basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

MATHEMATICS P1/*WISKUNDE V1*

NOVEMBER 2013

MEMORANDUM

MARKS/*PUNTE*: 150

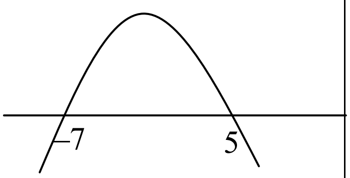
This memorandum consists of 24 pages.
Hierdie memorandum bestaan uit 24 bladsye.

NOTE:
- If a candidate answered a question TWICE, mark only the first attempt.
- If a candidate crossed out an attempt of a question and did not redo the question, mark the crossed-out question.
- Consistent accuracy applies in ALL aspects of the marking memorandum.
- Assuming values/answers in order to solve a problem is unacceptable.

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

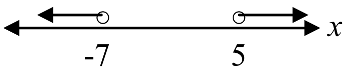
QUESTION/*VRAAG* 1

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

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


OR
<table>
<tr><td>x</td><td></td><td>-7</td><td></td><td>5</td><td></td></tr>
<tr><td>$x+7$</td><td>+</td><td>0</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>$x-5$</td><td>+</td><td>+</td><td>+</td><td>0</td><td>–</td></tr>
<tr><td>$-3(x+7)(x-5)$</td><td>–</td><td>0</td><td>+</td><td>0</td><td>–</td></tr>
</table>
$x<-7$ or $x>5$ OR $x\in(-\infty;-7)\cup(5;\infty)$
</td>
<td>
✓critical values
✓ $x<-7$
✓ $x>5$
✓or / $\cup$
</td>
</tr>
</table>

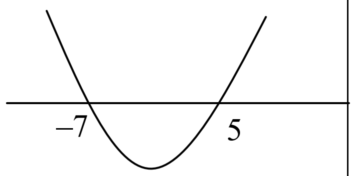
(4)

OR 

OR

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

+	0	−	0	+
	−7		5	

OR 

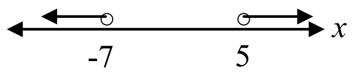
✓critical values

OR

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

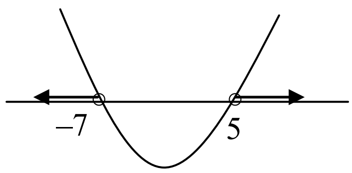
$x<-7$ or $x>5$ OR $x\in(-\infty\,;-7)\cup(5\,;\infty)$

✓ $x<-7$
✓ $x>5$
✓or / $\cup$

OR 

(4)

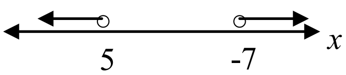
NOTE:
In this alternative, award max 3/4 marks since there is no conclusion



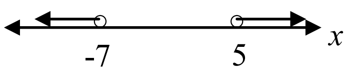
NOTE:
If $(x+7)(x-5)<0$ and get $-7<x<5$: max 2 / 4 marks

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

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



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



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

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

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

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

QUESTION/*VRAAG* 2

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

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

	$\frac{3}{2}+\frac{5}{2}+...$to 248 terms $=124\left[\frac{3}{2}+\frac{497}{2}\right]$ $=124\times 250$ $=31\,000$	✓$n = 248$ ✓ subs into correct formula ✓ $\frac{3}{2}+\frac{247}{2}$ ✓ answer (4)
	OR	
	$\frac{3}{2}+\frac{5}{2}+...$to 248 terms $=124[3+247]$ $=124\times 250$ $=31000$	✓$n = 248$ ✓ subs into correct formula ✓ $3 + 247$ ✓ answer (4)
	OR	
	Sum = 0 + 4 + 8 +…to 125 terms $=\frac{125}{2}[0+(125-1)4]$ $=31000$	✓$n = 125$ ✓$a = 0$ and $d = 4$ ✓ subs into correct formula ✓ answer (4)
2.4.1	$T_1=(4(1)-1)^2$ $=3^2$ $=9$ **NOTE:** If $k = 1$, $T_1 = 3$: max 1/2 mark	✓ subs $x = 1$ and $k = 2$ ✓ answer (2)
2.4.2	$r=4x-1$ $-1<r<1$ $-1<4x-1<1$ $0<4x<2$ $0<x<\frac{1}{2}$ **NOTE:** Incorrect r : max 1/3 marks If candidate only writes down $4x – 1$ and does nothing else: 0/3 marks	✓ $r = 4x-1$ ✓ $-1<4x-1<1$ ✓ answer (3) **[18]**

