

**OBJECTIVE #:** G.SRT.C.6**OBJECTIVE**

Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

**BIG IDEA** (Why is this included in the curriculum?)

- To understand that similarity in right triangles leads to proportional relationships, this produces the trigonometric ratios for the acute angles in a right triangle.
- To find the basic trig ratios from right triangles and understand that the sin, cos, and tan of certain angles in right triangles will always produce the same ratio of corresponding sides (opposite, adjacent, and hypotenuse).

**PREVIOUS KNOWLEDGE** (What skills do they need to have to succeed?)

- The student must know how to find and identify similar triangles.
- The student must know the difference in the parts of right triangles (legs and hypotenuse; opposite, adjacent, and hypotenuse).
- The student must know that non-right angles in right triangles are acute.
- The student must know how to find the missing sides of special right triangles ( $45^\circ$ - $45^\circ$ - $90^\circ$  and  $30^\circ$ - $60^\circ$ - $90^\circ$ ).

**VOCABULARY USED IN THIS OBJECTIVE** (What terms will be essential to understand?)**PREVIOUS VOCABULARY** (Terms used but defined earlier)

- Adjacent: Sharing a vertex and common side.
- Hypotenuse: Longest side in a right triangle. The side directly across from the right angle.
- Right Triangle: Any triangle with exactly one right angle.
- Triangle Sum Theorem: The three angles in any triangle have a sum of  $180^\circ$ .

**NEW VOCABULARY** (New terms and definitions introduced in this objective)

- Cosine: The trigonometric function that is equal to the ratio of the non-hypotenuse side (leg) adjacent a given angle (in a right triangle) to the hypotenuse.
- Sine: The trigonometric function that is equal to the ratio of the side (leg) opposite a given angle (in a right triangle) to the hypotenuse.
- SOH CAH TOA: Mnemonic for remembering the ratios of the three trig functions (Sine Opposite Hypotenuse; Cosine Adjacent Hypotenuse; Tangent Opposite Adjacent)
- Tangent: The trigonometric function that is equal to the ratio of the side (leg) opposite a given angle (in a right triangle) to the non-hypotenuse side (leg) adjacent to the given angle.

**SKILLS** (What will they be able to do after this objective?)

- The student will be able to find the trig ratios for a given acute angle in any right triangle given at least one side.
- The student will be able to calculate (with calculator) the values of trig functions of given angle measures.
- The student will compute the trig ratios of  $30^\circ$ ,  $60^\circ$ , and  $45^\circ$  angles using special right triangles ( $45^\circ$ - $45^\circ$ - $90^\circ$  and  $30^\circ$ - $60^\circ$ - $90^\circ$ ).

**SHORT NOTES** (A short summary of notes so that a teacher can get the basics of what is expected.)

- When given the trig ratios students should see two similar right triangles and how the trig ratios are going to be the same (for example 3,4,5 and 6,8,10 are similar and will produce the same corresponding angle measures thus producing the same trig values for those corresponding angle measures)
- Produce an isosceles right triangle and have students find the  $\sin 45^\circ$ ,  $\cos 45^\circ$ , and  $\tan 45^\circ$ . Some questions for students: Why are the  $\sin 45^\circ$  and  $\cos 45^\circ$  the same? Will these three trig values always be the same as they are here no matter the length of the sides?
- Produce a  $30^\circ$ - $60^\circ$ - $90^\circ$  triangle and have students find the  $\sin 30^\circ$ ,  $\cos 30^\circ$ , and  $\tan 30^\circ$ . Then have the students find the  $\sin 60^\circ$ ,  $\cos 60^\circ$ , and  $\tan 60^\circ$ . Why are the  $\sin 30^\circ$  and  $\cos 60^\circ$  the same? Why are the  $\sin 60^\circ$  and  $\cos 30^\circ$  the same? Will these six trig functions always have the same value no matter the length of the sides?
- Using a calculator have students type in different trig values (including  $\sin/\cos/\tan$  of  $30^\circ, 45^\circ, 60^\circ$ ) to see the correlation between the values.

