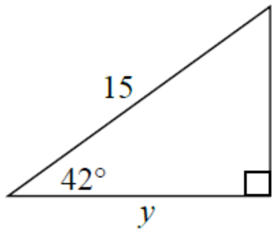
Basic Trigonometry – Section Test (Answers)

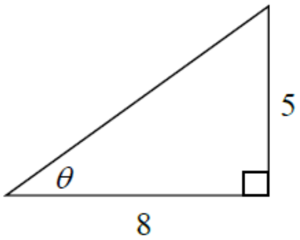
1.



The side marked y is adjacent to the 42° angle, and the side marked 15 is the hypotenuse, so use cos.

$$\cos 42^\circ = \frac{y}{15}$$
$$y = 15\cos 42^\circ$$
$$y = 11.1 \ (3 \text{ s.f.})$$

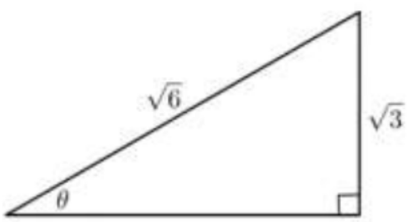
2.



The side marked 5 is opposite to the angle θ, and the side marked 8 is adjacent, so use tan.

$$\tan\theta = \frac{5}{8}$$
$$\theta = 32.0^\circ$$

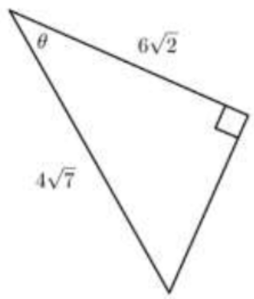
3.



The side marked $\sqrt{3}$ is opposite to the angle θ, and the side marked $\sqrt{6}$ is the hypotenuse so use sin.

$$\sin\theta = \frac{\sqrt{3}}{\sqrt{6}} = \frac{\sqrt{3}}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} = \frac{\sqrt{18}}{6} = \frac{3\sqrt{2}}{6} = \frac{\sqrt{2}}{2}$$
$$\theta = \sin^{-1}\left(\frac{\sqrt{2}}{2}\right) = 45^\circ$$

4.



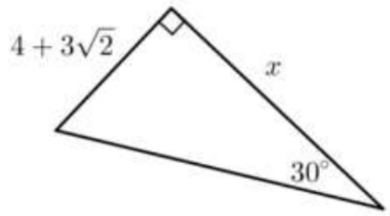
The side marked $6\sqrt{2}$ is adjacent to the angle θ, and the side marked $4\sqrt{7}$ is the hypotenuse so use cos.

$$\cos\theta = \frac{6\sqrt{2}}{4\sqrt{7}} = \frac{3\sqrt{2}}{2\sqrt{7}} = \frac{3\sqrt{2}}{2\sqrt{7}} \times \frac{2\sqrt{7}}{2\sqrt{7}}$$

$$= \frac{6\sqrt{14}}{28} = \frac{3\sqrt{14}}{14}$$

$$\theta = \cos^{-1}\left(\frac{3\sqrt{14}}{14}\right) = 36.7^\circ$$

5.



The side marked $4+3\sqrt{2}$ is opposite to the angle 30°, and the side marked x is adjacent, so use tan.

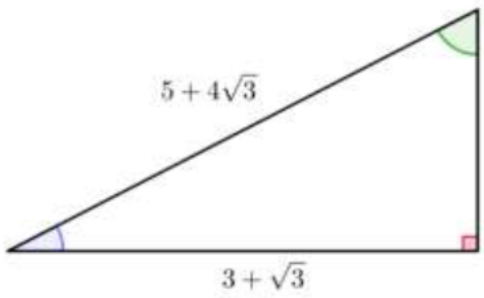
$$\tan 30^\circ = \frac{1}{\sqrt{3}} = \frac{4+3\sqrt{2}}{x}$$

$$\frac{1}{\sqrt{3}} = \frac{4+3\sqrt{2}}{x}$$

$$x = \frac{4+3\sqrt{2}}{\left(\frac{1}{\sqrt{3}}\right)} = \frac{\sqrt{3}\times(4+3\sqrt{2})}{1} = 4\sqrt{3}+3\sqrt{6}$$

So, $p = 4$ and $q = 3$

6.



