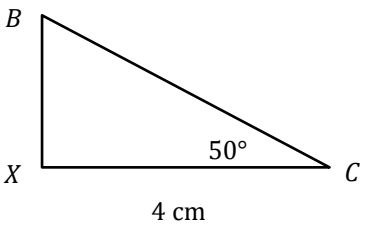
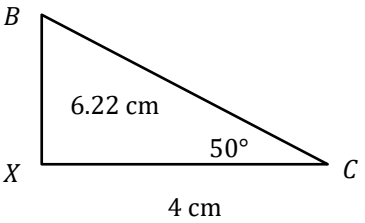
| 3D Pythagoras and Trigonometry Mark Scheme | | |
|---|---|---|
| **1(a)** | $CH^2 = 12^2 + 3^2 = 144 + 9 = 153$<br>$CH = \sqrt{153}$ | **[1]** Pythagoras |
| | $CH = 12.37 \text{ cm (2 dp)}$ | **[1]** Correct answer |
| **1(b)** | $CE^2 = 12.37^2 + 4^2 = 153.01 + 16 = 169.01$<br>$CE = \sqrt{169.01}$ | **[1]** Correct working even with error carry forward |
| | $CE = 13.00 \text{ cm (2 dp)}$ | **[1]** Correct answer |
| **2(a)** | $CA^2 = 5^2 + 7^2 = 25 + 49 = 74$<br>$CA = \sqrt{74}$ | **[1]** Pythagoras |
| | $CA = 8.60 \text{ (2 dp)}$<br>$XY = CA = 8.60 \text{ cm}$ | **[1]** Correct answer |
| **2(b)** | $CX^2 = 5^2 + 8.6^2 = 25 + 73.96 = 98.96$<br>$CX = \sqrt{98.96}$ | **[1]** Pythagoras |
| | $CX = 9.95 \text{ cm (2 dp)}$ | **[1]** Correct answer |
| **3(a)** | $AC^2 = 12^2 + 12^2 = 144 + 144 = 288$<br>$AC = \sqrt{288}$ | **[1]** Pythagoras |
| | $AE^2 = 10^2 + \left(\frac{\sqrt{288}}{2}\right)^2 = 100 + 72.08 = 172.08$<br>$AE = \sqrt{172.08} = 13.11 \text{ cm (2 dp)}$ | **[1]** Allow 13.12 due to early rounding |
| **3(b)** | $\cos(A) = \frac{(13.11^2 + 13.11^2) - 12^2}{2 \times 13.11 \times 13.11} = 0.581 \ldots$ | **[1]** Cosine rule |
| | $\text{A} = \cos^{-1}(0.581 \ldots) = 54.45°$ | **[1]** Allow $54.47°$ for using rounded answer to part (a) |
| **4** | $\cos(50) = \frac{4}{BC}$<br>$BC = \frac{4}{\cos(50)} = 6.22 \text{ cm}$<br>  | **[1]** Correct Trig rule |
| | $\sin(40) = \frac{6.22}{EC}$<br>  | **[1]** Correct Trig rule |
| | $EC = \frac{6.22}{\sin(40)} = 9.68 \text{ cm}$ | **[1]** Correct answer |

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| **5** | $\cos(30) = \frac{1}{AX}$<br>$AX = \frac{1}{\cos(30)} = \frac{2\sqrt{3}}{3}$ cm | **[1]** Creation of right-angled triangle with angle 30 |
| | $XD^2 = 2^2 - \left(\frac{2\sqrt{3}}{3}\right)^2 = 4 - \frac{4}{3} = \frac{8}{3}$ | **[1]** Use of Pythagoras |
| | $XD = \sqrt{\frac{8}{3}} = 1.63$ m (2 dp) | **[1]** Correct answer |
| **6** | $\cos(75) = \frac{3.5}{BC}$<br>$BC = \frac{3.5}{\cos(75)} = 13.52$ cm | **[1]** Calculation of $BC$ as $EF$ length same as $BC$ |
| | $CF = \frac{13.53}{\tan(35)} = 19.31$ cm | **[1]** Use $BC$ length to calculate $CF$ |
| | $\text{Area} = \frac{1}{2} \times 13.52 \times 7 \times \sin(75) = 45.71 \text{ cm}^2$ | **[1]** Area of $ABC = \frac{1}{2}absin(c)$ |
| | $45.71 \times 19.31 = 882.9 \text{ cm}^3$ | **[1]** Area of face $\times$ Length |
| **7** | $\tan(30) = \frac{AB}{4}$<br>$AB = 4 \times \tan(30) = \frac{4\sqrt{3}}{3}$ | **[1]** Calculation of $AD$ using Trig |
| | $AD = 2AB = 2 \times \frac{4\sqrt{3}}{3} = \frac{8\sqrt{3}}{3}$ | **[1]** Calculation of $AD$ from $AB$ |
| | $\cos(30) = \frac{4}{AC}$<br>$AC = \frac{4}{\cos(30)} = \frac{8\sqrt{3}}{3}$ | **[1]** $AC$ answer left in surd form |
| | $DC^2 = \left(\frac{8\sqrt{3}}{3}\right)^2 + \left(\frac{8\sqrt{3}}{3}\right)^2 = \frac{128}{3}$<br>$DC = \frac{8\sqrt{6}}{3}$ | **[1]** $DC$ calculated |
| | $DX = DC \div 2 = \frac{4\sqrt{6}}{3}$<br>$AX = BX = DX = CX$<br>$a = 4$ | **[1]** Correct value of $a$ |
| | | |

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