Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE/ NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD 12*

SEPTEMBER 2018

MATHEMATICS P1/*WISKUNDE V1* MARKING GUIDELINE/*NASIENRIGLYN*

MARKS/*PUNTE*: 150

FILE

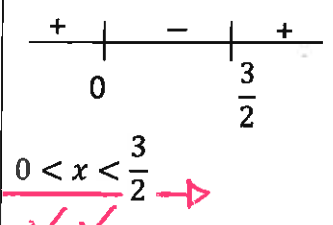This marking guideline consists of 12 pages./
Hierdie nasienriglyn bestaan uit 12 bladsye.

NOTE/LET WEL:

- If a candidate answers a question TWICE, mark the FIRST attempt ONLY.
  Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk SLEGS die EERSTE poging.
- Consistent accuracy applies in ALL aspects of the marking guideline.
  Volgehoue akkuraatheid geld deurgaans in ALLE aspekte van die nasienriglyn.
- If a candidate crossed out an attempt of a question and did not redo the question, mark the crossed-out attempt.
  Indien 'n kandidaat 'n poging vir 'n vraag deurgetrek het en nie die vraag weer beantwoord het nie, merk die poging wat deurgetrek is.
- The mark for substitution is awarded for substitution into the correct formula.
  Die punt vir substitusie word toegeken vir substitusie in die korrekte formule.

QUESTION 1/VRAAG 1

1.1.1	$\frac{1}{2}x^2 - x - 4 = 0$ pg 12 too $x^2 - 2x - 8 = 0$ $(x-4)(x+2) = 0$ **3** $x = 4$ or/of $x = -2$	✓✓ factors/*faktore* ✓ x-values/*waardes* (3)
1.1.2	$-3(x^2 + 3x) + 7 = 0$ $-3x^2 - 9x + 7 = 0$ ✓ $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \dfrac{-(-9) \pm \sqrt{(-9)^2 - 4(1)(7)}}{2(-3)}$ ✓ **4** $x = 0{,}64$ or/of $x = -3{,}64$	✓ standard form/*standaardvorm* ✓ substitution/*substitusie* ✓✓ x-values/*waardes* (4)
1.1.3	$2x^2 - 3x < 0$ $x(2x - 3) < 0$ ✓ $0; \frac{3}{2}$ $0 < x < \dfrac{3}{2}$ **4** ✓✓	✓ $x(2x - 3)$ ✓ critical values/*kritiese waardes* ✓✓ $0 < x < \frac{3}{2}$ (4)

1.2	$x - 2y = 3$ ....(1) $4x^2 - 3 = -6y + 5xy$.........(2) from (1)/*vanaf* (1) $x = 2y + 3$ ✓ sub into (2)/*vervang in* (2) $2(2y + 3)^2 - 3 = -6y + 5y(2y + 3)$ ✓ $4(4y^2 + 12y + 9) - 3 = -6y + 10y^2 + 15y$ $16y^2 + 48y + 36 - 3 = 10y^2 + 9y$ $6y^2 + 39y + 33 = 0$ $2y^2 + 13y + 11 = 0$ ✓ $(y + 1)(2y + 11) = 0$ ✓ $y = -1$ or $y = -\frac{11}{2}$ ✓ $x = 1$ or/*of* $x = -8$ ✓	✓ $x = 2y + 3$ ✓ substitution/*vervanging* ✓ standard form/*standaardvorm* ✓ factors/*faktore* ✓ y-values /*y-waardes* ✓ x-values/*x-waardes* (6)
1.3	$2x^2 - (k - 1)x + k - 3 = 0$ $\Delta = b^2 - 4ac$ $\Delta = [-(k - 1)]^2 - 4(2)(k - 3)$ ✓ $\Delta = k^2 - 2k + 1 - 8k + 24$ ✓ $\times$ out both $\Delta = k^2 - 10k + 25$ ✓ $\Delta = (k - 5)^2$ $(k - 5)^2 \geq 0$ ✓ ∴ Roots are Real/*Wortels is Reël*	✓ $\Delta = [-(k - 1)]^2 - 4(2)(k - 3)$ ✓ $\Delta = k^2 - 2k + 1 - 8k + 24$ ✓ $\Delta = k^2 - 10k + 25$ ✓ $\Delta = (k - 5)^2$ ✓ $(k - 5)^2 \geq 0$ (5)
1.4.1	$3^{2m} = \frac{3p}{3 - p}$ $3^{2m} = \frac{3(1,5)}{3 - 1,5}$ ✓ sub $3^{2m} = 3$ ∴ $2m = 1$ ∴ $m = \frac{1}{2}$ ✓	✓ sub. of/*vervanging van* $p = 1,5$ ✓ answer/*antwoord* (2)
1.4.2	$3^{2m} = \frac{3p}{3 - p}$ sub ✓ $3^{2(0)} = \frac{3p}{3 - p}$ $1 = \frac{3p}{3 - p}$ $3p = 3 - p$ $4p = 3$ ∴ $p = \frac{3}{4}$ ✓	✓ sub. of/*vervanging van* $m = 0$ ✓ answer/*antwoord* (2) **[26]**

