

Commentary on paper 2 candidate evidence

The candidate evidence has achieved the following marks for each question of this course assessment component.

Question 1	Candidate response	Commentary
Response 1	$100\% - 2\% = 98\%$ 125000×0.98^2 $= 120050 \text{ tonnes}$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✓•1 correct multiplier ×•2 incorrect power ✓•3 follow through working met the criterion for this mark
Response 2	$125,000 \times 1.02^{-3}$ $= 117,790.29 \text{ tonnes}$	<p>Mark: 1/3</p> <p>The candidate was awarded 1 mark; see note 2 in the marking instructions.</p> <ul style="list-style-type: none"> ×•1 incorrect multiplier ×•2 incorrect power ✓•3 follow through working met the criterion for this mark

Response 3	125000×1.02^3 125000 117790 tonnes	<p>Mark: 1/3</p> <p>The candidate was awarded 1 mark; see note 3(b) in the marking instructions.</p> <ul style="list-style-type: none"> ×•1 this mark is not available where division is used ×•2 this mark is not available where division along with an incorrect percentage is used ✓•3 follow through working met the criterion for this mark
Response 4	$100 - 2 = 88\% (0.88)$ $= 125000 \times (0.88)^3 = \del{117790}$ $= 85184$ <p>By 2020 = <u>85184 tonnes</u></p>	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks; see note 2 in the marking instructions.</p> <ul style="list-style-type: none"> ×•1 incorrect multiplier ✓•2 correct power in follow through ✓•3 follow through working met the criterion for this mark

Question 2	Candidate response	Commentary
Response 1	$\text{Arc AB} = \pi \times \frac{320}{360}$ $\text{Arc AB} = \pi \times 14.8 \times 0.8$ $\text{Arc AB} = \underline{\underline{37.17 \text{ cm}}}$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✓•¹ correct fraction ✓•² correct substitution into arc length formula; 0.8 accepted as evidence <ul style="list-style-type: none"> of $\frac{320}{360}$ ✗•³ calculation mark not available since $\frac{320}{360}$ has not been rounded correctly to at least 2 significant figures; see note 3 in the marking instructions
Response 2	$L_g = \frac{\theta}{360} \pi d$ $= \frac{40}{360} \cdot \pi \times 14.8$ $\cancel{5.17 \text{ cm}}$ $= 5.17 \text{ cm}$ $C = \pi d$ $= \pi \times 14.8$ $\cancel{46.5}$ $= 46.5$ $\text{Major arc AB} = 46.5 - 5.17$ $= \underline{\underline{41.33 \text{ cm}}}$	<p>Mark: 3/3</p> <p>The candidate was awarded 3 marks; see note 4 in the marking instructions.</p> <ul style="list-style-type: none"> ✓•¹ correct alternative method, ie circumference – length of minor arc ✓•² correct substitution into circumference and minor arc length formulae ✓•³ correct major arc length calculated

Response 3	$\frac{x}{360} \times \pi r^2$ $\frac{320}{360} \times \pi \times 7.4^2$ $= 152.92 \text{ cm}$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks; see commonly observed response 2 in the marking instructions.</p> <ul style="list-style-type: none"> ✓•¹ correct fraction ✗•² substitution into area of sector formula instead of arc length formula ✓•³ follow through working met the criterion for this mark
Question 3	Candidate response	Commentary
Response 1	$ n = \sqrt{24^2 + (-12)^2 + 8^2}$ $= \sqrt{576 + 144 + 64}$ $= \sqrt{432 + 64}$ $= \sqrt{496}$ $= 22.27105745$	<p>Mark: 1/2</p> <p>The candidate was awarded 1 mark; see commonly observed response 2 in the marking instructions.</p> <ul style="list-style-type: none"> ✓•¹ process started correctly ✗•² incorrect calculation; $(-12)^2 \neq -144$

Response 2	$\sqrt{24^2 + 12^2 + 8^2}$ $= \sqrt{784}$	<p>Mark: 1/2</p> <p>The candidate was awarded 1 mark; see note 2 in the marking instructions and commonly observed response 1.</p> <ul style="list-style-type: none"> ✓•¹ process started correctly ✗•² incomplete solution
Response 3	$ r = \sqrt{a^2 + b^2 + c^2}$ $= \sqrt{24^2 + 12^2 + 8^2}$ $= \sqrt{576 + 144 + 64}$ $ r = \sqrt{784} = \underline{\underline{28}}$	<p>Mark: 2/2</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✓•¹ process started correctly; see note 2 in the marking instructions - benefit of doubt is given that the candidate knows that $(-12)^2 = 12^2$ ✓•² correct solution

Question 4	Candidate response	Commentary
Response 1	$3x < 6(x-1) - 12$ $3x < 6x - 6 - 12$ $-9x < -18$ $x > 2$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✓•¹ right hand side of inequation processed correctly ×•² incorrect collection of x terms ✓•³ follow through working met the criterion for this mark
Response 2	$3x < 6(x-1) - 12.$ $3x < 6x - 6 - 12$ $3x < 6x - 18$ $\begin{array}{r} -6x \\ -6x \end{array}$ $\frac{-3x}{-3} < \frac{-18}{-3}$ $x < 6.$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks; see note 2 in the marking instructions.</p> <ul style="list-style-type: none"> ✓•¹ right hand side of inequation processed correctly ✓•² correct collection of like terms ×•³ incorrect inequality sign in final solution

