



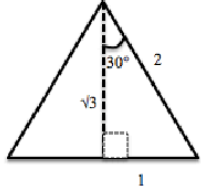
Surds

Mark schemes for the Surds question pack

WJEC Level 2 Additional Mathematics (9550) · Algebra

Official WJEC mark schemes for the 11 questions in the matching revise.wales question pack (54 marks total), from the 2011–2024 papers. Pack layout © revise.wales.

<p>3</p>	<p>(Area of a trapezium) $\frac{1}{2} \times \text{perpendicular height} \times (1 + \sqrt{5} + 6 + 2\sqrt{5})$ $= 20 + 4\sqrt{5}$</p> <p>(Perpendicular height $=$) $\frac{2(20 + 4\sqrt{5})}{1 + \sqrt{5} + 6 + 2\sqrt{5}}$ or $\frac{20 + 4\sqrt{5}}{\frac{1}{2}(1 + \sqrt{5} + 6 + 2\sqrt{5})}$ or $\frac{40 + 8\sqrt{5}}{7 + 3\sqrt{5}}$</p> <p>($=$) $\frac{2(20 + 4\sqrt{5})}{7 + 3\sqrt{5}} \times \frac{7 - 3\sqrt{5}}{7 - 3\sqrt{5}}$ or equivalent</p> <p style="text-align: center;">($=$) $40 - 16\sqrt{5}$</p>	<p>M2</p> <p>A1</p> <p>M1</p> <p>A2</p> <p>6</p>	<p>For M2 brackets must be shown unless implied in further working M1 for sight of $1 + \sqrt{5} + 6 + 2\sqrt{5}$ or $7 + 3\sqrt{5}$</p> <p>Mark final answer, then FT with this answer Do not FT from M1</p> <p><u>If no working for rationalising seen then M0 A0</u> Method working must be seen FT 'their perpendicular height' provided it is of equivalent level of difficulty, allow FT from e.g. $\frac{20 + 4\sqrt{5}}{7 + 3\sqrt{5}}$</p> <p>FT from previous M1 Mark final answer On FT only award A2 if 'their answer' is in the form $a + b\sqrt{5}$ where a and b are integers A1 for either numerator surds ($160 - 64\sqrt{5}$) or denominator surds (4) correctly simplified, including FT from previous M1 awarded</p> <p><i>Note:</i> $\frac{20 + 4\sqrt{5}}{7 + 3\sqrt{5}} = 20 - 8\sqrt{5}$</p>
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<p>5</p>	<p>(a) (Width =) $\frac{142}{2 + 5\sqrt{3}}$ or $142 \div (2 + 5\sqrt{3})$</p> <p>$\frac{142}{2 + 5\sqrt{3}} \times \frac{2 - 5\sqrt{3}}{2 - 5\sqrt{3}}$ or $\frac{142(2 - 5\sqrt{3})}{4 - 75}$ or $-2(2 - 5\sqrt{3})$</p> <p>$2(5\sqrt{3} - 2)$ or $2(-2 + 5\sqrt{3})$</p> <p>(b) Annotated diagram showing:</p> <ul style="list-style-type: none"> perpendicular (right angle indicated) (unambiguous) angle 30° (and right angle) (length of $\frac{1}{2}$ side as 1) with $\sqrt{3}$ derived or correct indication <p>For example:</p> 	<p>B2 B1 for width $\times (2 + 5\sqrt{3}) = 142$ or $a(b + c\sqrt{d}) \times (2 + 5\sqrt{3}) = 142$ Allow B1 for $x \times 2 + 5\sqrt{3} = 142$ or $142 \div 2 + 5\sqrt{3}$ unless treated correctly in further working</p> <p>M1 Working MUST be seen. No working, no marks Depends on B2 previously awarded</p> <p>A1 CAO. Mark final answer</p> <p>B2 Allow diagram with an appropriate height drawn without the right angle indicated as 'perpendicular' and a 'right angle'</p> <p>Allow if the correct angle of 30° is indicated unambiguously but not labelled</p> <p>Do not accept if both the 30° and 90° angles are both indicated by single arcs without labels</p> <p>Allow if length $\frac{1}{2}$ side as 1 is omitted</p> <p>B1 for sight of one of the following:</p> <ul style="list-style-type: none"> (perpendicular) height and (unambiguous) angle 30° $\sqrt{3}$ derived or correct indication <p>6</p>
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3		4	
	<p>(a) $48 + 4\sqrt{3} + 4\sqrt{3} + 1 (-1)$</p> <p style="text-align: center;">$48 + 8\sqrt{3}$</p> <p style="text-align: center;">$8(6 + \sqrt{3})$</p>	<p>M2</p> <p>A1</p> <p>A1</p>	<p>No marks if no working throughout</p> <p>Must be convincing non calculator, e.g. $48 + 8\sqrt{3} + 1 (-1)$ shown</p> <p>M1 for 3 or 4 terms correct in $48 + 4\sqrt{3} + 4\sqrt{3} + 1 - 1$, or 2 or 3 terms correct in $48 + 4\sqrt{3} + 4\sqrt{3} + 1$</p> <p>CAO, or correct but partially factorised</p> <p>FT from M1 for equivalent level of difficulty</p> <p>Mark final answer</p>
	<p>(a) <u>Alternative method (difference of two squares)</u></p> <p>$(4\sqrt{3} + 1 - 1)(4\sqrt{3} + 1 + 1)$</p> <p style="padding-left: 2em;">$4\sqrt{3}(4\sqrt{3} + 2)$</p> <p style="padding-left: 4em;">$48 + 8\sqrt{3}$</p> <p style="padding-left: 4em;">$8(6 + \sqrt{3})$</p>	<p>M1</p> <p>A1</p> <p>A1</p> <p>A1</p>	<p>CAO, or correct but partially factorised</p> <p>FT from M1 for 'their $a(b + \sqrt{c})$'</p>
	<p>(b) $\frac{1}{6 - \sqrt{7}} \times \frac{6 + \sqrt{7}}{6 + \sqrt{7}}$</p> <p style="padding-left: 10em;">$= \frac{6 + \sqrt{7}}{29}$</p>	<p>M1</p> <p>A1</p> <p>6</p>	<p>This step must be shown</p> <p>Mark final answer</p>

