Section 2: Basic trigonometry

Solutions to Exercise

1. (i) The side marked x is opposite the angle 50°, and the side marked 7 is adjacent, so use tan.

$$\tan 50° = \frac{\text{opposite}}{\text{adjacent}} = \frac{x}{7}$$
$$x = 7\tan 50°$$
$$x = 8.34 \text{ (3 s.f.)}$$

(ii) The side marked 5 is opposite the angle 32°, and the side marked y is the hypotenuse, so use sin.

$$\sin 32° = \frac{\text{opposite}}{\text{adjacent}} = \frac{5}{y}$$
$$y = \frac{5}{\sin 32°}$$
$$y = 9.44 \text{ (3 s.f.)}$$

(iii) The side marked 6 is adjacent to the angle p, and the side marked aa is the hypotenuse, so use cos.

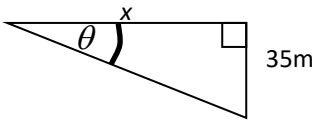
$$\cos p = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{6}{11}$$
$$p = 56.9° \text{ (3 s.f.)}$$

(iv) The side marked 8 is opposite the angle q, and the side marked 9 is adjacent, so use tan.

$$\tan q = \frac{\text{opposite}}{\text{adjacent}} = \frac{8}{9}$$
$$q = 41.6° \text{ (3 s.f.)}$$

2. For all parts

$$\tan(\theta) = \frac{35}{x}$$
$$x = \frac{35}{\tan(\theta)}$$



(i) when $\theta = 45 \Rightarrow \tan(\theta) = 1$ so x = 35m

(ii) when $\theta = 30 \Rightarrow \tan(\theta) = \frac{1}{\sqrt{3}}$ so $x = 35\sqrt{3} = 60.6m$

(iii) when $\theta = 15 \Rightarrow \tan(\theta) = 0.2679\ldots$ so $x = \frac{35}{0.2679\ldots} = 131m$

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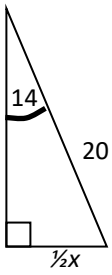
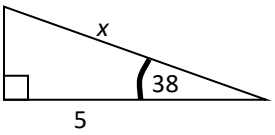
3. (i)



$\frac{1}{2}x = 20\sin 14°$

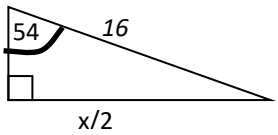
$x = 40\sin 14° = 9.68$ (3 s.f.)

(ii)



$$x = \frac{5}{\cos(38)} = 6.35 \text{ (3 s.f.)}$$

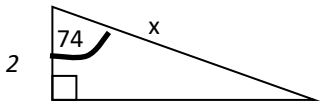
(iii)



$\frac{x}{2} = 16\sin(54) = 12.9$

$x = 25.9$ (3 s.f.)

(iv)



$$x = \frac{2}{\cos(74)} = 7.26 \text{ (3 s.f.)}$$

4. $\sin(60) = \dfrac{p}{\sqrt{3}+\sqrt{27}}$

$p = (\sqrt{3}+\sqrt{27})\sin(60)$

$p = \dfrac{\sqrt{3}}{2}(\sqrt{3}+3\sqrt{3}) = \dfrac{3}{2}+\dfrac{9}{2} = 6$

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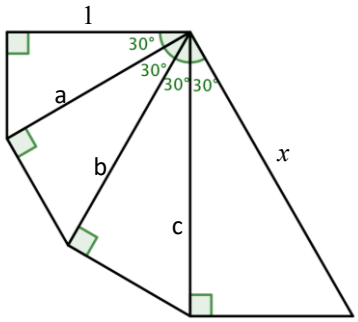
5. $a = \dfrac{1}{\cos 30} = \dfrac{2}{\sqrt{3}}$

$b = \dfrac{a}{\cos 30} = \dfrac{2}{\sqrt{3}} \times \dfrac{2}{\sqrt{3}} = \dfrac{4}{3}$

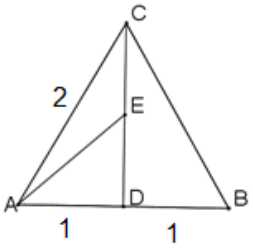
$c = \dfrac{b}{\cos 30} = \dfrac{4}{3} \times \dfrac{2}{\sqrt{3}} = \dfrac{8}{3\sqrt{3}}$

$x = \dfrac{c}{\cos 30} = \dfrac{8}{3\sqrt{3}} \times \dfrac{2}{\sqrt{3}} = \dfrac{16}{9} = \dfrac{4^2}{3^2}$



6. CD = $\sqrt{3}$ cm

$ED = \dfrac{\sqrt{3}}{2}$ cm



Method 1

$\tan EAD = \dfrac{\sqrt{3}}{2}$

$\tan 45° = 1$

$\dfrac{3}{4} < 1$

$\sqrt{\dfrac{3}{4}} < 1$

$\dfrac{\sqrt{3}}{2} < 1$

So $\angle EAD < 45°$.

Method 2

If $\angle EAD$ was 45°, triangle EAD would be isosceles with ED = 1.

$ED = \dfrac{\sqrt{3}}{2}$ cm

$\dfrac{3}{4} < 1$

$\sqrt{\dfrac{3}{4}} < 1$

$\dfrac{\sqrt{3}}{2} < 1$

ED is shorter than it would be for an angle of 45° so $\angle EAD < 45°$.

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