

# Geometry: 9.4-9.6 Notes

NAME \_\_\_\_\_

## 9.4 Use the Tangent Ratio

Date: \_\_\_\_\_

### Define Vocabulary:

trigonometric ratio –

tangent –

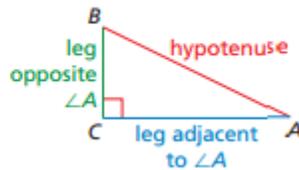
angle of elevation –

### Tangent Ratio

Let  $\triangle ABC$  be a right triangle with acute  $\angle A$ .

The tangent of  $\angle A$  (written as  $\tan A$ ) is defined as follows.

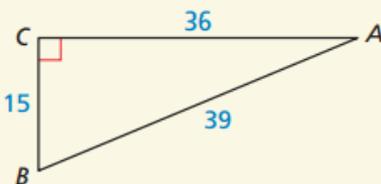
$$\tan A = \frac{\text{length of leg opposite } \angle A}{\text{length of leg adjacent to } \angle A} = \frac{BC}{AC}$$



### Examples: Finding Tangent Ratios

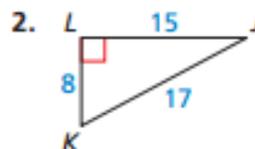
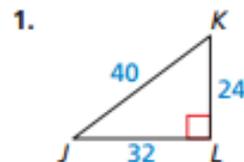
#### WE DO

Find  $\tan A$  and  $\tan B$ . Write each answer as a fraction and as a decimal rounded to four places.



#### YOU DO

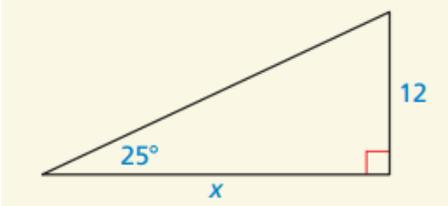
Find  $\tan J$  and  $\tan K$ . Write each answer as a fraction and as a decimal rounded to four places.



**Examples: Finding a leg length.**

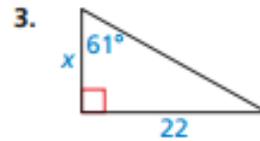
**WE DO**

Find the value of  $x$ . Round your answer to the nearest tenth.



**YOU DO**

Find the value of  $x$ . Round your answer to the nearest tenth.



**Examples: Using Special Right triangle to find a Tangent.**

**WE DO**

Use a special right triangle to find the tangent of a  $30^\circ$  angle.

**YOU DO**

Use a special right triangle to find the tangent of  $45^\circ$ .

**Examples: Modeling with Mathematics**

**WE DO**

You are measuring the height of a tree. You stand 40 feet from the base of the tree. The angle of elevation to the top of the tree is  $65^\circ$ . Find the height of the tree to the nearest foot.

**YOU DO**

You are measuring the height of a lamppost. You stand 40 inches from the base of the lamppost. You measure the angle of elevation from the ground to the top of the lamppost to be  $70^\circ$ . Find the height  $h$  of the lamppost to the nearest inch.

Assignment	
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**Define Vocabulary:**

sine –

cosine –

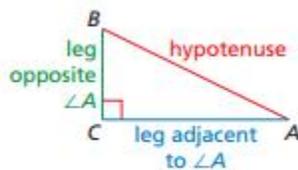
angle of depression –

**Sine and Cosine Ratios**

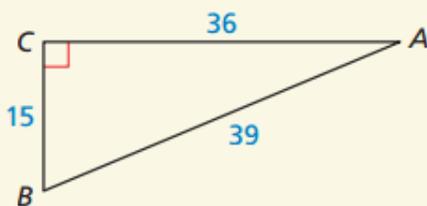
Let  $\triangle ABC$  be a right triangle with acute  $\angle A$ . The sine of  $\angle A$  and cosine of  $\angle A$  (written as  $\sin A$  and  $\cos A$ ) are defined as follows.

$$\sin A = \frac{\text{length of leg opposite } \angle A}{\text{length of hypotenuse}} = \frac{BC}{AB}$$

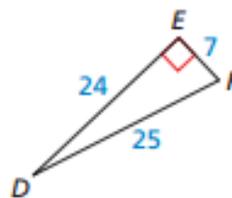
$$\cos A = \frac{\text{length of leg adjacent to } \angle A}{\text{length of hypotenuse}} = \frac{AC}{AB}$$

**Examples: Finding Sine and Cosine Ratios.****WE DO**

Find  $\sin A$ ,  $\sin B$ ,  $\cos A$ , and  $\cos B$ . Write each answer as a fraction and as a decimal rounded to four places.

