Geometry Unit 8

8-7 Word Problems with Trigonometry

Warm-Up

- Work on the problems from the last section of the 8-5/8-6 Notes.
- Answer with your groups then come up and fill in the answers on the board.

Applications of Right Triangle Trig

- **<u>Content Objective:</u>** Students will be able to solve for missing side lengths and angle measures in right triangles through word problems.

- **<u>Language Objective:</u>** Students will be able to draw and label diagrams for right triangle word problems.
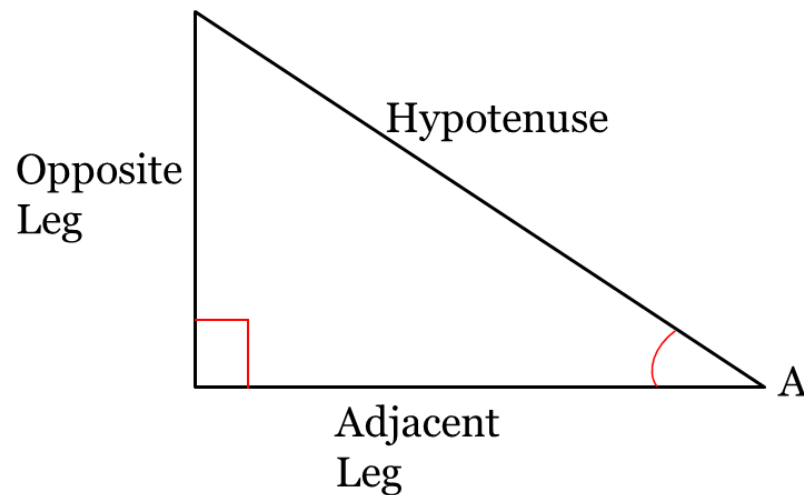
Quick Review of the Trig ratios

- Given a right triangle, with $\angle A$ marked, we have the following ratios:

$$\sin A = \frac{leg\ opposite\ \angle\ A}{hypotenuse}$$

$$\cos A = \frac{leg\ adjacent\ to \angle\ A}{hypotenuse}$$

$$\tan A = \frac{leg\ opposite\ \angle\ A}{leg\ adjacent\ to\ \angle A}$$

Trigonometry's Place in the World

- Trigonometry can be used on a daily basis in the workplace.

- Since trigonometry means "triangle measure", any profession that deals with measurement deals with trigonometry as well.

- Carpenters, construction workers and engineers, for example, must possess a thorough understanding of trigonometry.

Looking Up: Angle of Elevation

- The **angle of elevation** of an object as seen by an observer is the angle between the horizontal and the line from the object to the observer's eye (the line of sight).
- The **angle of elevation** is always measured from the ground up. It is always **INSIDE** the triangle.
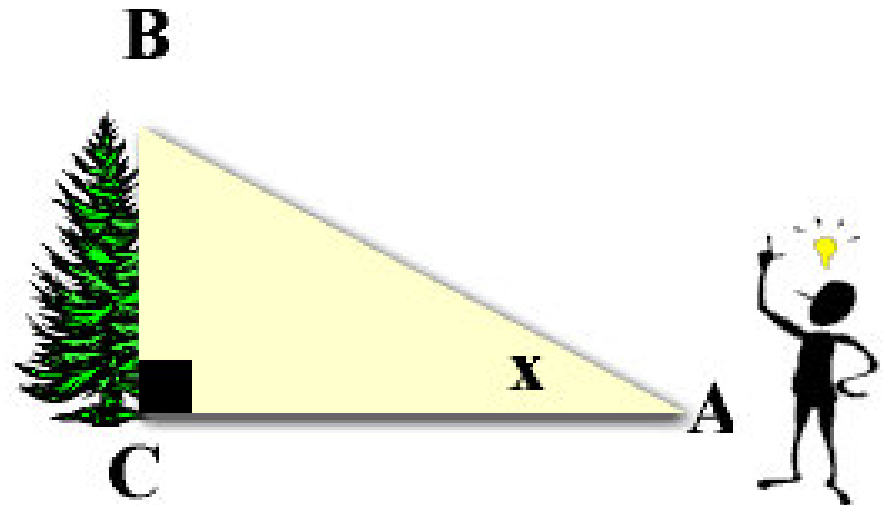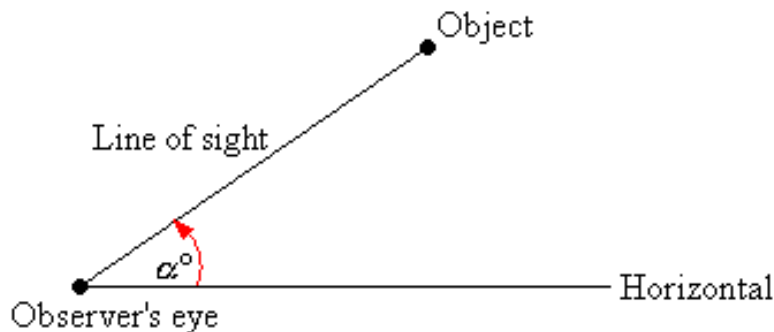
Looking Down: Angle of Depression

