

**GRADE 11**

**NATIONAL  
SENIOR CERTIFICATE**

**MATHEMATICS P2**

**NOVEMBER 2007**

**MEMORANDUM**

**This memorandum consists of 14 pages.**

**QUESTION 1**

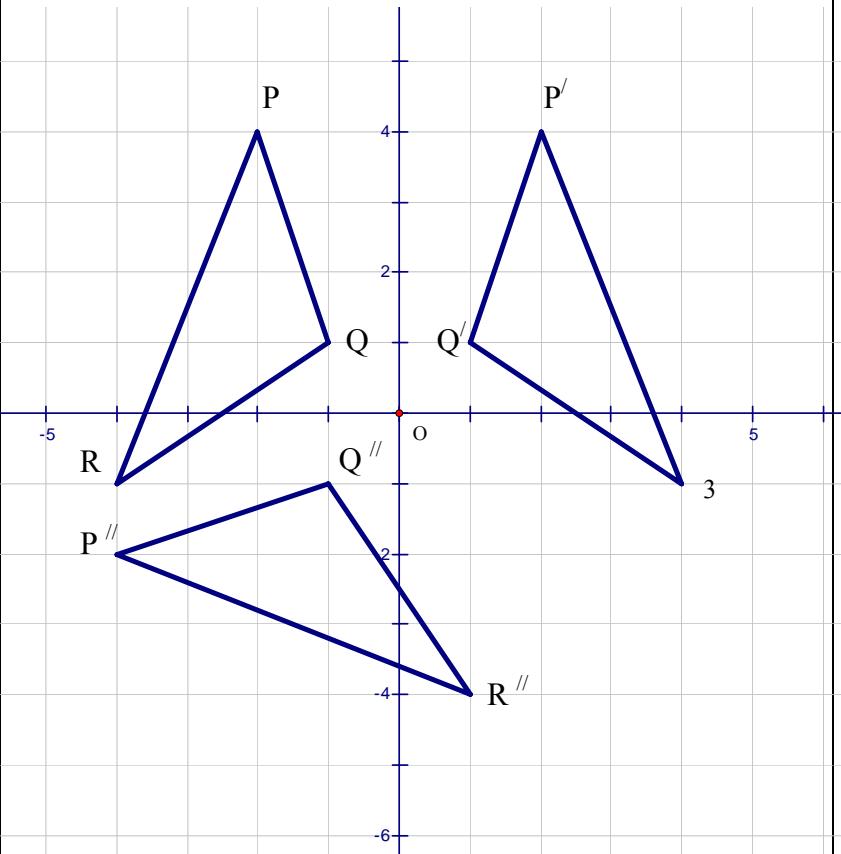
1.1	$\begin{aligned} m_{AB} &= \frac{17-5}{12-3} \\ &= \frac{12}{9} \\ &= \frac{4}{3} \end{aligned}$	✓ substitution  ✓ value (2)
1.2	$m_{BC} = -\frac{3}{4}$	✓ value (1)
1.3	$\begin{aligned} \frac{20-17}{x-12} &= -\frac{3}{4} \\ \frac{3}{x-12} &= -\frac{3}{4} \\ 3x-36 &= -12 \\ 3x &= 24 \\ x &= 8 \end{aligned}$ <p style="margin-left: 100px;">OR</p> $\begin{aligned} \left(\frac{20-17}{x-12}\right) \cdot \left(\frac{4}{3}\right) &= -1 \\ \left(\frac{3}{x-12}\right) \cdot \left(\frac{4}{3}\right) &= -1 \\ x-12 &= -4 \\ x &= 8 \end{aligned}$	✓ substitution  ✓ simplification ✓ $x = 8$ (3)
1.4	$\begin{aligned} AB &= \sqrt{(x_a - x_b)^2 + (y_a - y_b)^2} \\ &= \sqrt{(17-5)^2 + (12-3)^2} \\ &= \sqrt{225} \\ &= 15 \end{aligned}$ $\begin{aligned} BC^2 + AB^2 &= AC^2 & AC^2 &= \sqrt{(8-3)^2 + (20-5)^2} \\ 25 + 225 &= 250 & &= \sqrt{250} \\ AC &= 5\sqrt{10} & &= 5\sqrt{10} \end{aligned}$ $\begin{aligned} \text{Perimeter} &= 15 + 5 + 5\sqrt{10} \\ &= 20 + 5\sqrt{10} \text{ units} \end{aligned}$	✓ formula  ✓ substitution  ✓ value  ✓ correct use of Pythagoras' Theorem ✓ value AC  <b>OR</b> ✓ formula and substitution  ✓ value AC  ✓ value perimeter (6) <b>[11]</b>

