# Introduction to Trigonometry

The field of mathematics called Trigonometry is the study of _____ triangles and the ratios between the sides.

There are 3 of these relationships that we study:

- Sine is the ratio of the _____ side to the _____.

- Cosine is the ratio of the _____ side to the _____.

- Tangent is the ratio of the _____ side to the _____ side.

- The _____ NEVER changes, but _____ and _____ are dependent on the _____ used. The _____ angle is NEVER used.

The three sides of the triangles are referred to as Hypotenuse (H), Adjacent (A), and Opposite (O). Label each side of each triangle using angle W as your reference.
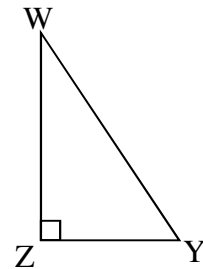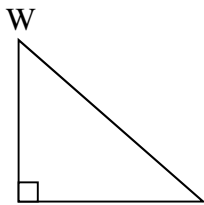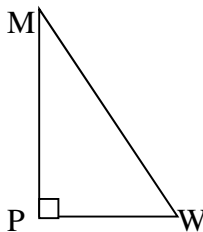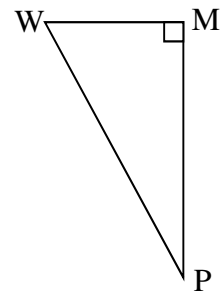
Ex 1.

Ex 2.   Y   Z

            W

Ex 3.   W

            Z   Y

1.   W

2.   M

         P   W

3.   W   M

                  P
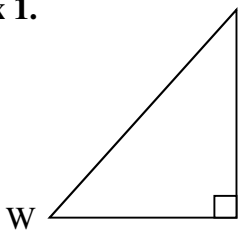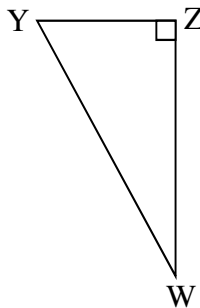
To help you remember these relationships, you can use the phrase _____ _____ _____.

Where: S: sine (sin)   O: opposite
         C: cosine (cos)   A: adjacent
         T: tangent (tan)   H: hypotenuse

The trigonometric ratios are written in an equation form. The Greek letter _____ (θ) is often used to represent an angle. Our angles will always be measured in _____.

$$Sine\ \theta = \frac{\qquad}{\qquad} \qquad Cosine\ \theta = \frac{\qquad}{\qquad} \qquad Tangent\ \theta = \frac{\qquad}{\qquad}$$

Use the triangle at the right to determine the following ratios. Be sure to simplify your answers!

Ex 4. $\sin 40° = $ —————

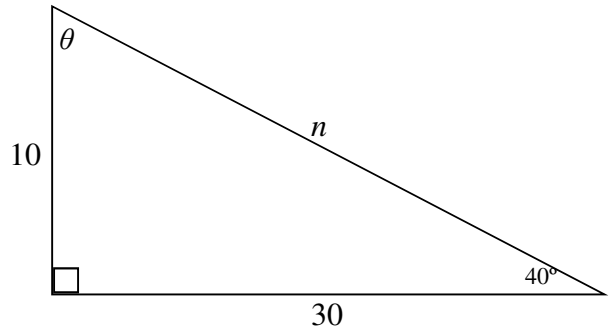**Ex 5.** $\sin \theta = $ —————

Ex 6. $\cos 40° = $ —————

Ex 7. $\cos \theta = $ —————

Ex 8. $\tan 40° = $ —————

Ex 9. $\tan \theta = $ —————

Use the triangle at the right to determine the following ratios. Be sure to simplify your answers!
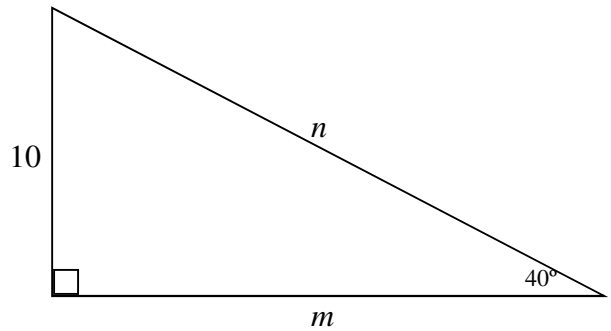
4. $\sin 40° = $ —————

