basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE 12/*GRAAD* 12

MATHEMATICS P1/*WISKUNDE V1*

NOVEMBER 2017

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE:* ***150***

This memorandum consists of 22 pages.
Hierdie memorandum bestaan uit 22 bladsye.

NOTE:

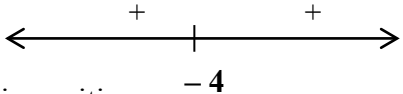
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking guidelines.

LET WEL:

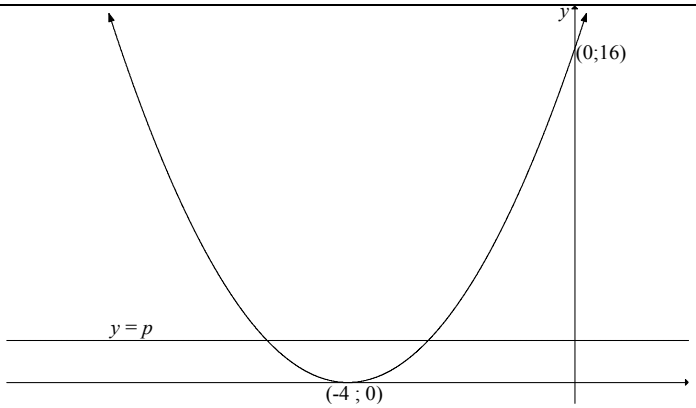
- *Indien 'n kandidaat 'n vraag TWEE KEER beantwoord, merk slegs die EERSTE poging.*
- *Volgehoue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.*

QUESTION/*VRAAG* 1

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

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

1.3.2



For two negative unequal roots:

$0 < p < 16$

✓ 0
✓ 16

✓ ✓ $0 < p < 16$ (4)

OR/*OF*

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

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

$0 < 16 - p < 16$

$-16 < -p < 0$

$0 < p < 16$

✓ 0
✓ 16

✓ ✓ $0 < p < 16$ (4)

OR/*OF*

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

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

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

$0 < 4p < 64$

$0 < p < 16$

✓ 0
✓ 16

✓ ✓ $0 < p < 16$ (4)

OR/*OF*

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

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

Roots are real and unequal:

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

$4p > 0$

$p > 0$

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

For both roots to be negative:

$\sqrt{4p} < 8$

$4p < 64$

$p < 16$

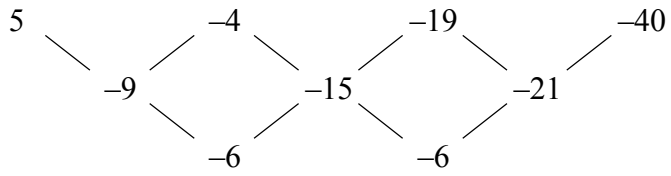
$0 < p < 16$

✓ 0
✓ 16

✓ ✓ $0 < p < 16$ (4)

[24]

QUESTION/*VRAAG* 2

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

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

QUESTION/*VRAAG* 3

3.1	$a+ar=2$ $a(1+r)=2$ $a=\frac{2}{1+r}$ **OR/*OF*** $\frac{a}{1-r}-2=\frac{1}{4}$ $4a-8(1-r)=1-r$ $4a-8+8r=1-r$ $4a=9-9r$ $a=\frac{9-9r}{4}$ **OR/*OF*** $S_n=\frac{a(r^n-1)}{r-1}$ $2=\frac{a(r^2-1)}{r-1}$ $2=\frac{a(r-1)(r+1)}{r-1}$ $2=a(r+1)$ $a=\frac{2}{r+1}$ **OR/*OF*** $\frac{ar^2}{1-r}=\frac{1}{4}$ $a=\frac{1-r}{4r^2}$	✓ $a+ar=2$ ✓ $a=\frac{2}{1+r}$ (2) ✓ $\frac{a}{1-r}-2=\frac{1}{4}$ ✓ $a=\frac{9-9r}{4}$ (2) **OR/*OF*** ✓ $2=\frac{a(r^2-1)}{r-1}$ ✓ $a=\frac{2}{1+r}$ (2) **OR/*OF*** ✓ $\frac{ar^2}{1-r}=\frac{1}{4}$ ✓ $a=\frac{1-r}{4r^2}$ (2)