Response 3	$3x < 6(x-1) - 12$ $= 3x < 6x - 6 - 12$ $= 3x < 6x - 18$ $= 3x - 6x < -18$ $= -3x < -18$ $= \underline{\underline{x > -6}}$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✓•¹ right hand side of inequation processed correctly ✗•² incorrect constant term; see line 4 of working ✓•³ follow through working met the criterion for this mark
Response 4	$3x < 6x - 6 - 72$ $3x < 6x - 78$ $\begin{array}{r} 3x < 6x - 78 \\ -6x & \quad -6x \\ \hline -3x < -78 \\ \quad \quad \quad -3 & \quad \quad -3 \\ \hline x > 26 \end{array}$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✗•¹ right hand side of inequation processed incorrectly ✓•² correct collection of like terms in follow through ✓•³ follow through working met the criterion for this mark

Question 5(a)	Candidate response	Commentary																											
<p>Response 1</p>	$\frac{120 + 124 + 125 + 126 + 130 + 131}{6}$ $= \frac{756}{6}$ $= 126$ <p style="text-align: center;">$n = 6$ $6 - 1 = 5$</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>$(x - \bar{x})$</th> <th>$(x - \bar{x})^2$</th> </tr> </thead> <tbody> <tr> <td>120</td> <td>$120 - 126 = -6$</td> <td>36</td> </tr> <tr> <td>124</td> <td>-2</td> <td>4</td> </tr> <tr> <td>125</td> <td>-1</td> <td>1</td> </tr> <tr> <td>126</td> <td>0</td> <td>0</td> </tr> <tr> <td>130</td> <td>4</td> <td>16</td> </tr> <tr> <td>131</td> <td>5</td> <td>25</td> </tr> <tr> <td></td> <td></td> <td>$\Sigma = 82$</td> </tr> <tr> <td></td> <td></td> <td>$n = 5$</td> </tr> </tbody> </table> $S-D = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}}$ $S-D = \sqrt{\frac{82}{5}}$ $S-D = 1.81$ <p style="margin-left: 200px;">mean = 126 S-D = 1.81</p>	x	$(x - \bar{x})$	$(x - \bar{x})^2$	120	$120 - 126 = -6$	36	124	-2	4	125	-1	1	126	0	0	130	4	16	131	5	25			$\Sigma = 82$			$n = 5$	<p>Mark: 3/4</p> <p>The candidate was awarded 3 marks; see note 3(b) in the marking instructions.</p> <ul style="list-style-type: none"> ✓¹ mean correct ✓² $(x - \bar{x})^2$ correct; see right hand column of table ✗³ incorrect substitution into standard deviation formula ✓⁴ follow through working met the criterion for this mark
x	$(x - \bar{x})$	$(x - \bar{x})^2$																											
120	$120 - 126 = -6$	36																											
124	-2	4																											
125	-1	1																											
126	0	0																											
130	4	16																											
131	5	25																											
		$\Sigma = 82$																											
		$n = 5$																											

Response 2

$$\text{MEAN} = \frac{120 + 126 + 125 + 131 + 130 + 124}{6} = \frac{756}{6} = 126$$

$$s = \frac{\sum (x - \bar{x})^2}{n - 1}$$

X	X - \bar{x}	(X - \bar{x}) ²
120	-6	36
126	0	0
125	-1	1
131	5	25
130	4	16
124	-2	4
Totals		82

$$s = \frac{82}{5} = 16.4$$

$$s \text{ standard deviation} = \underline{16.4}$$

$$\text{mean} = \underline{126}$$

Mark: 2/4

The candidate was awarded 2 marks.

- ✓•¹ mean correct
- ✓•² $(x - \bar{x})^2$ correct; see right hand column of table
- ✗•³ incomplete standard deviation formula used
- ✗•⁴ follow through working did **not** meet the criterion for this mark; did not involve square root calculation

<p>Response 3</p>	$120 + 126 + 125 + 131 + 130 + 124 = 631$ $120^2 + 126^2 + 125^2 + 131^2 + 130^2 + 124^2 = 79713$ $Sd = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$ $Sd = \sqrt{\frac{79713 - \frac{(631)^2}{6}}{6-1}}$ $Sd = 51.677523\dots$ $Sd = \overset{51.7}{\cancel{51.677523}} \quad (2 \cdot dp)$	<p>Mark: 2/4</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> x•1 no mean calculated x•2 calculated $\sum x^2$ incorrectly ✓•3 consistent substitution into standard deviation formula in follow through ✓•4 follow through working met the criterion for this mark
<p>Question 5(b)</p>	<p>Candidate response</p>	<p>Commentary</p>
<p>Response 1</p>	<p>On average there was a higher mean of people who visited on Sunday and also Sunday was more consistent but Saturday was more consistent with customers</p>	<p>Mark: 0/2</p> <p>The candidate was awarded 0 marks.</p> <ul style="list-style-type: none"> x•1 similar to note 3(b) (1st bullet point) in the marking instructions; comment refers to the mean rather than the average number of customers x•2 see note 2 (2nd bullet point, second example) in the marking instructions; candidate's comment does not refer to the number of customers

Response 2	<p>Sat mean = 126 Sun Mean = 117 SD = 4.05 SD = 6.2</p> <ul style="list-style-type: none"> - More customers visited the six stalls on Saturday on average than on Sunday - The standard deviation of customer visiting is more consistent on Saturday than on Sunday which is less consistent 	<p>Mark: 1/2</p> <p>The candidate was awarded 1 mark.</p> <ul style="list-style-type: none"> ✓•1 similar to note 3(a) in the marking instructions ✗•2 similar to note 4(b) (5th bullet point) in the marking instructions; comment refers to the consistency of the standard deviation rather than the consistency of the number of customers
Response 3	<p>On average more customers visited the stalls on Saturday. However on Sunday the numbers of customers was more varied.</p>	<p>Mark: 2/2</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✓•1 similar to note 3(a) (1st bullet point) in the marking instructions ✓•2 similar to note 4(a) (3rd bullet point) in the marking instructions

