



LEARNER NAME	<i>Selns</i>
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NATIONAL SENIOR CERTIFICATE

MATHEMATICS P2

GRADE 11

NOVEMBER 2015

SPECIAL ANSWER BOOK

QUESTION	MARK	INITIAL	MOD.
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
TOTAL	<i>149 + 1</i>		

This answer book consists of 22 pages.



* I W I S A B 2 *

QUESTION 1

	Solution	Marks																		
1.1	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">HEIGHT (cm)</th> <th style="text-align: center;">FREQUENCY</th> <th style="text-align: center;">CUMULATIVE FREQUENCY</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$150 < x \leq 155$</td> <td style="text-align: center;">4</td> <td style="text-align: center;">4</td> </tr> <tr> <td style="text-align: center;">$155 < x \leq 160$</td> <td style="text-align: center;">22</td> <td style="text-align: center;">26</td> </tr> <tr> <td style="text-align: center;">$160 < x \leq 165$</td> <td style="text-align: center;">56</td> <td style="text-align: center;">82</td> </tr> <tr> <td style="text-align: center;">$165 < x \leq 170$</td> <td style="text-align: center;">32</td> <td style="text-align: center;">114</td> </tr> <tr> <td style="text-align: center;">$170 < x \leq 175$</td> <td style="text-align: center;">6</td> <td style="text-align: center;">120</td> </tr> </tbody> </table>	HEIGHT (cm)	FREQUENCY	CUMULATIVE FREQUENCY	$150 < x \leq 155$	4	4	$155 < x \leq 160$	22	26	$160 < x \leq 165$	56	82	$165 < x \leq 170$	32	114	$170 < x \leq 175$	6	120	<p style="text-align: right;">✓✓ - 1 each error</p> <p style="text-align: right;">(2)</p>
HEIGHT (cm)	FREQUENCY	CUMULATIVE FREQUENCY																		
$150 < x \leq 155$	4	4																		
$155 < x \leq 160$	22	26																		
$160 < x \leq 165$	56	82																		
$165 < x \leq 170$	32	114																		
$170 < x \leq 175$	6	120																		
1.2	<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <p style="text-align: center;">Ogive</p> <p style="text-align: center;">Cumulative Frequency Table</p> <p style="text-align: center;">Heights (in centimetres)</p> </div> <div style="flex: 0.5;"> <p style="text-align: right;">— 50 — 40 — 30 — 20 — 10 — 0</p> <p style="text-align: right;">cf axis</p> </div> </div>	<p style="text-align: right;">✓ grounding point</p> <p style="text-align: right;">✓✓ plotting</p> <p style="text-align: right;">✓ smooth curve</p> <p style="text-align: right;">(4)</p>																		
1.3	<p>$T_1, \dots, T_{120} \therefore M = T_{\frac{1}{2}(14/120)} = T_{60,5}$</p> <p>$T_1, \dots, T_{60} \therefore Q_1 = T_{30,5}$ $T_{61}, \dots, T_{120} \therefore Q_3 = T_{90,5}$</p> <p><u>min = 150</u> <u>$Q_1 = 160,9$</u> <u>$M = 163$</u> <u>$Q_3 = 166$</u> <u>max = 175</u></p>	<p style="text-align: right;">(5)</p>																		
1.4	<p>$M - Q_1 = 163 - 160,9 = 2,1$ $Q_3 - M = 166 - 163 = 3$</p> <p>$\therefore Q_3 - M > M - Q_1$</p> <p>$\therefore$ data is skewed to the <u>right</u> ✓ (positively skewed)</p>	<p style="text-align: right;">(1)</p> <p style="text-align: right;">[12]</p>																		