QUESTION 2/*VRAAG 2*

2.1	$\dfrac{2x+2}{7x+1} = \dfrac{x-1}{2x+2}$ ✓ $(2x+2)^2 = (7x+1)(x-1)$ $4x^2 + 8x + 4 = 7x^2 - 6x - 1$ $3x^2 - 14x - 5 = 0$ ✓ $(3x+1)(x-5) = 0$ ✓ $x = -\dfrac{1}{3}$ or/*of* $x = 5$ ✓ ✓ ✓ 5	✓ $\dfrac{T_2}{T_1} = \dfrac{T_3}{T_2}$ ✓ standard form/*standaardvorm* ✓ factors/ *faktore* ✓ $x = -\dfrac{1}{3}$ ✓ $x = 5$ (5)
2.2	$25 \,; 20 \,; 16; \,....$ ✓ $a = 25$; $r = \dfrac{4}{5}$ ✓ $S_\infty = \dfrac{a}{1-r}$ ✓ $S_\infty = \dfrac{25}{1-\dfrac{4}{5}}$ ✓ ✓ no penalty missing units $S_\infty = 125m$ ✓ 4	✓ $r = \dfrac{4}{5}$ ✓ $S_\infty = \dfrac{a}{1-r}$ ✓ substitution/*vervanging* ✓ $S_\infty = 125\,m$ (4)
2.3	$a = 2$ $l = 29$ $S_n = 155$ $S_n = \dfrac{n}{2}(a+l)$ ✓ $155 = \dfrac{n}{2}(2+29)$ ✓ $n = 10$ ✓ $29 = 2 + (10-1)d$ ✓ $9d = 27$ $d = 3$ ✓ 5	✓ sum formula of AS/ *som formule van RR* ✓ sub./*vervanging van a* and/*en l* ✓ $n = 10$ ✓ sub./*vervanging van* $n = 10$ ✓ $d = 3$ (5) **[14]**

QUESTION 3/*VRAAG 3*

3.	$2a = 4$ ✓ $a = 2$ ✓ $24 = 2 + b + c$ ✓ ....(1) $24 = 50 + 5b + c$ ✓ ......(2) $4b = -48$ $(2)-(1)$ ✓ method sim eqn $b = -12$ ✓ $24 = 2 - 12 + c$ ✓ sub $b = -12$ $c = 34$ ✓ 8 $T_n = 2n^2 - 12n + 34$ See alternative answers/ *Kyk na alternatiewe antwoorde* pg 12 too	✓ $2a = 4$ ✓ $a = 2$ ✓ sub. into /*vervang in* T_1 ✓ sub. into /*vervang in* T_5 ✓ method of solving/*metode van oplossing* ✓ $b = -12$ ✓ sub. of /*vervanging van b* ✓ $c = 34$ (8) **[8]**
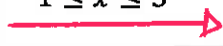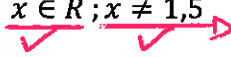
QUESTION 4/VRAAG 4

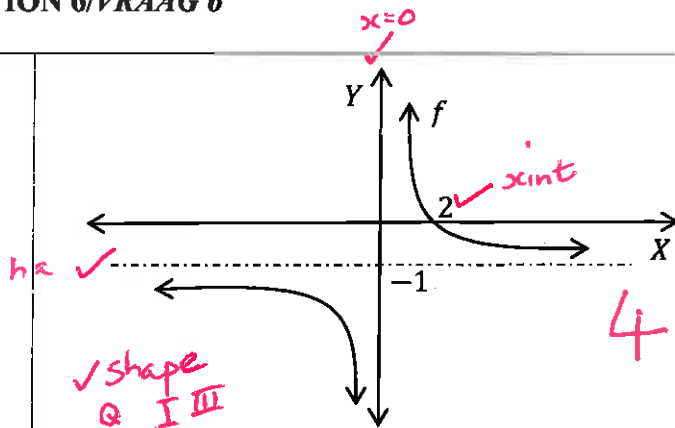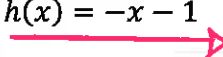| 4.1	$36 = k^2$ $\therefore k = 6$	✓ sub of point/*vervanging van punt* ✓ $k = 6$ (2)
4.2	$y = 6^x$ $x = 6^y$ $y = \log_6 x$ or ito k ans only 2/2	✓ swop of x and y. / *omruiling van x en y.* ✓ $y = \log_6 x$ (2)
4.3	$0 < x \le 1$	✓✓ answer/*antwoord* (2)
4.4	$y > 2$ val not^n	✓✓ answer/*antwoord* (2) **[8]**

← do not allocate if value is not correct

QUESTION 5/VRAAG 5

5.1	$B(5; 0)$	✓✓ answer /*antwoord* (2)
5.2	$y = a(x - p)^2 + q$ $y = a\left(x - \dfrac{3}{2}\right)^2 + \dfrac{49}{4}$ $0 = a\left(5 - \dfrac{3}{2}\right)^2 + \dfrac{49}{4}$ $a = -1$ $y = -1\left(x - \dfrac{3}{2}\right)^2 + \dfrac{49}{4}$ $y = -1\left(x^2 - 3x + \dfrac{9}{4}\right) + \dfrac{49}{4}$ $y = -x^2 + 3x + 10$ **OR/OF** $y = a(x - 5)(x + 2)$ Inspection/ *Inspeksie* $\dfrac{49}{4} = a(\dfrac{3}{2} - 5)(\dfrac{3}{2} + 2)$ Sub T$\left(\dfrac{3}{2}; \dfrac{49}{4}\right)$ $a = -1$ $y = -1(x - 5)(x + 2)$ $y = -x^2 + 3x + 10$	✓ sub of turning point/ *vervanging van draaipunt* ✓ sub of point B/ *vervanging van punt B* ✓ $a = -1$ ✓ $y = -x^2 + 3x + 10$ (4) ✓ sub of x-intercepts/ *vervanging van x-afsnitte* ✓ sub of turning point/ *vervanging van draaipunt* ✓ $a = -1$ ✓ $y = -x^2 + 3x + 10$ (4)

5.3	$-x^2 + 3x + 10 = -x + 5$ ✓
	 $x^2 - 4x - 5 = 0$ ✓
	 $(x - 5)(x + 1) = 0$ ✓
	 $x = 5$ or/*of* $x = -1$
	 $S(-1; 6)$
	 ✓→ **4**
		✓ $f(x) = g(x)$
		 ✓ standard form/
		     standaardvorm
		 ✓ factors/*faktore*
		 ✓ $S(-1; 6)$
		          (4)

5.4.1	✓ ✓ $-1 \le x \le 5$ → **2**	✓✓ answer/*antwoord* (2)

5.4.2	$-x^2 + 3x - 2{,}25 < 0$
	 $-x^2 + 3x + 10 < 2{,}25 + 10$
	 $\therefore \; f(x) < 12{,}25$ ✓
	 $x \in R \; ; x \ne 1{,}5$ → **3**
	 ✓ ✓
	 see pg 12 too
		✓ $f(x) < 12{,}25$
		 ✓✓ $x \in R \; ; x \ne 1{,}5$
		     accuracy/*akkuraatheid*
		          (3)
		          [15]

