



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE SENIOR  
SERTIFIKAAT**

**GRADE 12/GRAAD 12**

**MATHEMATICS P1/WISKUNDE VI  
NOVEMBER 2022  
MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS/PUNTE: 150**

**These marking guidelines consist of 21 pages.  
*Hierdie nasienriglyne bestaan uit 21 bladsye.***

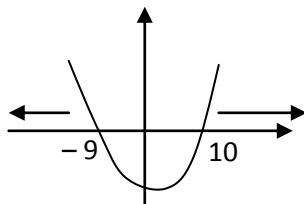
**NOTE:**

- 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, sien slegs die EERSTE poging na.
- Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die nasienriglyne van toepassing.

**QUESTION1/VRAAG 1**

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

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

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

	<p><b>OR/OF</b></p> $\frac{3^{y+1}}{32} = \sqrt{96^x}$ $\left(\frac{3^{y+1}}{2^5}\right)^2 = \left(\sqrt{(96)^x}\right)^2$ $\frac{3^{2y+2}}{2^{10}} = 2^{5x} \cdot 3^x$ $3^{2y+2} \cdot 2^{-10} = 2^{5x} \cdot 3^x$ $-10 = 5x$ $\therefore x = -2$ $2y + 2 = -2$ $\therefore y = -2$	<p><b>OR/OF</b></p> $\checkmark \left(\frac{3^{y+1}}{2^5}\right)^2 = \left(\sqrt{(96)^x}\right)^2$ $\checkmark 3^{2y+2} \cdot 2^{-10} = 2^{5x} \cdot 3^x$ $\checkmark x = -2$ $\checkmark y = -2 \quad (4)$
		<b>[25]</b>

## QUESTION 2/VRAAG 2

2.1.1	$a = 14$ $T_6 = 14r^5 = 448$ $r^5 = 32$ $\therefore r = 2$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 100px;">Answer only: full marks</div>	$\checkmark T_6 = 14r^5 = 448$ $\checkmark r = 2$ (2)
2.1.2	$T_n = 14(2)^{n-1}$ $S_n = \frac{14(2^6 - 1)}{2 - 1}$ $S_6 = 882$ $114\,674 - 882 = 113\,792$ $113\,792 = 896(2^n - 1)$ $128 = 2^n$ $n = 7$ <b>OR/OF</b> $S_n = \frac{a(r^n - 1)}{r - 1}$ $114\,674 = \frac{14(2^n - 1)}{2 - 1}$ $8\,191 = 2^n - 1$ $2^n = 8\,192$ $n = \log_2 8\,192$ $n = 13$ $\therefore 7$ more terms must be added to the first 6 terms.	$\checkmark$ substitution into correct formula $\checkmark S_6 = 882$ $\checkmark 128 = 2^n$ $\checkmark 7$ (4) <b>OR/OF</b> $\checkmark$ substitution into correct formula $\checkmark 2^n = 8\,192$ $\checkmark n = 13$ $\checkmark 7$ (4)
2.1.3	$r = \frac{1}{2}$ OR $448r^5 = 14$ $\therefore r = \frac{1}{2}$ $S_\infty = \frac{a}{1 - r}$ $S_\infty = \frac{448}{1 - \frac{1}{2}}$ $S_\infty = 896$	$\checkmark r = \frac{1}{2}$ $\checkmark$ substitution $\checkmark$ answer (3)

