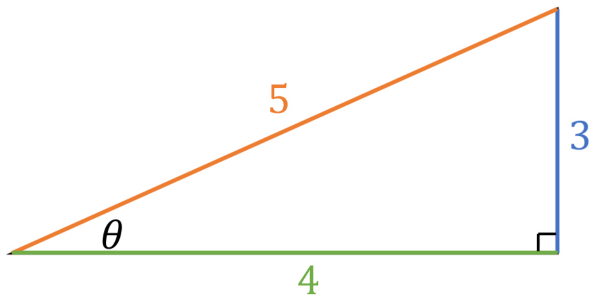
TOPIC: TRIGONOMETRIC FUNCTIONS ON RIGHT TRIANGLES

Introduction to Trigonometric Functions

- **Trig Functions** relate ________ to side lengths in right triangles.
  - The three main trig functions are Sine, Cosine, & Tangent which are _________.



SOH-CAH-TOA

New — **Trig Functions**

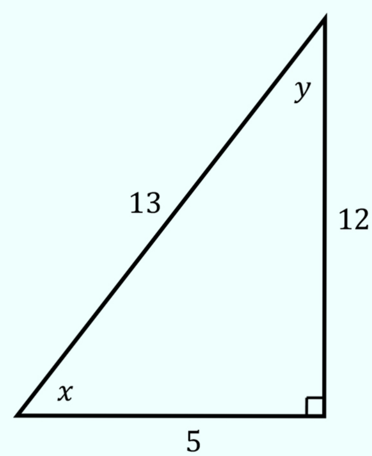
SOH	CAH	TOA
$\sin\theta = \frac{\text{Opposite Side}}{\text{Hypotenuse}}$	$\cos\theta = \frac{\text{Adjacent Side}}{\text{Hypotenuse}}$	$\tan\theta = \frac{\text{Opposite Side}}{\text{Adjacent Side}} = \frac{\sin\theta}{\cos\theta}$
$\sin\theta = \frac{\quad}{\quad}$	$\cos\theta = \frac{\quad}{\quad}$	$\tan\theta = \frac{\quad}{\quad}$

EXAMPLE Find the value of the trig function indicated, given the triangle.

(***A***) $\sin x$

(***B***) $\tan x$

(***C***) $\cos y$



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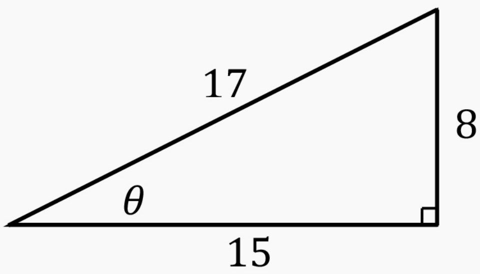
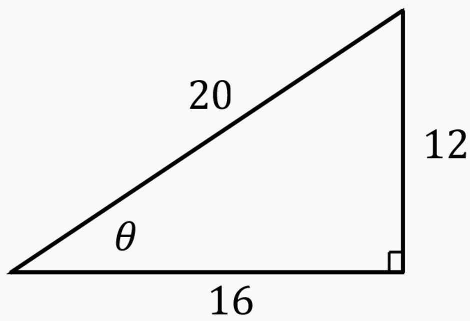
PRACTICE Given the right triangle below, evaluate $\cos(\theta)$.



PRACTICE Given the right triangle below, evaluate $\tan(\theta)$.



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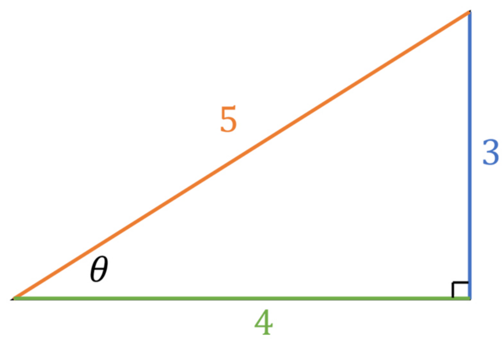
Fundamental Trigonometric Identities

- The other three trig functions are cosecant, secant, & cotangent.
  - These are _______________ of the other trig functions.

Recall: Trig Functions	New: Reciprocal Identities
$\sin\theta = \frac{Opp}{Hyp} = \frac{3}{5}$	$\csc\theta = \frac{1}{\_\_\_\,\theta} = \frac{Hyp}{Opp} = \frac{\_}{\_}$
$\cos\theta = \frac{Adj}{Hyp} = \frac{4}{5}$	$\sec\theta = \frac{1}{\_\_\_\,\theta} = \frac{Hyp}{Adj} = \frac{\_}{\_}$
$\tan\theta = \frac{Opp}{Adj} = \frac{3}{4}$	$\cot\theta = \frac{1}{\_\_\_\,\theta} = \frac{Adj}{Opp} = \frac{\_}{\_}$
$\tan\theta = \frac{\sin\theta}{\cos\theta}$	$\cot\theta = \_\_\_\_\_\_$

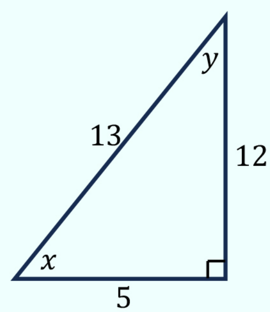


EXAMPLE Find the value of the trig function indicated, given the triangle.

