



# 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.

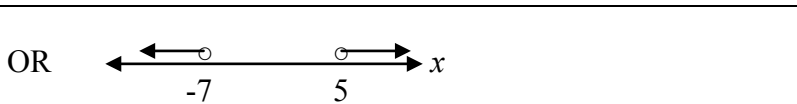
**LET WEL:**

- 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**

|                  |   |   |
|------------------|---|---|
| <p>1.1.1</p>     | $x^2 - x - 12 = 0$ $(x - 4)(x + 3) = 0$ $x = 4 \quad \text{or} \quad x = -3$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><b>NOTE:</b><br/>Answer only: max 2/3 marks</p> </div> <p><b>OR</b></p> $x^2 - x - 12 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-12)}}{2(1)}$ $= \frac{1 \pm \sqrt{49}}{2}$ $= 4 \quad \text{or} \quad -3$   | <p>✓ factors<br/>✓ answer<br/>✓ answer</p> <p style="text-align: right;">(3)</p> <p>✓ substitution into the correct formula<br/>✓ answer<br/>✓ answer</p> <p style="text-align: right;">(3)</p>   |
| <p>1.1.2 (a)</p> | $2x^2 - 5x - 11 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(2)(-11)}}{2(2)}$ $= \frac{5 \pm \sqrt{113}}{4}$ $= 3,91 \quad \text{or} \quad -1,41$ <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li>• Answer only: max 2/4 marks</li> <li>• If the answer is left as <math>\frac{5 \pm \sqrt{113}}{4}</math>: 4/4 marks</li> <li>• If candidate continues after correct surd but then has incorrect answers: max 4/4 marks</li> </ul> </div> | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><b>NOTE:</b><br/>Wrong formula: 0/4 marks</p> </div> <p>✓ correct substitution of <math>b</math> into correct formula<br/>✓ correct substitution of <math>a</math> and <math>c</math> into correct formula<br/>✓✓ <math>\frac{5 \pm \sqrt{113}}{4}</math> OR decimal answers</p> <p style="text-align: right;">(4)</p> |

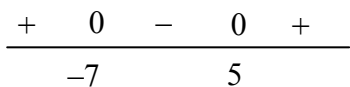
|                  |  |   |   |    |   |   |  |  |   |  |  |  |  |  |  |       |   |   |   |   |   |  |       |   |   |   |   |   |  |                  |   |   |   |   |   |  |                 |    |                       |  |  |  |  |   |
|------------------|--|---|---|----|---|---|--|--|---|--|--|--|--|--|--|-------|---|---|---|---|---|--|-------|---|---|---|---|---|--|------------------|---|---|---|---|---|--|-----------------|----|-----------------------|--|--|--|--|---|
|                  | $2x^2 - 5x - 11 = 0$ $x^2 - \frac{5}{2}x = \frac{11}{2}$ $\left(x - \frac{5}{4}\right)^2 = \frac{11}{2} + \frac{25}{16}$ $\left(x - \frac{5}{4}\right) = \pm\sqrt{\frac{113}{16}}$ $x = \frac{5}{4} \pm \sqrt{\frac{113}{16}}$ $x = 3,91 \quad \text{or} \quad x = -1,41$ <p><b>OR</b></p> $2x^2 - 5x - 11 = 0$ $x^2 - \frac{5x}{2} - \frac{11}{2} = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-\left(-\frac{5}{2}\right) \pm \sqrt{\left(-\frac{5}{2}\right)^2 - 4(1)\left(-\frac{11}{2}\right)}}{2(1)}$ $= \frac{\frac{5}{2} \pm \sqrt{\frac{113}{4}}}{2}$ $x = 3,91 \quad \text{or} \quad x = -1,41$   | <p>✓ division by 2</p> $\checkmark \left(x - \frac{5}{4}\right) = \pm\sqrt{\frac{113}{16}}$ $\checkmark x = \frac{5}{4} \pm \sqrt{\frac{113}{16}}$ <p>✓ answers (4)</p> <p>✓ division by 2</p> <p>✓ subs into correct formula</p> $\checkmark \frac{\frac{5}{2} \pm \sqrt{\frac{113}{4}}}{2}$ <p>✓ answer (4)</p>                             |   |    |   |   |  |  |   |  |  |  |  |  |  |       |   |   |   |   |   |  |       |   |   |   |   |   |  |                  |   |   |   |   |   |  |                 |    |                       |  |  |  |  |   |
| <p>1.1.2 (b)</p> | $2x^3 - 5x^2 - 11x = 0$ $x(2x^2 - 5x - 11) = 0$ $x = 0 \quad \text{or} \quad x = 3,91 \quad \text{or} \quad x = -1,41$ <p><b>OR</b></p> $x = 0 \quad \text{or} \quad x = \frac{5 \pm \sqrt{113}}{4}$   | <p>✓ factors</p> <p>✓ answers (2)</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li>• Division by x:           max 1/2 marks</li> <li>• Use quadratic formula to solve cubic:    0/2 marks</li> <li>• Answer only :           2/2 marks</li> </ul> </div> |   |    |   |   |  |  |   |  |  |  |  |  |  |       |   |   |   |   |   |  |       |   |   |   |   |   |  |                  |   |   |   |   |   |  |                 |    |                       |  |  |  |  |   |
| <p>1.1.3</p>     | $-3(x+7)(x-5) < 0$ $\begin{array}{ccccccc} - & 0 & + & 0 & - & & \\ & -7 & & 5 & & & \end{array} \quad \text{OR} \quad \begin{array}{c} \text{Graph of } y = -3(x+7)(x-5) \\ \text{with x-intercepts at } -7 \text{ and } 5 \end{array}$ <p><b>OR</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 10%;"></td> <td style="width: 10%; text-align: center;">-7</td> <td style="width: 10%;"></td> <td style="width: 10%; text-align: center;">5</td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> </tr> <tr> <td style="border-top: 1px solid black;">x</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>x + 7</td> <td style="text-align: center;">+</td> <td style="text-align: center;">0</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td></td> </tr> <tr> <td>x - 5</td> <td style="text-align: center;">+</td> <td style="text-align: center;">+</td> <td style="text-align: center;">+</td> <td style="text-align: center;">0</td> <td style="text-align: center;">-</td> <td></td> </tr> <tr> <td style="border-top: 1px solid black;">-3(x + 7)(x - 5)</td> <td style="text-align: center;">-</td> <td style="text-align: center;">0</td> <td style="text-align: center;">+</td> <td style="text-align: center;">0</td> <td style="text-align: center;">-</td> <td></td> </tr> <tr> <td style="border-top: 1px solid black;">x &lt; -7 or x &gt; 5</td> <td style="text-align: center;">OR</td> <td colspan="4" style="text-align: center;">x ∈ (-∞; -7) ∪ (5; ∞)</td> <td></td> </tr> </table> |   |   | -7 |   | 5 |  |  | x |  |  |  |  |  |  | x + 7 | + | 0 | - | - | - |  | x - 5 | + | + | + | 0 | - |  | -3(x + 7)(x - 5) | - | 0 | + | 0 | - |  | x < -7 or x > 5 | OR | x ∈ (-∞; -7) ∪ (5; ∞) |  |  |  |  | <p>✓ critical values</p> <p>✓ x &lt; -7</p> <p>✓ x &gt; 5</p> <p>✓ or / ∪</p> |
|                  |  | -7  |   | 5  |   |   |  |  |   |  |  |  |  |  |  |       |   |   |   |   |   |  |       |   |   |   |   |   |  |                  |   |   |   |   |   |  |                 |    |                       |  |  |  |  |   |
| x                |  |   |   |    |   |   |  |  |   |  |  |  |  |  |  |       |   |   |   |   |   |  |       |   |   |   |   |   |  |                  |   |   |   |   |   |  |                 |    |                       |  |  |  |  |   |
| x + 7            | +  | 0   | - | -  | - |   |  |  |   |  |  |  |  |  |  |       |   |   |   |   |   |  |       |   |   |   |   |   |  |                  |   |   |   |   |   |  |                 |    |                       |  |  |  |  |   |
| x - 5            | +  | +   | + | 0  | - |   |  |  |   |  |  |  |  |  |  |       |   |   |   |   |   |  |       |   |   |   |   |   |  |                  |   |   |   |   |   |  |                 |    |                       |  |  |  |  |   |
| -3(x + 7)(x - 5) | -  | 0   | + | 0  | - |   |  |  |   |  |  |  |  |  |  |       |   |   |   |   |   |  |       |   |   |   |   |   |  |                  |   |   |   |   |   |  |                 |    |                       |  |  |  |  |   |
| x < -7 or x > 5  | OR   | x ∈ (-∞; -7) ∪ (5; ∞)   |   |    |   |   |  |  |   |  |  |  |  |  |  |       |   |   |   |   |   |  |       |   |   |   |   |   |  |                  |   |   |   |   |   |  |                 |    |                       |  |  |  |  |   |