QUESTION/*VRAAG* 3

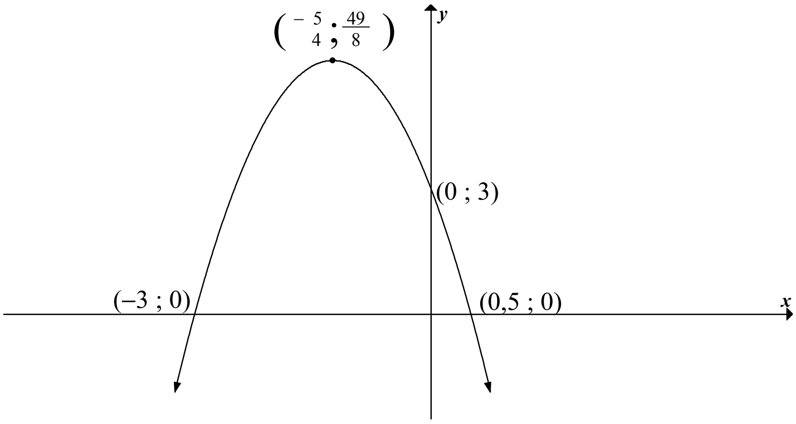
3.1.1	$T_n = 4n - 7$ **OR** $T_n = -3 + (n-1)(4)$	✓4n ✓ −7 (2) ✓ -3 ✓ $(n-1)(4)$ (2)
3.1.2	$T_4 = 9$ $T_5 = 13$ $T_6 = 17$ $T_7 = 21$	✓ any TWO consecutive answers correct ✓ last TWO answers correct (2)
3.1.3	0 ; 1 ; 2 ; 0 ; 1 ; 2 ; 0	2 marks for all 7 correct **OR** 1 mark for only **first** / **last** 3 correct **OR** 0 marks if less than 3 correct (2)
3.1.4	Multiples of 3 in the pattern are : $-3 ; 9 ; 21$ $T_n = -3 + 12(n-1)$ $T_n = 12n - 15$ $393 = 12n - 15$ $12n = 408$ $n = 34$ or $T_n = a + (n-1)d$ $393 = -3 + (n-1)(12)$ $393 = 12n - 15$ $12n = 408$ $n = 34$ $S_n = \frac{n}{2}[a + L]$ $S_{34} = \frac{34}{2}[-3 + 393]$ $S_{34} = 6630$ or $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{34} = \frac{34}{2}[2(-3) + 33(12)]$ $S_{34} = 6630$ **NOTE:** • If the candidate does not show the working to get to $n = 34$: no penalty • If a candidate sums the whole sequence: 0/5 marks • Answer only: max 1/5 marks	✓ $12n - 15$ ✓ $393 = 12n - 15$ ✓ $n = 34$ ✓ subs $a = -3$ and $d = 12$ into correct formula ✓ $S_{34} = 6630$ (5)
3.2.1	T_1: 1, T_2: 5, T_3: 12, T_4: 22, T_5: 35 4 ; 7 ; 10 ; 13 3 ; 3 ; 3 $T_5 = 35$	✓✓ answer (2)

	OR The sequence is 1, 5, 12, 22, 35. Therefore $T_5 = 35$ **OR** $T_5 = 22 + 13 = 35$	✓✓ answer (2) ✓✓ answer (2)
3.2.2	$T_{50} = T_1 + \frac{49}{2}\left[2(4) + 48(3)\right]$ $= 1 + 3724$ $= 3725$ **NOTE:** • Answer only: max 1 mark • If the candidate calculates the general formula in 3.2.1, they can be awarded 5/5 marks in 3.2.2 **OR** $2a = 3$ $a = \frac{3}{2}$ $3\left(\frac{3}{2}\right) + b = 4$ $b = -\frac{1}{2}$ $\left(\frac{3}{2}\right) + \left(-\frac{1}{2}\right) + c = 1$ $c = 0$ $T_n = \frac{3}{2}n^2 - \frac{1}{2}n$ $T_{50} = \frac{3}{2}(50)^2 - \frac{1}{2}(50)$ $= 3725$ **OR** $T_1 = 1$ $T_2 - T_1 = 4$ $T_3 - T_2 = 7$ $T_4 - T_3 = 10$ ... $T_{50} - T_{49} = ?$ Add both sides $T_{50} = 1 + 4 + 7 + 10 + ...$ to 50 terms $= \frac{50}{2}(2 + 49(3))$ $= 3725$	✓ $a = 4$ ✓ $d = 3$ ✓ $n = 49$ ✓ substitution into correct formula ✓ answer (5) ✓ $a = \frac{3}{2}$ ✓ $b = -\frac{1}{2}$ ✓ $c = 0$ ✓ subs $n = 50$ ✓ answer (5) ✓✓ expansion ✓ $T_{50} = 1 + 4 + 7 + 10 + ...$ to 50 terms ✓ subs into correct formula ✓ answer (5) **[18]**

