Section 2: Basic trigonometry

Exercise solutions

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.

$$\sin 32° = \frac{\text{opposite}}{\text{adjacent}} = \frac{5}{y}$$

$$y = \frac{5}{\tan 32°}$$

$$y = 8.00 \text{ (3 s.f.)}$$

(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.

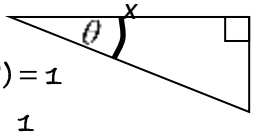
$$\tan q = \frac{\text{opposite}}{\text{adjacent}} = \frac{8}{9}$$

$$q = 41.6° \text{ (3 s.f.)}$$

2. For all parts

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

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

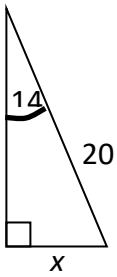


(i) when $\theta = 45 \Rightarrow \tan(\theta) = 1$ so $x = 35\text{m}$

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

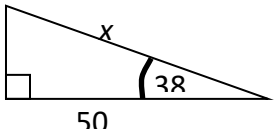
(iii) when $\theta = 15 \Rightarrow \tan(\theta) = 0.2679\ldots$ so $x = \frac{35}{0.2679\ldots} = 131\text{m}$

3. (i)



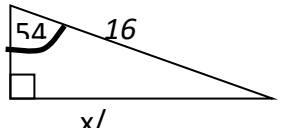
$x = 20\sin(14) = 4.84$

(ii)



$$x = \frac{50}{\cos(38)} = 63.5$$

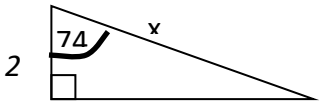
(iii)



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

$$x = 25.9$$

(iv)



$$x = \frac{2}{\cos(74)} = 1.81$$

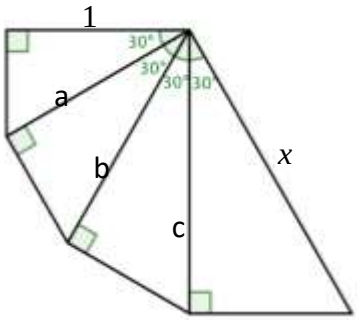
4.

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

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

$$p = \frac{1}{\sqrt{3}}(\sqrt{3}+\sqrt{27}) = 1 + \frac{\sqrt{27}}{\sqrt{3}} = 1 + \sqrt{9} = 1+3 = 4$$

5.



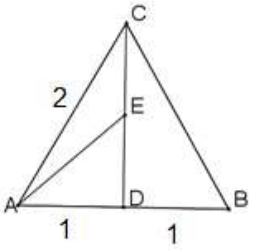
$$a = \frac{1}{\cos 30} = \frac{2}{\sqrt{3}}$$

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

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

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

6.



$CD = \sqrt{3}$ cm

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

Method 1

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

$\tan 45° = 1$

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

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

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

So $\angle EAD < 45°$.

Method 2

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

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

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

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

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

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