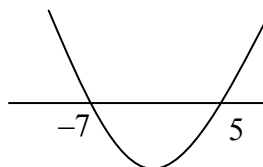
OR

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

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



OR



✓critical values

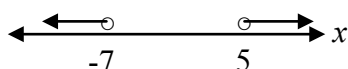
OR

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

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

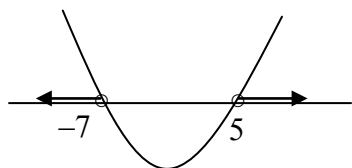
✓ $x < -7$   
✓ $x > 5$   
✓or /  $\cup$

OR



**NOTE:**

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



**NOTE:**

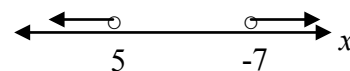
If  $(x+7)(x-5) < 0$  and get  $-7 < x < 5$ :  
max 2 / 4 marks

**NOTE:**

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

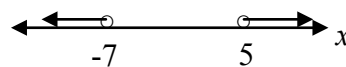
If the candidate writes  $x < 5$  or  $x > -7$  OR

$x \in (-\infty; 5) \cup (-7; \infty)$  OR award maximum 1/4 marks



If the candidate writes  $x \leq -7$  or  $x \geq 5$  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.

(4)

(4)

|            |   |   |
|------------|---|---|
| <p>1.2</p> | <p> <math>y + 2 = x</math> and <math>y = x^2 - x - 10</math><br/> <math>y + 2 = x</math><br/> <math>y = (y + 2)^2 - (y + 2) - 10</math><br/> <math>y = y^2 + 4y + 4 - y - 2 - 10</math><br/> <math>0 = y^2 + 2y - 8</math><br/> <math>0 = (y + 4)(y - 2)</math><br/> <math>y = -4</math> or <math>2</math><br/> <math>x = -4 + 2</math> or <math>x = 2 + 2</math><br/> <math>= -2</math>                      <math>= 4</math> </p> <p><b>OR</b></p> <p> <math>y + 2 = x</math> and <math>y = x^2 - x - 10</math><br/> <math>x^2 - x - 10 + 2 = x</math><br/> <math>0 = x^2 - 2x - 8</math><br/> <math>0 = x^2 - 2x - 8</math><br/> <math>0 = (x - 4)(x + 2)</math><br/> <math>x = 4</math> or <math>-2</math><br/> <math>y = 4 - 2</math> or <math>y = -2 - 2</math><br/> <math>= 2</math>                      <math>= -4</math> </p> <p><b>OR</b></p> <p> <math>y + 2 = x</math> and <math>y = x^2 - x - 10</math><br/> <math>y = x - 2</math><br/> <math>x - 2 = x^2 - x - 10</math><br/> <math>0 = x^2 - 2x - 8</math><br/> <math>0 = x^2 - 2x - 8</math><br/> <math>0 = (x - 4)(x + 2)</math><br/> <math>x = 4</math> or <math>-2</math><br/> <math>y = 4 - 2</math> or <math>y = -2 - 2</math><br/> <math>= 2</math>                      <math>= -4</math> </p> | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><b>Note:</b> If candidate makes a mistake which leads to both equations being LINEAR award maximum 2/6 marks</p> <ul style="list-style-type: none"> <li>✓ substitution</li> <li>✓ first unknown</li> </ul> </div> <p>                 ✓ substitution<br/>                 ✓ <math>0 = y^2 + 2y - 8</math><br/>                 ✓ factors<br/>                 ✓ y-values<br/>                 ✓✓ x-values             </p> <p style="text-align: right;">(6)</p> <p>                 ✓ substitution<br/>                 ✓ <math>0 = x^2 - 2x - 8</math><br/>                 ✓ factors<br/>                 ✓ x-values<br/>                 ✓✓ y-values             </p> <p style="text-align: right;">(6)</p> <p>                 ✓ substitution<br/>                 ✓ <math>0 = x^2 - 2x - 8</math><br/>                 ✓ factors<br/>                 ✓ x-values<br/>                 ✓✓ y-values             </p> <p style="text-align: right;">(6)</p> |
| <p>1.3</p> | <p> <math>\frac{3^{2015} + 3^{2013}}{9^{1006}}</math><br/> <math>= \frac{3^{2013}(3^2 + 1)}{3^{2012}}</math><br/> <math>= 3(10)</math><br/> <math>= 30</math> </p> <p><b>OR</b></p>   | <p>                 ✓ <math>3^{2013}(3^2 + 1)</math><br/>                 ✓ denominator<br/>                 ✓ answer             </p> <p style="text-align: right;">(3)</p>  |

|  |   |   |
|--|---|---|
|  | $\frac{3^{2015} + 3^{2013}}{9^{1006}}$ $= \frac{3^{2012}(3^3 + 3)}{3^{2012}}$ $= 27 + 3$ $= 30$ <p><b>OR</b></p> <p>Let <math>x = 3^{2012}</math></p> $\frac{3^{2015} + 3^{2013}}{9^{1006}}$ $= \frac{3^{2012} \cdot 3^3 + 3^{2012} \cdot 3}{3^{2012}}$ $= \frac{27x + 3x}{x}$ $= \frac{30x}{x}$ $= 30$ | $\checkmark 3^{2012}(3^3 + 3)$<br>$\checkmark$ denominator<br><br>$\checkmark$ answer<br><br><p style="text-align: right;">(3)</p><br><br>$\checkmark 3^{2012} \cdot 3^3 + 3^{2012} \cdot 3 / 27x + 3x$<br>$\checkmark$ denominator<br><br>$\checkmark$ answer<br><br><p style="text-align: right;">(3)</p> <p style="text-align: right;"><b>[22]</b></p> |
|--|---|---|

