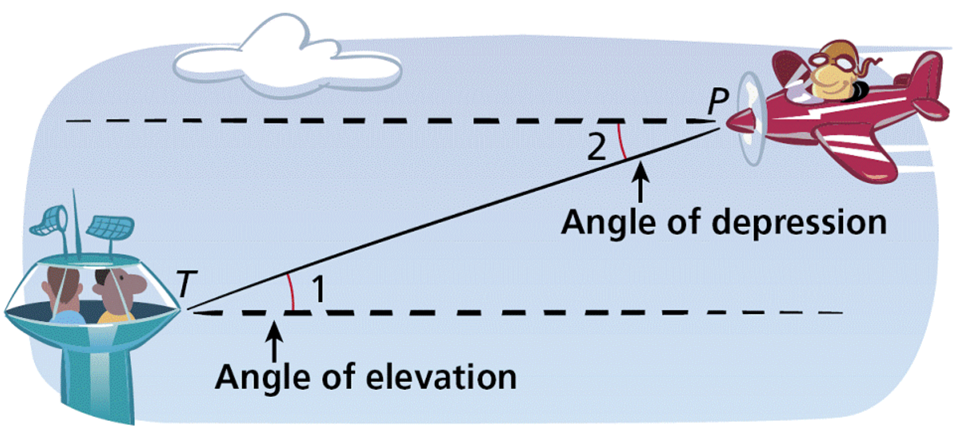
Objective

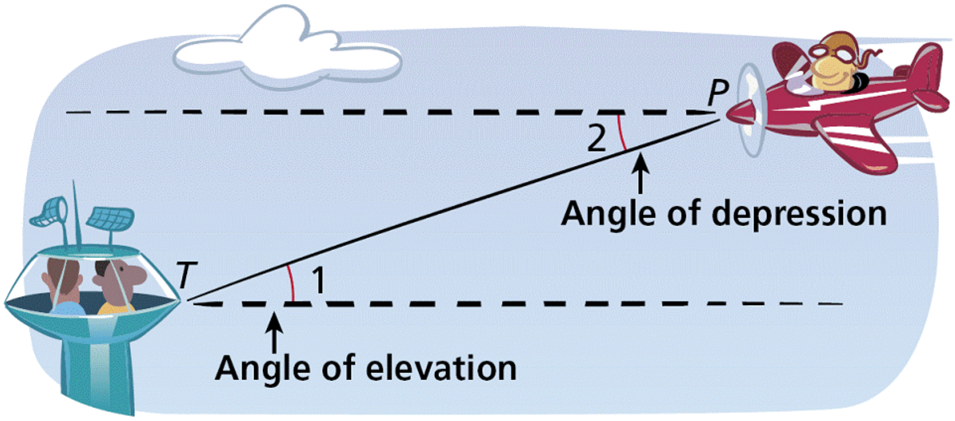
Solve problems involving angles of elevation and angles of depression.

angle of elevation is the angle formed by a horizontal line and a line of sight to a point *above* the line.

angle of depression is the angle formed by a horizontal line and a line of sight to a point *below* the line.

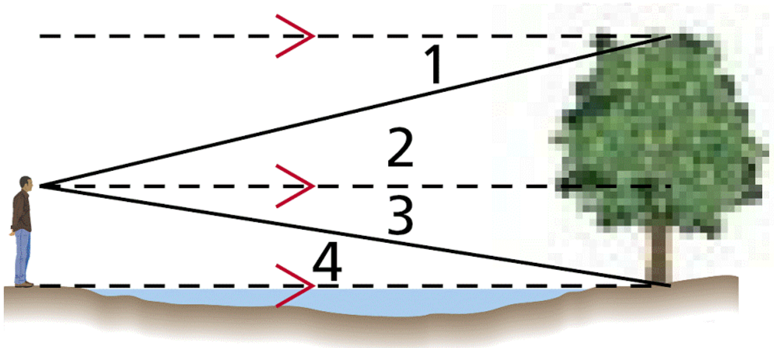


Since horizontal lines are parallel, $\angle 1 \cong \angle 2$ by the Alternate Interior Angles Theorem. Therefore the angle of elevation from one point is congruent to the angle of depression from the other point.