3.2	$S_\infty = T_1 + T_2 + \sum_{n=3}^{\infty} T_n$	
	$S_\infty = 2 + \frac{1}{4}$	✓ $S_\infty = 2 + \frac{1}{4}$
	$\frac{a}{1-r} = 2 + \frac{1}{4}$	
	$\frac{a}{1-r} = \frac{9}{4}$	✓ $\frac{a}{1-r} = \frac{9}{4}$
	$\left(\frac{2}{1+r}\right) \times \left(\frac{1}{1-r}\right) = \frac{9}{4}$	✓ substitution of a into the correct formula
	$\frac{2}{1-r^2} = \frac{9}{4}$	
	$8 = 9 - 9r^2$	
	$9r^2 = 1$	✓ $9r^2 = 1$
	$r = \frac{1}{3}$	✓ $r = \frac{1}{3}$
	$a = \frac{3}{2}$	✓ $a = \frac{3}{2}$
		(6)
	OR/*OF*	**OR/*OF***
	$S_\infty = T_1 + T_2 + \sum_{n=3}^{\infty} T_n$	
	$S_\infty = 2 + \frac{1}{4}$	✓ $S_\infty = 2 + \frac{1}{4}$
	$\frac{a}{1-r} = 2 + \frac{1}{4}$	
	$\frac{a}{1-r} = \frac{9}{4}$	✓ $\frac{a}{1-r} = \frac{9}{4}$
	$4a = 9 - 9r$	
	$r = \frac{9-4a}{9}$	✓ $r = \frac{9-4a}{9}$
	$a + a\left(\frac{9-4a}{9}\right) = 2$	
	$9a + 9a - 4a^2 = 18$	
	$2a^2 - 9a + 9 = 0$	✓ substitution of a into the correct formula
	$(a-3)(2a-3) = 0$	
	$a = \frac{3}{2}$ or $a = 3$	
	$r = \frac{1}{3}$ or $r = -\frac{1}{3}$	
	N/A	✓ $a = \frac{3}{2}$

OR/*OF*

$r = \frac{2-a}{a}$

$\frac{ar^2}{1-r} = \frac{1}{4}$

$4ar^2 = 1-r$

$4a\left(\frac{2-a}{a}\right)^2 = 1-\frac{2-a}{a}$

$16-16a+4a^2 = 2a+2$

$2a^2-9a+9=0$

$(2a-3)(a-3)=0$

$a = \frac{3}{2}$ $\quad a \neq 3$

$r = \frac{1}{3}$ $\quad r \neq -\frac{1}{3}$

✓ $r = \frac{1}{3}$

(6)

OR/*OF*

✓ $r = \frac{2-a}{a}$

✓ $\frac{ar^2}{1-r} = \frac{1}{4}$

✓ substitution of a

✓ $(2a-3)(a-3)=0$

✓ $a = \frac{3}{2}$

✓ $r = \frac{1}{3}$

(6)

OR/*OF*

$S_\infty = T_1 + T_2 + \sum_{n=3}^{\infty} T_n$

$S_\infty = 2 + \frac{1}{4}$

$\frac{a}{1-r} = 2 + \frac{1}{4}$

$\frac{a}{1-r} = \frac{9}{4}$

$\left(\frac{1-r}{4r^2}\right) \times \left(\frac{1}{1-r}\right) = \frac{9}{4}$

$\frac{1}{4r^2} = \frac{9}{4}$

$4 = 36r^2$

$9r^2 = 1$

$r = \frac{1}{3}$

$a = \frac{3}{2}$

OR/*OF*

✓ $S_\infty = 2 + \frac{1}{4}$

✓ $\frac{a}{1-r} = \frac{9}{4}$

✓ substitution of a

✓ $9r^2 = 1$

✓ $r = \frac{1}{3}$

✓ $a = \frac{3}{2}$

(6)