**QUESTION/VRAAG 2**

|              |   |  |
|--------------|---|--|
| <p>2.1</p>   | <p>Given geometric sequence : 7 ; x ; 63 ...</p> $\frac{T_2}{T_1} = \frac{T_3}{T_2}$ $\frac{x}{7} = \frac{63}{x}$ $x^2 = 441$ $x = \pm 21$ <p><b>OR</b></p> <p>Given geometric sequence : 7 ; x ; 63 ...</p> $\frac{T_2}{T_1} = \frac{T_3}{T_2}$ $\frac{x}{7} = \frac{63}{x}$ $x^2 = 441$ $x^2 - 441 = 0$ $(x - 21)(x + 21) = 0$ $x = \pm 21$ <p><b>OR</b></p> $63 = 7r^2$ $r^2 = 9$ $r = \pm 3$ $x = \pm 21$ | $\checkmark \frac{T_2}{T_1} = \frac{T_3}{T_2} / \frac{x}{7} = \frac{63}{x}$ $\checkmark x^2 = 441$ $\checkmark \text{both answers}$ <p style="text-align: right;">(3)</p><br>$\checkmark \frac{T_2}{T_1} = \frac{T_3}{T_2} / \frac{x}{7} = \frac{63}{x}$ $\checkmark x^2 = 441$ $\checkmark \text{both answers}$ <p style="text-align: right;">(3)</p><br>$\checkmark 63 = 7r^2$ $\checkmark r^2 = 9$ $\checkmark \text{both answers}$ <p style="text-align: right;">(3)</p> |
| <p>2.2.1</p> | $r = \frac{10}{15} = \frac{2}{3}$ $T_n = ar^{n-1}$ $T_{10} = 15 \left( \frac{2}{3} \right)^{10-1}$ $= \frac{2560}{6561} \text{ or } 0,39$ <p><b>OR</b></p> $r = \frac{10}{15} = \frac{2}{3}$ <p>Expansion of the series</p> $15 + 10 + \frac{20}{3} + \frac{40}{9} + \frac{80}{27} + \frac{160}{81} + \frac{320}{243} + \frac{640}{729} + \frac{1280}{2187} + \frac{2560}{6561}$ $T_{10} = \frac{2560}{6561}$ | $\checkmark r = \frac{2}{3}$ $\checkmark \text{correct subs into correct formula}$ $\checkmark \text{answer}$ <p style="text-align: right;">(3)</p><br>$\checkmark r = \frac{2}{3}$ $\checkmark \text{expansion of the series}$ $\checkmark \text{answer}$ <p style="text-align: right;">(3)</p>   |

|              |  |   |
|--------------|--|---|
| <p>2.2.2</p> | $S_n = \frac{a(r^n - 1)}{r - 1}$ $S_9 = \frac{15\left(\left(\frac{2}{3}\right)^9 - 1\right)}{\frac{2}{3} - 1}$ $= \frac{95855}{2187}$ $= 43,83$ <p><b>OR</b></p> $S_n = \frac{a(1 - r^n)}{1 - r}$ $S_9 = \frac{15\left(1 - \left(\frac{2}{3}\right)^9\right)}{1 - \left(\frac{2}{3}\right)}$ $= \frac{95855}{2187}$ $= 43,83$  | <p>✓ correct substitution into correct formula</p> <p>✓ answer (2)</p> <p>✓ substitution into correct formula</p> <p>✓ answer (2)</p>   |
| <p>2.3.1</p> | <p><math>T_{191} = 0</math></p>  | <p>✓ answer (1)</p>   |
| <p>2.3.2</p> | <p>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 <b>even</b> terms:</p> <p><i>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:</i></p> $S_{500} = \frac{250}{2} \left[ 2\left(-\frac{1}{2}\right) + (250 - 1)(1) \right]$ $= 31000$ <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p><b>NOTE:</b><br/>Breakdown:<br/>If <math>n = 500</math> with <math>a = -\frac{1}{2}</math> and <math>d = 1</math><br/>then <math>S_n = 124\,500</math>: max 2/4 marks</p> </div> <p><b>OR</b></p> $S_{500} = \frac{125[2(-1) + 249(2)]}{2}$ $= 31000$ <p><b>OR</b></p> | <p>✓ <math>n = 250</math><br/>✓ <math>a = -\frac{1}{2}</math> and <math>d = 1</math><br/>✓ substitution into correct formula<br/>✓ answer</p> <p>✓ <math>n = 125</math><br/>✓ <math>a = -1</math> and <math>d = 2</math><br/>✓ subs into correct formula<br/>✓ answer (4)</p> |



|              |  |   |
|--------------|--|---|
|              | $\frac{3}{2} + \frac{5}{2} + \dots \text{to } 248 \text{ terms}$ $= 124 \left[ \frac{3}{2} + \frac{497}{2} \right]$ $= 124 \times 250$ $= 31000$ <p><b>OR</b></p> $\frac{3}{2} + \frac{5}{2} + \dots \text{to } 248 \text{ terms}$ $= 124[3 + 247]$ $= 124 \times 250$ $= 31000$ <p><b>OR</b></p> <p>Sum = 0 + 4 + 8 + ... to 125 terms</p> $= \frac{125}{2} [0 + (125 - 1)4]$ $= 31000$ | $\checkmark n = 248$<br>$\checkmark$ subs into correct formula<br>$\checkmark \frac{3}{2} + \frac{247}{2}$<br>$\checkmark$ answer (4)<br><br>$\checkmark n = 248$<br>$\checkmark$ subs into correct formula<br>$\checkmark 3 + 247$<br>$\checkmark$ answer (4)<br><br>$\checkmark n = 125$<br>$\checkmark a = 0$ and $d = 4$<br>$\checkmark$ subs into correct formula<br>$\checkmark$ answer (4) |
| <p>2.4.1</p> | $T_1 = (4(1) - 1)^2$ $= 3^2$ $= 9$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> <p><b>NOTE:</b><br/>If <math>k = 1</math>, <math>T_1 = 3</math>: max 1/2 mark</p> </div>  | $\checkmark$ subs $x = 1$ and $k = 2$<br>$\checkmark$ answer (2)  |
| <p>2.4.2</p> | $r = 4x - 1$ $-1 < r < 1$ $-1 < 4x - 1 < 1$ $0 < 4x < 2$ $0 < x < \frac{1}{2}$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> <p><b>NOTE:</b><br/>Incorrect <math>r</math>: max 1/3 marks<br/>If candidate only writes down <math>4x - 1</math> and does nothing else: 0/3 marks</p> </div>                             | $\checkmark r = 4x - 1$<br>$\checkmark -1 < 4x - 1 < 1$<br>$\checkmark$ answer (3)<br><b>[18]</b>   |

**QUESTION/VRAAG 3**

|       |  |   |
|-------|--|---|
| 3.1.1 | $T_n = 4n - 7$<br><br><b>OR</b><br><br>$T_n = -3 + (n - 1)(4)$   | $\checkmark 4n$<br>$\checkmark -7$<br><br>(2)<br><br>$\checkmark -3$<br>$\checkmark (n - 1)(4)$<br><br>(2)  |
| 3.1.2 | $T_4 = 9$<br>$T_5 = 13$<br>$T_6 = 17$<br>$T_7 = 21$  | $\checkmark$ any TWO consecutive answers correct<br>$\checkmark$ last TWO answers correct<br><br>(2)  |
| 3.1.3 | 0 ; 1 ; 2 ; 0 ; 1 ; 2 ; 0  | 2 marks for all 7 correct<br><b>OR</b><br>1 mark for only <b>first / last</b> 3 correct<br><b>OR</b><br>0 marks if less than 3 correct<br><br>(2)   |
| 3.1.4 | Multiples of 3 in the pattern are: $-3 ; 9 ; 21$<br>$T_n = -3 + 12(n - 1)$<br>$T_n = 12n - 15$<br>$393 = 12n - 15$<br>$12n = 408$<br>$n = 34$<br><br>$S_n = \frac{n}{2}[a + L]$<br>$S_{34} = \frac{34}{2}[-3 + 393]$<br>$S_{34} = 6630$<br><br><div style="border: 1px solid black; padding: 5px;"> <p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li>If the candidate does not show the working to get to <math>n = 34</math>: no penalty</li> <li>If a candidate sums the whole sequence: 0/5 marks</li> <li>Answer only: max 1/5 marks</li> </ul> </div> | $T_n = a + (n - 1)d$<br>$393 = -3 + (n - 1)(12)$<br>$393 = 12n - 15$<br>$12n = 408$<br>$n = 34$<br><br>$S_n = \frac{n}{2}[2a + (n - 1)d]$<br>$S_{34} = \frac{34}{2}[2(-3) + 33(12)]$<br>$S_{34} = 6630$<br><br>$\checkmark 12n - 15$<br>$\checkmark 393 = 12n - 15$<br><br>$\checkmark n = 34$<br><br>$\checkmark$ subs $a = -3$ and $d = 12$ into correct formula<br><br>$\checkmark S_{34} = 6630$<br><br>(5) |
| 3.2.1 | <br><br>$T_5 = 35$   | $\checkmark \checkmark$ answer<br><br>(2)   |