9	$x = 5 \times \tan 60^\circ$ or $\tan 60^\circ = x/5$ ($x =$) $5\sqrt{3}$	2	
		M1	OR for use of $30^\circ, 60^\circ$ triangle with $5\times$ sides of 1, 2 & $\sqrt{3}$ Do not award A1 unless a line of working is seen, i.e. $5\sqrt{3}$ without working is M0, A0
		A1	
		2	

	Additional Mathematics Summer 2017		Final Version
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17	(a) 225	4	
		B1	<i>No marks if no working. Must see $15^{3 \times 6}$ or 15^2 or $3^2 \times 5^2$ or 9×25</i>
	(b) $\frac{1}{8 + \sqrt{5}} \times \frac{8 - \sqrt{5}}{8 - \sqrt{5}}$	M1	<i>No marks if no working.</i>
	$= \frac{8 - \sqrt{5}}{59}$	A1	Mark final answer
		3	

Differentiating from first principles. Marking guide.
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9	<p>(a) $\frac{1/\sqrt{2}}{1/\sqrt{2}} = 1$</p> <p>(b) $\left(\frac{1/2}{\sqrt{3}/1} = \right) \frac{1}{2\sqrt{3}} \frac{(\times\sqrt{3})}{(\times\sqrt{3})}$ or $\frac{1/2\sqrt{3}}{3}$ $= \sqrt{3}/6$</p> <p>(c) $(\sqrt{3}/2)^2 + 1^{(2)}$ $7/4$ or $1\frac{3}{4}$ or 1.75</p>	<p>/</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>5</p>	<p>Working must be shown throughout Must be sight of $1/\sqrt{2} / 1/\sqrt{2}$ or $\sqrt{2}/2 / \sqrt{2}/2$ or $\cos 45^\circ / \sin 45^\circ = 1/\tan 45^\circ$</p> <p>Must be sight of $\frac{1/2 \times \sqrt{3}}{\sqrt{3} \sqrt{3}}$ leading to $\frac{1/2\sqrt{3}}{3}$ Do not accept $1/2 \div \sqrt{3}$</p> <p>This stage must be seen, do not accept starting with $3/4 + 1$, this is M0, A0</p>
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	Additional Mathematics Summer 2016		Final
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		10	
10	(a) $(\frac{1}{2})^2 + (\frac{\sqrt{3}}{2})^2$ $\frac{1}{4} + \frac{3}{4} (=1)$	M1 A1	Use of $\frac{1}{2}$ and $\frac{\sqrt{3}}{2}$ appropriately in either order
	(b) $5 \times 1 + 2 \times \sqrt{3/2} + \sqrt{3}$	M2	M1 for any 2 terms correct M1 only if first line of working is $5 + \sqrt{3} + \sqrt{3}$, but allow FT for possible A1
	$5 + 2\sqrt{3}$	A1 5	CAO. Mark final answer

