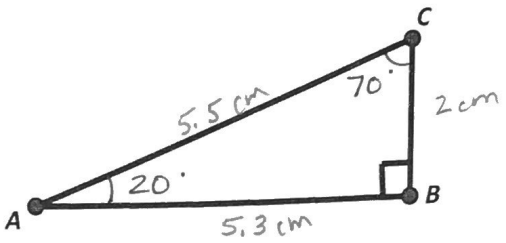
Investigation Task - Complements

You will need: a ruler, a scientific calculator

In this investigation you will make a small table of trigonometric ratios for angles measuring 20° and 70°.

Step 1 The right triangle ABC, below, has angle measures of: $m\angle A = 20°, m\angle B = 90°, m\angle C = 70°$



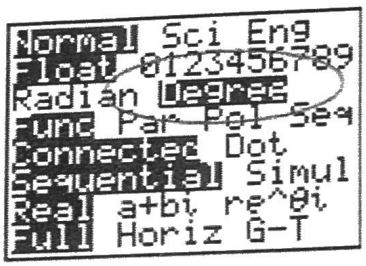
Step 2 Measure *AB*, *AC*, and *BC* to the nearest millimeter. Write the lengths on your triangle.

Step 3 Use your side lengths and the definitions of sine, cosine, and tangent to complete the table. Round your calculations to the nearest thousandth.

Often, you will be given the measure of θ. **YOU MUST MAKE SURE YOUR CALCULATE IS IN DEGREE MODE!**

If you are using any of the TI-83/84 calculators:

- Press MODE
- Use the arrow keys to highlight "Degree"
- Press ENTER once degree is highlighted in black
- Press 2nd, MODE to return to the home screen



m∠A	sin A	cos A	tan A
20°	2/5.5	5.3/5.5	2/5.3

m∠C	sin C	cos C	tan C
70°	5.3/5.5	2/5.5	5.3/2

Step 4 Share your results with your group. What observations can you make about the trigonometric ratios you found? What is the relationship between the values for 20° and the values for 70°? Explain why you think these relationships exist.

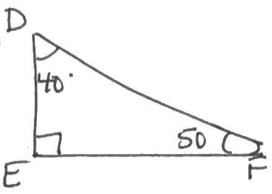
Today, trigonometric tables have been replaced by calculators that have sin, cos, and tan keys.

Step 5 Experiment with your calculator to determine how to find the sine, cosine, and tangent values of angles.

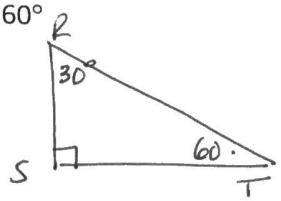
Step 6 Use your calculator to find sin 20°, cos 20°, tan 20°, sin 70°, cos 70°, and tan 70°. Check your group's table. How do the trigonometric ratios found by measuring sides compare with the trigonometric ratios you found on the calculator?

Step 7 **Recall that the acute angles of a right triangle are complementary angles.** Would the same relationship for the trigonometric ratios that you found in Step 6 exist with other complementary angles? Test your conjecture by repeating Step 6 with right triangles with the following acute angle measures:

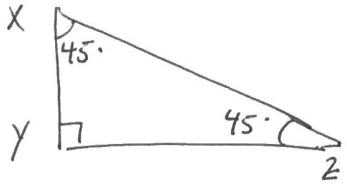
△ *DEF* with $m\angle D = 40°$, $m\angle F = 50°$



△ *RST* with $m\angle R = 30°$, $m\angle T = 60°$



△ *XYZ* with $m\angle X = 45°$, $m\angle Z = 45°$



Fill in the missing angle for the text box:

In any **right triangle:**

$\sin\theta$ = $\cos(90-\theta)$

$\cos\theta$ = $\sin(90-\theta)$

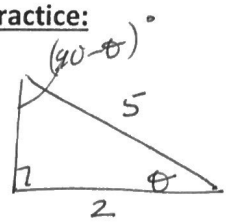
$\sin(90-\theta)$ = $\cos\theta$

$\cos(90-\theta)$ = $\sin\theta$

Guided Practice:

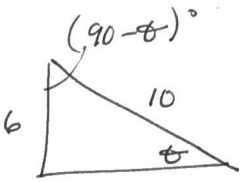
1. Let $\cos\vartheta = \frac{2}{5}$. What is the sin $(90-\vartheta)^o$?

