



# basic education

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

**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE SENIOR  
SERTIFIKAAT**

**GRADE 12/GRAAD 12**

**MATHEMATICS P1/WISKUNDE VI**

**FEBRUARY/MARCH/FEBRUARIE/MAART 2018**

**MARKING GUIDELINES/NASIENRIGLYNE**

**MARKS/PUNTE: 150**

**These marking guidelines consist of 17 pages./  
*Hierdie nasienriglyne bestaan uit 17 bladsye.***

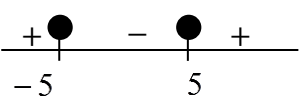
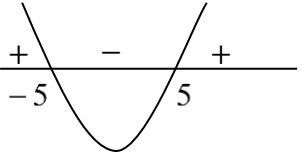
**NOTE:**

- 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.
- Volgheue akkuraatheid is op ALLE aspekte van die nasienriglyne van toepassing.

**QUESTION/VRAAG 1**

1.1.1	$x^2 - 6x - 16 = 0$ $(x - 8)(x + 2) = 0$ $x = -2 \text{ or } x = 8$	✓ factors ✓ $x = -2$ ✓ $x = 8$ (3)
1.1.2	$2x^2 + 7x - 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(7) \pm \sqrt{(7)^2 - 4(2)(-1)}}{2(2)}$ $= \frac{-7 \pm \sqrt{57}}{4}$ $x = 0,14 \text{ or } x = -3,64$ <p><b>OR/OF</b></p> $x^2 + \frac{7}{2}x + \frac{49}{16} = \frac{1}{2} + \frac{49}{16}$ $\left(x + \frac{7}{4}\right)^2 = \frac{57}{16}$ $x + \frac{7}{4} = \pm \frac{\sqrt{57}}{4}$ $x = \frac{-7 \pm \sqrt{57}}{4}$ $x = 0,14 \text{ or } x = -3,64$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>NOTE: Penalise 1 mark if the rounding to TWO decimal places is incorrect.</p> </div>	✓ subs into correct formula  $\checkmark \frac{-7 \pm \sqrt{57}}{4}$ ✓ $x = 0,14$ ✓ $x = -3,64$ <p><b>OR/OF</b></p> ✓ for adding $\frac{49}{16}$ on both sides  $\checkmark \frac{-7 \pm \sqrt{57}}{4}$ ✓ $x = 0,14$ ✓ $x = -3,64$ (4)
1.2	$x^2 - 25 < 0$ $(x - 5)(x + 5) < 0$ <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p><math>-5 &lt; x &lt; 5</math></p> </div> <div style="text-align: center;">  </div> </div> $x = \{-4; -3; -2; -1; 0; 1; 2; 3; 4\}$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>NOTE: Final answer only 2 / 2</p> </div>	✓ factors  ✓✓ inequality  ✓ answer (4)

