=Name________________________________ Per_____
Date________________

Lesson: 4.2.1 What if I know the Hypotenuse? – Day 1

In the previous chapter, you used the idea of similarity in right triangles to identify a relationship between the acute angles and the lengths of the legs of a right triangle. However, you do not always work just with the legs of a right triangle—sometimes you only know the length of the hypotenuse. By the end of today's lesson, you will be able to use two new trigonometric ratios that involve the hypotenuse of right triangles.

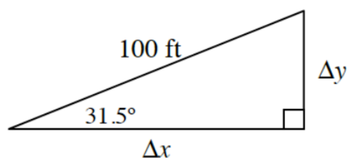
4-56.

THE STREETS OF SAN FRANCISCO

While traveling around the beautiful city of San Francisco, Juanisha climbs several steep streets. One of the steepest, Filbert Street, has a slope angle of $31.5°$, according to her guidebook.

Once Juanisha finishes walking 100 feet up the hill, she decides to figure out how high she has climbed. Juanisha draws the diagram below to represent this situation.

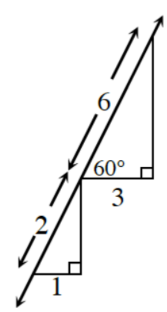
Can a tangent ratio be used to solve for Δy? Why or why not? Be prepared to share your thinking with the rest of the class.



Juanisha's Drawing

4-57.

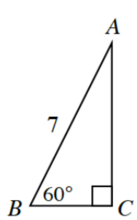
To find out how high Juanisha climbed in problem 4-56, you need to know more about the relationship between the ratios of the sides of a right triangle and the slope angle.



a. Use two different strategies to determine Δy for the slope triangles shown in the diagram at right.

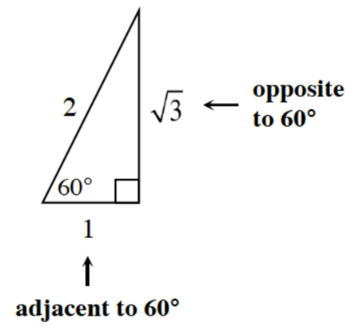
b. Calculate the ratio $\frac{\Delta x}{\text{hypotenuse}}$ for each triangle. Why must these ratios be equal?

c. Determine BC and AC in the triangle below. Show all work.



4-58.

NEW TRIG RATIOS



In problem 4-57, you used a ratio that included the hypotenuse of ΔABC. There are several ratios that you might have used. One of these ratios is known as the **sine ratio** (pronounced "sign"). This is the ratio of the length of the side opposite the acute angle to the length of the hypotenuse.

For the triangle shown at right, the sine of $60°$ is $\frac{\sqrt{3}}{2} \approx 0.866$. This is written:

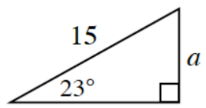
$$\sin 60° = \frac{\sqrt{3}}{2}$$

Another ratio comparing the length of the side adjacent to (which means "next to") the angle to the length of the hypotenuse is called the **cosine ratio** (pronounced "co-sign"). For the triangle above, the cosine of $60°$ is $\frac{1}{2} = 0.5$. This is written:

$$\cos 60° = \frac{1}{2}$$

a. Like the tangent ratio, your calculator can give you both the sine and cosine ratios for any angle. Locate the "sin" and "cos" buttons on your calculator and use them to determine the sine and cosine of $60°$. Does your calculator give you the correct ratios?

b. Use a trig ratio to write an equation and solve for a in the diagram below. Does this require the sine ratio or the cosine ratio?



c. Likewise, write an equation and solve for b for the triangle below.