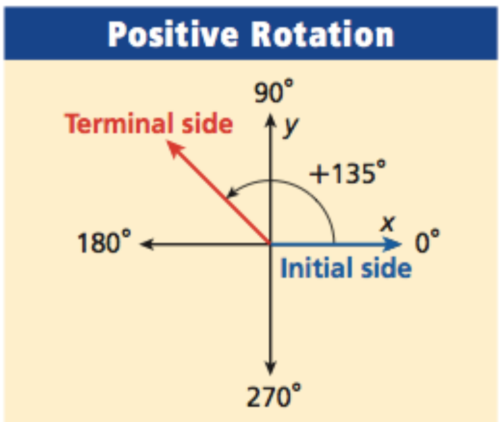
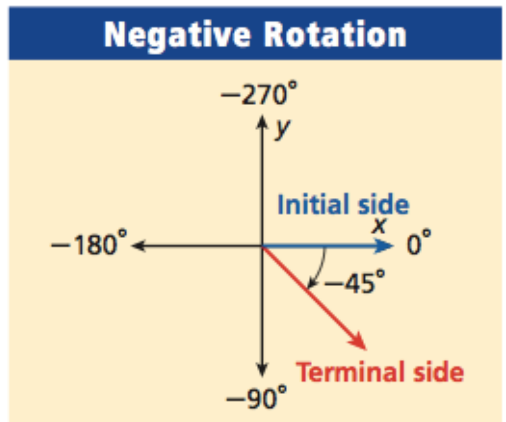
Coterminal Angles and Trig Ratios
11.9.15
Lesson 21

Section 5.1,5.2

The ***Initial Side*** of the angle is when the ray is on the x-axis.
The ***Terminal Side*** is the other ray.

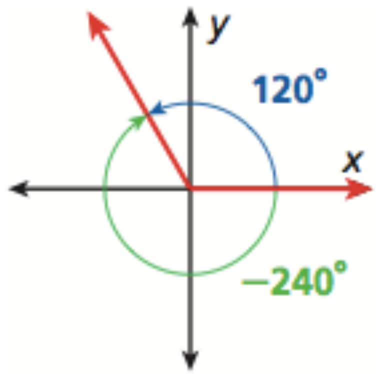




An angle is in ***Standard Position*** when its vertex is at the origin and one ray is on the positive x-axis.

Angle of rotation is formed by rotating the terminal side and keeping the initial side in place. It can be rotated more than 360°. If the terminal side is rotated counter-clockwise the angle of rotation is positive. If the terminal side is rotated clockwise, the angle of rotation is negative.

<u>Coterminal angles</u> are angles in standard position with the same terminal side.
$120° \text{ and } -240° \text{ are coterminal angles.}$



I do:
Find two Coterminal angles of 120°

Starting Angle	120°
To find a positive coterminal angle, add 360° until the angle is positive.	$120° + 360° = 480°$
To find a negative coterminal angle, subtract 360° until the angle is negative.	$120° - 360° = -240°.$

We do:
Find a positive and negative coterminal angle of 790°

Starting Angle	790°
To find a positive coterminal angle, add 360° until the angle is positive.	

To find a negative coterminal angle, subtract 360° until the angle is negative.	

You do on your whiteboards with your partner.
Left Talk, Right Write

Find a positive and negative coterminal angle of -790

Starting Angle	790°
To find a positive coterminal angle, add 360° until the angle is positive.	
To find a negative coterminal angle, subtract 360° until the angle is negative.	

You do on your whiteboards with your partner.
Right Talk, Left Write

Starting Angle	-290°
To find a positive coterminal angle, add 360° until the angle is positive.	

To find a negative coterminal angle, subtract 360° until the angle is negative.	

