

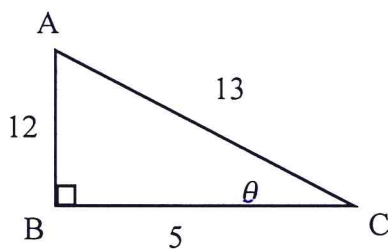
Trigonometry is a type of geometry that works with triangles. You are doing trigonometry when you are using both *side lengths* and *angle measurements* in the same triangle.

To start using trigonometry, you need three new equations. These equations all follow the same basic pattern:

$$\sin \angle A = \frac{\text{opposite side}}{\text{hypotenuse}} \quad \cos \angle A = \frac{\text{adjacent side}}{\text{hypotenuse}} \quad \tan \angle A = \frac{\text{opposite side}}{\text{adjacent side}}$$

Each of those equations compares an angle and two sides. We need all three because there are three different pairs of sides we could use. There is a helpful saying you can say to remember these three equations. Just remember **SOH-CAH-TOA**. Trust me. Say it aloud to yourself a couple of times. 😊

Example #1 Find the value of sine, cosine, and tangent functions for θ



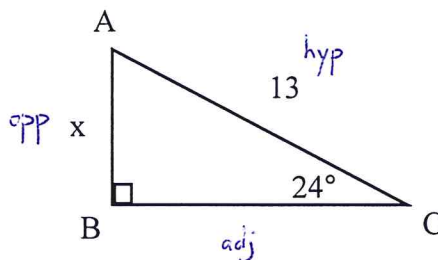
$$\sin \theta = \frac{12}{13}$$

$$\cos \theta = \frac{5}{13}$$

$$\tan \theta = \frac{12}{5}$$

Example #2

Sometimes you will be given a triangle that will have two sides and an angle. Sometimes the angle will be a variable and sometimes one of the sides will be a variable. Here is an example of a triangle you could be given.



Step 1: Our goal is to find the hypotenuse, the adjacent side, and the opposite side. Let's start with the hypotenuse. This is the easy one because it will always be across from the right angle.

What side is the hypotenuse? AC

Hopefully you said side AC. LABEL IT "hyp." in the picture above.

Now we want to find the other two sides. However, how we label the other two sides is ENTIRELY dependent on which angle we use. So therefore we must decide which angle of the triangle to use.

Algebra 2B

Trigonometry Introduction

Now you're saying "Mr. Ward, we are given two angles, Angle B and Angle C, which one do we use?" What I'm going to say next will help you decide. Read very carefully. WE WILL **NEVER** USE THE RIGHT ANGLE!!!

Therefore which angle will we use? Angle C

Hopefully you said Angle C.

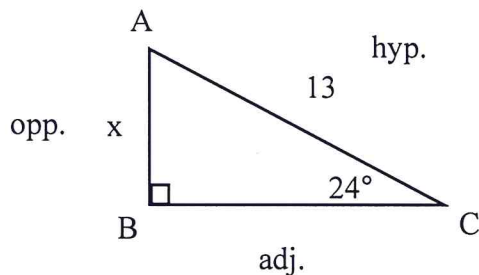
Now that we know we are going to use Angle C,

Which side then becomes the opposite side? AB LABEL IT "opp." in the picture.

Which side becomes the adjacent side? BC LABEL IT "adj." in the picture.

Hopefully you said side AB for the first question and side BC for the second question. If you did not, don't just fix them, come see me for help! It is extremely important that this step be done correctly!

Step 2: Now that we have our triangle labeled we need to ask ourselves, *Are we going to use sine, cosine, or tangent?*



Out of three sides, circle the two that you have a number/variable for:

Opposite

Adjacent

Hypotenuse

Hopefully you circled opposite and hypotenuse. Now, looking at our three choices below, circle the equation that has opposite and hypotenuse in it.

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

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

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

If you circled the sine equation, then pat yourself on the back and continue.

Step 3: Set up and solve the equation.

Write out the sine equation. Put the 13 into the hypotenuse spot. Put the x into the opposite side spot. Then put 24 into the angle spot (next to the sine).

$\sin \underline{24} = \frac{x}{13}$

Now that you've got it set up, put a 1 underneath the sin 24 part (just like a fraction). Now you will need to cross multiply (and if necessary divide too). Solve it below.

$$\frac{\sin 24}{1} = \frac{x}{13}$$

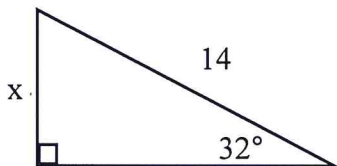
$$x = 13 \cdot \sin 24$$

$$x = 5.29$$

If you did not get the 5.29 for x, come see me and ask for help. It is important that you know and understand the proper way to solve these types of problems! ☺

*** I will now show you how to do one of these types of problems. Watch closely how I solve them because you will be doing the one right next to it. ***

Step 1: Label the different sides.



