



# basic education

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

## **NATIONAL SENIOR CERTIFICATE**

**GRADE 12**

**MATHEMATICS P1**

**NOVEMBER 2010**

**MEMORANDUM**

**MARKS: 150**

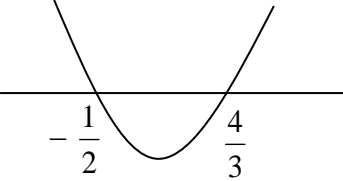
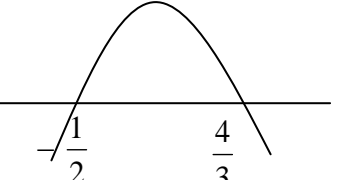
**This memorandum consists of 27 pages.**

**NOTE:**

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out version.
- Consistent Accuracy applies in all aspects of the marking memorandum.

**QUESTION 1**

<p>1.1.1</p>	$(3 - x)(5 - x) = 3$ $15 - 8x + x^2 = 3$ $x^2 - 8x + 12 = 0$ $(x - 6)(x - 2) = 0$ $x = 6 \text{ or } x = 2$ <p><b>OR</b></p> $(3 - x)(5 - x) = 3$ $15 - 8x + x^2 = 3$ $x^2 - 8x + 12 = 0$ $(x - 4)^2 = 4$ $x - 4 = 2 \text{ or } x - 4 = -2$ $x = 6 \text{ or } x = 2$	<div style="border: 1px solid black; padding: 5px;"> <p><b>Note:</b> If answer only : Full Marks</p> <p>If the candidate makes it a linear equation, no marks</p> <p>For only 1 answer: 1 / 3</p> </div>	<p>✓ expansion ✓ factors ✓ answers (3)</p> <p>✓ expansion ✓ completed square form ✓ answers (3)</p>
<p>1.1.2</p>	$3x^2 = 2(x + 2)$ $3x^2 - 2x - 4 = 0$ $x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-4)}}{2(3)}$ $= \frac{2 \pm \sqrt{52}}{6}$ $x = 1,54 \text{ or } -0,87$ <p><b>OR</b></p> $3x^2 = 2(x + 2)$ $3x^2 - 2x - 4 = 0$ $x^2 - \frac{2}{3}x = \frac{4}{3}$ $\left(x - \frac{1}{3}\right)^2 = \frac{4}{3} + \frac{1}{9}$ $\left(x - \frac{1}{3}\right)^2 = \frac{13}{9}$ $x - \frac{1}{3} = \pm \frac{\sqrt{13}}{3}$ $x = \frac{1 \pm \sqrt{13}}{3}$ $x = 1,54 \text{ or } -0,87$	<div style="border: 1px solid black; padding: 5px;"> <p><b>Note:</b> No penalty for incorrect rounding off of answers.</p> <p>Substitution into incorrect formula, no marks</p> </div>	<p>✓ standard form ✓✓ substitution ✓ answers (4)</p> <p>✓ expansion ✓ completed square ✓ <math>\pm \frac{\sqrt{13}}{3}</math> ✓ answers (4)</p>

<p>1.1.3</p>	<p> <math>4 + 5x &gt; 6x^2</math>  <math>0 &gt; 6x^2 - 5x - 4</math>  <math>0 &gt; (3x - 4)(2x + 1)</math>                      critical values: <math>x = \frac{5 \pm \sqrt{121}}{12}</math>  <math>x = -\frac{1}{2}</math> or <math>\frac{4}{3}</math> </p> <p> <math>+</math>   <math>0</math>   <math>-</math>   <math>0</math>   <math>+</math>   <b>OR</b>    </p> <p> <math>-\frac{1}{2} &lt; x &lt; \frac{4}{3}</math>   <b>OR</b>   <math>x \in \left(-\frac{1}{2}; \frac{4}{3}\right)</math>   <b>OR</b>   <math>-\frac{1}{2} &lt; x</math> and <math>x &lt; \frac{4}{3}</math> </p> <p><b>OR</b></p> <p> <math>-6x^2 + 5x + 4 &gt; 0</math>  <math>(-3x + 4)(2x + 1) &gt; 0</math>                      critical values: <math>-\frac{1}{2}</math> and <math>\frac{4}{3}</math> </p> <p> <math>-</math>   <math>0</math>   <math>+</math>   <math>0</math>   <math>-</math>   <b>OR</b>    </p> <p> <math>-\frac{1}{2} &lt; x &lt; \frac{4}{3}</math>   <b>OR</b>   <math>x \in \left(-\frac{1}{2}; \frac{4}{3}\right)</math>   <b>OR</b>   <math>-\frac{1}{2} &lt; x</math> and <math>x &lt; \frac{4}{3}</math> </p>	<p>                     ✓ correct inequality                      ✓ factors                      ✓ critical values  <math>-\frac{1}{2}</math> and <math>\frac{4}{3}</math> </p> <p>                     ✓ answer                 </p> <p>(4)</p> <p>                     ✓ correct inequality                      ✓ factors                      ✓ critical values  <math>-\frac{1}{2}</math> and <math>\frac{4}{3}</math> </p> <p>                     ✓ answer                 </p> <p>(4)</p>
<p>1.2</p>	<p> <math>3y = 2x</math>  <math>y = \frac{2x}{3}</math>  <math>x^2 - \left(\frac{2x}{3}\right)^2 + 2x - \left(\frac{2x}{3}\right) = 1</math>   <b>OR</b>   <math>x^2 - \left(\frac{2x}{3}\right)^2 + 2x - \left(\frac{2x}{3}\right) = 1</math>  <math>x^2 - \frac{4x^2}{9} + 2x - \frac{2x}{3} = 1</math>   <math>\frac{5x^2}{9} + \frac{4x}{3} - 1 = 0</math>  <math>9x^2 - 4x^2 + 18x - 6x = 9</math>   <math>x = \frac{-\frac{4}{3} \pm \sqrt{\left(\frac{4}{3}\right)^2 - 4\left(\frac{5}{9}\right)(-1)}}{2\left(\frac{5}{9}\right)}</math>  <math>5x^2 + 12x - 9 = 0</math>   <math>= \frac{-\frac{4}{3} \pm \sqrt{\frac{16}{9} + \frac{20}{9}}}{\frac{10}{9}}</math>  <math>(5x - 3)(x + 3) = 0</math>  <math>x = \frac{3}{5}</math> or <math>x = -3</math>   <math>x = 0,6</math> or <math>x = -3</math> </p>	<p>                     ✓ <math>y = \frac{2x}{3}</math>                      ✓ substitution                      ✓ simplification                      ✓ standard forms                      ✓ factors or substitution into correct formula                      ✓ x-answers                      ✓ y-answers                 </p>