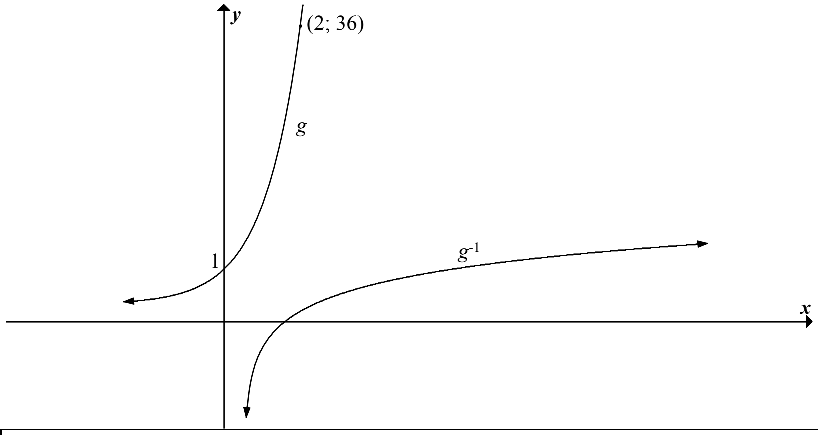
QUESTION/*VRAAG* 4

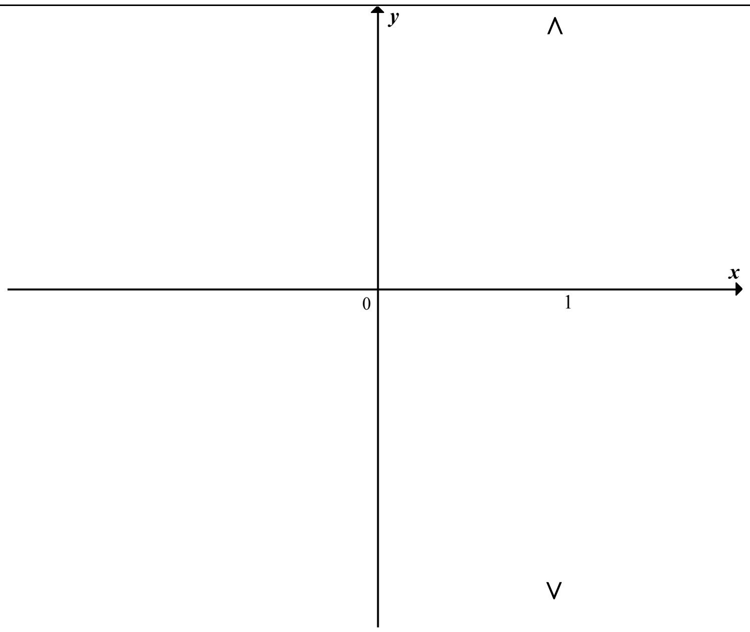
Given: $f(x) = -2x^2 - 5x + 3$

4.1	$(0\ ;\ 3)$ **OR** $x = 0$ and $y = 3$ • If there is evidence that the candidate has indicated that $x = 0$ and $y = 3$: 1 mark • If candidate just states $y = 3$: 1 mark	✓ answer in coordinate form (1) ✓ both values correct (1)
4.2	$0 = -2x^2 - 5x + 3$ $0 = 2x^2 + 5x - 3$ $0 = (2x-1)(x+3)$ $x = \frac{1}{2}$ or -3	✓ $y = 0$ ✓factors ✓x-values (3)
4.3	$f(x) = -2x^2 - 5x + 3$ $x = -\frac{b}{2a}$ $= -\frac{(-5)}{2(-2)}$ $= -\frac{5}{4}$ or $-1\frac{1}{4}$ or $f'(x) = 0$ $-4x - 5 = 0$ $x = -\frac{5}{4}$ or $-1\frac{1}{4}$ or $\dfrac{\frac{1}{2} - 3}{2}$ $= \frac{-2{,}5}{2}$ $= -\frac{5}{4}$ $y = f\left(-\frac{5}{4}\right)$ $= -2\left(-\frac{5}{4}\right)^2 - 5\left(-\frac{5}{4}\right) + 3$ $= \frac{49}{8}$ or $6\frac{1}{8}$ or Hence the turning point of f is $\left(-\frac{5}{4}\ ;\ \frac{49}{8}\right)$ or $(-1{,}25\ ;\ 6{,}13)$ **OR** $f(x) = -2x^2 - 5x + 3$ $= -2\left(x^2 + \frac{5x}{2} - \frac{3}{2}\right)$ $= -2\left(x + \frac{5}{4}\right)^2 + \frac{25}{8} + \frac{24}{8}$ $= -2\left(x + \frac{5}{4}\right)^2 + \frac{49}{8}$ Hence the turning point of f is $\left(-\frac{5}{4}\ ;\ \frac{49}{8}\right)$	✓ $x = -\frac{(-5)}{2(-2)}$ or $f'(x) = 0$ or $\dfrac{\frac{1}{2} - 3}{2}$ ✓x-coordinate ✓ y-coordinate (3) ✓ $-2\left(x + \frac{5}{4}\right)^2 + \frac{49}{8}$ ✓x-coordinate ✓ y-coordinate (3)

