

REVISE

.wales

3.16 – Sine & cosine rules, area = $\frac{1}{2}ab \sin C$

Mark schemes for the 3.16 question pack

Spec 3.7.5, 3.7.6, 3.7.7 – Unit 3

SOLUTIONS · 2025 SPECIFICATION

Mark schemes for the 13 questions in the corresponding revise.wales question pack (69 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.

			$a - 3$	$\bar{a}^{''}$
13. $(\sin BAC) = \frac{6.4 \times \sin 46^\circ}{5.3}$	✓✓	M2	M1 for $\frac{\sin BAC}{6.4} = \frac{\sin 46^\circ}{5.3}$ or equivalent	
60.3(006...°)	✓	A1	Allow 60(°) from correct working.	
Area = $\frac{1}{2} \times 5.3 \times 6.4 \times \sin (180^\circ - 46^\circ - 60.3(006...^\circ))$	✓	M1	FT 'their derived 60.3(006...°)'	
= 16.2(78....cm ²) or 16.3(cm ²)	✓	A1	Accept 16(cm ²) from correct working. SC1 for 11.78(cm ²).	

<p>4.(a)</p> $35^2 = 21^2 + AB^2 \quad \text{OR} \quad (AB^2 =) 35^2 - 21^2$ $(AB^2 =) 784 \quad \text{or} \quad (AB =) \sqrt{784}$ $(AB =) 28(\text{cm})$ $(\text{Area ABC} =) \frac{21 \times 28}{2} = 294(\text{cm}^2)$	<p>M1 A1 A1</p> <p>M1 A1</p> <p>OC1</p> <p>W1</p>	<p><i>Work for 4(a) must be seen in 4(a) and not awarded retrospectively from work in 4(b).</i> In (a) allow correctly working in metres BUT final answer must be in cm^2.</p> <p>F.T. 'their784' if M1 gained and if <1225 0</p> <p>F.T. (21 × 'their stated or shown AB') / 2 AND (AB ≠ 35 and ≠ 21)</p> <p><u>Alternative method.</u> $\cos C = 21/35$ M1 $C = \cos^{-1} 0.6$ m1 $ACB = 53(.13..)(^\circ)$ A1 F.T. 'their 53°' $\text{Area ABC} = \frac{1}{2} \times 21 \times 35 \times \sin 53.13^\circ$ M1 $= 294(\text{cm}^2)$ A1 <i>Answer from a 'FT angle' must be correct to at least 1 dp. (Note using 53° leads to 293.498....)</i></p> <p>Organisation and Communication. For OC1, candidates will be expected to:</p> <ul style="list-style-type: none"> • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanation and working in a way that is clear and logical <p>Accuracy of writing. For W1, candidates will be expected to:</p> <ul style="list-style-type: none"> • show all their working • make few, if any, errors in spelling, punctuation and grammar • use correct mathematical form in their working • use appropriate terminology, units, etc
<p>4.(b)</p> <p>Use of 'Volume = area ABC × length'.</p> $(\text{Volume} =) 294 \times 200 \quad \text{OR} \quad 0.0294 \times 2$ $= 58800 \text{ cm}^3 \quad \text{OR} \quad 0.0588 \text{ m}^3.$	<p>M1</p> <p>m1</p> <p>A1</p>	<p><i>Work for 4(b) must be seen in 4(b).</i> Allow this M1 even if using 'mixed units'. Where 'area ABC' is that shown in 4(a) or calculated using 'their AB' from 4(a) AND the length is '2×10ⁿ'. (Note: using 'their AB' as an area is M0.)</p> <p>F.T. 'their area of ABC' OR 294 AND using 'consistent' units. Correct units must be shown. Mark final answer. An unsupported 588 × 10ⁿ implies M1.</p>

