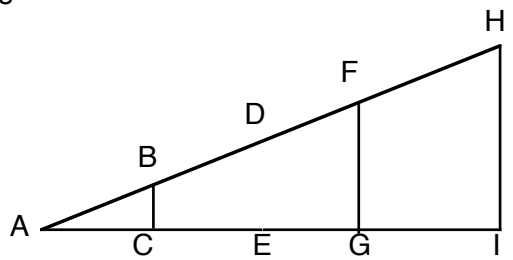
Geometry, *You Can Do It !*
Trigonometry

by Bill Hanlon

Many distances can be found directly by measuring with a ruler or tape measure. However, some distances can not be found directly. For instance, it's not practical to determine the height of a mountain by dropping a tape measure from the highest peak. So what do we do?

You've got it, find in indirectly. How? We could try to use those special right triangles we found last time. Remember we said there was a relationship in their sides. Trigonometry means "triangle measurement" in Greek. That's why trig is Greek to so many people.

Confining our discussion of trigonometry to special relationships that exist in right triangles, consider the right triangles shown in the diagram below.



Since each of the triangles contain $\angle A$ and a right angle, the triangles are all similar to one another by the Angle Angle Postulate. That means the sides are in proportion.

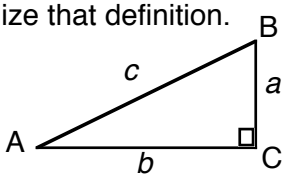
That means

$$\frac{BC}{AC} = \frac{DE}{AE} = \frac{FG}{AG} = \frac{HI}{AI}$$

This is called the **tangent ratio**.

The **tangent** (tan) of an acute angle of a right triangle is the ratio of the length of the leg opposite the acute angle to the length of the leg adjacent to the acute angle.

Let's visualize that definition.



Using that picture and definition, we would write the

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

The easiest way I know to remember the trig ratios is by memorizing **SOHCAHTOA**.

The **S** stands for sine, **O** for opposite side, **H** for hypotenuse, **C** for cosine, **A** for adjacent side, and **T** for tangent.

I know this interests you, if you were to write all the possible ratios for the sides of a triangle, you would find there would be six. How many trig ratios do you think there are? That's right, there are six. So trigonometry is nothing more than the study of the ratios of right triangles. We just happen to give those ratios names; sine ,cosine, tangent, cosecant, secant, and cotangent.

We'll only study sine (sin), cosine (cos), and tangent (tan) today.

Using **SOHCAHTOA,** the

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

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

and the

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

By using right triangles, we can now determine the sine, cosine, and tangent of angles. That, in turn, will allow us to find the sides of different triangles if we know an angle.

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, etc.

