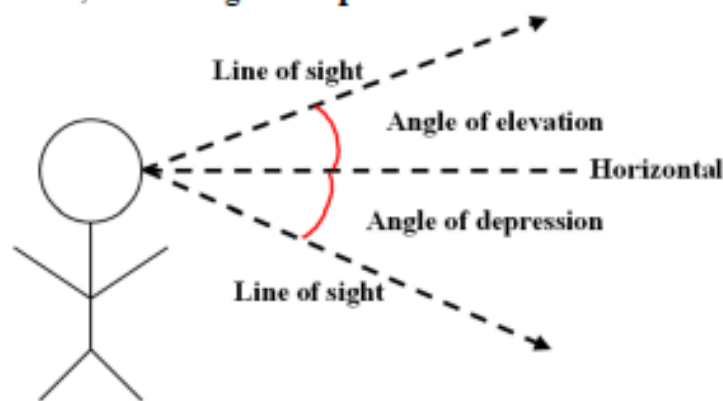# Angles of Elevation and Depression

SOL G.8c (2016)

Angles of elevation and depression are angles between the line of sight and the horizontal. If the observer is looking up, it is an **angle of elevation**. If the observer is looking down, it is an **angle of depression**.

Drawings are essential to making sense of practical problems involving angles of elevation and depression. From the drawing, an appropriate trigonometric ratio can be selected to solve the problem.

Example 1: A pilot flying at an altitude of 35,000 feet wants to descend to 20,000 feet over the next 60 miles. What should be his angle of depression to the nearest tenth?
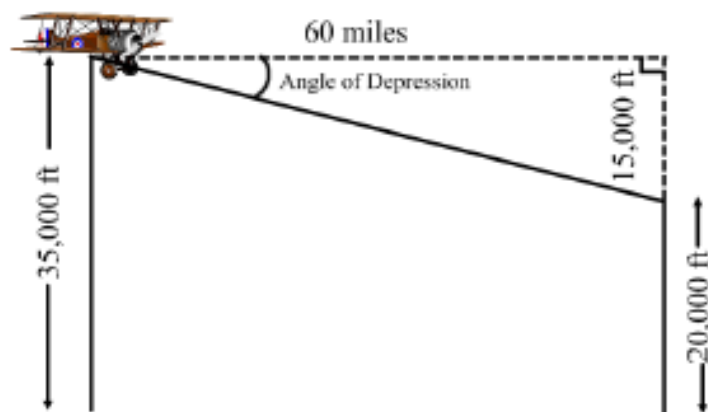
60 miles = 316800 feet

$$\text{Tan } R = \frac{15000}{316800}$$

Tan R = .0473

$m\angle R \approx 2.7°$

1. Change to identical units.
   1 mile = 5280 feet.
2. Subtract to find the distance the plane descends (35000 − 20000 = 15000).
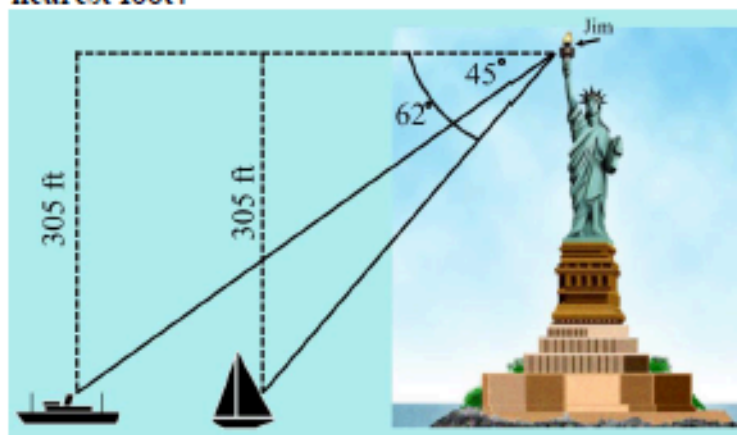3. Set up a trigonometric equation.
4. Solve.

The angle of depression should be about 2.7°.

Illustrate and solve each problem.

1. A pilot is flying at an altitude of 15,000 feet. At descent, she wants her angle of depression to be 2.5°. What should be her horizontal distance (to the nearest foot) from the runway when she begins her descent?

2. The angle of depression from the top of a ski jump is 58°. How high is the starting gate of the ski jump if the horizontal distance from top to bottom is 60 ft. (Answer to the nearest foot.)

Example 2: Jim is looking down from the top of the Statue of Liberty's torch, 305 feet above sea level. From his vantage point, he observes a ship and a sailboat in New York Harbor. The angles of depression to the ship is 45° and the angle of depression to the sailboat is 62°. How far apart are the ship and the sailboat to the nearest foot?

$$\tan 62° = \frac{305}{x}$$

$$x \tan 62° = 305$$

$$x = \frac{305}{\tan 62°}$$

$$x \approx 162.17$$

Distance to sailboat = 162 ft

1. Set up a trigonometric equation to find the horizontal distance between Jim and the sailboat.
2. Solve.

$$\tan 45° = \frac{305}{y}$$

$$y \tan 45° = 305$$

$$y = \frac{305}{\tan 45°}$$

$$y = 305$$

Distance to ship = 305 ft

3. Set up a trigonometric equation to find the horizontal distance between Jim and the ship.
4. Solve.

$$305 - 162 = 143$$

5. Find the difference of the two distances.

The boats are 143 feet apart.

3. Samantha is looking through binoculars at an eagle's nest at the top of a tree. She is standing 85 yards away from the base of the tree. What is the angle of elevation (to the nearest tenth) if the nest is on situated 70 feet up a tree?

4. Trish and Anne-Marie are standing in the field looking up at the top of an 88-ft fire tower. Their angles of elevation are 78° and 61°, respectively. How far apart are the girls standing to the nearest tenth of a foot?