[8]

QUESTION/*VRAAG* 4

4.1	$f(x) = -ax^2 + bx + 6$ $f'(x) = -2ax + b$ $-2ax + b = 3$ at $x = -1$ $2a + b = 3$ [1] $f(-1) = \frac{7}{2}$ $-a - b + 6 = \frac{7}{2}$ $-2a - 2b + 12 = 7$ $2a + 2b = 5$ [2] [2] – [1] $b = 2$ $2a + 2 = 3$ $a = \frac{1}{2}$ **OR/*OF*** $f'(x) = -2ax + b$ $3 = 2a + b$ $b = 3 - 2a$ $\frac{7}{2} = -a(-1)^2 + (3 - 2a)(-1) + 6$ $a + 3 = \frac{7}{2}$ $a = \frac{1}{2}$ $b = 2$	✓$-2ax + b$ ✓✓$2a + b = 3$ ✓$-a - b + 6 = \frac{7}{2}$ ✓solve simultaneously (5) ✓$-2ax + b$ ✓✓$2a + b = 3$ ✓ $\frac{7}{2} = -a(-1)^2 + (3 - 2a)(-1) + 6$ ✓solve simultaneously (5)
4.2	$f(x) = -\frac{1}{2}x^2 + 2x + 6$ x – intercepts: $-\frac{1}{2}x^2 + 2x + 6 = 0$ $-x^2 + 4x + 12 = 0$ $x^2 - 4x - 12 = 0$ $(x - 6)(x + 2) = 0$ $(-2\,;0)$ $(6\,;0)$	✓ $-\frac{1}{2}x^2 + 2x + 6 = 0$ ✓$(-2\,;0)$ ✓ $(6\,;0)$ (3)

4.3

$f(x)=-\frac{1}{2}x^2+2x+6$

$f'(x)=0$ or $x=-\frac{b}{2a}$ or $x=\frac{-2+6}{2}$

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

$x=2$ $x=2$

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

$=-2+4+6$

$=8$

TP $(2;8)$

OR/OF

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

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

$=-\frac{1}{2}(x-2)^2+8$

TP $(2;8)$

✓ $-x+2$ / $-\frac{2}{2.\left(-\frac{1}{2}\right)}$ / $\frac{-2+6}{2}$

✓ $x=2$

✓ $y=8$

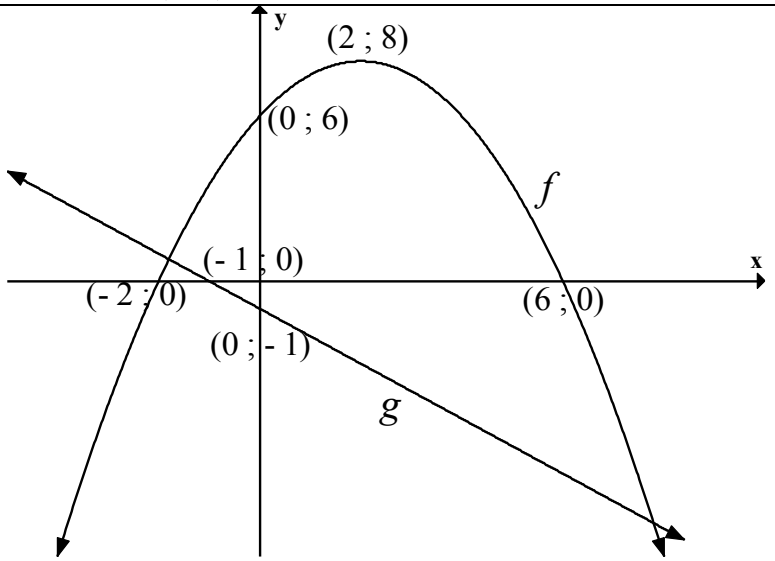
OR/*OF*

✓ $-\frac{1}{2}(x-2)^2+8$

✓ $x=2$
✓ $y=8$

(3)