Red angle: 90°

Blue angle:

$$\cos\theta = \left(\frac{3+\sqrt{3}}{5+4\sqrt{3}}\right)\times\frac{5-4\sqrt{3}}{5-4\sqrt{3}}$$

$$= \frac{15-12\sqrt{3}+5\sqrt{3}-12}{25-48}$$

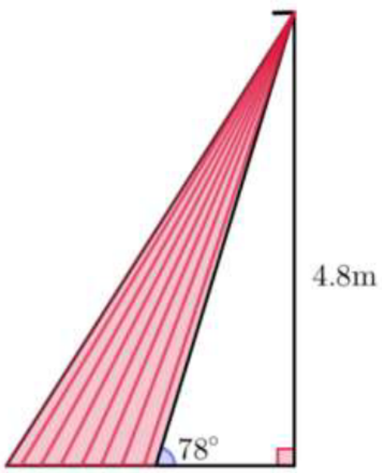
$$= \frac{3-7\sqrt{3}}{-23} = \frac{-3+7\sqrt{3}}{23}$$

$$\theta = \cos^{-1}\left(\frac{-3+7\sqrt{3}}{23}\right) = 66.6^\circ$$

Green angle:

180° – 90° – 66.6° =23.4° (3.s.f.)

7. The shortest length of ladder can be used if the cleaner puts the ladder at an angle of 78°



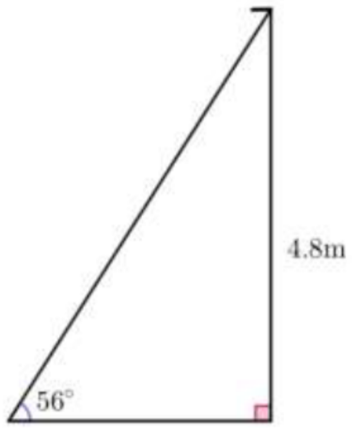
The length of the ladder is the hypotenuse in the diagram. 4.8m is the length opposite the angle so we can use sin to work out the length of the ladder.

$$\sin 78 = \frac{4.8}{\text{hypotenuse}}$$

$$\text{hypotenuse} = \frac{4.8}{\sin 78} = 4.90723\ldots$$

So, the shortest length of ladder that can be used is 4.91m to 3 significant figures

8.



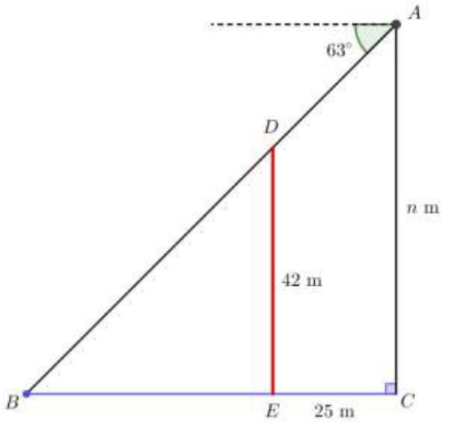
The furthest away the base of the ladder can be placed from the wall is when the angle of the ladder to the floor is 56°. Working out the adjacent side using tan:

$$\tan 56 = \frac{4.8}{\text{adjacent}}$$

$$\text{adjacent} = \frac{4.8}{\tan 56} = 3.2376$$

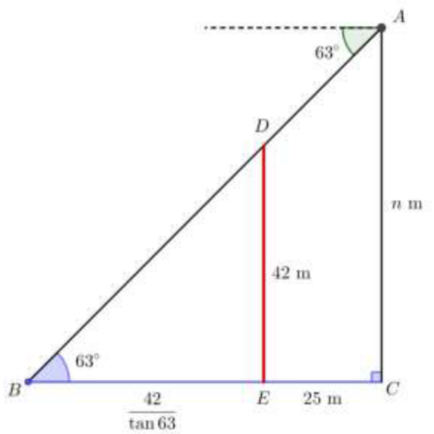
The furthest the base of the ladder can be placed from the base of the wall is 3.24 meters so there is no way to avoid the flowerbed and keep the ladder at a safe angle.