|              |  |   |
|--------------|--|---|
|              | <p><b>OR</b></p> <p>The sequence is 1, 5, 12, 22, 35. Therefore <math>T_5 = 35</math></p> <p><b>OR</b></p> <p><math>T_5 = 22 + 13 = 35</math></p>  | <p>✓✓ answer (2)</p> <p>✓✓ answer (2)</p>   |
| <p>3.2.2</p> | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li>• Answer only: max 1 mark</li> <li>• If the candidate calculates the general formula in 3.2.1, they can be awarded 5/5 marks in 3.2.2</li> </ul> </div> <p><math>T_{50} = T_1 + \frac{49}{2}[2(4) + 48(3)]</math><br/> <math>= 1 + 3724</math><br/> <math>= 3725</math></p> <p><b>OR</b></p> <p><math>2a = 3</math><br/> <math>a = \frac{3}{2}</math></p> <p><math>3\left(\frac{3}{2}\right) + b = 4</math><br/> <math>b = -\frac{1}{2}</math></p> <p><math>\left(\frac{3}{2}\right) + \left(-\frac{1}{2}\right) + c = 1</math><br/> <math>c = 0</math></p> <p><math>T_n = \frac{3}{2}n^2 - \frac{1}{2}n</math><br/> <math>T_{50} = \frac{3}{2}(50)^2 - \frac{1}{2}(50)</math><br/> <math>= 3725</math></p> <p><b>OR</b></p> <p><math>T_1 = 1</math><br/> <math>T_2 - T_1 = 4</math><br/> <math>T_3 - T_2 = 7</math><br/> <math>T_4 - T_3 = 10</math><br/>         ...<br/> <math>T_{50} - T_{49} = ?</math><br/>         Add both sides</p> <p><math>T_{50} = 1 + 4 + 7 + 10 + \dots</math> to 50 terms</p> <p><math>= \frac{50}{2}(2 + 49(3))</math><br/> <math>= 3725</math></p> | <p>✓ <math>a = 4</math><br/>         ✓ <math>d = 3</math><br/>         ✓ <math>n = 49</math><br/>         ✓ substitution into correct formula<br/>         ✓ answer (5)</p> <p>✓ <math>a = \frac{3}{2}</math></p> <p>✓ <math>b = -\frac{1}{2}</math></p> <p>✓ <math>c = 0</math></p> <p>✓ subs <math>n = 50</math><br/>         ✓ answer (5)</p> <p>✓✓ expansion</p> <p>✓ <math>T_{50} = 1 + 4 + 7 + 10 + \dots</math> to 50 terms</p> <p>✓ subs into correct formula<br/>         ✓ answer (5)</p> <p style="text-align: right;"><b>[18]</b></p> |

**QUESTION/VRAAG 4**

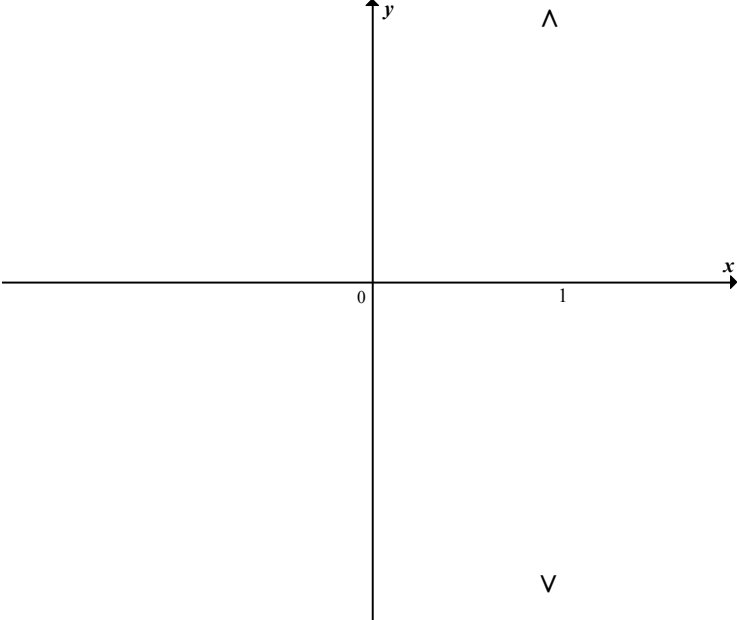
Given:  $f(x) = -2x^2 - 5x + 3$

|            |  |   |
|------------|--|---|
| <p>4.1</p> | <p><math>(0 ; 3)</math></p> <p><b>OR</b></p> <p><math>x = 0</math> and <math>y = 3</math></p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <ul style="list-style-type: none"> <li>If there is evidence that the candidate has indicated that <math>x = 0</math> and <math>y = 3</math>: 1 mark</li> <li>If candidate just states <math>y = 3</math>: 1 mark</li> </ul> </div>  | <p>✓ answer in coordinate form (1)</p> <p>✓ both values correct (1)</p>   |
| <p>4.2</p> | <p><math>0 = -2x^2 - 5x + 3</math></p> <p><math>0 = 2x^2 + 5x - 3</math></p> <p><math>0 = (2x - 1)(x + 3)</math></p> <p><math>x = \frac{1}{2}</math> or <math>-3</math></p>  | <p>✓ <math>y = 0</math></p> <p>✓ factors</p> <p>✓ <math>x</math>-values (3)</p>   |
| <p>4.3</p> | <p><math>f(x) = -2x^2 - 5x + 3</math></p> <p><math>x = -\frac{b}{2a}</math></p> <p><math>= -\frac{(-5)}{2(-2)}</math></p> <p><math>= -\frac{5}{4}</math> or <math>-1\frac{1}{4}</math></p> <p><math>y = f\left(-\frac{5}{4}\right)</math></p> <p><math>= -2\left(-\frac{5}{4}\right)^2 - 5\left(-\frac{5}{4}\right) + 3</math></p> <p><math>= \frac{49}{8}</math> or <math>6\frac{1}{8}</math></p> <p>or</p> <p>Hence the turning point of <math>f</math> is <math>\left(-\frac{5}{4}; \frac{49}{8}\right)</math> or <math>(-1,25; 6,13)</math></p> <p><b>OR</b></p> <p><math>f(x) = -2x^2 - 5x + 3</math></p> <p><math>= -2\left(x^2 + \frac{5x}{2} - \frac{3}{2}\right)</math></p> <p><math>= -2\left(x + \frac{5}{4}\right)^2 + \frac{25}{8} + \frac{24}{8}</math></p> <p><math>= -2\left(x + \frac{5}{4}\right)^2 + \frac{49}{8}</math></p> <p>Hence the turning point of <math>f</math> is <math>\left(-\frac{5}{4}; \frac{49}{8}\right)</math></p> | <p>✓ <math>x = -\frac{(-5)}{2(-2)}</math> or <math>\frac{1}{2} - 3</math></p> <p><math>f'(x) = 0</math> or <math>\frac{1}{2} - 3</math></p> <p>✓ <math>x</math>-coordinate</p> <p>✓ <math>y</math>-coordinate (3)</p> <p>✓ <math>-2\left(x + \frac{5}{4}\right)^2 + \frac{49}{8}</math></p> <p>✓ <math>x</math>-coordinate</p> <p>✓ <math>y</math>-coordinate (3)</p> |

|     |  |  |                    |
|-----|--|--|--------------------|
| 4.4 |  | ✓ shape<br>✓ intercepts with the axes<br>✓ turning point | (3)<br><b>[10]</b> |
|-----|--|--|--------------------|