	<p> <math>y = \frac{2}{5}</math> or <math>y = -2</math> </p> <p> <math>(x ; y) = \left(\frac{3}{5}; \frac{2}{5}\right)</math> or <math>(-3 ; -2)</math> </p> <p><b>OR</b></p> <p> <math>3y = 2x</math> </p> <p> <math>x^2 - y^2 + 2x - y = 1</math> </p> <p> <math>4x^2 - 4y^2 + 8x - 4y = 4</math> </p> <p> <math>(2x)^2 - 4y^2 + 8x - 4y = 4</math> </p> <p> <math>(3y)^2 - 4y^2 + 4(3y) - 4y = 4</math> </p> <p> <math>9y^2 - 4y^2 + 8y = 4</math> </p> <p> <math>5y^2 + 8y - 4 = 0</math> </p> <p> <math>(5y - 2)(y + 2) = 0</math> </p> <p> <math>y = \frac{2}{5}</math> or <math>y = -2</math> </p> <p> <math>x = \frac{3}{5}</math> or <math>x = -3</math> </p> <p> <math>(x ; y) = \left(\frac{3}{5}; \frac{2}{5}\right)</math> or <math>(-3 ; -2)</math> </p> <p><b>OR</b></p> <p> <math>3y = 2x</math> </p> <p> <math>x = \frac{3y}{2}</math> </p> <p> <math>\left(\frac{3y}{2}\right)^2 - y^2 + 2\left(\frac{3y}{2}\right) - y = 1</math> </p> <p> <math>\frac{9y^2}{4} - y^2 + 3y - y = 1</math> </p> <p> <math>9y^2 - 4y^2 + 8y = 4</math> </p> <p> <math>5y^2 + 8y - 4 = 0</math> </p> <p> <math>(5y - 2)(y + 2) = 0</math> </p> <p> <math>y = \frac{2}{5}</math> or <math>y = -2</math> </p> <p> <math>x = \frac{3}{5}</math> or <math>x = -3</math> </p> <p> <math>(x ; y) = \left(\frac{3}{5}; \frac{2}{5}\right)</math> or <math>(-3 ; -2)</math> </p>	<p style="text-align: right;">(7)</p> <p>                 ✓ simplification of original quadratic                  ✓ substitution  <math>2x = 3y</math> </p> <p>                 ✓ simplification                  ✓ standard form             </p> <p>                 ✓ factors or substitution into correct formula                  ✓ y-answers                  ✓ x-answers             </p> <p style="text-align: right;">(7)</p> <p>                 ✓ <math>x = \frac{3y}{2}</math> </p> <p>                 ✓ substitution                  ✓ simplification                  ✓ standard forms             </p> <p>                 ✓ factors or substitution into correct formula                  ✓ y-answers                  ✓ x-answers             </p> <p style="text-align: right;">(7)</p>
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**Note:**  
If mathematical breakdown eg. if  $y = 2x - 3$  is used, max 3 / 7

<p>1.3</p> $\frac{5^{2007} + 5^{2010}}{5^{2008} + 5^{2009}}$ $= \frac{5^{2007} + 5^{2007} \cdot 5^3}{5^{2008} + 5^{2008} \cdot 5}$ $= \frac{5^{2007}(1 + 5^3)}{5^{2008}(1 + 5)}$ $= \frac{126}{5 \times 6}$ $= \frac{126}{30}$ $= \frac{21}{5}$ $= 4 \frac{1}{5}$ $\approx 4$ <p><b>OR</b></p> $\frac{5^{2007} + 5^{2010}}{5^{2008} + 5^{2009}} \quad (\text{divide each term by } 5^{2007})$ $= \frac{5^{2007} + 5^{2007} \cdot 5^3}{5^{2007} \cdot 5 + 5^{2007} \cdot 5^2}$ $= \frac{1 + 5^3}{5 + 5^2}$ $= \frac{126}{30}$ $\approx 4$ <p><b>OR</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%; vertical-align: top;"> <p>let <math>x = 2009</math></p> <math display="block">\frac{5^{x-2} + 5^{x+1}}{5^{x-1} + 5^x}</math> <math display="block">= \frac{5^x(5^{-2} + 5)}{5^x(5^{-1} + 1)}</math> <math display="block">= \frac{1}{25} + 5</math> <math display="block">= \frac{1}{5} + 1</math> <math display="block">= \frac{21}{5}</math> <math display="block">= 4 \frac{1}{5}</math> <math display="block">\approx 4</math> </td> <td style="width: 33%; vertical-align: top; text-align: center;"> <p><b>OR</b></p> </td> <td style="width: 33%; vertical-align: top;"> <p>let <math>x = 2007</math></p> <math display="block">\frac{5^x + 5^{x+3}}{5^{x+1} + 5^{x+2}}</math> <math display="block">= \frac{5^x(1 + 5^3)}{5^x(5 + 5^2)}</math> <math display="block">= \frac{1 + 125}{5 + 25}</math> <math display="block">= \frac{126}{30}</math> <math display="block">= \frac{21}{5}</math> <math display="block">= 4 \frac{1}{5}</math> <math display="block">\approx 4</math> </td> </tr> <tr> <td style="width: 33%; vertical-align: top;"> <p>let <math>x = 2010</math></p> <math display="block">\frac{5^{x-3} + 5^x}{5^{x-2} + 5^{x-1}}</math> <math display="block">= \frac{5^x(5^{-3} + 1)}{5^x(5^{-2} + 5^{-1})}</math> <math display="block">= \frac{\frac{1}{125} + 1}{\frac{1}{25} + \frac{1}{5}}</math> <math display="block">= \frac{126}{30}</math> <math display="block">= \frac{21}{5}</math> <math display="block">= 4 \frac{1}{5}</math> <math display="block">\approx 4</math> </td> <td style="width: 33%;"></td> <td style="width: 33%;"></td> </tr> </table>	<p>let <math>x = 2009</math></p> $\frac{5^{x-2} + 5^{x+1}}{5^{x-1} + 5^x}$ $= \frac{5^x(5^{-2} + 5)}{5^x(5^{-1} + 1)}$ $= \frac{1}{25} + 5$ $= \frac{1}{5} + 1$ $= \frac{21}{5}$ $= 4 \frac{1}{5}$ $\approx 4$	<p><b>OR</b></p>	<p>let <math>x = 2007</math></p> $\frac{5^x + 5^{x+3}}{5^{x+1} + 5^{x+2}}$ $= \frac{5^x(1 + 5^3)}{5^x(5 + 5^2)}$ $= \frac{1 + 125}{5 + 25}$ $= \frac{126}{30}$ $= \frac{21}{5}$ $= 4 \frac{1}{5}$ $\approx 4$	<p>let <math>x = 2010</math></p> $\frac{5^{x-3} + 5^x}{5^{x-2} + 5^{x-1}}$ $= \frac{5^x(5^{-3} + 1)}{5^x(5^{-2} + 5^{-1})}$ $= \frac{\frac{1}{125} + 1}{\frac{1}{25} + \frac{1}{5}}$ $= \frac{126}{30}$ $= \frac{21}{5}$ $= 4 \frac{1}{5}$ $\approx 4$			<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p><b>Note:</b> If the candidate leaves the answer as 4,2 <b>max 2 / 3 marks</b></p> <p>Answer only of 4,2 <b>0 / 3 marks</b></p> </div> <p>✓ <math>\frac{5^{2007} + 5^{2007} \cdot 5^3}{5^{2008} \cdot 5 + 5^{2008} \cdot 5^2}</math></p> <p>✓ simplification to <math>\frac{1 + 5^3}{5 + 5^2}</math> or <math>\frac{126}{30}</math> or <math>\frac{21}{5}</math></p> <p>✓ answer = 4 (3)</p> <p>✓ <math>\frac{5^{2007} + 5^{2007} \cdot 5^3}{5^{2007} \cdot 5 + 5^{2007} \cdot 5^2}</math></p> <p>✓ simplification to <math>\frac{1 + 5^3}{5 + 5^2}</math> or <math>\frac{126}{30}</math> or <math>\frac{21}{5}</math></p> <p>✓ answer = 4</p> <p>✓ <math>\frac{5^{x-2} + 5^{x+1}}{5^{x-1} + 5^x}</math> or <math>\frac{5^x + 5^{x+3}}{5^{x+1} + 5^{x+2}}</math> or <math>\frac{5^{x-3} + 5^x}{5^{x-2} + 5^{x-1}}</math></p> <p>✓ simplification to <math>\frac{1}{25} + 5</math> or <math>\frac{1}{5} + 1</math> or <math>\frac{1 + 125}{5 + 25}</math> or <math>\frac{\frac{1}{125} + 1}{\frac{1}{25} + \frac{1}{5}}</math></p> <p>✓ answer = 4 (3)</p> <p style="text-align: right;"><b>[21]</b></p>
<p>let <math>x = 2009</math></p> $\frac{5^{x-2} + 5^{x+1}}{5^{x-1} + 5^x}$ $= \frac{5^x(5^{-2} + 5)}{5^x(5^{-1} + 1)}$ $= \frac{1}{25} + 5$ $= \frac{1}{5} + 1$ $= \frac{21}{5}$ $= 4 \frac{1}{5}$ $\approx 4$	<p><b>OR</b></p>	<p>let <math>x = 2007</math></p> $\frac{5^x + 5^{x+3}}{5^{x+1} + 5^{x+2}}$ $= \frac{5^x(1 + 5^3)}{5^x(5 + 5^2)}$ $= \frac{1 + 125}{5 + 25}$ $= \frac{126}{30}$ $= \frac{21}{5}$ $= 4 \frac{1}{5}$ $\approx 4$					
<p>let <math>x = 2010</math></p> $\frac{5^{x-3} + 5^x}{5^{x-2} + 5^{x-1}}$ $= \frac{5^x(5^{-3} + 1)}{5^x(5^{-2} + 5^{-1})}$ $= \frac{\frac{1}{125} + 1}{\frac{1}{25} + \frac{1}{5}}$ $= \frac{126}{30}$ $= \frac{21}{5}$ $= 4 \frac{1}{5}$ $\approx 4$							