- When an object is below the level of the observer, the angle between the horizontal and the observer's line of sight is called the **angle of depression**.
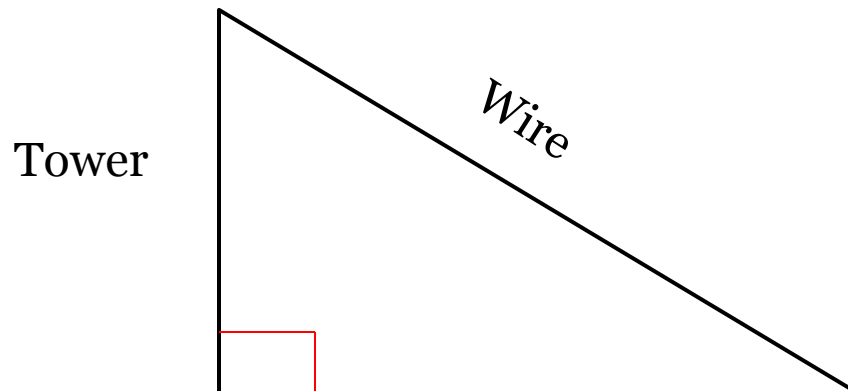- It is always **OUTSIDE** the triangle. It is never inside the triangle.
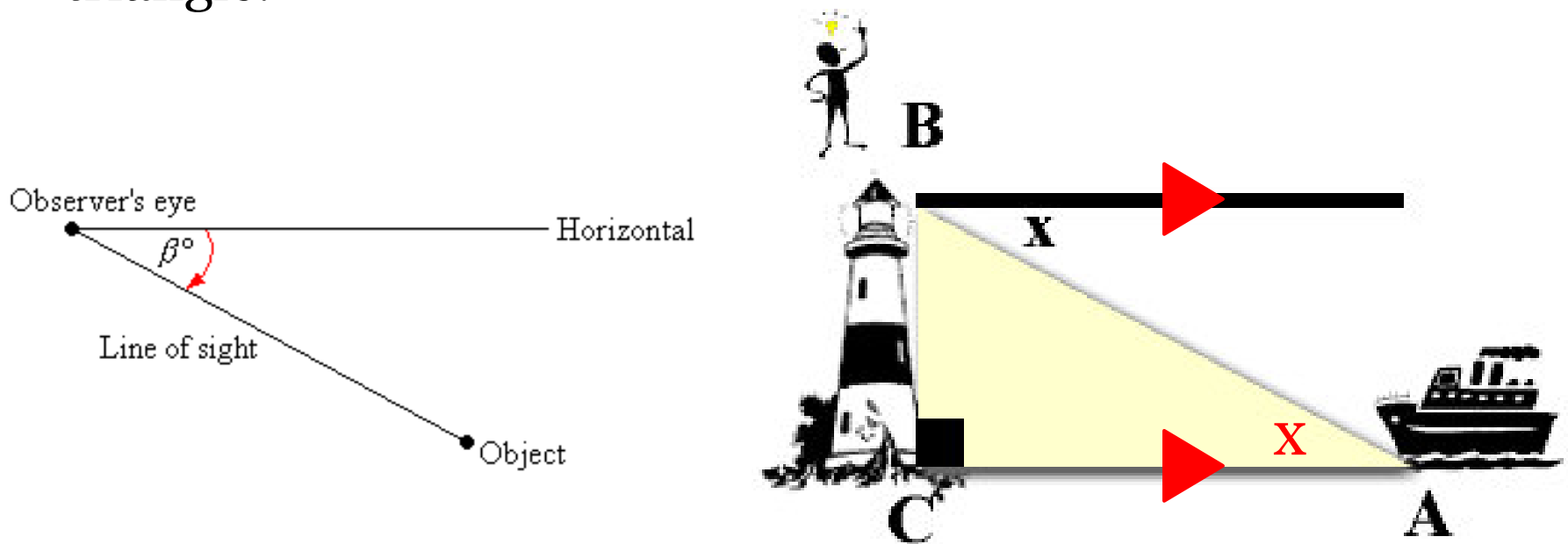
Example: Word Problem with Elevation