<p>1.3</p>	$x = 2y - 1$ $(2y - 1)^2 - 7 - y^2 = -y$ $4y^2 - 4y + 1 - 7 - y^2 = -y$ $3y^2 - 3y - 6 = 0$ $y^2 - y - 2 = 0$ $(y - 2)(y + 1) = 0$ $y = 2 \text{ or } y = -1$ $x = 2(2) - 1 \text{ or } x = 2(-1) - 1$ $x = 3 \text{ or } x = -3$ <p><b>OR/OF</b></p> $y = \frac{x + 1}{2}$ $x^2 - 7 - y^2 = -y$ $x^2 - 7 - \left(\frac{x + 1}{2}\right)^2 = -\left(\frac{x + 1}{2}\right)$ $x^2 - 7 - \left(\frac{x^2 + 2x + 1}{4}\right) = \frac{-x - 1}{2}$ $4x^2 - 28 - x^2 - 2x - 1 = -2x - 2$ $3x^2 - 27 = 0$ $x^2 - 9 = 0$ $(x - 3)(x + 3) = 0$ $x = -3 \text{ or } x = 3$ $y = \frac{-3 + 1}{2} \text{ or } y = \frac{3 + 1}{2}$ $y = -1 \text{ or } y = 2$	<p>✓ <math>x = 2y - 1</math>                  ✓ substitution</p> <p>✓ correct standard form</p> <p>✓ factors                  ✓ <math>y</math> - values</p> <p>✓ <math>x</math> - values</p> <p><b>OR/OF</b></p> <p>✓ <math>y = \frac{x + 1}{2}</math></p> <p>✓ substitution</p> <p>✓ correct standard form</p> <p>✓ factors                  ✓ <math>x</math> - values</p> <p>✓ <math>y</math> - values (6)</p>
<p>1.4</p>	$\frac{3^{2018} + 3^{2016}}{3^{2017}}$ $= \frac{3^{2017}(3^1 + 3^{-1})}{3^{2017}}$ $= 3 + \frac{1}{3}$ $= 3\frac{1}{3} \text{ or } \frac{10}{3}$ <p><b>OR/OF</b></p>	<p>✓ common factor <math>3^{2017}</math></p> <p>✓ answer</p> <p><b>OR/OF</b></p>

	$\frac{3^{2018} + 3^{2016}}{3^{2017}}$ $= \frac{3^{2016}(3^2 + 1)}{3^{2017}}$ $= \frac{10}{3}$ <p><b>OR/OF</b></p> $\frac{3^{2018} + 3^{2016}}{3^{2017}}$ $= \frac{3^{2018}}{3^{2017}} + \frac{3^{2016}}{3^{2017}}$ $= 3 + \frac{1}{3}$ $= 3\frac{1}{3} \text{ or } \frac{10}{3}$	<p>✓ common factor <math>3^{2016}</math></p> <p>✓ answer</p> <p><b>OR/OF</b></p> <p>✓ dividing by <math>3^{2017}</math></p> <p>✓ answer</p> <p>(2)</p>
<p>1.5.1</p>	$3x - 5 \geq 0 \text{ and } x \neq 3$ $x \geq \frac{5}{3} \text{ and } x \neq 3$	<p>✓ <math>3x - 5 \geq 0</math></p> <p>✓ <math>x \geq \frac{5}{3}</math></p> <p>✓ <math>x \neq 3</math></p> <p>(3)</p>
<p>1.5.2</p>	$\frac{\sqrt{3x-5}}{x-3} = 1$ $\sqrt{3x-5} = x-3$ $3x-5 = (x-3)^2$ $3x-5 = x^2 - 6x + 9$ $x^2 - 9x + 14 = 0$ $(x-7)(x-2) = 0$ $x \neq 2 \text{ or } x = 7$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>NOTE: If <math>x = 2</math> is not rejected, then maximum 3 / 4 marks</p> </div>	<p>✓ <math>\sqrt{3x-5} = x-3</math></p> <p>✓ <math>3x-5 = (x-3)^2</math></p> <p>✓ factors</p> <p>✓ <math>x = 7</math></p> <p>(4) <b>[26]</b></p>

