \frac{80}{150}$ $P(\text{Female not playing tennis}) = \frac{50}{150} = 0,3333$ $P(\text{Female}) \times P(\text{Not playing tennis}) = \left(\frac{70}{150}\right)\left(\frac{80}{150}\right) = \frac{5600}{22500} = 0,25$ $P(\text{Female not playing tennis}) \neq P(\text{Female}) \times P(\text{Not playing tennis})$ Therefore the events of playing tennis and gender are not independent.	✓ $P(\text{not play ten}) = \frac{80}{150}$ ✓ $\left(\frac{70}{150}\right)\left(\frac{80}{150}\right) = \frac{5600}{22500} = 0,25$ ✓ $P(\text{F not play t}) \neq P(\text{F}) \times P(\text{Not play t})$ Not independent (3)
10.2	$P(B) = 1 - P(B')$ $= 1 - 0,28$ $= 0,72$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $0,96 = 0,24 + 0,72 - P(A \text{ and } B)$ $0,96 = 0,96 - P(A \text{ and } B)$ $P(A \text{ and } B) = 0$ Events A and B are mutually exclusive *Gebeurtenis A en B is onderling uitsluitend*	✓ $P(B) = 0,72$ ✓ $P(A) = 0,24$ ✓ substitution into correct formula ✓ $P(A \text{ and } B) = 0$ (4) **[10]**

Question 11 **May June 2016**

11.1	2 x 2! x 7! = 20 160	✓ 2 x 2! ✓ 7! ✓ 20 160 (3)
11.2	All seated in 9! = 362 880 ways Girls seated together in 4! ways. With the girls as one unit they can all be seated in 4! 6! ways = 17280	✓ 9! or 362 880 ✓ 4! 6! or 17280
	P(all girls seated together/al die meisies sit saam) $= \frac{4!\,6!}{9!}$ $= \frac{17280}{362880}$ $= \frac{1}{21}$ $= 0,047619....$ $= 4,76\%$	✓ $\frac{17280}{362880}$ or $\frac{1}{21}$ or 0,047619 or 4,76% (3) **[6]**

Question 11 **November 2016**

11.1

	Watches TV during exams	Do not watch TV during exams	Total
Male	80	a	$80+a$
Female	48	12	60
Total	b	32	160

$a+12=32$

$a=20$

$b=80+48$

$=128$

✓$a=20$

✓$b=128$

(2)

11.2

No

$P(\text{M and not watching TV})=\frac{20}{160}\neq 0$

✓No

✓reason

(2)

11.3.1

$\text{P(watching TV)}=\frac{128}{160}=\frac{4}{5}=0,8=80\%$

✓128

✓160

(2)

11.3.2

$\text{P(female and not watching TV)}=\frac{12}{160}=\frac{3}{40}=0,075=7,5\%$

✓ 12

✓160

(2)

[8]

Question 12 **November 2016**

12.	We want to create codes that are even numbers greater than 5000. The digit 6 can be used in one of two places in these codes and therefore this presents two scenarios. *Ons wil kodes kry wat ewe getalle groter as 5000 is. Die syfer 6 kan in twee posisies in die kode gebruik word en twee opsies is moontlik:* CASE 1: The first digit is a 6./*Die eerste syfer is 'n* 6. **6** $\times$ 5 $\times$ 4 $\times$ **2** / **4** 1 $\times$ 5 $\times$ 4 $\times$ 2 Number of codes starting with 6./*Getal kodes wat met* 6 *begin.* $= 1 \times 5 \times 4 \times 2 = 40$ CASE 2: The first digit is a 5 or 7./*Die eerste syfer is 'n* 5 *of* 7. **5** / **7** $\times$ 5 $\times$ 4 $\times$ **2** / **4** / **6** 2 $\times$ 5 $\times$ 4 $\times$ 3 Number of codes not starting with 6./*Getal kodes wat nie met* 6 *begin* $= 2 \times 5 \times 4 \times 3 = 120$ Therefore total number of possible codes./*Die totale getal moontlike kodes* $= 40 + 120 = 160$. **OR/OF** $(3\times5\times4\times1) + (3\times5\times4\times1) + (2\times5\times4\times1)$ $= 60 + 60 + 40$ $= 160$ **OR/OF** $(3\times5\times4\times3) - (1\times5\times4\times1)$ $= 180 - 20$ $= 160$	✓ $1 \times 5 \times 4 \times 2$ ✓ 40 ✓ $2 \times 5 \times 4 \times 3$ ✓ 120 ✓ 160 **[5]** ✓ $(3\times5\times4\times1)$ ✓ $(3\times5\times4\times1)$ ✓ $(2\times5\times4\times1)$ ✓✓ 160 **[5]** ✓✓ $(3\times5\times4\times3)$ ✓✓ $(1\times5\times4\times1)$ ✓ 160 **[5]**