QUESTION 2

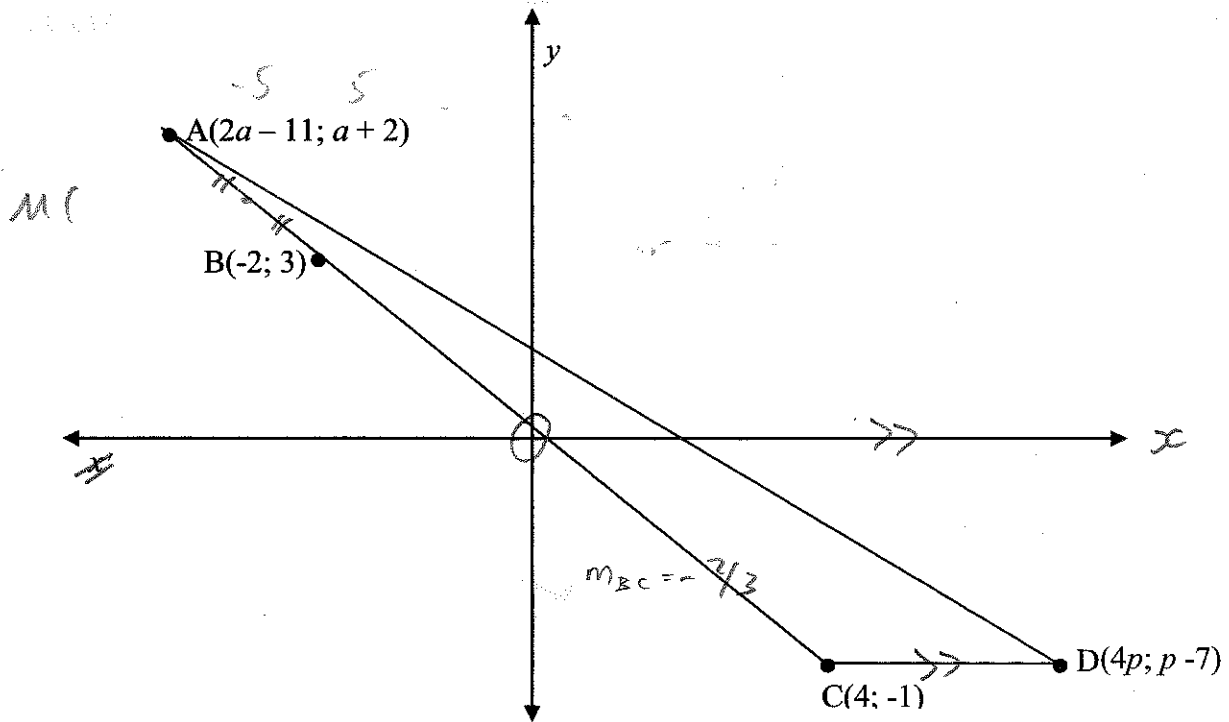
	Solution	Marks
2.1	$\bar{x} = R \ 3 \ 555 \checkmark \checkmark$	
2.2	$s = R \ 900,12 \checkmark$	(2)
2.3	$2250 \ 2250 \ 3000 \ 3300 \ 3300 \ 3600 \ 3900 \ 4350 \ 4350 \ 5250$ $\bar{x} - 10 \quad \quad \quad \bar{x} + 10$ $= 3555 - 900,12 \quad \quad \quad = 3555 + 900,12$ $= 2654,88 \checkmark \quad \quad \quad = 4455,12 \checkmark$	(1)
	$\therefore \frac{7}{10} \times 100 = 70 \% \checkmark$	(4)
		[7]