**QUESTION/VRAAG 2**

<p>2.1.1</p>	<p> <math>30 ; 10 ; \frac{10}{3} \dots\dots</math>  <math>a = 30 \quad r = \frac{1}{3}</math>  <math>T_n = ar^{n-1}</math>  <math>\frac{10}{729} = 30\left(\frac{1}{3}\right)^{n-1}</math>  <math>\frac{1}{2187} = 3^{1-n}</math>  <math>3^{-7} = 3^{1-n}</math>  <math>-7 = 1-n</math>  <math>n = 8</math> </p> <p style="text-align: center;"><b>OR/OF</b></p> <p> <math>\frac{1}{2187} = \left(\frac{1}{3}\right)^{n-1}</math>  <math>\left(\frac{1}{3}\right)^7 = \left(\frac{1}{3}\right)^{n-1}</math>  <math>7 = n-1</math>  <math>n = 8</math> </p>	<p> <math>\checkmark r = \frac{1}{3}</math>   <math>\checkmark</math> substitution into correct formula   <math>\checkmark 3^{-7} = 3^{1-n}</math> or  <math>\left(\frac{1}{3}\right)^7 = \left(\frac{1}{3}\right)^{n-1}</math> or                      use of logs  <math>\checkmark n = 8</math> </p> <p style="text-align: right;">(4)</p>
<p>2.1.2</p>	<p> <math>S_\infty = \frac{a}{1-r}</math>  <math>= \frac{30}{1-\frac{1}{3}}</math>  <math>= 45</math> </p>	<p> <math>\checkmark</math> substitution into correct formula   <math>\checkmark</math> answer                 </p> <p style="text-align: right;">(2)</p>
<p>2.2</p>	<p> <math>S_n = a + (a+d) + \dots + (a+(n-2)d) + (a+(n-1)d) \quad (1)</math>  <math>S_n = (a+(n-1)d) + (a+(n-2)d) + \dots + (a+d) + a \quad (2)</math>                      Adding both equations/Tel die twee vergelykings bymekaar:  <math>2S_n = 2a + (n-1)d + 2a + (n-1)d + 2a + (n-1)d + \dots</math>  <math>= n[2a + (n-1)d]</math>  <math>S_n = \frac{n}{2}[2a + (n-1)d]</math> </p> <p style="text-align: center;"><b>OR/OF</b></p> <p> <math>S_n = a + (a+d) + \dots + (a+(n-2)d) + T_n \quad (1)</math>  <math>S_n = T_n + (T_n - d) + (T_n - 2d) + \dots + a \quad (2)</math>                      Adding both equations/Tel die twee vergelykings bymekaar:  <math>2S_n = (a+T_n) + (a+T_n) + (a+T_n) + \dots + (a+T_n)</math>  <math>S_n = \frac{n}{2}(a+T_n)</math>                      but <math>T_n = a + (n-1)d</math>  <math>S_n = \frac{n}{2}[2a + (n-1)d]</math> </p>	<p> <math>\checkmark</math> expanding <math>S_n</math>  <math>\checkmark</math> reverse writing   <math>\checkmark 2S_n = n[2a + (n-1)d]</math>  <math>\checkmark S_n = \frac{n}{2}[2a + (n-1)d]</math> </p> <p style="text-align: right;">(4)</p> <p> <math>\checkmark</math> expanding <math>S_n</math>  <math>\checkmark</math> reverse writing   <math>\checkmark 2S_n = n(a+T_n)</math> </p> <p> <math>\checkmark S_n = \frac{n}{2}[2a + (n-1)d]</math> </p> <p style="text-align: right;">(4)</p> <p style="text-align: right;"><b>[10]</b></p>