QUESTION 6/*VRAAG 6*

6.1		✓ horizontal asymptote/*asimptoot*
		 ✓ x-intercept/*x-afsnit*
		 ✓ shape/*vorm*
		 ✓ other point/*ander punt*
		     vertical asymptote
		          (4)

6.2	$f(x) = 2x^{-1} - 1$ ✓ $f'(x) = -2x^{-2}$ ✓ → **2**	✓ $f'(x) = -2x^{-2} - 1$ ✓ $f'(x) = -2x^{-2}$ (2)
6.3	✓ ✓ $h(x) = -x - 1$ or $y = -x - 1$ → **2**	✓✓ answer/*antwoord* (2)

6.4	$f'(x) = -\frac{2}{x^2}$ and/*en* $h(x) = -x - 1$	
	$-\frac{2}{x^2} = -1$ $f'(x) = m_{tan}$	✓ setting up of equation/ *opstel van vergelyking*
	$x^2 = 2$	✓ $x = \sqrt{2}$
	$x = \sqrt{2}$; $x > 0$	✓ $\frac{2}{\sqrt{2}} - 1$
	$f(\sqrt{2}) = \frac{2}{\sqrt{2}} - 1 = y_{poc}$	✓ sub of $(\sqrt{2}; \frac{2}{\sqrt{2}} - 1)$/
	Equation of tangent/*vergelyking van raaklyn:*	*vervanging van* $(\sqrt{2}; \frac{2}{\sqrt{2}} - 1)$
	$y = -x + c$	✓ $k = 2\sqrt{2}$
	$\frac{2}{\sqrt{2}} - 1 = -\sqrt{2} + c$ sub $(\sqrt{2}; \sqrt{2} - 1)$	
	$c = -1 + 2\sqrt{2}$	
	$\therefore k = 2\sqrt{2}$ 2,83	(5)
		[13]

QUESTION 7/*VRAAG 7*

7.1	$2000\left(1 + \frac{8}{1200}\right)^{12} = 2000\left(1 + \frac{r}{200}\right)^2$ both i	
	$\sqrt{\left(1 + \frac{8}{1200}\right)^{12}} = \left(1 + \frac{r}{200}\right)$ both n	✓ $\frac{8}{1200}$ and/*en* $\frac{r}{200}$
		✓ $n = 12$ and/*en* $n = 2$
		✓ $r = 8{,}13\%$
	$r = 8{,}13\%$	
		(3)

7.2	$A = P(1 - i)^n$	
	$4\,500 = 9\,500\left(1 - \frac{7{,}7}{100}\right)^n$	✓ correct formula/*korrekte formule*
	$n = \dfrac{\log \frac{9}{19}}{\log\left(\frac{923}{1000}\right)}$ logs	✓ sub. of A and P/ *vervanging van A en P*
		✓ use of logs/*gebruik van logs*
	$n \approx 9{,}33$ full	
	It will take 10 years/*Dit sal 10 jaar neem.*	✓ $n \approx 9{,}325$
		✓ 10 years/*10 jaar* (5)

7.3.1	$\frac{75}{100} \times 170\,500 = R127\,875$	✓✓ answer/*antwoord*
		(2)
	OR/ *OF*	**OR/*OF***
	$\frac{25}{100} \times 170\,500 = 42\,625$	
	Loan/*lening* $= 170\,500 - 42\,625$	✓ R 42 625
	Loan/*lening* $= R127\,875$	✓ answer/*antwoord*
		(2)

7.3.2	$127\,875 = \dfrac{x\left[1 - \left(1 + \frac{13{,}2}{1200}\right)^{-60}\right]}{\frac{13{,}2}{1200}}$ sub	✓ $\frac{13.2}{1200}$
		✓ $n = 60$
		✓ sub of i, n and 127 875 into correct formula/ *vervanging van i , n en 127 875 in die korrekte formule*
	$x = R\,2\,922{,}66$	✓✓ answer/*antwoord* (5)
		[15]

QUESTION 8/VRAAG 8

8.1	$f(x) = x - 2x^2$	
	$f'(x) = \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$	✓ formula/*formule*
	$= \lim\limits_{h \to 0} \dfrac{(x+h) - 2(x+h)^2 - (x - 2x^2)}{h}$	✓ substitution of/*substitusie van* $(x+h)$
	$= \lim\limits_{h \to 0} \dfrac{(x+h) - 2(x^2 + 2xh + h^2) - x + 2x^2}{h}$	✓ simplification/*vereenvoudiging*
	$= \lim\limits_{h \to 0} \dfrac{x + h - 2x^2 - 4xh - 2h^2 - x + 2x^2}{h}$	✓ simplification to/ *vereenvoudiging na* $(-4xh - 2h^2 + h)$
	$= \lim\limits_{h \to 0} \dfrac{-4xh - 2h^2 + h}{h}$	
	$= \lim\limits_{h \to 0} \dfrac{h(-4x - 2h + 1)}{h}$	✓ common factor/*gemene faktor*
	$= \lim\limits_{h \to 0} (-4x - 2h + 1)$	
	$= -4x + 1$ Answer ONLY: 0 marks *SLEGS antwoord: 0 punte*	✓ answer/*antwoord*
	Penalise 1 mark for incorrect use of formula. Must show $f'(x)$. *Penaliseer 1 punt vir verkeerde gebruik van formule. Moet $f'(x)$ toon.*	(6)
8.2.1	$y = \dfrac{1}{9}x^{-3} + 9x$ $\dfrac{dy}{dx} = -\dfrac{1}{3}x^{-4} + 9$ Penalise 1 mark for incorrect notation. *Penaliseer 1 punt vir verkeerde notasie.*	✓ $-\dfrac{1}{3}x^{-4}$ ✓ 9 (2)
8.2.2	$y = -\dfrac{1}{2x\sqrt{x}} + x^3$ $y = -\dfrac{1}{2x \cdot x^{\frac{1}{2}}} + x^3$ $y = -\dfrac{1}{2}x^{-\frac{3}{2}} + x^3$ $\dfrac{dy}{dx} = \dfrac{3}{4}x^{-\frac{5}{2}} + 3x^2$	✓ $\sqrt{x} = x^{\frac{1}{2}}$ ✓ $-\dfrac{1}{2}x^{-\frac{3}{2}}$ ✓ $\dfrac{3}{4}x^{-\frac{5}{2}}$ ✓ $3x^2$ (4) **[12]**