2

1

4

QUESTION 3



	Solution	Marks
3.1	$A(2a-11; a+2)$ $B(-2; 3)$ $C(4; -1)$ $m_{AB} = \frac{a+2-3}{2a-11-(-2)} = \frac{a-1}{2a-9}$ $m_{BC} = \frac{-1-3}{4-(-2)} = -\frac{2}{3}$ Collinear $\therefore m_{AB} = m_{BC}$ $\frac{a-1}{2a-9} = -\frac{2}{3}$ $3(a-1) = -2(2a-9)$ $3a-3 = -4a+18$ $7a = 21$ $a = 3$	(4)
3.2	$m_{AC} = m_{BC} = -\frac{2}{3}$ $y = -\frac{2}{3}x + c$ Sub $C(4; -1)$ $-1 = -\frac{2}{3}(4) + c$ $\frac{5}{3} = c$ $\therefore y = -\frac{2}{3}x + \frac{5}{3}$	(3)
3.3	$A(2(3)-11; 3+2) = A(-5; 5)$ $B(-2; 3)$ $x_M = \frac{-5+(-2)}{2} = -\frac{7}{2}$ $y_M = \frac{5+3}{2} = 4$ $\therefore M(-\frac{7}{2}; 4)$	(3)

3.4

$$y_c = y_D$$

$$-1 = p - 7$$



$$\underline{6 = p} \rightarrow$$

For CD to be a line:

$$x_c \neq x_D$$

$$4 \neq 4p$$

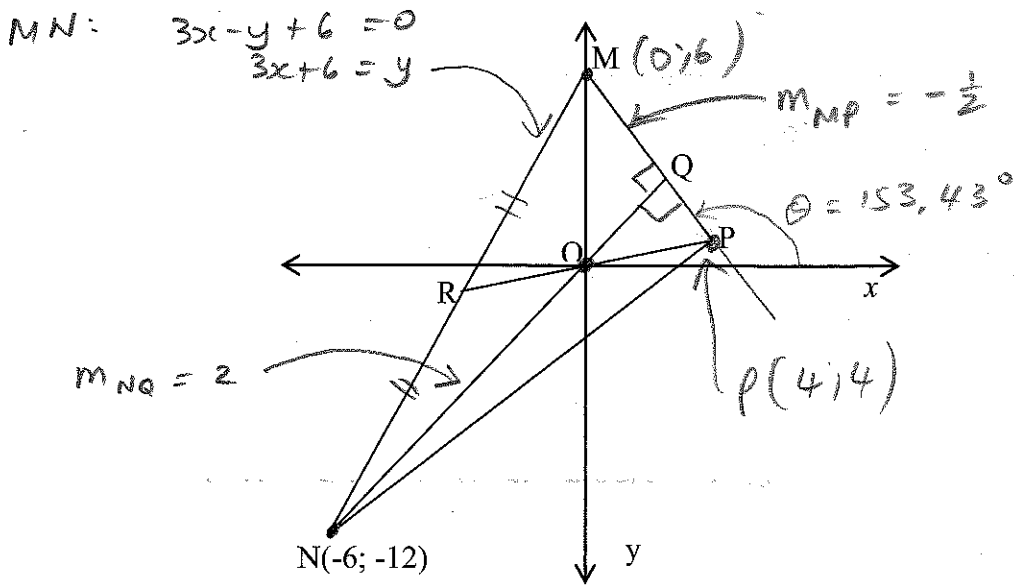
$$\underline{1 \neq p} \rightarrow$$

~~(8)~~
[13]