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



## QUESTION 3/VRAAG 3

3.1	$3a + b = 7$ $3 + b = 7$ $b = 4$  <b>OR/OF</b> $T_2 - T_1 = 7$ $4 + 2b + 9 - (1 + b + 9) = 7$ $b = 4$	$\checkmark 3a + b = 7$ $\checkmark 3 + b = 7$ (2)  <b>OR/OF</b> $\checkmark T_2 - T_1 = 7$ $\checkmark$ substitution (2)
3.2	$T_n = n^2 + 4n + 9$ $T_{60} = (60)^2 + 4(60) + 9$ $= 3849$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only: full marks</div>	$\checkmark$ substitution $\checkmark$ answer (2)
3.3	14 ; 21 ; 30 ; 41; First difference: 7 ; 9 ; 11 ; ... Common 2 <sup>nd</sup> difference: 2  $T_p = 2p + 5$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only: full marks</div>  <b>OR/OF</b> First difference: 7 ; 9 ; 11 ; ... $T_n = a + (n-1)d$ $T_p = 7 + (p-1)(2)$ $T_p = 2p + 5$	$\checkmark$ first difference $\checkmark 2$  $\checkmark 2p + 5$ (3)  <b>OR/OF</b> $\checkmark$ first difference  $\checkmark 2$ $\checkmark 2p + 5$ (3)
3.4	$157 = 2p + 5$ $p = 76$ $\therefore$ Between $T_{76}$ and $T_{77}$  <b>OR/OF</b>  $T_{n+1} - T_n = 157$ $(n+1)^2 + 4(n+1) + 9 - (n^2 + 4n + 9) = 157$ $n^2 + 2n + 1 + 4n + 4 + 9 - n^2 - 4n - 9 = 157$ $2n = 152$ $n = 76$ $\therefore$ Between $T_{76}$ and $T_{77}$	$\checkmark 157 = 2p + 5$ $\checkmark p = 76$ $\checkmark T_{76}$ and $T_{77}$ (3)  <b>OR/OF</b>  $\checkmark T_{n+1} - T_n = 157$  $\checkmark n = 76$ $\checkmark T_{76}$ and $T_{77}$ (3)
<b>[10]</b>		

## QUESTION 4/VRAAG 4

4.1.1	$p = -1$ and $q = 2$	$\checkmark p = -1$ $\checkmark q = 2$ (2)
4.1.2	$\frac{1}{x-1} + 2 = 0$ $-2x + 2 = 1$ $x = \frac{1}{2}$ $\left(\frac{1}{2}; 0\right)$	$\checkmark = 0$  $\checkmark$ answer (2)
4.1.3	$x = \frac{1}{2} - 3$ $= \frac{-5}{2}$ <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 100px;">Answer only: full marks</div>	$\checkmark -3$ $\checkmark x = \frac{-5}{2}$ (2)
4.1.4	$y = x + t$ $2 = 1 + t$ $t = 1$	$\checkmark$ subst (1 ; 2)  $\checkmark t = 1$ (2)
4.1.5	$-2 \leq \frac{1}{x-1}$ <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 100px;">Answer only: full marks</div>  $\frac{1}{x-1} + 2 \geq 0$  $\therefore x \leq \frac{1}{2} \text{ or } x > 1$ <b>OR/OF</b> $x \in \left(-\infty; \frac{1}{2}\right] \text{ or } (1; \infty)$	$\checkmark \frac{1}{x-1} + 2 \geq 0$ $\checkmark x \leq \frac{1}{2}$ $\checkmark x > 1$ (3)
4.2.1	$y = -5$	$\checkmark$ answer (1)
4.2.2	$x = \frac{-b}{2a} = \frac{-(-4)}{2(1)} = 2$ $f(2) = 2^2 - 4(2) - 5 = -9$ $\therefore D(2; -9)$  <b>OR/OF</b> $f'(x) = 2x - 4$ $2x - 4 = 0$ $x = 2$ $f(2) = 2^2 - 4(2) - 5 = -9$ $\therefore D(2; -9)$	$\checkmark x = 2$ $\checkmark y = -9$ (2)  <b>OR/OF</b>  $\checkmark x = 2$ $\checkmark y = -9$ (2)

4.2.3	$q = -5$ $-9 = a(2)^2 - 5$ $-4 = 4a$ $a = -1$ $\therefore g(x) = -2^x - 5$	$\checkmark q = -5$ $\checkmark$ substitution of (2 ; -9)  $\checkmark a = -1$ <p style="text-align: right;">(3)</p>
4.2.4	$y \in (-\infty; -5)$ OR $y < -5; y \in R$	$\checkmark$ answer <p style="text-align: right;">(1)</p>
4.2.5	$k < -9$	$\checkmark -9$ $\checkmark k < -9$ <p style="text-align: right;">(2)</p>
		<b>[20]</b>