4.4
4.6



4.4:
f:
✓shape
✓*x*- intercepts
✓*y*- intercept
✓(2 ; 8)

(4)

4.6:
g:

✓ *x*- intercept
✓ *y*- intercept

(2)

4.5

$0 < x < 4$ or $(0 ; 4)$

✓ 4
✓✓ $0 < x < 4$ (3)

4.7

$x \le -2$ or $-1 \le x \le 6$

OR/OF

$(-\infty ; -2]$ or $[-1;6]$

✓ $x \le -2$
✓✓ $-1 \le x \le 6$

(3)
[23]

QUESTION/*VRAAG* 5

5.1	$y \in R\,;\, y \neq -1$ **OR/*OF*** $y < -1$ or $y > -1$ **OR/*OF*** $y \in (-\infty\,;-1)$ or $y \in (-1\,;\infty)$ **OR/*OF*** $R - \{-1\}$	✓✓ answer (2)
5.2	$\text{D}(2\,;-1)$ $g(x) = \dfrac{2}{x-2} - 1$	✓ $\text{D}(2\,;-1)$ ✓ $\dfrac{2}{x-2} - 1$ (2)
5.3	$f(x) = \log_3 x.$ $\log_3 t = 1$ $t = 3$ **OR/*OF*** $g(x) = \dfrac{2}{x-2} - 1$ $1 = \dfrac{2}{t-2} - 1$ $2 = \dfrac{2}{t-2}$ $2t - 4 = 2$ $t = 3$	✓correct substitution of A ✓✓ $t = 3$ (3)
5.4	$x = \log_3 y$ $y = 3^x$	✓interchange x and y ✓ $y = 3^x$ (2)
5.5	$3^x < 3^1$ $x < 1$ **OR/*OF*** $3^x < 3^1$ $x \in (-\infty\,;1)$	✓$3^x < 3^1$ ✓$x < 1$ (2) ✓$3^x < 3^1$ ✓$x \in (-\infty\,;1)$ (2)
5.6	Equation of the axis of symmetry: $y = -x + 1$ x-intercept of the axis of symmetry is at $x = 1$ f has an x-intercept at B(1 ; 0) which is the same as the x-intercept of the axis of symmetry Point of intersection: B $(1\,;0)$ **OR/*OF*** Since BE = ED = 1 and D lies on the axis of symmetry and the gradient of the axis of symmetry is –1, B will also lie on the axis of symmetry. But B also lies on f. Therefore B(1 ; 0) is the point of intersection between f and the axis of symmetry with a negative gradient./ *Omdat* BE = ED = 1 *en* D *op die simmetrie-as lê en die simmetrie-as se gradiënt* –1 *is, sal* B *ook op die simmetrie-as lê. Maar* B *lê ook op f. Dus is* B(1 ; 0) *die snypunt van f en die simmetrie-as met negatiewe gradiënt.*	✓✓ equation of axis of symmetry ✓B or $(1\,;0)$ **OR/*OF*** ✓✓ BE = ED = 1 ✓ B or $(1\,;0)$ (3) **[14]**