Step 2: Which equation am I going to use?

I have the opposite side and the hypotenuse so therefore I will be using the sine equation.

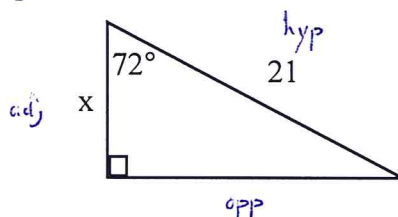
Step 3: Set up and solve

$$\sin 32^\circ = \frac{x}{14}$$

$$x = 14 \cdot \sin 32^\circ$$

$$x = 7.42$$

Step 1:



Step 2:

I have adj and hyp so I will use cosine.

Step 3:

$$\frac{\cos 72^\circ}{1} = \frac{x}{21}$$

$$x = 21 \cdot \cos 72^\circ$$

$$x = 6.49$$

Reciprocal Trig. Values (Cosecant, Secant, and Cotangent)

$$\csc \angle A = \frac{\text{hypotenuse}}{\text{opposite}}$$

$$\sec \angle A = \frac{\text{hypotenuse}}{\text{adjacent}}$$

$$\cot \angle A = \frac{\text{adjacent}}{\text{opposite}}$$

These values are the reciprocals of sine, cosine, and tangent respectively. If you notice each one is just the reciprocal of the original trig function. So if a problem asked you for the cosecant, all you would have to do is find the sine and take the reciprocal of your answer. We will use all 6 of these trigonometric values when solving certain types of problems.

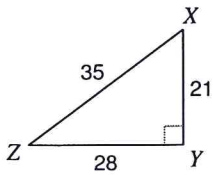
Assignment: Kuta Worksheet

Trigonometric Ratios

SOH - CAH - TOA

Date _____ Period _____

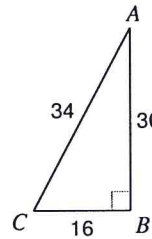
Find the value of each trigonometric ratio.

1) $\tan Z$ 

$$\tan Z = \frac{21}{28} \quad \cot Z = \frac{28}{21}$$

$$\sin Z = \frac{21}{35} \quad \csc Z = \frac{35}{21}$$

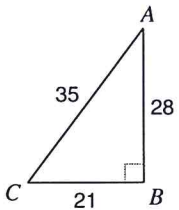
$$\cos Z = \frac{28}{35} \quad \sec Z = \frac{35}{28}$$

2) $\cos C$ 

$$\cos C = \frac{16}{34} \quad \sec C = \frac{34}{16}$$

$$\sin C = \frac{30}{34} \quad \csc C = \frac{34}{30}$$

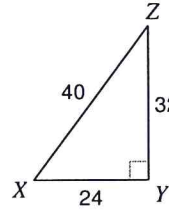
$$\tan C = \frac{30}{16} \quad \cot C = \frac{16}{30}$$

3) $\sin C$ 

$$\sin C = \frac{28}{35} \quad \csc C = \frac{35}{28}$$

$$\cos C = \frac{21}{35} \quad \sec C = \frac{35}{21}$$

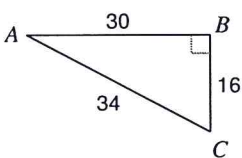
$$\tan C = \frac{28}{21} \quad \cot C = \frac{21}{28}$$

4) $\tan X$ 

$$\tan X = \frac{32}{24} \quad \cot X = \frac{24}{32}$$

$$\sin X = \frac{32}{40} \quad \csc X = \frac{40}{32}$$

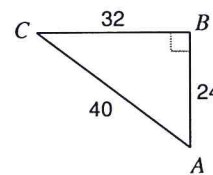
$$\cos X = \frac{24}{40} \quad \sec X = \frac{40}{24}$$

5) $\cos A$ 

$$\cos A = \frac{30}{34} \quad \sec A = \frac{34}{30}$$

$$\sin A = \frac{16}{34} \quad \csc A = \frac{34}{16}$$

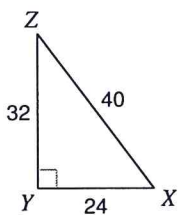
$$\tan A = \frac{16}{30} \quad \cot A = \frac{30}{16}$$

6) $\sin A$ 

$$\sin A = \frac{32}{40} \quad \csc A = \frac{40}{32}$$

$$\cos A = \frac{24}{40} \quad \sec A = \frac{40}{24}$$

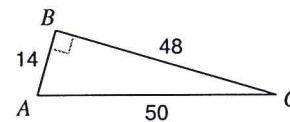
$$\tan A = \frac{32}{24} \quad \cot A = \frac{24}{32}$$