**QUESTION 2**

<p>2.1</p>	$\sum_{n=1}^{20} 3^{n-2}$ $= \frac{1}{3} + 1 + 3 + \dots \text{ to 20 terms}$ $= \frac{1}{3} \frac{(3^{20} - 1)}{3 - 1} ; r = 3; n = 20$ $= \frac{3^{20} - 1}{6}$ $= 581130733,33 \quad \text{OR} \quad 581130733\frac{1}{3} \quad \text{OR} \quad 581130733,3$ <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Note:</b> If leave only as</p> <math display="block">\frac{1}{3} + 1 + 3 + 9 + 27 + 81 + 243 + 729 + 2187 + 6561 + 19683</math> <math display="block">+ 59049 + 177147 + 531441 + 1594323 + 4782969</math> <math display="block">+ 14348907 + 43046721 + 129140163 + 387420489</math> <p><b>only</b>, then 2 / 4</p> <p><b>Note:</b> The 20<sup>th</sup> term is <b>387 420 489</b></p> <p><b>Answer only:</b> 3 / 4 marks</p> </div>	<p>✓ <math>a = \frac{1}{3}</math></p> <p>✓ <math>r = 3</math></p> <p>✓ <math>n = 20</math></p> <p>✓ answer (4)</p>
<p>2.2.1</p>	$5x ; x^2 ; \frac{x^3}{5} ; \dots$ $r = \frac{x}{5}$ $-1 < \frac{x}{5} < 1$ $-5 < x < 5$ <p><b>Answer can be written as</b> <math>x \in (-5 ; 5)</math></p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Note:</b> If <math>-1 &lt; x &lt; 1</math> 1 mark</p> <p><b>Note:</b> If answer is <math>-5 \leq x \leq 5</math> then 2 / 3</p> </div>	<p>✓ <math>r = \frac{x}{5}</math> or <math>\frac{x^2}{5x}</math></p> <p>✓ <math>-1 &lt; r &lt; 1</math></p> <p>✓ answer (3)</p>
<p>2.2.2</p>	$r = \frac{2}{5} \text{ and } a = 10$ $S_{\infty} = \frac{10}{1 - \frac{2}{5}}$ $= \frac{50}{3} \text{ or } 16,67$	<p>✓ <math>a = 10</math></p> <p>✓ answer (2)</p>

<p>2.3.1</p>	$T_n = 20 + 3(n - 1)$ $101 = 20 + (n - 1)3$ $84 = 3n$ $n = 28$ <p><b>OR</b></p> $T_n = 3n + 17$ $101 = 3n + 17$ $84 = 3n$ $n = 28$	<p><b>Note:</b> If <math>n = -\frac{17}{3}</math> Then 1 / 2 marks</p> <p><b>Answer only:</b> Full marks</p>		<p>✓ <math>101 = 20 + 3(n - 1)</math> or <math>101 = 3n + 17</math> ✓ answer (2)</p> <p>✓ substitution ✓ answer (2)</p>
<p>2.3.2</p>	<p>23 + 29 + ... to 14 terms</p> $= \frac{14}{2} [2(23) + (14 - 1)6] \quad \text{OR} \quad \frac{14}{2} [23 + 101]$ $= 868$ <p><b>OR</b></p> <p>Even numbers = 20 ; 26 ; ... ; 98</p> $T_n = 6n + 14 \qquad T_n = 20 + (n - 1)6$ $98 = 6n + 14 \qquad \text{OR} \qquad 98 = 20 + (n - 1)6$ <p><b>OR</b></p> $84 = 6n \qquad 84 = 6n$ $14 = n \qquad 14 = n$ $S_{\text{remaining}} = \frac{28}{2} [2(20) + (27)(3)] - \frac{14}{2} [2(20) + (13)(6)]$ $= 14(121) - 7(118)$ $= 1694 - 826$ $= 868$ <p><b>OR</b></p> <p>Sequence is 20; 23; 26; 29; 32; 35; 38; 41; 44; 47; 50; 53; 56; 59; 62; 65; 68; 71; 74; 77; 80; 83; 86; 89; 92; 95; 98; 101</p> <p>Sum of odd numbers <math>= 23 + 29 + 35 + 41 + 47 + 53 + 59 + 65 + 71 + 77 + 83 + 89 + 95 + 101</math> <math>= 868</math></p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p><b>Note:</b> If “to 14 terms” is left out, do not penalise</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p><b>Note:</b> If incorrect value for <math>n</math>, max 4 / 6</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p><b>Note:</b> If incorrect formula, max 2 / 6</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p><b>Note:</b> If the candidate only works out the even numbers i.e. 826, then 3 / 6 marks</p> <p>If only 1694 max 1 / 6 marks</p> </div>		<p>✓ 23 + 29 + ... ✓ <math>a = 23</math> ✓ <math>n = 14</math></p> <p>✓ <math>d = 6</math> or <math>l = 101</math> ✓ substitution into correct formula ✓ answer (6)</p> <p><b>OR</b></p> <p>✓ <math>98 = 6n + 14</math> or <math>98 = 20 + (n - 1)</math> ✓ <math>14 = n</math></p> <p>✓ substitution into correct formula ✓ 1694</p> <p>✓ 826 ✓ answer (6)</p> <p>Full marks (6)</p> <p><b>[17]</b></p>