QUESTION/*VRAAG* 6

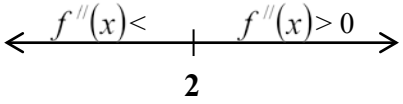
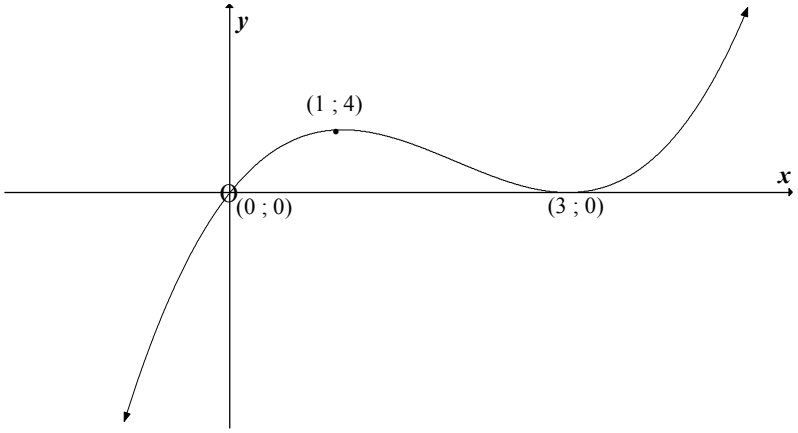
6.1	$A = P(1+i)^n$ $12\ 146{,}72 = 10\ 000\left(1+\frac{r}{12}\right)^{36}$ $\left(1+\frac{r}{12}\right)^{36} = 1{,}214672$ $1+\frac{r}{12} = \sqrt[36]{1{,}214672}$ $= 1{,}005416$ $\frac{r}{12} = 0{,}005416$ $r = 0{,}06500$ $r = 6{,}5\%$	✓ $\frac{r}{12}$ ✓ $n = 36$ ✓ correct substitution into formula ✓ $1+\frac{r}{12} = \sqrt[36]{1{,}214672}$ ✓ 6,5% (5)
6.2.1	$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $235\ 000 = \frac{x\left[1-\left(1+\frac{0{,}11}{12}\right)^{-54}\right]}{\frac{0{,}11}{12}}$ $x = \frac{235\ 000\times\frac{0{,}11}{12}}{\left[1-\left(1+\frac{0{,}11}{12}\right)^{-54}\right]}$ $= \text{R}5\ 536{,}95$ His monthly instalment is R 5 536,95	✓ $i = \frac{0{,}11}{12}$ ✓ $n = 54$ ✓ correct substitution in P ✓ answer (4)
6.2.2	Amount paid for the year : $(5\ 536{,}95\times 12) = \text{R}66\ 443{,}40$ $\text{Balance} = 235\ 000\left(1+\frac{0{,}11}{12}\right)^{12} - \frac{5\ 536{,}95\left[\left(1+\frac{0{,}11}{12}\right)^{12}-1\right]}{\frac{0{,}11}{12}}$ $= 192\ 296{,}17$ $\text{Interest} = (5\ 536{,}95\times 12) - (235\ 000 - 192\ 296{,}17)$ $= 66\ 443{,}40 - 42\ 703{,}83$ $= 23\ 739{,}57$ **OR/*OF***	✓ R66 443,40 ✓ $235\ 000\left(1+\frac{0{,}11}{12}\right)^{12}$ ✓ $\frac{5\ 536{,}95\left[\left(1+\frac{0{,}11}{12}\right)^{12}-1\right]}{\frac{0{,}11}{12}}$ ✓ R192 296,17 ✓ R42 703,83 ✓ R23 739,57 **OR/*OF***

	Total amount paid in first year $= \text{R } 5\,536.95 \times 12$ $= \text{R}66\,443{,}40$ Balance on loan after 1 year = P of remaining installments $\text{P} = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $= \frac{5\ 536{,}95\left[1-\left(1+\frac{0{,}11}{12}\right)^{-42}\right]}{\frac{0{,}11}{12}}$ $= \text{R}192\,296{,}20$ Amount paid off in the first year: $\text{R}235\,000 - \text{R}192\,296{,}20 = \text{R}42\,703{,}80$ Amount of interest = $\text{R}66\,443{,}40 - \text{R}42\,703{,}80$ $= \text{R}23\,739{,}60$ **OR/*OF*** $P = \frac{5536{,}95\left[1-\left(1+\frac{0{,}11}{12}\right)^{-12}\right]}{\frac{0{,}11}{12}}$ $= R\ 62\,648{,}18$ $235\,000 - 62\,648{,}18 = \text{R}172\,351{,}82$ After 12 months, money owed on house is $172\,351{,}82\left(1+\frac{0{,}11}{12}\right)^{12}$ $= 192\,296{,}17$ Amount paid after 12 months is $5\,536{,}95 \times 12 = \text{R}\ 66\,443{,}40$ Amount of interest paid: R 66 443, 40 – (235 000 – 192 296,17) = R 23 739, 57	✓ R66 443,40 ✓ $n = -42$ ✓ substitution into correct formula ✓ R192 296,20 ✓ R42 703,80 ✓ R23 739,60 (6) **OR/*OF*** ✓ R62 648,18 ✓ R172 351,82 ✓ R192 296,17 ✓ R66 443,40 ✓ 235 000 – 192 296,17 ✓ R23 739,57 (6) **[15]**