Response 4	<ul style="list-style-type: none"> • On average less customers visited on Sunday than visited on Saturday. • However the range of amount of customers visiting individual stalls was larger on Sunday than on Saturday. 	<p>Mark: 1/2</p> <p>The candidate was awarded 1 mark.</p> <ul style="list-style-type: none"> ✓•¹ similar to note 3(a) (1st bullet point) in the marking instructions ×•² similar to note 4(b) (2nd bullet point) in the marking instructions; use of the word 'range' not accepted since it can mean the difference between the largest and smallest values in the data set
Question 6	Candidate response	Commentary
Response 1	$a = 17$ $f(17) = 5 + 4 \times 17$ $= \underline{\underline{73}}$	<p>Mark: 2/2</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✓•¹ valid strategy; see line 2 of working ✓•² correct answer; see line 1 of working

Response 2	$5 + 4x = 73$ $\begin{matrix} -5 \\ \hline 4x = \end{matrix} \del{73} \del{68}$ $\del{4x = 17.6}$ $x = 13.6$	<p>Mark: 1/2</p> <p>The candidate was awarded 1 mark; see note 3 in the marking instructions.</p> <ul style="list-style-type: none"> ✓•1 valid strategy with x used in place of a ✗•2 incorrect answer
Response 3	$f(a) = 73$ $5 + 4x = 73$ $4x = 68$ $x = 17$	<p>Mark: 2/2</p> <p>The candidate was awarded 2 marks; see note 3 in the marking instructions.</p> <ul style="list-style-type: none"> ✓•1 valid strategy with x used in place of a ✓•2 correct value with x used in place of a
Question 7	Candidate response	Commentary
Response 1	$V = \frac{4}{3} \pi r^3$ $V = \frac{4}{3} \times \pi \times 3.2^3$ $= 137.2582\dots$ $\rightarrow \underline{140.0 \text{ cm}^3}$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✓•1 correct substitution into formula ✓•2 correct volume ✗•3 incorrect rounding

Response 2	$V = \frac{4}{3} \pi r^3$ $V = \frac{4}{3} \pi \times 3.2$ $= 13.404$ $\approx \underline{\underline{13.4 \text{ cm}}}$	<p>Mark: 0/3</p> <p>The candidate was awarded 0 marks; similar to commonly observed response 4 in the marking instructions, but without rounding mark.</p> <ul style="list-style-type: none"> x•1 incorrect substitution into formula x•2 mark not available; calculation eased since it does not involve a power of r x•3 incorrect rounding
Response 3	$V = \frac{4}{3} \pi r^3$ $6.4 \div 2$ $= 3.2$ $V = \frac{4}{3} \times \pi \times 3.2$ $V = 13.404 \text{ (3dp)}$ $V = 13 \text{ cm}^3$	<p>Mark: 1/3</p> <p>The candidate was awarded 1 mark; see commonly observed response 4 in the marking instructions.</p> <ul style="list-style-type: none"> x•1 incorrect substitution into formula x•2 mark not available; calculation eased since it does not involve a power of r ✓•3 answer rounded to 2 significant figures

Response 4	$V = \frac{3}{4} \pi r^3$ $V = \frac{3}{4} \times \pi \times 3 \cdot 2^3$ $V = 77.20778 \dots$ $\underline{\underline{= 77.21}}$	<p>Mark: 1/3</p> <p>The candidate was awarded 1 mark.</p> <ul style="list-style-type: none"> x•¹ incorrect formula ✓•² correctly followed through to calculate consistent volume x•³ incorrect rounding
Question 8	Candidate response	Commentary
Response 1	$7 \sin \alpha + 2 = 3$ $\frac{7}{7} \sin \alpha = \frac{1}{7}$ $\sin \alpha = \frac{1}{7}$ $\alpha = \sin^{-1}\left(\frac{1}{7}\right)$ $\alpha = \underline{0.143}$ $\begin{array}{r} S/A \\ T/C \end{array}$ $180 - 0.143 =$ $\underline{\underline{179.857}}$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks; see note 5(a) in the marking instructions.</p> <ul style="list-style-type: none"> ✓•¹ correct rearrangement of equation x•² value of $\sin^{-1}\left(\frac{1}{7}\right)$ given in radians; this candidate would not be penalised again for inappropriate use of radians in questions 9, 13 or 17 ✓•³ correct follow through to calculate consistent 2nd value of x

Response 2	$7 \sin x + 2 = 3$ $\frac{7 \sin x}{7} = \frac{1}{7}$ $\sin x = 0.14$ $x = \sin^{-1}(0.14)$ $x = \underline{8}$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks; see notes 2 and 4(a) in the marking instructions.</p> <ul style="list-style-type: none">✓•¹ correct rearrangement of equation✓•² correct value of x✗•³ no attempt to calculate 2nd value of x
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Response 3



$$7 \sin x^\circ + 9 = 3$$

$$-2 \quad -2$$

$$7 \sin x^\circ = 1$$

$$\sin x^\circ = \frac{1}{7}$$

$$\sin x^\circ = 0.142857$$

$$x = \sin^{-1}(0.142857)$$

$$x = 8.21521\dots$$

$$x = 8.2^\circ$$

$$180 + 8.2^\circ$$

$$= 188.2^\circ$$

$$\underline{\underline{x = 188.2^\circ, 8.2^\circ}}$$

Mark: 2/3

The candidate was awarded 2 marks.