<p>17. $(\sin ABE =) \frac{11 \times \sin 37^\circ}{13}$</p> <p>$(ABE =) 30.6(\dots^\circ)$ $(CBD =) 30.6(\dots^\circ)$</p> <p>$(CD =) \sqrt{[10^2 + 7^2 - 2 \times 10 \times 7 \times \cos 30.6(\dots^\circ)]}$</p> <p>$(CD =) 5.3(\dots\text{cm})$</p>	<p>M2</p> <p>A1 B1</p> <p>M2</p> <p>A1</p>	<p>M1 for $\sin ABE = \frac{\sin 37^\circ}{13}$ or equivalent.</p> <p>Allow 31°. FT from their derived angle ABE stated or seen on the diagram. Use of $30.6(\dots^\circ)$ or 'their $30.6(\dots^\circ)$' in subsequent calculation gains B1.</p> <p>M1 for $(CD^2 =) 10^2 + 7^2 - 2 \times 10 \times 7 \times \cos 30.6(\dots^\circ)$ FT 'their CBD' from either B0 or B1.</p> <p>Allow an answer of 5.4(cm) from the use of 31°.</p>
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<p>17.(b) <i>Alternative method</i></p> $1 - \left[\left(\frac{96}{100} \times \frac{95}{99} \right) + \left(2 \times \frac{3}{100} \times \frac{96}{99} \right) + \left(2 \times \frac{1}{100} \times \frac{96}{99} \right) \right]$ $= \frac{12}{9900} \left(= \frac{1}{825} \right) \text{ ISW}$	<p>M2</p> <p>A1</p>	<p>M1 for sight of: $\left[\left(\frac{96}{100} \times \frac{95}{99} \right) + \left(2 \times \frac{3}{100} \times \frac{96}{99} \right) + \left(2 \times \frac{1}{100} \times \frac{96}{99} \right) \right]$ OR $1 - \left[\left(\frac{96}{100} \times \frac{95}{99} \right) + \left(\frac{3}{100} \times \frac{96}{99} \right) + \left(\frac{1}{100} \times \frac{96}{99} \right) \right]$</p> <p>Allow $1(.21\dots) \times 10^{-3}$ OR $0.001(21\dots)$ or equivalent. An unsupported answer of $0.00121(2\dots)$ gains M2A1. AO for $0.001(21\dots)\%$. SC1 for working with replacement leading to an answer of $12/10000$ ($3/2500$) OR $0.001(2)$ [may be unsupported].</p>
<p>18. $(\cos CAB =) (13^2 + 17^2 - 23^2) / (2 \times 13 \times 17)$ $(= -71/442 \text{ OR } -0.16(06\dots))$ $(CAB =) 99(.2\dots)^\circ$</p>	<p>M2</p> <p>A1</p>	<p>M1 for $23^2 = 13^2 + 17^2 - 2 \times 13 \times 17 \times \cos CAB$</p> <p>SC1 for the correct evaluation of either of the two other angles. $ABC = 33(.9\dots)$ and $ACB = 46(.8\dots)$.</p>
<p>19. Sight of $9x^2 - 6x - 6x + 4$ Sight of $x^2 + x + 2x + 2$ $8x^2 - 15x + 2 = 0$</p> $x = \frac{-(-15) \pm \sqrt{(-15)^2 - 4 \times 8 \times 2}}{2 \times 8}$ $x = \frac{15 \pm \sqrt{161}}{16}$ <p>$x = 1.73$ with $x = 0.14$ (answers to 2dp)</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>A1</p>	<p>Or equivalent.</p> <p>Or equivalent.</p> <p>FT expansions of equivalent level of difficulty provided B1 previously awarded. '= 0' required, but may be implied by an attempt to use the quadratic formula or if $a = 8, b = -15, c = 2$ used in the quadratic formula.</p> <p>This substitution into the formula must be seen for M1. FT 'their derived quadratic equation' equated to zero of equivalent difficulty (a, b and c must be non-zero). Allow one slip in substitution for M1 only, but must be correct formula.</p> <p>Can be implied from at least one correct value of x evaluated.</p> <p>CAO for their quadratic equation but not if complex roots. M0A0A0 if trial and improvement used or for unsupported answers.</p>
<p>20. Volume scale factor: $(\sqrt{199/47})^3 (= 8.712\dots)$ OR $(\sqrt{47/199})^3 (= 0.114\dots)$ or equivalent.</p> <p>Volume of larger solid $350 \times (\sqrt{199/47})^3$ OR $350 \div (\sqrt{47/199})^3$ or equivalent.</p> <p>$3049(.305\dots \text{cm}^3)$</p>	<p>B2</p> <p>M1</p> <p>A1</p>	<p>May be seen in parts.</p> <p>Award B1 for a linear scale factor: $\sqrt{(199/47)} (= 2.057\dots)$ OR $\sqrt{(47/199)} (= 0.485\dots)$ or equivalent OR Award B1 for $(199/47)^3 (= 75.904\dots)$ OR $(47/199)^3 (= 0.013\dots)$.</p> <p>CAO. Not from premature approximation.</p>