QUESTION/*VRAAG* 7

7.1	$f(x+h) = 2(x+h)^2 - (x+h)$ $= 2(x^2 + 2xh + h^2) - x - h$ $= 2x^2 + 4xh + 2h^2 - x - h$ $f(x+h) - f(x) = 2x^2 + 4xh + 2h^2 - x - h - 2x^2 + x$ $= 4xh + 2h^2 - h$ $f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h\to 0} \frac{4xh + 2h^2 - h}{h}$ $= \lim_{h\to 0} \frac{h(4x + 2h - 1)}{h}$ $= \lim_{h\to 0} (4x + 2h - 1)$ $= 4x - 1$ **OR/*OF*** $f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h\to 0} \frac{2(x+h)^2 - (x+h) - (2x^2 - x)}{h}$ $= \lim_{h\to 0} \frac{2x^2 + 4xh + 2h^2 - x - h - 2x^2 + x}{h}$ $= \lim_{h\to 0} \frac{4xh + 2h^2 - h}{h}$ $= \lim_{h\to 0} \frac{h(4x + 2h - 1)}{h}$ $= \lim_{h\to 0} (4x + 2h - 1)$ $= 4x - 1$	✓ $2x^2 + 4xh + 2h^2 - x - h$ ✓ $4xh + 2h^2 - h$ ✓ $f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$ ✓subst. into formula ✓ $\lim_{h\to 0}(4x + 2h - 1)$ ✓$4x - 1$ **OR/*OF*** ✓ $f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$ ✓subst. into formula ✓ $2x^2 + 4xh + 2h^2 - x - h$ ✓ $4xh + 2h^2 - h$ ✓ $\lim_{h\to 0}(4x + 2h - 1)$ ✓ $4x - 1$ (6)
7.2.1	$D_x[(x+1)(3x-7)]$ $= D_x(3x^2 - 4x - 7)$ $= 6x - 4$	✓ $3x^2 - 4x - 7$ ✓ $6x - 4$ (2)
7.2.2	$y = \sqrt{x^3} - \frac{5}{x} + \frac{1}{2}\pi$ $y = x^{\frac{3}{2}} - 5x^{-1} + \frac{1}{2}\pi$ $\frac{dy}{dx} = \frac{3}{2}x^{\frac{1}{2}} + 5x^{-2}$	✓ $x^{\frac{3}{2}} - 5x^{-1}$ ✓ $\frac{3}{2}x^{\frac{1}{2}}$ ✓ $+5x^{-2}$ ✓ derivative of $\frac{1}{2}\pi$ is 0 (4) **[12]**

QUESTION/*VRAAG* 8

8.1	$f(x) = x^3 - 6x^2 + 9x$ $f'(x) = 3x^2 - 12x + 9$ $f''(x) = 6x - 12 = 0$ $x = 2$ $f''(0) = 6(0) - 12$ $= -12$ $f''(3) = 6(3) - 12$ $= 6$  Point of inflection at $x = 2$	✓ $x^3 - 6x^2 + 9x$ ✓ $3x^2 - 12x + 9$ ✓ $6x - 12$ ✓ $6x - 12 = 0$ ✓ explanation (5)
8.2	 	✓shape ✓ (0 ; 0) ✓ (3 ; 0) as TP ✓(1 ; 4) (4)
8.3	f concave up for $x > 2$ $y = -f(x)$ will be concave down for $x > 2$	✓✓ $x > 2$ (2)
8.4.1	$(3;7)$	✓ 3 ✓7 (2)
8.4.2	Do not agree with Claire as her statement is incorrect. Between $x = 1$ and $x = 3$ the graph of f is decreasing. Therefore at $x = 2$ the gradient will have a negative value. *Stem nie saam met Claire nie, want haar stelling in verkeerd.* *Die grafiek van f is dalend/afnemend tussen $x = 1$ en $x = 3$.* *By $x = 2$ moet die gradiënt dus 'n negatiewe waarde hê.* **OR/*OF*** $f'(2) = 3(2)^2 - 12(2) + 9$ $= -3$ $\neq 1$	✓no ✓justification (2) **[15]**