**MISCONCEPTIONS** (What are the typical errors or difficult areas? Also suggest ways to teach them.)

- Remind students that when they find a ratio of two sides using  $\sin/\cos/\tan$  the given value is not the measure of the angle, but the ratio of the given sides (opposite:hypotenuse; adjacent:hypotenuse; opposite:adjacent)
- Students should have their calculators set to degree mode instead of radians when calculating trig values (unless they want to type in the degree symbol every time).

**FUTURE CONNECTIONS** (What will they use these skills for later?)

- Students will continue to use basic trigonometry ratios in Geometric proofs and also throughout the trigonometry portion of Algebra 2.

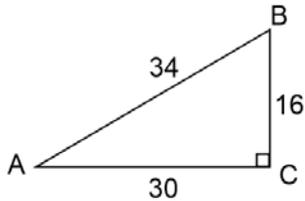
**ADDITIONAL EXTENSIONS OR EXPLANATIONS** (What needs greater explanation?)

- Additional examples are helpful in showing students how to write all the different types of trig ratios.
- Students should see examples when given only two sides to remind them to use the Pythagorean Theorem when missing a third side in a right triangle.
- Have students identify three sides to a right triangle. Have them find a certain trig value ( $\sin/\cos/\tan$ ) and then use the calculator to guess and check the measure of the angle. Then discuss with them if they think there might be an easier way to find the missing side leading into the next lesson.

**ASSESSMENTS** (Questions that get to the heart of the objective – multiple choice, short answer, multi-step)

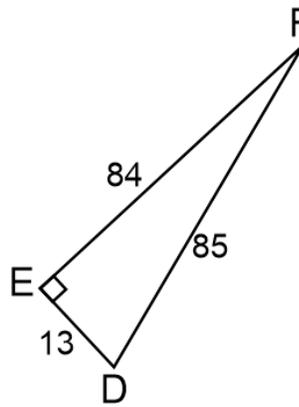
Use the triangles below to find the given trig ratios.

A)



1.  $\sin A = \frac{16}{34} = \frac{8}{17}$
2.  $\cos A = \frac{30}{34} = \frac{15}{17}$
3.  $\tan A = \frac{16}{30} = \frac{8}{15}$
4.  $\sin B = \frac{30}{34} = \frac{15}{17}$
5.  $\cos B = \frac{16}{34} = \frac{8}{17}$
6.  $\tan B = \frac{30}{16} = \frac{15}{8}$

B)



7.  $\sin D = \frac{84}{85}$
8.  $\cos D = \frac{13}{85}$
9.  $\tan D = \frac{84}{13}$
10.  $\sin F = \frac{13}{85}$
11.  $\cos F = \frac{84}{85}$
12.  $\tan F = \frac{13}{85}$

13. Use special right triangles to find the following (leave in simplest radical or fraction form):

a.  $\sin 45^\circ$

$$\frac{\sqrt{2}}{2}$$

b.  $\cos 45^\circ$

$$\frac{\sqrt{2}}{2}$$

c.  $\sin 30^\circ$

$$\frac{1}{2}$$

d.  $\cos 30^\circ$

$$\frac{\sqrt{3}}{2}$$

e.  $\sin 60^\circ$

$$\frac{\sqrt{3}}{2}$$

f.  $\cos 60^\circ$

$$\frac{1}{2}$$

g.  $\tan 45^\circ$

$$1$$

h.  $\tan 30^\circ$

$$\frac{\sqrt{3}}{3}$$

i.  $\tan 60^\circ$

$$\sqrt{3}$$

14. Find the given trig values (round to the nearest thousandth):

a.  $\sin 43^\circ$

$$0.682$$

b.  $\cos 17^\circ$

$$0.956$$

c.  $\tan 88^\circ$

$$28.636$$

d.  $\sin 58^\circ$

$$0.848$$

e.  $\cos 32^\circ$

$$0.848$$

f.  $\tan 25^\circ$

$$0.466$$