(**A**) $\sec x$

(**B**) $\csc x$

(**C**) $\cot y$



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PRACTICE If $\tan\theta = \frac{12}{5}$, find the values of the five other trigonometric functions. Rationalize the denominators if necessary.

PRACTICE If $\sin\theta = \frac{\sqrt{17}}{17}$, find the values of the five other trigonometric functions. Rationalize the denominators if necessary.

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How to Use a Calculator for Trig Functions

◆ For certain problems you will need to use a calculator to evaluate the function, rather than using fractions.

- For trig functions, use the **sin** **cos** and **tan** buttons on the calculator.
- Make sure your calculator is in the correct **MODE** (________ or radian) when solving problems.

EXAMPLE Find the value for each of the following trigonometric operations and round to the nearest tenth.

(***A***)

$\sin(37°)$

[RADIAN | DEGREE]

(***B***)

$\tan\left(\frac{2\pi}{15}\right)$

[RADIAN | DEGREE]

(***C***)

$\sec(50°)$

[RADIAN | DEGREE]

(***D***)

$\arctan\left(\frac{3}{4}\right)$ ******degrees*

[RADIAN | DEGREE]

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PRACTICE

What is the positive value of A in the interval $[0°, 90°)$ that will make the following statement true? Express the answer in four decimal places.

$\sin A = 0.9235$

PRACTICE

What is the positive value of P in the interval $[0°, 90°)$ that will make the following statement true? Express the answer in four decimal places.

$\cot P = 5.2371$

PRACTICE

What is the positive value of D in the interval $[0, \frac{\pi}{2})$ that will make the following statement true? Express the answer in four decimal places.

$\sec D = 3.2842$

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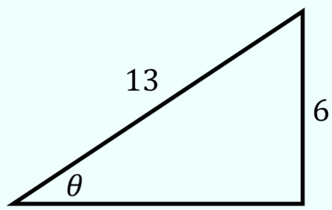
EXAMPLE Determine the missing angle θ in degrees for the right triangle below (approximate your answer to 2 decimal places).

$$\theta = \sin^{-1}\left(\frac{6}{13}\right)$$

[RADIAN | DEGREE]



HOW TO: Using Inverse Trig Functions to Find Angles with Calculator

1) Chose a trig function which includes the correct **angles** and sides

2) Write equation with the chosen trig function

3) Take the inverse on **both** sides to isolate the angle

4) Press the **2nd** key, and the associated trig function to get the inverse trig function.

5) Approximate the inverse trig function using a calculator

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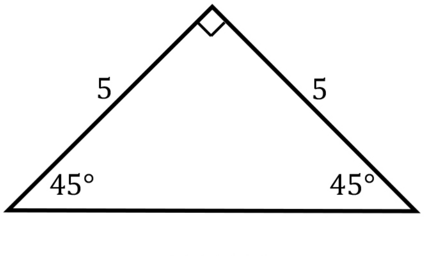
45-45-90 Triangles

- In triangles with 45° angles, the 2 legs are always the ________ length.
    - The hypotenuse will always be a multiple of the leg length, which you can find using:

Recall $a^2 + b^2 = c^2$

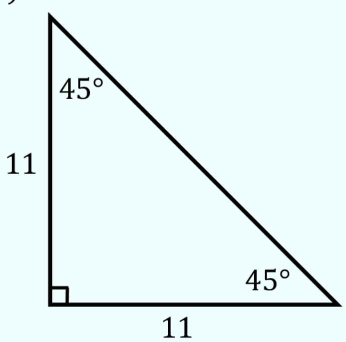


New $hyp = leg \cdot$ ___

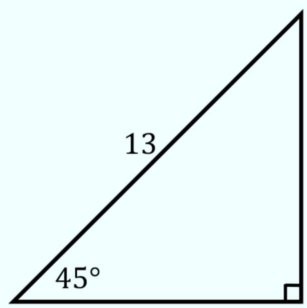
(45 – 45 – 90)

EXAMPLE Solve for the unknown side(s) of each triangle.

