Right triangles have another surprising quality.

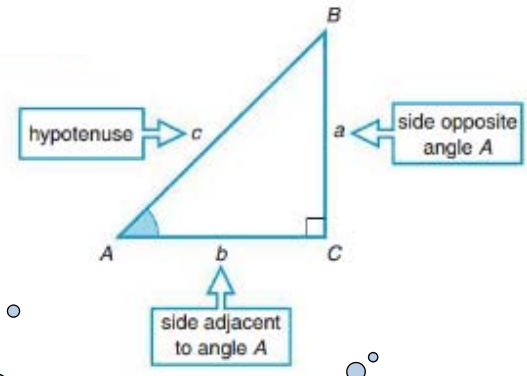
Technology Integrated Mathematics
Class Notes
Trigonometry: Trigonometric Ratios (Section 10.2)

We looked at specific right triangles (45°-45°-90° and 30°-60°-90°) in the previous section. We saw how the side lengths were related to each other. Here, we will explore another relationship that spells out how the side lengths are related to each other for *any* right triangle. First, some definitions…

Recall, the **hypotenuse** is the side opposite the right angle (labeled c in the picture).

We also need the concept of adjacent side and opposite side.

For either acute angle (A is chosen in the picture), locate the side that is **opposite** that angle and the side that is **adjacent** (meaning next to but *not* the hypotenuse) to that angle.



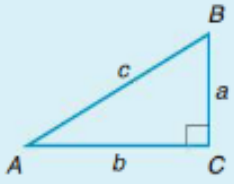
Can you locate the adjacent and opposite sides if we were to consider the angle B?

An acute angle is less than 90°.

Trigonometric Ratios:
We will explore the three trigonometry relationships called **sine**, **cosine**, and **tangent**. We find the sine, cosine, and tangent of various acute angles in right triangles.

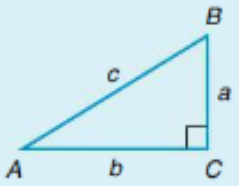
We have the following (always true) relationships using **abbreviations** sin, cos, and tan.

$$\sin A = \frac{\text{side opposite angle } A}{\text{hypotenuse}} = \frac{a}{c}$$

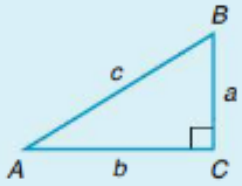


We can find the trig ratios of either acute angle but I only show it for angle A.

$$\cos A = \frac{\text{side adjacent to angle } A}{\text{hypotenuse}} = \frac{b}{c}$$

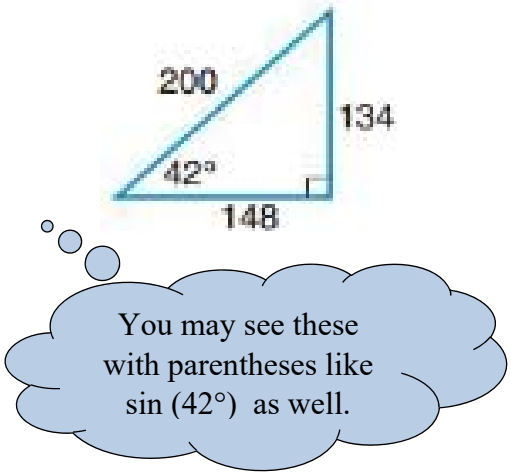


$$\tan A = \frac{\text{side opposite angle } A}{\text{side adjacent to angle } A} = \frac{a}{b}$$



A helpful mnemonic device is **SOH CAH TOA**. (Sounds like "Soak your toe" but with more flare.) This stands for Sine: Opposite/Hypotenuse, Cosine: Adjacent/Hypotenuse, and Tangent: Opposite/Adjacent.

expl 1: Calculate the trig ratios for the angle given (42° shown in picture). Use the side lengths as opposed to the calculator. Round to the nearest hundredth.



