Transition to College Math Name ______________________________

Period __________

Date:

Unit: 3 Trigonometry

Lesson: 1 Right-Angle Trigonometry

Essential Question: **The diameter of the Earth's orbit is about 300,000,000 km. As the Earth orbits the sun, stars lying in the plane of the Earth's orbit appear to shift their position by a small angle throughout the year. This is called parallax. The definition of a parsec is the distance to a star whose yearly parallax is 1 second of arc. Explain how you would determine the length of a parsec?**

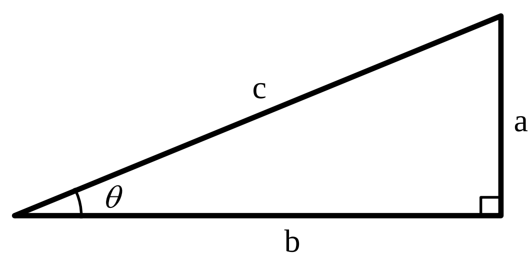
Standard: F-TF.3

Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.

Learning Target:

Understand and use trigonometric relationships of acute angles in triangles. Determine the side lengths of right triangles by using trigonometric functions. Find the ratio of the opposite side to the hypotenuse of a right triangle when the angle is 30°.

Definitions:



Sine:

$$\sin\theta = \frac{opposite\ side}{hypotenuse} = \frac{a}{c}$$

Cosine:

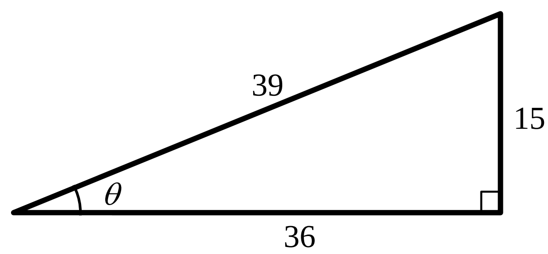
$$\cos\theta = \frac{adjacent\ side}{hypotenuse} = \frac{b}{c}$$

Tangent:

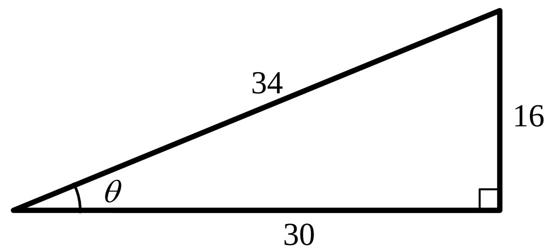
$$\tan\theta = \frac{opposite\ side}{adjacent\ side} = \frac{a}{b}$$

Summary

In your own words, define the following terms:	
Right Triangle	
Opposite Side	
Adjacent Side	
Hypotenuse	
Trigonometry	

***Similar Triangles*: *Example 1*:**	Triangles are similar if they have the same shape, but can be different sizes.[1] The ratios of corresponding sides in similar triangles are the same. Moreover, corresponding angles are equal. Therefore, the values of the trigonometric functions depend only on the angle, not the size of the triangle.  $\sin\theta = \frac{opposite\ side}{hypotenuse} = \frac{15}{39} = \frac{5}{13}$ $\cos\theta = \frac{adjacent\ side}{hypotenuse} = \frac{36}{39} = \frac{12}{13}$ $\tan\theta = \frac{opposite\ side}{adjacent\ side} = \frac{15}{36} = \frac{5}{12}$
Define: ***Similarity***	

[1] http://www.mathopenref.com/similartriangles.html

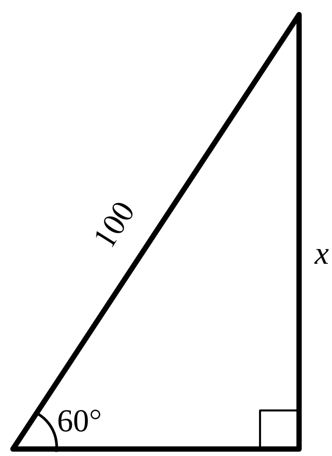
Exercise 1:	Find the values for the sine, cosine, and tangent functions for angle θ. 

Frequently Used Angles:	Three angles occur frequently: 30°, 45°, and 60°. The following table depicts the values of three trigonometric functions of these three angles.

	30°	45°	60°
Sine	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$
Cosine	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$
Tangent	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$

Example 2:

Use a trigonometric function to find the value of *x*.

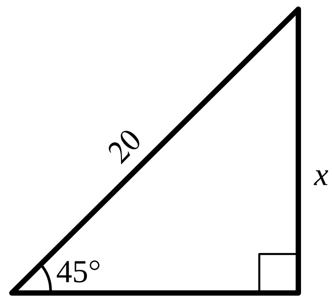


$$\sin 60 = \frac{opposite\ side}{hypotenuse} = \frac{x}{100}$$

$$x = 100 \sin 60 = 100\frac{\sqrt{3}}{2} = 50\sqrt{3}$$

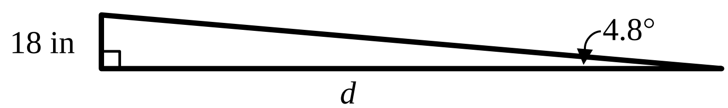
***Exercise 2*:**

Use a trigonometric function to find the value of x.



***Example 3*:**

A builder is constructing a wheelchair ramp from the ground to a deck with a height of 18 in. The angle between the ground and the ramp must be 4.8°. To the nearest inch, what should be the distance *d* between the end of the ramp and the deck?