- The length of a wire supporting a radio tower is 157 feet. The angle of elevation from the top of the radio tower to the foot of the wire is 56°. How tall is the radio tower?
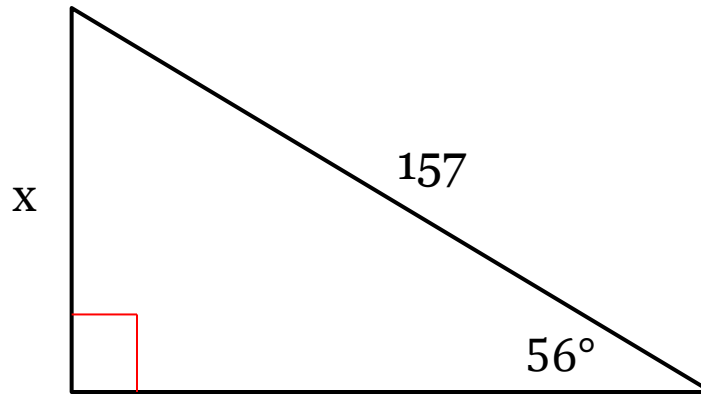
Each of these problems can be solved with the following steps:

Step 1: Draw a diagram of the problem

Tower   Wire

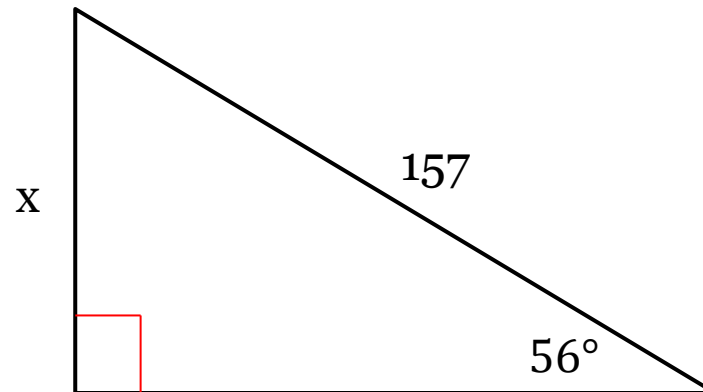# Example: Word Problem with Elevation

Step 2: Label the diagram

X   157

56°

Step 3: Identify and setup the trig ratio required from the information given.