2

2

QUESTION 4



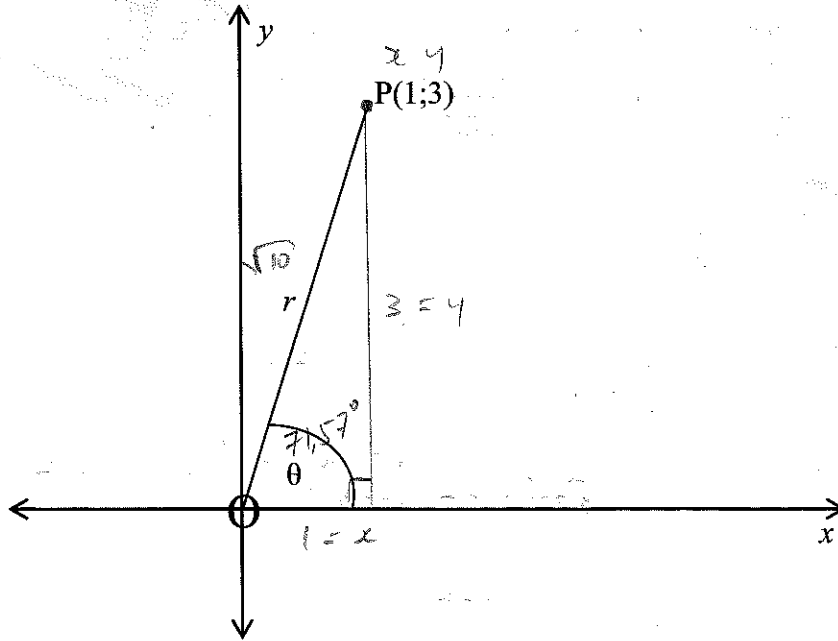
	Solution	Marks
4.1	$m_{NR} = \frac{-12 - 0}{-6 - 0}$ $= \frac{-12}{-6} = 2$	$N(-6;-12)$ $Q(0;0)$
4.2	$m_{MP} = -\frac{1}{2}$	$MP \perp NQ$
4.3	$\tan \theta = -\frac{1}{2}$ $\text{ref}^\circ = 26,56 \dots$ $\tan = \text{in}$ $\text{II: } \theta = 153,43^\circ$	MP
4.4	$MN \ y = 3x + 6$ $y\text{-int: } y = 6 \therefore M(0;6)$ $\therefore MP: \ y = -\frac{1}{2}x + 6$	
		(4) 3

1
2
2
2
3

4.5	$x_p = \frac{0+(-6)}{2} \quad y_p = \frac{6+(-12)}{2}$ $= -3 \quad \checkmark \quad = -3 \quad \checkmark \quad \therefore R(-3; -3)$ $M(0; 6) \quad N(-6; -12)$ $M_{OR} = \frac{-3-0}{-3-0} = 1 \quad \therefore RP: y = x \quad \dots 1$ $MP: y = -\frac{1}{2}x + 6 \quad \dots 2$ $x = -\frac{1}{2}x + 6 \quad \therefore \frac{3}{2}x = 6 \quad \therefore x = 4$ $\therefore P(4; 4)$	
4.6	$R(-3; -3)$ <p style="text-align: center;">award once in 4.5, or 4.6.</p>	(4) 8
		(3) [16]

8

QUESTION 5



	Solution	Marks
5.1.1	$\tan \theta = \frac{3}{1}$ ✓ $\text{ref}^\circ = 71,57\dots^\circ$ tan + in I: $\theta = 71,57^\circ$ ✓	
5.1.2	$3^2 + 1^2 = r^2$ ✓ $10 = r^2$ ✓ $\sqrt{10} = r$ ✓ Pythag	(2)
5.1.3a	$\sin \theta = \frac{3}{\sqrt{10}}$ ✓ sin	(2)
5.1.3b	$\cos(180^\circ + \theta) = -\cos \theta$ ✓ $= -\left(\frac{1}{\sqrt{10}}\right)$ ✓ $= -\frac{1}{\sqrt{10}}$ ✓	(1)
5.2	$2 \cos^2 x + 5 \sin x = 4$ $2(1 - \sin^2 x) + 5 \sin x - 4 = 0$ $-2 \sin^2 x + 2 + 5 \sin x - 4 = 0$ $0 = 2 \sin^2 x - 5 \sin x + 2$ ✓ $0 = (\sin x - 2) (2 \sin x - 1)$ ✓ $\therefore \sin x = 2$ ✓ or $\sin x = \frac{1}{2}$ ✓ no soln $\text{ref}^\circ = 30^\circ$ sin + in I: $x = 30^\circ + k360^\circ$ ✓ II: $x = 150^\circ + k360^\circ$ ✓ -1 no KEZ	(6)