QUESTION/*VRAAG* 9

	$y = x^2 + 2$ $\text{P}\left(x\,;x^2+2\right)$ $\text{B}(0\,;3)$	
	$\text{PB}^2 = (x-0)^2 + \left(x^2+2-3\right)^2$	✓ $(x-0)^2 + \left(x^2+2-3\right)^2$
	$= x^2 + x^4 - 2x^2 + 1$	
	$= x^4 - x^2 + 1$	✓ $x^4 - x^2 + 1$
	PB will be a minimum if PB^2 is a minimum	
	$\frac{d\left(\text{PB}^2\right)}{dx} = 4x^3 - 2x$	✓ $4x^3 - 2x$
	$4x^3 - 2x = 0$	✓ $\frac{d\left(\text{PB}^2\right)}{dx} = 0$
	$x\left(2x^2 - 1\right) = 0$	
	$x = 0$ or $x^2 = \frac{1}{2}$	
	$x = \frac{1}{\sqrt{2}}$	✓ $x = \frac{1}{\sqrt{2}}$
	$\text{PB}^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1$	✓ $\text{PB}^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1$
	$= \frac{1}{4} - \frac{1}{2} + 1$	
	$= \frac{3}{4}$	
	$\text{PB} = \frac{\sqrt{3}}{2} = 0{,}87$	✓ answer
	OR/*OF*	**OR/*OF***

Gradient of tangent to curve $= 2x$ ✓ $= 2x$

Gradient of line joining B and the curve $= \dfrac{x^2+2-3}{x-0}$

$= \dfrac{x^2-1}{x}$ ✓ $= \dfrac{x^2-1}{x}$

Shortest distance will be where tangent to curve is perpendicular to the line joining P and the curve.

$\dfrac{x^2-1}{x} = -\dfrac{1}{2x}$ ✓ $\dfrac{x^2-1}{x} = -\dfrac{1}{2x}$

$2x\left(x^2-1\right) = -x$

$2x^3 - 2x = 0$ ✓ $2x^3 - 2x = 0$

$x\left(2x^2-1\right) = 0$

$x = 0 \quad \text{or} \quad x^2 = \dfrac{1}{2}$

$x = \dfrac{1}{\sqrt{2}}$ ✓ $x = \dfrac{1}{\sqrt{2}}$

$\text{PB}^2 = \left(\dfrac{1}{\sqrt{2}}\right)^4 - \left(\dfrac{1}{\sqrt{2}}\right)^2 + 1$ ✓ $\text{PB}^2 = \left(\dfrac{1}{\sqrt{2}}\right)^4 - \left(\dfrac{1}{\sqrt{2}}\right)^2 + 1$

$= \dfrac{1}{4} - \dfrac{1}{2} + 1$

$= \dfrac{3}{4}$

$\text{PB} = \dfrac{\sqrt{3}}{2} = 0{,}87$ ✓ answer

OR/*OF*

OR/*OF*

$\text{P}\left(k; k^2+2\right)$ and B(0; 3) ✓ $\text{P}\left(k; k^2+2\right)$

$\text{BP} \perp$ tangent passing through $y = x^2 + 2$ at P.