QUESTION 9/VRAAG 9

9.1	$h(x) = x^3 - 9x^2 + 23x - 15.$ $h'(x) = 3x^2 - 18x + 23 = 0$ ✓ $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$ $$x = \frac{-(-18) \pm \sqrt{(-18)^2 - 4(3)(23)}}{2(3)}$$ ✓ $x = 4{,}15 \quad \overset{\text{or}}{\underset{\text{of}}{}} \quad x = 1{,}85$ $x = 1{,}85$ at C/by C ✓✓	✓ $h'(x) = 3x^2 - 18x + 23$ ✓ sub into formula/ vervang in formule ✓ both x-values/ beide x-waardes ✓ $x = 1{,}85$ (4)
9.2	$h(x) = x^3 - 9x^2 + 23x - 15.$ $h(x) = (x-1)(x^2 - 8x + 15)$ ✓ $h(x) = (x-1)(x-3)(x-5)$ ✓ $\therefore F(5;0)$ ✓✓ A	✓ $(x-1)(x^2 - 8x + 15)$ ✓ $(x-1)(x-3)(x-5)$ ✓✓ $F(5;0)$ (4)
9.3	$h(x) = x^3 - 9x^2 + 23x - 15.$ $h'(x) = 3x^2 - 18x + 23$ $h''(x) = 6x - 18$ ✓ h'' $6x - 18 = 0$ ✓ $= 0$ $x = 3$ $\therefore k = 3$ ✓ $$x = \frac{4{,}15 + 1{,}85}{2}$$ $$x = \frac{6}{2}$$ $x = 3$	✓ $h''(x) = 6x - 18$ ✓ $6x - 18 = 0$ ✓ $\therefore k = 3$ (3)
9.4	$h'(x) = 3x^2 - 18x + 23 = m\,\tan$ $h'(3) = 3(3)^2 - 18(3) + 23$ $h'(3) = -4$ ✓ m $y = -4x + c$ $0 = -4(3) + c$ ✓ Sub $D(3;0)$ $c = 12$ $y = -4x + 12$ ✓	✓ $h'(3) = -4$ ✓ sub of point D/ vervanging van punt D ✓ $y = -4x + 12$ (3) **[14]**

QUESTION 10/VRAAG 10

10.1	$P = x\left(50 - \frac{1}{2}x\right) - \left(\frac{1}{4}x^2 + 35x + 25\right)$ ✓ sp – cp $P = 50x - \frac{1}{2}x^2 - \frac{1}{4}x^2 - 35x - 25$ $P = -\frac{3}{4}x^2 + 15x - 25$ 2	✓ $x\left(50 - \frac{1}{2}x\right)$ ✓ subtracting total cost/ *aftrekking van totale koste* (2)
10.2 p' ✓	$\frac{dP}{dx} = -\frac{3}{2}x + 15$ $-\frac{3}{2}x + 15 = 0$ ✓ 0 $x = 10$ ✓ 3	✓ $\frac{dP}{dx} = -\frac{3}{2}x + 15$ ✓ $-\frac{3}{2}x + 15 = 0$ ✓ $x = 10$ (3)
10.3 c' ✓	$C = \dfrac{\frac{1}{4}x^2 + 35x + 25}{x}$ ✓ per cake $C = \frac{1}{4}x + 35 + 25x^{-1}$ ✓ $\frac{dC}{dx} = \frac{1}{4} - 25x^{-2}$ $\frac{1}{4} - 25x^{-2} = 0$ ✓ 0 $\frac{25}{x^2} = \frac{1}{4}$ $x^2 = 100$ ✓ $x = 10$ 5 ∴ Minimum /*Minimum*	✓ $C = \dfrac{\frac{1}{4}x^2 + 35x + 25}{x}$ ✓ $C = \frac{1}{4}x + 35 + 25x^{-1}$ ✓ $\frac{dC}{dx} = \frac{1}{4} - 25x^{-2}$ ✓ $\frac{1}{4} - 25x^{-2} = 0$ ✓ $x = 10$ $x^2 = 100$ ↑ given (5) **[10]**

QUESTION 11/*VRAAG 11*

11.1.1	$P(M) = \dfrac{1200}{1600}$ $P(M) = \dfrac{3}{4}$ or/of $0,75$		✓ answer/*antwoord* (1)
11.1.2	$P(Fail) = \dfrac{200}{1600}$ $P(Fail) = \dfrac{1}{8}$		✓ answer/*antwoord* (1)
11.1.3	$P(M) \times P(F) = \dfrac{3}{4} \times \dfrac{1}{8}$ $= \dfrac{3}{32}$ $\dfrac{3}{32} = \dfrac{A}{1600}$ P(M∩Fa) eqⁿ $A = 150$	3	✓ $\dfrac{3}{4} \times \dfrac{1}{8}$ ✓ $\dfrac{3}{32}$ ✓ $\dfrac{3}{32} = \dfrac{A}{1600}$ (3)
11.1.4	$B = 1050$ $C = 50$ $D = 350$	3	✓$B = 1050$ ✓$C = 50$ ✓$D = 350$ (3)
11.1.5	$P(F/F) = \dfrac{50}{1600}$ $P(F/F) = \dfrac{1}{32}$	2	✓ 50 ✓ 1600 (2)
11.2.1	$9! = 362880$	2	✓✓ answer/*antwoord* (2)
11.2.2	$4! \times 5! \times 6$ $= 17\ 280$ OR/*OF* $6! \times 4! = 17\ 280$	3	✓ $4! \times 5!$ ✓ $\times 6$ ✓ 17280 (3) **[15]**