**YOU DO**

Find  $\sin D$ ,  $\sin F$ ,  $\cos D$ , and  $\cos F$ . Write each answer as a fraction and as a decimal rounded to four places.



### Sine and Cosine of Complementary Angles

The sine of an acute angle is equal to the cosine of its complement. The cosine of an acute angle is equal to the sine of its complement.

Let  $A$  and  $B$  be complementary angles. Then the following statements are true.

$$\sin A = \cos(90^\circ - A) = \cos B \quad \sin B = \cos(90^\circ - B) = \cos A$$

$$\cos A = \sin(90^\circ - A) = \sin B \quad \cos B = \sin(90^\circ - B) = \sin A$$

### Examples: Rewriting Trigonometric Expressions.

#### WE DO

Write  $\cos 68^\circ$  in terms of sine.

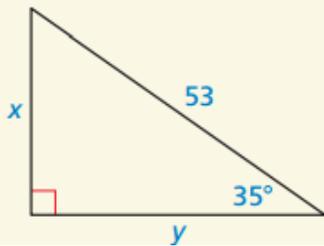
#### YOU DO

Write  $\cos 23^\circ$  in terms of sine.

### Examples: Finding Leg Lengths

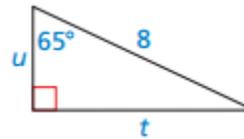
#### WE DO

Find the values of  $x$  and  $y$  using sine and cosine. Round your answers to the nearest tenth.



#### YOU DO

Find the values of  $u$  and  $t$  using sine and cosine. Round your answers to the nearest tenth.

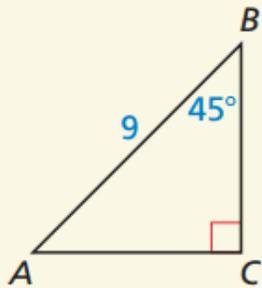


**Examples: Finding Sine and Cosine in Special Right Triangles.**

**WE DO**

Which ratios are equal to  $\frac{\sqrt{2}}{2}$ ? Select all that apply.

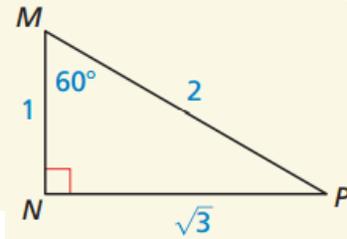
- $\sin A$
- $\cos A$
- $\tan A$
- $\sin B$
- $\cos B$
- $\tan B$



**YOU DO**

Which ratios are equal to  $\frac{\sqrt{3}}{2}$ ? Select all that apply.

- $\sin M$
- $\sin P$
- $\cos M$
- $\cos P$



**Examples: Modeling with Mathematics**

**WE DO**

**You are skiing down a hill with an altitude of 800 feet. The angle of depression is  $15^\circ$ . Find the distance  $x$  you ski down the hill to the nearest foot.**

**YOU DO**

A camera attached to a kite is filming the damage caused by a brush fire in a closed-off area. The camera is directly above the center of the closed-off area. A person is standing 100 feet away from the center of the closed-off area. The angle of depression from the camera to the person flying the kite is  $60^\circ$ . How long is the string on the kite?

Assignment	
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**Define Vocabulary:**

inverse tangent –

inverse sine –

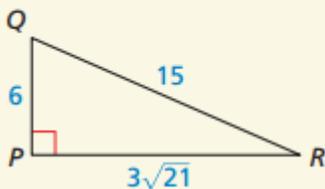
inverse cosine –

solve a right triangle –

**Examples: Identifying Angles from Trigonometric Ratios**

**WE DO**

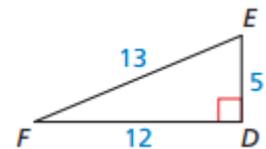
Determine which of the two acute angles has a sine of 0.4.