5. $\sin 50° = $ —————

6. $\cos 40° = $ —————

7. $\cos 50° = $ —————

8. $\tan 40° = $ —————
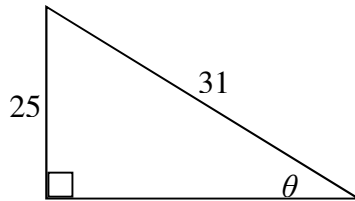
9. $\tan 50° = $ —————

Set up equations using trig ratios that could be used to solve for the variable.

10.
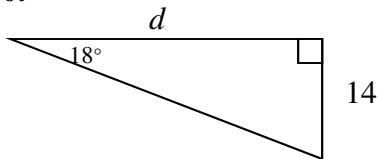
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12.
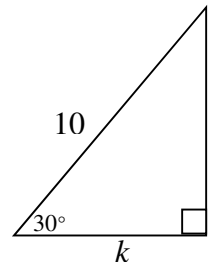
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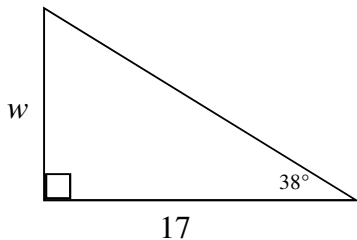
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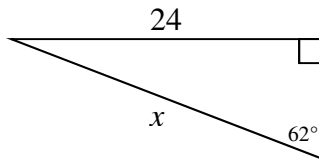
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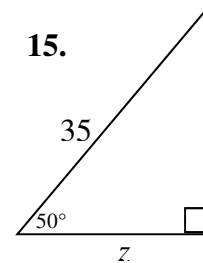
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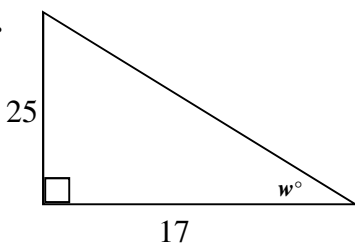
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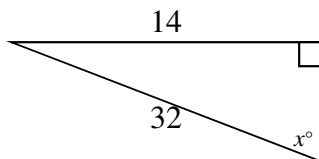
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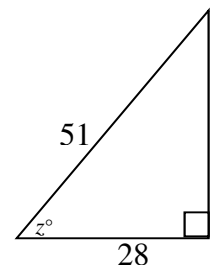
You can also take the reciprocal of each trigonometric function.

Turn the page. Worksheet continues.

The Reciprocal Trigonometric Ratios are as follows:

- Reciprocal of Sine Function:

    Cosecant (csc) is the ratio of the _____ side to the _____.

    Cosecant is also: $\csc\theta = \dfrac{1}{\sin\theta}$

- Reciprocal of Cosine Function:

    Secant (sec) is the ratio of the _____ side to the _____.

    Secant is also: $\sec\theta = \dfrac{1}{\cos\theta}$

- Reciprocal of Tangent Function:

    Cotangent (cot) is the ratio of the _____ side to the _____.

    Cotangent is also: $\cot\theta = \dfrac{1}{\tan\theta}$

Use the triangle at the right to determine the following ratios. *Be sure to simplify your answers!*

Ex 9. $\csc\theta$ = _____   **1.** $\csc 40°$ = _____
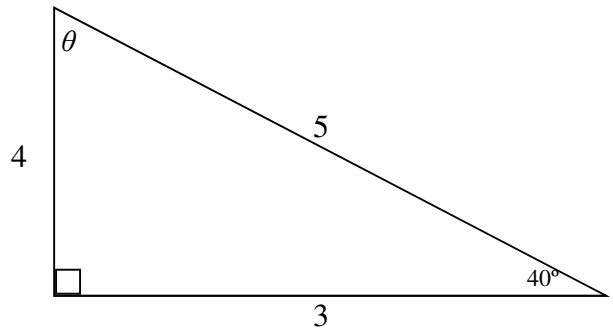
Ex 10. $\sec\theta$ = _____   **2.** $\sec 40°$ = _____

Ex 11. $\cot\theta$ = _____   **3.** $\cot 40°$ = _____

**Set up equations using trig ratios that could be used to solve for the variable.**

19.