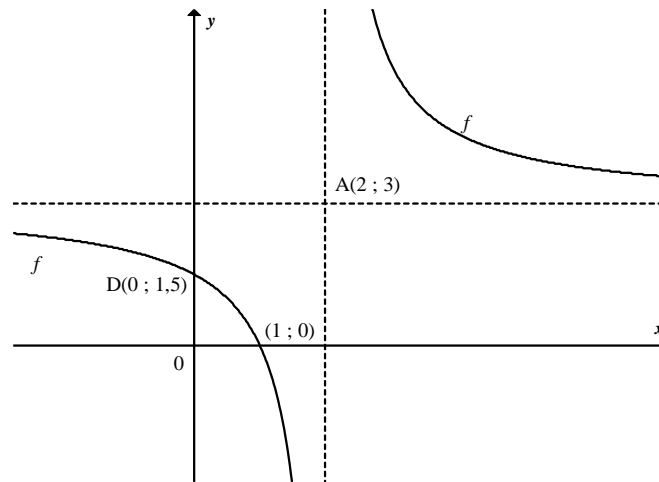
**QUESTION 3**

<p>3.1</p>	<p>First difference : 5; <math>x - 9</math>; <math>37 - x</math>                  Second difference : <math>x - 14</math>; <math>- 2x + 46</math>  <math>x - 14 = 46 - 2x</math>  <math>3x = 60</math>  <math>x = 20</math></p> <p><b>OR</b></p> <p><math>(x - 9) + (x - 14) = 37 - x</math>  <math>2x - 23 = 37 - x</math>  <math>3x = 60</math>  <math>x = 20</math></p> <p><b>OR</b></p> <p><math>(x - 9) - 5 = (37 - x) - (x - 9)</math>  <math>x - 14 = -2x + 46</math>  <math>3x = 60</math>  <math>x = 20</math></p> <p style="text-align: center;"><b>OR</b></p> <p><math>x + (x - 9) + (x - 14) = 37</math>  <math>3x - 23 = 37</math>  <math>3x = 60</math>  <math>x = 20</math></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><b>Note:</b> Answer only: <b>Full Marks</b></p> </div>	<p>✓ first differences 5; <math>x - 9</math>; <math>37 - x</math> ✓ seconds difference ✓ answer (3)</p> <p>✓ equating ✓ manipulation ✓ answer (3)</p> <p>✓ first differences 5; <math>x - 9</math>; <math>37 - x</math> ✓ equating ✓ answer (3)</p>
<p>3.2</p>	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><b>Note:</b> If <math>x</math> is incorrect in 3.1 then <b>max 2 / 4 marks</b></p> </div>	<p>✓ <math>a = 3</math> ✓ <math>T_n = 3n^2 + bn + c</math></p> <p>✓ <math>b = -4</math> ✓ <math>c = 5</math> (4)</p>





**QUESTION 4**



<p>4.1</p>	<p><math>x = 2</math> <math>y = 3</math></p> <p><b>OR</b> <math>x</math>-asymptote = 2 <math>y</math>-asymptote = 3</p> <p>If <math>x = p ; y = q</math> then 1 mark</p> <p><b>Note:</b> If the candidate just writes down the number 2 or 3 or just coordinates (2 ; 3), then no marks</p>	<p>✓ answer ✓ answer (2)</p>
<p>4.2</p>	<p><math>f(x) = \frac{a}{x-2} + 3</math></p> <p><math>0 = \frac{a}{1-2} + 3</math></p> <p><math>0 = -a + 3</math></p> <p><math>a = 3</math></p> <p><math>f(x) = \frac{3}{x-2} + 3</math></p> <p><b>OR</b></p> <p><math>y = \frac{a}{x-2} + 3</math></p> <p><math>y - 3 = \frac{a}{x-2}</math></p> <p><math>(x-2)(y-3) = a</math></p> <p>But (1;0) lies on the graph <math>\therefore (-1)(-3) = a = 3</math> <math>\therefore (x-2)(y-3) = 3</math></p>	<p>✓ subs in of asymptotes ✓ subs in (1 ; 0)</p> <p>✓ answer (3)</p> <p>✓ equation ✓ subs in (1 ; 0) ✓ answer (3)</p>
<p>4.3</p>	<p>When <math>x = 0, y = \frac{3}{0-2} + 3</math> <math>= \frac{3}{2}</math></p> <p><math>D\left(0; \frac{3}{2}\right)</math></p>	<p>If asymptotes swopped: <math>x = 0</math></p> <p><math>y = \frac{4}{0-3} + 2</math></p> <p><math>y = \frac{2}{3}</math></p> <p><math>D\left(0; \frac{2}{3}\right)</math></p> <p>✓ <math>x = 0</math> ✓ <math>y = \frac{3}{2}</math> (2)</p>

<p>4.4</p>	$m_{AD} = \frac{3-1,5}{2-0}$ $= \frac{3}{4}$ $y = \frac{3}{4}x + \frac{3}{2}$ <p><b>OR</b></p> $4y = 3x + 6$ <p><b>OR</b></p> $y = mx + \frac{3}{2}$ $3 = m(2) + \frac{3}{2}$ $m = \frac{3}{4}$ $y = \frac{3}{4}x + \frac{3}{2}$	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>If asymptotes swopped:</p> <math display="block">m_{AD} = \frac{3-\frac{2}{3}}{2-0}</math> <math display="block">= \frac{7}{3} \times \frac{1}{2}</math> <math display="block">= \frac{7}{6}</math> <math display="block">y = \frac{7}{6}x + \frac{2}{3}</math> </div> <p>✓ substitution into gradient</p> <p>✓ <math>\frac{3}{4}</math></p> <p>✓ answer (3)</p> <p>✓ substitution of point (2 ; 3) and <math>c = \frac{3}{2}</math></p> <p>✓ <math>\frac{3}{4}</math></p> <p>✓ answer (3)</p>
<p>4.5</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px; text-align: center;"> <p><b>Answer only: Full Marks</b></p> </div> $\frac{p+0}{2} = 2$ $p = 4$ $\frac{q+\frac{3}{2}}{2} = 3$ $q = 4\frac{1}{2}$ <p>Other point of intersection is <math>\left(4; 4\frac{1}{2}\right)</math></p> <p><b>OR</b></p> <p>By symmetry the rule to calculate the point of intersection is</p> $(x ; y) \rightarrow \left(x+2 ; y+\frac{3}{2}\right)$ <p>Other point of intersection is</p> $\left(2+2 ; 3+\frac{3}{2}\right)$ $= \left(4 ; 4\frac{1}{2}\right)$ <div style="border: 1px solid black; padding: 5px; margin-top: 10px; text-align: center;"> <p>To help with applying CA the y-coordinate will be <math>3 + (3 - y)</math></p> </div>	<p>✓ <math>\frac{p+0}{2} = 2</math></p> <p>✓ <math>\frac{q+\frac{3}{2}}{2} = 3</math></p> <p>✓ <math>x = 4</math></p> <p>✓ <math>y = 4\frac{1}{2}</math> (4)</p> <p>✓✓ x-answer</p> <p>✓✓ y-answer (4)</p>

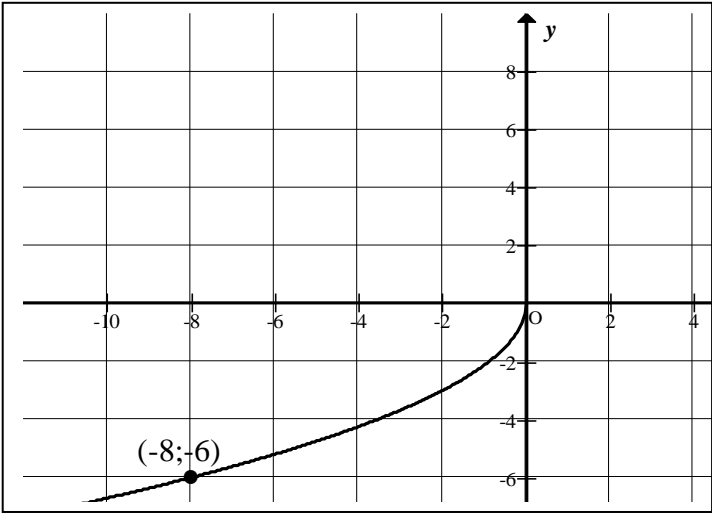
	<p><b>OR</b></p> $\frac{3}{4}x + \frac{3}{2} = \frac{3}{x-2} + 3$ $3x(x-2) + 6(x-2) = 12 + 12(x-2)$ $3x^2 - 6x + 6x - 12 = 12 + 12x - 24$ $3x^2 - 12x = 0$ $3x(x-4) = 0$ $x = 0 \text{ and } x = 4$ <p>Other point of intersection is <math>\left(4; 4\frac{1}{2}\right)</math></p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: 80%;"> <p><b>Note:</b> If the candidate does not select the <math>x</math>-value greater than 2 i.e. a realistic answer, max 3 / 4 marks</p> </div> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: 80%;"> <p>If asymptotes swapped:</p> <math display="block">\frac{7}{6}x + \frac{2}{3} = \frac{4}{x-3} + 2</math> <math display="block">7x(x-3) + 4(x-3) = 4(6) + 2(6)(x-3)</math> <math display="block">7x^2 - 29x = 0</math> <math display="block">x(7x-29) = 0</math> <math display="block">x = 0 \text{ or } x = \frac{29}{7}</math> <p>Other point of intersection is <math>\left(\frac{29}{7}; \frac{11}{2}\right)</math></p> </div>	<p>✓ equating</p> <p>✓ standard form</p> <p>✓ <math>x</math>-values</p> <p>✓ <math>y</math>-value</p> <p style="text-align: right;">(4)</p> <p style="text-align: right;"><b>[14]</b></p>
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**QUESTION 5**