TOTAL/*TOTAAL*: **150**

ALTERNATIVE ANSWERS / ALTERNATIEWE ANTWOORDE

1.1.1	$\frac{1}{2}x^2 - x - 4 = 0$ $\left(\frac{1}{2}x + 1\right)(x - 4) = 0$ $x = -2$ or/of $x = 4$ **OR/OF** $\frac{1}{2}x^2 - x - 4 = 0$ $\left(\frac{1}{2}x - 2\right)(x + 2) = 0$ $x = 4$ or/of $x = -2$ **OR/OF** $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \dfrac{-(-1) \pm \sqrt{(-1)^2 - 4\left(\frac{1}{2}\right)(-4)}}{2\left(\frac{1}{2}\right)}$ $x = 4$ or/of $x = -2$	✓✓ factors/*faktore* ✓ x-values/*waardes* (3) ✓✓ factors/*faktore* ✓ x-values/*waardes* (3) ✓✓ sub into formula/ *vervang in formule* ✓ x-values/*waardes*
3.1	$2a = 4$ $a = 2$ $T_3 =$ axis of symmetry /*simmetriese as* $T_n = a(n + p)^2 + q$ $T_n = 2(n + p)^2 + q$ $T_n = 2(n - 3)^2 + q$ $24 = 2(1 - 3)^2 + q$ $q = 16$ $T_n = 2(n - 3)^2 + 16$ $T_n = 2(n^2 - 6n + 9) + 16$ $T_n = 2n^2 - 12n + 34$	✓ $2a = 4$ ✓ $a = 2$ ✓ $T_n = 2(n + p)^2 + q$ ✓ $T_n = 2(n - 3)^2 + q$ ✓ $24 = 2(1 - 3)^2 + q$ ✓ $q = 16$ ✓ $T_n = 2(n^2 - 6n + 9) + 16$ ✓ $T_n = 2n^2 - 12n + 34$ (8)
5.4.2	$-x^2 + 3x - \dfrac{9}{4} < 0$ $x^2 - 3x + \dfrac{9}{4} > 0$ $4x^2 - 12x + 9 > 0$ $(2x - 3)(2x - 3) > 0$ $\therefore x \in R \, ; x \neq \dfrac{3}{2}$	✓ factors/*faktore* ✓✓ answer/*antwoord* (3)

150

Question 1

1.1. 1. $\frac{1}{2}x^2 - x - 4 = 0$

$\times 2$: $x^2 - 2x - 8 = 0$

$(x + 2)(x - 4) = 0$

$\therefore x = -2$ or 4 $\longrightarrow$

2. $-3(x^2 + 3x) + 7 = 0$

$-3x^2 - 9x + 7 = 0$

$\times -1$: $3x^2 + 9x - 7 = 0$

$(\quad)(\quad) = 0$

$\overset{\times\,\times}{}$

$x = \dfrac{-9 \pm \sqrt{(9)^2 - 4(3)(-7)}}{2(3)}$

$= \dfrac{-9 \pm \sqrt{165}}{6}$

$= 0{,}64$ or $-3{,}64$ $\longrightarrow$

3. $2x^2 - 3x < 0$

$x(2x - 3) < 0$

$\dfrac{+ \quad \overset{0}{\underset{0}{|}} \quad \ominus \quad \overset{0}{\underset{3/2}{|}} \quad +}{}$

$0 < x < \dfrac{3}{2}$ $\longrightarrow$

1.2. $x - 2y = 3$

$4x^2 - 3 = -6y + 5xy$

$x = 2y + 3$

$4(2y+3)^2 - 3 = -6y + 5(2y+3)y$

$4(4y^2 + 12y + 9) - 3 = -6y + 5(2y^2 + 3y)$... ... ...

$16y^2 + 48y + 36 - 3 = -6y + 10y^2 + 15y$

$6y^2 + 39y + 33 = 0$

$\div 3$: $2y^2 + 13y + 11 = 0$

$(2y + 11)(y + 1) = 0$

$y = -\frac{11}{2}$ or -1

$\therefore x = 2(-\frac{11}{2}) + 3$ or $2(-1) + 3$

$= -8 \qquad\qquad = 1$

$\therefore x = -8$ and $y = -\frac{1}{2}$

or

$x = 1$ and $y = -1$ $\longrightarrow$

1.3. $2x^2 - (k-1)x + k - 3 = 0$

$\Delta = (-(k-1))^2 - 4(2)(k-3)$

$= (k-1)^2 - 4(2k - 6)$

$= k^2 - 2k + 1 - 8k + 24$

$= k^2 - 10k + 25$

$= (k - 5)^2$

Now for all $k \in \mathbb{R}$:

$$(k-5)^2 \geqslant 0$$
$$\therefore \quad \Delta \quad \geqslant 0$$

$\therefore$ roots are real $\longrightarrow$

1.4. $\qquad 3^{2m} = \dfrac{3p}{3-p}$

1.4.1. $\qquad 3^{2m} = \dfrac{3(1,5)}{3-(1,5)}$

$$= 3$$
$$= 3^1$$
$$\therefore 2m = 1$$
$$\therefore m = \tfrac{1}{2} \longrightarrow D$$

