

Understanding the Three Trigonometric Ratios

Study the triangles on the activity sheet: 3-4-5 RIGHT TRIANGLES. Label the triangles as follows: Triangle 1: $AB=8$ and $AC=6$, Triangle 2: $AC=4$ and $BC=5$, Triangle 3: $AB=9$ and $BC=15$, and Triangle 4: $AC=20$ and $BC=25$. Find the missing side in each triangle.

What is the relationship between the four triangles on the activity sheet. Explain why this relationship is true.

Notice that the four triangles have all different measurements. The longest side, called the hypotenuse is opposite the right angle. Notice there are two different size legs. We'll call them the shorter and longer legs.

From your four triangles, use Table 1 to complete the three ratios. Simplify each ratio. What do you notice about the ratios.

Study the triangles on the activity sheet: 30° - 60° -RIGHT TRIANGLES. Label the sides as follows: Triangle 1: $BC=4$, Triangle 2: $AB=6$, Triangle 3: $BC=7$, and Triangle 4: $AC=5\sqrt{3}$. Find the length of each missing side in all four triangles. Find the missing sides on each triangle.

From your four triangles, use Table 2 to complete the three ratios. Simplify each ratio.

What do you notice about the ratios?

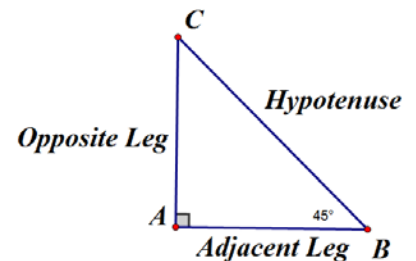
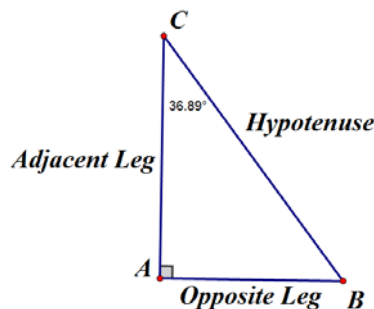
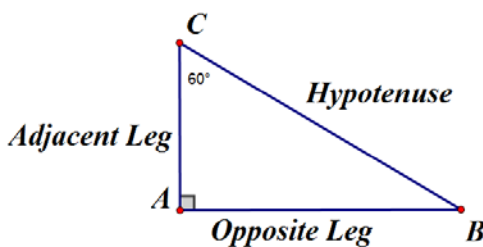
Study the triangles on the activity sheet: 45° - 45° -RIGHT TRIANGLES. Label the triangles as follows:

Triangle 1: $AB=6$, Triangle 2: $AC=5$, Triangle 3: $BC=4\sqrt{2}$, and Triangle 4: $AB=7.5$. Find the missing sides in each triangle.

Notice that the two legs are equal in these right triangles. Therefore, from your four triangles, use Table 3 to complete the three ratios. Simplify each ratio.

What do you notice about the ratios?

In mathematics these ratios have special names. To name a ratio you must first identify an acute angle in the triangle. Notice that in each triangle one acute angle has been labeled. When an angle has been identified, we use new terms in place of longer and shorter leg. We can now use new terms: opposite leg and adjacent leg.



The three ratios are sine, cosine, and tangent. They are identified as:

$$\text{sine } 60^\circ = \frac{\textit{opposite leg}}{\textit{hypotenuse}} \quad \text{cosine } 60^\circ = \frac{\textit{adjacent leg}}{\textit{hypotenuse}} \quad \text{and} \quad \text{tangent } 60^\circ = \frac{\textit{opposite leg}}{\textit{adjacent leg}}$$

Return to your drawings of 30°-60°-RIGHT TRIANGLES and complete the table 4 for the sine 60°, cosine 60°, and tangent 60°.

On the 3-4-5 RIGHT TRIANGLES one acute angle has been identified. Complete the table 5 for the sine 36.88°, cosine 36.88°, and the tangent 36.88°.

On the 45°-45°-RIGHT TRIANGLES one acute angle has been identified. Complete the table 6 for the sine 45°, cosine 45°, and the tangent 45°.

Return to each of the activity sheets and find the measure of the missing acute angle. Complete table 7 and 8 by using the appropriate activity sheet.

There are several ways to help you remember these special ratios:

Some **O**ld **H**orse

(S=Sine, O = Opposite Leg, H= Hypotenuse)

Caught **A**nother **H**orse

(C=Cosine, A = Adjacent Leg, H= Hypotenuse)

Taking **O**ats **A**way

(T=Tangent, O=Opposite Leg, A = Adjacent Leg)

Sometimes this is shortened to **SOH, CAH, TOA**