4.4		✓shape ✓intercepts with the axes ✓ turning point (3) **[10]**

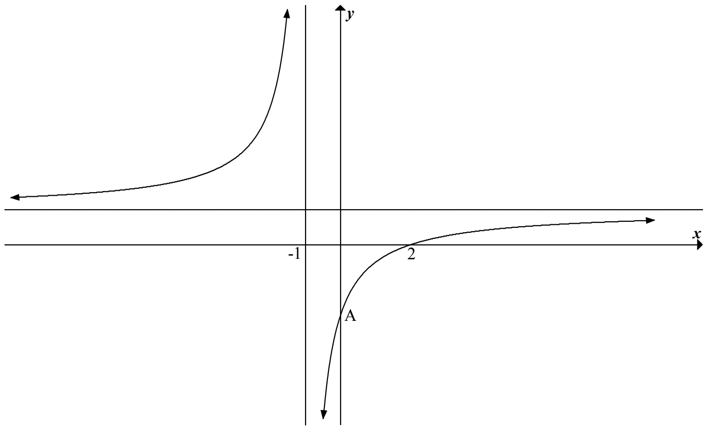
QUESTION/*VRAAG* 5

Given: $g(x)=k^x$ and $y=g^{-1}(x)$ 		
5.1.1	$k^2=36$ $k=6$	✓ $k^2=36$ ✓answer (2)
5.1.2	g: $y=6^x$ g^{-1}: $x=6^y$ $y=\log_6 x$ or $y=\dfrac{\log x}{\log 6}$ **NOTE:** Answer only : 2/2 marks	✓ $x=6^y$ ✓ $y=\log_6 x$ or $y=\dfrac{\log x}{\log 6}$ (2)
5.1.3	$0<x\leq 1$ **OR** $(0;1]$	✓ $0<x$ ✓ $x\leq 1$ (2)
5.1.4	$x>3$ **OR** $(3;\infty)$	✓ answer (1)

5.2.1		✓ vertical line ✓ vertical line has x-intercept (1 ; 0) (2) **NOTE:** Any other graph cutting at (1 ; 0): 0 / 2 marks
5.2.2	**NOTE:** If $x = 1$ is not drawn in 5.2.1: 0/2 marks No, the inverse of f is not a function because the vertical line test fails in the graph of $x = 1$. *Nee, die inverse van f is nie 'n funksie nie omdat die vertikalelyn-toets vir die grafiek $x = 1$ faal.*	✓ not a function ✓ valid reason (2)
	OR	
	No, the inverse of f is not a function because the horizontal line test fails in the graph of $y = 1$. *Nee, die inverse van f is nie 'n funksie nie omdat die horisontalelyn-toets vir die grafiek $y = 1$ faal.*	✓ not a function ✓ valid reason (2)
	OR	
	Since f as defined is a many-to-one function it does not have an inverse function. *f is gedefinieerd as 'n meer-tot-een-funksie en het dus nie 'n inverse funksie nie.*	✓ not a function ✓ valid reason (2)
	OR	
	The inverse of f is a one-to-many relation. *Die inverse funksie van f is ‘n een-tot-meer relasie.*	✓ not a function ✓ explanation (2)
	OR	

	No, the inverse of f is not a function because there are some input (x) values (for example, $x = 0$) which have more than one output (y) value. *Nee, die inverse van f is nie 'n funksie nie omdat van die x-waardes (bv. $x = 0$) meer as een y-waarde het.* **OR** No, for one x-value there are more than one y-values. *Nee, vir 'n x-waarde is daar meer as een y-waarde.*	✓ not a function ✓ valid reason (2) ✓ not a function ✓ valid reason (2) **[11]**

QUESTION/*VRAAG* 6

Given: $f(x)=\dfrac{x-d}{x-p}$ 		
6.1.1	$0=\dfrac{2-d}{2-p}$ $d=2$ $-1-p=0$ $p=-1$ **NOTE:** If candidate leaves answer as $f(x)=\dfrac{x-2}{x+1}$: 2/2 marks	✓d value ✓ p value (2)
6.1.2	$y=\dfrac{x-2}{x+1}$ $=\dfrac{(x+1)-3}{x+1}$ $=\dfrac{x+1}{x+1}-\dfrac{3}{x+1}$ $=\dfrac{-3}{x+1}+1$ **OR** $\dfrac{-3}{x+1}+1$ $=\dfrac{-3+x+1}{x+1}$ $=\dfrac{x-2}{x+1}$ **NOTE:** • If the candidate starts with $y=\dfrac{a}{x+1}+1$ and substitutes (2 ; 0) and proves $a=-3$: 0/2 marks • If the candidate starts with $y=\dfrac{-3}{x+1}+1$ and calculates (2 ; 0) as x-intercept: 0/2 marks	✓ $\dfrac{x-2}{x+1}=\dfrac{x+1-3}{x+1}$ ✓ $\dfrac{x+1}{x+1}-\dfrac{3}{x+1}$ (2)

	OR $x+1\overline{)\,x-2\,}$ quotient 1 $\underline{-x-1}$ -3 Remainder = -3 $\therefore x-2=1(x+1)-3$ $\dfrac{x-2}{x+1}=1-\dfrac{3}{x+1}$ $f(x)=\dfrac{-3}{x+1}+1$	✓ $\dfrac{-3+x+1}{x+1}$ ✓ simplification (2) ✓ long division ✓ remainder = –3 (2)
6.1.3	P(– 1 ; 1)	✓*x*-coordinate ✓*y*-coordinate (2)
6.1.4	$(-2\,;4)$	✓*x*-coordinate ✓*y*-coordinate (2)
6.2	$q=1$ Substitute $A(0;-2)$ into $g(x)=p\cdot 2^x+1$: $-2=p(2)^0+1$ $p=-3$ Hence $g(x)=-3.2^x+1$ **NOTE:** Answer only: 3/3 marks	✓ $q=1$ ✓ substitute A(0; –2) ✓ $p=-3$ (3) **[11]**