<p>3.4</p>	$T_{11} = (T_{11} - T_{10}) + (T_{10} - T_9) + (T_9 - T_8) + \dots + (T_3 - T_2) + (T_2 - T_1) + T_1$ $125 = 29 + 26 + 23 + \dots + 2 + T_1$ $= \frac{10}{2}(29 + 2) + T_1$ $= 155 + T_1$ $T_1 = -30$ <p><b>OR/OF</b></p> $T_n = an^2 + bn + c$ $\therefore T_{11} = 121a + 11b + c = 125$ $T_n - T_{n-1} = an^2 + bn + c - [a(n-1)^2 + b(n-1) + c]$ $= an^2 + bn + c - an^2 + 2an - a - bn + b - c$ $= 2an + b - a$ $T_n - T_{n-1} = 3n - 4$ $2a = 3 \quad \text{and} \quad b - a = -4$ $a = \frac{3}{2} \quad \text{and} \quad b = -\frac{5}{2}$ $121a + 11b + c = 125$ $121\left(\frac{3}{2}\right) + 11\left(-\frac{5}{2}\right) + c = 125$ $c = -29$ $T_n = \frac{3}{2}n^2 - \frac{5}{2}n - 29$ $T_1 = \frac{3}{2}(1)^2 - \frac{5}{2}(1) - 29$ $= -30$	<p>✓✓ generating sum                  ✓ 29 + 26 + 23 + ... + 2                  ✓ <math>\frac{10}{2}(29 + 2)</math>                  ✓ 155                  ✓ -30</p> <p><b>OR/OF</b></p> <p>✓ <math>121a + 11b + c = 125</math></p> <p>✓ calculating <math>T_n - T_{n-1}</math> in terms of <math>a, b</math> and <math>c</math></p> <p>✓ <math>a = \frac{3}{2}</math>                  ✓ <math>b = -\frac{5}{2}</math>                  ✓ <math>c = -29</math>                  ✓ -30</p> <p style="text-align: right;">(6) [13]</p>
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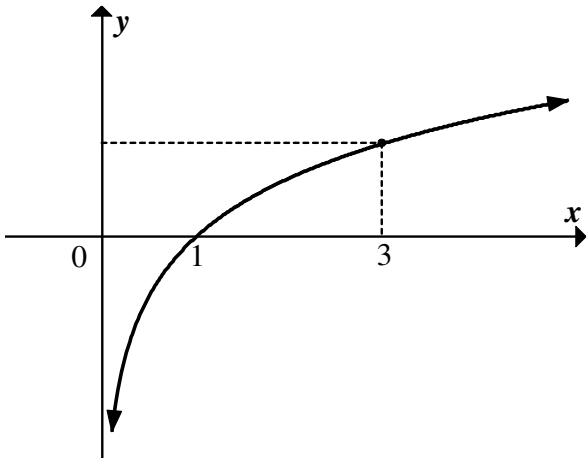


**QUESTION/VRAAG 4**

4.1	E(4 ; -9)	✓ $x = 4$ ✓ $y = -9$ (2)
4.2	$f(x) = (x-4)^2 - 9$ $(x-4)^2 - 9 = 0$ $(x-4)^2 = 9$ $x-4 = \pm 3$ $x = 7 \quad \text{or} \quad x = 1$ A(1 ; 0)  <b>OR/OF</b>  $f(x) = (x-4)^2 - 9$ $0 = x^2 - 8x + 16 - 9$ $0 = x^2 - 8x + 7$ $(x-7)(x-1) = 0$ $x = 7 \quad \text{or} \quad x = 1$ A(1 ; 0)	✓ $y = 0$  ✓ $x - 4 = \pm 3$  ✓ A(1 ; 0)  <b>OR/OF</b>  ✓ $y = 0$  ✓ $(x-7)(x-1)$  ✓ A(1 ; 0) (3)
4.3	C(0 ; 7) M(8 ; 7) <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">                     NOTE:                      Answer only 3 / 3                 </div>	✓ C(0 ; 7) ✓ $x = 8$ ✓ $y = 7$ (3)
4.4	C(0 ; 7) D(4 ; 0)  $m = \frac{7-0}{0-4} \quad \text{or} \quad m = \frac{0-7}{4-0} \quad \text{or} \quad 0 = 4m + 7$ $m = -\frac{7}{4} \quad m = -\frac{7}{4} \quad m = -\frac{7}{4}$ $y - 0 = -\frac{7}{4}(x - 4)$ $y = -\frac{7}{4}x + 7$	✓ D(4 ; 0)  ✓ $m = -\frac{7}{4}$  ✓ $y = -\frac{7}{4}x + 7$ (3)
4.5	$g : y = -\frac{7}{4}x + 7$ $g^{-1} : x = -\frac{7}{4}y + 7$ $4x = -7y + 28$ $7y = -4x + 28$ $y = -\frac{4}{7}x + 4$ <b>OR/OF</b>	✓ interchange $x$ and $y$  ✓ simplification ✓ $y = -\frac{4}{7}x + 4$  <b>OR/OF</b>