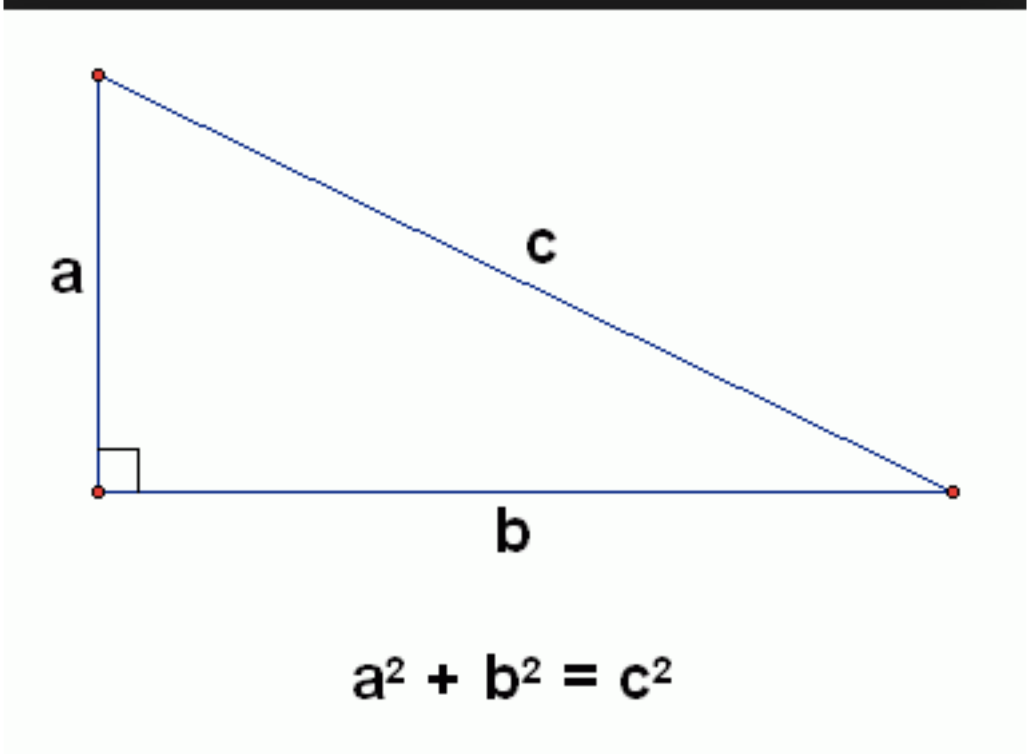
You do SOLO

Starting Angle	-120°
To find a positive coterminal angle, add 360° until the angle is positive.	
To find a negative coterminal angle, subtract 360° until the angle is negative.	

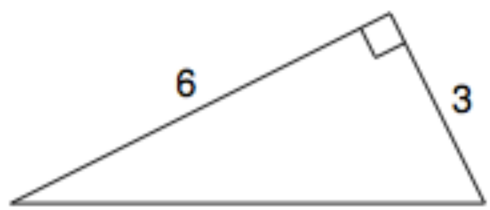
Trigonometry Ratios

The Pythagorean Theorem $a^2 + b^2 = c^2$, where c is the longest side of the right triangle.
The longest side of a right triangle is called the **hypotenuse**.

The other two sides are called the **legs.**

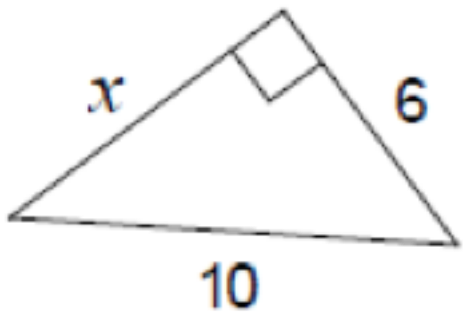


Find the missing length.



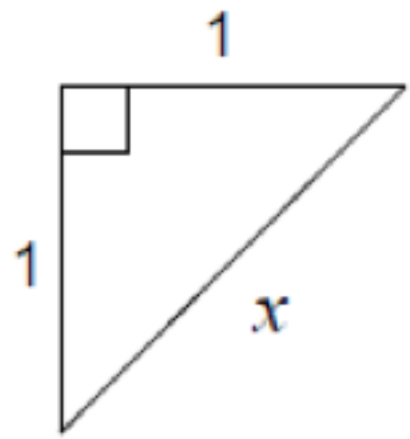
Determine the missing side.	Hypotenuse
Plug givens into equation $a^2 + b^2 = c^2$	$6^2 + 3^2 = c^2$
Solve for the missing side.	$36 + 9 = c^2$ $45 = c^2$ $c = 3\sqrt{5}$

We Try:



Determine the missing side.	
Plug givens into equation $a^2 + b^2 = c^2$	
Solve for the missing side.	

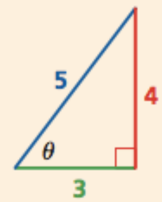
You Try with your partner on the whiteboard:
Solve for x using the Pythagorean theorem.



Determine the missing side.	
Plug givens into equation $a^2 + b^2 = c^2$	
Solve for the missing side.	

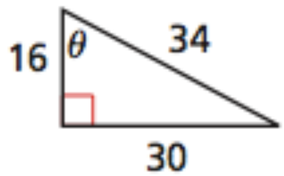
Trigonometric Functions

WORDS	NUMBERS	SYMBOLS
The **sine** (sin) of angle θ is the ratio of the length of the **opposite** leg to the length of the **hypotenuse**.	$\sin\theta = \frac{4}{5}$	$\sin\theta = \frac{\text{opp.}}{\text{hyp.}}$
The **cosine** (cos) of angle θ is the ratio of the length of the **adjacent** leg to the length of the **hypotenuse**.	$\cos\theta = \frac{3}{5}$	$\cos\theta = \frac{\text{adj.}}{\text{hyp.}}$
The **tangent** (tan) of angle θ is the ratio of the length of the **opposite** leg to the length of the **adjacent** leg.	$\tan\theta = \frac{4}{3}$	$\tan\theta = \frac{\text{opp.}}{\text{adj.}}$



Soh Cah Toa

First we need to identify the parts of a triangle!

