

Trigonometry Word Problems Using SOH-CAH-TOA

Geometry & Trigonometry Worksheet · Grade 9–11

Name: _____

Date: _____

Learning Objectives

- Identify opposite, adjacent, and hypotenuse sides relative to a given angle in a right triangle
- Apply sine, cosine, and tangent ratios to solve real-world word problems
- Translate word problem scenarios into right triangle diagrams and solve for missing sides or angles

Problems

1. A 10-meter ladder leans against a wall and makes an angle of 30 degrees with the ground. How high up the wall does the ladder reach? Round to two decimal places.

$$\sin(30^\circ) = \frac{x}{10}$$

2. A 6-meter ladder leans against a building and makes a 60-degree angle with the ground. How far is the base of the ladder from the wall? Round to two decimal places.

$$\cos(60^\circ) = \frac{y}{6}$$

3. A ramp makes an angle of 15 degrees with the ground. If the ramp is 8 meters long, how high does the ramp rise? Round to two decimal places.

$$\sin(15^\circ) = \frac{h}{8}$$

4. A person standing 20 meters from the base of a tree looks up at the top of the tree at an angle of 40 degrees. How tall is the tree? Round to two decimal places.

$$\tan(40^\circ) = \frac{h}{20}$$

Scan to watch



5. A kite is flying on a 50-meter string. The string makes a 55-degree angle with the ground. How high is the kite above the ground? Round to two decimal places.

$$\sin(55^\circ) = \frac{h}{50}$$

6. A building casts a shadow of 35 meters when the sun's angle of elevation is 50 degrees. How tall is the building? Round to two decimal places.

$$\tan(50^\circ) = \frac{h}{35}$$

7. An airplane is flying at an altitude of 3000 meters. The angle of depression to a point on the ground is 25 degrees. What is the horizontal distance from the airplane to that point? Round to two decimal places.

$$\tan(25^\circ) = \frac{3000}{d}$$

8. A zip-line starts at the top of a 45-meter tall platform and reaches the ground. The zip-line cable makes a 35-degree angle with the ground. How long is the zip-line cable? Round to two decimal places.

$$\sin(35^\circ) = \frac{45}{L}$$

9. From the top of a lighthouse 60 meters tall, the angle of depression to a boat at sea is 18 degrees. What is the horizontal distance from the base of the lighthouse to the boat? Round to two decimal places.

$$\tan(18^\circ) = \frac{60}{d}$$

10. Two buildings are 80 meters apart. From the top of the shorter building, the angle of elevation to the top of the taller building is 22 degrees, and the angle of depression to the base of the taller building is 14 degrees. Find the height of the taller building. Round to two decimal places.

$$h_{\text{total}} = 80\tan(22^\circ) + 80\tan(14^\circ)$$

Scan to watch



Trigonometry Word Problems Using SOH-CAH-TOA — Answer Key

Geometry & Trigonometry Worksheet · Grade 9–11

Answer Key

1. Answer: 5.00 meters

- Identify: opposite = x (height), hypotenuse = 10 m, angle = 30°
 - Use SOH: $\sin(\theta) = \text{opposite} / \text{hypotenuse}$
 - $\sin(30^\circ) = x / 10$
 - $x = 10 \times \sin(30^\circ) = 10 \times 0.5 = 5.00$ meters
-

2. Answer: 3.00 meters

- Identify: adjacent = y (base distance), hypotenuse = 6 m, angle = 60°
 - Use CAH: $\cos(\theta) = \text{adjacent} / \text{hypotenuse}$
 - $\cos(60^\circ) = y / 6$
 - $y = 6 \times \cos(60^\circ) = 6 \times 0.5 = 3.00$ meters
-

3. Answer: 2.07 meters

- Identify: opposite = h (height), hypotenuse = 8 m, angle = 15°
 - Use SOH: $\sin(\theta) = \text{opposite} / \text{hypotenuse}$
 - $\sin(15^\circ) = h / 8$
 - $h = 8 \times \sin(15^\circ) = 8 \times 0.2588 \approx 2.07$ meters
-

4. Answer: 16.78 meters

- Identify: opposite = h (tree height), adjacent = 20 m, angle = 40°
 - Use TOA: $\tan(\theta) = \text{opposite} / \text{adjacent}$
 - $\tan(40^\circ) = h / 20$
 - $h = 20 \times \tan(40^\circ) = 20 \times 0.8391 \approx 16.78$ meters
-

5. Answer: 40.96 meters

- Identify: opposite = h (height of kite), hypotenuse = 50 m, angle = 55°
 - Use SOH: $\sin(\theta) = \text{opposite} / \text{hypotenuse}$
 - $\sin(55^\circ) = h / 50$
 - $h = 50 \times \sin(55^\circ) = 50 \times 0.8192 \approx 40.96$ meters
-

6. Answer: 41.70 meters

- Identify: opposite = h (building height), adjacent = 35 m (shadow), angle = 50°
 - Use TOA: $\tan(\theta) = \text{opposite} / \text{adjacent}$
 - $\tan(50^\circ) = h / 35$
 - $h = 35 \times \tan(50^\circ) = 35 \times 1.1918 \approx 41.70$ meters
-

7. Answer: 6434.56 meters



- Identify: opposite = 3000 m (altitude), adjacent = d (horizontal distance), angle = 25°
 - Use TOA: $\tan(25^\circ) = 3000 / d$
 - $d = 3000 / \tan(25^\circ)$
 - $d = 3000 / 0.4663 \approx 6434.56$ meters
-

8. Answer: 78.45 meters

- Identify: opposite = 45 m (height of platform), hypotenuse = L (cable length), angle = 35°
 - Use SOH: $\sin(35^\circ) = 45 / L$
 - $L = 45 / \sin(35^\circ)$
 - $L = 45 / 0.5736 \approx 78.45$ meters
-

9. Answer: 184.65 meters

- Identify: opposite = 60 m (lighthouse height), adjacent = d (horizontal distance), angle of depression = 18°
 - The angle of depression equals the angle of elevation from the boat, so use $\tan(18^\circ) = 60 / d$
 - $d = 60 / \tan(18^\circ)$
 - $d = 60 / 0.3249 \approx 184.65$ meters
-

10. Answer: 52.29 meters

- Let the shorter building height be the reference level; the two buildings are 80 m apart horizontally
 - Height above shorter building to top of taller = $80 \times \tan(22^\circ) = 80 \times 0.4040 \approx 32.32$ m
 - Height from ground to top of shorter building using angle of depression: $80 \times \tan(14^\circ) = 80 \times 0.2493 \approx 19.95$ m (this is the height of the shorter building)
 - Total height of taller building = $32.32 + 19.97 \approx 52.29$ meters
-

Scan to watch