	$g^{-1}$ is the straight line through (0 ; 4) and ( 7 ; 0) $y = mx + 4$ $0 = 7m + 4$ $y = -\frac{4}{7}x + 4$	✓ straight line through (0 ; 4) and ( 7 ; 0)  ✓ substitution ✓ $y = -\frac{4}{7}x + 4$	(3)
4.6	$x \cdot f(x) \leq 0$  $\therefore x \leq 0$ or $1 \leq x \leq 7$	✓✓ $x \leq 0$ ✓✓ $1 \leq x \leq 7$	(4) <b>[18]</b>

**QUESTION/VRAAG 5**

5.1	$a^0 = 1$ T(0 ; 1)	✓ $x = 0$ ✓ $y = 1$	(2)
5.2	$g(x) = a^x$ $9 = a^2$ $a = 3$ $a > 0$	✓ substitution  ✓ $a = 3$	(2)
5.3	$y = \left(\frac{1}{3}\right)^x$ or $y = 3^{-x}$	✓✓ $y = \left(\frac{1}{3}\right)^x$	(2)
5.4	$3^0 < 3^{\log_3 x} < 3^1$ $1 < x < 3$  <b>OR</b>   $1 < x < 3$	✓ $1 < x$ ✓ $x < 3$         ✓ $1 < x$ ✓ $x < 3$	(2) <b>[8]</b>

**QUESTION/VRAAG 6**

6.1	$q = 1$	✓ $q = 1$  (1)
6.2	Subs (0;0) $0 = \frac{a}{0+p} + 1$  $\frac{a}{p} = -1$ $a = -p$  Subs P: $\sqrt{2} + 1 = \frac{a}{\sqrt{2} + 2 + p} + 1$  $\sqrt{2} = \frac{a}{\sqrt{2} + 2 + p}$  $2 + 2\sqrt{2} + \sqrt{2}p = a$ $2 + 2\sqrt{2} = a - p\sqrt{2} = a + a\sqrt{2}$ $2(1 + \sqrt{2}) = a(1 + \sqrt{2})$ $a = 2 ; p = -2$	✓ $0 = \frac{a}{0+p} + 1$  ✓ $a = -p$  ✓ substitution      ✓ $a = 2$ ✓ $p = -2$  (5)
6.3		✓ $y = 1$ ✓ $x = 2$  ✓ shape ✓ (0 ; 0)  (4) <b>[10]</b>

