

Trigonometric Inverses

Recall:

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$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

When the length of two sides of a right triangle are given, an inverse trigonometric function can be used to solve angles in the triangle.

The inverse trigonometric functions are $\sin^{-1}()$, $\cos^{-1}()$, $\tan^{-1}()$.

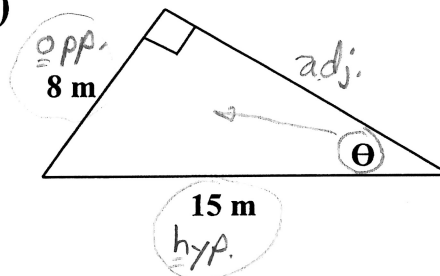
Example 1

Use the inverse of sine to determine angle θ .

a) $\sin \theta = 0.86$

$$\theta = \sin^{-1}(0.86)$$
$$\theta \approx 59.3^\circ$$

b)



$$\sin \theta = \frac{\text{opp.}}{\text{hyp.}}$$

$$\sin \theta = \frac{8}{15}$$

$$\theta \approx \sin^{-1}\left(\frac{8}{15}\right)$$

$$\theta \approx 32.2^\circ$$

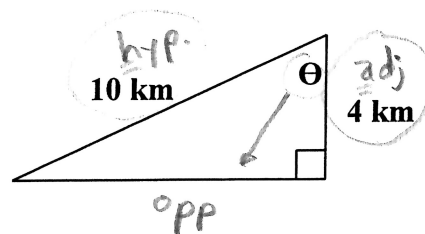
Example 2

Use the inverse of cosine to determine the angle θ .

a) $\cos \theta = 0.54$

$$\theta = \cos^{-1}(0.54)$$
$$\theta = 57.3^\circ$$

b)



$$\cos \theta = \frac{\text{adj.}}{\text{hyp.}}$$

$$\cos \theta = \frac{4}{10}$$

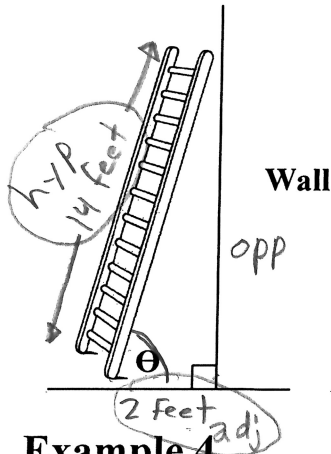
$$\theta = \cos^{-1}\left(\frac{4}{10}\right)$$

$$\theta \approx 66.4^\circ$$

Example 3

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A 14 foot ladder leans against a wall. The base of the ladder is 2 feet from the wall. Safety standards state that the angle between the ladder and ground can be no larger than 80° . Is the ladder safe?



$$\cos \theta = \frac{\text{adj}}{\text{hyp}}$$

$$\cos \theta = \frac{2}{14}$$

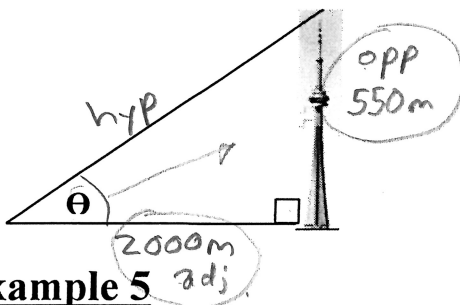
$$\theta = \cos^{-1}\left(\frac{2}{14}\right)$$

$$\theta \approx 81.8^\circ$$

No, the ladder is not safe since the angle is greater than 80° .

Example 4

The CN Tower is 550m tall. If an observer looks at the top of the CN tower from 2 km away, at what angle of elevation should the observer look?