a.) sin 42°

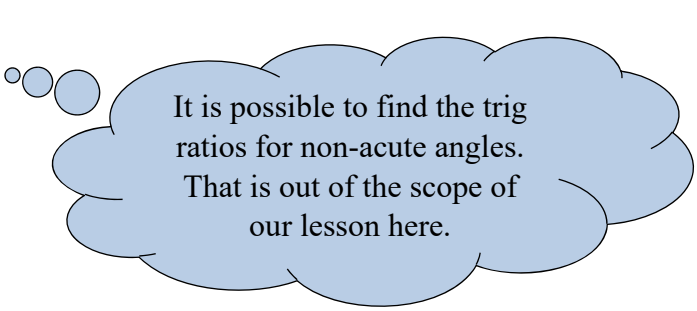
b.) cos 42°

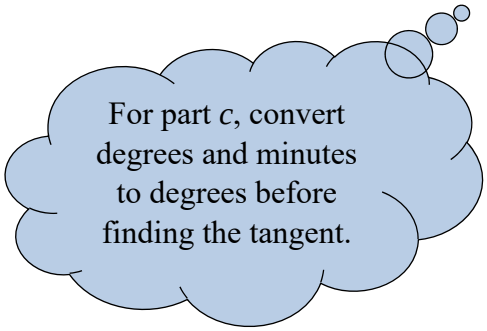
c.) tan 42°

Calculator Usage:
You must have the calculator either set to degrees for these problems. You will get the wrong answer if your calculator is set incorrectly. Other applications may require you find the trig ratios of angles given in radian measure but it appears the MML homework does *not* do this.

expl 2: Verify your calculator is set to **degree mode**. Find each of the following. Round to three decimal places.

a.) sin 27° b.) cos 50° c.) tan 35°20'

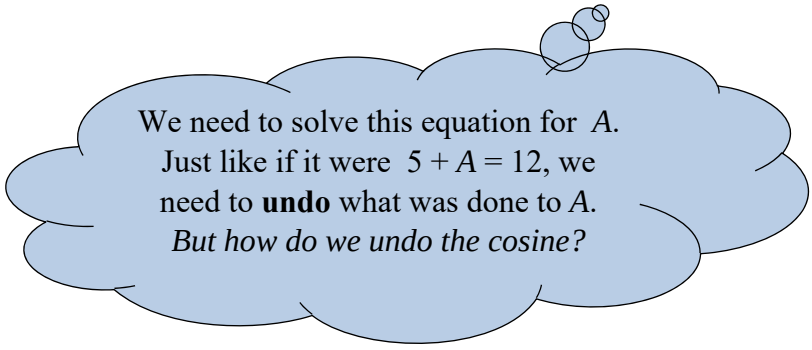




Inverse Trig Ratios:

What if we have the ratio of sides but want the angle?

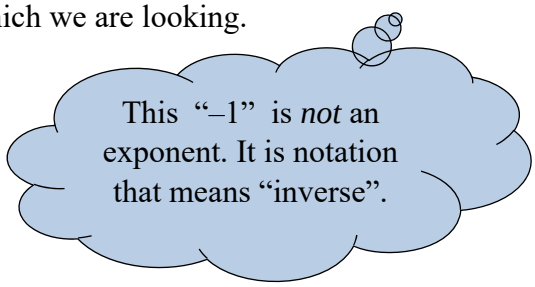
expl 3: Find the acute angle A if $\cos A = 0.262$. Round to the nearest tenth of a degree.



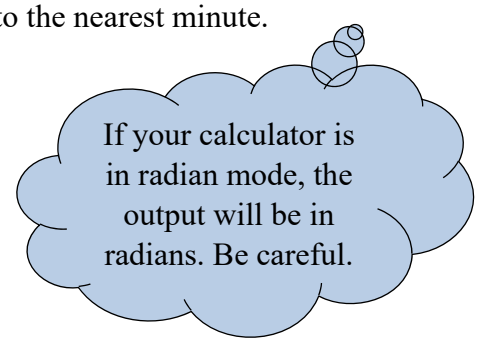
Inverse Sine, Cosine, and Tangent:

There are function buttons on the calculator which will *undo* the three trig functions. They will likely be the second functions of the sine, cosine, and tangent buttons. Find them now.

Here, write the algebra that gets you A alone in the equation. Then, find the value $\cos^{-1}(0.262)$ on the calculator; this will be the acute angle A for which we are looking.



expl 4: Find the acute angle B if $\tan B = 0.875$. Round to the nearest minute.



Worksheet: Trigonometry Ratios:
We will practice finding angles using the inverse trig functions as well as finding the trig ratios of known angles with the calculator.