QUESTION/*VRAAG* 7

7.1.1	$1+i_{eff}=\left(1+\frac{0{,}09}{4}\right)^4$ $i_{eff}=\left(1+\frac{0{,}09}{4}\right)^4-1$ $=0{,}093083318$ $=0{,}0931$ $=9{,}31\%$	✓ $\left(1+\frac{0{,}09}{4}\right)^4$ ✓ 9,31% or 0,0931 (2)
7.1.2	$A=P(1+i)^n$ $30\,440=12\,500\left(1+\frac{0{,}09}{4}\right)^{4k}$ $\frac{30440}{12500}=\left(1+\frac{0{,}09}{4}\right)^{4k}$ $2{,}4352=1{,}0225^{4k}$ $4k=\log_{1{,}0225}2{,}4352$ $4k=40{,}00020365...$ $k=10$ years $A=P(1+i)^n$ $30\,440=12\,500\left(1+\frac{0{,}09}{4}\right)^{4k}$ $\frac{30440}{12500}=\left(1+\frac{0{,}09}{4}\right)^{4k}$ $2{,}4352=1{,}0225^{4k}$ $4k\log 1{,}0225=\log 2{,}4352$ $4k=\frac{\log 2{,}4352}{1{,}0225}$ $4k=40{,}00020365...$ $k=10$ years	✓ $n=4k$ ✓ $i=\frac{0{,}09}{4}$ ✓ subs into correct formula ✓use of logs ✓answer (5)
	OR $A=P(1+i)^n$ $30\,440=12\,500(1+0{,}09308...)^k$ $\frac{30440}{12500}=(1+0{,}09308...)^k$ $2{,}4352=(1{,}09308...)^k$ $k=\log_{1{,}09308...}2{,}4352$ $k=9{,}998336572...$ $k=10$ years $A=P(1+i)^n$ $30\,440=12\,500(1+0{,}09308...)^k$ $\frac{30440}{12500}=(1+0{,}09308....)^k$ $2{,}4352=(1{,}09308....)^k$ $k\log 1{,}09308....=\log 2{,}4352$ $k=\frac{\log 2{,}4352}{\log 1{,}09308...}$ $k=9{,}998336572...$ $k=10$ years	✓ $n=k$ ✓ i=0,09308… (from 7.1.1) ✓ subs into correct formula ✓ use of logs ✓answer (5)
	OR **NOTE:** Incorrect formula: max 2/5 marks If A and P are swapped: max 2 /5 marks	

	$4n = \dfrac{\log \frac{A}{P}}{\log(1+i)}$ $4k = \dfrac{\log \frac{30440}{12500}}{\log\left(1+\frac{0,09}{4}\right)}$ $4k = 40,00020365...$ $k = 10$ years	✓ $n = 4k$ ✓ $i = \dfrac{0,09}{4}$ ✓ subs into correct formula ✓use of logs ✓answer (5)
7.2.1	30% of R18 480 $= \left(\dfrac{30}{100}\right)(18\ 480)$ $=$ R5 544	✓answer (1)
7.2.2	$P = \dfrac{x\left[1-(1+i)^{-n}\right]}{i}$ $= \dfrac{5544\left[1-\left(1+\frac{0,08}{12}\right)^{-300}\right]}{\frac{0,08}{12}}$ $=$ R 718 305,71 **NOTE:** Incorrect formula: max 2/4 marks If the answer is R 717 550,42 (used n = 299): award 3 /4 marks **OR** $x\left(1+\dfrac{0,08}{12}\right)^{300} = \dfrac{5544\left[\left(1+\frac{0,08}{12}\right)^{300}-1\right]}{\frac{0,08}{12}}$ $x\left(1+\dfrac{0,08}{12}\right)^{300} = 5272490,33...$ $x =$ R 718 305,71	✓ $i = \dfrac{0,08}{12}$ ✓ $n = 300$ ✓substitution ✓answer (4) ✓ $i = \dfrac{0,08}{12}$ ✓ $n = 300$ ✓substitution ✓answer (4) **[12]**