<p>11.</p> $\frac{63 \cdot 5^2}{8 \cdot 65}$ <p>= 466(·156...) or 466·16 or 466·2</p>	<p>M2</p> <p>A1</p>	<p>If many attempts are offered without a method/answer being identified, then mark the final attempt.</p> <p>If M2 not gained, award M1 for correct use of values $63 \leq d < 64$ AND $8 \cdot 6 < e \leq 8 \cdot 7$</p> <p>Mark final answer. M2 required for A1.</p> <p>Fractional equivalent $466(\cdot 156 \dots) = 80645/173$</p> <p>Allow this A1 for an answer of 470 only from correct unambiguous working seen.</p> <p>If no marks gained, award SC1 for sight of 63·5 and 8·65 used within the same calculation.</p>
<p>12. Use of cosine rule followed by sine rule</p> <p>(EG =) $\sqrt{2 \cdot 7^2 + 3 \cdot 2^2 - 2 \times 2 \cdot 7 \times 3 \cdot 2 \times \cos 79^\circ}$</p> <p>(EG =) 3·77.... (cm)</p> <p>$\sin EFG = EG \times \sin 65^\circ / 6 \cdot 4$ OR $EFG = \sin^{-1}(EG \times \sin 65^\circ / 6 \cdot 4)$</p> <p>$F = 32(\cdot 29 \dots^\circ)$</p>	<p>S1</p> <p>M2</p> <p>A1</p> <p>M2</p> <p>A1</p>	<p>M1 for $(EG^2 =) 2 \cdot 7^2 + 3 \cdot 2^2 - 2 \times 2 \cdot 7 \times 3 \cdot 2 \times \cos 79^\circ$ or for $(EG^2 =) 14 \cdot 2(3 \dots)$</p> <p>Accept 3·8 cm</p> <p>Allow $\sqrt{14 \cdot 2(3 \dots)}$ if used in this form in subsequent work, provided not evaluated as a decimal (at any stage)</p> <p>F.T. 'their derived EG' (not 2·7, 3·2, 6·4 or spurious EG).</p> <p>Award M1 for $\sin EFG / EG = \sin 65^\circ / 6 \cdot 4$ OR $EG / \sin EFG = 6 \cdot 4 / \sin 65^\circ$</p> <p>Dependent on previous M2.</p>
<p>13. (Numerator) Sight of $3x(2x - 3)$ (Denominator) Sight of $(2x - 3)(2x + 3)$</p> $\frac{3x}{2x + 3}$	<p>B1</p> <p>B2</p> <p>B1</p>	<p>B1 for $(2x \dots 3)(2x \dots 3)$</p> <p>Mark final answer.</p> <p>F.T. provided at least one previous B1 awarded AND provided simplification required.</p>
<p>14. (a) $\frac{1}{2} \times (x - 1) \times (2x + 3) \times \sin 30^\circ [= 6]$ OR $\frac{1}{2} \times (2x^2 + 3x - 2x - 3) \times \sin 30^\circ [= 6]$</p> <p>$2x^2 + x - 3 (= 6 \times 2 \times 2)$</p> <p>$2x^2 + x - 27 = 0$</p>	<p>B1</p> <p>B1</p> <p>B1</p>	<p>Use of 'Area = $\frac{1}{2} ab \sin C$'.</p> <p>Correct expansion of brackets and correct collection of x terms. May be implied within equation.</p> <p>Must be convincing.</p>
<p>14. (b) $(x =) \frac{-1 \pm \sqrt{[1]^2 - 4(2)(-27)}}{2(2)}$</p> <p>$(x =) \frac{-1 \pm \sqrt{217}}{4}$</p> <p>$(x =) -3 \cdot 93$ AND $3 \cdot 43$</p>	<p>M1</p> <p>A1</p> <p>A1</p>	<p>This substitution into the formula must be seen for M1, otherwise award M0A0A0.</p> <p>Allow one slip in substitution for M1 only, but must be correct formula.</p> <p>Can be implied from at least one correct value of x evaluated, provided M1 awarded.</p> <p>Both solutions required.</p> <p><i>Using trial and improvement</i> Award B3 for a method leading to <u>both</u> solutions, namely $x = -3 \cdot 93$ AND $x = 3 \cdot 43$, otherwise B0.</p> <p>An unsupported answer gains zero marks.</p>
<p>14. (c) (AC =) 2·43 (cm)</p> <p>Length cannot be negative / must be positive.</p>	<p>B1</p> <p>E1</p>	<p>F.T. 'their derived x' provided one positive and one negative solution.</p> <p>Accept any valid explanation, e.g. $x - 1 > 0$, so $x > 1$, x cannot be negative (as $x - 1$ must be > 0)</p>
<p>15. (a) $y = f(x) - 3$</p>	<p>B1</p>	
<p>15. (b) $y = -f(x)$</p>	<p>B1</p>	
<p>15. (c) $y = f(x - 10)$</p>	<p>B1</p>	

