



# education

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Department:  
Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**MATHEMATICS P2**

**EXEMPLAR 2007**

**MEMORANDUM**

**This memorandum consists of 12 pages.**

**QUESTION 1**

1.1	$m_{AB} = \frac{1-4}{3-0} = -1$ $m_{CD} = \frac{-2-(-5)}{-6-(-3)} = -1$ $m_{AD} = \frac{-2-4}{-6-0} = 1$ $m_{BC} = \frac{-5-1}{-3-3} = 1$ $m_{AB} = m_{CD}$ $\therefore AB \parallel CD$ $m_{AD} = m_{BC}$ $\therefore AD \parallel BC$ $\therefore ABCD \text{ is a parallelogram as both pairs of opposite sides are parallel.}$ $m_{AB} \cdot m_{AD} = (-1) \times (1) = -1$ $AB \perp AD$ $ABCD \text{ is a rectangle (internal angles} = 90^\circ)$	<p>✓ substitution into formula</p> <p>✓ answer <math>m_{AB}</math>.</p> <p>✓ answer <math>m_{CD}</math>.</p> <p>✓ answer <math>m_{AD}</math>.</p> <p>✓ answer <math>m_{BC}</math>.</p> <p>✓ parallel lines</p> <p>✓ parallelogram</p> <p>✓ multiply gradients = -1</p> <p>✓ reason</p> <p style="text-align: right;">(9)</p>
1.2	$\text{Midpoint} = \left( \frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2} \right)$ $\text{Midpoint AC} = \left( \frac{0-3}{2}; \frac{4-5}{2} \right) = \left( -\frac{3}{2}; -\frac{1}{2} \right)$	<p>✓ answer <math>x</math></p> <p>✓ answer <math>y</math></p> <p style="text-align: right;">(2)</p>
<b>[11]</b>		

## QUESTION 2

2.1	$m_{PQ} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{2 + 4}{-4 + 2}$ $= -3$ $m_{PR} = \frac{-4 + 1}{-2 - 7}$ $= \frac{1}{3}$ $m_{PQ} \cdot m_{PR} = -3 \times \frac{1}{3} = -1$ $\therefore \Delta PQR \text{ is right-angled at } \hat{P}$	✓ formula ✓ substitution ✓ answer  ✓ substitution ✓ answer  ✓ multiplication ✓ conclusion (7)
2.2	$PQ = \sqrt{(-4 - (-2))^2 + (2 - (-4))^2}$ $PQ = \sqrt{4 + 36}$ $PQ = 2\sqrt{10}$ $PR = \sqrt{(7 - (-2))^2 + (-1 - (-4))^2}$ $PR = \sqrt{81 + 9}$ $PR = 3\sqrt{10}$ $\text{Area } \Delta PQR = \frac{1}{2} PR \cdot PQ$ $\text{Area } \Delta PQR = \frac{1}{2} (3\sqrt{10})(2\sqrt{10})$ $\text{Area } \Delta PQR = 30 \text{ units}^2$	✓ substitution ✓ answer PQ ✓ substitution  ✓ answer PR  ✓ substitution ✓ (6)
2.3	$\tan \theta = -3$ $\text{ref angle: } 71,57^\circ \approx 72^\circ$ $P\hat{Q}R = 180^\circ - 72^\circ$ $P\hat{Q}R = 108^\circ$	✓ statement ✓ reference angle  ✓ answer (3)
2.4	$M\left(\frac{-4 + 7}{2}; \frac{2 - 1}{2}\right)$ $M\left(\frac{3}{2}; \frac{1}{2}\right)$	✓ x-coordinate ✓ y-coordinate (2)

<p>2.5</p>	$y - \frac{1}{2} = \frac{1}{3} \left( x - \frac{3}{2} \right)$ $y = \frac{1}{3}x$	<p>✓ gradient = <math>\frac{1}{3}</math>                  ✓ substitution <math>x</math>                  ✓ substitution <math>y</math>                  ✓ ✓ answer                  (5)</p>
<p>2.6</p>	<p>Midpoint PQ <math>\left( \frac{-4-2}{2}, \frac{2-4}{2} \right)</math>                  Midpoint PQ <math>(-3; -1)</math>  <math>y = \frac{1}{3}(-3)</math>  <math>y = -1</math>  <math>\therefore</math> Midpoint PQ does lie on the line MN</p>	<p>✓ <math>x</math>-coordinate                  ✓ <math>y</math>-coordinate                    ✓ substitution of <math>x</math>                    ✓ conclusion                  (4)</p>
		<p><b>[27]</b></p>