**QUESTION 5/VRAAG 5**

5.1	$g(x) = 2x + 6$ $y = 6$	$\checkmark y = 6$ (1)
5.2	$y = 2x + 6$ $x = 2y + 6$ $y = \frac{1}{2}x - 3$	<div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 10px auto;">Answer only: Full marks</div> $\checkmark$ swop $x$ and $y$ $\checkmark$ equation (2)
5.3	$\frac{1}{2}x - 3 = 2x + 6$ $x - 6 = 4x + 12$ $3x = -18$ $x = -6$ $A(-6; -6)$  <b>OR/OF</b>  $2x + 6 = x$ $x = -6$ $y = -6$	$\checkmark$ equating  $\checkmark x = -6$ $\checkmark y = -6$ (3)  <b>OR/OF</b>  $\checkmark$ equating $\checkmark x = -6$ $\checkmark y = -6$ (3)
5.4	$AB = \sqrt{(6)^2 + (12)^2}$ $= \sqrt{180} = 6\sqrt{5} = 13,42$	$\checkmark$ substitution $\checkmark$ answer (2)

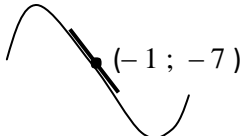

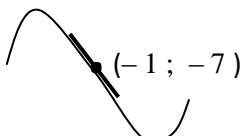

5.5	$BC = \sqrt{6^2 + 6^2} = \sqrt{72} = 6\sqrt{2}$ $AB = AC = \sqrt{180} \quad \text{symmetry of } g \text{ and } g^{-1}$ $\perp h = (\sqrt{180})^2 - \left(\frac{\sqrt{72}}{2}\right)^2$ $= \sqrt{162} = 9\sqrt{2}$ $\text{area of } \triangle ABC = \frac{1}{2} BC \times h$ $= \frac{1}{2} \times \sqrt{72} \times \sqrt{162} = 54 \text{ units}^2$ <p><b>OR/OF</b></p> $\tan \hat{BDC} = 2$ $\therefore \hat{BDC} = 63,43^\circ$ $\tan \hat{DCA} = \frac{1}{2}$ $\therefore \hat{DCA} = 26,57^\circ$ $\therefore \hat{DAC} = 36,86^\circ \quad (\text{ext angle triangle})$ $\text{Area of } \triangle ABC = \frac{1}{2} (\sqrt{180}) (\sqrt{180}) \sin 36,86^\circ$ $= 53,99 \text{ units}^2$ <p><b>OR/OF</b></p> $\text{Area of } \triangle ABC = \text{Area of } \triangle BDC + \text{Area of } \triangle ADC$ $= \frac{1}{2} DC \cdot BO + \frac{1}{2} DC \cdot \text{height}$ $= \frac{1}{2} (9)(6) + \frac{1}{2} (9)(6)$ $= 54 \text{ units}^2$	<p>✓ BC</p> <p>✓ AB = AC /midpoint (3 ; 3)</p> <p>✓ <math>\perp h</math> (A)</p> <p>✓ substitution</p> <p>✓ answer (A) (5)</p> <p><b>OR/OF</b></p> <p>✓ <math>\hat{BDC} = 63,43^\circ</math></p> <p>✓ <math>\hat{DAC} = 36,86^\circ</math></p> <p>✓ <math>AC = \sqrt{180}</math></p> <p>✓ substitution into the correct formula</p> <p>✓ answer (A) (5)</p> <p><b>OR/OF</b></p> <p>✓ Areas (<math>\triangle BDC + \triangle ADC</math>)</p> <p>✓ <math>\frac{1}{2} DC \cdot BO</math></p> <p>✓ <math>\frac{1}{2} DC \cdot \text{height}</math></p> <p>✓ substitution</p> <p>✓ answer (A) (5)</p>
		<b>[13]</b>

