

2003 Mathematics

Intermediate 2 – Units 1, 2 and Applications

Finalised Marking Instructions

Special Instructions

- 1 The main principle in marking scripts is to give credit for the skills which have been demonstrated. Failure to have the correct method may not preclude a pupil gaining credit for the calculations involved or for the communication of the answer.

Where a candidate has scored zero marks for any question attempted, "0" should be shown against the answer in the place in the margin.

It is of great importance that the utmost care should be exercised in adding up the marks. Where appropriate, all summations for totals and grand totals must be carefully checked.

- 2 The answer to one part, correct or incorrect must be accepted as a basis for subsequent dependent parts of a question. Full marks in the dependent part is possible if it is of equivalent difficulty.

- 3 Working after a correct answer should only be taken into account if it provides **firm** evidence that the requirements of the question have not been met.

- 4 In certain cases an error will ease subsequent working. **Full** credit cannot be given for this subsequent work but **partial** credit may be given.

- 5 Accept answers arrived at by inspection or mentally, where it is possible for the answer to have been so obtained.

- 6 Do not penalise omission or misuse of units unless marks have been specifically allocated to units.

- 7 A wrong answer without working receives no credit unless specifically mentioned in the marking scheme.

The rubric on the outside of the papers emphasises that working must be shown. In general markers will only be able to give credit to partial answers if working is shown. However there may be a few questions where partially correct answers unsupported by working can still be given some credit. **Any such instances will be stated in the marking scheme.**

- 8 Acceptable alternative methods of solution can only be given the marks specified, ie a more sophisticated method cannot be given more marks.

Note that for some questions a method will be specified.

- 9 In general do not penalise the same error twice in the one question.

- 10 Accept legitimate variations in numerical/algebraic questions.

- 11 Do not penalise bad form eg $\sin x^\circ = 0.5 = 30^\circ$.

- 12 A transcription error is not normally penalised except where the question has been simplified as a result.

- 13 Do not penalise inadvertent use of radians in trigonometry questions, provided its use is consistent within the question.

