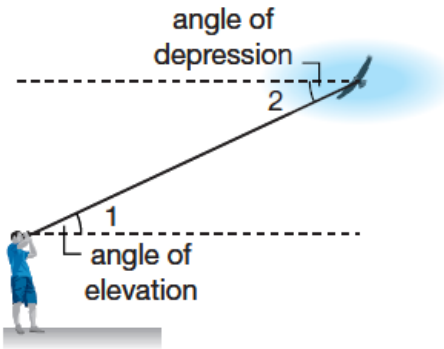


Geometry Lesson 73

Objective: TSW apply trigonometry with angles of elevation and depression.



An angle of _____ is the angle formed by a horizontal line and the line of sight to a point above. In the diagram, $\angle 1$ is the angle of elevation. It is the angle to which the bird watcher raises (or elevates) his line of sight from the horizontal to see the bird.

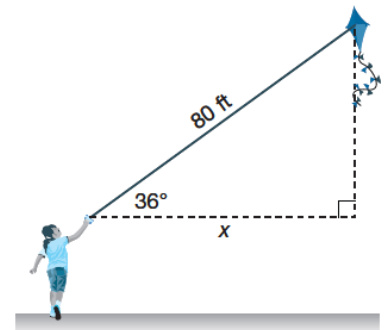
An angle of _____ is the angle formed by a horizontal line and a line of sight to a point below. In the diagram, $\angle 2$ is the angle of depression. It is the angle that the bird would lower (or depress) its line of sight from the horizontal to see the bird watcher.

You can use trigonometry to find the angle of elevation and the angle of depression.

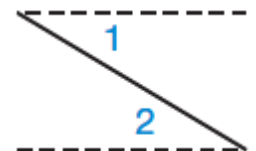
Example 1 Angle of Elevation

Use the angle of elevation between the kite and the child to find the horizontal distance between the kite and the child.

SOLUTION



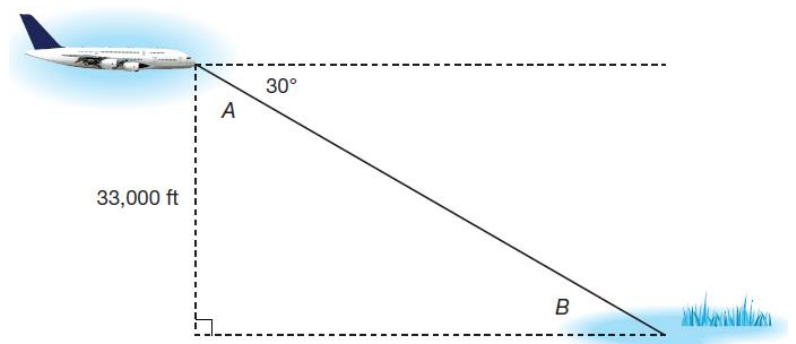
The horizontal lines used to measure the angles of elevation and depression are parallel, so the angle of elevation, $\angle 2$, and the angle of depression, $\angle 1$, are congruent, because they are alternate interior angles.



Example 2 Angle of Depression

The pilot in a plane cruising at 33,000 feet sees a lake. If the angle of depression from the plane to the lake is 30° , how far is the plane from the lake?

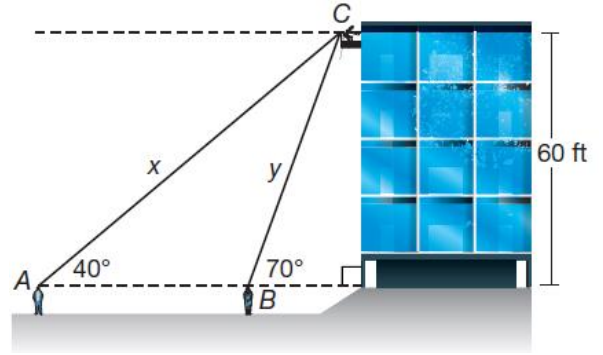
SOLUTION



Example 3 Angles of Elevation from Multiple Points

A window washer is working 60 feet above the ground. About how far away is each person pictured at street level?