**QUESTION 6/VRAAG 6**

6.1	$A = P(1+i)^n$ $13\,459 = 12\,000\left(1 + \frac{m}{400}\right)^8$ $\left(1 + \frac{m}{400}\right)^8 = 1,121\dots$ $1 + \frac{m}{400} = \sqrt[8]{1,121\dots}$ $\frac{m}{400} = 0,0144\dots$ $\therefore m = 5,78\%$	<p>✓ 8 ✓ subst into correct formula</p> <p>✓ <math>1 + \frac{m}{400} = \sqrt[8]{1,121\dots}</math></p> <p>✓ 5,78 %</p> <p style="text-align: right;">(4)</p>
6.2	$F = \frac{x[(1+i)^n - 1]}{i}$ $F = \frac{1\,000\left[\left(1 + \frac{0,075}{12}\right)^{12} - 1\right]}{\frac{0,075}{12}}$ $= R12\,421,22$ <p>He won't be able to buy the computer because R13 000 – R12 421,22 = R578,78</p> <p><b>OR/OF</b></p> <p>He won't be able to buy the computer because R12 421,22 &lt; R13 000</p>	<p>✓ <math>\frac{0,075}{12}</math> ✓ 12</p> <p>✓ answer</p> <p>✓ conclusion</p> <p style="text-align: right;">(4)</p>
6.3.1	<p>Loan amount = 85% × R250 000 = R212 500</p> <p><b>OR/OF</b></p> <p>Loan amount = R250 000 – (15% × R250 000) = R212 500</p>	<p>✓ answer (1)</p> <p><b>OR/OF</b></p> <p>✓ answer (1)</p>
6.3.2	$A = 212\,500\left(1 + \frac{0,13}{12}\right)^5$ $A = 224\,262,53$ $P = \frac{x[1 - (1+i)^{-n}]}{i}$ $224\,262,53 = \frac{x\left[1 - \left(1 + \frac{0,13}{12}\right)^{-67}\right]}{\frac{0,13}{12}}$ $\therefore x = R4\,724,96$	<p>✓ <math>A = 212\,500\left(1 + \frac{0,13}{12}\right)^5</math> ✓ answer</p> <p>✓ substitution into correct formula ✓ – 67</p> <p>✓ answer (5)</p> <p style="text-align: right;"><b>[14]</b></p>

**QUESTION 7/VRAAG 7**

7.1	$f(x) = x^2 + x$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{(x+h)^2 + (x+h) - (x^2 + x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 + x + h - x^2 - x}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2 + h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h + 1)}{h}$ $\therefore f'(x) = 2x + 1$ <p><b>OR/OF</b></p> $f(x) = x^2 + x$ $f(x+h) = (x+h)^2 + (x+h) = x^2 + 2xh + h^2 + x + h$ $f(x+h) - f(x) = x^2 + 2xh + h^2 + x + h - x^2 - x$ $= 2xh + h^2 + h$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2 + h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h + 1)}{h}$ $\therefore f'(x) = 2x + 1$	<p>✓ substitution into the formula</p> <p>✓ <math>x^2 + 2xh + h^2 + x + h</math></p> <p>✓ <math>2xh + h^2 + h</math></p> <p>✓ common factor</p> <p>✓ answer (5)</p> <p><b>OR/OF</b></p> <p>✓ <math>x^2 + 2xh + h^2 + x + h</math></p> <p>✓ <math>2xh + h^2 + h</math></p> <p>✓ substitution into the formula</p> <p>✓ common factor</p> <p>✓ answer (5)</p>
7.2	$f(x) = 2x^5 - 3x^4 + 8x$ $f'(x) = 10x^4 - 12x^3 + 8$	<p>✓ <math>10x^4</math></p> <p>✓ <math>-12x^3</math></p> <p>✓ 8 (3)</p>
7.3	$g(x) = ax^3 + 3x^2 + bx + c$ $g'(x) = 3ax^2 + 6x + b$ $g''(x) = 6ax + 6$ $g''(-1) = 6a(-1) + 6 = 0$ $\therefore a = 1$ <p>For concave up <math>g''(x) &gt; 0</math></p> $6x + 6 > 0$ $x > -1$	<p>✓ <math>g'(x) = 3ax^2 + 6x + b</math></p> <p>✓</p> <p><math>g''(-1) = 6a(-1) + 6 = 0</math></p> <p>✓ <math>a = 1</math></p> <p>✓ <math>x &gt; -1</math> (4)</p>