Paper 1, Units 1, 2 and App. of Maths

Marking Instructions

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •																		
1.	<p>Ans: £106.60</p> <ul style="list-style-type: none"> •¹ strategy: knows how to calculate pay for weekdays •² strategy: knows how to calculate pay at time and a half •³ process: calculates gross pay correctly <p><u>ALTERNATIVE METHOD</u></p> <ul style="list-style-type: none"> •¹ strategy: knows how to calculate number of hours to be paid •² strategy: knows how to calculate gross pay •³ process: calculates gross pay correctly 	<ul style="list-style-type: none"> •¹ $5 \times 4 \times 4.10$ •² $1.5 \times 4 \times 4.10$ •³ £106.60 <p style="text-align: right;">3 marks</p> <ul style="list-style-type: none"> •¹ $5 \times 4 + 1.5 \times 4$ •² $(5 \times 4 + 1.5 \times 4) \times 4.10$ •³ £106.60 																		
<p>NOTES:</p> <p>(i) Common wrong answers with working</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">£88.15</td> <td style="width: 50%;">(5 × 4 × 4.10 + 1.5 × 4.10)</td> <td style="width: 25%;">award 2/3</td> </tr> <tr> <td>£45.10</td> <td>(5 × 4.10 + 1.5 × 4 × 4.10)</td> <td>award 2/3</td> </tr> <tr> <td>£41</td> <td>(4 × 4.10 + 1.5 × 4 × 4.10)</td> <td>award 2/3</td> </tr> <tr> <td>£26.65</td> <td>(5 × 4.10 + 1.5 × 4.10)</td> <td>award 1/3</td> </tr> <tr> <td>£114.80</td> <td>(5 × 4 × 4.10 + 2 × 4 × 4.10)</td> <td>award 1/3</td> </tr> <tr> <td>£98.40</td> <td>(4 × 6 × 4.10)</td> <td>award 0/3</td> </tr> </table>			£88.15	(5 × 4 × 4.10 + 1.5 × 4.10)	award 2/3	£45.10	(5 × 4.10 + 1.5 × 4 × 4.10)	award 2/3	£41	(4 × 4.10 + 1.5 × 4 × 4.10)	award 2/3	£26.65	(5 × 4.10 + 1.5 × 4.10)	award 1/3	£114.80	(5 × 4 × 4.10 + 2 × 4 × 4.10)	award 1/3	£98.40	(4 × 6 × 4.10)	award 0/3
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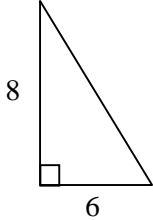
Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark •																														
2 (a)	<p>Ans:</p> <table border="1" data-bbox="325 398 952 719"> <thead> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> </tr> </thead> <tbody> <tr> <td>Red</td> <td>R,1</td> <td>R,2</td> <td>R,3</td> <td>R,4</td> <td>R,5</td> </tr> <tr> <td>Yellow</td> <td>Y,1</td> <td>Y,2</td> <td>Y,3</td> <td>Y,4</td> <td>Y,5</td> </tr> <tr> <td>Blue</td> <td>B,1</td> <td>B,2</td> <td>B,3</td> <td>B,4</td> <td>B,5</td> </tr> <tr> <td>Green</td> <td>G,1</td> <td>G,2</td> <td>G,3</td> <td>G,4</td> <td>G,5</td> </tr> </tbody> </table> <p>•¹ Process: completes table correctly</p>		1	2	3	4	5	Red	R,1	R,2	R,3	R,4	R,5	Yellow	Y,1	Y,2	Y,3	Y,4	Y,5	Blue	B,1	B,2	B,3	B,4	B,5	Green	G,1	G,2	G,3	G,4	G,5	<p>•¹ correct table</p> <p style="text-align: right;">1 mark</p>
	1	2	3	4	5																											
Red	R,1	R,2	R,3	R,4	R,5																											
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Green	G,1	G,2	G,3	G,4	G,5																											
NOTES:																																
(b)	<p>Ans: $\frac{2}{20}$ (or equivalent)</p> <p>•¹ process: calculate probability</p>	<p>•¹ $\frac{2}{20}$ (or equivalent)</p> <p style="text-align: right;">1 mark</p>																														
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Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
3.	Ans: 1256 cm³ • ¹ process: substitute correctly into formula for the volume of cone • ² process: calculates correct answer	• ¹ $V = \frac{1}{3} \times 3.14 \times 10^2 \times 12$ • ² $V = 1256 \text{ cm}^3$ <div style="text-align: right;">2 marks</div>
<p>NOTES:</p> <p>Alternative correct answers: 1260 cm³ (1.05 × 10² × 12) or 1254.744 cm³ (0.333 × 3.14 × 10² × 12)</p> <p>All other answers, the maximum award is 1/2, where the criteria for the first mark is clearly met.</p>		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