- ✓•¹ correct rearrangement of equation
- ✓•² correct value of x
- ✗•³ incorrect 2nd value of x

<p>Response 4</p>	$7 \sin \alpha + 2 = 3$ $7 \sin \alpha = 3 - 2$ $\sin \alpha = \frac{1}{7}$ $\alpha = 8.213210702$ $\alpha = 180 + 8.213 = 188.21^\circ$ $\alpha = 360 - 8.213 = 351.787^\circ$ <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">S</td> <td style="text-align: center;">A</td> </tr> <tr> <td style="text-align: center;">180 - \alpha</td> <td style="text-align: center;">.</td> </tr> <tr> <td style="text-align: center;">T</td> <td style="text-align: center;">C</td> </tr> <tr> <td style="text-align: center;">180 + \alpha</td> <td style="text-align: center;">360 - \alpha</td> </tr> </table>	S	A	180 - \alpha	.	T	C	180 + \alpha	360 - \alpha	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks; see commonly observed response 2(a) in the marking instructions.</p> <ul style="list-style-type: none"> ✗•¹ incorrect rearrangement of equation ✓•² correct follow through to calculate consistent value of x ✓•³ correct follow through to calculate consistent 2nd value of x
S	A									
180 - \alpha	.									
T	C									
180 + \alpha	360 - \alpha									
<p>Response 5</p>	$7 \sin x + 2 = 3$ $\sin x = \frac{1}{7}$ $\sin^{-1} \left(\frac{1}{7} \right) = 45.584$ $= 45.6$ $x = 180 + 45.6, 360 - 45.6$ $= 225.6^\circ, 314.4^\circ$ <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">S</td> <td style="text-align: center;">A</td> </tr> <tr> <td style="text-align: center;">T</td> <td style="text-align: center;">C</td> </tr> </table>	S	A	T	C	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks; similar to combination of commonly observed responses 1 and 2(a) in the marking instructions.</p> <ul style="list-style-type: none"> ✗•¹ incorrect rearrangement of equation ✓•² correct follow through to calculate consistent value of x ✓•³ correct follow through to calculate consistent 2nd value of x 				
S	A									
T	C									

Question 9	Candidate response	Commentary
Response 1	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\frac{x}{\sin 75} = \frac{20}{\sin 37}$ $\frac{x}{\sin 75} = \frac{20}{\sin 37} \quad \times \sin(75)$ $x = \frac{20 \times \sin(75)}{\sin(37)}$ $x = 32.100$ $x = \underline{\underline{32.1}}$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks; see note 3 in the marking instructions.</p> <ul style="list-style-type: none"> ×¹ incorrect substitution into sine rule ✓² consistent follow through to re-arrange formula ✓³ consistent follow through to calculate length

Response 2

$$\frac{a}{\sin A} = \frac{c}{\sin C}$$

$$\frac{a}{\sin 105} = \frac{20}{\sin 37}$$

$$\frac{a}{0.97} = \frac{20}{0.6}$$

$$a = \left(\frac{20}{0.6} \right) \times 0.97$$

$$a = 33.3 \times 0.97$$

$$a = 32.301 \text{ cm}$$

Mark: 3/3

The candidate was awarded 3 marks.

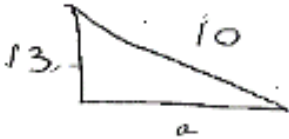
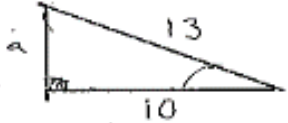
- ✓¹ correct substitution into sine rule
- ✓² correct re-arrangement of formula
- ✓³ correct calculation of length; see note 4 in the marking instructions

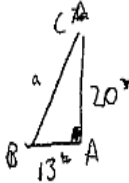

<p>Response 3</p>	$180 - 75$ $= 105$ $37 + 105^\circ$ $= 142$ $\frac{d}{\sin 105} = \frac{20}{\sin 37}$ $d \sin 37 = \frac{20 \sin 105}{\sin 37}$ $d = 30.16267$ $= 30.2 \text{ cm}$	<p>Mark: 2/3 or 3/3 depending on whether the candidate had already been penalised in question 8 for the inappropriate use of radians; see note 5(a) in the marking instructions.</p> <p>The candidate was awarded 2 marks if the use of radians had not already been penalised in question 8.</p> <ul style="list-style-type: none"> ✓•¹ correct substitution into sine rule ✓•² correct re-arrangement of formula ✗•³ incorrect calculation of length; radians used <p>Or</p> <p>The candidate was awarded 3 marks if the use of radians had already been penalised in question 8.</p> <ul style="list-style-type: none"> ✓•¹ correct substitution into sine rule ✓•² correct re-arrangement of formula ✓•³ incorrect calculation of length but use of radians already penalised in question 8
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Response 4	$\frac{a}{\sin 15^\circ} = \frac{20}{\sin 37^\circ}$ $\times \sin 15 \quad \times \sin 15$ $a = \frac{20 \sin 15}{\sin 37^\circ}$ $\underline{a = 8.6 \text{ cm}}$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ×•¹ incorrect substitution into sine rule ✓•² consistent follow through to re-arrange formula ✓•³ consistent follow through to calculate length
Question 10	Candidate response	Commentary
Response 1	$\vec{BC} = -\underline{u} - \underline{w} + 2\underline{u} + \frac{1}{2}\underline{w}$ \underline{u} \underline{w}	<p>Mark: 1/2</p> <p>The candidate was awarded 1 mark; see note 4(a) in the marking instructions.</p> <ul style="list-style-type: none"> ✓•¹ correct expressions for \vec{ED} in terms of \mathbf{u} and \vec{DC} in terms of \mathbf{w} ×•² \vec{BC} not expressed in simplest form