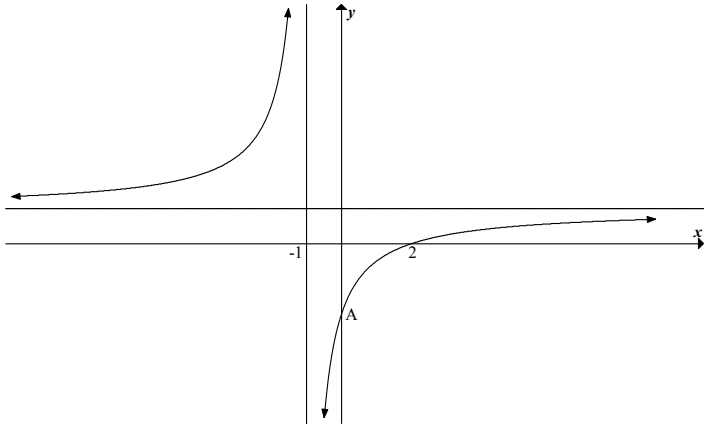
**QUESTION/VRAAG 5**

|       |  |  |     |
|-------|--|--|-----|
|       | Given: $g(x) = k^x$ and $y = g^{-1}(x)$  |  |     |
| 5.1.1 | $k^2 = 36$<br>$k = 6$  | ✓ $k^2 = 36$<br>✓ answer                                       | (2) |
| 5.1.2 | g: $y = 6^x$<br>g <sup>-1</sup> : $x = 6^y$<br>$y = \log_6 x$<br>or $y = \frac{\log x}{\log 6}$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 10px;"> <b>NOTE:</b><br/>                     Answer only : 2/2 marks                 </div> | ✓ $x = 6^y$<br>✓ $y = \log_6 x$ or $y = \frac{\log x}{\log 6}$ | (2) |
| 5.1.3 | $0 < x \leq 1$<br><b>OR</b><br>$(0; 1]$  | ✓ $0 < x$<br>✓ $x \leq 1$                                      | (2) |
| 5.1.4 | $x > 3$<br><b>OR</b><br>$(3; \infty)$  | ✓ answer   | (1) |

|              |  |  |
|--------------|--|--|
| <p>5.2.1</p> |   | <ul style="list-style-type: none"> <li>✓ vertical line</li> <li>✓ vertical line has <math>x</math>-intercept <math>(1 ; 0)</math></li> </ul> <p style="text-align: right;">(2)</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b><br/>Any other graph cutting at <math>(1 ; 0)</math>: 0 / 2 marks</p> </div>  |
| <p>5.2.2</p> | <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p><b>NOTE:</b><br/>If <math>x = 1</math> is not drawn in 5.2.1:<br/>0/2 marks</p> </div> <p>No, the inverse of <math>f</math> is not a function because the vertical line test fails in the graph of <math>x = 1</math>.<br/><i>Nee, die inverse van <math>f</math> is nie 'n funksie nie omdat die vertikalelyn-toets vir die grafiek <math>x = 1</math> faal.</i></p> <p><b>OR</b></p> <p>No, the inverse of <math>f</math> is not a function because the horizontal line test fails in the graph of <math>y = 1</math>.<br/><i>Nee, die inverse van <math>f</math> is nie 'n funksie nie omdat die horisontalelyn-toets vir die grafiek <math>y = 1</math> faal.</i></p> <p><b>OR</b></p> <p>Since <math>f</math> as defined is a many-to-one function it does not have an inverse function.<br/><i><math>f</math> is gedefinieerd as 'n meer-tot-een-funksie en het dus nie 'n inverse funksie nie.</i></p> <p><b>OR</b></p> <p>The inverse of <math>f</math> is a one-to-many relation.<br/><i>Die inverse funksie van <math>f</math> is 'n een-tot-meer relasie.</i></p> <p><b>OR</b></p> | <ul style="list-style-type: none"> <li>✓ not a function</li> <li>✓ valid reason</li> </ul> <p style="text-align: right;">(2)</p> <ul style="list-style-type: none"> <li>✓ not a function</li> <li>✓ valid reason</li> </ul> <p style="text-align: right;">(2)</p> <ul style="list-style-type: none"> <li>✓ not a function</li> <li>✓ valid reason</li> </ul> <p style="text-align: right;">(2)</p> <ul style="list-style-type: none"> <li>✓ not a function</li> <li>✓ explanation</li> </ul> <p style="text-align: right;">(2)</p> |

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

**QUESTION/VRAAG 6**

|              |   |  |
|--------------|---|--|
|              | <p>Given: <math>f(x) = \frac{x-d}{x-p}</math></p>    |  |
| <p>6.1.1</p> | $0 = \frac{2-d}{2-p}$ $d = 2$ $-1-p = 0$ $p = -1$ <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b><br/>If candidate leaves answer as<br/><math>f(x) = \frac{x-2}{x+1}</math> : 2/2 marks</p> </div>   | <p>✓ <math>d</math> value<br/>✓ <math>p</math> value (2)</p>   |
| <p>6.1.2</p> | $y = \frac{x-2}{x+1}$ $= \frac{(x+1)-3}{x+1}$ $= \frac{x+1}{x+1} - \frac{3}{x+1}$ $= \frac{-3}{x+1} + 1$ <p><b>OR</b></p> $\frac{-3}{x+1} + 1$ $= \frac{-3+x+1}{x+1}$ $= \frac{x-2}{x+1}$ <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li>• If the candidate starts with <math>y = \frac{a}{x+1} + 1</math> and substitutes (2 ; 0) and proves <math>a = -3</math>: 0/2 marks</li> <li>• If the candidate starts with <math>y = \frac{-3}{x+1} + 1</math> and calculates (2 ; 0) as <math>x</math>-intercept: 0/2 marks</li> </ul> </div> | <p>✓ <math>\frac{x-2}{x+1} = \frac{x+1-3}{x+1}</math><br/>✓ <math>\frac{x+1}{x+1} - \frac{3}{x+1}</math> (2)</p> |

|       |   |  |
|-------|---|--|
|       | <p><b>OR</b></p> $x+1 \overline{)x-2}$ $\underline{-x-1}$ $-3$ <p>Remainder = -3<br/> <math>\therefore x-2 = 1(x+1) - 3</math></p> $\frac{x-2}{x+1} = 1 - \frac{3}{x+1}$ $f(x) = \frac{-3}{x+1} + 1$  | <p>✓ <math>\frac{-3+x+1}{x+1}</math></p> <p>✓ simplification (2)</p><br><p>✓ long division</p> <p>✓ remainder = -3 (2)</p> |
| 6.1.3 | P(-1 ; 1)   | <p>✓ x-coordinate</p> <p>✓ y-coordinate (2)</p>  |
| 6.1.4 | (-2 ; 4)  | <p>✓ x-coordinate</p> <p>✓ y-coordinate (2)</p>  |
| 6.2   | <p><math>q = 1</math></p> <p>Substitute A(0; -2) into <math>g(x) = p \cdot 2^x + 1</math>:</p> $-2 = p(2)^0 + 1$ $p = -3$ <p>Hence <math>g(x) = -3 \cdot 2^x + 1</math></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> <p><b>NOTE:</b><br/>Answer only: 3/3 marks</p> </div> | <p>✓ <math>q = 1</math></p> <p>✓ substitute A(0; -2)</p> <p>✓ <math>p = -3</math></p> <p>(3)<br/><b>[11]</b></p>           |