4. (a)	<p>Ans: $6a^2 + ab - 2b^2$</p> <ul style="list-style-type: none"> •¹ process: starts to multiply out brackets •² process: completes the process of multiplying out brackets correctly and collects like terms 	<ul style="list-style-type: none"> •¹ evidence of any 2 correct terms from: $6a^2 + 4ab - 3ab - 2b^2$ •² $6a^2 + ab - 2b^2$ <p style="text-align: right;">2 marks</p>
NOTES:		
(b)	<p>Ans: $(7 - x)(1 + x)$</p> <ul style="list-style-type: none"> •¹ process: factorise trinomial expression •² process: completes factorisation 	<ul style="list-style-type: none"> •¹ one correct factor •² second correct factor <p style="text-align: right;">2 marks</p>
<p>NOTES:</p> <p>(i) For an answer of $(7 + x)(1 - x)$, award 1/2</p>		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
5. (a)	Ans: (i) 27.5 (ii) 13 (iii) 35 • ¹ communicate: state median • ² communicate: state lower quartile • ³ communicate: state upper quartile	• ¹ median = 27.5 • ² $Q_1 = 13$ • ³ $Q_3 = 35$ <p style="text-align: right;">3 marks</p>
NOTES: (i) An incorrect answer for the median must be followed through with the possibility of awarding 2/3		
(b)	Ans: 11 • ¹ process: calculates semi-interquartile range	• ¹ 11 <p style="text-align: right;">1 mark</p>
NOTES: (i) Incorrect answer(s) in (a) must be followed through to give the possibility of awarding 1/1		
(c)	Ans: FASTCABS, with valid reason • ¹ communicate: FASTCABS with reason	• ¹ <p style="text-align: right;">1 mark</p>
NOTES: <u>Examples For 1 Mark:</u> (i) Fastcabs because their semi-interquartile range is much smaller (ii) Fastcabs because their waiting times are less spread out <u>Examples For no Marks:</u> (i) Fastcabs because they are faster (ii) Fastcabs is better as the SIQR is lower and they do not take as long (iii) Fastcabs are more consistent as the waiting time is a lot shorter for them		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
6.	Ans: Yes, with valid explanation • ¹ communicate: • ² communicate:	• ¹ evidence • ² evidence <p style="text-align: right;">2 marks</p>
<p>NOTES:</p> <p>(i) For a possible route, with wrong conclusion, award 1/2</p> <p>(ii) <u>Possible responses for 2 marks</u></p> <p>(i) yes, because the route has only 2 odd vertices/nodes</p> <p>(ii) yes, with any correct route</p> <p><u>Possible responses for 1 mark</u></p> <p>(i) an incomplete route (ONLY one omission allowed eg Green Park to Oxford Circus) with a decision of Yes or No</p> <p>(ii) a route where only one part of the network is travelled twice</p> <p><u>Response which gains 0 marks</u></p> <p>(i) yes, with all stations listed once</p> <p>(ii) For yes with no explanation, award 0/2</p>		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
7.	<p>Ans: 10 cm</p> <ul style="list-style-type: none"> •¹ strategy: marshal facts and recognise right-angled triangle •² strategy: correct use of Pythagoras Theorem •³ process: calculate radius correctly 	<ul style="list-style-type: none"> •¹  •² $r^2 = 8^2 + 6^2$ •³ $r = 10$ <p style="text-align: right;">3 marks</p>
<p>NOTES:</p> <p>(i) A correct answer, without working, award 0/3</p> <p>(ii) Where there is a wrong assumption that angle $BCA = 90^\circ$, the last 2 marks are available. An answer of $\sqrt{128}$ or $\frac{16}{\sqrt{2}}$, with working, could gain these 2 marks.</p>		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
8. (a)	Ans: 219.5 • ¹ process: substitute correctly into formula • ² process: carry out all calculations correctly	• ¹ $s = 2 \times 8.5 \times 4.5 + 2 \times 4.5 \times 5.5 + 2 \times 8.5 \times 5.5$ • ² 219.5 <p style="text-align: right;">2 marks</p>
NOTES:		
(b)	Ans: 9.7 • ¹ process: substitute correctly into formula • ² process: starts to solve equation • ³ process: completes process	• ¹ $2170 = 2 \times 30 \times 20 + 2 \times 20 \times h + 2 \times 30 \times h$ • ² $2170 = 1200 + 100h$ (minimum requirement) • ³ 9.7 <p style="text-align: right;">3 marks</p>
NOTES: Where a candidate has changed the subject of the formula incorrectly, has then substituted correctly <u>and</u> followed through correctly, a maximum of 1/3 can be awarded		