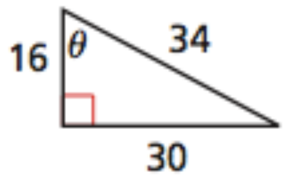


Discuss with your partner about which is the adjacent, hypotenuse, and opposite side? How do you know?

Hypotenuse Side is always the longest side. It is across from the right angle.

Adjacent Side is always the side touching the θ $angle$.
Opposite Side is the side not touching the θ $angle$. It is opposite of θ.

Find the Sine, Cosine, and Tangent functions for θ.



Adjacent=
Opposite=
Hypotenuse=

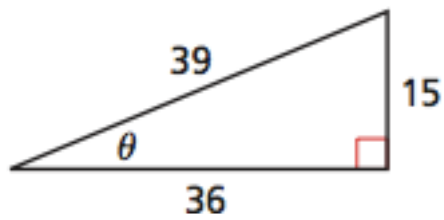
Sine θ = $\frac{Opposite}{Hypotenuse}$=

Cosine θ =$\frac{Adjacent}{Hypotenuse}$ $=$

$Tangent\theta = \frac{Opposite}{Adjacent}$=

We Try:

Find the Sine, Cosine, and Tangent functions for θ.



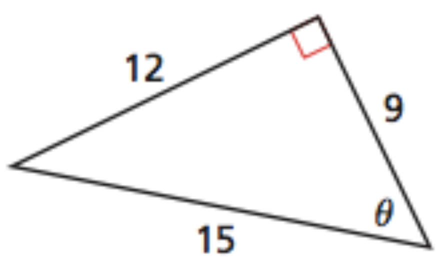
Adjacent=
Opposite=
Hypotenuse=

Sine $\theta = \frac{Opposite}{Hypotenuse}$=

Cosine $\theta = \frac{Adjacent}{Hypotenuse} =$

$Tangent\theta = \frac{Opposite}{Adjacent}$=

You Try on whiteboards: Left Talk, Right write



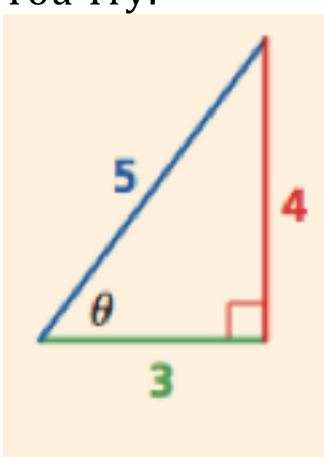
Find the Sine, Cosine, and Tangent functions for θ.
Adjacent=
Opposite=
Hypotenuse=

Sine θ = $\frac{Opposite}{Hypotenuse}$=

Cosine θ =$\frac{Adjacent}{Hypotenuse}$ =

$Tangent\theta = \frac{Opposite}{Adjacent}$=

You Try:



Find the Sine, Cosine, and Tangent functions for θ.
Adjacent=
Opposite=
Hypotenuse=

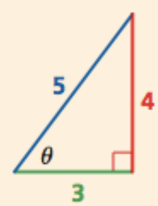
Sine θ = $\frac{Opposite}{Hypotenuse}$=

Cosine θ =$\frac{Adjacent}{Hypotenuse}$ =

$Tangent\theta$ = $\frac{Opposite}{Adjacent}$=

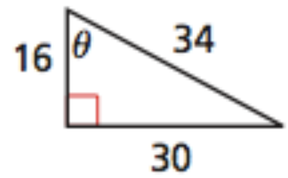
Reciprocal Trigonometric Functions

WORDS	NUMBERS	SYMBOLS
The **cosecant** (csc) of angle θ is the reciprocal of the sine function.	$\csc\theta = \frac{5}{4}$	$\csc\theta = \frac{1}{\sin\theta} = \frac{hyp.}{opp.}$
The **secant** (sec) of angle θ is the reciprocal of the cosine function.	$\sec\theta = \frac{5}{3}$	$\sec\theta = \frac{1}{\cos\theta} = \frac{hyp.}{adj.}$
The **cotangent** (cot) of angle θ is the reciprocal of the tangent function.	$\cot\theta = \frac{3}{4}$	$\cot\theta = \frac{1}{\tan\theta} = \frac{adj.}{opp.}$



There are actually six trigonometric properties.
Sine, Cosine, Tangent.
Cosecant, Secant, Cotangent

I try:
Find the Sine, Cosine, and Tangent functions for θ.