**QUESTION 2**

2.1	Midpoint AC $\left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$ Midpoint AC $\left( \frac{6+6}{2}; \frac{4+(-2)}{2} \right)$ Midpoint AC (6 ; 1)	✓ substitution into correct formula ✓ y-coordinate ✓ x-coordinate (3)
2.2	$m_{BD} = \frac{y_b - y_d}{x_b - x_d}$ $= \frac{2-1}{-2-6}$ $= -\frac{1}{8}$ <p>equation of BD:</p> $y = -\frac{1}{8}x + c$ $2 = -\frac{1}{8}(-2) + c$ $c = \frac{7}{4}$ <p>equation of BD :</p> $y = -\frac{1}{8}x + \frac{7}{4}$ $\text{OR}$ $y - y_1 = m(x - x_1)$ $y - 2 = -\frac{1}{8}(x + 2)$ $y = -\frac{1}{8}x - \frac{1}{4} + 2$ $y = -\frac{1}{8}x + \frac{7}{4}$ $y = -\frac{1}{8}x + \frac{7}{4}$ $y = -\frac{1}{8}x + \frac{7}{4} \text{ or } x + 8y - 14 = 0$	✓ formula and substitution ✓ value of gradient ✓ formula ✓ substitution ✓ equation of BD (any form accepted) (5)
2.3	$y = -2x + 8$ equation : $y = -2x + c$ $4 = -2(6) + c$ $c = 16$ $y = -2x + 16$	✓ gradient ✓ substitution ✓ value (3)
2.4	$m_{BC} = \frac{2 - (-2)}{-2 - 6}$ $m_{BC} = \frac{4}{-8}$ $m_{BC} = -\frac{1}{2}$ $\tan \theta = -\frac{1}{2}$ reference angle : $26,6^\circ$ $\theta = 180^\circ - 26,6^\circ$ (obtuse angle) $\theta = 153,4^\circ$	✓ substitution $\checkmark m_{BC} = -\frac{1}{2}$ ✓ $\tan \theta$ ✓ ref angle ✓ value (5)

2.5	$AC \perp x\text{-axis}$ $\hat{C} = \theta - 90^\circ$ (exterior angle of triangle) $= 153,4^\circ - 90^\circ$ $= 63,4^\circ$	<ul style="list-style-type: none"> <li>✓ <math>AC \perp x\text{-axis}</math></li> <li>✓ substitution</li> <li>✓ value</li> </ul> <p>(3) [19]</p>
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**QUESTION 3**

3.1.1	Reflection in the $y$ -axis	<ul style="list-style-type: none"> <li>✓ reflection</li> <li>✓ <math>y</math>-axis</li> </ul>	(2)
3.1.2		<ul style="list-style-type: none"> <li>✓ image</li> <li>✓✓ correct coordinates</li> </ul>	(3)
3.1.3	$R''(1; -4)$	<ul style="list-style-type: none"> <li>✓ coordinates</li> </ul>	(1)
3.1.4	$(x; y) \rightarrow (-y; x)$	<ul style="list-style-type: none"> <li>✓ <math>x</math>-coordinate</li> <li>✓ <math>y</math>-coordinate</li> </ul>	(2)