TOTAL MARKS FOR PAPER 1 26

Paper 2, Units 1, 2 & App. of Maths

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
1.	<p>Ans: 102°</p> <ul style="list-style-type: none"> •¹ process: calculates the size of $\angle PLJ$ •² process: calculates the size of $\angle PLK$ •³ process: calculates the size of $\angle KLJ$ 	<ul style="list-style-type: none"> •¹ 43° •² 59° •³ 102° <p style="text-align: right;">3 marks</p>
<p>NOTES:</p> <p>(i) Angle PLJ and angle PLK may not be explicitly stated, they may be worked in a diagram and can be awarded the first and second marks.</p> <p>(ii) A correct answer, without working, award 3/3</p>		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
2.	<p>Ans: Pie Chart</p> <ul style="list-style-type: none"> •¹ process: knows how to calculate angles in a pie chart •² process: calculates angles in pie chart correctly •³ process: constructs pie chart with all sections labelled 	<ul style="list-style-type: none"> •¹ $\frac{250}{1000} \times 360, \frac{375}{1000} \times 360, \frac{125}{1000} \times 360$ •² 90°, 135°, 45° •³ diagram (angles correct $\pm 2^\circ$) <p style="text-align: right;">3 marks</p>
<p>NOTES:</p> <p>(i) For a correctly constructed pie chart with all sections labelled, award 3/3, with or without working</p> <p>(ii) Where percentages or fractions have been calculated, <u>and</u> an incorrect pie chart is drawn, the second mark is available for 25%, 37.5% and 12.5% <u>or</u> $\frac{1}{4}, \frac{3}{8}$ and $\frac{1}{8}$.</p>		
3. (a)	<p>Ans: $x + y = 130$</p> <ul style="list-style-type: none"> •¹ interpret: interpret the text 	<ul style="list-style-type: none"> •¹ $x + y = 130$ <p style="text-align: right;">1 mark</p>
<p>NOTES:</p>		
(b)	<p>Ans: $30x + 50y = 6000$</p> <ul style="list-style-type: none"> •¹ interpret: interpret the text 	<ul style="list-style-type: none"> •¹ $30x + 50y = 6000$ <p style="text-align: right;">1 mark</p>
<p>NOTES:</p>		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
(c)	<p>Ans: 25 seats sold at £30, 105 seats sold at £50</p> <ul style="list-style-type: none"> •¹ strategy: know to solve system of equations •² process: follow a valid strategy through to produce a value for x and y •³ process: correct value for x and y •⁴ communicate: state result 	<ul style="list-style-type: none"> •¹ evidence •² a value for x and y •³ $x = 25, y = 105$ •⁴ 25 seats at £30 105 seats at £50 <p style="text-align: right;">4 marks</p>

NOTES:

- (i) Incorrect answers in (a) and (b) must be followed through to give the possibility of awarding 4/4
- (ii) Any valid strategy must involve the use of two equations
- (iii) For an answer of $x = 25$ and $y = 105$, award 3/4 (loses the communication mark)
- (iv) Where a trial and improvement method is used:
 - (a) The minimum acceptable working for the first two marks is:

$$\left. \begin{array}{l} 50 \times 105 + 30 \times 25 = 6000 \\ \text{or } 50 \times 105 = 5250 \\ 25 \times 30 = 750 \end{array} \right\} \text{Where } 6000 \text{ is clearly implied}$$

The final two marks can then be awarded for 25 seats at £30 and 105 seats at £50 (x and y values implied) clearly stated.
 - (b) For an answer of $x = 25$ and $y = 105$ with working, award 3/4 (loses the communication mark as in note (iii))
- (v) For a wrong answer, without working or based on an invalid strategy, the final mark cannot be awarded.
- (vi) For a correct answer, without working, award 0/4.