1.4.2. $\qquad 3^{2,0} = \dfrac{3p}{3-p}$

$$3^0 =$$
$$1 = \dfrac{3p}{3-p}$$

$LCD = 3-p$ $\quad (\therefore p \neq 3)$
$\times$ thru

$$3-p = 3p$$
$$3 = 4p$$
$$\tfrac{3}{4} = p \longrightarrow$$

2

Question 2

2.1. $7x+1 \; ; \; 2x+2 \; ; \; x-1$

Geometric

$$\therefore \frac{2x+2}{7x+1} = \frac{x-1}{2x+2}$$

$(2x+2)(2x+2) = (x-1)(7x+1)$

$4x^2 + 8x + 4 = 7x^2 - 6x - 1$

$0 = 3x^2 - 14x - 5$

$= (3x + 1)(x - 5)$

$\therefore x = -\frac{1}{3}$ or 5

2.2. $25 \; ; \; 20 \; ; \; 16 \; ;$

$r = \frac{4}{5} \qquad a = 25$

$$S_\infty = \frac{a}{1-r}$$

$$= \frac{25}{1 - \frac{4}{5}}$$

$= 125$

$\not> 125$

$\therefore$ distance does not exceed 125 m

2.3. Arithmetic

$T_1 = 2 \qquad T_n = 29 \qquad S_n = 155$

$a = 2 \qquad a+(n-1)d = 29 \qquad \frac{n}{2}(2a+(n-1)d)=15$

$\qquad\qquad 2+(n-1)d = 29$

$\qquad\qquad (n-1)d = 27$

$$\therefore \frac{n}{2}(2(2) + 27) = 155$$

$$\frac{n}{2} \cdot 31 = 155$$

$n = 10$

3

Question 3

3. $T_n = an^2 + bn + c$

$T_1 = a(1)^2 + b(1) + c$

$24 = a + b + c$ ... 1

$T_5 = a(5)^2 + b(5) + c$

$24 = 25a + 5b + c$ ... 2

$d_2 = 2a$

$4 = 2a$

$2 = a$

(1) : $24 = 2 + b + c$

$22 = b + c$ ... 3

(2) : $24 = 25(2) + 5b + c$

$-26 = 5b + c$ ... 4

(3) : $22 - b = c$ ... 5

(4) : $-26 = 5b + 22 - b$

$-48 = 4b$

$-12 = b$

(5) $22 - (-12) = c$

$34 =$

$\therefore T_n = 2n^2 - 12n + 34$

$24 \quad \overset{12}{\_} \quad \overset{16}{\_} \quad 18 \quad 24$

$\vee \vee \vee \vee$

$-6 \quad -2 \quad 2 \quad 6$

$j \vee \vee$

$4 \quad 4 \quad 4$

4

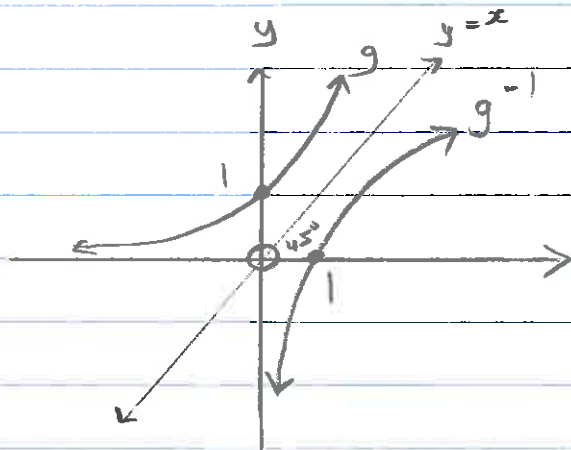## Question 4

4.1. g : $y = k^x$

sub $(2; 36)$

$36 = k^2$

$\pm 6 = k$

$\therefore k = 6$ (rejed -)

4.2. g : $y = 6^x$

g^{-1} : $x = 6^y$

$y = \log_6 x$

4.3.

g

xint : $y = 6^0$

$= 1$

$\therefore g^{-1}(x) \leq 0$

$y_{g^{-1}} \quad \underset{=}{0}$

$\therefore x \in (0; 1]$

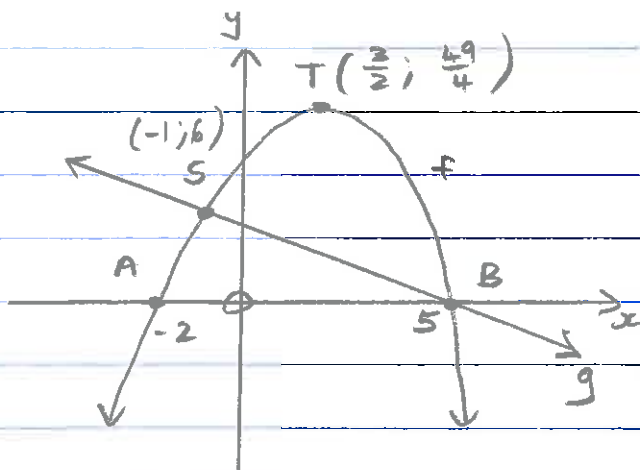**4.4.** g : $y = 6^x$

h : $y = 6^{x-3} + 2$

$\therefore R_h$: $y \in (2; \infty)$

5

Question 5

5.

$f: y = ax^2 + bx + c$

$g: y = -x + 5$

5.1 xint: $0 = -x + 5$

$x = 5$

$\therefore \underline{B(5;0)}$

5.2 $f: y = a(x-p)^2 + q$

$y = a(x - \frac{3}{2})^2 + \frac{49}{4}$

Sub $B(5;0)$

$0 = a(5 - \frac{3}{2})^2 + \frac{49}{4}$

$-\frac{49}{4} = a \cdot \frac{49}{4}$

$-1 = a$

$\therefore y = -1(x - \frac{3}{2})^2 + \frac{49}{4}$

$= -(x^2 - 3x + \frac{9}{4}) + \frac{49}{4}$

$= -x^2 + 3x - \frac{9}{4} + \frac{49}{4}$

$= -x^2 + 3x + 10$

$\frac{x_A + 5}{2} = \frac{3}{2}$

$x_A + 5 = 3$

$x_A = -2$
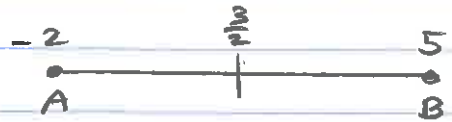
$\therefore y = a(x + 2)(x - 5)$