<p>9</p> <p>Sight of $\cos 45^\circ = 1/\sqrt{2}$ or $\sqrt{2}/2$ OR $\sin 45^\circ = 1/\sqrt{2}$ or $\sqrt{2}/2$ $\cos 45^\circ = DB/4$ OR $\sin 45^\circ = DB/4$ $DB = 4/\sqrt{2}$ or $2\sqrt{2}$ Sight of $\cos 30^\circ = \sqrt{3}/2$ $\cos 30^\circ = BC/DB$ $BC = \sqrt{3}/2 \times 4/\sqrt{2}$ OR $BC = \sqrt{3}/2 \times 2\sqrt{2}$ OR $BC = \sqrt{3}\sqrt{2}$ $BC = \sqrt{6}$ (cm)</p>		<p>B1 MI AI B1 MI AI AI 7</p>	<p><i>Alternative method for first 2 marks:</i> $DB=AD (=x)$, hence $x^2+x^2 = 4^2$ <i>B1</i> $2x^2 = 16$ or $x^2 = 16/2$ or $x^2 = 8$ <i>M1</i> B0 if not seen, allow embedded sight Working must be shown MI B0 if not seen, allow embedded sight Working must be shown FT their DB provided working with surd AI 7 CAO from convincing working involving surds seen. Mark final answer</p>
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		+	<i>u = 1 3 2 1 2 1 = 3</i>
6	(a) Multiplier $(2-\sqrt{5}) / (2-\sqrt{5})$ Denominator $4 + 2\sqrt{5} - 2\sqrt{5} - 5$ OR $4 - 5$ OR -1 $3\sqrt{5} - 6$ or $(6 - 3\sqrt{5})/-1$	M1 A1 A1	CAO. Mark final answer
	(b) $\{3+2\sqrt{3} + 2\sqrt{3} + 4\} - \{3 - 2\sqrt{3} - 2\sqrt{3} + 4\}$ OR $\{(\sqrt{3}+2)+(\sqrt{3}-2)\}\{(\sqrt{3}+2)-(\sqrt{3}-2)\}$	B2	B1 for 1 slip <i>'3+2√3 + 2√3 + 4 - 3 - 2√3 - 2√3 + 4' is 3 slips, unless brackets were intended as implied by further working</i>
	$8\sqrt{3}$	B1 6	CAO. Mark final answer

		8	
6	Sight of $\tan 60 = \sqrt{3}$ $\tan 60 = 7/h$ $h = 7/\sqrt{3}$ (= $7\sqrt{3}/3$ or equivalent) $BX = h$ OR $AB^2 = h^2 + h^2$ OR $\cos 45 = h/AB$ OR $\sin 45 = BX/AB$ with $AX = AB$ $AB = 7\sqrt{(2/3)}$ or equivalent ($7\sqrt{6}/3$)	M1 M1 A1 M1 A1 5	<u>Or for equivalent processes</u> OR $\sin 30 = \frac{1}{2}$ and $\sin 60 = \frac{\sqrt{3}}{2}$ with sine rule method $AX/\sin 30 = 7/\sin 60$ or equivalent CAO. Do not accept decimal notation FT 'their h'. Or cosine rule CAO. Do not accept decimal notation Use of decimal notation, max mark is M0, M1, A0, M1, A0

	WJEC Level 2 Certificate in Additional Mathematics Summer 2011	Mark	Comments (Final)
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End of solutions