**QUESTION/VRAAG 7**

|  |  |  |   |  |  |  |  |
|--|--|--|---|--|--|--|--|
| <p>7.1.1</p>   | $1 + i_{eff} = \left(1 + \frac{0,09}{4}\right)^4$ $i_{eff} = \left(1 + \frac{0,09}{4}\right)^4 - 1$ $= 0,093083318$ $= 0,0931$ $= 9,31\%$  | $\checkmark \left(1 + \frac{0,09}{4}\right)^4$ $\checkmark 9,31\% \text{ or } 0,0931$ <p>(2)</p>   |   |  |  |  |  |
| <p>7.1.2</p>   | <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <math display="block">A = P(1+i)^n</math> <math display="block">30\,440 = 12\,500 \left(1 + \frac{0,09}{4}\right)^{4k}</math> <math display="block">\frac{30\,440}{12\,500} = \left(1 + \frac{0,09}{4}\right)^{4k}</math> <math display="block">2,4352 = 1,0225^{4k}</math> <math display="block">4k = \log_{1,0225} 2,4352</math> <math display="block">4k = 40,00020365\dots</math> <math display="block">k = 10 \text{ years}</math> <p><b>OR</b></p> <math display="block">A = P(1+i)^n</math> <math display="block">30\,440 = 12\,500(1 + 0,09308\dots)^k</math> <math display="block">\frac{30\,440}{12\,500} = (1 + 0,09308\dots)^k</math> <math display="block">2,4352 = (1,09308\dots)^k</math> <math display="block">k = \log_{1,09308\dots} 2,4352</math> <math display="block">k = 9,998336572\dots</math> <math display="block">k = 10 \text{ years}</math> </td> <td style="width: 50%; vertical-align: top;"> <math display="block">A = P(1+i)^n</math> <math display="block">30\,440 = 12\,500 \left(1 + \frac{0,09}{4}\right)^{4k}</math> <math display="block">\frac{30\,440}{12\,500} = \left(1 + \frac{0,09}{4}\right)^{4k}</math> <math display="block">2,4352 = 1,0225^{4k}</math> <math display="block">4k \log 1,0225 = \log 2,4352</math> <math display="block">4k = \frac{\log 2,4352}{1,0225}</math> <math display="block">4k = 40,00020365\dots</math> <math display="block">k = 10 \text{ years}</math> </td> </tr> <tr> <td colspan="2" style="vertical-align: top;"> <p><b>OR</b></p> <math display="block">A = P(1+i)^n</math> <math display="block">30\,440 = 12\,500(1 + 0,09308\dots)^k</math> <math display="block">\frac{30\,440}{12\,500} = (1 + 0,09308\dots)^k</math> <math display="block">2,4352 = (1,09308\dots)^k</math> <math display="block">k \log 1,09308\dots = \log 2,4352</math> <math display="block">k = \frac{\log 2,4352}{\log 1,09308\dots}</math> <math display="block">k = 9,998336572\dots</math> <math display="block">k = 10 \text{ years}</math> </td> <td style="vertical-align: top;"> <p><b>NOTE:</b><br/>Incorrect formula: max 2/5 marks<br/><br/>If A and P are swapped: max 2 /5 marks</p> </td> </tr> </table> | $A = P(1+i)^n$ $30\,440 = 12\,500 \left(1 + \frac{0,09}{4}\right)^{4k}$ $\frac{30\,440}{12\,500} = \left(1 + \frac{0,09}{4}\right)^{4k}$ $2,4352 = 1,0225^{4k}$ $4k = \log_{1,0225} 2,4352$ $4k = 40,00020365\dots$ $k = 10 \text{ years}$ <p><b>OR</b></p> $A = P(1+i)^n$ $30\,440 = 12\,500(1 + 0,09308\dots)^k$ $\frac{30\,440}{12\,500} = (1 + 0,09308\dots)^k$ $2,4352 = (1,09308\dots)^k$ $k = \log_{1,09308\dots} 2,4352$ $k = 9,998336572\dots$ $k = 10 \text{ years}$ | $A = P(1+i)^n$ $30\,440 = 12\,500 \left(1 + \frac{0,09}{4}\right)^{4k}$ $\frac{30\,440}{12\,500} = \left(1 + \frac{0,09}{4}\right)^{4k}$ $2,4352 = 1,0225^{4k}$ $4k \log 1,0225 = \log 2,4352$ $4k = \frac{\log 2,4352}{1,0225}$ $4k = 40,00020365\dots$ $k = 10 \text{ years}$ | <p><b>OR</b></p> $A = P(1+i)^n$ $30\,440 = 12\,500(1 + 0,09308\dots)^k$ $\frac{30\,440}{12\,500} = (1 + 0,09308\dots)^k$ $2,4352 = (1,09308\dots)^k$ $k \log 1,09308\dots = \log 2,4352$ $k = \frac{\log 2,4352}{\log 1,09308\dots}$ $k = 9,998336572\dots$ $k = 10 \text{ years}$ |  | <p><b>NOTE:</b><br/>Incorrect formula: max 2/5 marks<br/><br/>If A and P are swapped: max 2 /5 marks</p> | $\checkmark n = 4k$ $\checkmark i = \frac{0,09}{4}$ <p><math>\checkmark</math> subs into correct formula</p> <p><math>\checkmark</math> use of logs</p> <p><math>\checkmark</math> answer</p> <p>(5)</p><br>$\checkmark n = k$ $\checkmark i = 0,09308\dots \text{ (from 7.1.1)}$ <p><math>\checkmark</math> subs into correct formula</p> <p><math>\checkmark</math> use of logs</p> <p><math>\checkmark</math> answer</p> <p>(5)</p> |
| $A = P(1+i)^n$ $30\,440 = 12\,500 \left(1 + \frac{0,09}{4}\right)^{4k}$ $\frac{30\,440}{12\,500} = \left(1 + \frac{0,09}{4}\right)^{4k}$ $2,4352 = 1,0225^{4k}$ $4k = \log_{1,0225} 2,4352$ $4k = 40,00020365\dots$ $k = 10 \text{ years}$ <p><b>OR</b></p> $A = P(1+i)^n$ $30\,440 = 12\,500(1 + 0,09308\dots)^k$ $\frac{30\,440}{12\,500} = (1 + 0,09308\dots)^k$ $2,4352 = (1,09308\dots)^k$ $k = \log_{1,09308\dots} 2,4352$ $k = 9,998336572\dots$ $k = 10 \text{ years}$ | $A = P(1+i)^n$ $30\,440 = 12\,500 \left(1 + \frac{0,09}{4}\right)^{4k}$ $\frac{30\,440}{12\,500} = \left(1 + \frac{0,09}{4}\right)^{4k}$ $2,4352 = 1,0225^{4k}$ $4k \log 1,0225 = \log 2,4352$ $4k = \frac{\log 2,4352}{1,0225}$ $4k = 40,00020365\dots$ $k = 10 \text{ years}$  |  |   |  |  |  |  |
| <p><b>OR</b></p> $A = P(1+i)^n$ $30\,440 = 12\,500(1 + 0,09308\dots)^k$ $\frac{30\,440}{12\,500} = (1 + 0,09308\dots)^k$ $2,4352 = (1,09308\dots)^k$ $k \log 1,09308\dots = \log 2,4352$ $k = \frac{\log 2,4352}{\log 1,09308\dots}$ $k = 9,998336572\dots$ $k = 10 \text{ years}$   |  | <p><b>NOTE:</b><br/>Incorrect formula: max 2/5 marks<br/><br/>If A and P are swapped: max 2 /5 marks</p>   |   |  |  |  |  |