**QUESTION 3**

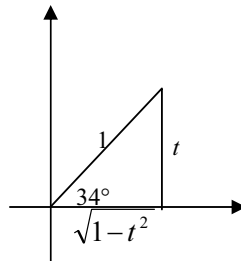
<p>3.1</p>	<p><math>(x ; y) \rightarrow (-x ; y)</math></p>	<p>✓ <math>x</math>-coordinate                  ✓ <math>y</math>-coordinate                  (2)</p>
<p>3.2</p>	<p>Transformation 1:      Rotation around the origin through <math>180^\circ</math>                   Transformation 2:      Reflection about the <math>y</math>-axis and a reflection about the <math>x</math>-axis</p>	<p>✓ rotation                  ✓ <math>180^\circ</math>                  ✓ Reflection                  ✓ <math>y</math>-axis                  ✓ Reflection                  ✓ <math>x</math>-axis                  (6)</p>
<p>3.3</p>	<p><math>D'(2; -2)</math></p>	<p>✓ <math>x</math>-coordinate                  ✓ <math>y</math>-coordinate                  (2)</p>
		<p><b>[10]</b></p>

**QUESTION 4**

<p>4.1.1</p>		<ul style="list-style-type: none"> <li>✓ correct vertex <math>A'</math></li> <li>✓ correct vertex <math>B'</math></li> <li>✓ correct vertex <math>C'</math></li> <li>✓ correct vertex <math>D'</math></li> <li>✓ accuracy of drawing</li> </ul> <p style="text-align: right;">(5)</p>
<p>4.1.2</p>	<p><math>A'(2;6)</math> <math>C'(4;-2)</math></p>	<ul style="list-style-type: none"> <li>✓ coordinate <math>A'</math></li> <li>✓ coordinate <math>C'</math></li> </ul> <p style="text-align: right;">(2)</p>
<p>4.1.3</p>	<p><math>A'B'C'D' = 4x</math> square units</p>	<ul style="list-style-type: none"> <li>✓ ✓ answer</li> </ul> <p style="text-align: right;">(2)</p>
<p>4.2.1</p>	<p><math>(x; y) \rightarrow (-y; x)</math></p>	<ul style="list-style-type: none"> <li>✓ interchanging</li> <li>✓ correct signs</li> </ul> <p style="text-align: right;">(2)</p>
<p>4.2.2</p>	<p><math>A''(-3; 1)</math> <math>B''(-2; 3)</math> <math>C''(1; 2)</math> <math>D''(0; 1)</math></p>	<ul style="list-style-type: none"> <li>✓ coordinate <math>A''</math></li> <li>✓ coordinate <math>B''</math></li> <li>✓ coordinate <math>C''</math></li> <li>✓ coordinate <math>D''</math></li> </ul> <p style="text-align: right;">(4)</p>
<p><b>[15]</b></p>		

**QUESTION 5**

<p>5.1.1</p>	$\frac{\cos 150^\circ \tan 225^\circ}{\sin(-60^\circ) \cos 480^\circ}$ $= \frac{-\frac{\sqrt{3}}{2} \cdot 1}{-\frac{\sqrt{3}}{2} \cdot -\frac{1}{2}}$ $= -2$	<p>✓ <math>\tan 225^\circ = \tan 45^\circ = 1</math></p> <p>✓ <math>\cos 150^\circ = -\cos 30^\circ = -\frac{\sqrt{3}}{2}</math></p> <p>✓ <math>\sin(-60^\circ) = -\sin 60^\circ = -\frac{\sqrt{3}}{2}</math></p> <p>✓ <math>\cos 480^\circ = -\cos 60^\circ = -\frac{1}{2}</math></p> <p>✓ answer</p> <p style="text-align: right;">(5)</p>
<p>5.1.2</p>	$\frac{\cos(90^\circ + x)}{\cos(360^\circ - x) \tan(180^\circ - x)}$ $= \frac{(-\sin x)}{(\cos x)(-\tan x)}$ $= \frac{\sin x}{\cos x} \div \frac{\sin x}{\cos x} \quad \text{OR} \quad -\tan x \times \frac{1}{-\tan x}$ $= 1$	<p>✓ <math>-\sin x</math></p> <p>✓ <math>\cos x</math></p> <p>✓ <math>-\tan x</math></p> <p>✓ <math>\tan x = \frac{\sin x}{\cos x}</math></p> <p>✓ answer</p> <p style="text-align: right;">(5)</p>
<p>5.1.3</p>	$\cos^2 x \left[ \frac{1}{\sin x - 1} + \frac{1}{\sin x + 1} \right]$ $= \cos^2 x \left[ \frac{\sin x + 1 + \sin x - 1}{(\sin x + 1)(\sin x - 1)} \right]$ $= \cos^2 x \left[ \frac{2 \sin x}{\sin^2 x - 1} \right]$ $= \cos^2 x \left[ \frac{2 \sin x}{\cos^2 x} \right]$ $= 2 \sin x$	<p>✓ denominator</p> <p>✓ numerator</p> <p>✓ <math>2 \sin x</math></p> <p>✓ <math>\sin^2 x - 1</math></p> <p>✓ <math>\cos^2 x</math></p> <p>✓ answer</p> <p style="text-align: right;">(6)</p>
<p>5.2.1</p>	<p><math>\cos 56^\circ</math>  <math>= \cos(90^\circ - 34^\circ)</math>  <math>= \sin 34^\circ</math>  <math>= t</math></p>	<p>✓ <math>\sin 34^\circ</math></p> <p>✓ answer</p> <p style="text-align: right;">(2)</p>
<p>5.2.2</p>	<p><math>\tan(-34^\circ)</math>  <math>= (-\tan 34^\circ)</math>  <math>= \left( -\frac{t}{\sqrt{1-t^2}} \right)</math></p>	<p>✓ <math>-\tan 34^\circ</math></p> <p>✓✓ trig ratio</p> <p style="text-align: right;">(3)</p>