<p>5.1</p>	<p><math>f(x) = 4^{-x} - 2</math></p> <p><math>y</math>-intercept: <math>x = 0; y = 4^0 - 2 = -1; (0; -1)</math></p> <p><math>x</math>-intercept:</p> $4^{-x} - 2 = 0$ $4^{-x} = 2$ $\log 4^{-x} = \log 2$ $-x = \frac{\log 2}{\log 4} \quad \text{OR} \quad -x = \frac{\log 2}{2 \log 2}$ $x = -\frac{1}{2}$ <p><math>x</math>-intercept is <math>\left(-\frac{1}{2}; 0\right)</math></p>	<p>✓✓ <math>y</math>-intercept</p> <p>✓✓ <math>x</math>-intercept</p> <p style="text-align: right;">(4)</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Note:</b> No penalty if the answer is not left as a coordinate.</p> </div>
<p>5.2</p>	<p><math>y = -2</math></p>	<p>✓ equation</p> <p style="text-align: right;">(1)</p>

<p>5.3</p>		<ul style="list-style-type: none"> <li>✓ asymptote</li> <li>✓ y-intercept or x-intercept</li> <li>✓ shape (decreasing)</li> </ul> <p style="text-align: right;">(3)</p>
<p>5.4</p>	<p><math>g(x) = 4^{-x} - 2 + 2</math>  <math>g(x) = 4^{-x}</math></p> <p><b>OR</b> <math>g(x) = \left(\frac{1}{4}\right)^x</math></p> <p><b>OR</b> <math>g(x) = 2^{-2x}</math></p> <p><b>OR</b> <math>g(x) = \left(\frac{1}{2}\right)^{2x}</math></p>	<p>✓ equation</p> <p style="text-align: right;">(1)</p>
<p>5.5</p>	<p><math>4^{-x} - 2 = 3</math>  <math>4^{-x} = 5</math>  <math>-x \log 4 = \log 5</math>  <math>x = -\frac{\log 5}{\log 4}</math> <b>OR</b> <math>x = -\log_4 5</math> <b>OR</b> <math>x = \log_{\frac{1}{4}} 5</math> <b>OR</b> <math>x = \log_4 \frac{1}{5}</math></p> <p><b>OR</b> <math>x = -1,16</math> <b>OR</b> <math>x = \frac{\log 5}{\log \frac{1}{4}}</math> <b>OR</b> <math>x = \frac{\log \frac{1}{5}}{\log 4}</math></p>	<ul style="list-style-type: none"> <li>✓ <math>4^{-x} = 5</math></li> <li>✓ <math>-x \log 4 = \log 5</math></li> </ul> <p>✓ answer</p> <p style="text-align: right;">(3) [12]</p>

**QUESTION 6**

<p>6.1</p>	$f(x) = ax^2$ $-8 = a(-6)^2$ $-8 = 36a$ $a = -\frac{8}{36}$ <p><b>OR</b></p> $a = -\frac{2}{9}$	<p>✓ substitution</p> <p>✓ answer (2)</p>
<p>6.2</p>	$f(x): y = -\frac{2}{9}x^2$ $x = -\frac{2}{9}y^2$ $9x = -2y^2$ $-\frac{9x}{2} = y^2$ $y = \pm\sqrt{\frac{-9x}{2}}, \text{ since } y \leq 0$ $y = -\sqrt{\frac{-9x}{2}} \text{ OR } y = -3\sqrt{\frac{-x}{2}}$ <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p><b>Note:</b> If candidate does not substitute the value of <math>a</math> the answer is <math>y = -\sqrt{\frac{x}{a}}</math> then 2 / 3 marks</p> </div>	<p>✓ swop <math>x</math> and <math>y</math></p> <p>✓ <math>y^2 = -\frac{9x}{2}</math> or <math>y = \pm\sqrt{\frac{-9x}{2}}</math></p> <p>✓ <math>y = -\sqrt{\frac{-9x}{2}}</math> (3)</p>
<p>6.3</p>	<p><math>y \leq 0</math></p> <p><b>OR</b></p> <p><math>y \in (-\infty; 0]</math></p>	<p>✓ answer (1)</p>
<p>6.4</p>		<p>✓ shape (third quadrant) (concave upward)</p> <p>✓ Any point other than (0 ; 0) that lies on the graph</p> <p>Point corresponding from original graph will be (- 8 ; - 6) (2)</p>

<p>6.5</p>	<p> <math>y = -f^{-1}(x)</math>  <math>= \sqrt{\frac{-9x}{2}}</math> </p> <p><b>OR</b></p> <p> <math>y = -\frac{2}{9}x^2</math> </p> <p>Reflection in <math>y = x</math>: <math>x = -\frac{2}{9}y^2</math></p> <p><math>-\frac{9}{2}x = y^2</math></p> <p><math>y = -\sqrt{-\frac{9x}{2}}</math></p> <p>Reflection about y-axis: <math>y = \sqrt{-\frac{9x}{2}}</math></p>	<p> <math>y = -f^{-1}(x)</math>  <math>= 3\sqrt{\frac{-x}{2}}</math> </p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p><b>Note:</b> If candidate has <math>(x ; y) \rightarrow (y ; -x)</math> then 2 / 3 marks</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p><b>Note:</b> If candidate does not substitute the value of <math>a</math> the answer is <math>y = \sqrt{\frac{x}{a}}</math> then full marks</p> </div>	<p>✓✓ <math>-f^{-1}(x)</math></p> <p>✓ answer (3)</p> <p>✓ <math>x = -\frac{2}{9}y^2</math></p> <p>✓ <math>y = -\sqrt{-\frac{9x}{2}}</math></p> <p>✓ <math>y = \sqrt{-\frac{9x}{2}}</math></p> <p>(3) <b>[11]</b></p>
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**QUESTION 7**