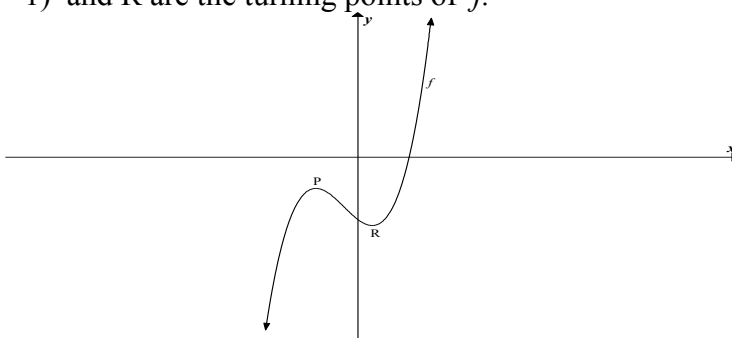
|              |   |  |
|--------------|---|--|
|              | $4n = \frac{\log \frac{A}{P}}{\log(1+i)}$ $4k = \frac{\log \frac{30440}{12500}}{\log\left(1 + \frac{0,09}{4}\right)}$ $4k = 40,00020365\dots$ $k = 10 \text{ years}$  | <ul style="list-style-type: none"> <li>✓ <math>n = 4k</math></li> <li>✓ <math>i = \frac{0,09}{4}</math></li> <li>✓ subs into correct formula</li> <li>✓ use of logs</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(5)</p>   |
| <p>7.2.1</p> | <p>30% of R18 480</p> $= \left(\frac{30}{100}\right)(18\ 480)$ $= R5\ 544$  | <ul style="list-style-type: none"> <li>✓ answer</li> </ul> <p style="text-align: right;">(1)</p>   |
| <p>7.2.2</p> | $P = \frac{x[1 - (1+i)^{-n}]}{i}$ $= \frac{5544 \left[ 1 - \left( 1 + \frac{0,08}{12} \right)^{-300} \right]}{\frac{0,08}{12}}$ $= R\ 718\ 305,71$ <p><b>OR</b></p> $x \left( 1 + \frac{0,08}{12} \right)^{300} = \frac{5544 \left[ \left( 1 + \frac{0,08}{12} \right)^{300} - 1 \right]}{\frac{0,08}{12}}$ $x \left( 1 + \frac{0,08}{12} \right)^{300} = 5272490,33\dots$ $x = R\ 718\ 305,71$ <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p><b>NOTE:</b><br/>                 Incorrect formula: max 2/4 marks<br/>                 If the answer is R 717 550,42<br/>                 (used <math>n = 299</math>): award 3 /4 marks</p> </div> | <ul style="list-style-type: none"> <li>✓ <math>i = \frac{0,08}{12}</math></li> <li>✓ <math>n = 300</math></li> <li>✓ substitution</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(4)</p><br><ul style="list-style-type: none"> <li>✓ <math>i = \frac{0,08}{12}</math></li> <li>✓ <math>n = 300</math></li> <li>✓ substitution</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(4)</p> <p style="text-align: right;"><b>[12]</b></p> |

**QUESTION/VRAAG 8**

|              |   |  |
|--------------|---|--|
| <p>8.1.1</p> | $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{3(x+h)^2 - 4 - (3x^2 - 4)}{h}$ $= \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 - 4 - 3x^2 + 4}{h}$ $= \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h} ; h \neq 0$ $= \lim_{h \rightarrow 0} (6x + 3h)$ $= 6x$ <p><b>OR</b></p> $f(x) = 3x^2 - 4$ $f(x+h) = 3(x+h)^2 - 4$ $= 3x^2 + 6xh + 3h^2 - 4$ $f(x+h) - f(x) = 6xh + 3h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h}$ $= \lim_{h \rightarrow 0} (6x + 3h)$ $= 6x$ | <p>✓ formula</p> <p>✓ substitution of<br/>of <math>x + h</math></p> <p>✓ simplification<br/>to <math>\frac{6xh + 3h^2}{h}</math></p> <p>✓ <math>\lim_{h \rightarrow 0} (6x + 3h)</math></p> <p>✓ answer (5)</p><br><p>✓ substitution of<br/>of <math>x + h</math></p> <p>✓ simplification<br/>to <math>6xh + 3h^2</math></p> <p>✓ formula</p> <p>✓ <math>\lim_{h \rightarrow 0} (6x + 3h)</math></p> <p>✓ answer (5)</p> |
| <p>8.1.2</p> | $f(x) = 3x^2 - 4$ <p>average gradient of <math>f</math> between <math>A(-2 ; y)</math> and <math>B(x ; 23)</math></p> $y = 3(-2)^2 - 4 = 8$ $23 = 3x^2 - 4$ $27 = 3x^2$ $9 = x^2$ $x = 3$   | <p>✓ <math>y = 8</math></p> <p>✓ <math>23 = 3x^2 - 4</math></p> <p>✓ <math>x = 3</math></p>  |

|            |  |   |
|------------|--|---|
|            | <p>Average gradient <math>= \frac{23 - y}{x - (-2)}</math><br/> <math>= \frac{23 - 8}{3 + 2}</math><br/> <math>= 3</math></p>  | <p>✓ <math>\frac{23 - y}{x - (-2)}</math><br/>                 ✓ answer<br/>                 (5)</p>  |
| <p>8.2</p> | <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p><b>NOTE:</b><br/>There is a maximum penalty of 1 mark for incorrect notation in question 8.</p> </div> <p><math>y = \frac{x + 5}{x^{\frac{1}{2}}}</math><br/> <math>= \frac{x}{x^{\frac{1}{2}}} + \frac{5}{x^{\frac{1}{2}}}</math><br/> <math>= x^{\frac{1}{2}} + 5x^{-\frac{1}{2}}</math></p> <p><math>\frac{dy}{dx} = \frac{1}{2}x^{-\frac{1}{2}} - \frac{5}{2}x^{-\frac{3}{2}}</math></p> <p><b>OR</b></p> <p><math>y = \frac{x + 5}{x^{\frac{1}{2}}}</math><br/>                 By the quotient rule<br/> <math>\frac{dy}{dx} = \frac{1 \cdot x^{\frac{1}{2}} - \frac{1}{2}x^{-\frac{1}{2}}(x + 5)}{(x^{\frac{1}{2}})^2}</math><br/> <math>= \frac{x^{\frac{1}{2}} - \frac{1}{2}x^{\frac{1}{2}} - \frac{5}{2}x^{-\frac{1}{2}}}{x}</math><br/> <math>= \frac{1}{2x^{\frac{1}{2}}} - \frac{5}{2x^{\frac{3}{2}}}</math></p> | <p>✓ <math>x^{\frac{1}{2}} + 5x^{-\frac{1}{2}}</math><br/>                 ✓ <math>\frac{1}{2}x^{-\frac{1}{2}}</math> or <math>\frac{1}{2\sqrt{x}}</math><br/>                 ✓ <math>-\frac{5}{2}x^{-\frac{3}{2}}</math> or <math>\frac{-5}{2\sqrt{x^3}}</math><br/>                 (3)</p> <p>✓ ✓ <math>\frac{1 \cdot x^{\frac{1}{2}} - \frac{1}{2}x^{-\frac{1}{2}}(x + 5)}{(x^{\frac{1}{2}})^2}</math><br/>                 ✓ <math>\frac{1}{2}x^{-\frac{1}{2}}</math> or <math>\frac{1}{2\sqrt{x}}</math> or<br/> <math>-\frac{5}{2}x^{-\frac{3}{2}}</math> or <math>\frac{-5}{2\sqrt{x^3}}</math><br/>                 (3)</p> |
| <p>8.3</p> | <p><math>f(x) = -3x^3 - 4x + 5</math><br/> <math>f'(x) = -9x^2 - 4</math><br/> <math>m_{\tan} = -9(-1)^2 - 4</math><br/> <math>= -13</math></p>  | <p>✓ <math>-9x^2</math><br/>                 ✓ <math>-4</math><br/>                 ✓ substitution of <math>x = -1</math><br/>                 ✓ answer<br/>                 (4)<br/> <b>[17]</b></p>   |