5.3.1	$7 \cos 2x = -2$ $\cos 2x = -\frac{2}{7}$ ref angle : $73,3984504\dots^\circ \approx 73,4^\circ$ $2x = 180^\circ - 73,4^\circ$ $2x = 180^\circ + 73,4^\circ$ $x = 53,3^\circ$ or $x = 126,7^\circ$	$\checkmark \cos 2x = -\frac{2}{7}$  $\checkmark$ ref. angle  $\checkmark \checkmark$ correct quadrants  $\checkmark \checkmark$ answers  (6)
5.3.2	$\cos x(\sin x - 1) = 0$ $\cos x = 0 \text{ or } \sin x = 1$ $x = 90^\circ + k.360^\circ \quad k \in \mathbb{Z} \text{ or } x = 90^\circ + k.360^\circ \quad k \in \mathbb{Z}$ $x = 270^\circ + k.360^\circ \quad k \in \mathbb{Z}$ which is the same as $\therefore x = 90^\circ + k.180^\circ \quad k \in \mathbb{Z}$	$\checkmark \sin x = 1$ $\checkmark \cos x = 0$ $\checkmark x = 90^\circ + k.360^\circ \quad k \in \mathbb{Z}$ $\checkmark x = 270^\circ + k.360^\circ \quad k \in \mathbb{Z}$ $\checkmark x = 90^\circ + k.360^\circ \quad k \in \mathbb{Z}$  (5)

**[32]****QUESTION 6**

6.1.1	$\hat{L} = 10^\circ$	$\checkmark$ answer  (1)
6.1.2	$\frac{25}{KT} = \sin 17^\circ$ $KT \cdot \sin 17^\circ = 25$ $KT = \frac{25}{\sin 17^\circ}$ $KT = 85,51m$	$\checkmark \sin 17^\circ$ $\checkmark \frac{25}{KT}$ $\checkmark$ answer  (3)
6.1.3	$\frac{KL}{\sin 7^\circ} = \frac{85,51}{\sin 10^\circ}$ $KL = \frac{85,51 \cdot \sin 7^\circ}{\sin 10^\circ}$ $KL = 60,01m$	$\checkmark$ sine rule  $\checkmark \checkmark$ substitution  $\checkmark$ answer  (4)
6.2.1	$\hat{C}_1 = 36^\circ$ $G\hat{C}A = 41^\circ$ $GA^2 = (8,3)^2 + (4,8)^2 - 2(8,3)(4,8) \cdot \cos 41^\circ$ $GA^2 = 31,79474065\dots$ $GA = 5,6 \text{ kms}$	$\checkmark G\hat{C}A = 41^\circ$ $\checkmark$ cos rule $\checkmark$ substitution $\checkmark$ answer  (4)