$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

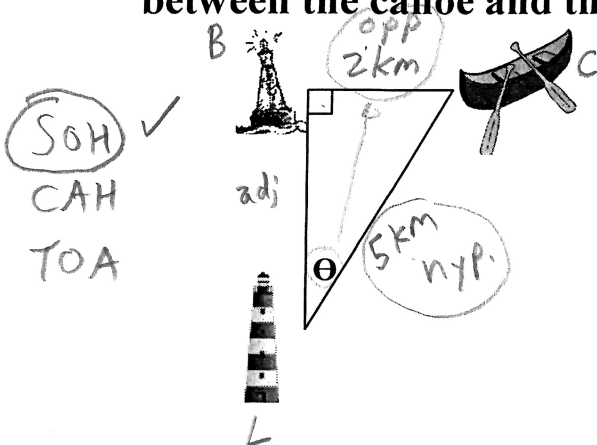
$$\tan \theta = \frac{550}{2000}$$

$$\theta = \tan^{-1}\left(\frac{550}{2000}\right)$$

$$\theta \approx 15.4^\circ$$

Example 5

A stranded canoe is located 5 km from a lighthouse. The distance between the canoe and the buoy is 2 km. What is θ ?



$$\sin \theta = \frac{\text{opp}}{\text{hyp}}$$

$$\sin \theta = \frac{2}{5}$$

$$\theta = \sin^{-1}\left(\frac{2}{5}\right)$$

$$\theta \approx 23.6^\circ$$

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Homework - Trigonometric Inverses

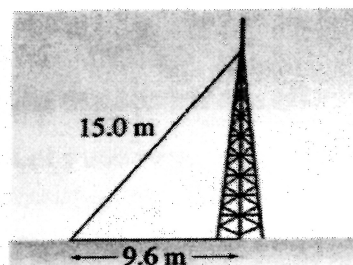
1. Find the measure of each angle, to the nearest degree.

a) $\sin \theta = 0.8933$ b) $\sin \theta = 0.5032$ c) $\sin \theta = \frac{2}{5}$

2. Find the measure of each angle, to the nearest degree.

a) $\cos \theta = 0.4481$ b) $\cos \theta = 0.3432$ c) $\cos \theta = \frac{1}{6}$

3. A guy wire is 15.0 m long. It supports a vertical television tower. The wire is fastened to the ground 9.6 m from the base of the tower.

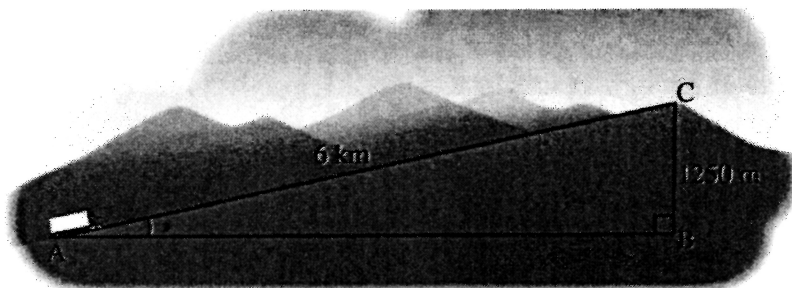


- a) Calculate the measure of the angle formed by the guy wire and the ground.
 b) Use the Pythagorean Theorem to calculate how far up the tower the guy wire is.

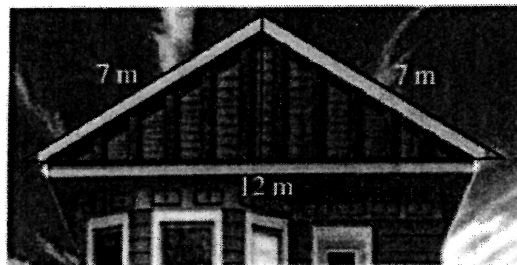
4. A 6.0-m ladder is leaning against a wall. The foot of the ladder is 1.8 m from the wall.

- a) Calculate the measure of the angle formed by the ladder and the ground.
 b) Use the Pythagorean Theorem to calculate how high up the wall the ladder reaches.

5. A truck travels 6 km up a mountain road. The change in height is 1250 m. Angle CAB is the angle of inclination of the road. What is the measure of the angle of inclination?



6. We can only use the cosine and sine ratios in a right triangle. Any triangle can be cut to form two right triangles by drawing an altitude. When the triangle is isosceles, the two right triangles are congruent. This roof has the shape of an isosceles triangle. The altitude is marked.



Calculate the measure of the angle between the sloping edge of the roof and the horizontal.

Answers: 1. a) 63° b) 30° c) 24° 2. a) 63° b) 70° c) 80° 3. a) 50° b) 11.5m 4. a) 73° b) 5.7 m 5. 12° 6. 31°