2/5



2. Let $\sin\vartheta = \frac{6}{10}$. What is the cos$(90-\vartheta)^o$? (Sketch a picture of the triangle)

6/10 = 3/5



3a. Write the trigonometric function for α represented in the right triangle below.

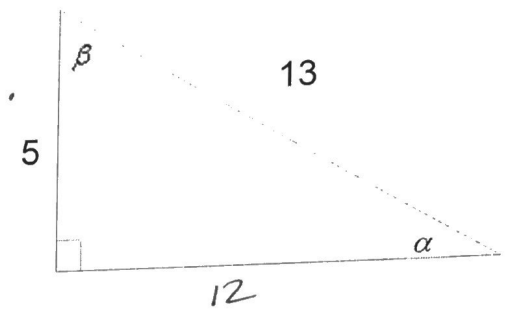
$\sin\alpha = 5/13$

b. What is the length of the missing leg of the triangle?

$13^2 = 5^2 + x^2$

$144 = x^2$

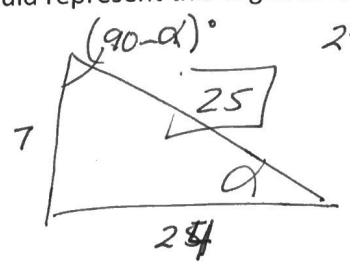
$12 = x$



Find the following values: $\cos\alpha =$ 12/13 $\tan\alpha =$ 5/12

$\sin\beta =$ 12/13 $\tan\beta =$ 12/5 $\frac{\sin\beta}{\cos\beta} = \frac{12/13}{5/13} = \frac{12}{13} \div \frac{13}{5} = \frac{12}{5} = \tan\beta$

4. Given $\tan\alpha = \frac{7}{24}$, draw a right triangle that would represent this trigonometric ratio.



$24^2 + 7^2 = x^2$

$625 = x^2$

$25 = x$

Find the following:

$\sin\alpha =$ 7/25

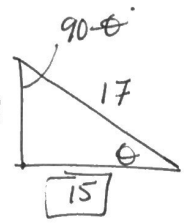
$\cos\alpha =$ 24/25

$\sin(90-\alpha) =$ 24/25

$\cos(90-\alpha) =$ 7/25

Skills Practice:

1. Given $\sin\theta = \frac{8}{17}$.



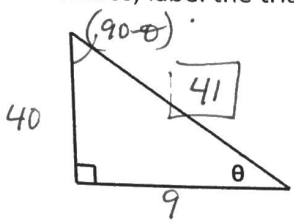
$17^2 - 8^2 = x^2$

$\cos\theta =$ 15/17

$\sin(90-\theta) =$ 15/17 $\cos(90-\theta) =$ 8/17

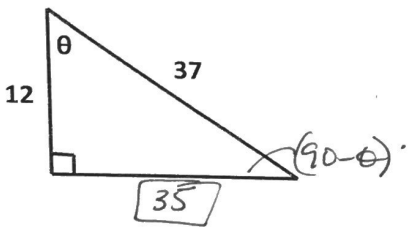
2. Given the following trigonometric values, label the triangle's sides.

$\tan\theta = \frac{40}{9}$



$\cos\theta =$ 9/41 $\sin(90-\theta) =$ 9/41 $\cos(90-\theta) =$ 40/41 $\sin\theta =$ 40/41

3. Given the triangle below, find the length missing side. Then answer the questions about the triangle.



$37^2 - 12^2 = x^2$

Missing side length = 35

$\sin\theta =$ 35/37 $\cos\theta =$ 12/37 $\sin(90-\theta) =$ 12/37 $\cos(90-\theta) =$ 35/37