Oxford Revise | AQA GCSE Maths Higher | Answers

Chapter 25 Trigonometry in 3D, sine and cosine rules

Question	Answer	Extra information	Marks
25.1	$12^2+3^2+h^2=13^2$ $144+9+h^2=169$ $h=16$ $h=4$ cm	$12^2+3^2+h^2=13^2$ Correctly rearranged Correct answer	1 1 1
25.2	Same method as for a 2 cm × 2 cm × 1 cm cuboid Length of PQ = $\sqrt{2^2+2^2+1^2}=3$ cm	1 mark for $\sqrt{2^2+2^2+1^2}$ Correct answer	1 1
25.3	Let the centre of the base be O and let the midpoint of AB be M. Using triangle AOM: $AO=\sqrt{\left(\frac{\sqrt{2}}{2}\right)^2+\left(\frac{\sqrt{2}}{2}\right)^2}=1$ cm Using triangle AEO: $h=\sqrt{\left(\sqrt{3}\right)^2-1^2}=\sqrt{2}$ cm	$AO=\sqrt{\left(\frac{\sqrt{2}}{2}\right)^2+\left(\frac{\sqrt{2}}{2}\right)^2}$ $h=\sqrt{\left(\sqrt{3}\right)^2-1^2}$ Correct answer	1 1 1

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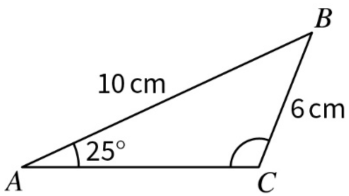
25.4	Let *M* be the midpoint of *WX*. Using triangle *MOX*: $OX = \dfrac{1.5}{\cos 30°} = \sqrt{3}$ (Angle $OXM = 30°$ since OX bisects angle VXW which is $60°$ because VXW is an equilateral triangle.) Using triangle YOX : $\cos YXO = \dfrac{\sqrt{3}}{3}$ $\Rightarrow YXO = 54.735... = 55°$ to the nearest degree	Attempt to use $90°$, $60°$, $30°$ triangle $OX = \dfrac{1.5}{\cos 30°} = \sqrt{3}$ $\cos YXO = \dfrac{\sqrt{3}}{3}$ Correct answer to the nearest degree	1 1 1 1
25.5	$OP = \dfrac{12}{\tan 38°} = 15.539...$ cm $ST = \dfrac{7}{10} \times 20 = 14$ cm $PT = \sqrt{12^2 + 14^2} = 18.439...$ cm $\tan OTP = \dfrac{15.539...}{18.439...} = 0.832...$ $OTP = 39.793...$ $OTP = 39.8°$ to 1 decimal place	Correct trig. ratio used to find OP Uses ratio correctly to find ST Pythagoras used to find PT Correct trig. ratio used to find OTP Correct answer to 1 decimal place	1 1 1 1 1
25.6	$OC = \sqrt{2^2 + 3^2} = \sqrt{13}$ cm $\tan FOC = \dfrac{5}{\sqrt{13}}$ $FOC = 54.204...$ $= 54.2°$, to 1 decimal place	Pythagoras used to find OC Correct trig. ratio used to find FOC Correct answer to 1 decimal place	1 1 1

Question	Answer	Extra information	Marks
25.7	Using the cosine rule: $x^2 = 14^2 + 11^2 - 2 \times 14 \times 14 \times \cos 42° = 88.111...$ $x = 9.4$ cm, to 1 dp	$x^2 = 14^2 + 11^2 - 2 \times 14 \times 14 \times \cos 42°$ $88.111...$ Correct answer to 1 decimal place	1 1 1
25.8	Using the sine rule: $\frac{\sin x}{13} = \frac{\sin 67}{19}$ $\sin x = \frac{13 \times \sin 67}{19} = 0.6298...$ $x = 39.036... = 39.0°$, to 1 dp	$\frac{\sin x}{13} = \frac{\sin 67°}{19}$ $\sin x = \frac{13 \times \sin 67°}{19}$ $39.0°$, to 1 dp	1 1 1
25.9	 Using the sine rule: $\frac{\sin ACB}{10} = \frac{\sin 25°}{6}$ $\sin ACB = \frac{10 \times \sin 25°}{6} = 0.704...$ $ACB = 44.778...$ ACB is obtuse, so $ACB = 180 - 44.778... = 135.2°$, 1 dp	$\frac{\sin ACB}{10} = \frac{\sin 25°}{6}$ $\sin ACB = \frac{10 \times \sin 25°}{6} = 0.704...$ $ACB = 44.778...$ Subtract $: 180 - 44.778...$ to obtain correct answer	1 1 1 1