7) $\sin Z$ 

$$\sin Z = \frac{24}{40} \quad \csc Z = \frac{40}{24}$$

$$\cos Z = \frac{32}{40} \quad \sec Z = \frac{40}{32}$$

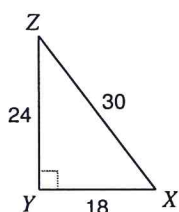
$$\tan Z = \frac{24}{32} \quad \cot Z = \frac{32}{24}$$

8) $\sin C$ 

$$\sin C = \frac{14}{50} \quad \csc C = \frac{50}{14}$$

$$\cos C = \frac{48}{50} \quad \sec C = \frac{50}{48}$$

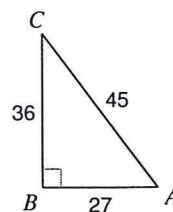
$$\tan C = \frac{14}{48} \quad \cot C = \frac{48}{14}$$

9) $\cos Z$ 

$$\cos Z = \frac{24}{30} \quad \sec Z = \frac{30}{24}$$

$$\sin Z = \frac{18}{30} \quad \csc Z = \frac{30}{18}$$

$$\tan Z = \frac{18}{24} \quad \cot Z = \frac{24}{18}$$

10) $\tan C$ 

$$\tan C = \frac{27}{36} \quad \cot C = \frac{36}{27}$$

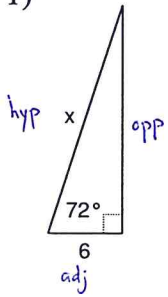
$$\sin C = \frac{27}{45} \quad \csc C = \frac{45}{27}$$

$$\cos C = \frac{36}{45} \quad \sec C = \frac{45}{36}$$

Solving Right Triangles

Find the missing side. Round to the nearest tenth.

1)



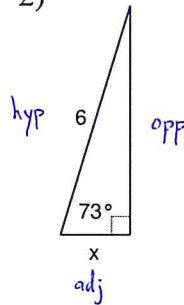
$$\frac{\cos 72}{1} = \frac{6}{x}$$

$$\frac{6}{\cos 72} = \frac{x \cdot \cancel{\cos 72}}{\cancel{\cos 72}}$$

$$x = \frac{6}{\cos 72}$$

$$x = 19.42$$

2)

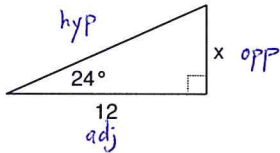


$$\frac{\cos 73}{1} = \frac{x}{6}$$

$$x = 6 \cdot \cos 73$$

$$x = 1.75$$

3)

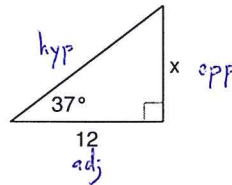


$$\frac{\tan 24}{1} = \frac{x}{12}$$

$$x = 12 \cdot \tan 24$$

$$x = 5.34$$

4)

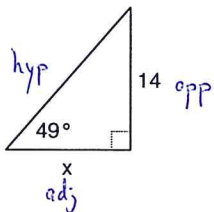


$$\frac{\tan 37}{1} = \frac{x}{12}$$

$$x = 12 \cdot \tan 37$$

$$x = 9.04$$

5)



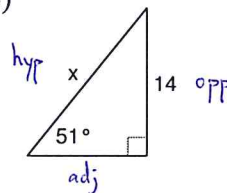
$$\frac{\tan 49}{1} = \frac{14}{x}$$

$$\frac{14}{\tan 49} = \frac{x \cdot \cancel{\tan 49}}{\cancel{\tan 49}}$$

$$x = \frac{14}{\tan 49}$$

$$x = 12.17$$

6)



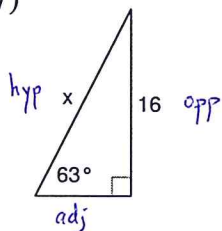
$$\frac{\sin 51}{1} = \frac{14}{x}$$

$$\frac{14}{\sin 51} = \frac{x \cdot \cancel{\sin 51}}{\cancel{\sin 51}}$$

$$x = \frac{14}{\sin 51}$$

$$x = 18.01$$

7)



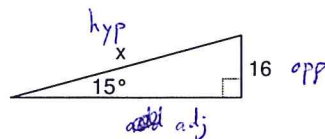
$$\frac{\sin 63}{1} = \frac{16}{x}$$

$$\frac{16}{\sin 63} = \frac{x \cdot \cancel{\sin 63}}{\cancel{\sin 63}}$$

$$x = \frac{16}{\sin 63}$$

$$x = 17.96$$

8)



$$\frac{\sin 15}{1} = \frac{16}{x}$$

$$\frac{16}{\sin 15} = \frac{x \cdot \cancel{\sin 15}}{\cancel{\sin 15}}$$

$$x = \frac{16}{\sin 15}$$

$$x = 61.82$$