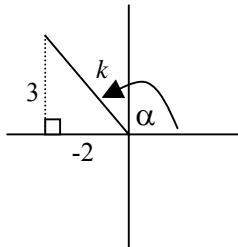
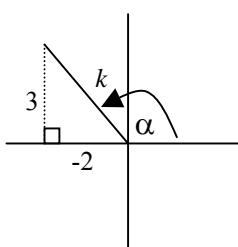
3.2.1 & 3.2.2	<p>A coordinate grid with x and y axes ranging from 0 to 16. Grid lines are spaced at 1-unit intervals. Three squares are plotted:     <ul style="list-style-type: none"> <li><b>Square A:</b> Centered at (1; 1), side length 1.</li> <li><b>Square A':</b> Centered at (3; 3), side length 3.</li> <li><b>Square A'':</b> Centered at (6; 6), side length 6.</li> <li><b>Square B'':</b> Centered at (9; 9), side length 9.</li> </ul>     Points are marked with red dots: A(1; 1), A'(3; 3), C'(6; 6), and A''(9; 9).</p>	<ul style="list-style-type: none"> <li>✓ first enlargement</li> <li>✓ second enlargement</li> <li>✓✓ enlarged figures centred at the origin</li> </ul> <span style="float: right;">(4)</span> <ul style="list-style-type: none"> <li>✓ C' coordinates</li> <li>✓ B'' coordinates</li> </ul> <span style="float: right;">(2)</span>
3.3	$\frac{40}{20} = 2 \quad \text{and} \quad \frac{80}{40} = 2$ $\therefore k = 2$	<ul style="list-style-type: none"> <li>✓✓ value</li> </ul> <span style="float: right;">(2)</span> <span style="float: right;">[16]</span>

**QUESTION 4**

4.1 $  \begin{aligned}  & \frac{3 \cos 150^\circ \cdot \sin 270^\circ}{\tan(-45^\circ) + \cos 600^\circ} \\  &= \frac{3 \left( -\frac{\sqrt{3}}{2} \right) (-1)}{\left( -1 \right) + \left( -\frac{1}{2} \right)} \\  &= \frac{3\sqrt{3}}{-\frac{3}{2}} \\  &= -\sqrt{3}  \end{aligned}  $	<ul style="list-style-type: none"> <li>✓ <math>\cos 150^\circ = -\frac{\sqrt{3}}{2}</math></li> <li>✓ <math>\sin 270^\circ = -1</math></li> <li>✓ <math>\tan(-45^\circ) = -1</math></li> <li>✓ <math>\cos 600^\circ = -\frac{1}{2}</math></li> <li>✓ simplification</li> </ul> <span style="float: right;">(5)</span>
4.2 $  \begin{aligned}  & \frac{\tan(180^\circ - x) \cdot \sin(90^\circ + x)}{\sin(-x)} - \sin y \cdot \cos(90^\circ - y) \\  &= \frac{(-\tan x) \cdot (\cos x)}{(-\sin x)} - \sin y \cdot \sin y \\  &= \frac{\sin x}{\cos x} \cdot \frac{\cos x}{\sin x} - \sin^2 y \\  &= 1 - \sin^2 y \\  &= \cos^2 y  \end{aligned}  $	<ul style="list-style-type: none"> <li>✓ <math>\sin y</math></li> <li>✓ <math>-\tan x</math></li> <li>✓ <math>\cos x</math></li> <li>✓ <math>-\sin x</math></li> <li>✓ <math>\frac{\sin x}{\cos x}</math> identity</li> <li>✓ 1</li> <li>✓ identity</li> </ul> <span style="float: right;">(7)</span>

[12]