6.2.2	$\text{Area } \triangle GCA = \frac{1}{2} \cdot (8,3)(4,8) \cdot \sin 41^\circ$ $\text{Area } \triangle GCA = 13,07 \text{ kms}^2$	<ul style="list-style-type: none"> <li>✓ area rule</li> <li>✓ substitution</li> <li>✓ answer</li> </ul> <p style="text-align: right;">(3)</p> <p style="text-align: right;"><b>[15]</b></p>
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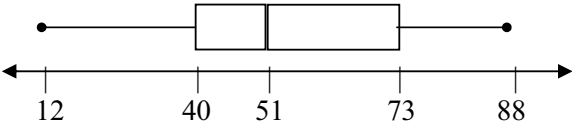
**QUESTION 7**

7.1	<p>Height of the cone = <math>140 - 40 = 100 \text{ cm}</math></p> <p>Volume of cone = <math>\frac{1}{3} \pi r^2 h</math></p> $= \frac{1}{3} \cdot \pi \cdot (40)^2 \cdot 100$ $= 167551,6082 \text{ cm}^3$ <p>Volume of the hemisphere = <math>\frac{1}{2} \cdot \left[ \frac{4}{3} \pi r^3 \right]</math></p> $= \frac{1}{2} \cdot \frac{4}{3} \cdot \pi \cdot (40)^3$ $= 134041,2866 \text{ cm}^3$ <p>Total volume of model = <math>301\,592,89 \text{ cm}^3</math></p>	<ul style="list-style-type: none"> <li>✓ substitution</li> <li>✓ answer</li> <li>✓ <math>\frac{1}{2}</math></li> <li>✓ answer</li> <li>✓ total answer</li> </ul> <p style="text-align: right;">(5)</p>
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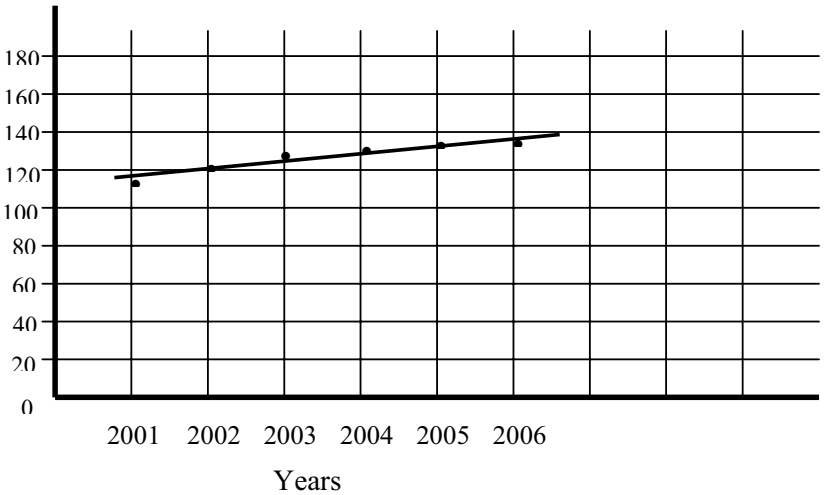


<p>7.2</p>	$H^2 = 1^2 + (0,4)^2 = 1,16$ $H = 1,077032961 m$ <p>Total exterior surface area = surface area of hemisphere + surface area of cone</p> $= \frac{1}{2} \cdot 4\pi r^2 + \pi r H$ $= 2 \cdot \pi \cdot (0,4)^2 + \pi \cdot (0,4) \cdot (1,07703961)$ $= 2,358... m^2$ $= 2,36 m^2$	<p>✓ Pythagoras ✓ Slant height</p> <p>✓ addition of formulae ✓ substitution</p> <p>✓ answer (5)</p>
<p>7.3</p>	<p>mass = <math>2,36 \times 2,5</math> mass = 5,90 kg</p>	<p>✓ answer (1)</p> <p><b>[11]</b></p>

**QUESTION 8**

<p>8.1</p>	<p>12 29 33 39 40 42 48 50 50 51 55 58 62 64 73 76 77 80 88 median : 51</p>	<p>✓ ordered data ✓ median (2)</p>
<p>8.2</p>	<p>lower quartile : 40 upper quartile : 73</p>	<p>✓ <math>Q_1</math> ✓ <math>Q_3</math> (2)</p>
<p>8.3</p>		<p>✓ min / max ✓ quartiles ✓ box joining ✓ whiskers (4)</p>
<p>8.4</p>	<p>One quarter, 25%, of the player's scores were below 40 runs OR Three quarters, 75%, of the player's scores were above 40 runs.</p>	<p>✓ answer (1)</p> <p><b>[9]</b></p>