<p>4. $(BC^2 =) 9 \cdot 6^2 + 12 \cdot 8^2$ or equivalent</p> <p>$(BC^2 =) 256$ or $(BC =) \sqrt{256}$</p> <p>$(BC =) 16$ (cm)</p> <p>$CD = 2 \times 60 \div 16$ or equivalent</p> <p>$(CD =) 7.5$ (cm)</p>	<p>M1</p> <p>A1</p> <p>A1</p> <p>M2</p> <p>A1</p>	<p>note: $(BC^2 =) 92 \cdot 16 + 163 \cdot 84$ (ignore place values for M1)</p> <p>Award M1 for the correct values substituted into the Cosine rule.</p> <p>Allow $(BC =) \pm 16$ (cm).</p> <p>FT from M1 for the correctly evaluated square root of 'their 256' provided their answer $> 12 \cdot 8$.</p> <p>FT 'their derived BC' OR 'their stated 16' (not derived) provided $12 \cdot 8 < \text{'their stated 16'} < 22 \cdot 4$.</p> <p>Award M1 for $60 = \frac{1}{2} \times 16 \times CD$ or equivalent.</p> <p>Allow M2A1 for a correct embedded answer BUT M2A0 if contradicted by $CD \neq 7 \cdot 5$ (cm).</p>
<p>4. <u>Alternative method:</u> Correct use of 'two-step' method</p> <p>$(BC =) 16$ (cm)</p> <p>$CD = 2 \times 60 \div 16$ or equivalent</p> <p>$(CD =) 7.5$ (cm)</p>	<p>M2</p> <p>A1</p> <p>M2</p> <p>A1</p>	<p>A partial trigonometric method is M0.</p> <p>FT 'their derived BC' OR 'their stated 16' (not derived) provided $12 \cdot 8 < \text{'their stated 16'} < 22 \cdot 4$.</p> <p>Award M1 for $60 = \frac{1}{2} \times 16 \times CD$ or equivalent.</p> <p>Allow M2A1 for a correct embedded answer BUT M2A0 if contradicted by $CD \neq 7 \cdot 5$ (cm).</p>
<p>Organisation and Communication.</p> <p>Accuracy of writing.</p>	<p>OC1</p> <p>W1</p>	<p>For OC1, candidates will be expected to:</p> <ul style="list-style-type: none"> • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanation and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means <p>For W1, candidates will be expected to:</p> <ul style="list-style-type: none"> • show all their working • make few, if any, errors in spelling, punctuation and grammar • use correct mathematical form in their working • use appropriate terminology, units, etc

b.	$3^{\circ}048' \times 10^7$	D I	
7. (a)	$(x =) 14.5 \times \sin 42$ $= 9.7(02\dots)$	M2 A1	Award M2 for $14.5 \times \cos 48$ or $\frac{14.5 \times \sin 42}{\sin 90}$ M1 for $\sin 42 = \frac{x}{14.5}$ or $\cos 48 = \frac{x}{14.5}$ or $\frac{x}{\sin 42} = \frac{14.5}{\sin 90}$ Allow 10 from correct working. Award M2 A0 for an unsupported answer of $-13.2895\dots$ (radians) or $8.88715\dots$ (gradians).
7. (a) <u>Alternative method:</u> Correct use of 'two-step' method.	$(x) = 9.7(02\dots)(\text{cm})$	M2 A1	A partial trigonometric method is M0. Accept an answer that rounds to $9.7(\text{cm})$ Award M2 A0 for an answer of $-13.2895\dots$ (radians) or $8.88715\dots$ (gradians).
7. (b)	$(y =) \cos^{-1} \frac{13.5}{15.8}$ Correct evaluation in the range 31.3 to 31.4	M2 A1	M1 for $\cos y = \frac{13.5}{15.8} (= 0.854\dots)$ Allow 31 from correct working. Allow correct angles given in radians ($0.5463\dots$) or gradians ($34.7812\dots$) Note: $\cos y = 0.85$ $y = 31.788\dots$ is awarded M2A0.
7. (b) <u>Alternative method:</u> Correct use of 'two-step' method.	Correct evaluation in the range 31.3 to 31.4	M2 A1	A partial trigonometric method is M0. Allow 31 from correct working. Allow correct angles given in radians ($0.5463\dots$) or gradians ($34.7812\dots$)