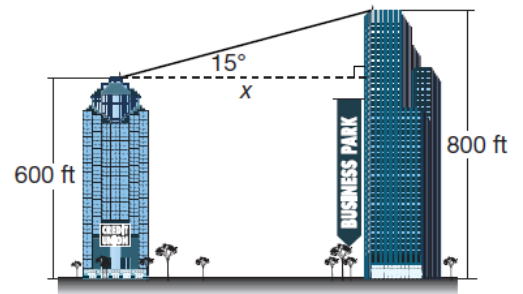
SOLUTION



Example 4 Application: Surveying

A surveyor on the Credit Union building measures an angle of elevation of 15° to the top of the Business Park building. The Credit Union building is 600 feet tall, and the Business Park building is 800 feet tall. What is the distance between the buildings, to the nearest foot?

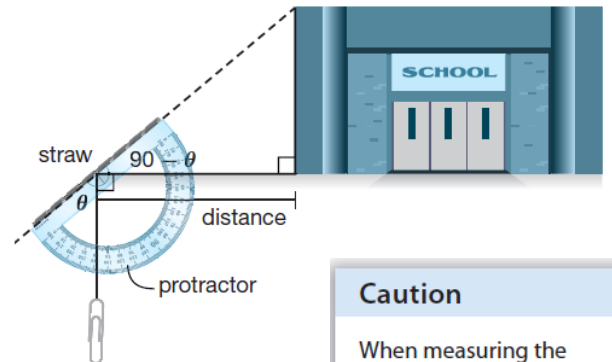
SOLUTION



Exploration Making and Using a Hypsometer

In this exploration, you will construct a hypsometer. A hypsometer is used to measure an angle of elevation or an angle of depression.

- To make a hypsometer, you will need a drinking straw, a protractor, string, a paperclip (or small weight), and tape. First, attach the straw to the straight edge of the protractor with tape. Tie one end of the string to the paper clip. Attach the other end of the string to the center point of the protractor.
- Work with a partner to use the hypsometer to measure the height of your school. While one person looks through the straw at the top of the school, the other person measures the angle of the string on the protractor. As you can see in the diagram, the angle that the string makes with the protractor will be the complement of the angle of elevation.
- Measure the distance to the school.



Caution

When measuring the distance to the school, be sure to measure the distance from the point where you used the hypsometer to the point on the school directly below where you viewed the school's height, and not the point on the school closest to where you used the hypsometer.

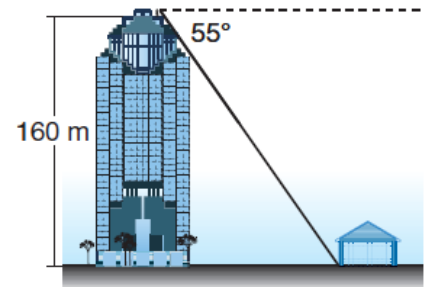
4. Use the tangent function to find the height of the school. The adjacent side is the distance between you and the school. The opposite side is the school's height. Remember to add the height of your eyes from the ground to the calculated height of the school to get a more accurate measurement. After you calculate the height of the school, compare your answer with those of other students.

5. Use the same method to find the heights of trees or other buildings.

You Try!!!!

a. Standing 300 feet away from a building, the angle of elevation to the roof is 67° . Find the height of the building to the nearest foot.

b. A family sees their house from a window of a tall building. The angle of depression is 55° . The window where the family is standing is 160 meters above the street. How far away is their house from the window, to the nearest meter?



c. Jocelyn sees a hot-air balloon at an angle of elevation of 30° . Anthony sees the same hot-air balloon at an angle of elevation of 50° . The balloon is 140 meters off the ground. They are standing on the same side of the balloon. How far apart are Jocelyn and Anthony, to the nearest meter? Who is farther away from the balloon?

d. Surveying: A surveyor on the top of Blake Hill measures an angle of depression of 16° to the top of Pike Hill. The height of Blake Hill is 400 meters, and the height of Pike Hill is 300 meters. What is the distance between the hilltops, to the nearest meter?