2

2

1

2

6

5.3	$\bullet \cos(90^\circ - x) = \sin x \quad \bullet \sin(-x) = -\sin x$ $\bullet \cos^2(180^\circ + x) = [\cos(180^\circ + x)]^2 = [-\cos x]^2 = \cos^2 x$ $\frac{\cos(90^\circ - x) \cdot \sin(-x)}{\cos^2(180^\circ + x)} = \frac{(\sin x)(-\sin x)}{\cos^2 x}$ $= -\frac{\sin^2 x}{\cos^2 x}$ $= -\tan^2 x$	(5)
5.4		
5.4	$\text{LHS} = \frac{\sin x}{1 + \cos x} + \frac{1 + \cos x}{\sin x}$ $= \frac{(\sin x)(\sin x) + (1 + \cos x)(1 + \cos x)}{(1 + \cos x)(\sin x)}$ $= \frac{\sin^2 x + (1 + 2\cos x + \cos^2 x)}{(1 + \cos x)(\sin x)}$ $= \frac{\sin^2 x + 1 + 2\cos x + \cos^2 x}{(1 + \cos x)(\sin x)}$	num den
	$= \frac{2 + 2\cos x}{(1 + \cos x)(\sin x)}$ $= \frac{2(1 + \cos x)}{(1 + \cos x)(\sin x)}$ $= \frac{2}{\sin x}$ $= \text{RHS} \rightarrow$	(5) [23]

5

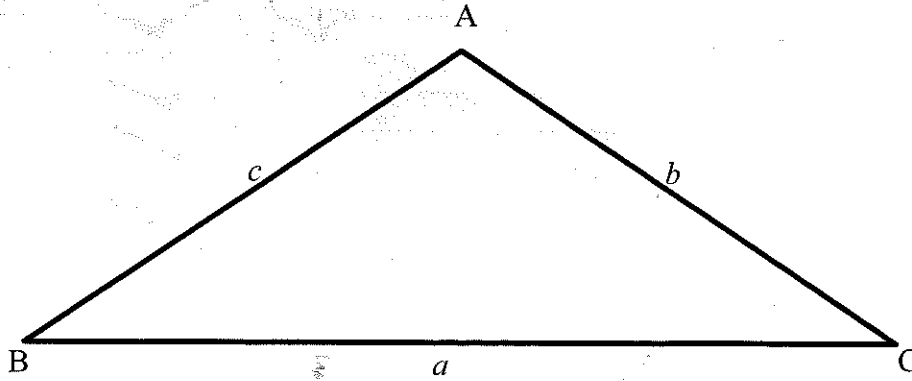
5

5.3

$$\frac{(\cos x)(-\sin x)}{\cos^2 x} = -\frac{\sin x}{\cos x} = -\tan x$$

\checkmark CA \checkmark CA
 \checkmark CA

QUESTION 6



	Solution	Marks
6.1	$b^2 = a^2 + c^2 - 2ac \cos B$	
		(2)
6.2		
6.2.1	$\hat{R}_1 = 65^\circ \quad \text{in } \Delta = 180^\circ$ $\frac{PS}{\sin 65^\circ} = \frac{158}{\sin 25^\circ}$ $PS = 338,83 \text{ m}$	
6.2.2	$SQ^2 = 338,83^2 + 1500^2 - 2 \cdot 338,83 \cdot 1500 \cdot \cos 30^\circ$ $= 1\,484\,499,60 \dots$ $SQ = 1\,218,4 \text{ m}$	(3)

2

3

3

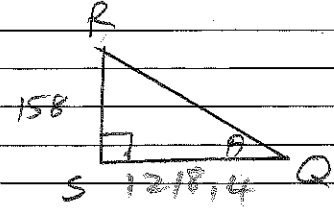
6.2.3

$$\tan \theta = \frac{158}{1218,4} \quad \begin{matrix} \text{opp} \\ \text{adj} \end{matrix}$$

$$= 0,12 \dots$$

$$\text{sub}^{\wedge} = 7,38 \dots^{\circ}$$

$$\text{tan}^{\wedge} \text{ I : } \theta = 7,39^{\circ}$$



(3)

