Geometry, *You Can Do It !*
Applications; sin, cos, tan

by Bill Hanlon

Last time we looked at the ratios formed by the sides of right triangles and gave them names. We call that right triangle trigonometry.

We used the acronym **SOHCAHTOA** to help us remember the names of the ratios and how they were defined.

Using **SOHCAHTOA,** the

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

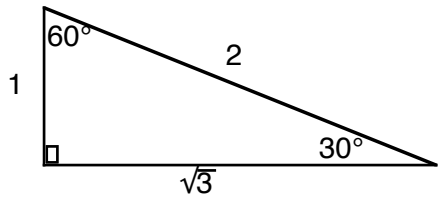
$$\cos A = \frac{\text{adjacent}}{\text{hypotenuse}} \quad \frac{b}{c}$$

and the

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

By knowing **SOHCAHTOA**, you will be able to remember the **S**ine is equal to **O**pposite over the **H**ypotenuse, the **C**osine is equal to the **A**djacent over the **H**ypotenuse, and the **T**angent is the **O**pposite over the **A**djacent.

Let's combine this knowledge of ratios with our knowledge of special triangles. For instance, in a 30-60-90 triangle we know the sides have the following relationships: the hypotenuse is twice as long as the shorter side and the longer side (not the hypotenuse) is √3 times the shorter side.



Now using a little trig, if I wanted to know the sine 30°, I would use

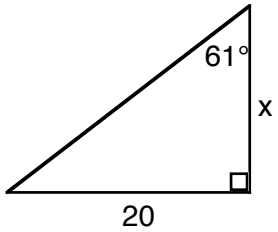
$$\sin 30° = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{1}{2}$$

Piece of cake, don't you think?

Let's say I only know the ratio of the sides, I could go backwards and find the angles. In other words, if I knew the sine of and angle was 1/2 (.5), then I would know the angle is 30°.

The only trick to solving problems is using the most appropriate trig ratio. In other words, you want to use a trig ratio, sine, cosine or tangent that is the wisest choice to set up the problem.

Before I go on, let me just say that I could use the special angles we learned earlier to solve problems or use trig tables or calculators to find the ratios for other angles.



Let's say I wanted to find the height of the above triangle. With the given information and wanting to find "x", which trig ratio would I use, sine, cosine, or tangent?

If I use the 61° angle, the sine is the opposite over the hypotenuse. The hypotenuse has nothing to do with the information given. In other words, using sine is not a wise choice. The cosine of 61° also uses the hypotenuse, again not a good choice. The tangent of 61° is the opposite, which is 20, over the adjacent, which is x. That gives us something to work with.

$$\tan 61° = \frac{\text{opposite}}{\text{adjacent}} = \frac{20}{x}$$

Now I either look up the tangent of 61° in a table or I use a calculator to find the ratio is 1.8040. Substituting, I have

$$1.8040 \approx \frac{20}{x}$$

Therefore, $x \approx 11.08$