<p>7.1</p>	$A = P(1+i)^n$ $2P = P\left(1 + \frac{r}{4}\right)^{6 \times 4}$ $2 = \left(1 + \frac{r}{4}\right)^{24}$ $1 + \frac{r}{4} = 2^{\frac{1}{24}}$ $r = 4\left(2^{\frac{1}{24}} - 1\right)$ $r = 4\left(2^{\frac{1}{24}}\right) - 4$ $r = 0,1172 \dots$ <p>rate = 11,72% p.a. compounded quarterly</p> <p><b>OR</b></p> $A = P(1+i)^n$ $2P = P\left(1 + \frac{r}{400}\right)^{6 \times 4}$ $2 = \left(1 + \frac{r}{400}\right)^{24}$ $1 + \frac{r}{400} = 2^{\frac{1}{24}}$ $r = 400\left(2^{\frac{1}{24}} - 1\right)$ $r = 400\left(2^{\frac{1}{24}}\right) - 400$ $r = 11,72\% \text{ p.a.}$	<p>✓ 2P</p> <p>✓ <math>\frac{r}{4}</math> and 24</p> <p>✓ <math>1 + \frac{r}{4} = 2^{\frac{1}{24}}</math></p> <p>✓ <math>r = 4\left(2^{\frac{1}{24}}\right) - 4</math></p> <p>✓ answer (5)</p> <p>✓ 2P</p> <p>✓ <math>\frac{r}{400}</math> and 24</p> <p>✓ <math>1 + \frac{r}{400} = 2^{\frac{1}{24}}</math></p> <p>✓ <math>r = 400\left(2^{\frac{1}{24}}\right) - 400</math></p> <p>✓ answer (5)</p>
<p>7.2.1</p>	$A = 10000\left(1 + \frac{0,095}{12}\right)^5$ <p>= R 10 402,15</p>	<p>✓ substitution in correct formula</p> <p>✓ answer (2)</p>



7.2.2	$10402,15 = \frac{450 \left[ 1 - \left( 1 + \frac{0,095}{12} \right)^{-n} \right]}{0,095}$ $0,183000787 = 1 - \left( 1 + \frac{0,095}{12} \right)^{-n}$ $\left( 1 + \frac{0,095}{12} \right)^{-n} = 0,816999213$ $\log \left( 1 + \frac{0,095}{12} \right)^{-n} = \log 0,816999213$ $-n \log \left( 1 + \frac{0,095}{12} \right) = \log 0,816999213 \dots$ $n = 25,63151282 \dots$ $n = 25,63 \text{ months}$ $n = 26$ <p>Accept: <math>n = 31</math> (because of first 5 months)</p> <p><b>OR</b></p> $10402,15 \left( 1 + \frac{0,095}{12} \right)^n = \frac{450 \left[ \left( 1 + \frac{0,095}{12} \right)^n - 1 \right]}{0,095}$ $10402,15 \left( 1 + \frac{0,095}{12} \right)^n = 56842,10526 \left[ \left( 1 + \frac{0,095}{12} \right)^n - 1 \right]$ $56842,10526 = 46439,95526 \left( 1 + \frac{0,095}{12} \right)^n$ $\log 1,223991387 = n \log \left( 1 + \frac{0,095}{12} \right)$ $n = \frac{\log 1,223991387}{\log \left( 1 + \frac{0,095}{12} \right)}$ $n = 25,63 \text{ months}$ $n = 26$ <p>Accept: <math>n = 31</math> (because of first 5 months)</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Note:</b> If the Present value of R 10 000 is used, then <math>n = 25,53</math> months is obtained. Max 3 / 4 marks.</p> </div>	<p>✓ 10 402,15 ✓ substitution into present value formula</p> <p>✓ application of logs</p> <p>✓ answer</p> <p style="text-align: right;">(4)</p> <p>✓ 10 402,15 ✓ substitution into future value formula</p> <p>✓ application of logs</p> <p>✓ answer</p> <p style="text-align: right;">(4)</p>
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<p>7.2.3</p>	<p>Balance outstanding after 25 months</p> $= 10402,15 \left(1 + \frac{0,095}{12}\right)^{25} - \frac{450 \left[ \left(1 + \frac{0,095}{12}\right)^{25} - 1 \right]}{\frac{0,095}{12}}$ <p>= R 282,36</p> <p><b>OR</b></p> <p>Balance Outstanding after 25 months</p> $= 10000 \left(1 + \frac{0,095}{12}\right)^{30} - \frac{450 \left[ \left(1 + \frac{0,095}{12}\right)^{25} - 1 \right]}{\frac{0,095}{12}}$ <p>= R 282,36</p> <p><b>OR</b></p> <p><math>n = 25,6315128204\dots - 25</math>  <math>= 0,6315128204 \dots</math></p> <p>Balance Outstanding after 25 months</p> $= \frac{450 \left[ 1 - \left(1 + \frac{0,095}{12}\right)^{-0,631512804} \right]}{\frac{0,095}{12}}$ <p>= R 282,36</p> <p><b>OR</b></p> <p>Present value at beginning of 25 months</p> $= 10402,15 - \frac{450 \left[ 1 - \left(1 + \frac{0,095}{12}\right)^{-25} \right]}{\frac{0,095}{12}}$ <p>= R 231,84</p> <p>Balance Outstanding</p> $= 231,84 \left(1 + \frac{0,095}{12}\right)^{25}$ <p>= R 282,36</p>	<p>✓ correct formula                  ✓ substitution into</p> $\frac{450 \left[ \left(1 + \frac{0,095}{12}\right)^{25} - 1 \right]}{\frac{0,095}{12}}$ <p>✓ answer (3)</p> <p>✓ correct formula                  ✓</p> $\frac{450 \left[ \left(1 + \frac{0,095}{12}\right)^{25} - 1 \right]}{\frac{0,095}{12}}$ <p>✓ answer (3)</p> <p>✓ correct formula                  ✓ substitution into</p> $\frac{450 \left[ 1 - \left(1 + \frac{0,095}{12}\right)^{-0,631512804} \right]}{\frac{0,095}{12}}$ <p>✓ answer (3)</p> <p>✓ correct formula                  ✓ substitution into</p> $\frac{450 \left[ 1 - \left(1 + \frac{0,095}{12}\right)^{-25} \right]}{\frac{0,095}{12}}$ <p>✓ answer (3)</p> <p style="text-align: right;"><b>[14]</b></p>
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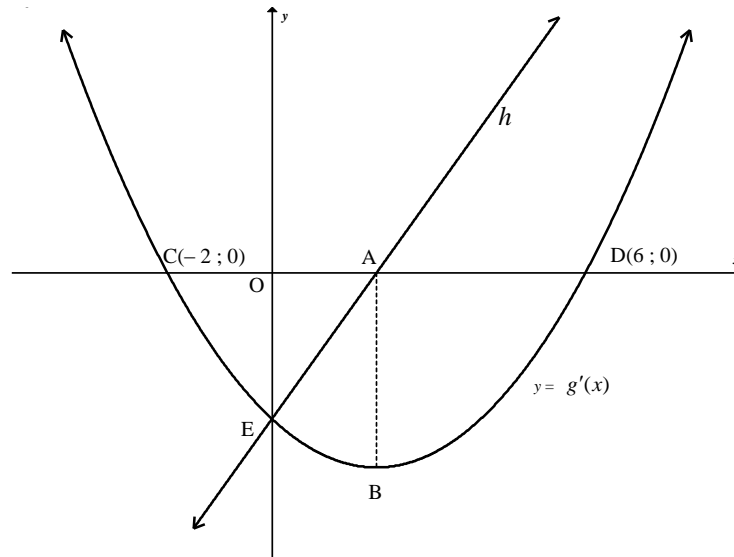
**Note: Accept**  
 If a candidate uses  
 – 0,63, the final  
 answer is R 281,68