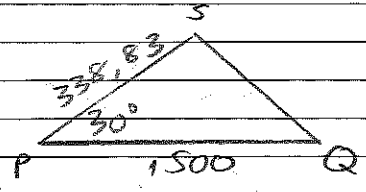
3

6.2.4

Area ΔSPO

$$= \frac{1}{2} (1500)(338,83) \sin 30^{\circ}$$

$$= 127\,061,25 \text{ m}^2$$



(4)

[15]

4

QUESTION 7

$f: y = \frac{1}{2} \tan x$

$g: y = \sin 2x$

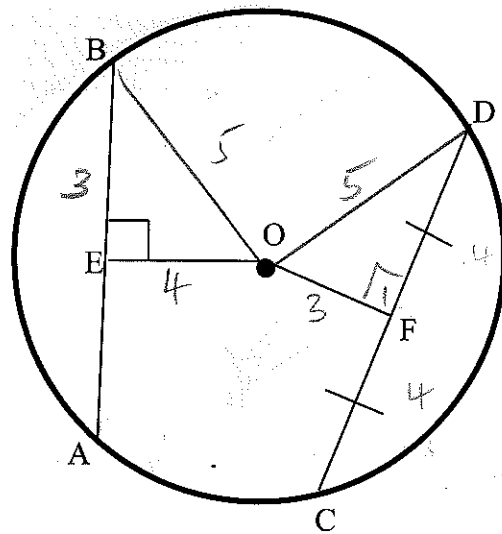
np = 180°
steps = $\frac{180^\circ}{4} = 45^\circ$

np = $\frac{360^\circ}{2} = 180^\circ$

steps = $\frac{180^\circ}{4} = 45^\circ$

	Solution	Marks
7.1		<p>f</p> <p>✓ easy</p> <p>✓</p> <p>✓</p> <p>g</p> <p>✓ top's</p> <p>✓ x/0 int</p> <p>✓ slope 3</p> <p>(6)</p>
7.2	<p>$f(x) > g(x) \therefore y_f > y_g$ tan above sin</p> <p><u>$x \in (-60^\circ; 0^\circ)$ or $(60^\circ; 90^\circ)$ or $(120^\circ; 180^\circ)$</u></p>	<p>6</p>
7.3	<p>$g(x) = \sin 2x$</p> <p>$g(2x) = \sin 2(2x)$</p> <p>$= \sin 4x$</p>	<p>(6)</p>
	<p>np = $\frac{360^\circ}{4}$</p> <p><u>$= 90^\circ$</u></p>	<p>(1)</p> <p>[13]</p>