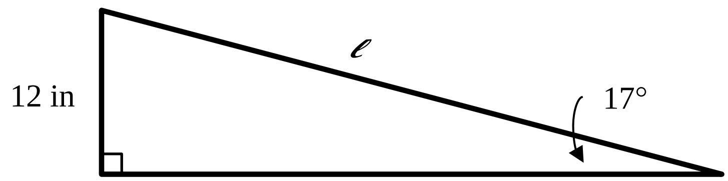
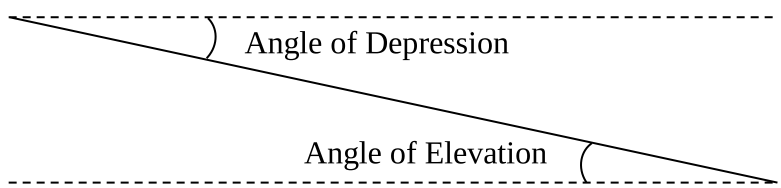
$$\tan 4.8° = \frac{opposite\ side}{adjacent\ side} = \frac{18}{d}$$

$$d = \frac{18}{\tan 4.8}$$

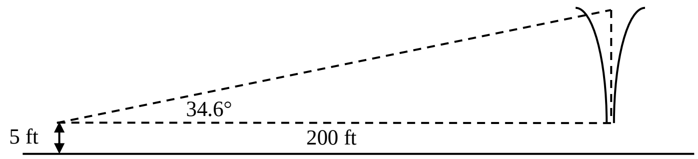
Using a calculator,

```
18/tan(4.8)
        214.356283
█
```

$$d \cong 214\ in = 17\ ft\ 10\ in$$

***Exercise 3*:**	A skateboard ramp will have a height of 12 in, and the angle between the ramp and the ground will be 17°. To the nearest inch, what will be the length ℓ of the ramp? 
***Angle of Elevation/Depression*:**	When an object is above or below another object, you can find the distances indirectly by using the ***angle of elevation*** or the ***angle of depression***.  Since the dashed lines are parallel, the angle of elevation equals the angle of depression.
***Example 4*:**	A park ranger whose eye level is 5 ft above the ground measures the angle of elevation to the top of an eruption of a geyser to be 34.6°. If the ranger is standing 200 ft from the geyser's base, what is the height of the eruption to the nearest foot? 

Step 1: Draw and label a diagram to depict the information given in the problem.



Step 2: Let *x* represent the height of the eruption compared to the ranger's eye level. Determine the value of *x*.

$$\tan 34.6° = \frac{opposite\ side}{adjacent\ side} = \frac{x}{200}$$

$$x = 200 \tan 34.6$$

Using a calculator,

```
200tan(34.6)
     137.9707584
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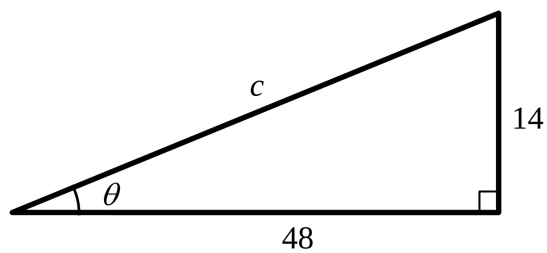
$$x \cong 138$$

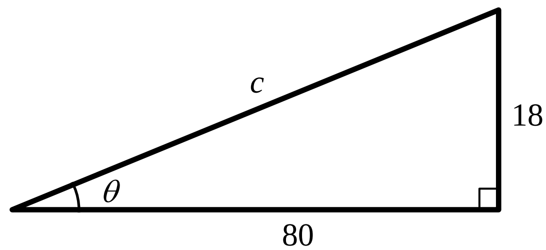
Step 3: Determine the overall height of the eruption.

$$x + 5 = 138 + 5 = 143$$

The height of the eruption is about 143 ft.

***Exercise 4*:**	A surveyor whose eye level is 6 ft above the ground measures the elevation to the highest hill on a roller coaster to be 60.7°. If the surveyor is standing 120 ft from the hill's base, what is the height of the hill to the nearest foot?

Reciprocal Trigonometric Functions:	The reciprocals of the sine, cosine, and tangent functions are also trigonometric functions. They are defined below:
cosecant:	$\csc\theta = \dfrac{1}{\sin\theta} = \dfrac{hypotenuse}{opposite\ side}$
secant:	$\sec\theta = \dfrac{1}{\cos\theta} = \dfrac{hypotenuse}{adjacent\ side}$
cotangent:	$\cot\theta = \dfrac{1}{\tan\theta} = \dfrac{adjacent\ side}{opposite\ side}$
Example 5:	Find the values for the six trigonometric functions for θ.  First find the length of the hypotenuse, *c*. Using the Pythagorean Theorem, $c^2 = 48^2 + 14^2$ $= 2304 + 196 = 2500$ $c = 50$ $\sin\theta = \frac{14}{50} = \frac{7}{25}$ $\csc\theta = \frac{1}{\sin\theta} = \frac{25}{7}$ $\cos\theta = \frac{48}{50} = \frac{24}{25}$ $\sec\theta = \frac{1}{\cos\theta} = \frac{25}{24}$ $\tan\theta = \frac{14}{48} = \frac{7}{24}$ $\cot\theta = \frac{1}{\tan\theta} = \frac{24}{7}$

Exercise 5:	Find the values for the six trigonometric functions for θ. 
Class work:	p 697 Guided Practice: 1-12
Homework:	p 697 Practice and Problem Solving: 13-36