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
4.	<p>Ans: $V = -30t + 150$</p> <ul style="list-style-type: none"> •¹ process: find gradient •² process: state y – intercept or C in $y = mx + c$ •³ communicate: state equation connecting V and t 	<ul style="list-style-type: none"> •¹ $m = -30$ •² $c = 150$ •³ $V = -30t + 150$ <p style="text-align: right;">3 marks</p>
<p>NOTES:</p> <ul style="list-style-type: none"> (i) For a correct answer without working, award 3/3 (ii) For $V = -30t$, with or without working, award 1/3 (iii) For $V = 150t - 30$ without working, award 0/3 (iv) Where m and/or c are incorrect, the working must be followed through to give the possibility of awarding 1/3 or 2/3 (v) For $y = -30x + 150$, with or without working, award 3/3 		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
5. (a)	<p>Ans: (i) $\bar{x} = 19$ (ii) $s = 3.65$</p> <p>(i) •¹ process: calculate the mean</p> <p>(ii) •¹ process: calculate $(x - \bar{x})^2$</p> <p>•² process: substitute into formula</p> <p>•³ process: calculate standard deviation</p>	<p>•¹ $\bar{x} = 19$</p> <p>•¹ 4, 9, 36, 4, 9, 9, 9</p> <p>•² $\sqrt{\frac{80}{6}}$</p> <p>•³ 3.65</p> <p style="text-align: right;">4 marks</p>
<p>NOTES:</p> <p>(i) <u>Use of alternative formula in part (ii):</u> the first mark can be awarded for the correct calculation of $\sum x^2$ leading to 2607</p>		
(b)	<p>Ans: Yes, with reasons covering both conditions</p> <p>•¹ communicate: $s = 3.65$ which is less than 5</p> <p>•² communicate: $\bar{x} = 19$ which is between 15 and 25</p>	<p>•¹</p> <p>•²</p> <p style="text-align: right;">2 marks</p>
<p>NOTES:</p>		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
6. (a)	<p>Ans: 52 000 cm³</p> <ul style="list-style-type: none"> •¹ strategy: know how to calculate volume of trough •² process: substitute correctly into formulae for volume •³ process: calculate total volume •⁴ process: rounds answer to 2 significant figures 	<ul style="list-style-type: none"> •¹ volume of cuboid + volume of cylinder •² $46 \times 30 \times 25 + \pi \times 15^2 \times 25$ •³ 52171 cm³ •⁴ 52 000 cm³ <p style="text-align: right;">4 marks</p>
<p>NOTES:</p> <p>(i) Accept variations in the volume due to variations in the value of π.</p> <p>(ii) The fourth mark is available for rounding an answer correct to two significant figures. Where the answer requires no rounding, the fourth mark cannot be awarded.</p>		
(b)	<p>Ans: 43.7 cm</p> <ul style="list-style-type: none"> •¹ strategy: know how to find expression for volume of trough •² process: equate volume with 30 000 •³ communicate: state value for r 	<ul style="list-style-type: none"> •¹ $\frac{1}{4} \times \pi \times r^2 \times 20$ •² $\frac{1}{4} \times \pi \times r^2 \times 20 = 30\,000$ •³ $r = 43.7$ <p style="text-align: right;">3 marks</p>
<p>NOTES:</p> <p>(i) Accept variations in the radius due to variations in the value of π or premature rounding</p>		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
7. (a)	Ans: £8873.50 • ¹ strategy: know to find 1.5% and then add on • ² process: correct calculations within a valid strategy	• ¹ evidence • ² £8873.50 <p style="text-align: right;">2 marks</p>
NOTES:		
(b)	Ans: £55 000 • ¹ strategy: know to calculate commission • ² strategy: start to experiment • ³ communicate: state conclusion • ⁴ process: calculate value of sales	• ¹ 9600 – 8500 • ² eg 1.75% of £50 000 = £875 • ³ rate paid must be 2% • ⁴ £55 000 <p style="text-align: right;">4 marks</p>
NOTES: (i) the second mark can be awarded for using a percentage from the table with either a threshold from the table or £1100 (ii) a correct answer without working , award 4/4		