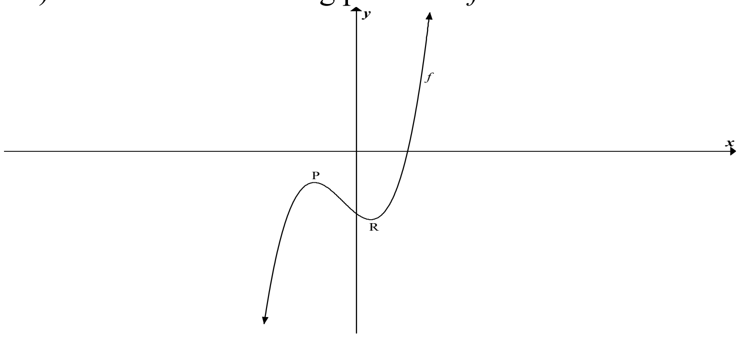
QUESTION/*VRAAG* 8

8.1.1	$f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{3(x+h)^2-4-(3x^2-4)}{h}$ $=\lim_{h\to 0}\frac{3x^2+6xh+3h^2-4-3x^2+4}{h}$ $=\lim_{h\to 0}\frac{6xh+3h^2}{h}$ $=\lim_{h\to 0}\frac{h(6x+3h)}{h}\quad ;h\neq 0$ $=\lim_{h\to 0}(6x+3h)$ $=6x$ **NOTE:** • Incorrect notation: max 4/5 marks (Leaving out limit / incorrect use of limit, leaving out $f'(x)$, = in the wrong place constitute incorrect notation) • If $\lim_{h\to 0}\frac{3x^2+6xh+3h^2-3x^2-8}{h}$, take out common factor, then correct to the final answer: max 3/5 marks. **OR** $f(x)=3x^2-4$ $f(x+h)=3(x+h)^2-4$ $=3x^2+6xh+3h^2-4$ $f(x+h)-f(x)=6xh+3h^2$ **NOTE:** If candidate uses differentiation rules: 0/5 marks $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{6xh+3h^2}{h}$ $=\lim_{h\to 0}\frac{h(6x+3h)}{h}$ $=\lim_{h\to 0}(6x+3h)$ $=6x$	✓ formula ✓ substitution of of $x+h$ ✓ simplification to $\frac{6xh+3h^2}{h}$ ✓ $\lim_{h\to 0}(6x+3h)$ ✓ answer (5) ✓ substitution of of $x+h$ ✓ simplification to $6xh+3h^2$ ✓ formula ✓ $\lim_{h\to 0}(6x+3h)$ ✓ answer (5)
8.1.2	$f(x)=3x^2-4$ average gradient of f between $A(-2\ ;\ y)$ and $B(x\ ;\ 23)$ $y=3(-2)^2-4=8$ $23=3x^2-4$ $27=3x^2$ $9=x^2$ $x=3$	✓ $y=8$ ✓ $23=3x^2-4$ ✓ $x=3$

	Average gradient $= \frac{23-y}{x-(-2)}$ $= \frac{23-8}{3+2}$ $= 3$	✓ $\frac{23-y}{x-(-2)}$ ✓answer (5)
8.2	**NOTE:** There is a maximum penalty of 1 mark for incorrect notation in question 8. $y = \frac{x+5}{x^{\frac{1}{2}}}$ $= \frac{x}{x^{\frac{1}{2}}} + \frac{5}{x^{\frac{1}{2}}}$ $= x^{\frac{1}{2}} + 5x^{-\frac{1}{2}}$ $\frac{dy}{dx} = \frac{1}{2}x^{-\frac{1}{2}} - \frac{5}{2}x^{-\frac{3}{2}}$ **OR** $y = \frac{x+5}{x^{\frac{1}{2}}}$ By the quotient rule $\frac{dy}{dx} = \frac{1.x^{\frac{1}{2}} - \frac{1}{2}x^{-\frac{1}{2}}(x+5)}{\left(x^{\frac{1}{2}}\right)^2}$ $= \frac{x^{\frac{1}{2}} - \frac{1}{2}x^{\frac{1}{2}} - \frac{5}{2}x^{-\frac{1}{2}}}{x}$ $= \frac{1}{2x^{\frac{1}{2}}} - \frac{5}{2x^{\frac{3}{2}}}$	✓ $x^{\frac{1}{2}} + 5x^{-\frac{1}{2}}$ ✓ $\frac{1}{2}x^{-\frac{1}{2}}$ or $\frac{1}{2\sqrt{x}}$ ✓ $-\frac{5}{2}x^{-\frac{3}{2}}$ or $\frac{-5}{2\sqrt{x^3}}$ (3) ✓✓ $\frac{1.x^{\frac{1}{2}} - \frac{1}{2}x^{-\frac{1}{2}}(x+5)}{\left(x^{\frac{1}{2}}\right)^2}$ ✓ $\frac{1}{2}x^{-\frac{1}{2}}$ or $\frac{1}{2\sqrt{x}}$ or $-\frac{5}{2}x^{-\frac{3}{2}}$ or $\frac{-5}{2\sqrt{x^3}}$ (3)
8.3	$f(x) = -3x^3 - 4x + 5$ $f'(x) = -9x^2 - 4$ $m_{\tan} = -9(-1)^2 - 4$ $= -13$	✓ $-9x^2$ ✓ -4 ✓ substitution of $x = -1$ ✓ answer (4) **[17]**

QUESTION/*VRAAG* 9

Given: $f(x)=x^3+ax^2+bx-2$
P(–1 ; – 1) and R are the turning points of *f*.