**QUESTION 5**

5.1.1 $k \cdot \cos \alpha = -2$ and $k \cdot \sin \alpha = 3$ $\therefore \cos \alpha < 0$ and $\sin \alpha > 0$ $\therefore$ quadrant II $\therefore \alpha \in (90^\circ; 180^\circ)$	<ul style="list-style-type: none"> <li>✓ <math>\cos \alpha &lt; 0</math></li> <li>✓ <math>\sin \alpha &gt; 0</math></li> <li>✓ conclusion of quadrant</li> </ul> <span style="float: right;">(3)</span>
5.1.2 $\begin{aligned} \tan \alpha &= \frac{\sin \alpha}{\cos \alpha} \\ &= \frac{\frac{3}{k}}{\frac{-2}{k}} \\ &= \frac{3}{-2} \end{aligned}$	<ul style="list-style-type: none"> <li>✓ use correct ratio</li> <li>✓ value</li> </ul> <span style="float: right;">(2)</span>
OR $\tan \alpha = -\frac{3}{2}$	 <ul style="list-style-type: none"> <li>✓ sketch</li> <li>✓ value</li> </ul> <span style="float: right;">(2)</span>
5.1.3 $\begin{aligned} \cos^2 \alpha + \sin^2 \alpha &= 1 \\ \left(\frac{-2}{k}\right)^2 + \left(\frac{3}{k}\right)^2 &= 1 \\ 4 + 9 &= k^2 \\ k^2 &= 13 \\ k &= \sqrt{13} \end{aligned}$	<ul style="list-style-type: none"> <li>✓ identity</li> <li>✓ substitution</li> <li>✓ multiplication by LCD</li> <li>✓ <math>k^2 = 13</math></li> </ul>
OR $\begin{aligned} k^2 &= 3^2 + (-2)^2 \\ &= 9 + 4 \\ &= 13 \\ k &= \sqrt{13} \end{aligned}$	 <ul style="list-style-type: none"> <li>✓ sketch</li> <li>✓ use of Pythagoras statement</li> <li>✓ <math>k^2 = 13</math></li> </ul> <span style="float: right;">(4)</span>

5.2	$5^{\tan x} = 125$ $5^{\tan x} = 5^3$ $\tan x = 3$ $\text{reference angle} = 71,6^\circ$ $x = 71,6^\circ \quad \text{or } x = 180^\circ + 71,6^\circ \\ = 251,6^\circ$	$\checkmark 5^3$ $\checkmark \tan x = 3$ $\checkmark \text{ref angle} = 71,6^\circ$ $\checkmark x = 71,6^\circ$ $\checkmark x = 251,6^\circ$ <span style="float: right;">(5)</span>
5.3	$\sin x(2\cos x - 1) = 0$ $\sin x = 0 \quad \text{or } \cos x = \frac{1}{2}$ $x = 0^\circ + k \cdot 360^\circ \quad \text{or } x = 180^\circ + k \cdot 360^\circ \quad \text{or } x = 60^\circ + k \cdot 360^\circ \\ \text{or } x = 300^\circ + k \cdot 360^\circ$ $\therefore x = k \cdot 180^\circ$ $k \in \mathbb{Z}$	$\checkmark \sin x = 0 \text{ en}$ $\cos x = \frac{1}{2}$ $\checkmark \checkmark x = k \cdot 180^\circ$ $\checkmark x = 60^\circ + k \cdot 360^\circ$ $\checkmark x = 300^\circ + k \cdot 360^\circ$ $\checkmark k \in \mathbb{Z}$ $\checkmark \text{general solution notation}$ <span style="float: right;">(7)</span>

[21]

## QUESTION 6

6.1.1	$\hat{CGS} = 64^\circ$ $\sin 64^\circ = \frac{15}{SG}$ $SG = \frac{15}{\sin 64^\circ}$ $SG = 16,69 \text{ m}$	$\checkmark \text{definition}$ $\checkmark \text{substitution}$ $\checkmark SG$ <span style="float: right;">(3)</span>
6.1.2	$SH^2 = (16,69)^2 + (7,32)^2 - 2(16,69)(7,32)\cos 116^\circ$ $= 439,2508074\dots$ $SH = 20,96 \text{ m}$ <p>OR</p> $CG = \sqrt{16,69^2 - 15^2} = 7,32$ $SH = \sqrt{15^2 + 14,64^2} = 20,96$	$\checkmark \text{cos rule or pythagoras}$ $\checkmark \text{substitution}$ $\checkmark \text{value}$ <span style="float: right;">(3)</span>