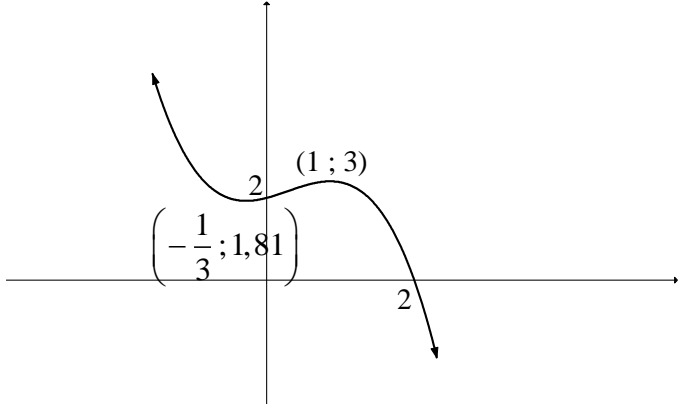
	<p><b>OR/OF</b>                  Min gradient at <math>(-1 ; -7)</math> implies:                  at <math>x = -1</math> - point of inflection                  and <math>g</math> will be positive cubic                  hence <math>a &gt; 0</math></p> <p>Since <math>g</math> is concave up  <math>x &gt; -1</math></p> <p><b>OR/OF</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p><math>(-1 ; -7)</math></p> <p>Since <math>g</math> is concave up  <math>x &gt; -1</math></p> </div> <div style="text-align: center;">  <p><math>(-1 ; y)</math></p> <p>Since <math>g</math> is concave up  <math>x &gt; -1</math></p> </div> </div> <div style="border: 1px solid black; width: fit-content; margin: 10px auto; padding: 5px;">                 Answer only: <math>\frac{1}{4}</math> </div>	
	<p><b>OR/OF</b>                  Min gradient at <math>(-1 ; -7)</math> implies:                  at <math>x = -1</math> - point of inflection                  and <math>g</math> will be positive cubic                  hence <math>a &gt; 0</math></p> <p>Since <math>g</math> is concave up  <math>x &gt; -1</math></p> <p><b>OR/OF</b></p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p><math>(-1 ; -7)</math></p> <p>Since <math>g</math> is concave up  <math>x &gt; -1</math></p> </div> <div style="text-align: center;">  <p><math>(-1 ; y)</math></p> <p>Since <math>g</math> is concave up  <math>x &gt; -1</math></p> </div> </div> <div style="border: 1px solid black; width: fit-content; margin: 10px auto; padding: 5px;">                 Answer only: <math>\frac{1}{4}</math> </div>	



	<p><b>OR/OF</b>                  Min gradient at <math>(-1; -7)</math> implies:                  at <math>x = -1</math> - point of inflection                  and <math>g</math> will be positive cubic                  hence <math>a &gt; 0</math></p> <p>Since <math>g</math> is concave up  <math>x &gt; -1</math></p> <p><b>OR/OF</b></p> <p>Since <math>g</math> is concave up  <math>x &gt; -1</math></p> <p>Since <math>g</math> is concave up  <math>x &gt; -1</math></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">                 Answer only: <math>\frac{1}{4}</math> </div>	<p><b>OR/OF</b></p> <p>✓ point of inflection                  ✓✓ <math>a &gt; 0</math></p> <p>✓ <math>x &gt; -1</math> (4)</p> <p><b>OR/OF</b></p> <p>✓✓ pos graph                  ✓ point of inflection</p> <p>✓ <math>x &gt; -1</math> (4)</p>
		<p><b>[12]</b></p>