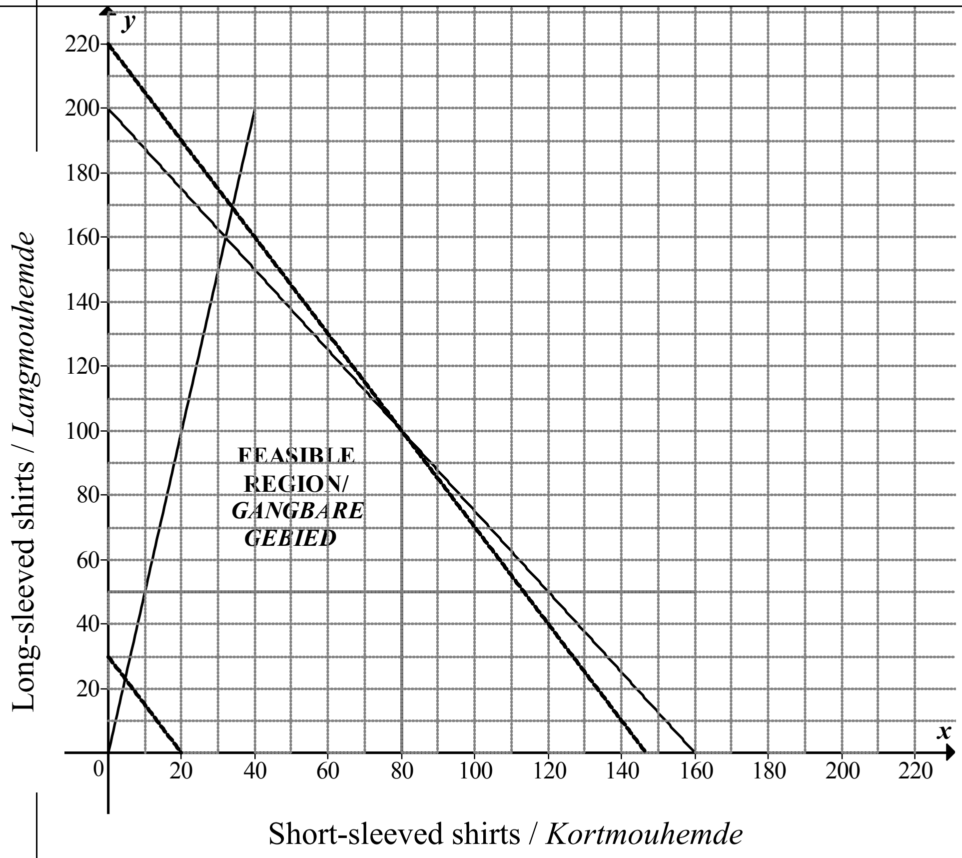


9.1	$f(x)=x^3+ax^2+bx-2$ $-1=(-1)^3+a(-1)^2+b(-1)-2$ $2=a-b \quad ...(1)$ $f'(x)=3x^2+2ax+b$ $0=3(-1)^2+2a(-1)+b$ $-3=-2a+b \quad ...(2)$ $-1=-a \quad ...(1)+(2)$ $a=1$ $b=-1$ **NOTE:** • The = 0 must be explicitly stated • If the candidate starts with what is given and then prove (1 ; 1) is a TP: 0/6 marks	✓ $-1=(-1)^3+a(-1)^2+b(-1)-2$ ✓ $2=a-b$ ✓ $f'(x)=3x^2+2ax+b$ ✓ $f'(-1)=0$ ✓ $-3=-2a+b$ ✓ method (6)
9.2	R is a turning point of *f*, hence at R, $f'(x)=0$ i.e. $3x^2+2x-1=0$ $(3x-1)(x+1)=0$ $x=\frac{1}{3}$ or -1 $\therefore x=\frac{1}{3}$ **NOTE:** Answer only: 1/3 marks	✓ $f'(x)=0$ ✓ $f'(x)=3x^2+2x-1$ ✓ selection of $x=\frac{1}{3}$ (3)
9.3	$(-1;2f(-1)-4)$ $=(-1;-6)$ **OR** $\left(\frac{1}{3};2f\left(\frac{1}{3}\right)-4\right)$ $=\left(\frac{1}{3};-\frac{226}{27}\right)$ or $(0{,}33;-8{,}37)$	✓ *x*-coordinate ✓ *y*-coordinate (2) ✓ *x*-coordinate ✓ *y*-coordinate (2) **[11]**