This will require the Sine ratio

$$\sin 56° = \frac{x}{157}$$

X   157

56°

Example: Word Problem with Elevation

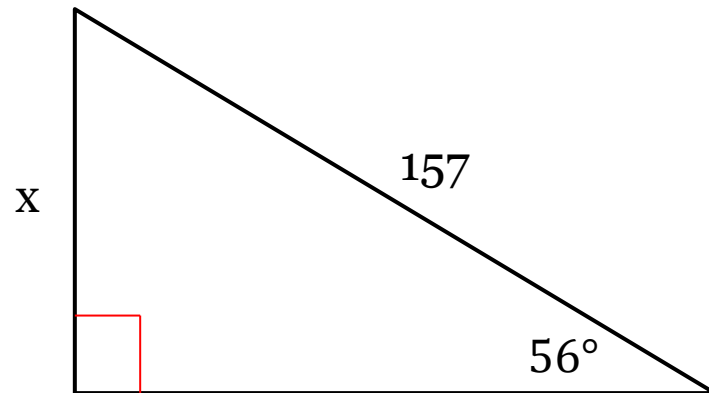**Step 4**: Solve the Problem

$$\sin 56° = \frac{x}{157}$$

$$x = 157 \times \sin 56°$$

$$x = 157 \times 0.8290$$

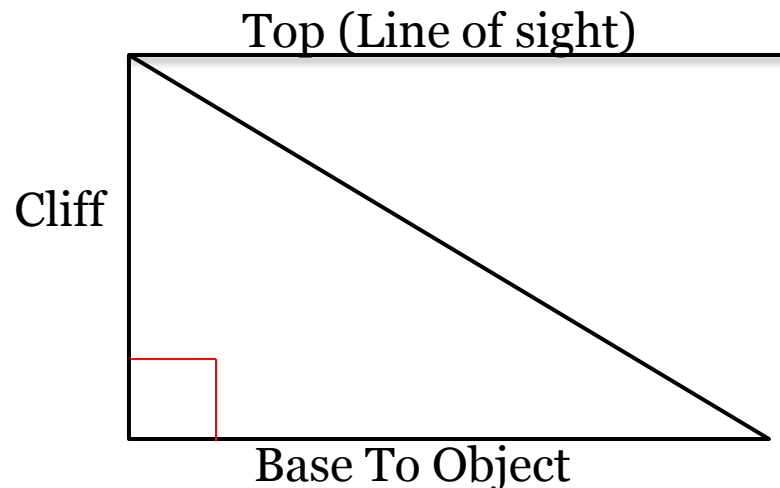$$x \approx 130.16 \quad \text{or} \quad x \approx 130$$

Example: Word Problem with Depression

- From the top of a vertical cliff 40 m high, the angle of depression of an object that is level with the base of the cliff is 34°. How far is the object from the base of the cliff?
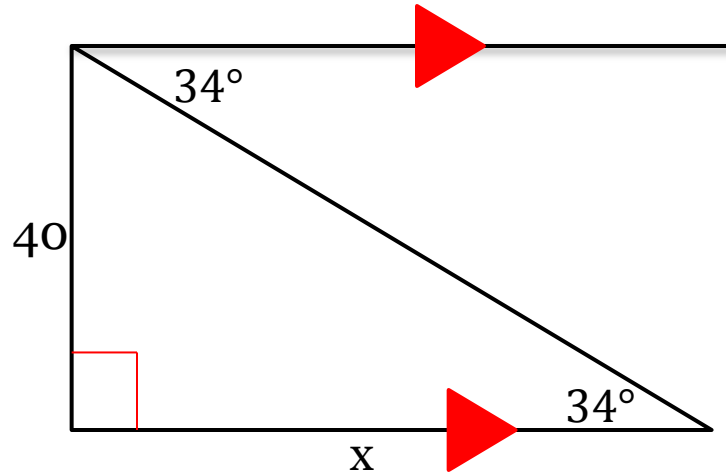
Follow the same steps as before to solve this

Step 1: Draw a diagram of the problem

Top (Line of sight)

