

Here are some more applications of trig functions. In some of these you may need to find a missing side, and, in others, a missing angle.

Use the skills you have learned so far to answer the questions. Always begin by making a drawing and labeling the known information.

- 1) If a girl 1.6 meters tall stands on level ground, and the elevation of the sun is 60° above the horizon, what will the length of her shadow be?
- 2) If the girl in #1 casts a shadow that is 1 meter long, what is the elevation of the sun?
- 3) A stairway forms an angle with the floor from which it rises. This angle may be called the angle of inclination. What is the angle of inclination of a stairway if the steps have a tread of 20 centimeters and a rise of 16 centimeters?

Some problems require more of your algebra skills. The first one is done for you.

- 4) An observation balloon is attached to the ground at point A. On a level with A and in the same straight line, the points B and C were chosen so that BC equals 100 meters. From the points B and C the angle of elevation of the balloon is 40° and 30° respectively. Find the height of the balloon.

First, make a drawing. We do not have enough information to find X using either the angle at B or the angle at C. However, we can make two equations using X and Y.

$$\tan 40^\circ = \frac{X}{Y} \qquad \tan 30^\circ = \frac{X}{Y + 100}$$

$$.8391 = \frac{X}{Y} \qquad .5774 = \frac{X}{Y + 100}$$

$$X = .8391 Y \qquad .5774 = \frac{.8391 Y}{Y + 100}$$

$$.5774(Y + 100) = .8391 Y \qquad .5774 Y + 57.74 = .8391 Y \qquad \text{Solve for Y.}$$

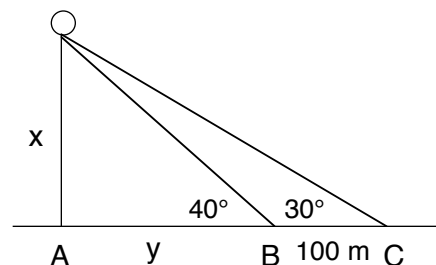
$$57.74 = .2617 Y \qquad Y = 220.6 \text{ (rounded)}$$

$$X = .8391 (220.6) = 185.1 \text{ m}$$

Replace tan with actual ratio.

Solve first equation for X and substitute for X in second equation.

Solve for X, which is the height of the balloon.



- 5) Tom wished to find the width of a river. He observed a tree directly across the river on the bank. The angle of elevation to the top of the tree was 32° . Then Tom moved directly back from the bank 50 meters and found that the angle of elevation to the top of the tree was 21° . What was the width of the river?
- 6) In the side of a hill that slopes upward at an angle of 32° , a tunnel is bored sloping downward at an angle of $12^\circ 15'$ from the horizontal. How far below the surface of the hill is a point 38 meters down the tunnel?