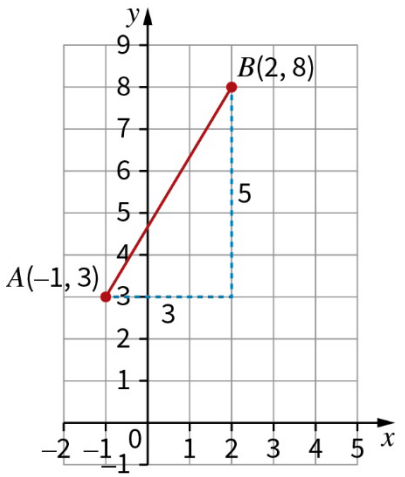
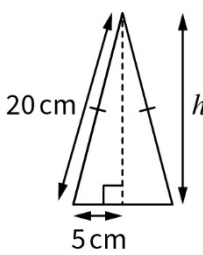


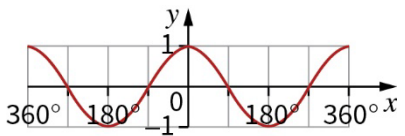
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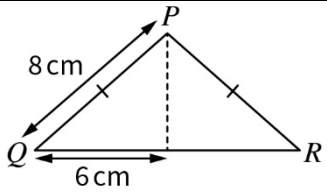
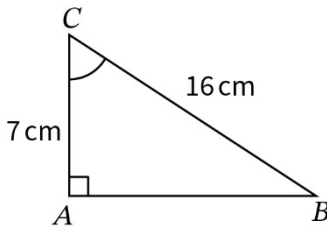
Chapter 21 Pythagoras and 2D trigonometry

Question	Answer	Extra information	Marks
21.1	$a^2 + b^2 = c^2$ $BC^2 + 20^2 = 21^2$ $BC^2 + 400 = 441$ $BC^2 = 41$ $BC = \sqrt{41} = 6.40 \text{ cm}$	$a^2 + b^2 = c^2$ Correct answer	1 1

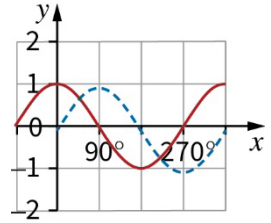
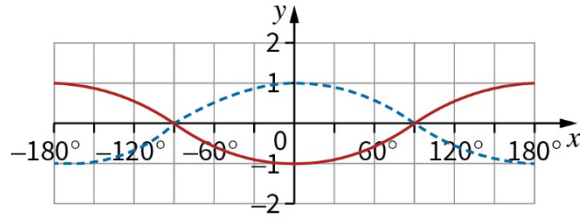
Question	Answer	Extra information	Marks
21.2	 <p>From the diagram, $(AB)^2 = 5^2 + 3^2 = 34$ $AB = 5.83$ to 3 sf</p>	<p>Identifying at least one of 3 and 5 as sides of a right-angled triangle</p> <p>Squaring and adding</p> <p>Taking the square root of your answer</p> <p>Correct answer to 3 sf</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>

Question	Answer	Extra information	Marks
21.3	 <p>From the diagram, $h^2 = 20^2 - 5^2 = 375$ $h = 19.364\dots = 19.4 \text{ cm to 1 dp}$</p>	<p>Splitting into two right-angled triangles with side 5 and squaring and subtracting; Taking the square root of your answer Correct answer to 1 dp</p>	<p>1 1 1</p>
21.4	$(3h)^2 = 90^2 - 60^2 = 4500$ $3h = 67.082\dots$ $h = 22.360\dots = 22.4 \text{ cm to 1 dp}$	<p>Squaring and subtracting Taking the square root of your answer Dividing by 3 Correct answer to 1 dp</p>	<p>1 1 1 1</p>
21.5 (a)	$\text{Volume} = \frac{1}{3}\pi \times 10^2 \times 24 = 800\pi \text{ cm}^3$	$\frac{1}{3}\pi \times 10^2 \times 24$ Correct answer	<p>1 1</p>
21.5 (b)	<p>Slant height = $\sqrt{10^2 + 24^2} = 26$ Curved surface area = $\pi \times 10 \times 26 = 260\pi$ Base area = $\pi \times 10^2 = 100\pi$ Total surface area = $360\pi \text{ cm}^2$</p>	<p>Attempt to use Pythagoras to find slant height $\pi \times 10 \times \text{slant height}$ Base area Correct answer</p>	<p>1 1 1 1</p>

Question	Answer	Extra information	Marks
21.6	$\sqrt{\frac{\sin 47^\circ \cos 21^\circ}{\cos 21^\circ - \sin 47^\circ}} = 1.84$ (3 sf)	Clear attempt to use calculator and write down at least 3 decimal places Correct answer, to 3 sf	1 1
21.7	$\cos 35^\circ = \frac{x}{16}$ $x = 16 \cos 35^\circ = 13.1$ cm	Correct ratio for cosine Correct answer	1 1
21.8	The trapezium can be split into a rectangle 24 cm by h cm and a right-angled triangle of height h Base of triangle = $40 - 24 = 16$ cm $h = 16 \tan 50^\circ = 19.1$ cm to 3 sf	$40 - 24$ (= 16) $16 \tan 50$ Correct answer to 3 sf.	1 1 1
21.9 (a)		Correct cosine graph between 0° and 360° Fully correct graph for the whole range	1 1
21.9 (b)	(180, -1)		1
21.10	Using the left triangle in the diagram, the common side = $6.4 \div \tan 52^\circ = 5.0002\dots$ cm Using the right triangle in the diagram, $b = 5.0002\dots \div \tan 31^\circ = 8.3$ cm to 1 dp	$\tan 52^\circ$ (= 5.0002...) Dividing answer by $\tan 31^\circ$ Correct answer to 1 dp	1 1 1