**QUESTION/VRAAG 9**

|   |   |  |
|---|---|--|
| <p>Given: <math>f(x) = x^3 + ax^2 + bx - 2</math><br/> <math>P(-1; -1)</math> and R are the turning points of <math>f</math>.</p>  |   |  |
| 9.1   | $f(x) = x^3 + ax^2 + bx - 2$ $-1 = (-1)^3 + a(-1)^2 + b(-1) - 2$ $2 = a - b \quad \dots(1)$ $f'(x) = 3x^2 + 2ax + b$ $0 = 3(-1)^2 + 2a(-1) + b$ $-3 = -2a + b \quad \dots(2)$ $-1 = -a \quad \dots(1) + (2)$ $a = 1$ $b = -1$ <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b></p> <ul style="list-style-type: none"> <li>• The = 0 must be explicitly stated</li> <li>• If the candidate starts with what is given and then prove (1 ; 1) is a TP: 0/6 marks</li> </ul> </div> | <p>✓ <math>-1 = (-1)^3 + a(-1)^2 + b(-1) - 2</math></p> <p>✓ <math>2 = a - b</math></p> <p>✓ <math>f'(x) = 3x^2 + 2ax + b</math></p> <p>✓ <math>f'(-1) = 0</math></p> <p>✓ <math>-3 = -2a + b</math></p> <p>✓ method</p> <p style="text-align: right;">(6)</p> |
| 9.2   | <p>R is a turning point of <math>f</math>, hence at R, <math>f'(x) = 0</math><br/>             i.e. <math>3x^2 + 2x - 1 = 0</math><br/> <math>(3x - 1)(x + 1) = 0</math></p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b><br/>Answer only: 1/3 marks</p> </div> $x = \frac{1}{3} \text{ or } -1$ $\therefore x = \frac{1}{3}$   | <p>✓ <math>f'(x) = 0</math></p> <p>✓ <math>f'(x) = 3x^2 + 2x - 1</math></p> <p>✓ selection of <math>x = \frac{1}{3}</math></p> <p style="text-align: right;">(3)</p>   |
| 9.3   | $(-1; 2f(-1) - 4)$ $= (-1; -6)$ <p><b>OR</b></p> $\left(\frac{1}{3}; 2f\left(\frac{1}{3}\right) - 4\right)$ $= \left(\frac{1}{3}; -\frac{226}{27}\right) \text{ or } (0,33; -8,37)$   | <p>✓ x-coordinate</p> <p>✓ y-coordinate</p> <p style="text-align: right;">(2)</p> <p>✓ x-coordinate</p> <p>✓ y-coordinate</p> <p style="text-align: right;">(2)</p> <p style="text-align: right;"><b>[11]</b></p>  |

**QUESTION/VRAAG 10**

|             |   |   |
|-------------|---|---|
| <p>10.1</p> | $\frac{dr}{dt} = -0,4t + 10$ $0 = -0,4t + 10$ $0,4t = 10$ $t = \frac{10}{0,4}$ $= 25 \text{ seconds}$ <p><b>OR</b></p> $t = -\frac{b}{2a}$ $= -\frac{10}{2(-0,2)}$ $= 25 \text{ seconds}$ <p><b>OR</b></p> $r = \frac{1}{5}t(50 - t)$ $0 = \frac{t}{5}(50 - t)$ $t = 0 \text{ or } t = 50$ <p>Fastest at <math>t = \frac{0 + 50}{2}</math></p> $t = 25 \text{ seconds}$ | $\checkmark \frac{dr}{dt} = -0,4t + 10$ $\checkmark 0 = -0,4t + 10$<br>$\checkmark t \text{ value}$ <p style="text-align: right;">(3)</p><br>$\checkmark t = -\frac{b}{2a}$ $\checkmark \text{substitution}$ $\checkmark t \text{ value}$ <p style="text-align: right;">(3)</p><br>$\checkmark t = 0 \text{ or } t = 50$ $\checkmark t = \frac{0 + 50}{2}$ $\checkmark t \text{ value}$ <p style="text-align: right;">(3)</p> |
| <p>10.2</p> | $-0,2t^2 + 10t = 0$ $t(-0,2t + 10) = 0$ $-0,2t + 10 = 0 \text{ or } t = 0$ $t = \frac{-10}{-0,2}$ $= 50 \text{ sec}$ <p>Hence the water stops flowing 50 seconds after it started.</p> <p><b>OR</b></p> $-0,2t^2 + 10t = 0$ $t^2 - 50t = 0$ $t(t - 50) = 0$ $t = 0 \text{ or } t = 50$ <p>Hence the water stops flowing 50 seconds after it started.</p>                | $\checkmark -0,2t^2 + 10t = 0$ $\checkmark \text{factors}$<br>$\checkmark \text{answer}$ <p style="text-align: right;">(3)</p><br>$\checkmark -0,2t^2 + 10t = 0$ $\checkmark \text{factors}$<br>$\checkmark \text{answer}$ <p style="text-align: right;">(3)</p> <p style="text-align: right;"><b>[6]</b></p>   |

**QUESTION/VRAAG 11**

|               |  |   |
|---------------|--|---|
| <p>11.1</p>   | <p> <math>y \geq 50</math><br/> <math>x \leq 80</math><br/> <math>y \leq 5x</math> OR <math>\frac{y}{5} \leq x</math><br/> <math>y \leq -\frac{5}{4}x + 200</math> OR <math>5x + 4y \leq 800</math> </p>   | <p> <math>\checkmark y \geq 50</math><br/> <math>\checkmark x \leq 80</math><br/> <math>\checkmark y \leq 5x</math><br/> <math>\checkmark 5x + 4y \leq 800</math> </p> <p style="text-align: right;">(4)</p>  |
| <p>11.2</p>   |  | <p> <math>\checkmark y = 50</math><br/> <math>\checkmark x = 80</math><br/> <math>\checkmark 5x + 4y = 800</math><br/> <math>\checkmark y = 5x</math> </p> <p><math>\checkmark</math> feasible region / gangbare gebied</p> <p style="text-align: right;">(5)</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> <p><b>NOTE:</b><br/>Maximum of 2 marks for vertical and horizontal lines</p> </div> |
| <p>11.3.1</p> | <p><math>P = 30x + 20y</math></p>  | <p><math>\checkmark P = 30x + 20y</math></p> <p style="text-align: right;">(1)</p>  |
| <p>11.3.2</p> | <p> <math>y = -\frac{3}{2}x + \frac{P}{20}</math><br/>             80 short-sleeved shirts and 100 long-sleeved shirts<br/>             (Point (80 ; 100))         </p>  | <p> <math>\checkmark</math> 80 short-sleeved shirts<br/> <math>\checkmark</math> 100 long-sleeved shirts         </p> <p style="text-align: right;">(2)</p>   |
| <p>11.4</p>   | <p> <math>P = ax + by</math><br/> <math>m = -\frac{a}{b}</math><br/> <math>-\frac{5}{4} = -\frac{a}{b}</math><br/> <math>\frac{a}{b} = \frac{5}{4}</math> </p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> <p><b>NOTE:</b><br/>Answer only: 2/2 marks</p> </div> | <p> <math>\checkmark -\frac{5}{4} = -\frac{a}{b}</math><br/> <math>\checkmark</math> answer         </p> <p style="text-align: right;">(2)<br/><b>[14]</b></p>  |

**TOTAL/TOTAAL: 150**