20.

21.

$\csc w° =$ _____ $\csc x° =$ _____ $\csc z° =$ _____

$\sec w° =$ _____ $\sec x° =$ _____ $\sec z° =$ _____

$\cot w° =$ _____ $\cot x° =$ _____ $\cot z° =$ _____

Name:_____   Period _____   GH
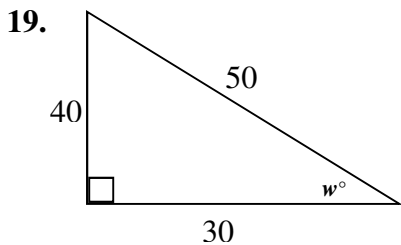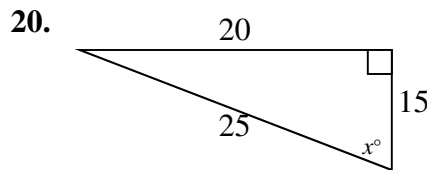
Trigonometry Applications

Set up equations that could be used to solve each problem.
Step 1: Draw a picture
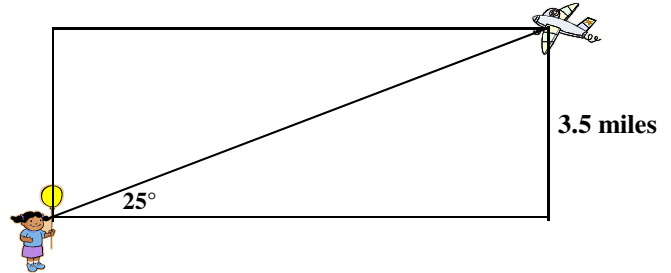**Step 2: Label picture**
Step 3: Pick the best trig ratio
Step 4: Set up equation

> *Angle of depression – looking down from a horizontal line*
>
> *Angle of elevation – looking up from a horizontal line*

Ex. 1 Angie looks up at 25 degrees to see an airplane flying toward her. If the plane is flying at an altitude of 3.5 miles, how far is it from being directly above Angie?

3.5 miles

25°

Ex. 2 A six foot vertical pole casts a shadow of 11 feet. What is the angle of elevation with the ground?

Ex. 3 Lauren is at the top of a 15 meter tall lookout tower. She looks down at an angle of depression of 25° and sees Evan coming toward her. How far is Evan from the base of the tower?

1. What is the angle of elevation if you stand 850 feet away from a cliff that is 400 feet high and look at the top?

2. The string of a flying kite makes an angle of 63° with the ground. If all 250 feet of string are out, and there is no sag in the string, how high is the kite?

3. Tal's hill at Minute Maid Park has an elevation of 30°. If the hill has a six foot vertical rise, how long is its hypotenuse?

☞Turn the page. Worksheet continues.

4. Joey is putting up an antenna. At the 30 foot mark, he attaches a 50 foot guy wire. What angle does the guy wire form with the antenna?

5. A person at the top of a cliff 100 feet tall sees Gilligan's boat. His sighting of the boat is at an angle of depression of 10°. How far is the boat from the base of the cliff?

6. A 24 foot ladder is leaned against a wall at 55° with the ground. How far away from the wall is the base of the ladder?

7. A 32 in. bat is leaning against a fence. If the bat is 15 in. away from the base of the fence, what angle is formed between the ground and the bat?

8. A plane takes off at an elevation of 20°. In its path, 500 feet away from the takeoff point, is a 170-ft tall tower. Will the plan clear the tower? If yes, by how much?

9. Ana knows that she is one mile from the base of a tower. Using a protractor she estimates an angle of elevation to be 3°. How tall is the tower to the nearest foot? (1 mile = 5280 feet)

10. The base of an isosceles triangle has a length of 16cm. and the vertex angle measures 68°. What is the length of each leg? Round to the nearest tenth of a cm.

11. Matt hiked to the top of the smaller cliff shown below. From the top, he could see the bottom of the large cliff at an angle of depression of 25°. He could see the top of the large cliff at an angle of elevation of 20°. Find the height of each cliff (x and y).