Question	Answer	Extra information	Marks
25.10	Triangle ABD Using the sine rule: $\frac{BD}{\sin 70°} = \frac{16}{\sin 37°}$ $BD = \frac{\sin 70° \times 16}{\sin 37°} = 24.982...$ Triangle BCD Using the cosine rule: $BC^2 = 18^2 + BD^2 - 2 \times 18 \times BD \times \cos 43°$ $= 290.377...$ $BC = 17.0$ cm, to 1 dp	$\frac{BD}{\sin 70°} = \frac{16}{\sin 37°}$ $BD = \frac{\sin 70° \times 16}{\sin 37°}$ $BC^2 = 18^2 + BD^2 - 2 \times 18 \times BD \times \cos 43°$ $290.377...$ Correct final answer	1 1 1 1 1
25.11	Area = $\frac{1}{2} \times 6 \times 9 \times \sin 32° = 14.31$ cm	Use of the sine formula to find the area Correct answer	1 1
25.11	Area = $\frac{1}{2} \times 10.21 \times 13.64 \times \sin 80° = 68.57$ cm	Use of the sine formula to find the area Correct answer	1 1
25.12	Area of one face = $\frac{1}{2} \times 8 \times 8 \sin 60° = 16\sqrt{3}$ Surface area = $4 \times 16\sqrt{3} = 64\sqrt{3}$ cm^2	$60°$ Attempt to use $\frac{1}{2}ab\sin C$ $64\sqrt{3}$ Answer with correct units	1 1 1 1

Question	Answer	Extra information	Marks
25.13	Work out the areas of triangles *ABC* and *ACD* separately and then sum. $AC = 25\sin 32° = 13.2479...$ $BC = 25\cos 32° = 21.2012...$ Area of $ABC = \frac{1}{2} \times AC \times BC = 140.4365...$ You need to work out one of the angles in *ACD*. Using the cosine rule: $AC^2 = 36^2 + 26^2 - 2 \times 36 \times 26 \times \cos ADC$ $ADC = \cos^{-1}\left(\frac{36^2 + 26^2 - 13.2479...^2}{2 \times 36 \times 26}\right)$ Area of $ACD = \frac{1}{2} \times AD \times DC \times \sin ADC$ $= \frac{1}{2} \times 36 \times 26 \times \sin 16.3288...°$ $= 131.5779...$ Total area = 140.4365 + 131.4365 = 272.0 units^2 to 1 dp	Base or height of ABC Correct area of ABC Attempt to use the cosine rule Use of $\frac{1}{2}ab\sin C$ Correct rounded answer	1 1 1 1 1

Question	Answer	Extra information	Marks
25.14 (a)	Equilateral triangle, so angle $DOC = 60°$	$60°$	1
	Area of triangle $OAB = \frac{1}{2} \times 8 \times 8 \times \sin 60° = 16\sqrt{3}$	$\frac{1}{2} \times 8 \times 8 \times \sin 60°$	1
	Radius of circle $= 8 \div 2 = 4$ Area of sector = $\frac{60}{360} \times \pi \times 4^2 = \frac{8\pi}{3}$ cm^2	$\frac{60}{360} \times \pi \times 4^2$	1
	Shaded area = $\left(16\sqrt{3} - \frac{8\pi}{3}\right)$ cm^2	Correct final answer or equivalent expression	1

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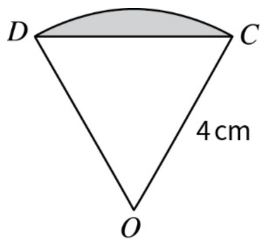
25.14 (b)	 Sector area from part (a) = $\frac{8\pi}{3}$ cm^2 Triangle area = $\frac{1}{2}\times 4\times 4\times \sin 60°$ $= 4\sqrt{3}$ cm^2 Segment area = $\frac{8\pi}{3} - 4\sqrt{3} = 1.4493...$ Segment area $= 1.4$ cm^2, to 1 dp	Triangle area formula Subtracting from sector area Final answer, correct to 1 dp	1 1 1
25.15	$\frac{1}{2}\times 12\times AB\times \sin 39° = 80 AB = 21.1868$ $...BC^2 = 12^2 + AB^2 - 2\times 12\times AB\times \cos 39°$ $BC = 14.0611$ $...\frac{\sin 46°}{14.0611} = \frac{\sin C\,BD}{15} CBD = 50.1°$, to 1 dp	Use of area formula to find AB Use of cosine rule to find BC Use of sine rule to find CBD Correct answer Correct to 3 sf	1 1 1 1 1

Question	Answer	Extra information	Marks
25.16 (a)	The second digit must be either $1, 3, 5, 7$ or 9, so that is 5 possibilities The first digit can be any digit except 0, so that makes 9 possibilities $9 \times 5 = 45$ possible different numbers	Identifying the number of possibilities for each digit. Multiplying them together	1 1
25.16 (b)	There are 90 possible numbers $(10 – 99)$ and of these, there are 11 with the same digits $(11, 22, 33, \ldots. 99)$ Thus, the probability of one of these numbers being written is $\frac{11}{90}$	Identifying that there are 90 two-digit numbers overall Correct answer, either as a fraction or a decimal or a percentage	1 1
25.17	The three reflected vertices are: $A'(2, 0)$, $B'(0, –2)$ and $C'(3, –4)$	1 mark for two correct vertices 1 mark for all three	1 1