9.



From the diagram, we can see angle $\angle ABC = 63°$ because of alternate angles.
From this we can work out the length of BE.

$$\tan 63 = \frac{42}{\text{adjacent}}$$



Using this, we work out $BC = \frac{42}{\tan 63} + 25$.

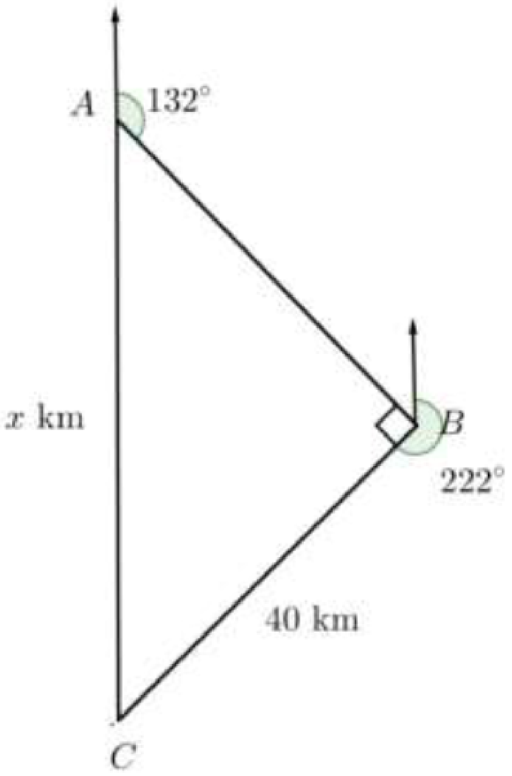
We then have the angle $\angle ABC = 63°$ and the length BC so we can work out the length AC using tan again.

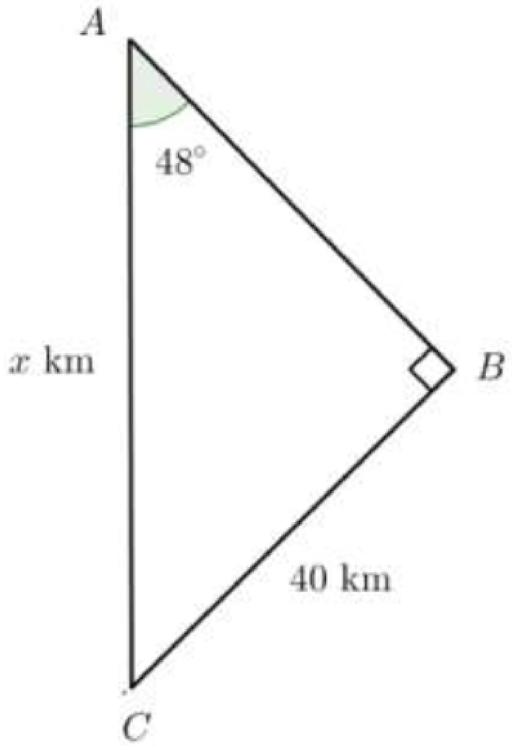
$$\tan 63 = \frac{n}{\left(\frac{42}{\tan 63} + 25\right)}$$

$$n = \tan 63 \times \left(\frac{42}{\tan 63} + 25\right)$$
$$= 42 + 25\tan 63$$
$$= 91.065...$$

If we round down to $n = 91$, the drone will not clear the cliff so the smallest integer value for n is 92.

10. If we draw the diagram using bearings we can work out the angles in the triangle:





We can see that in the triangle, x is the hypotenuse and BC is the line opposite the angle of 48°. So, using sin:

$$\sin 48 = \frac{40}{\text{hypotenuse}}$$

$$\text{hypotenuse} = \frac{40}{\sin 48} = 53.825...$$

The distance x is 53.8 to 3 significant figures.