Question	Answer	Extra information	Marks
21.11	$\sin x = \frac{4}{7}$ $x = \sin^{-1}\left(\frac{4}{7}\right) = 34.8^\circ$	$\sin x = \frac{4}{7}$ Answer correct to 1 dp	1 1
21.12	 $\cos PQR = \frac{6}{8}$ $\angle PQR = \cos^{-1}\left(\frac{6}{8}\right) = 41.4^\circ$	$12 \div 2$ $\cos PQR = \frac{6}{8}$ Answer correct to 1 dp	1 1 1
21.13	 $\cos BCA = \frac{7}{16}$ $BCA = \cos^{-1}\left(\frac{7}{16}\right) = 64.1^\circ$	Correctly sketched and labelled $\cos BCA = \frac{7}{16}$ Answer correct to 1 dp	1 1 1

Question	Answer	Extra information	Marks
21.14 (a)		Correct section of graph of $\sin x$ between 0° and 360° Fully correct graph	1 1
21.14 (b)	$\theta = 135^\circ, 405^\circ$	135 405	1 1
21.15	$\cos x = \frac{1 + \sqrt{2}}{2 + \sqrt{2}} = \frac{1 + \sqrt{2}}{2 + \sqrt{2}} = \frac{1}{\sqrt{2}}$ $x = \cos^{-1}\left(\frac{1}{\sqrt{2}}\right) = 45^\circ$	$\cos x = \frac{1 + \sqrt{2}}{2 + \sqrt{2}}$ $\cos x = \frac{1}{\sqrt{2}}$ Correct answer	1 1 1
21.16 (a)		Correct section of graph of $\tan x$ between 0° and 360° Fully correct graph.	1 1
21.16 (b)	$\tan 30^\circ = \frac{\sqrt{3}}{3}$		1

Question	Answer	Extra information	Marks
21.16 (c) (i)	$\tan 210^\circ = \tan 30^\circ = \frac{\sqrt{3}}{3}$		1
21.16 (c) (ii)	$\tan(-30)^\circ = -\tan 30^\circ = -\frac{\sqrt{3}}{3}$		1
21.17		<p>Horizontal translation of $y = \sin x$</p> <p>Correct answer (translating 90 left).</p>	<p>1</p> <p>1</p>
21.18		<p>Reflecting $y = \cos x$</p> <p>Correct answer (reflecting in the x-axis).</p>	<p>1</p> <p>1</p>
21.19 (a)	<p>Base of right-angled triangle = 6 cm</p> $EF^2 = 6^2 + 8^2$ $EF = 10$	<p>6 cm stated</p> <p>Pythagoras correctly used</p> <p>Correct answer</p>	<p>1</p> <p>1</p> <p>1</p>

Question	Answer	Extra information	Marks
21.19 (b)	$\tan ECF = \frac{10}{8} = \frac{5}{4}$ $ECF = \tan^{-1}\left(\frac{5}{4}\right) = 51.3^\circ$		
21.20 (a)	$AE^2 = 10.7^2 - 6.2^2$ $AE = 8.7206\dots$ $BE = 17.3 - 8.7206\dots = 8.5793\dots$ $BF = 8.5793\dots - 7.6 = 0.9793\dots$ $\tan ABC = \frac{62}{0.9793\dots}$ $ABC = 81.0238\dots$ $ABC = 81.0^\circ \text{ (1 dp)}$	Pythagoras used correctly to find AE Process to find BF Correct use of $\tan ABC$ $81.0238\dots$ Correct answer, to 1 dp	1 1 1 1 1
21.20 (b)	If the adjacent side increases, then the ratio of $\frac{\text{opposite}}{\text{adjacent}}$ will decrease, so the tangent of ACB will also decrease	Decrease, with acceptable reasoning	1

Question	Answer	Extra information	Marks
21.21	$x = 702702702\dots$ $1000x = 702.702702\dots$ $999x = 702$ $x = \frac{702}{999}$ $= \frac{26}{37}$	Use of $1000x$ Subtract to get $999x$ Correct final answer	1 1 1
21.22	$V = 60.75\pi = \frac{1}{2} \times \frac{4}{3} \pi r^3$ $60.75 = \frac{2}{3} r^3$ $91.125 = r^3$ $r = \sqrt[3]{91.125}$ $= 4.5$ The surface area is made up of two parts: the circular base, and the hemispheric shell: $SA = \pi r^2 + \frac{1}{2} \times 4\pi r^2 = 3\pi r^2$ $= 3\pi \times 4.25^2 = 60.75\pi \text{ cm}^2$ The volume and surface are numerically equal.	Use the formula for the volume and take half of that Solve for the radius Use the radius to calculate the surface area Fully correct surface area Notice that the volume and surface area are numerically equal. (Will this always be true for any radius?)	1 1 1 1 1