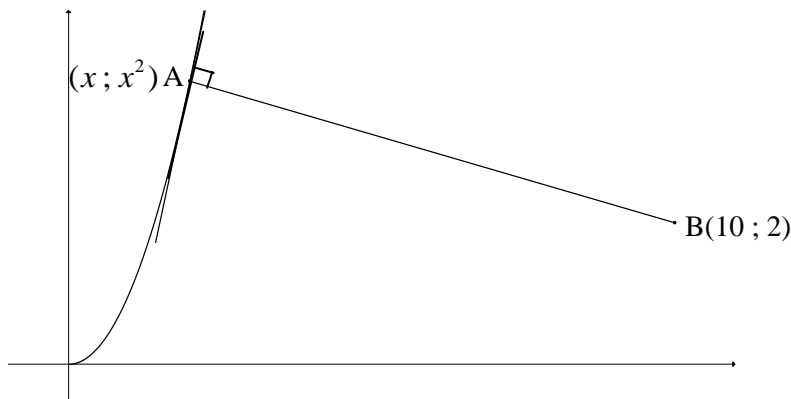
**QUESTION 8/VRAAG 8**

8.1	$f'(x) = mx^2 + nx + k$ $f'(x) = m\left(x + \frac{1}{3}\right)(x-1)$ $1 = m\left(0 + \frac{1}{3}\right)(0-1)$ $1 = -\frac{1}{3}m$ $\therefore m = -3$ $f'(x) = -3\left(x + \frac{1}{3}\right)(x-1)$ $f'(x) = -3\left(x^2 - \frac{2}{3}x - \frac{1}{3}\right)$ $f'(x) = -3x^2 + 2x + 1$ $\therefore n = 2$ $\therefore k = 1$ <p><b>OR/OF</b></p> $k = 1$ $0 = m + n + 1 \quad \text{and} \quad \frac{1}{9}m - \frac{1}{3}n + 1 = 0$ $m + n = -1 \quad (1)$ $m - 3n = -9 \quad (2)$ $(1) - (2)$ $4n = 8$ $\therefore n = 2$ $m + 2 = -1$ $\therefore m = -3$	$\checkmark \text{ substitution of } \left(-\frac{1}{3}; 0\right)$ $\text{and } (1; 0)$ $\checkmark \text{ substitution of } (0; 1)$ $\checkmark m = -3$ $\checkmark f'(x) = -3\left(x^2 - \frac{2}{3}x - \frac{1}{3}\right)$ $\checkmark n = 2$ $\checkmark k = 1 \quad (6)$ <p><b>OR/OF</b></p> $\checkmark k = 1$ $\checkmark m + n = -1$ $\checkmark m - 3n = -9$ $\checkmark 4n = 8$ $\checkmark n = 2$ $\checkmark m = -3 \quad (6)$
8.2.1	$f(x) = -x^3 + x^2 + x + 2$ $f\left(-\frac{1}{3}\right) = \frac{49}{27} = 1,81$ $\text{T.P}\left(-\frac{1}{3}; \frac{49}{27}\right)$ $f(1) = 3$ $\text{T.P}(1; 3)$	$\checkmark \text{ x-coordinates of the TP}$ $\checkmark \text{T.P}\left(-\frac{1}{3}; \frac{49}{27}\right)$ $\checkmark \text{T.P}(1; 3) \quad (3)$

<p>8.2.2</p>	$f(x) = -x^3 + x^2 + x + 2$ $-x^3 + x^2 + x + 2 = 0$ $(x-2)(-x^2 - x - 1) = 0$ $x = 2 \text{ or no solution}$ 	<p>✓ <math>x = 2</math></p> <p>✓ one <math>x</math>-intercept</p> <p>✓ two turning points</p> <p>✓ <math>y</math>-intercept</p> <p>✓ shape: neg cubic</p> <p style="text-align: right;">(5)</p>
<p>8.3.1</p>	$a = \frac{-\frac{1}{3} + 1}{2}$ $= \frac{1}{3}$ <p><b>OR/OF</b></p> $f'(x) = -3x^2 + 2x + 1$ $f''(x) = -6x + 2$ $f''(a) = -6a + 2 = 0$ $-6a = -2$ $a = \frac{1}{3}$	<p>✓ answer (1)</p> <p><b>OR/OF</b></p> <p>✓ answer (1)</p>
<p>8.3.2</p>	<p><math>b &lt; \frac{4}{3}</math> units</p>	<p>✓ <math>\frac{4}{3}</math></p> <p>✓ <math>b &lt; \frac{4}{3}</math> (2)</p>
		<p>[17]</p>