Sub $T(\frac{3}{2}; \frac{49}{4})$

$\frac{49}{4} = a(\frac{3}{2} + 2)(\frac{3}{2} - 5)$

$= a \cdot (-\frac{49}{4})$

$-1 = a$

$\therefore y = -1(x + 2)(x - 5)$

$= -(x^2 - 3x - 10)$

$= -x^2 + 3x + 10$

5.3 $f: y = -x^2 + 3x + 10$

$g: y = -x + 5$

$-x + 5 = -x^2 + 3x + 10$

$x^2 - 4x - 5 = 0$

$(x + 1)(x - 5) = 0$

$\therefore x = -1$ or $\cancel{5}$

reject

$y = -(-1) + 5$

$= 6$

$\therefore \underline{S(-1; 6)}$

5.4.1. $f(x) \geqslant g(x)$

$y_f \geqslant y_g$

$\therefore x \in [-1; 5]$

5.4.2. $-x^2 + 3x - 2\frac{1}{4} < 0$

$-x^2 + 3x - \frac{9}{4} < 0$

$+ \frac{49}{4}$:

$-x^2 + 3x + 10 < \frac{49}{4}$

$y_f \qquad < \frac{49}{4} \quad 12,25$

$\qquad \qquad \nwarrow y_{tp}$

$x \in \mathbb{R}; \quad x \neq \frac{3}{2}$

Question 6

6. $f(x) = \dfrac{2}{x} - 1$

6.1. $f: \quad y = \dfrac{2}{x} - 1$

- y int: $\quad y = \dfrac{2}{0} - 1$

  $\qquad\qquad = \text{VD}$

  $\therefore$ no y int

- x int: $\quad 0 = \dfrac{2}{x} - 1$

  $\qquad\qquad 1 = \dfrac{2}{x}$

  $\qquad\qquad x = 2$

- ha : $\quad y = -1$

- va : $\quad x = 0 \quad \text{ie} \quad y\,axis$

- shape : $k = 2$

6.2. $f(x) = 2 \cdot x^{-1} - 1$

  $f'(x) = -2x^{-2}$

6.3. $h : \quad \text{AOS} \quad m -$

  $y = -x - 1$

6.4. $y = -x - 1 + k \quad \text{tan}$
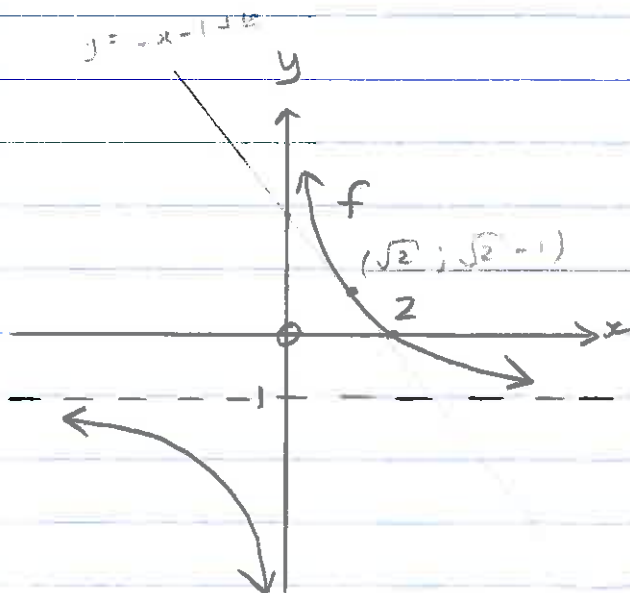
  $M_{tan} = f'(x)$

  $-1 = -2x^{-2}$

  $\pm\left(\dfrac{1}{2}\right)^{-\frac{1}{2}} = (x^{-2})^{-\frac{1}{2}}$

  $\sqrt{2} = x \qquad \text{reject} -$

  $\therefore y = \dfrac{2}{\sqrt{2}} - 1$

  $\qquad = \sqrt{2} - 1$

  $\therefore \text{sub} \; (\sqrt{2} ; \sqrt{2} - 1)$

  $\sqrt{2} - 1 = -\sqrt{2} - 1 + k$

  $2\sqrt{2} = k$

  $2,83 = k$

8

Question 7

7.1. $A = P(1+i)^n$

Jack
$$2000\left(1+\frac{8}{1200}\right)^{12} = 2000\left(1+\frac{r}{200}\right)^2$$

$$1,089\ldots = \left(1+\frac{r}{200}\right)^2$$

$$\sqrt{1,089\ldots} = 1 + \frac{r}{200}$$

(reject $-$)

$$1,040\ldots = 1 + \frac{r}{200}$$

$$8,13\ldots = r$$

$$\underline{8,13\ \% \text{ p a comp sa}} \longrightarrow$$

7.2. $A = P(1-i)^n$

$$4500 = 9500\left(1-\frac{7,7}{100}\right)^n$$

$$\frac{9}{19} = \left(\frac{923}{1000}\right)^n$$

$$n = \frac{\log\frac{9}{19}}{\log\frac{923}{1000}}$$

$$= \underline{9,33 \text{ years}} \longrightarrow$$

(10 full years)

7.3.1. $170\,500 - 42\,625$

$$= \underline{R\ 127\,875} \longrightarrow$$

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

$$127\,875 = \frac{x\left[1-\left(1+\frac{13,2}{1200}\right)^{-60}\right]}{\frac{13,2}{1200}}$$

$$\underline{x = R\ 2\,922,66} \longrightarrow$$

9

Question 8

8.1 $f(x) = x - 2x^2$

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

$\qquad = x+h - 2(x^2 + 2xh + h^2)$

$\qquad = x+h - 2x^2 - 4xh - 2h^2$

$f'(x)$

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

$= \lim_{h \to 0} \dfrac{x+h - 2x^2 - 4xh - 2h^2 - (x - 2x^2)}{h}$

$= \lim_{h \to 0} \dfrac{x+h - 2x^2 - 4xh - 2h^2 - x + 2x^2}{h}$

$= \lim_{h \to 0} \dfrac{h - 4xh - 2h^2}{h}$

$= \lim_{h \to 0} \dfrac{h(1 - 4x - 2h)}{h}$

$= \lim_{h \to 0} (1 - 4x - 2h)$

$= 1 - 4x - 2(0)$

$= 1 - 4x \quad \longrightarrow$

8.2.1 $y = \dfrac{1}{9} x^{-3} + 9x$

$\dfrac{dy}{dx} = -\dfrac{1}{3} x^{-4} + 9 \quad \longrightarrow$

2. $y = -\dfrac{1}{2x\sqrt{x}} + x^3$

$\quad = -\dfrac{1}{2x \cdot x^{\frac{1}{2}}} + x^3$

$\quad = -\dfrac{1}{2x^{3/2}} + x^3$

$\quad = -\dfrac{1}{2} x^{-3/2} + x^3$

$\therefore \dfrac{dy}{dx} = \dfrac{3}{4} x^{-5/2} + 3x^2 \quad \longrightarrow$

Question 9

9. $h: y = x^3 - 9x^2 + 23x - 15$

$y' = 3x^2 - 18x + 23$

$y'' = 6x - 18$

9.1.