<p>b.</p> $(AC^2 =) 8^2 + 6^2$ $(AC =) \sqrt{8^2 + 6^2} \text{ or equivalent}$ $(AC =) 10 \text{ (cm)}$ <p>(Curved length =)</p> <ul style="list-style-type: none"> • $\frac{6 \times 3 \cdot 14}{2}$ • $\frac{2 \times 3 \times 3 \cdot 14}{2}$ • $3 \times 3 \cdot 14$ • 3π • $9 \cdot 42$ or equivalent <p>(Perimeter of shape = $8 + 10 + 9 \cdot 42 =$) $27 \cdot 42$(cm)</p>	<p>M1 m1 A1</p> <p>B1</p> <p>A1</p>	<p>Check diagram. Note: $(AC^2 =) 64 + 36$ FT from $\sqrt{\text{their } 8^2} + \text{their } 6^2$ CAO. Final answer of $AC = 100$ is M1m0A0.</p> <p>Do not ignore subsequent working e.g. $3 \times 3 \cdot 14 = 9 \cdot 42$, then $9 \cdot 42 \times 2$ or $9 \cdot 42 \div 2$ would gain B0.</p> <p>Allow $27 \cdot 4$(cm). Award A0 for $18 + 3\pi$. FT 'their AC' only if M1 gained. FT 'their curved length' only if B0 awarded and for one of the following:</p> <ul style="list-style-type: none"> • $3 \cdot 14$ used to find the circumference of a circle • area of a semicircle used. <p>For example, M1m1A1 awarded for 10 (cm), B1 for $3 \times 3 \cdot 14 = 9$ (cm) A0 for $8 + 10 + 9 = 27$ (cm) as B1 previously awarded.</p> <p>Note, if a final answer of:</p> <ul style="list-style-type: none"> • $33 \cdot 4(2)$(cm) is given (6cm also included) award M1m1A1B1A0 • $36 \cdot 8(4)$(cm) is given (full circumference used) award M1m1A1B0A1 • $32 \cdot 1(3)$ (cm) is given (area semicircle used) award M1m1A1B0A1.
<p>Organisation and Communication.</p> <p>Accuracy of writing.</p>	<p>OC1</p> <p>W1</p>	<p>For OC1, candidates will be expected to:</p> <ul style="list-style-type: none"> • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanation and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means <p>For W1, candidates will be expected to:</p> <ul style="list-style-type: none"> • show all their working • make few, if any, errors in spelling, punctuation and grammar • use correct mathematical form in their working • use appropriate terminology, units, etc

$\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6} + \frac{3}{8} \times \frac{2}{7} \times \frac{1}{6} \text{ or equivalent}$ $\frac{66}{336} (= \frac{11}{56}) \text{ or equivalent}$	M2 A1	M1 for sight of one correct product. M0 for use of an incorrect total e.g. 9. Must show intention to <u>add</u> for second M mark. ISW If no marks awarded, SC1 for an answer of $\frac{152}{512}$ or equivalent (from a method 'with replacement').
		FT from part (a) consistent use of a wrongly calculated denominator ($8 \times 7 \times 6$) OR use of an