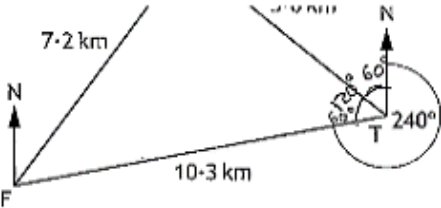
Response 2	$\begin{aligned}\vec{BA} &= \vec{AE} + \vec{ED} + \vec{DC} \\ &= -\underline{u} + (-\underline{w}) + 2\underline{v} + \frac{1}{2}\underline{w} \\ &= 2\underline{v} - \underline{u} + (-\underline{w}) + \frac{1}{2}\underline{w} \\ &= \underline{u} + (-\frac{1}{2}\underline{w})\end{aligned}$	<p>Mark: 2/2</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✓•¹ correct expressions for \vec{ED} in terms of \underline{u} and \vec{DC} in terms of \underline{w} ✓•² \vec{BC} expressed in acceptable simplest form; see note 2 in the marking instructions
Question 11	Candidate response	Commentary
Response 1	$\begin{aligned}(9.3 \times 10^{11}) \times 1.95 \\ = 1.0695 \times 10^{12}\end{aligned}$	<p>Mark: 0/3</p> <p>The candidate was awarded 0 marks; see note 2 in the marking instructions.</p> <ul style="list-style-type: none"> ×•¹ no evidence of $85\% = 9.3 \times 10^{11}$ ×•² invalid strategy ×•³ calculation not within valid strategy

Response 2	$9.3 \times 10^{11} = 85\%$ $9.3 \times 10^{11} \times 1.15$ $= 1.07 \times 10^{12} \text{ km}^3$	<p>Mark: 1/3</p> <p>The candidate was awarded 1 mark; see note 2 in the marking instructions.</p> <ul style="list-style-type: none"> ✓•1 $85\% = 9.3 \times 10^{11}$ stated ×•2 invalid strategy ×•3 calculation not within valid strategy
Response 3	$15\% = 9.3 \times 10^{11}$ $9.3 \times 10^{11} \div 0.15$ $V = 6.2 \times 10^{12} \text{ km}^3$	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks; see commonly observed response 3 in the marking instructions.</p> <ul style="list-style-type: none"> ×•1 no evidence of $85\% = 9.3 \times 10^{11}$ ✓•2 valid strategy on follow through from $15\% = 9.3 \times 10^{11}$ ✓•3 follow through working met the criterion for this mark

Question 12	Candidate response	Commentary
<p>Response 1</p>	 $a^2 = b^2 + c^2$ $a^2 = 13^2 + 10^2$ $a^2 = 169 + 100$ $a^2 = 269$ $a = \sqrt{269}$ $a = 16.401 \text{ cm}$ <p>width = 16.401 - 13 = 3.401 cm</p> $\text{width} = 16.401 \times 2$ $= 32.802 \text{ cm}$	<p>Mark: 1/4</p> <p>The candidate was awarded 1 mark; see note 3 in the marking instructions.</p> <ul style="list-style-type: none"> x•¹ incorrect diagram x•² Pythagoras statement inconsistent with candidate's diagram ✓•³ consistent follow through to calculate x x•⁴ incorrect method for calculating width
<p>Response 2</p>	 $a^2 = b^2 + c^2 - 2 \times b \times c \times \cos A$ $a^2 = 13^2 + 10^2 - 2 \times 13 \times 10 \times \cos(90)$ $a^2 = 269$ $a = \sqrt{269}$ $a = 16.401 \dots$ $\text{width} = \underline{29 \text{ cm}}$ <p>$16 + 13 = 29$?</p>	<p>Mark: 3/4</p> <p>The candidate was awarded 3 marks; see commonly observed response 1(a) in the marking instructions.</p> <ul style="list-style-type: none"> ✓•¹ correct diagram x•² incorrect substitution into cosine rule ✓•³ consistent follow through to calculate a ✓•⁴ consistent follow through to calculate width

<p>Response 3</p>	 <p>$20^2 + 13^2$</p> $a^2 = b^2 + c^2 - 2bc \cos A$ $a^2 = 20^2 + 13^2 - (2 \times 20 \times 13 \times \cos 90)$ $a^2 = 569 - 0$ $a^2 = 569$ $a = \sqrt{569}$ $a = 23.853$ <p>width of shape, 23.853×2 $= 47.7$ $= 47.7 - 7$ $= 40.7$</p>	<p>Mark: 2/4</p> <p>The candidate was awarded 2 marks; see note 4 in the marking instructions.</p> <ul style="list-style-type: none"> ×●¹ incorrect diagram ✓●² substitution into cosine rule consistent with candidate's diagram ✓●³ consistent follow through to calculate a ×●⁴ incorrect method for calculating width
<p>Response 4</p>	 $13^2 = 10^2 + w^2$ $169 = 100 + w^2$ $w^2 = 100 - 169$ $w^2 = -69$ $w = \sqrt{-69}$ $w = 8.31 \text{ cm}$	<p>Mark: 1/4</p> <p>The candidate was awarded 1 mark.</p> <ul style="list-style-type: none"> ✓●¹ correct diagram ×●² Pythagoras statement inconsistent with candidate's diagram ×●³ incorrect calculation of x ; no real value for $\sqrt{-69}$ ×●⁴ no attempt to calculate width