**QUESTION/VRAAG 7**

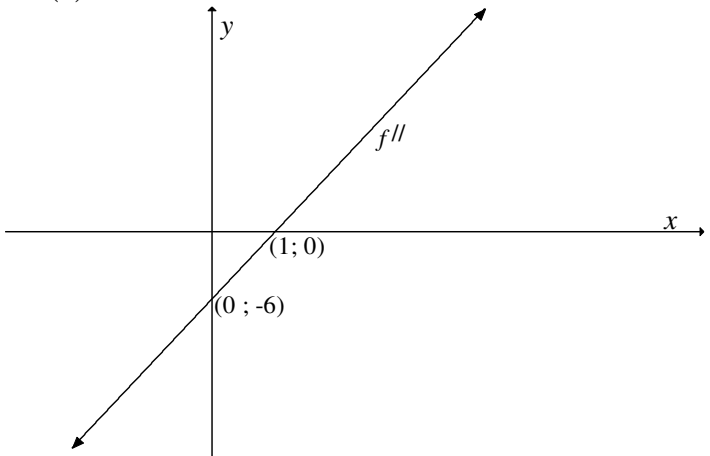
7.1	$F = \frac{x[(1+i)^n - 1]}{i}$ $= \frac{2500 \left[ \left(1 + \frac{0,06}{12}\right)^{60} - 1 \right]}{\frac{0,06}{12}}$ $= R174\,425,08$	<ul style="list-style-type: none"> <li>✓ <math>n = 60</math> and <math>i = \frac{0,06}{12} / 0,005</math></li> <li>✓ correct substitution into correct formula</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(3)</p>
7.2.1	<p>After eleven months, Genevieve will owe/ <i>Na elf maande skuld Genevieve</i></p> $A = 82\,000 \left(1 + \frac{0,15}{12}\right)^{11}$ $= R\,94\,006,79$	<ul style="list-style-type: none"> <li>✓ <math>n = 11</math></li> <li>✓ correct substitution into correct formula</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(3)</p>
7.2.2	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $94\,006,79 = \frac{3\,200 \left[ 1 - \left(1 + \frac{0,15}{12}\right)^{-n} \right]}{\frac{0,15}{12}}$ $\frac{94\,006,79}{3\,200} \times \frac{0,15}{12} = 1 - \left(1 + \frac{0,15}{12}\right)^{-n}$ $\left(1 + \frac{0,15}{12}\right)^{-n} = 1 - 0,3672147\dots$ $-n \log \left(1 + \frac{0,15}{12}\right) = \log 0,6327852\dots$ $-n = -36,8382\dots$ $n = 36,84$ <p>Genevieve will have to pay 36 installments of R3 200</p>	<ul style="list-style-type: none"> <li>✓ 94006,79</li> <li>✓ substitute into correct formula</li> <li>✓ correct use of logs (logs to be defined)</li> <li>✓ <math>n = 36,84</math></li> <li>✓ 36 installments</li> </ul> <p style="text-align: right;">(5)</p>

<p>7.2.3</p>	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $= \frac{3200 \left[ 1 - \left( 1 + \frac{0,15}{12} \right)^{-0,83826912} \right]}{\frac{0,15}{12}}$ <p><math>P = 2652</math></p> <p>Outstanding balance after 36 installments is R2 652 Final payment will be:</p> $A = 2652,00 \left( 1 + \frac{0,15}{12} \right)^1$ $= R\ 2685,00$ <p><b>OR/OF</b></p> $\text{Balance : } 94006,79 \left( 1 + \frac{0,15}{12} \right)^{36} - \frac{3200 \left[ \left( 1 + \frac{0,15}{12} \right)^{36} - 1 \right]}{\frac{0,15}{12}}$ $= R2\ 651,72$ <p>Final payment will be:</p> $A = 2651,72 \left( 1 + \frac{0,15}{12} \right)^1$ $= R\ 2685,00$	<p>✓ <math>n = -0,83826912</math></p> <p>✓ substitute into correct formula</p> <p>✓ answer</p> <p>✓ <math>2652,00 \left( 1 + \frac{0,15}{12} \right)^1</math></p> <p>✓ answer</p> <p><b>OR/OF</b></p> <p>✓ <math>94006,79 \left( 1 + \frac{0,15}{12} \right)^{36}</math></p> <p>✓ <math>\frac{3200 \left[ \left( 1 + \frac{0,15}{12} \right)^{36} - 1 \right]}{\frac{0,15}{12}}</math></p> <p>✓ <math>2\ 651,72</math></p> <p>✓ <math>2651,72 \left( 1 + \frac{0,15}{12} \right)^1</math></p> <p>✓ answer</p> <p style="text-align: right;">(5) <b>[16]</b></p>
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**QUESTION/VRAAG 8**