Example 1A: Classifying Angles of Elevation and Depression

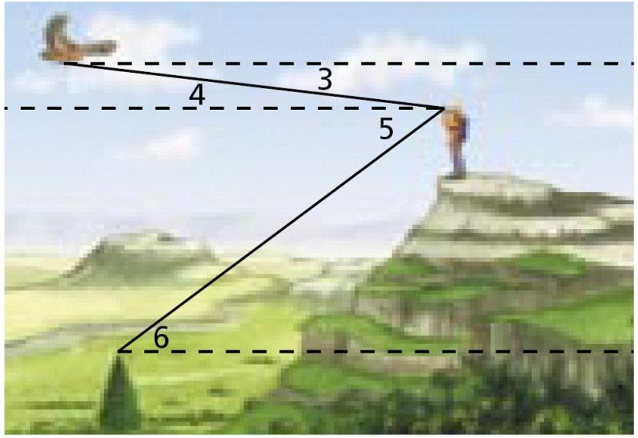
Classify each angle as an angle of elevation or an angle of depression.



$\angle 1$ $\angle 4$ $\angle 3$ $\angle 2$

Check It Out! Example 1

Use the diagram above to classify each angle as an angle of elevation or angle of depression.



1a. ∠5

∠5 is formed by a horizontal line and a line of sight to a point below the line. It is an angle of depression.

1b. ∠6

∠6 is formed by a horizontal line and a line of sight to a point above the line. It is an angle of elevation.

Example 2: Finding Distance by Using Angle of Elevation

The Seattle Space Needle casts a 67-meter shadow. If the angle of elevation from the tip of the shadow to the top of the Space Needle is 70º, how tall is the Space Needle? Round to the nearest meter.

Draw a sketch to represent the given information. Let *A* represent the tip of the shadow, and let *B* represent the top of the Space Needle. Let *y* be the height of the Space Needle.

Example 2 Continued

$$\tan 70° = \frac{y}{67}$$

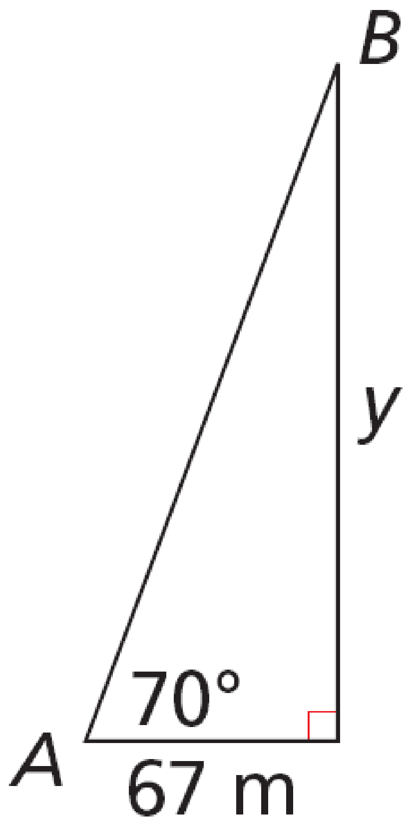
You are given the side adjacent to ∠A, and y is the side opposite ∠A. So write a tangent ratio.

$$y = 67 \tan 70°$$

Multiply both sides by 67.

$$y \approx 184 \text{ m}$$

Simplify the expression.



Check It Out! Example 2

What if…? Suppose a plane is at an altitude of 3500 ft and the angle of elevation from the airport to the plane is 29°. What is the horizontal distance between the plane and the airport? Round to the nearest foot.

$$\tan 29° = \frac{3500}{x}$$

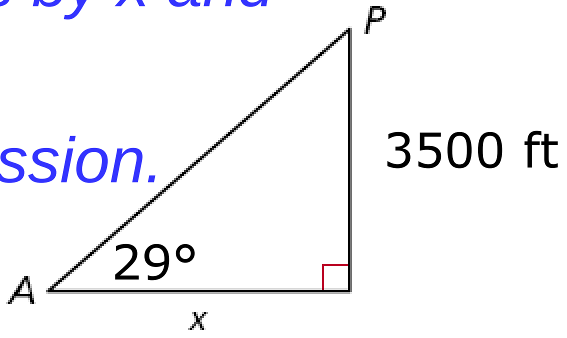
You are given the side opposite ∠A, and x is the side adjacent to ∠A. So write a tangent ratio.

$$x = \frac{3500}{\tan 29°}$$

Multiply both sides by x and divide by tan 29°.

$$x \approx 6314 \text{ ft}$$

Simplify the expression.



Check It Out! Example 3

What if...? Suppose a ranger in a 90 ft tower sees a fire and the angle of depression to the fire is 3°. What is the horizontal distance to this fire? Round to the nearest foot.

By the Alternate Interior Angles Theorem, m$\angle F$ = 3°.

$$\tan 3^\circ = \frac{90}{x}$$ *Write a tangent ratio.*

$$x = \frac{90}{\tan 3^\circ}$$ *Multiply both sides by x and divide by tan 3°.*

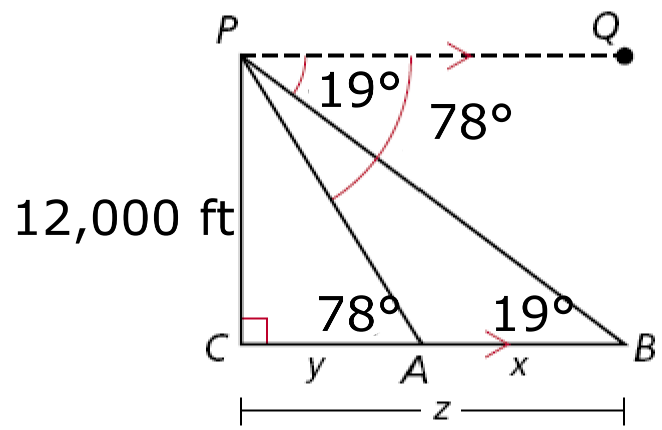
$x \approx 1717$ ft *Simplify the expression.*

Check It Out! Example 4

A pilot flying at an altitude of 12,000 ft sights an airport directly in front of him. The angle of depression to the airport is 78°. What is the distance to the airport? Round to the nearest foot.

Check It Out! Example 4 Continued

Step 1 Draw a sketch. Let *P* represent the pilot and let *A* and *B* represent the two airports. Let *x* be the distance between the two airports.



Check It Out! Example 4 Continued

Step 2 Find *y*.

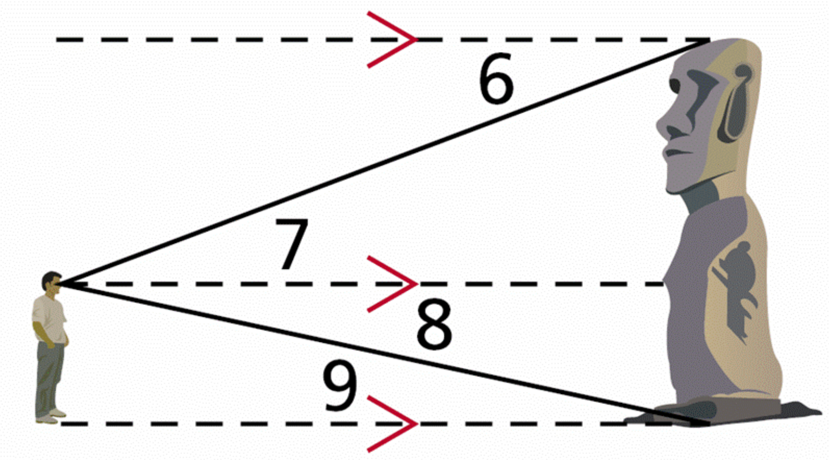
By the Alternate Interior Angles Theorem, $m\angle CAP = 78°$.

In ΔAPC, $\tan 78° = \dfrac{12{,}000}{y}$.

So $y = \dfrac{12{,}000}{\tan 78°} \approx 2551 \text{ ft.}$

Lesson Quiz: Part I

Classify each angle as an angle of elevation or angle of depression.



1. ∠6 angle of depression

2. ∠9 angle of elevation

Lesson Quiz: Part II

3. A plane is flying at an altitude of 14,500 ft. The angle of depression from the plane to a control tower is 15°. What is the horizontal distance from the plane to the tower? Round to the nearest foot.

54,115 ft

Pg. 547 # 3-8, 10-13, 15, 24