Response 5	$a^2 = b^2 + c^2$ $= 20^2 + 26^2$ $= 400 + 676$ $= 1076$ $= \sqrt{1076} = 32.8 \text{ cm}$	<p>Mark: 1/4</p> <p>The candidate was awarded 1 mark; see commonly observed response 2(c) in the marking instructions.</p> <ul style="list-style-type: none"> ×●¹ no diagram ×●² incorrect Pythagoras statement ✓●³ consistent follow through to calculate x ×●⁴ no attempt to calculate width
Question 13	Candidate response	Commentary
Response 1	$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ $\cos A = \frac{5.6^2 + 10.3^2 - 7.2^2}{2 \times 5.6 \times 10.3} = \frac{85.61}{115.36}$ $A = \cos^{-1}(0.742)$ $A = 42.1^\circ$ $360 - (240 + 42.1)$ $360 - 282.1$ $= 77.9^\circ$	<p>Mark: 3/4</p> <p>The candidate was awarded 3 marks; see note 2 in the marking instructions</p> <ul style="list-style-type: none"> ✓●¹ correct substitution into cosine rule; accept use of A in place of T where substitution is correct ✓●² correct calculation of $\cos A$ ✓●³ correct calculation of angle A ×●⁴ incorrect method for calculating bearing

Response 2	$\cos A = \frac{10.3^2 + 5.6^2 - 7.2^2}{2 \times 10.3 \times 5.6} = \frac{-11.63}{115.36} = -0.1$ $A = 84.2^\circ$ $\text{bearing} = 324.2^\circ$	<p>Mark: 2/4</p> <p>The candidate was awarded 2 marks; see note 2 in the marking instructions.</p> <ul style="list-style-type: none"> ✓●¹ correct substitution into cosine rule; accept use of A in place of T where substitution is correct ×●² incorrect calculation of $\cos A$ ×●³ incorrect calculation of $\cos^{-1}(-0.1)$ ✓●⁴ consistent follow through to calculate bearing
Response 3	 <ul style="list-style-type: none"> • FY is 7.2 kilometres. • TY is 5.6 kilometres. • FT is 10.3 kilometres. • F is on a bearing of 240° from T. <p>Calculate the bearing of the yacht from the trawler.</p> <p>Bearing of yacht from trawler = 300°</p> <p>= 300° because the full circle is 360° that leaves two sections each 60°, $240^\circ + 60^\circ = 300^\circ$</p>	<p>Mark: 0/4</p> <p>The candidate was awarded 0 marks; see note 5 in the marking instructions</p> <ul style="list-style-type: none"> ×●¹ incorrect method ×●² no follow through mark available ×●³ no follow through mark available ×●⁴ no follow through mark available

Response 4	$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ $\cos A = \frac{7.2^2 + 5.6^2 - 10.3^2}{2 \times 7.2 \times 5.6}$ $\cos A = -0.283\dots$ $A = \cos^{-1}(\text{Ans})$ $A = 106.49$ <p>Y is on a bearing of 106.49° from T</p>	<p>Mark: 2/4</p> <p>The candidate was awarded 2 marks; see commonly observed response 2(b) in the marking instructions.</p> <ul style="list-style-type: none"> x●¹ incorrect substitution into cosine rule; do not accept use of A in place of T where substitution is incorrect ✓●² consistent follow through to calculate $\cos A$ ✓●³ consistent follow through calculation of $\cos^{-1}(-0.283\dots)$ x●⁴ no attempt made to calculate bearing
Question 14	Candidate response	Commentary
Response 1	$2x - 5y = 20$ $2(0) - 5y = 20$ $-5y = 20$ $y = \underline{\underline{-4}}$	<p>Mark: 1/2</p> <p>The candidate was awarded 1 mark; see commonly observed response 2 in the marking instructions.</p> <ul style="list-style-type: none"> ✓●¹ correct substitution into equation x●² coordinates not stated

Response 2	$-5y = -2x + 20$ $y = \frac{-2x + 20}{-5}$ $y = \frac{-2x + 20}{5}$ $y = \frac{-2}{5}x + 4$ $= (0, 4)$	<p>Mark: 1/2</p> <p>The candidate was awarded 1 mark.</p> <ul style="list-style-type: none"> ✓•¹ correct isolation of y term ✗•² incorrect y term
Response 3	$2x - 5 \times 0 = 20$ $2x = 20$ $x = 10$ $x = (10, 0)$	<p>Mark: 1/2</p> <p>The candidate was awarded 1 mark; see note 3 in the marking instructions.</p> <ul style="list-style-type: none"> ✗•¹ incorrect substitution into equation ✓•² consistent follow through to state coordinates of x intercept
Question 15	Candidate response	Commentary
Response 1	$\frac{n}{(n-2)(n+2)} \times \frac{n-2}{3} = \frac{n}{3(n+2)} \Rightarrow \frac{n}{3n+6}$	<p>Mark 3/3:</p> <p>The candidate was awarded 3 marks.</p> <ul style="list-style-type: none"> ✓•¹ evidence of multiplication of first fraction by reciprocal of second fraction ✓•² correct factorisation of $n^2 - 4$ ✓•³ correct simplification and multiplication

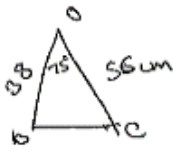
Response 2	$= \frac{n(n-2)}{(n^2-4)(n-2)} = \frac{3(n^2-4)}{(n^2-4)(n-2)}$ $= \frac{n(n-2)}{(n^2-4)(n-2)} \times \frac{(n^2-4)(n-2)}{3(n^2-4)}$ $= \frac{n(n-2)}{3(n^2-4)}$	<p>Mark: 1/3</p> <p>The candidate was awarded 1 mark.</p> <ul style="list-style-type: none"> ✓●¹ evidence of multiplication of first fraction by reciprocal of second fraction ×●² no attempt to factorise $n^2 - 4$ ×●³ answer not in simplest form
Response 3	$\frac{n}{n^2-4} \div \frac{3}{n-2}$ $\frac{n}{n^2-4} \times \frac{n-2}{3}$ $\frac{n \times (n-2)}{3}$ $\frac{(n-2)(n+2)}{3}$ $= \frac{3n}{(n+2)}$ $\frac{n}{n^2-4} \div \frac{3}{n-2}$ $\frac{n}{n^2-4} \times \frac{n-2}{3}$ $\frac{n(n-2)}{3}$ 	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✓●¹ evidence of multiplication of first fraction by reciprocal of second fraction ✓●² correct factorisation of $n^2 - 4$ ×●³ incorrect multiplication