<p>6.(a)</p> <p>$(x =) \sin^{-1} \frac{7.7}{11.3}$ or $\sin^{-1} \frac{7.7 \times \sin 90}{11.3}$ or equivalent</p> <p>Allow an answer between 42.8 and 43(°) ISW</p>	<p>M2</p> <p>A1</p>	<p>Check diagram for answers Award M1 for one of the following:</p> <ul style="list-style-type: none"> $\sin x = \frac{7.7}{11.3} (= 0.68(1..))$ $\frac{\sin x}{7.7} = \frac{\sin 90}{11.3}$ or equivalent <p>Allow correct angles given in radians or gradians:</p> <table border="1" data-bbox="852 427 1366 577"> <thead> <tr> <th>Method</th> <th>Radians</th> <th>Gradians</th> </tr> </thead> <tbody> <tr> <td>$\sin^{-1} \frac{7.7}{11.3}$</td> <td>0.7496...</td> <td>47.727....</td> </tr> <tr> <td>$\sin^{-1} \frac{7.7 \times \sin 90}{11.3}$</td> <td>0.655...</td> <td>47.001</td> </tr> </tbody> </table>	Method	Radians	Gradians	$\sin^{-1} \frac{7.7}{11.3}$	0.7496...	47.727....	$\sin^{-1} \frac{7.7 \times \sin 90}{11.3}$	0.655...	47.001
Method	Radians	Gradians									
$\sin^{-1} \frac{7.7}{11.3}$	0.7496...	47.727....									
$\sin^{-1} \frac{7.7 \times \sin 90}{11.3}$	0.655...	47.001									
<p>6.(a) <u>Alternative method</u> Correct use of a 'two-step' method.</p> <p>Allow an answer between 42.8 and 43(°) ISW</p>	<p>M2</p> <p>A1</p>	<p>A partial trigonometric method is M0.</p> <p>Allow 42.8(...°)</p> <p>Allow correct angles given in radians or gradians.</p>									

$$DBE = (90 - 43) = 47(^{\circ}) \quad \text{OR} \quad BED = 43(^{\circ})$$

Valid method to find the length DE

$$DE = 13.1 \times \tan 47$$

$$DE = \frac{13.1}{\tan 43}$$

$$DE = \frac{13.1 \times \sin 47}{\sin 43}$$

DE in the range 14.04 to 14.1 (cm) ISW

- B1** **Strict FT** for $DBE = 90 -$ 'their x ' or $BED =$ 'their x ', provided 'their x ' $\neq 45^{\circ}$.
 Note: DBE must be acute for B1.
 May be implied in further work.
- M2** If B1 already awarded for 'their angle DBE ' but then 'their angle BED ' is incorrect and 'their BED ' is then used (or vice versa) for either M2 or M1, then award B0 previously.
- Or award M2 for correct use of a 'two-step' method (e.g. 'Pythagoras and similar triangles' or 'Pythagoras and correct trigonometric relationship').
- FT 'their angle DBE ' or 'their angle BED ' provided not 0° , 45° , 90° or 180° .
- Award M1 for one of the following:
- $\tan 47 = \frac{DE}{13.1}$
 - $\tan 43 = \frac{13.1}{DE}$
 - $\frac{DE}{\sin 47} = \frac{13.1}{\sin 43}$ or equivalent
- For all M2 or M1 scenarios, FT their clearly stated or shown angle BED or DBE where appropriate.
- For $\frac{13.1 \times \sin 47}{\sin 43}$ FT their clearly stated or shown angles BED and DBE **only** if $BED + DBE = 90^{\circ}$.
- A1** Allow 14 from correct workings.
 FT from M2 only and provided that angle is acute and leads to a positive answer.
- Award B1M2A0 for any of the following unsupported answers:

Method	Radians	Gradians
$13.1 \times \tan 47$	-1.63 to 1...	11.92 to 12
$\frac{13.1}{\tan 43}$	-8.743 to -5.36	16.35 to 16.5
$\frac{13.1 \times \sin 47}{\sin 43}$	-1.95 to 1.08	14.1 to 14.21

