

Trigonometry problems

Trigonometry problems are often attempted using the following steps:

- Step 1** Draw and label a diagram with the information given
- Step 2** Decide which ratio links the information involved
- Step 3** Write an equation and solve for the unknown.

The following terminology is often used:

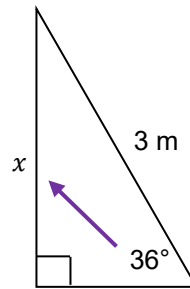
Angle of depression: The angle measured down from horizontal.

Angle of elevation: The angle measured up from horizontal.

Examples

- 1) A 3 metre ladder is placed against the wall making an angle of 36° from the ground. How far up the wall does it reach?

Step 1



Step 2

We require *sine* since we want to find the opposite (O) side length and have the angle size and hypotenuse length (H) => SOH

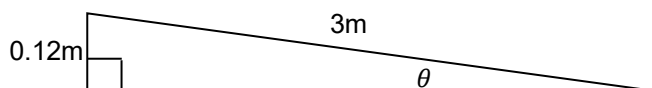
Step 3

Now solve $\sin 36 = \frac{x}{3}$

Multiplying both sides by 3 gives,

$$x = 3 \times \sin 36 = 1.76 \text{ m}$$

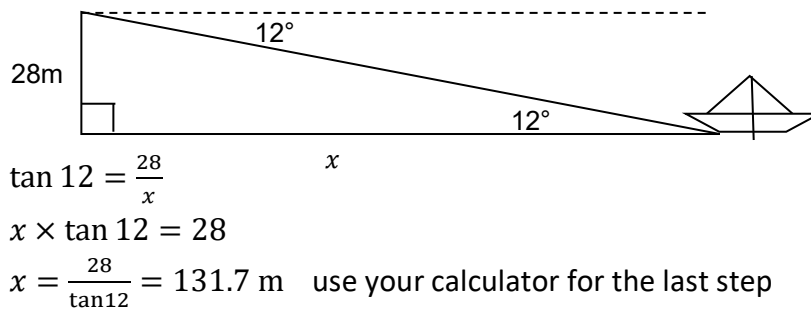
- 2) A 3 metre ramp is placed on a 0.12 metre high step. What angle does it form with the horizontal?



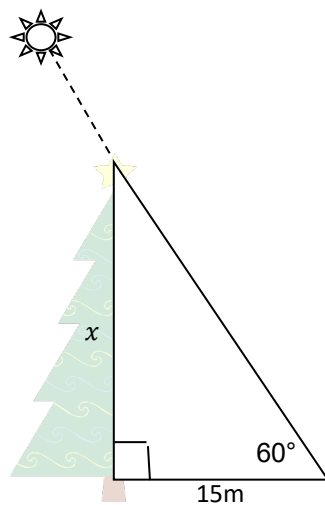
$$\sin \theta = \frac{0.12}{3}$$

$$\theta = \sin^{-1} \left(\frac{0.12}{3} \right) \approx 2.29^\circ \text{ or } 2^\circ 18'$$

- 3) The coast guard tower is 28m above sea level on the edge of a cliff. The angle of depression of a boat seen from the tower is 12° . How far out to sea is the boat?



- 4) When the angle of elevation of the sun is 60° , a tree casts a shadow 15m long. How tall is the tree?



$$\tan 60 = \frac{x}{15}$$

$$x = 15 \times \tan 60 = 25.98$$

$$\approx 26 \text{ m (to the nearest metre)}$$

Exercises

1. A ladder that is 10m long is placed at an angle of 34° to the wall. How far up the wall does it reach?
2. The foot of a ladder is 1.4m from the wall and it makes an angle of 40° with the floor. How long is the ladder?
3. Smoke can be seen from the fire spotter's tower which is 50m tall. The angle of depression of the smoke is 5° . How far away is the fire?
4. If a vertical pole 6m high casts a horizontal shadow 10m long what is the angle of elevation of the sun? (to the nearest degree)
5. A 20m tight rope has been stretched from the top of a 20m pole to the top of a 15m pole. The clown is attempting to walk up the incline the tight rope. What is the angle of incline? (to the nearest minute)

Answers

- | | |
|---------|-------------------|
| 1. 5.3m | 4. 31° |
| 2. 1.8m | 5. $14^\circ 26'$ |
| 3. 572m | |