6.1.3	$\frac{\sin G\hat{S}H}{7,32} = \frac{\sin 116^\circ}{20,96}$ $\sin G\hat{S}H = 0,3138918139\dots$ $G\hat{S}H = 18,3^\circ$ $5a = 360^\circ$ $a = 72^\circ$ $DE^2 = OD^2 + OE^2 - 2OD \cdot OE \cdot \cos a$ $= (7)^2 + (7)^2 - 2(7)(7) \cdot \cos 72^\circ$ $= 67,71633455$ $DE = 8,23 \text{ cm}$ <p style="text-align: center;"><b>OR</b></p> $OD = OE \text{ (radii)}$ $O\hat{E}D = O\hat{D}E \text{ (angles opp = sides of isosceles triangle)}$ $O\hat{E}D = \frac{180^\circ - 72^\circ}{2} \text{ (sum angles in a triangle)}$ $O\hat{E}D = 54^\circ$ $\frac{DE}{\sin 72^\circ} = \frac{OD}{\sin 54^\circ}$ $DE = \frac{7 \cdot \sin 72^\circ}{\sin 54^\circ}$ $= 8,23 \text{ cm}$ $\text{area } OED = \frac{1}{2} \cdot OE \cdot OD \cdot \sin E\hat{O}D$ $= \frac{1}{2} \cdot (7)(7) \cdot \sin 72^\circ$ $= 23,30 \text{ cm}^2$	✓ sine rule ✓✓ substitution ✓ value (4) ✓ 5a = 360° ✓ value (2) ✓ cos rule ✓ substitution ✓ CD <sup>2</sup> = 67,71633455 ✓ value ✓ OED = 54° ✓ sine rule ✓ substitution ✓ value (4) ✓ area rule ✓ substitution ✓ value (3) <b>[19]</b>
6.2.1		
6.2.2		
6.2.3		

**QUESTION 7**

7.1      surface area of cylinder $= 2\pi rh$ $= 2\pi(10)(65)$ $= 4084,07 \text{ m}^2$  surface area of dome $= \frac{1}{2}(4\pi r^2)$ $= 2.(10)^2 \pi$ $= 628,32 \text{ m}^2$  Total surface area = $4712,39 \text{ m}^2$	<ul style="list-style-type: none"> <li>✓ substitution</li> <li>✓ radius = <math>10 \text{ m}</math></li> <li>✓ value</li>    <li>✓ <math>\frac{1}{2}</math></li> <li>✓ value</li>    <li>✓ value</li> </ul> <p style="text-align: right;">(6)</p>
7.2      Volume of rectangular prism $= lbh$ $= 0,6 \times 0,5 \times 2$ $= 0,6 \text{ m}^3$  Volume of pyramid $= \frac{1}{3}lbh$ $= \frac{1}{3}(0,6)(0,5)(0,8)$ $= 0,08 \text{ m}^3$  Total Volume of 2 pillars $= 2(0,6 + 0,08)$ $= 1,36 \text{ m}^3$	<ul style="list-style-type: none"> <li>✓ substitution</li> <li>✓ value</li>    <li>✓ substitution</li> <li>✓ value</li>    <li>✓ multiplication by 2</li> <li>✓ value</li> </ul> <p style="text-align: right;">(6) [12]</p>

**QUESTION 8**

8.1	48, 50, 52, 59, 60, 68, 73, 76, 76, 76, 78, 79, 80, 81, 82, 82, 84, 91, 92, 98  $\text{median} = \frac{76 + 78}{2}$ $= 77$	✓ ordered data  ✓ value (2)
8.2	$\text{lower quartile} = \frac{60 + 68}{2} = 64$ $\text{upper quartile} = \frac{82 + 82}{2} = 82$	✓ lower quartile value ✓ upper quartile value (2)
8.3	 <p>A box plot on a number line from 48 to 98. The number line has tick marks at 48, 64, 77, 82, and 98. The minimum value is 48, and the maximum value is 98. The box starts at 64 and ends at 82. The median is at 77. Whiskers extend from the box to the minimum and maximum values.</p>	✓ quartiles ✓ box ✓ whiskers (3)
8.4	The data is skewed to the left.	✓ statement (1) <b>[8]</b>