<p>Response 4</p>	$\frac{n}{n^2-4} \div \frac{3}{n-2}$ $\frac{n}{n^2-4} \times \frac{n-2}{3}$ $\frac{n(n-2)}{3(n^2-4)}$ $\frac{n^2-2n}{3n^2-12}$ $\frac{-2n}{2n^2-12}$	<p>Mark: 1/3</p> <p>The candidate was awarded 1 mark.</p> <ul style="list-style-type: none"> ✓●¹ evidence of multiplication of first fraction by reciprocal of second fraction ×●² no attempt to factorise $n^2 - 4$ ×●³ incorrect simplification
<p>Question 16</p>	<p>Candidate response</p>	<p>Commentary</p>
<p>Response 1</p>	$c^2 = b^2 + a^2$ $c^2 = 70^2 + 40^2$ $c^2 = 4900 + 1600$ $c^2 = 6500$ $c = \sqrt{6500}$ $c = 80.62 \text{ cm}$ <hr/> $PM = 80.62 \text{ cm}$ <p style="margin-left: 200px;">He will not be able to fit the umbrella in because $85 > 80.62$</p>	<p>Mark: 2/4</p> <p>The candidate was awarded 2 marks; see commonly observed response 1(a) in the marking instructions.</p> <ul style="list-style-type: none"> ✓●¹ correct start of valid strategy ×●² no continuation of valid strategy ×●³ mark not available since calculation has been simplified ✓●⁴ follow through to consistent valid conclusion with comparison

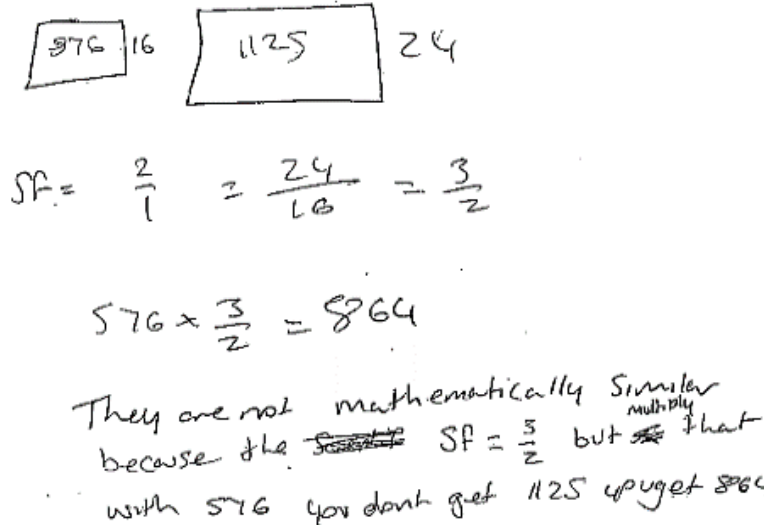
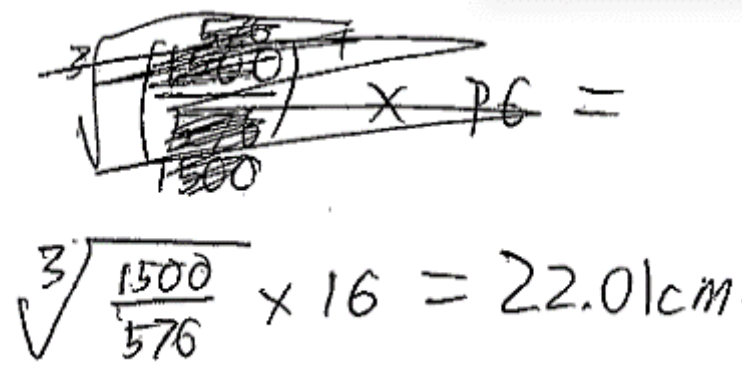
Response 2	$85^2 = 7225$ $40^2 + 40^2 + 70^2$ $= 8100$ <p>Chris will not be able to fit his Umbrella into the locker as $85^2 \neq 40^2 + 40^2 + 70^2$.</p>	Mark: 3/4 <p>The candidate was awarded 3 marks; see commonly observed response 3(b) in the marking instructions.</p> <ul style="list-style-type: none">✓●¹ correct start of valid strategy✓●² correct continuation of valid strategy✓●³ all calculations correct within valid strategy×●⁴ comparison does not justify conclusion
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Response 3	$P = (0, 40, 70)$ $M = (40, 0, 0)$ $ P - M = \begin{pmatrix} 0 \\ 40 \\ 70 \end{pmatrix} - \begin{pmatrix} 40 \\ 0 \\ 0 \end{pmatrix}$ $= \begin{pmatrix} -40 \\ 40 \\ 70 \end{pmatrix}$ $ P - M = \sqrt{(-40)^2 + 40^2 + 70^2}$ $= \sqrt{8100}$ $= 90 \text{ cm}$ <p>Yes it will fit as between points P and M there is 90cm and since $85 < 90$ there is enough room</p>	<p>Mark: 4/4</p> <p>The candidate was awarded 4 marks; see note 3 in the marking instructions.</p> <ul style="list-style-type: none"> ✓●¹ correct start of valid strategy ✓●² correct continuation of valid strategy ✓●³ all calculations correct within valid strategy ✓●⁴ valid conclusion with comparison
Question 17	Candidate response	Commentary
Response 1	$A = \frac{1}{2} ab \sin C$ $= \frac{1}{2} 55 \times 38.5 \sin 75^\circ$ $= \underline{\underline{1009 \text{ cm}^2}} \quad \cdot 4 \text{ cm}^2$	<p>Mark: 1/5</p> <p>The candidate was awarded 1 mark; see commonly observed response 5 in the marking instructions.</p> <ul style="list-style-type: none"> ✓●¹ correct substitution into area of triangle formula ×●² no attempt to state appropriate fraction for sector ×●³ no attempt to substitute into area of sector formula