$m_{\text{tangent at P}} = 2k$ ✓ $m_{\text{tangent at P}} = 2k$

$m_{\text{BP}} = -\dfrac{1}{2k}$ ✓ $m_{BP} = -\dfrac{1}{2k}$

Equation of BP: $y = \left(-\dfrac{1}{2k}\right)x + 3$ ✓ $y = \left(-\dfrac{1}{2k}\right)x + 3$

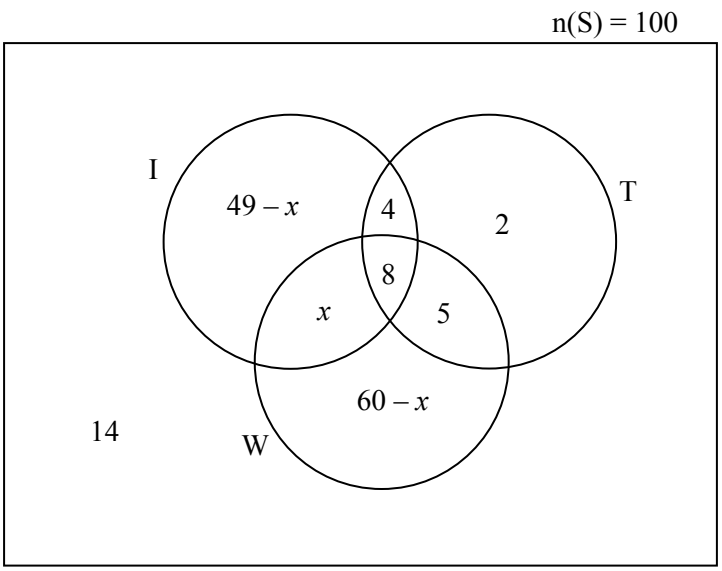
$y_{\text{P}} = \left(-\dfrac{1}{2k}\right)(k) + 3 = 2{,}5$ ✓ value of y at P

$\Rightarrow k^2 + 2 = 2{,}5$ and so $k = \sqrt{0{,}5}$ and $\text{P}\left(\sqrt{0{,}5}; 2{,}5\right)$ ✓ value of k

$\text{BP} = \sqrt{\left(\sqrt{0{,}5}-0\right)^2 + (2{,}5-3)^2} = \sqrt{\dfrac{3}{4}} = \dfrac{\sqrt{3}}{2} = 0{,}87$ ✓ answer

[7]

QUESTION/*VRAAG* 10

10.1		8 values need to be placed in correct position: 2 or 3 correct: 1 mark 4 or 5 correct: 2 marks 6 or 7 correct: 3 marks 8 correct: 4 marks (4)
10.2	$(49-x)+x+8+4+5+2+(60-x)+14=100$ $-x+142=100$ $x=42$	✓ setting up equation ✓ answer (2)
10.3	P (use only one application) $=\frac{7+2+18}{100}$ $=\frac{27}{100}$ or 27%	✓ $\frac{7+2+18}{100}$ ✓answer (2) **[8]**

QUESTION/*VRAAG* 11

11.1	5 x 5 x 10 x 9 = 2250	✓ 5 x 5 ✓ 10 x 9 ✓ 2250 (3)
11.2	<table><tr><th>No of digits used</th><th>Letters</th><th>Digits</th><th>Total</th></tr><tr><td>1</td><td>5 x 5</td><td>10</td><td>250</td></tr><tr><td>2</td><td>5 x 5</td><td>10 x 9</td><td>2 250</td></tr><tr><td>3</td><td>5 x 5</td><td>10 x 9 x 8</td><td>18 000</td></tr><tr><td>4</td><td>5 x 5</td><td>10 x 9 x 8 x7</td><td>126 000</td></tr><tr><td>5</td><td>5 x 5</td><td>10 x 9 x 8 x7 x 6</td><td>756 000</td></tr></table> Codes of two letters and five digits will ensure unique numbers for 700 000 clients.	✓ 5 x 5 x 10 x 9 x 8 x 7 x 6 ✓✓ five digits (3) **[6]**

TOTAL/*TOTAAL*: 150