**QUESTION 8**

<p>8.1</p>	$g(x) = x^2 - 5$ $g'(x) = \lim_{h \rightarrow 0} \frac{g(x+h) - g(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{(x+h)^2 - 5 - (x^2 - 5)}{h}$ $= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - 5 - x^2 + 5}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h)}{h}$ $= \lim_{h \rightarrow 0} (2x + h)$ $= 2x$ <p><b>OR</b></p> $g(x) = x^2 - 5$ $g'(x) = \lim_{h \rightarrow 0} \frac{g(x+h) - g(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{(x+h)^2 - 5 - (x^2 - 5)}{h}$ $= \lim_{h \rightarrow 0} \frac{(x+h)^2 - x^2}{h}$ $= \lim_{h \rightarrow 0} \frac{(x+h+x)(x+h-x)}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x+h)}{h}$ $= \lim_{h \rightarrow 0} (2x+h)$ $= 2x$	<p><b>Note:</b> If the notation is incorrect, penalty 1 mark</p> <p>If candidate subtracts and gets <math>x^2 + 2xh + h^2 - 5 - x^2 - 5</math> in the numerator and then candidate corrects themselves, max 2 / 5</p> <p>Answer only: 0 / 5</p>	<ul style="list-style-type: none"> <li>✓ formula</li> <li>✓ substitution</li> <li>✓ expansion</li> <li>✓ 2x + h</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(5)</p> <ul style="list-style-type: none"> <li>✓ formula</li> <li>✓ substitution</li> <li>✓ expansion</li> <li>✓ 2x + h</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(5)</p>
<p>8.2</p>	$y = \frac{x^6}{2} + 4\sqrt{x}$ $y = \frac{1}{2}x^6 + 4x^{\frac{1}{2}}$ $\frac{dy}{dx} = 3x^5 + 2x^{-\frac{1}{2}}$	<p><b>Note:</b> If <math>\frac{dy}{dx}</math> or <math>y'</math> is left out, penalty 1 mark</p> <p>If a candidate shows evidence of how to differentiate from an incorrect function which involves breakdown, then max 1 / 3</p>	<ul style="list-style-type: none"> <li>✓ <math>+4x^{\frac{1}{2}}</math></li> <li>✓ <math>3x^5</math></li> <li>✓ <math>2x^{-\frac{1}{2}}</math></li> </ul> <p style="text-align: right;">(3)</p>

<p>8.3</p> $g(x) = ax^2 + \frac{b}{x}$ $g(x) = ax^2 + bx^{-1}$ $g'(x) = 2ax - bx^{-2}$ $0 = 2a(4) - \frac{b}{(4)^2}$ $8a = \frac{b}{16}$ $b = 128a$ $96 = a(4)^2 + \frac{b}{4}$ $96 = 16a + \frac{1}{4}(128a)$ $96 = 48a$ $a = 2$ $b = 256$ <p><b>OR</b></p> $g'(x) = 2ax - \frac{b}{x^2}$ $g'(4) = 8a - \frac{b}{16} = 0$ $g(4) = 16a + \frac{b}{4} = 96$ $32a - \frac{b}{4} = 0$ $48a = 96$ $a = 2$ $b = 256$	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> <p><b>Note:</b> In the equation <math>g'(x) = 0; = 0</math> must be shown in the equation.</p> </div>	$\checkmark g'(x) = 2ax - bx^{-2}$ $\checkmark 0 = g'(x)$ $\checkmark 2a(4) - \frac{b}{(4)^2}$ $\checkmark \text{subs } (4 ; 96)$ $\checkmark a = 2$ $\checkmark b = 256$ <p style="text-align: right;">(6)</p> $\checkmark g'(x) = 2ax - \frac{b}{x^2}$ $\checkmark g'(4) = 8a - \frac{b}{16}$ $\checkmark g'(x) = 0$ $\checkmark g(4) = 16a + \frac{b}{4} = 96$ $\checkmark a = 2$ $\checkmark b = 256$ <p style="text-align: right;">(6) <b>[14]</b></p>
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**QUESTION 9**



<p>9.1</p>	<p>The y-intercept of g is E(0 ; -4)</p> <p><b>OR</b>  <math>x = 0</math> and <math>y = -4</math></p>	<p>✓ answer (1)</p>
<p>9.2</p>	<p><math>y = a(x + 2)(x - 6)</math>  <math>-4 = a(0 + 2)(0 - 6)</math>  <math>-4 = -12a</math>  <math>a = \frac{1}{3}</math>  <math>y = \frac{1}{3}(x + 2)(x - 6)</math>  <math>y = \frac{1}{3}x^2 - \frac{4}{3}x - 4</math></p> <p><b>OR</b>  <math>g'(0) = -4 = c</math>  <math>g'(x) = ax^2 + bx - 4</math>  <math>g'(-2) = 0</math>  <math>4a - 2b - 4 = 0</math>  <math>b = 2a - 2</math>  <math>g''(2) = 0</math>  <math>2a(2) + b = 0</math>  <math>b = -4a</math>  <math>2a - 2 = -4a</math>  <math>a = \frac{1}{3}</math>  <math>b = -\frac{4}{3}</math>  <math>y = \frac{1}{3}x^2 - \frac{4}{3}x - 4</math></p>	<p>✓ setting up of equation                  ✓ subs (0 ; -4)</p> <p>✓ <math>a = \frac{1}{3}</math></p> <p>✓ <math>y = \frac{1}{3}x^2 - \frac{4}{3}x - 4</math> (4)</p> <p>✓ substitution <math>x = -2</math>                  and <math>g'(x) = 0</math></p> <p>✓ <math>g''(2) = 0</math></p> <p>✓ <math>a = \frac{1}{3}</math></p> <p>✓ <math>y = \frac{1}{3}x^2 - \frac{4}{3}x - 4</math> (4)</p>

**OR**

$$c = -4$$

$$4a - 2b - 4 = 0$$

$$36a + 6b - 4 = 0$$

$$48a - 16 = 0$$

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

$$b = -\frac{4}{3}$$

$$y = \frac{1}{3}x^2 - \frac{4}{3}x - 4$$

**OR**

$$y = a(x + 2)(x - 6)$$

$$= a(x^2 - 4x - 12)$$

$$= ax^2 - 4ax - 12a$$

$$-12a = -4$$

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

$$y = \frac{1}{3}x^2 - \frac{4}{3}x - 4$$

**OR**

$$\frac{dy}{dx} = 2ax + b$$

$$0 = 2a(2) + b$$

$$b = -4a$$

**EITHER**

subs (6 ; 0)

$$0 = 36a + 6b - 4$$

$$4 = 36a + 6b$$

$$2 = 18a + 3b$$

$$2 = 18a + 3(-4a)$$

$$2 = 6a$$

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

$$b = -\frac{4}{3}$$

$$y = \frac{1}{3}x^2 - \frac{4}{3}x - 4$$

**OR**

$$0 = 4a - 2b - 4$$

$$0 = 4a - 2(-4a) - 4$$

$$12a = 4$$

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

$$b = -\frac{4}{3}$$

$$y = \frac{1}{3}x^2 - \frac{4}{3}x - 4$$

- ✓ setting up of equation
- ✓ simultaneous equation

$$✓ a = \frac{1}{3}$$

$$✓ y = \frac{1}{3}x^2 - \frac{4}{3}x - 4$$

(4)

- ✓ setting up of equation
- ✓  $ax^2 - 4ax - 12a$

$$✓ a = \frac{1}{3}$$

$$✓ y = \frac{1}{3}x^2 - \frac{4}{3}x - 4$$

(4)

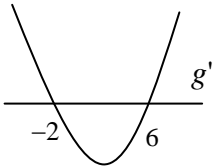
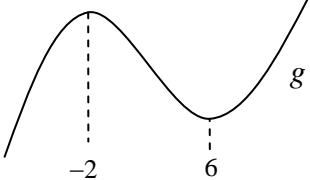
$$✓ b = -4a$$