		<ul style="list-style-type: none"> ×●⁴ no attempt to subtract area of sector from area of triangle ×●⁵ mark not available since calculations have been simplified
Response 2	$ \begin{aligned} \text{A sector} &= \text{angle fraction} \times \pi \times r^2 \\ &= \frac{75^\circ}{360^\circ} \times \pi \times 30^2 \\ &= 589.04\dots \\ &= \underline{589 \text{ cm}} \\ \text{triangle} &= \frac{1}{2} \times 38 \times 55 \times \sin 75^\circ \\ &= 2009.39\dots \\ &= 2009 \text{ cm} \\ \text{total Area} &= 2009 + 589 \\ &= \underline{\underline{1598 \text{ cm}^2}} \end{aligned} $	<p>Mark: 4/5</p> <p>The candidate was awarded 4 marks; see commonly observed response 2 in the marking instructions.</p> <ul style="list-style-type: none"> ✓●¹ correct substitution into area of triangle formula ✓●² appropriate fraction for sector ✓●³ correct substitution into area of sector formula ×●⁴ area of sector added to area of triangle ✓●⁵ follow through working met the criterion for this mark; see note 6 in the marking instructions

<p>Response 3</p>	$\text{Area sector} = \frac{75}{360} \times \pi \times 60^2$ $= 39.26990817 \text{ cm}^2$ $= 39.3 \text{ cm}^2$ $A = \frac{1}{2} ab \sin c^\circ$ $= \frac{1}{2} \times 38 \times 55 \sin 75^\circ$ $= 1009.392468 \text{ cm}^2$ $\approx 1009.4 \text{ cm}^2$ $\text{Area triangle} = \text{Area sector}$ $= 1009.4 \text{ cm}^2 - 39.3 \text{ cm}^2$ $= \underline{970.1 \text{ cm}^2}$	<p>Mark: 4/5</p> <p>The candidate was awarded 4 marks; see commonly observed response 1 in the marking instructions.</p> <ul style="list-style-type: none"> ✓●¹ correct substitution into area of triangle formula ✓●² appropriate fraction for sector ✗●³ substitution into length of arc formula instead of area of sector formula ✓●⁴ consistent follow through to subtract length of arc from area of triangle ✓●⁵ follow through working met the criterion for this mark
<p>Response 4</p>	$A' = \frac{75}{360} \times \pi \times 30^2$ $A' = 589$ $A' = \frac{75}{360} \times \pi \times 30^2$ $= \frac{75}{360} \times 30^2$ $= 589$  $A = \frac{1}{2} ab \sin c$ $A = \frac{1}{2} \times 38 \times 55 \times \sin 75$ $A = 1009.39$ $1009.39 - 589$ $A = \underline{420.39}$	<p>Mark: 4/5</p> <p>The candidate was awarded 4 marks.</p> <ul style="list-style-type: none"> ✓●¹ correct substitution into area of triangle formula ✓●² appropriate fraction for sector ✓●³ correct substitution into area of sector formula ✓●⁴ evidence of subtracting area of sector from area of triangle ✗●⁵ correct calculations but no units in final answer

Question 18(a)	Candidate response	Commentary
Response 1	<p>If $\left(\frac{16}{24}\right)^3 \times 1125 = 576$ then the cartons are mathematically similar.</p> <p>$\left(\frac{16}{24}\right)^3 \times 1125 = 333.3 \text{ cm}^3$</p> <p>Because $333.3 \neq 576$ the triangles are not mathematically similar.</p>	<p>Mark: 3/3</p> <p>The candidate was awarded 3 marks; see commonly observed response 1 in the marking instructions.</p> <ul style="list-style-type: none"> ✓•¹ correct linear scale factor ✓•² correct volume scale factor multiplied by appropriate volume ✓•³ correct calculation, valid comparison and conclusion
Response 2	<p>$\frac{\text{new}}{\text{old}} = \left(\frac{24}{16}\right)^3$</p> <p>$= 3.375 \times 1125 = 576$</p> <p>$= 1944 \neq 1125$</p>	<p>Mark: 2/3</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✓•¹ correct linear scale factor ✓•² correct volume scale factor multiplied by appropriate volume ✗•³ correct calculation, valid comparison but no conclusion

<p>Response 3</p>		<p>Mark: 1/3</p> <p>The candidate was awarded 1 mark; see commonly observed response 2(a) in the marking instructions.</p> <ul style="list-style-type: none"> ✓•¹ correct linear scale factor ×•² linear scale factor used in calculation instead of volume scale factor ×•³ calculation did not involve a power of the scale factor
<p>Question 18(b)</p>	<p>Candidate response</p>	<p>Commentary</p>
<p>Response 1</p>		<p>Mark: 2/2</p> <p>The candidate was awarded 2 marks.</p> <ul style="list-style-type: none"> ✓•¹ correct volume scale factor ✓•² correct answer

Response 2

$$SF = \frac{\text{new}}{\text{old}} = \frac{1500}{576} = 2.6041... \times 16$$
$$= 41.6 \text{ cm} \text{ } \text{\textcircled{E}}$$

The depth of the redesigned large carton is 41.6 cm.

Mark: 1/2

The candidate was awarded 1 mark; see commonly observed response 1 in the marking instructions.

- ✓•¹ correct volume scale factor
- ×•² incorrect method