

# SOH CAH TOA

**Objectives:**

- I can find an angle using the inverse trigonometric ratios.
- I can find the angle of elevation and the angle of depression in applied problems.

**Example 1:** Solving for a side length vs. Solving for an angle

1. Solve for the indicated side length.

$\text{hyp} = 13.7$   
 $\text{opp} = x$   
 $\text{adj} = 13.7$   
 $\angle = 48^\circ$

$\sin 48^\circ = \frac{x}{13.7}$   
 $x = 13.7 \sin 48^\circ$   
 $x = 10.18$

2. Solve for the missing angle.

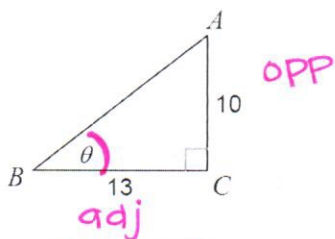
$\cos \rightarrow \cos^{-1}$

$\text{hyp} = 13$   
 $\text{adj} = 4.7$   
 $\text{opp} = ?$   
 $\angle = \theta$

$\cos \theta = \frac{4.7}{13}$   
 $\theta = \cos^{-1}\left(\frac{4.7}{13}\right)$   
 $\theta = 68.81^\circ$

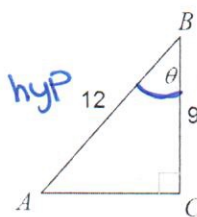
**Practice Problems:** Find the indicated angle for each triangle.

1.



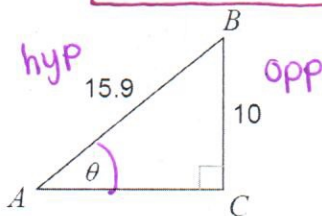
$\tan \theta = \frac{10}{13}$   
 $\theta = \tan^{-1}\left(\frac{10}{13}\right)$   
 $\theta = 37.57^\circ$

2.



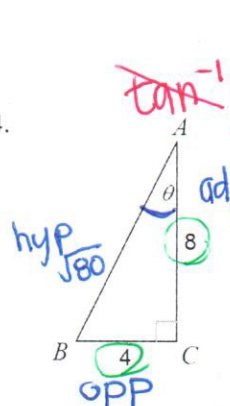
$\cos B = \frac{9}{12}$   
 $B = \cos^{-1}\left(\frac{9}{12}\right)$   
 $B = 41.41^\circ$

3.



$\sin \theta = \frac{10}{15.9}$   
 $\theta = \sin^{-1}\left(\frac{10}{15.9}\right)$   
 $\theta = 38.97^\circ$

4.



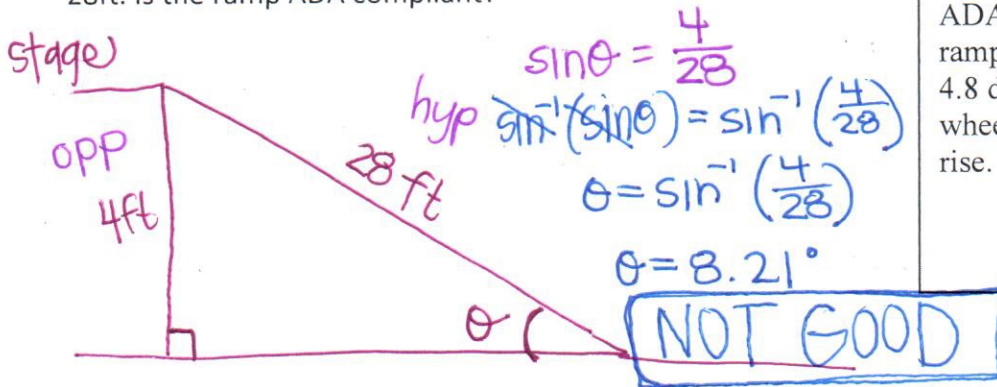
$4^2 + 8^2 = c^2$   
 $16 + 64 = c^2$   
 $80 = c^2$   
 $c = \sqrt{80}$

$\sin \theta = \frac{4}{\sqrt{80}}$   
 $\theta = \sin^{-1}\left(\frac{4}{\sqrt{80}}\right)$   
 $\theta = 26.57^\circ$

$\cos \theta = \frac{8}{\sqrt{80}}$   
 $\theta = \cos^{-1}\left(\frac{8}{\sqrt{80}}\right)$   
 $\theta = 26.57^\circ$

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5. **Application Problem:** A ramp has been built to make a stage wheelchair accessible. The building inspector needs to find the angle of the ramp to see if it meets regulations. He has no instrument for measuring angles. With a tape measure, he sees the stage is 4ft high and the distance along the ramp is 28ft. Is the ramp ADA compliant?

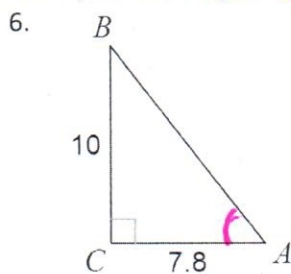


ADA Standards Require a 1:12 ramp slope ratio which equals 4.8 degrees slope or one foot of wheelchair ramp for each inch of rise.



ADA Handicapped Approved

Let's put it all together – **Solve the Triangle** (this means you need to find all angles and all sides).



$$\tan A = \frac{10}{7.8}$$

$$\tan^{-1}(\tan A) = \tan^{-1}\left(\frac{10}{7.8}\right)$$

$$A = \tan^{-1}\left(\frac{10}{7.8}\right)$$

$$\boxed{A = 52.05^\circ}$$

$$B = 180 - 90 - 52.05$$

$$\boxed{B = 37.95^\circ}$$

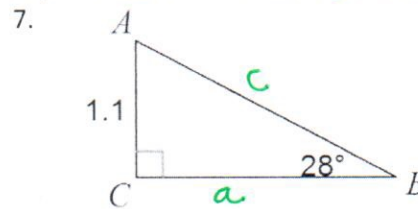
$$7.8^2 + 10^2 = c^2$$

$$60.84 + 100 = c^2$$

$$c^2 = 160.84$$

$$c = \sqrt{160.84}$$

$$\boxed{c = 12.68}$$



$$A = 180 - 90 - 28$$

$$\boxed{A = 62^\circ}$$

$$\sin 28^\circ = \frac{1.1}{c}$$

$$c = \frac{1.1}{\sin 28^\circ}$$

$$\boxed{c = 2.34}$$

$$\tan 28^\circ = \frac{1.1}{a}$$

$$a = \frac{1.1}{\tan 28^\circ}$$

$$\boxed{a = 2.07}$$