<p>12. (BC² =) $36 \cdot 1^2 + 13 \cdot 8^2 - 2 \times 36 \cdot 1 \times 13 \cdot 8 \times \cos 29$ OR (BC =) $\sqrt{[36 \cdot 1^2 + 13 \cdot 8^2 - 2 \times 36 \cdot 1 \times 13 \cdot 8 \times \cos 29]}$</p> <p style="text-align: center;">(BC =) 24.9(4...cm)</p>	M1	or 2 or 29.						
	A2	Accept 25(cm) from correct working. A1 for (BC ² =) 622.2(1...)						
	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th data-bbox="850 344 1046 371"><i>Method</i></th> <th data-bbox="1046 344 1225 371"><i>Radians</i></th> <th data-bbox="1225 344 1410 371"><i>Gradians</i></th> </tr> </thead> <tbody> <tr> <td data-bbox="850 371 1046 461"><i>Evaluating cos29 using 29rads or 29grads</i></td> <td data-bbox="1046 371 1225 461">47.31...</td> <td data-bbox="1225 371 1410 461">24.472...</td> </tr> </tbody> </table>			<i>Method</i>	<i>Radians</i>	<i>Gradians</i>	<i>Evaluating cos29 using 29rads or 29grads</i>	47.31...
<i>Method</i>	<i>Radians</i>	<i>Gradians</i>						
<i>Evaluating cos29 using 29rads or 29grads</i>	47.31...	24.472...						

<p>18.(a)</p> <p>$E\hat{C}G = 30(^{\circ})$ Sight of $C\hat{E}G = 45(^{\circ})$ AND $C\hat{G}E = 105(^{\circ})$</p> $CE = \frac{5 \times \sin 105}{\sin 45}$ $= 6.8(3\dots\text{cm}) \text{ or } \frac{5+5\sqrt{3}}{2} (\text{cm})$	<p>B1 B2</p> <p>M2</p> <p>A1</p>	<p>Angles must be clearly stated or seen on the diagram.</p> <p>B1 for $C\hat{E}G = 45(^{\circ})$ OR $C\hat{G}E = 105(^{\circ})$ Sight of $C\hat{E}G = 45(^{\circ})$-implies previous B1. FT 'their $E\hat{C}G = 30'$ to calculate: • $C\hat{G}E = 'their 30'/2 + 90$ • $C\hat{E}G = 90 - 'their 30' \times 3/2$</p> <p>Use of correct angles implies B1B2. FT 'their $C\hat{G}E = 105'$ AND 'their $C\hat{E}G = 45'$. M1 for $\frac{CE}{\sin 105} = \frac{5}{\sin 45}$ Award M2 for a correct use of 'two-step' trigonometric relationship. M0 otherwise.</p> <p>A1 Allow 7(cm) from correct working.</p>
<p><u>18(a) Alternative version to find OC first and then use triangle OCE</u></p> <p>$C\hat{O}E = 30(^{\circ})$ Sight of $C\hat{E}G = 45(^{\circ})$</p> $(OC = \frac{2.5}{\sin(15)} =)$ $9.6(5\dots\text{cm}) \text{ or } 9.7(\text{cm}) \text{ or } \frac{5\sqrt{6} + 5\sqrt{2}}{2} (\text{cm})$ $CE = \frac{9.6(5\dots) \times \sin 30}{\sin 45}$ $= 6.8(3\dots\text{cm}) \text{ or } \frac{5+5\sqrt{3}}{2} (\text{cm})$	<p>B1 B1</p> <p>B1</p> <p>M2</p> <p>A1</p>	<p>Angles must be clearly stated or seen on the diagram.</p> <p>B1 B1 B1 Sight of $C\hat{E}G = 45(^{\circ})$ implies previous B1 FT 'their $E\hat{C}G = 30'$ to calculate: $C\hat{E}G = 90 - 'their 30' \times 3/2$</p> <p>Or equivalent e.g. using the sine rule in triangle OCG FT 'sin ($\frac{1}{2}$ of 'their $C\hat{O}E = 30'$)</p> <p>Use of correct side and angles implies B1B1B1. FT 'their derived OC' AND 'their $C\hat{O}E = 30'$ AND 'their $C\hat{E}G = 45'$. M1 for $\frac{CE}{\sin 30} = \frac{9.6(5\dots)}{\sin 45}$ Award M2 for a correct use of 'two-step' trigonometric relationship. M0 otherwise.</p> <p>A1 Allow an answer of 7(cm) from correct working.</p>
<p>18.(b) $\frac{1}{2} \times 5 \times 6.8(3\dots) \times \sin 30$</p> $= 8.5(\dots\text{cm}^2) \text{ or } \frac{25+25\sqrt{3}}{8} (\text{cm}^2)$	<p>M1</p> <p>A1</p>	<p>FT their solution in (a), provided it does not refer to a side other than CE AND 'their $E\hat{C}G = 30(^{\circ})$'.</p>