**QUESTION 9**

9.1

Distance, $d$	Frequency	Cumulative Frequency
$0 < d \leq 5$	5	5
$5 < d \leq 10$	41	46
$10 < d \leq 15$	77	123
$15 < d \leq 20$	58	181
$20 < d \leq 25$	39	220
$25 < d \leq 30$	17	237
$30 < d \leq 35$	3	240

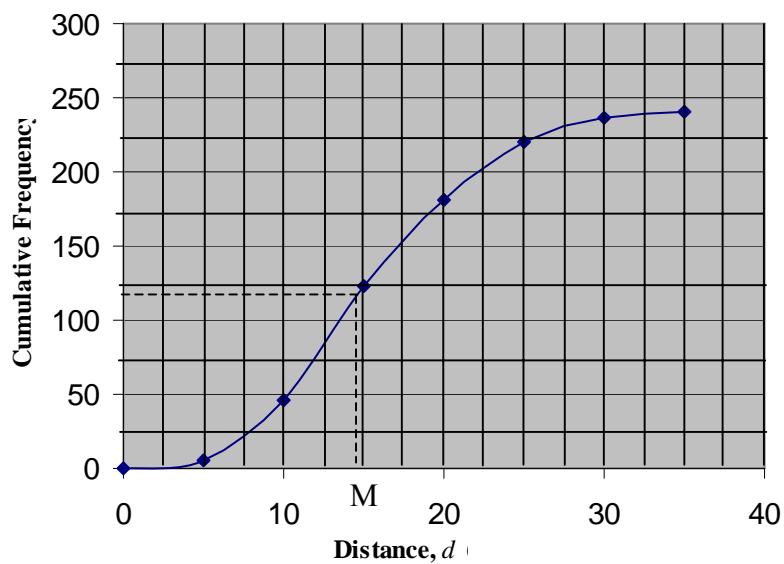
✓✓ correct totals

✓ 240

(3)

9.2

**Cumulative Frequency Graph showing the distances that 240 people travel to work**



- ✓ shape
- ✓ axes (correctly labeled)
- ✓✓ plotting points correctly

(4)

9.3

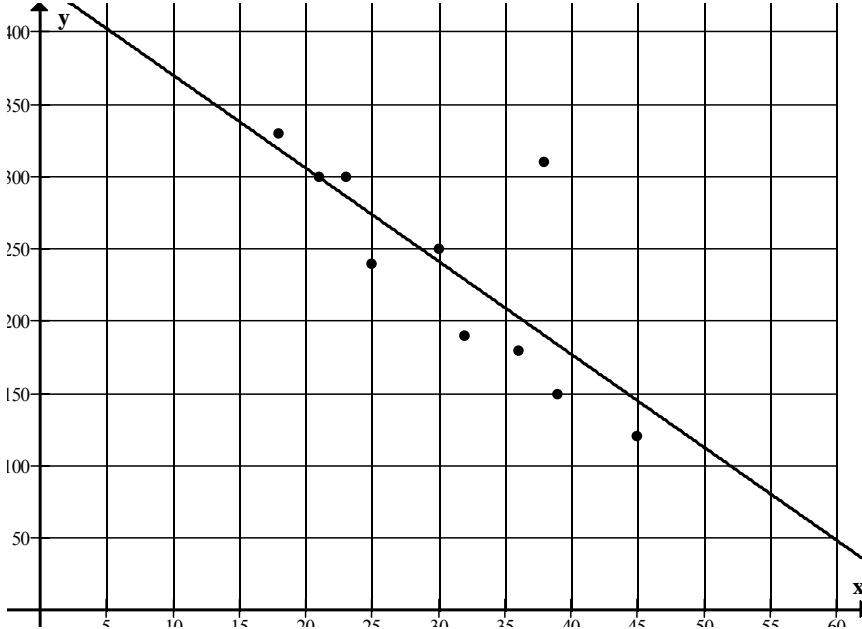
Median  $\approx 14$  kms

- ✓ value
- ✓✓ indication on graph

(3)