$y' = 0$

$3x^2 - 18x + 23 = 0$

$(\quad x \quad) = 0$

$\times \times$

$x = \dfrac{-(-18) \pm \sqrt{(-18)^2 - 4(3)(23)}}{2(3)}$

$= \dfrac{18 \pm \sqrt{48}}{6}$

$= \underset{x_c}{1,85} \quad \text{or} \quad \underset{\text{reject}}{4,\cancel{15}}$

9.2 $x_B = 1$

$\therefore \ x - 1 \ \text{is a factor}$

$x^3 - 9x^2 + 23x - 15$

$= (x-1)(x^2 - 8x + 15)$

$\boxed{\begin{array}{l} \llcorner \quad \lrcorner \\ -x^2 \\ -8x^2 \end{array}}$

$= -9x^2$

$= (x-1)(x-3)(x-5)$

$= 0$

$\therefore x = 1 \ ; \ 3 \ \text{or} \ 5$

$\qquad B \qquad D \qquad F$

$\therefore \ \underline{x_F = 5} \longrightarrow$

9.3. Concave down $\cap$

$h'' < 0$

$6x - 18 < 0$

$6x < 18$

$x < 3$

$x < k$

$\therefore \ \underline{k = 3} \longrightarrow$

9.4. $D(3 ; 0)$

$m_{\tan} = h'$

$= 3x^2 - 18x + 23$

$= 3(3)^2 - 18(3) + 23$

$= -4$

$\therefore y = -4x + c$

Sub $D(3;0)$

$0 = -4(3) + c$

$12 = c$

$\therefore \ \underline{y = -4x + 12} \longrightarrow$

Question 10

10.1. Cost   CP

$R\left(\frac{1}{4}x^2 + 35x + 25\right)$ for x cakes

Selling price for x cakes

$R\left(50 - \frac{1}{2}x\right) \times x$ SP

$$P = SP - CP$$
$$= \left(50 - \frac{1}{2}x\right) \times x - \left(\frac{1}{4}x^2 + 35x + 25\right)$$
$$= 50x - \frac{1}{2}x^2 - \frac{1}{4}x^2 - 35x - 25$$
$$= -\frac{3}{4}x^2 + 15x - 25$$

10.2. $P' = 0$

$$-\frac{3}{2}x + 15 = 0$$
$$x = 10 \text{ cakes}$$

10.3. Cost of baking per cake

$$c = \frac{\frac{1}{4}x^2 + 35x + 25}{x}$$
$$= \frac{1}{4}x + 35 + \frac{25}{x}$$
$$= \frac{1}{4}x + 35 + 25x^{-1}$$

$$c' = 0$$
$$\frac{1}{4} - 25x^{-2} = 0$$

$$\frac{1}{4} = 25x^{-2}$$
$$\pm\left(\frac{1}{100}\right)^{-\frac{1}{2}} = \left(x^{-2}\right)^{-\frac{1}{2}}$$
$$\pm 10 = x$$

(reject $-$)

$$\therefore x = 10 \text{ cakes}$$

Question 11

11.1. 1. $P(M) = \dfrac{1200}{1600}$

$= \dfrac{3}{4}$ →

11.1. 2. $P(Fa) = \dfrac{200}{1600}$

$= \dfrac{1}{8}$ →

11.1. 3. Independent

$P(M \text{ and } Fa) = P(M) \times P(Fa)$

$\dfrac{A}{1600} = \dfrac{3}{4} \times \dfrac{1}{8}$

$A = \dfrac{3}{32} \cdot 1600$

$= 150$ →

11.1. 4.

	Fa	P	Σ
M	^{A}150	^{B}1050	1200
Fe	^{C}50	^{D}350	400
Σ	200	1400	1600

$B = 1050$

$C = 50$

$D = 350$ →

11.1. 5. $P(Fe \cap Fa) = \dfrac{50}{1600}$

$= \dfrac{1}{32}$ →

11.2. 9 different cars

4 black   5 other

11.2. 1. $9! = 362\,880$ →

11.2. 2. Let 4 black $= B$

$B + 5 = 6$ objects

$\therefore 6!$

but B $4!$

$\therefore 6! \times 4!$

$= 720 \times 24$

$= 17\,280$ →

(OR)

$$\underset{1}{\dfrac{B}{}} \quad \underset{5}{\rule{0.6cm}{0.4pt}} \quad \underset{4}{\rule{0.6cm}{0.4pt}} \quad \underset{3}{\rule{0.6cm}{0.4pt}} \quad \underset{2}{\rule{0.6cm}{0.4pt}} \quad \underset{1}{\rule{0.6cm}{0.4pt}} \quad 5!$$

$\_\ B \ \_ \ \_ \ \_ \ \_ \quad 5!$

$\_ \ \_ \ B \ \_ \ \_ \ \_ \quad 5!$

$\_ \ \_ \ \_ \ B \ \_ \ \_ \quad 5!$

$\_ \ \_ \ \_ \ \_ \ B \ \_ \quad 5!$

$\_ \ \_ \ \_ \ \_ \ \_ \ B \quad 5!$

$\therefore 6 \times 5!$

but B $4!$

$\therefore 6 \times 5! \times 4! = 17280$