**YOU DO**

Determine which of the two acute angles has the given trigonometric ratio.

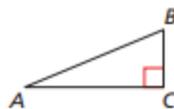
1. The sine of the angle is  $\frac{12}{13}$ .



2. The tangent of the angle is  $\frac{5}{12}$ .

**Inverse Trigonometric Ratios**

Let  $\angle A$  be an acute angle.



**Inverse Tangent** If  $\tan A = x$ , then  $\tan^{-1} x = m\angle A$ .       $\tan^{-1} \frac{BC}{AC} = m\angle A$

**Inverse Sine** If  $\sin A = y$ , then  $\sin^{-1} y = m\angle A$ .       $\sin^{-1} \frac{BC}{AB} = m\angle A$

**Inverse Cosine** If  $\cos A = z$ , then  $\cos^{-1} z = m\angle A$ .       $\cos^{-1} \frac{AC}{AB} = m\angle A$

## Examples: Finding Angle Measures

### WE DO

Let  $\angle A$ ,  $\angle B$ , and  $\angle C$  be acute angles.  
Use a calculator to approximate the measures of  $\angle A$ ,  $\angle B$ , and  $\angle C$  to the nearest tenth of a degree.

- $\tan A = 3.29$
- $\sin B = 0.55$
- $\cos C = 0.87$

### YOU DO

Let  $\angle G$ ,  $\angle H$ , and  $\angle K$  be acute angles.  
Use a calculator to approximate the measures of  $\angle G$ ,  $\angle H$ , and  $\angle K$  to the nearest tenth of a degree.

- $\tan G = 0.43$
- $\sin H = 0.68$
- $\cos K = 0.94$

### **Solving a Right Triangle**

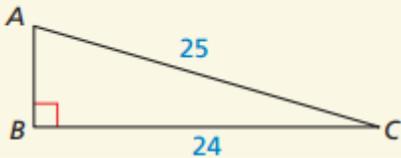
To **solve a right triangle** means to find all unknown side lengths and angle measures. You can solve a right triangle when you know either of the following.

- two side lengths
- one side length and the measure of one acute angle

## Examples: Solving a Right Triangle

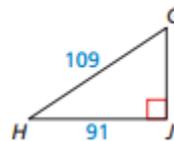
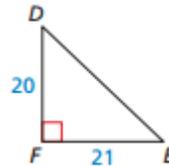
### WE DO

Solve the right triangle. Round decimal answers to the nearest tenth.



### YOU DO

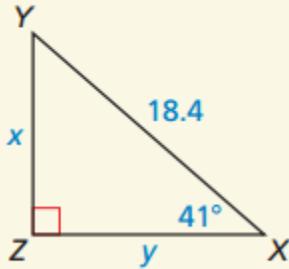
Solve the right triangle. Round decimal answers to the nearest tenth.



## Examples: Solving a Right Triangle

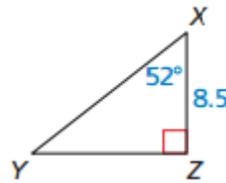
### WE DO

Solve the right triangle. Round decimal answers to the nearest tenth.



### YOU DO

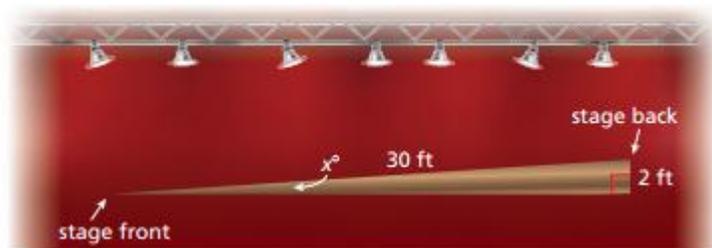
Solve the right triangle. Round decimal answers to the nearest tenth.



## Examples: Solving a Real-Life Problem

### WE DO

Use the information in Example 5. Another raked stage is 25 feet long from front to back with a total rise of 1.5 feet. You want the rake to be  $5^\circ$  or less. Is the raked stage within your desired range? Explain.



Assignment	
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