**[10]**

**QUESTION 10**

10.1	(38; 310)	✓ value (1)																						
10.2	 <p>A scatter plot showing a negative linear trend. The x-axis ranges from 5 to 60 with increments of 5. The y-axis ranges from 50 to 400 with increments of 50. A straight line of best fit passes through approximately 10 data points.</p> <table border="1"> <caption>Data points estimated from the graph</caption> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr><td>15</td><td>330</td></tr> <tr><td>20</td><td>300</td></tr> <tr><td>25</td><td>240</td></tr> <tr><td>30</td><td>190</td></tr> <tr><td>35</td><td>180</td></tr> <tr><td>40</td><td>150</td></tr> <tr><td>45</td><td>120</td></tr> <tr><td>50</td><td>100</td></tr> <tr><td>55</td><td>80</td></tr> <tr><td>60</td><td>60</td></tr> </tbody> </table>	x	y	15	330	20	300	25	240	30	190	35	180	40	150	45	120	50	100	55	80	60	60	✓✓ plotting the points ✓ axes (correctly labeled) (3)
x	y																							
15	330																							
20	300																							
25	240																							
30	190																							
35	180																							
40	150																							
45	120																							
50	100																							
55	80																							
60	60																							
10.3	Line of best fit is a straight line with a negative slope	✓ straight line ✓ negative slope (2)																						
10.4	As women get older, the trend is that they spend less money on clothing items.	✓ value (1)																						
10.5	R140	✓ value ✓ reading from the graph (2) <b>[9]</b>																						

**QUESTION 11**

11.1	$\text{Mean} = \frac{847}{11}$ $\text{Mean} = 77 \text{ cm}$	✓ sum ✓ value (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>72</td><td>-5</td><td>25</td></tr> <tr><td>77</td><td>0</td><td>0</td></tr> <tr><td>75</td><td>-2</td><td>4</td></tr> <tr><td>78</td><td>1</td><td>1</td></tr> <tr><td>76</td><td>-1</td><td>1</td></tr> <tr><td>93</td><td>16</td><td>256</td></tr> <tr><td>64</td><td>-13</td><td>169</td></tr> <tr><td>100</td><td>23</td><td>529</td></tr> <tr><td>62</td><td>-15</td><td>225</td></tr> <tr><td>81</td><td>4</td><td>16</td></tr> <tr><td>69</td><td>-8</td><td>64</td></tr> <tr> <td colspan="2"> <math display="block">\sum_{i=1}^n (x_i - \bar{x})^2 =</math> </td><td>1290</td></tr> </tbody> </table>	DATA	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$	72	-5	25	77	0	0	75	-2	4	78	1	1	76	-1	1	93	16	256	64	-13	169	100	23	529	62	-15	225	81	4	16	69	-8	64	$\sum_{i=1}^n (x_i - \bar{x})^2 =$		1290	✓✓ calculating differences ✓ calculating squares ✓ sum (4)
DATA	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$																																							
72	-5	25																																							
77	0	0																																							
75	-2	4																																							
78	1	1																																							
76	-1	1																																							
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62	-15	225																																							
81	4	16																																							
69	-8	64																																							
$\sum_{i=1}^n (x_i - \bar{x})^2 =$		1290																																							
11.3	$Var = \frac{1290}{11}$ $Var = 117,27$	✓ dividing by 11 ✓ value (2)																																							
11.4	$\partial = \sqrt{Var}$ $= \sqrt{117,27}$ $= 10,83 \text{ cm}$	✓ value (1)																																							
11.5	7 of the players' have a waistline that is within the standard deviation distance from the mean. Or any suitable interpretation	✓✓ interpretation (2) <b>[11]</b>																																							