Unit 2: Higher Tier	Mark	Comments									
<p>6.</p> $13 \cdot 8^2 = BD^2 + 7 \cdot 3^2 \quad \text{OR} \quad (BD^2 =) 13 \cdot 8^2 - 7 \cdot 3^2$ <p style="text-align: center;">or equivalent</p> $(BD =) \sqrt{13 \cdot 8^2 - 7 \cdot 3^2} \quad \text{or equivalent}$ $(BD =) 11 \cdot 7(1 \dots) \text{ (cm)}$ $y = \sin^{-1} \left(\frac{5 \cdot 5}{11 \cdot 7} \right) \quad \text{or}$ $\sin^{-1} \frac{5 \cdot 5 \times \sin 90}{11 \cdot 7} \quad \text{or equivalent}$ $y = 28(\cdot 0 \dots)$	<p>M1</p> <p>m1</p> <p>A1</p> <p>M2</p> <p>A1</p>	<p>Check diagram for answers. Note: $190 \cdot 44 - 53 \cdot 29 = 137 \cdot 15$</p> <p>Note: $(BD =) \sqrt{137 \cdot 15}$ FT 'their 137·15' for m1 only, provided M1 previously gained.</p> <p>CAO. Final answer of $BD = 137 \cdot 15$ is M1m0A0. Accept an answer rounded or truncated to at least 1 decimal place. If $\sqrt{137 \cdot 15}$ is used correctly for BD in subsequent work, then award this A1 retrospectively. An unsupported answer of $11 \cdot 7(1 \dots)$ (cm) is awarded M1m1A1.</p> <p>Check diagram for answers. FT 'their stated BD' (may be on diagram), provided $> 5 \cdot 5$.</p> <p>Award M1 for one of the following:</p> <ul style="list-style-type: none"> $\sin y = \left(\frac{5 \cdot 5}{11 \cdot 7} \right) (= 0 \cdot 47(0 \dots))$ $\frac{\sin y}{5 \cdot 5} = \frac{\sin 90}{11 \cdot 7}$ or equivalent <p>Accept an answer rounded or truncated.</p> <p>An unsupported answer of $28(\cdot 0 \dots)$ is awarded M1m1A1M2A1. Allow correct angles given in radians or gradians:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Method</th> <th>Radians</th> <th>Gradians</th> </tr> </thead> <tbody> <tr> <td>$\sin^{-1} \frac{5 \cdot 5}{11 \cdot 7}$</td> <td>0·4893...</td> <td>31·155...</td> </tr> <tr> <td>$\sin^{-1} \frac{5 \cdot 5 \times \sin 90}{11 \cdot 7}$</td> <td>0·4337...</td> <td>30·738...</td> </tr> </tbody> </table>	Method	Radians	Gradians	$\sin^{-1} \frac{5 \cdot 5}{11 \cdot 7}$	0·4893...	31·155...	$\sin^{-1} \frac{5 \cdot 5 \times \sin 90}{11 \cdot 7}$	0·4337...	30·738...
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<p>6. Alternative method for first 3 marks Correct use of a 'two-step' method.</p> $(BD =) 11 \cdot 7(1 \dots) \text{ (cm)}$	<p>M2</p> <p>A1</p>	<p>A partial trigonometric method is M0.</p>									
<p>6. Alternative method for final 3 marks Correct use of a 'two-step' method.</p> $(y =) 28(\cdot 0)$	<p>M2</p> <p>A1</p>	<p>A partial trigonometric method is M0.</p> <p>Allow correct angles given in radians or gradians.</p>									

14. $\frac{1}{2} \times 24 \cdot 1 \times 17 \cdot 9 \times \sin 37$ $= 129 \cdot 8(08\dots \text{cm}^2)$ OR $129 \cdot 81(\text{cm}^2)$ OR $130(\text{cm}^2)$	M1 A1	<i>the entirety of its drawn length.</i> Accept a complete alternative correct method. CAO. Not from premature approximation. <table border="1" data-bbox="852 259 1369 344"> <tr> <td></td> <td>Radians</td> <td>Gradians</td> </tr> <tr> <td>Area</td> <td>-138·807...</td> <td>118·421....</td> </tr> </table>		Radians	Gradians	Area	-138·807...	118·421....
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