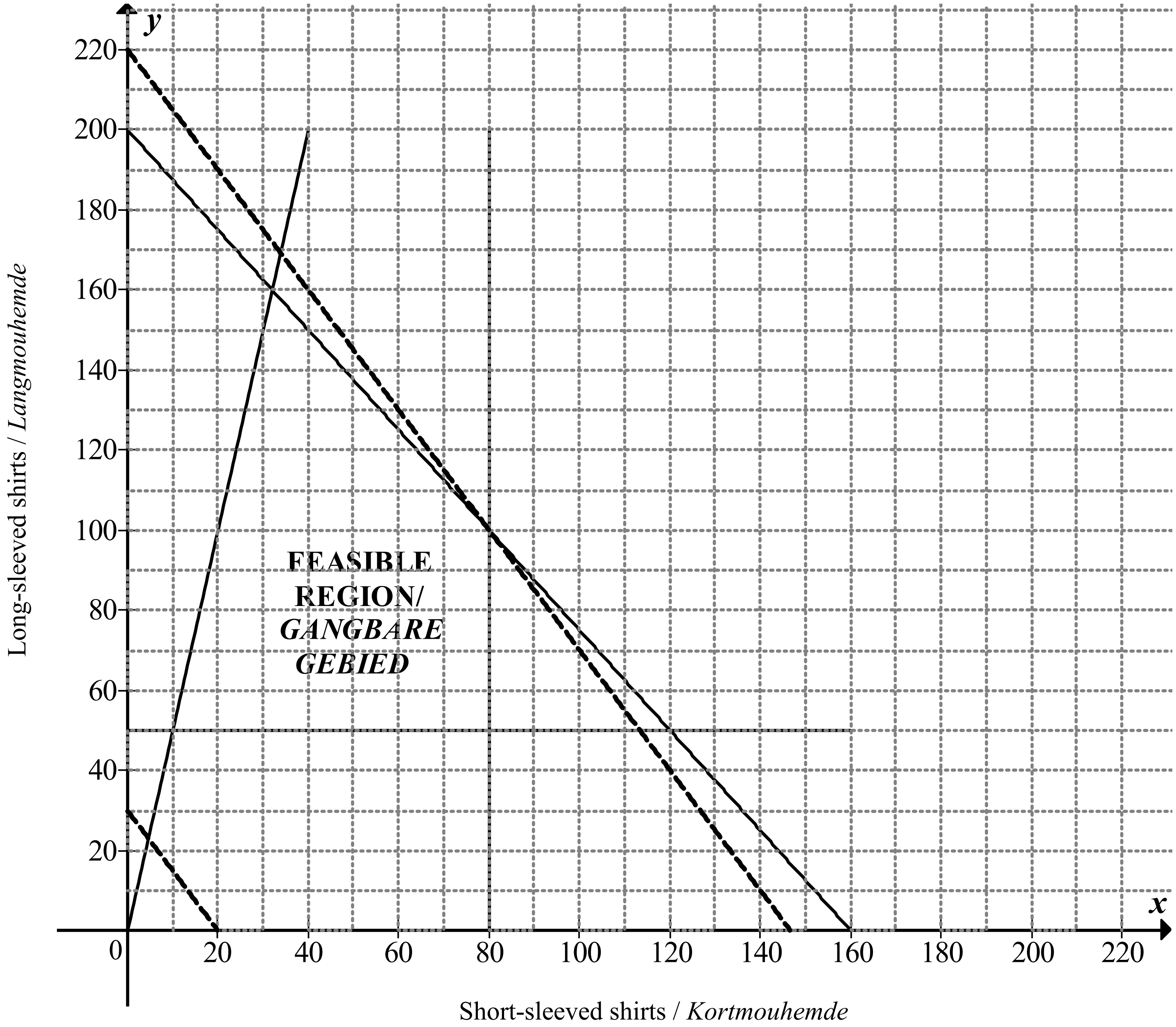
QUESTION/*VRAAG* 10

10.1	$\frac{dr}{dt} = -0{,}4t + 10$ $0 = -0{,}4t + 10$ $0{,}4t = 10$ $t = \frac{10}{0{,}4}$ $= 25$ seconds	✓ $\frac{dr}{dt} = -0{,}4t + 10$ ✓ $0 = -0{,}4t + 10$ ✓ t value (3)
	OR $t = -\frac{b}{2a}$ $= -\frac{10}{2(-0{,}2)}$ $= 25$ seconds	✓ $t = -\frac{b}{2a}$ ✓ substitution ✓ t value (3)
	OR $r = \frac{1}{5}t(50 - t)$ $0 = \frac{t}{5}(50 - t)$ $t = 0 \quad or \quad t = 50$ Fastest at $t = \frac{0 + 50}{2}$ $t = 25$ seconds	✓ $t = 0$ or $t = 50$ ✓ $t = \frac{0 + 50}{2}$ ✓ t value (3)
10.2	$-0{,}2t^2 + 10t = 0$ $t(-0{,}2t + 10) = 0$ $-0{,}2t + 10 = 0$ or $t = 0$ $t = \frac{-10}{-0{,}2}$ $= 50$ sec Hence the water stops flowing 50 seconds after it started. **NOTE:** Answer only: 3/3 marks	✓ $-0{,}2t^2 + 10t = 0$ ✓ factors ✓ answer (3)
	OR $-0{,}2t^2 + 10t = 0$ $t^2 - 50t = 0$ $t(t - 50) = 0$ $t = 0$ or $t = 50$ Hence the water stops flowing 50 seconds after it started.	✓ $-0{,}2t^2 + 10t = 0$ ✓ factors ✓ answer (3) **[6]**

QUESTION/*VRAAG* 11

11.1	$y \geq 50$ $x \leq 80$ $y \leq 5x$ **OR** $\frac{y}{5} \leq x$ $y \leq -\frac{5}{4}x + 200$ **OR** $5x + 4y \leq 800$	✓ $y \geq 50$ ✓ $x \leq 80$ ✓ $y \leq 5x$ ✓ $5x + 4y \leq 800$ (4)
11.2		✓ $y = 50$ ✓ $x = 80$ ✓ $5x + 4y = 800$ ✓ $y = 5x$ ✓feasible region / *gangbare gebied* (5) **NOTE:** Maximum of 2 marks for vertical and horizontal lines
11.3.1	$\text{P} = 30x + 20y$	✓ $\text{P} = 30x + 20y$ (1)
11.3.2	$y = -\frac{3}{2}x + \frac{P}{20}$ 80 short-sleeved shirts and 100 long-sleeved shirts (Point (80 ; 100))	✓80 short-sleeved shirts ✓100 long-sleeved shirts (2)
11.4	$\text{P} = ax + by$ $m = -\frac{a}{b}$ $-\frac{5}{4} = -\frac{a}{b}$ $\frac{a}{b} = \frac{5}{4}$ **NOTE:** Answer only: 2/2 marks	✓ $-\frac{5}{4} = -\frac{a}{b}$ ✓ answer (2) **[14]**

TOTAL/*TOTAAL*: 150


y
x
0
20
40
60
80
100
120
140
160
180
200
220
Long-sleeved shirts / *Langmouhemde*
Short-sleeved shirts / *Kortmouhemde*
FEASIBLE REGION/
GANGBARE GEBIED