Cliff

Base To Object

Example: Word Problem with Elevation

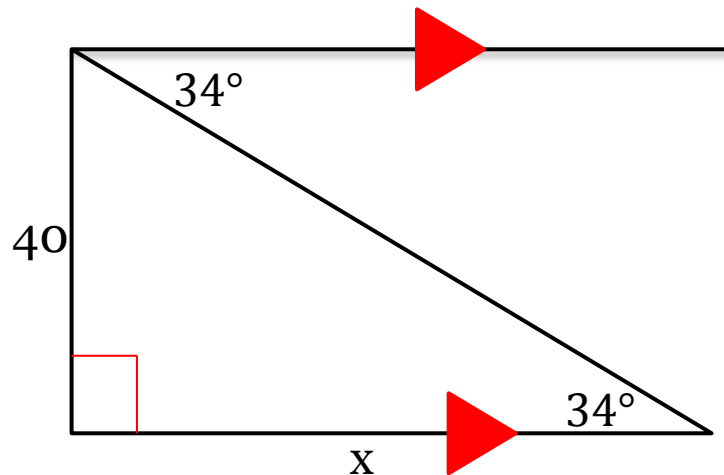**Step 2**: Label the diagram

Step 3: Identify and setup the trig ratio required from the information given.

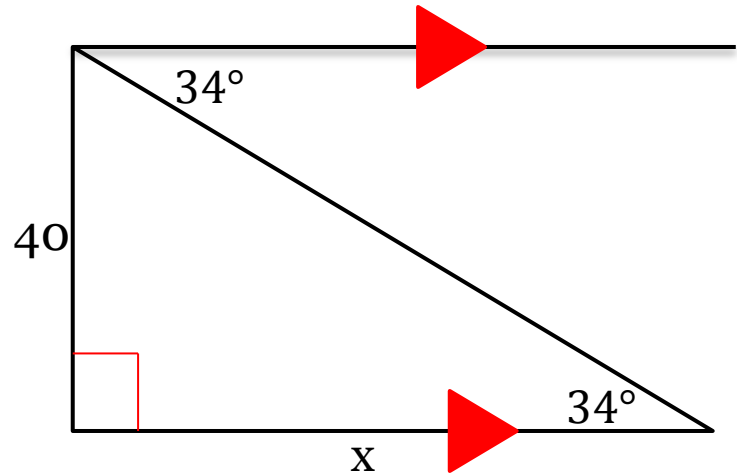This will require the Tangent ratio

$$\tan 34° = \frac{40}{x}$$

Example: Word Problem with Elevation

Step 4: Solve the Problem

$$\tan 34° = \frac{40}{x}$$
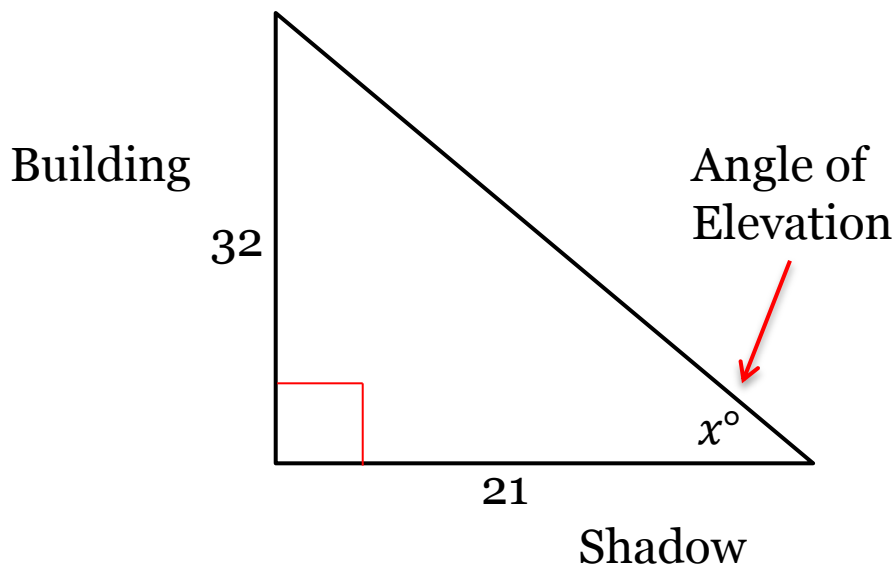
$$x = \frac{40}{\tan 34°}$$

$$x \approx 59.3024 \quad \text{or} \quad x \approx 59$$

Example: Finding the Angle

- When the sun is at a certain angle of elevation, a 32 m tall building casts a shadow 21 m long. What is the angle of elevation that causes this shadow with the building?