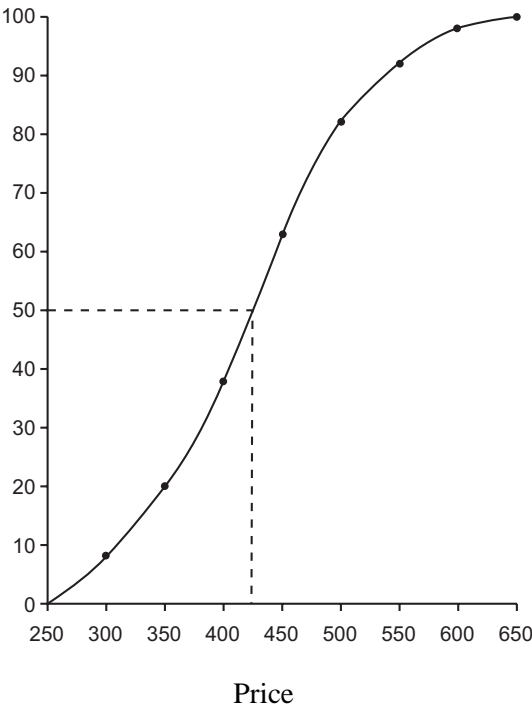
Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
8.	<p>Ans: 24.7 m</p> <ul style="list-style-type: none"> •¹ strategy: knows to find circumference •² process: express arc angle as fraction of circle •³ strategy: knows how to find arc length •⁴ process: calculates arc length within valid strategy 	<ul style="list-style-type: none"> •¹ $C = 2 \times \pi \times 9$ •² $\frac{7}{16}$ •³ $\frac{7}{16} \times 2 \times \pi \times 9$ •⁴ 24.7 m <p style="text-align: right;">4 marks</p>
<p>NOTES:</p> <p>(i) Accept variations in π; disregard premature or incorrect rounding of $\frac{7}{16}$</p> <p>(ii) For 157.5°, award the second mark (implies $\frac{7}{16}$ of 360°)</p> <p>(iii) For $\frac{7}{16} \times \pi \times 9$, $\frac{7}{16} \times \pi \times 9^2$, award 3/4 provided the criteria for the other marks are met</p> <p>(iv) For a correct answer, without working, award 0/4</p>		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
9. (a)	Ans: C 20 x 1·0052 • ¹ communicate: state formula	• ¹ C 20 × 1·0052 1 mark
NOTES:		
(b)	Ans: £51 825·16 • ¹ communicate: state amount	• ¹ £51 825·16 1 mark
NOTES: (i) An incorrect answer in (a) must be followed through to give the possibility of awarding 1/1		
(c)	Ans: 54 500 × 0·064 or H 10 × 0·064 • ¹ communicate: state formula	• ¹ 54 500 × 0·064 or H 10 × 0·064 or H 5 × 0·064 1 mark
NOTES:		
(d)	Ans: Evergreen by £162·84 • ¹ strategy: know to calculate final amount owed by Evergreen • ² communicate: state conclusion based on evidence	• ¹ 54 500 × 0·064 + 54 500 – 6000 = £51 988 • ² Evergreen by £162·84 (disregard rounding) 2 marks
NOTES: (i) Incorrect answers in (b) and (c) must be followed through to give the possibility of awarding 2/2		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
10. (a)	<p>Ans: PQR = 78.6°</p> <ul style="list-style-type: none"> •¹ strategy: know to apply cosine rule to find PQR •² process: correct application of cosine rule •³ calculates PQR 	<ul style="list-style-type: none"> •¹ cosine rule •² $\cos Q = \frac{11.2^2 + 8.4^2 - 12.6^2}{2 \times 11.2 \times 8.4}$ •³ PQR = 78.6° <p style="text-align: right;">3 marks</p>
<p>NOTES:</p> <p>(i) Disregard errors due to rounding provided there is evidence</p> <p>(ii) Where an angle other than PQR has been calculated, a maximum of 2/3 can be awarded provided the value of the angle is consolidated with the application of the cosine rule</p> <p>(iii) For a correct answer without working, award 0/3</p>		
(b)	<p>Ans: 92.2 cm²</p> <ul style="list-style-type: none"> •¹ strategy: knows how to find area of PQRS •² process: substitutes correctly into formula •³ process: calculates area correctly 	<ul style="list-style-type: none"> •¹ evidence •² $2 \times \frac{1}{2} \times 11.2 \times 8.4 \times \sin 78.6^\circ$ •³ 92.2 cm² <p style="text-align: right;">3 marks</p>
<p>NOTES:</p> <p>An incorrect answer for angle PQR must be followed through with the possibility of awarded 3/3</p>		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
11. (a)	Ans: 8, 20, 38, 63, 82, 92, 98, 100 • ¹ process: complete frequency table	• ¹ 8, 20, 38, 63, 82, 92, 98, 100 1 mark

NOTES:

(b)	Ans:  • ¹ process: choose suitable scale/label axes • ² process: plot all points correctly • ³ process: join up points to produce a cumulative frequency curve	• ¹ evidence • ² evidence • ³ evidence 3 marks
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NOTES:

