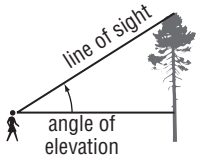
NAME _____ DATE _____ PERIOD _____

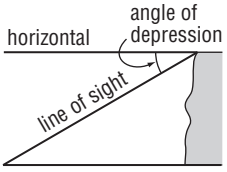
8-5 Study Guide and Intervention

Angles of Elevation and Depression

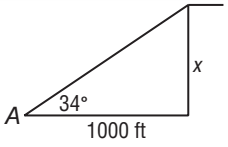
Angles of Elevation and Depression Many real-world problems that involve looking up to an object can be described in terms of an **angle of elevation,** which is the angle between an observer's line of sight and a horizontal line.



When an observer is looking down, the **angle of depression** is the angle between the observer's line of sight and a horizontal line.



Example **The angle of elevation from point *A* to the top of a cliff is 34°. If point *A* is 1000 feet from the base of the cliff, how high is the cliff?**



Let x = the height of the cliff.

$\tan 34° = \frac{x}{1000}$ $\tan = \frac{\text{opposite}}{\text{adjacent}}$

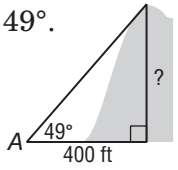
$1000(\tan 34°) = x$ Multiply each side by 1000.

$674.5 = x$ Use a calculator.

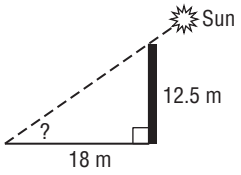
The height of the cliff is about 674.5 feet.

Exercises

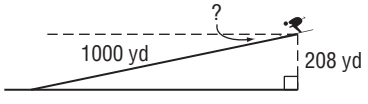
1. **HILL TOP** The angle of elevation from point *A* to the top of a hill is 49°. If point *A* is 400 feet from the base of the hill, how high is the hill?



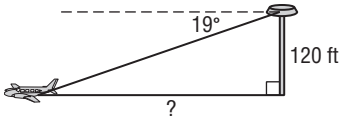
2. **SUN** Find the angle of elevation of the Sun when a 12.5-meter-tall telephone pole casts an 18-meter-long shadow.



3. **SKIING** A ski run is 1000 yards long with a vertical drop of 208 yards. Find the angle of depression from the top of the ski run to the bottom.



4. **AIR TRAFFIC** From the top of a 120-foot-high tower, an air traffic controller observes an airplane on the runway at an angle of depression of 19°. How far from the base of the tower is the airplane?



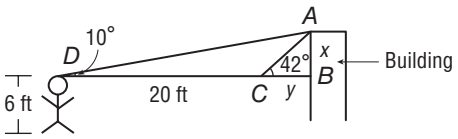
NAME _____ DATE _____ PERIOD _____

8-5 Study Guide and Intervention *(continued)*

Angles of Elevation and Depression

Two Angles of Elevation or Depression Angles of elevation or depression to two different objects can be used to estimate distance between those objects. The angles from two different positions of observation to the same object can be used to estimate the height of the object.

Example **To estimate the height of a garage, Jason sights the top of the garage at a 42° angle of elevation. He then steps back 20 feet and sites the top at a 10° angle. If Jason is 6 feet tall, how tall is the garage to the nearest foot?**



$\triangle ABC$ and $\triangle ABD$ are right triangles. We can determine $AB = x$ and $CB = y$, and $DB = y + 20$.

Use $\triangle ABC$. $\tan 42° = \frac{x}{y}$ or $y \tan 42° = x$

Use $\triangle ABD$. $\tan 10° = \frac{x}{y + 20}$ or $(y + 20) \tan 10° = x$

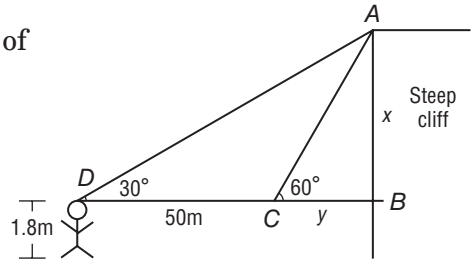
Substitute the value for x from $\triangle ABD$ in the equation for $\triangle ABC$ and solve for y.

$$y \tan 42° = (y + 20) \tan 10°$$
$$y \tan 42° = y \tan 10° + 20 \tan 10°$$
$$y \tan 42° - y \tan 10° = 20 \tan 10°$$
$$y (\tan 42° - \tan 10°) = 20 \tan 10°$$
$$y = \frac{20 \tan 10°}{\tan 42° - \tan 10°} \approx 4.87$$

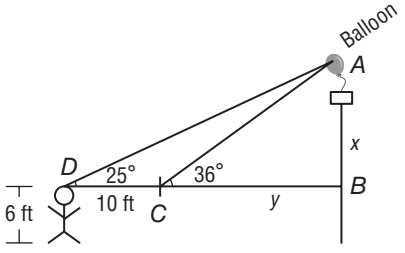
If $y = 4.87$, then $x = 4.87 \tan 42°$ or about 4.4 feet. Add Jason's height, so the garage is about 4.4 + 6 or 10.4 feet tall.

Exercises

1. **CLIFF** Sarah stands on the ground and sights the top of a steep cliff at a 60° angle of elevation. She then steps back 50 meters and sights the top of the steep cliff at a 30° angle. If Sarah is 1.8 meters tall, how tall is the steep cliff to the nearest meter?



2. **BALLOON** The angle of depression from a hot air balloon in the air to a person on the ground is 36°. If the person steps back 10 feet, the new angle of depression is 25°. If the person is 6 feet tall, how far off the ground is the hot air balloon?



Lesson 8-5