If you follow the steps, you should have this diagram

With this ratio:

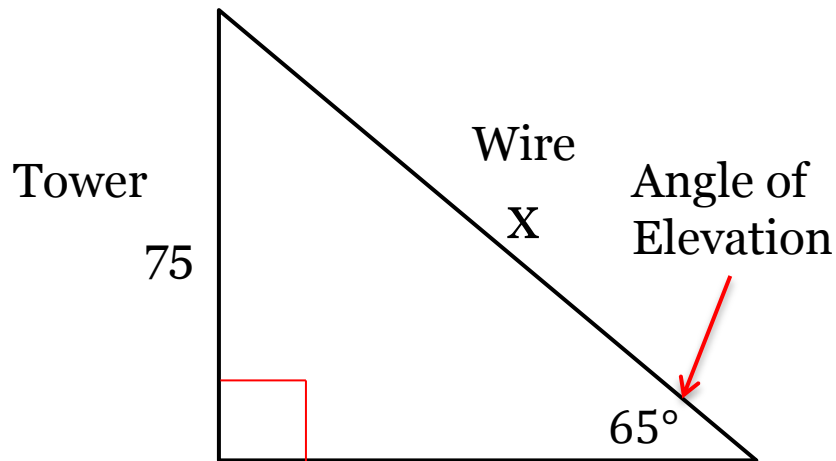$$\tan x° = \frac{32}{21}$$

Solution:

$$x = \tan^{-1}\frac{32}{21}$$

$$x \approx 57°$$

Building

32

Angle of
Elevation

$x°$

21

Shadow

Final Checks

Use the steps given to solve the following problems:

1.) A guy wire is attached to the top of a 75 foot tower and meets the ground at a **65°** angle. How long is the wire?

If you follow the steps, you should have this diagram

With this ratio:

$$\sin 65° = \frac{75}{x}$$

Tower
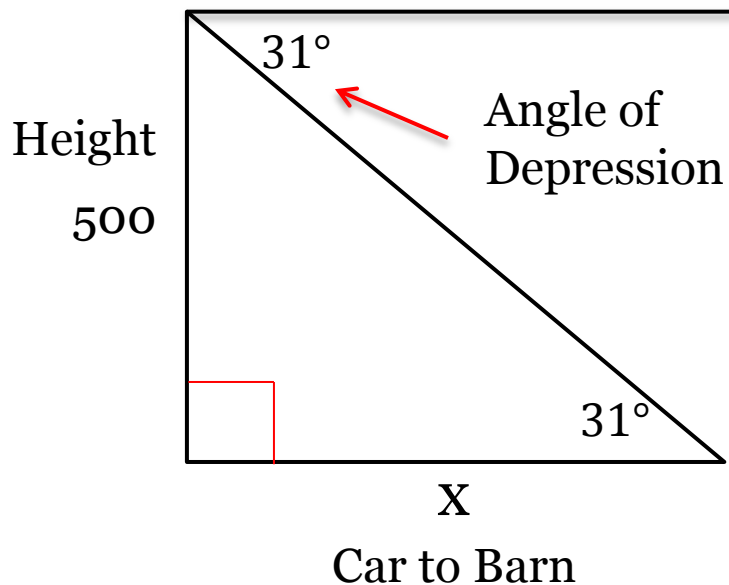
Wire

X

Angle of Elevation

75

65°

Solution:

$$x = \frac{75}{\sin 65}$$

$$x \approx 83$$

Final Checks

2.) An observer in an airplane at a height of 500 meters sees a car at an angle of depression of **31°** . If the plane is over a barn, how far is the car from the barn?

If you follow the steps, you should have this diagram

With this ratio:

$$\tan 31° = \frac{500}{x}$$

Solution:

$$x = \frac{500}{\tan 31}$$

$$x \approx 832$$

31°

Height

500

Angle of
Depression

31°

X

Car to Barn