8.1	$f(x+h) = 4x^2$ $f(x+h) - f(x) = 4(x+h)^2 - 4x^2$ $= 4(x^2 + 2xh + h^2) - 4x^2$ $= 4x^2 + 8xh + 4h^2 - 4x^2$ $= 8xh + 4h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \left[ \frac{8xh + 4h^2}{h} \right]$ $= \lim_{h \rightarrow 0} \left[ \frac{h(8x + 4h)}{h} \right]$ $= 8x$ <p><b>OR/OF</b></p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \left[ \frac{4(x+h)^2 - 4x^2}{h} \right]$ $= \lim_{h \rightarrow 0} \left[ \frac{4x^2 + 8xh + 4h^2 - 4x^2}{h} \right]$ $= \lim_{h \rightarrow 0} \left[ \frac{8xh + 4h^2}{h} \right]$ $= \lim_{h \rightarrow 0} \left[ \frac{h(8x + 4h)}{h} \right]$ $= 8x$	$\checkmark 4(x+h)^2$ $\checkmark 8xh + 4h^2$ $\checkmark \frac{f(x+h) - f(x)}{h}$ $\checkmark \frac{h(8x + 4h)}{h}$ $\checkmark 8x$ <p><b>OR/OF</b></p> $\checkmark \frac{f(x+h) - f(x)}{h}$ $\checkmark 4(x+h)^2$ $\checkmark 8xh + 4h^2$ $\checkmark \frac{h(8x + 4h)}{h}$ $\checkmark 8x$ <p style="text-align: right;">(5)</p>
8.2.1	$D_x \left[ \frac{x^2 - 2x - 3}{x - 1} \right]$ $= D_x \left[ \frac{(x-3)(x+1)}{x+1} \right]$ $= D_x(x-3)$ $= 1$	$\checkmark \frac{(x-3)(x+1)}{x+1}$ $\checkmark (x-3)$ $\checkmark 1$ <p style="text-align: right;">(3)</p>
8.2.2	$f(x) = \sqrt{x} = x^{\frac{1}{2}}$ $f'(x) = \frac{1}{2} x^{-\frac{1}{2}}$ $f''(x) = -\frac{1}{4} x^{-\frac{3}{2}}$	$\checkmark x^{\frac{1}{2}}$ $\checkmark \frac{1}{2} x^{-\frac{1}{2}}$ $\checkmark -\frac{1}{4} x^{-\frac{3}{2}}$ <p style="text-align: right;">(3) <b>[11]</b></p>

**QUESTION/VRAAG 9**

9.1	$f(x) = (x+2)(x-1)(x-4)$ $= (x^2 + x - 2)(x-4)$ $= x^3 + x^2 - 2x - 4x^2 - 4x + 8$ $= x^3 - 3x^2 - 6x + 8$ $b = -3 ; c = -6 ; d = 8$	$\checkmark\checkmark f(x) = (x+2)(x-1)(x-4)$ $\checkmark \text{ expansion}$ $\checkmark x^3 - 3x^2 - 6x + 8$ <p style="text-align: right;">(4)</p>
9.2	$f(x) = x^3 - 3x^2 - 6x + 8$ $f'(x) = 0$ $3x^2 - 6x - 6 = 0$ $x^2 - 2x - 2 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{2 \pm \sqrt{(2)^2 - 4(1)(-2)}}{2(1)}$ $= \frac{2 \pm \sqrt{12}}{2}$ $x = -0,73$	$\checkmark f'(x) = 0$ $\checkmark 3x^2 - 6x - 6$ $\checkmark \text{ substitution into correct formula}$ $\checkmark x = -0,73$ <p style="text-align: right;">(4)</p>
9.3	$f(x) = x^3 - 3x^2 - 6x + 8$ $f(-1) = (-1)^3 - 3(-1)^2 - 6(-1) + 8 \quad \text{or} \quad f(-1) = (1)(-2)(-5)$ $= 10 \qquad \qquad \qquad = 10$ $f'(-1) = 3(-1)^2 - 6(-1) - 6$ $= 3$ $y - 10 = 3(x + 1)$ $y = 3x + 13$	$\checkmark f(-1) = 10$ $\checkmark f'(-1) = 3$ $\checkmark \text{ substitution}$ $\checkmark y = 3x + 13$ <p style="text-align: right;">(4)</p>
9.4	$f''(x) = 6x - 6$ 	$\checkmark f''(x) = 6x - 6$ $\checkmark x\text{- intercept}$ $\checkmark y\text{- intercept}$ <p style="text-align: right;">(3)</p>