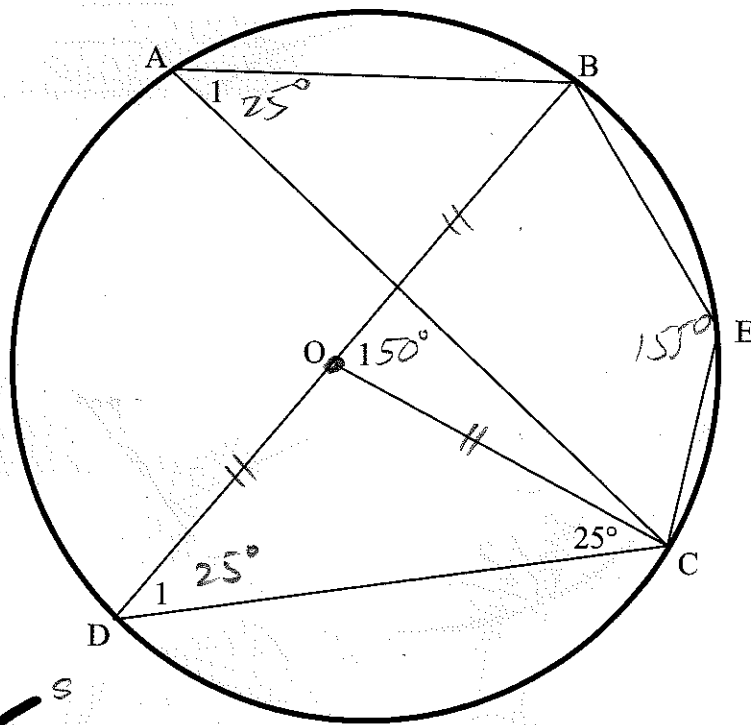
QUESTION 8



	Solution	Marks
8.1	<u>bisects the chord</u> ✓ ^S	
		(1)
8.2.1	$FD = 4$ given $\angle OFD = 90^\circ$ line centre O to midpt chord is \perp ✓ ^{SR} $\therefore OD = 5 \text{ cm}$ ✓ ^S Pythagoras ✓ ^R	
		(3)
8.2.2	$OB = 5$ radii ✓ ^{SR} $BE = 3$ Pythag ✓ ^{SR} $\therefore EA = 3$ line centre O \perp to chord bisects chord ✓ ^{SR} $\therefore AB = 6$ ✓	
		(4)
		[8]

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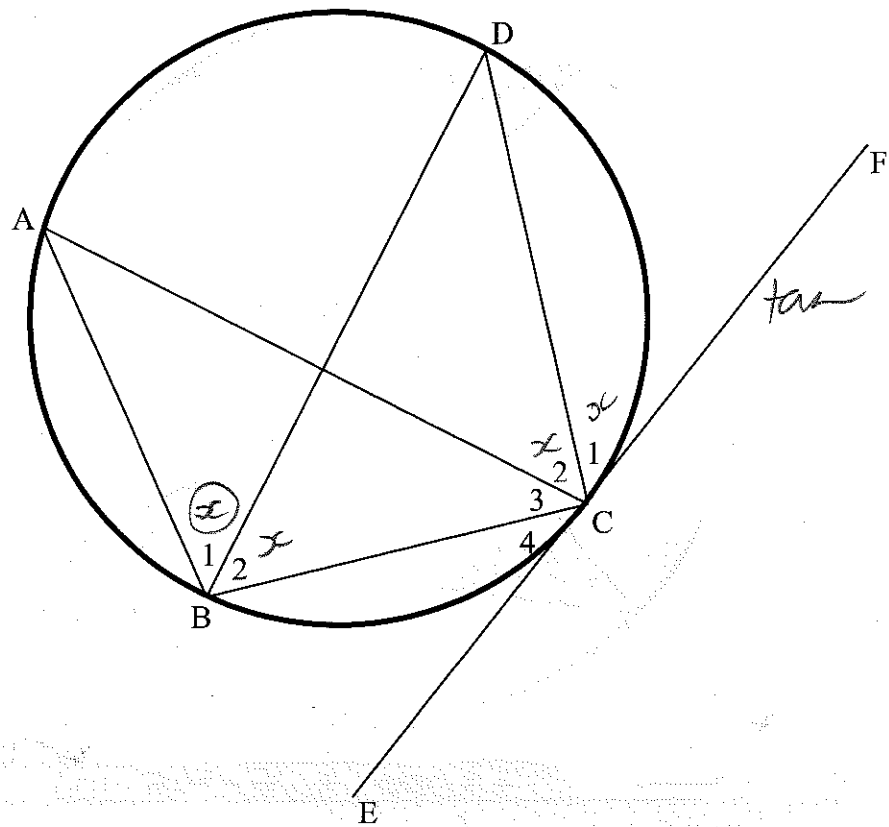
9.2