(A)



(B)



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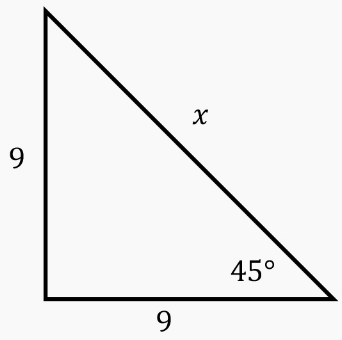
PRACTICE

Given the triangle below, determine the missing side(s) without using the Pythagorean theorem (make sure your answer is fully simplified).



PRACTICE

Without using a calculator, determine all values of P in the interval $[0, 90°)$ with the following trigonometric function value.

$\csc P = \sqrt{2}$

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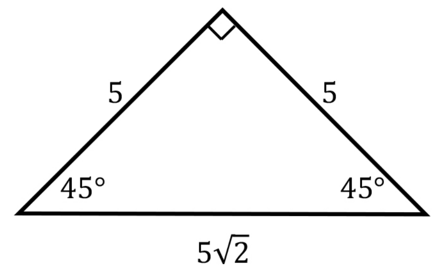
Common Trig Functions For 45-45-90 Triangles

◆ The common trig functions follow a specific pattern for 45-45-90 triangles.



New **Trig Function Values for 45-45-90 Triangle**

sin	$= \frac{\text{Opp}}{\text{Hyp}} =$	**csc**	$= \frac{1}{\sin(\theta)} =$
cos	$= \frac{\text{Adj}}{\text{Hyp}} =$	**sec**	$= \frac{1}{\cos(\theta)} =$
tan	$= \frac{\text{Opp}}{\text{Adj}} =$	**cot**	$= \frac{1}{\tan(\theta)} =$

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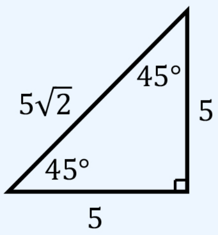
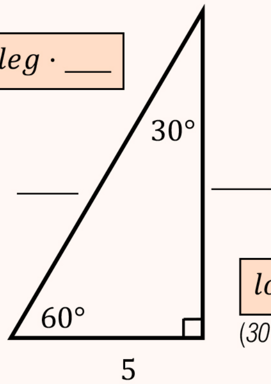
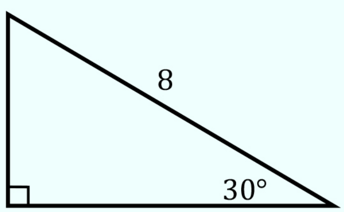
30-60-90 Triangles

◆ For the 30-60-90 triangle, relate side lengths to the *shortest* leg.

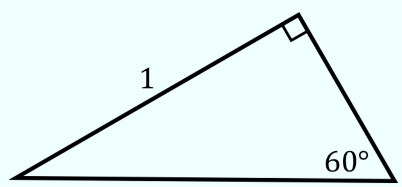
Recall 45 – 45 – 90	**New** 30 – 60 – 90
 $hyp = leg \cdot \sqrt{2}$ (45 – 45 – 90)	$hyp = short\ leg \cdot$ ___ (30 – 60 – 90)  $long\ leg = short\ leg \cdot$ ___ (30 – 60 – 90)

EXAMPLE Solve for the unknown sides of each triangle.

$(\boldsymbol{A})$



$(\boldsymbol{B})$



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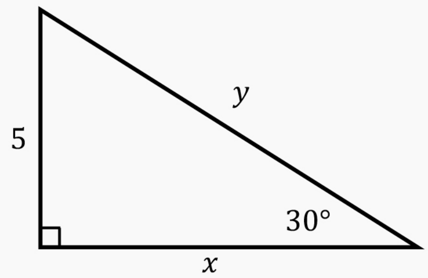
PRACTICE

Given the triangle below, determine the missing side(s) without using the Pythagorean theorem (make sure your answer is fully simplified).



PRACTICE

Without using a calculator, determine all values of A in the interval $\left[0, \frac{\pi}{2}\right)$ with the following trigonometric function value.

$$\cos A = \frac{\sqrt{3}}{2}$$

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Common Trig Functions For 30-60-90 Triangles

◆ The common trig functions follow a specific pattern for 30-60-90 triangles.

New **Trig Function Values for 30-60-90 Triangle**

	30°	60°
sin	$= \frac{\textbf{Opp}}{\textbf{Hyp}} =$	
cos	$= \frac{\textbf{Adj}}{\textbf{Hyp}} =$	
tan	$= \frac{\textbf{Opp}}{\textbf{Adj}} =$	
csc	$= \frac{\mathbf{1}}{\boldsymbol{sin(\theta)}} =$	
sec	$= \frac{\mathbf{1}}{\boldsymbol{cos(\theta)}} =$	
cot	$= \frac{\mathbf{1}}{\boldsymbol{tan(\theta)}} =$