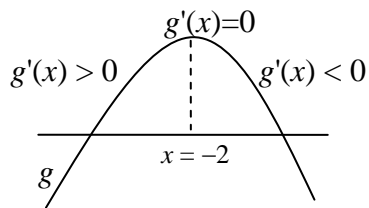
- ✓ simultaneous equation

$$✓ a = \frac{1}{3}$$

$$✓ y = \frac{1}{3}x^2 - \frac{4}{3}x - 4$$

(4)

<p>9.3</p>	<p>At turning point <math>g'(x) = 0</math> <math>x = -2</math> and <math>x = 6</math></p>	<p><b>Answer only:</b> Full marks</p> <p>If only 1 value given, max 1 / 2</p>	<p>✓ <math>g'(x) = 0</math> ✓ <math>x = 6</math> and <math>x = -2</math> (2)</p>
<p>9.4</p>	<p><math>x = \frac{-2+6}{2}</math> <math>x = 2</math></p> <p><b>OR</b></p> <p><math>x</math>-value of point of inflection of <math>g</math> is at A. <math>g''(x) = 0</math> <math>\frac{2x}{3} - \frac{4}{3} = 0</math> <math>2x - 4 = 0</math> <math>2x = 4</math> <math>x = 2</math></p> <p><b>OR</b></p> <p><math>x = -\frac{b}{2a}</math> <math>x = \frac{\frac{4}{3}}{2(\frac{1}{3})}</math> <math>x = 2</math></p>	<p><b>Note:</b> Answer only Full marks</p>	<p>✓ <math>x = \frac{-2+6}{2}</math> ✓ answer (2)</p> <p>✓ <math>2x - 4 = 0</math> ✓ answer (2)</p> <p>✓ <math>x = \frac{\frac{4}{3}}{2(\frac{1}{3})}</math> ✓ answer (2)</p> <p>✓ <math>g'(x) = \frac{1}{3}(x-2)^2 - \frac{16}{3}</math> ✓ answer (2)</p>
<p>9.5</p>	<p><math>g'(x) &gt; 0</math> for <math>x &lt; -2</math>, so <math>g</math> is increasing for <math>x &lt; -2</math>. <math>g'(x) &lt; 0</math> for <math>x &gt; -2</math>, so <math>g</math> is decreasing for <math>x &gt; -2</math>. <math>\therefore g</math> has a local maximum at <math>x = -2</math> because the graph is increasing followed by decreasing</p> <p><b>OR</b></p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p><math>\therefore g</math> has a local maximum at <math>x = -2</math></p> <p><b>OR</b></p>		<p>✓ <math>g'(x) &gt; 0</math> ✓ <math>g</math> is incr for <math>x &lt; -2</math> ✓ <math>g</math> is decr for <math>x &gt; -2</math> (3)</p> <p>✓ <math>g'(x) &gt; 0</math> for <math>x &lt; -2</math> ✓ <math>g'(x) &lt; 0</math> for <math>x &gt; -2</math> ✓ max at <math>x = -2</math> (3)</p>

**OR**

$$g'(-2) = 0$$

$g''(-2) < 0$  so graph is concave down at  $x = -2$ , so  $g$  has a local maximum

- ✓  $g'(x) > 0$  for  $x < -2$
- ✓  $g'(x) < 0$  for  $x > -2$
- ✓ max at  $x = -2$

(3)

- ✓  $g'(-2) = 0$
- ✓  $g''(-2) < 0$
- ✓ max at  $x = -2$

(3)

**[12]**



**QUESTION 10**

10.1	$V = \pi r^2 h + 2 \times \frac{1}{2} \times \frac{4}{3} \pi r^3$ $V = \pi r^2 h + \frac{4}{3} \pi r^3$ $\frac{\pi}{6} = \pi r^2 h + \frac{4}{3} \pi r^3$ $\pi r^2 h = \frac{\pi}{6} - \frac{4}{3} \pi r^3$ $h = \frac{\pi}{6\pi r^2} - \frac{4\pi r^3}{3\pi r^2}$ $h = \frac{1}{6r^2} - \frac{4r}{3}$	<p>✓ volume equation</p> <p>✓ substitution of <math>\frac{\pi}{6}</math></p> <p>✓ <math>h = \frac{\pi}{6\pi r^2} - \frac{4\pi r^3}{\pi r^2}</math></p> <p>(3)</p>
10.2	$S = 2 \times 2\pi r^2 + 2\pi rh$ $S = 4\pi r^2 + 2\pi rh$ $S = 4\pi r^2 + 2\pi r \left( \frac{1}{6r^2} - \frac{4r}{3} \right)$ $S = 4\pi r^2 + \frac{\pi}{3r} - \frac{8\pi r^2}{3}$ $= \frac{4}{3} \pi r^2 + \frac{\pi}{3r}$	<p>✓ surface area equation</p> <p>✓ substitution of <math>h</math></p> <p>✓ simplification</p> <p>(3)</p>
10.3	$S = \frac{4}{3} \pi r^2 + \frac{\pi}{3} r^{-1}$ $\frac{dS}{dr} = \frac{8\pi r}{3} - \frac{\pi}{3r^2} = 0$ $8r = \frac{1}{r^2}$ $8r^3 = 1$ $r = \frac{1}{2}$ <p>Then <math>S = \frac{4}{3} \pi \left( \frac{1}{2} \right)^2 + \frac{\pi}{3} (2)</math></p> $S = \pi \text{ square metres}$ $= 3,14 \text{ square metres}$	<p>✓ <math>\frac{\pi}{3} r^{-1}</math></p> <p>✓ <math>\frac{dS}{dr} = \frac{\pi}{3} \left( 8r - \frac{1}{r^2} \right)</math></p> <p>or</p> $\frac{dS}{dr} = \frac{\pi}{3} (8r - r^{-2})$ <p>✓ <math>\frac{dS}{dr} = 0</math></p> <p>✓ <math>8r = \frac{1}{r^2}</math></p> <p>✓ <math>r = \frac{1}{2}</math></p> <p>✓ <math>S = \pi</math></p> <p>(6) [12]</p>

**QUESTION 11**

<p>11.1</p>	<p><math>x, y \in N_0</math></p> <p><math>x + 2y \leq 28</math> or <math>y \leq -\frac{x}{2} + 14</math></p> <p><math>3x + y \leq 24</math> or <math>y \leq -3x + 24</math></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><b>Note:</b> If inequality signs incorrect or equal signs used: max 3 / 4 marks</p> </div>	<p>✓✓ First inequality ✓✓ Second inequality  (4)</p>
<p>11.2</p>		<p>✓ graph of <math>x + 2y \leq 28</math> ✓ graph of <math>3x + y \leq 24</math>  ✓ feasible region (quadrilateral)  (3)</p>
<p>11.3.1</p>	<p>8</p>	<p>✓ answer (1)</p>
<p>11.3.2</p>	<p>14</p>	<p>✓ answer (1)</p>
<p>11.4</p>	<p>Maximise <math>x + y</math> Use search line with gradient <math>-1</math></p> <p>4 Type A 12 Type B</p>	<p>✓ 4 Type A ✓ 12 Type B  (2)</p>

11.5	$x \geq y$ $y \leq x$ New Feasible region (triangle) in diagram Maximise $x + y$ . Maximum at (6 ; 6) Answer: $6 + 6 = 12$ braai stands Machine Time = $x + 2y$ = $6 + 2 \times 6$ = $6 + 12$ = 18 hours	<b>Note:</b> Answer only of machine time 18 hours and braai stands 12 Full marks	$\checkmark y \leq x$  $\checkmark (6 ; 6)$  $\checkmark \checkmark 12$  $\checkmark 18$ hours (5) <b>[16]</b>
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**TOTAL: 150**