9.5	$f$ concave upwards $f''(x) > 0$ $6x - 6 > 0$ $x > 1$	<b>NOTE:</b> Answer only 2 / 2	$\checkmark f''(x) > 0$ $\checkmark x > 1$ <div style="text-align: right;">(2) <b>[17]</b></div>
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**QUESTION/VRAAG 10**

	$f(x) = -3x^3 + x$ $-9x^2 + 1 = 0$ $x = \frac{1}{3} \quad \text{or} \quad x = -\frac{1}{3}$ <p>Maximum of <math>f</math> will be at <math>x = \frac{1}{3}</math></p> $f\left(\frac{1}{3}\right) = -3\left(\frac{1}{3}\right)^3 + \left(\frac{1}{3}\right)$ $= \frac{2}{9}$ <p>Maximum of <math>f(x) + q</math> will also be at <math>x = \frac{1}{3}</math></p> $f\left(\frac{1}{3}\right) + q = \frac{8}{9}$ $\frac{2}{9} + q = \frac{8}{9}$ $q = \frac{6}{9}$ $= \frac{2}{3}$ <p>For <math>f(x) + q</math> to have a maximum of <math>\frac{8}{9}</math> the value of <math>q</math> has to be <math>\frac{2}{3}</math>.</p>	$\checkmark -9x^2 + 1 = 0$ $\checkmark x = \frac{1}{3} \quad \text{or} \quad x = -\frac{1}{3}$ $\checkmark$ Maximum at $x = \frac{1}{3}$ $\checkmark f\left(\frac{1}{3}\right) = \frac{2}{9}$ $\checkmark \frac{2}{9} + q = \frac{8}{9}$ $\checkmark q = \frac{2}{3}$ <div style="text-align: right;"><b>[6]</b></div>
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**QUESTION/VRAAG 11**

11.1.1	Let the event Veli arrive late for school be V. Let the event Bongsi arrive late for school be B. / <i>Laat V die gebeurtenis wees dat Veli Laat B die gebeurtenis wees dat Bongsi laatkom</i> $P(V \text{ or } B) = 1 - 0,7$ $= 0,3$	✓ answer (1)
11.1.2	$P(V \text{ or } B) = P(V) + P(B) - P(V \text{ and } B)$ $0,3 = 0,25 + P(B) - 0,15$ $P(B) = 0,2$	✓ $P(V \text{ or } B) = P(V) + P(B) - P(V \text{ and } B)$ ✓ substitution ✓ 0,2 (3)
11.1.3	$P(V) \times P(B) = 0,25 \times 0,2$ $= 0,05$ $P(V) \times P(B) \neq P(V \text{ and } B)$ V and B are NOT independent/ <i>V en B is NIE onafhanklik nie.</i>	✓ $P(V) \times P(B) = 0,05$  ✓ $P(V) \times P(B) \neq P(V \text{ and } B)$ ✓ NOT independent (3)
11.2.1	$6! = 720$	✓ 6! or 720 (2)
11.2.2	Number of arrangements $= 3! \times 3! \times 2$ $= 72$	✓ $3! \times 3!$ ✓ $\times 2$ ✓ answer (3)
11.2.3	$P(\text{hearts next to each other}) = \frac{3! \times 4!}{6!}$ $= \frac{144}{720}$ $= \frac{1}{5}$ or 0,2 or 20%  <b>OR/OF</b> $P(\text{hearts next to each other}) = \frac{4 \times 3! \times 3!}{6!}$ $= \frac{144}{720}$ $= \frac{1}{5}$ or 0,2 or 20%	✓ ✓ $3! \times 4!$  ✓ $\frac{1}{5}$ or 0,2 or 20%  <b>OR/OF</b> ✓ ✓  ✓ $\frac{1}{5}$ or 0,2 or 20%  (3) <b>[15]</b>

**TOTAL/TOTAAL: 150**