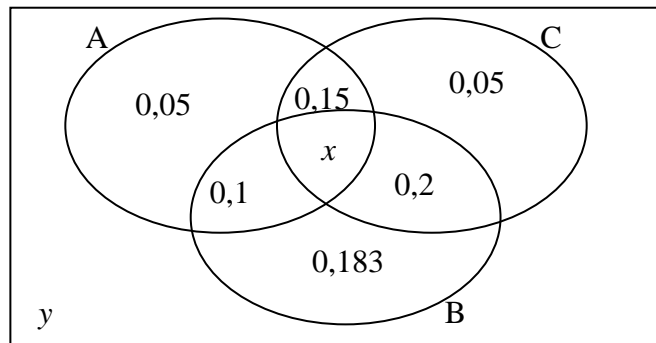
**QUESTION9/VRAAG 9**

9.1	<p>Any point on <math>f : (x; x^2)</math></p> $\text{distance} = \sqrt{(x-10)^2 + (x^2-2)^2}$ $= \sqrt{x^2 - 20x + 100 + x^4 - 4x^2 + 4}$ $= \sqrt{x^4 - 3x^2 - 20x + 104}$ <p>For min distance</p> $\frac{d}{dx}(x^4 - 3x^2 - 20x + 104) = 0$ $4x^3 - 6x - 20 = 0$ $(x-2)(4x^2 + 8x + 10) = 0$ $\Delta = 8^2 - 4(4)(10) = -96 \quad \therefore \text{no roots}$ $\therefore x = 2$ $d = \sqrt{2^4 - 3(2)^2 - 20(2) + 104} = 2\sqrt{17} = 8,25$	<p>✓ <math>(x; x^2)</math></p> <p>✓ substitution</p> <p>✓ simplification</p> <p>✓ answer</p> <p>✓ <math>4x^3 - 6x - 20</math></p> <p>✓ derivative = 0</p> <p>✓ <math>x = 2</math></p> <p>✓ answer (A) (8)</p>
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9.2	$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{x^2 - 2}{x - 10}$ $\therefore m_{\text{tang}} = -\frac{x-10}{x^2-2}$ $f'(x) = 2x$ $\therefore 2x = -\frac{x-10}{x^2-2}$ $-2x^3 + 4x = x - 10$ $2x^3 - 3x - 10 = 0$ $x = 2$ $y = (2)^2 = 4$ $\therefore AB = \sqrt{(2-10)^2 + (4-2)^2}$ $= 2\sqrt{17} = 8,25$	<p>✓ <math>m_{AB}</math></p> <p>✓ <math>m_{\text{tang}} = -\frac{x-10}{x^2-2}</math></p> <p>✓ <math>f'(x) = 2x</math></p> <p>✓ equating</p> <p>✓ standard form</p> <p>✓ <math>x = 2</math></p> <p>✓ substitute into distance</p> <p>✓ answer (A) (8)</p>
<b>[8]</b>		

**QUESTION 10/VRAAG 10**



10.1.1(a)	$y = 1 - 0,893 = 0,107$ (0,11)	✓ $y = 1 - 0,893$ (1)
10.1.1(b)	$x = 0,893 - 0,733 = 0,16$	✓ $x = 0,893 - 0,733$ (1)
10.1.2	$P(\text{at least 2 events}) = 0,1 + 0,15 + 0,16 + 0,2 = 0,61$ <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only: Full Marks</div>	✓ values ✓ answer (2)
10.1.3	$P(B) = 0,643$ $P(C) = 0,56$ $P(B \text{ and } C) = 0,36$ $P(B) \times P(C) = 0,643 \times 0,56 = 0,36$ $\therefore P(B \text{ and } C) = P(B) \times P(C)$ $\therefore B \text{ and } C \text{ are independent}$	✓ $P(B) = 0,643$ ✓ $P(C) = 0,56$ ✓ $P(B \text{ and } C) = 0,36$ ✓ $P(B) \times P(C) = 0,36$ ✓ independent because $P(B \text{ and } C) = P(B) \times P(C)$ (5)
10.2.1	$7 \times 6 \times 5 \times 4 = 840$	✓ $4 \times 7$ ✓ $7 \times 6 \times 5 \times 4 = 840$ (3)
10.2.2	start with 5, 7, 9 or start with 6 or start with 8 $(3 \times 5 \times 1 \times 3) + (1 \times 5 \times 1 \times 2) + (1 \times 5 \times 1 \times 2)$ $= 45 + 10 + 10$ $= 65$ $P = \frac{65}{840} = \frac{13}{168} = 0,08$  <b>OR/OF</b> ends in 4 or ends in 6 or ends in 8 $(5 \times 5 \times 1 \times 1) + (4 \times 5 \times 1 \times 1) + (4 \times 5 \times 1 \times 1)$ $= 25 + 20 + 20$ $= 65$ $P = \frac{65}{840} = \frac{13}{168} = 0,08$	✓ $(3 \times 5 \times 1 \times 3) = 45$ ✓ $(1 \times 5 \times 1 \times 2) = 10$ ✓ $(1 \times 5 \times 1 \times 2) = 10$ ✓ 65 ✓ answer (5)  <b>OR/OF</b> ✓ $(5 \times 5 \times 1 \times 1) = 25$ ✓ $(4 \times 5 \times 1 \times 1) = 20$ ✓ $(4 \times 5 \times 1 \times 1) = 20$ ✓ 65 ✓ answer (5)
		<b>[17]</b>

**TOTAL/TOTAAL: 150**