**QUESTION 9**

<p>9.1</p>	<p style="text-align: center;">Scatter plot</p> 	<p>✓ axes ✓✓ plotting the points</p> <p style="text-align: right;">(3)</p>
<p>9.2</p>	<p>Linear</p>	<p>✓ answer</p> <p style="text-align: right;">(1)</p>
<p>9.3</p>	<p>141 People</p>	<p>✓ answer</p> <p style="text-align: right;">(1) <b>[5]</b></p>

**QUESTION 10**

10.1	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;">Mark</th> <th style="padding: 5px;">Frequency</th> <th style="padding: 5px;">Cumulative Frequency</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;"><math>0 \leq m &lt; 30</math></td> <td style="padding: 5px;">6</td> <td style="padding: 5px;">6</td> </tr> <tr> <td style="padding: 5px;"><math>30 \leq m &lt; 60</math></td> <td style="padding: 5px;">12</td> <td style="padding: 5px;">18</td> </tr> <tr> <td style="padding: 5px;"><math>60 \leq m &lt; 90</math></td> <td style="padding: 5px;">38</td> <td style="padding: 5px;">56</td> </tr> <tr> <td style="padding: 5px;"><math>90 \leq m &lt; 120</math></td> <td style="padding: 5px;">42</td> <td style="padding: 5px;">98</td> </tr> <tr> <td style="padding: 5px;"><math>120 \leq m &lt; 150</math></td> <td style="padding: 5px;">12</td> <td style="padding: 5px;">110</td> </tr> <tr> <td style="padding: 5px;"><math>150 \leq m &lt; 180</math></td> <td style="padding: 5px;">10</td> <td style="padding: 5px;">120</td> </tr> </tbody> </table>	Mark	Frequency	Cumulative Frequency	$0 \leq m < 30$	6	6	$30 \leq m < 60$	12	18	$60 \leq m < 90$	38	56	$90 \leq m < 120$	42	98	$120 \leq m < 150$	12	110	$150 \leq m < 180$	10	120	<p>✓ correct totals ✓ 120</p> <p style="text-align: right;">(2)</p>
Mark	Frequency	Cumulative Frequency																					
$0 \leq m < 30$	6	6																					
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$150 \leq m < 180$	10	120																					
10.2	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p><b>Ogive representing Marks obtained in Accounting Examination</b></p> </div>	<p>✓ axes (correctly labelled) ✓ plotting points correctly ✓ shape</p> <p style="text-align: right;">(3)</p>																					
10.3	<p>Median <math>\approx</math> 91</p>	<p>✓ answer</p> <p style="text-align: right;">(1)</p>																					
		<b>[6]</b>																					

**QUESTION 11**

11.1	$\bar{x} = \frac{480}{10} = 48$	✓ sum ✓ answer (2)																																				
11.2	<table border="1"> <thead> <tr> <th>Data</th> <th><math>(x_i - \bar{x})</math></th> <th><math>(x_i - \bar{x})^2</math></th> </tr> </thead> <tbody> <tr><td>21</td><td>-27</td><td>729</td></tr> <tr><td>32</td><td>-16</td><td>256</td></tr> <tr><td>37</td><td>-11</td><td>121</td></tr> <tr><td>38</td><td>-10</td><td>100</td></tr> <tr><td>42</td><td>-6</td><td>36</td></tr> <tr><td>51</td><td>3</td><td>9</td></tr> <tr><td>55</td><td>7</td><td>49</td></tr> <tr><td>62</td><td>14</td><td>196</td></tr> <tr><td>68</td><td>20</td><td>400</td></tr> <tr><td>74</td><td>26</td><td>676</td></tr> <tr> <td colspan="2" style="text-align: center;"><math>\sum_{i=1}^n (x_i - \bar{x})^2 =</math></td> <td style="text-align: center;">2572</td> </tr> </tbody> </table>	Data	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$	21	-27	729	32	-16	256	37	-11	121	38	-10	100	42	-6	36	51	3	9	55	7	49	62	14	196	68	20	400	74	26	676	$\sum_{i=1}^n (x_i - \bar{x})^2 =$		2572	✓ calculating differences ✓ calculating squares ✓ sum (3)
Data	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$																																				
21	-27	729																																				
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$\sum_{i=1}^n (x_i - \bar{x})^2 =$		2572																																				
11.3	Variance = $\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{10} = 257,2$	✓ dividing by 10 ✓ answer (2)																																				
11.4	Standard Deviation = $\sqrt{257,2} = 16,04$	✓ answer (1)																																				
11.5	Seven of the players are within the standard deviation distance from the mean. These players have scored points close to the mean score. This suggests that they have played well together as a team.	✓ close to the mean score (1)																																				
<b>[9]</b>																																						