9.2.1	$\hat{D}_1 = 25^\circ$ radii opp = sides } $\hat{O}_1 = 150^\circ$	(2)
9.2.2	$\hat{O}_1 = 50^\circ$ Ext \hat{A}	(2)
9.2.3	$\hat{A}_1 = 25^\circ$ \hat{C} in same \odot segm =	(2)
9.2.4	$\hat{E} = 155^\circ$ opp \hat{C} cyclic quad = 180°	(2)
		(2)
		[14]

2
2
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2

QUESTION 10



	Solution	Marks
10.1	$\hat{B}_2 = x$ ✓ given ✓ $\hat{C}_1 = x$ ✓ tan chord ✓ OR $\hat{C}_2 = x$ ✓ arcs in same segm = ✓	
10.2	$\hat{C}_2 = x$ ✓ arcs in same segm = ✓ $\therefore \hat{C}_1 = \hat{C}_2$ ✓ both = x $\therefore DC$ bisects \hat{ACF} ✓	(4)
		(2)
		[6]

4

2

QUESTION 11

	Solution	Marks
11.1	<u>are supplementary</u> ✓	








		(1)
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11.2

11.2.1	$\hat{A} = x$ Corr \hat{A} 's =, $AB \parallel CD$ ✓ SR	
	$\therefore \hat{C}_2 = x$ ✓ ext \hat{A} cyclic quad ✓ R	
	$\therefore \hat{C}_2 = \hat{D}_3$ ✓ both \hat{A} 's = x	
	$\therefore MC = MD$ sides opp = \hat{A} 's ✓ R	

		(5)
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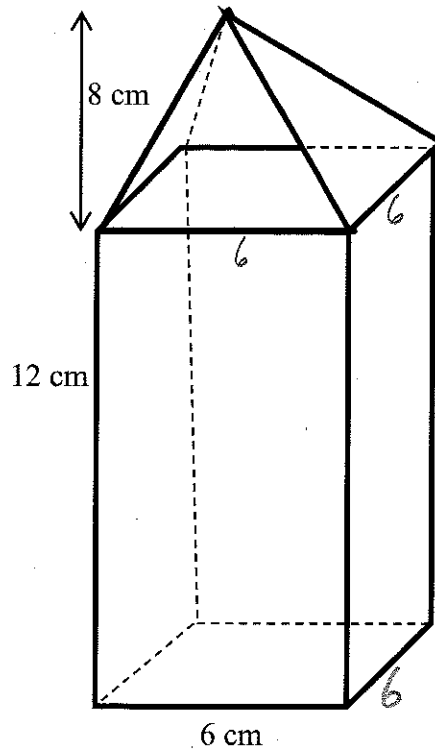
5

11.2.2	$\hat{M} = 180^\circ - 2x$  $\hat{S} \Delta = 180^\circ$ 	
11.2.3	$\hat{O}_1 = 2x$ \hat{O} @ centre  $\therefore \hat{O}_1 + \hat{M}$ $= 2x + 180^\circ - 2x$  $= 180^\circ$  \therefore <u>BODM is a cyclic quad</u>  $\text{conv opp } \hat{S} \text{ cyclic quad} = 180^\circ$ 	(2)
		(3) [11]

2

3

QUESTION 12



	Solution	Marks
12.1	$h_s^2 = 8^2 + 3^2 \checkmark$ $= 73$ $h_s = \sqrt{73} \checkmark$ $= 8,54 \text{ cm} \checkmark$	
12.2	$\text{Area } \Delta = \frac{1}{2}(6)(8,54) \checkmark$ $= 25,62 \text{ cm}^2 \checkmark$	(3)
12.3	$\text{TSA} = 4 \times \Delta + 4 \times \square_{6 \times 12} + \square_{6 \times 6}$ $= 4 \times (25,62) + 4 \times (6 \times 12) + 6 \times 6 \checkmark$ $= 102,48 + 288 + 36$ $= 426,48 \text{ cm}^2 \checkmark$	(5)
		[11]

3

3

5