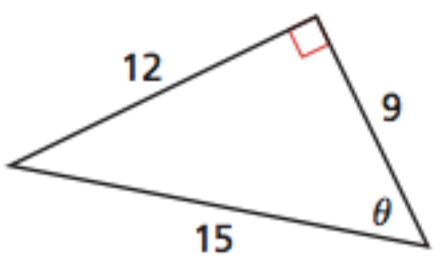
Adjacent=
Opposite=
Hypotenuse=

Sine θ = $\frac{Opposite}{Hypotenuse}$= Cosecant θ = $\frac{1}{sin\theta}$ =

Cosine θ =$\frac{Adjacent}{Hypotenuse}$ = Secant θ =$\frac{1}{cosine\theta}$ =

$Tangent\theta = \frac{Opposite}{Adjacent}$= Cotangent θ =$\frac{1}{tangent\theta}$ =

We Try



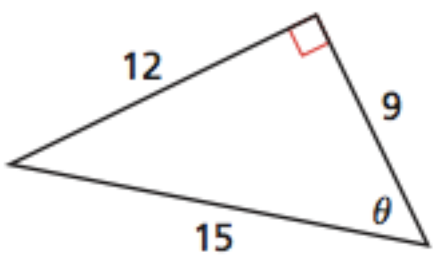
Find the Sine, Cosine, and Tangent functions for θ.
Adjacent=
Opposite=
Hypotenuse=

Sine θ = $\frac{Opposite}{Hypotenuse}$= Cosecant θ = $\frac{1}{sin\theta}$ =

Cosine θ =$\frac{Adjacent}{Hypotenuse}$ = Secant θ =$\frac{1}{cosine\theta}$ =

$Tangent\theta = \frac{Opposite}{Adjacent}$=   Cotangent θ =$\frac{1}{tangent\theta}$ =

You Try with your partner on whiteboards: Right Talk, Left write



Find the Sine, Cosine, and Tangent functions for θ.

Adjacent=

Opposite=

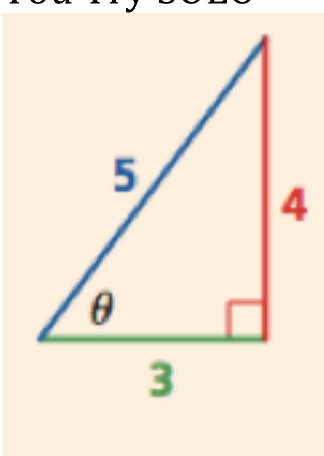
Hypotenuse=

Sine θ = $\frac{Opposite}{Hypotenuse}$=   Cosecant θ = $\frac{1}{sin\theta}$ =

Cosine θ =$\frac{Adjacent}{Hypotenuse}$ =   Secant θ =$\frac{1}{cosine\theta}$ =

$Tangent\theta = \frac{Opposite}{Adjacent}$= Cotangent θ =$\frac{1}{tangent\theta}$ =

You Try SOLO



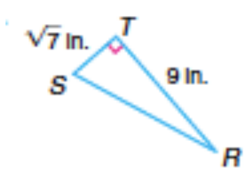
Sine θ = $\frac{Opposite}{Hypotenuse}$= Cosecant θ = $\frac{1}{sin\theta}$ =

Cosine θ =$\frac{Adjacent}{Hypotenuse}$ = Secant θ =$\frac{1}{cosine\theta}$ =

$Tangent\theta = \frac{Opposite}{Adjacent}$= Cotangent θ =$\frac{1}{tangent\theta}$ =

Sometimes they don't give you the sides!

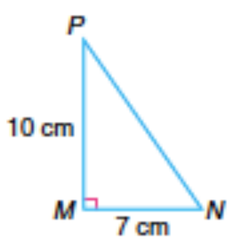
Find the values of the six trig ratios.



Solve for the missing side using Pythagorean's theorem. $a^2 + b^2 = c^2$	$a =$ $b =$ $c =$
Sine $\theta = \frac{Opposite}{Hypotenuse} =$ Cosecant $\theta = \frac{1}{sin\theta} =$ Cosine $\theta = \frac{Adjacent}{Hypotenuse} =$ Secant $\theta = \frac{1}{cosine\theta} =$	

$Tangent\theta = \frac{Opposite}{Adjacent}$= Cotangent θ =$\frac{1}{tangent\theta}$ $=$	

We Try:



Solve for the missing side using Pythagorean's theorem. $a^2 + b^2 = c^2$	$a =$ $b =$ $c =$
Sine θ = $\frac{Opposite}{Hypotenuse}$= Cosecant θ = $\frac{1}{sin\theta}$ $=$ Cosine θ =$\frac{Adjacent}{Hypotenuse}$ $=$ Secant θ =$\frac{1}{cosine\theta}$ $=$	

$Tangent\theta = \frac{Opposite}{Adjacent}$= Cotangent θ =$\frac{1}{tangent\theta}$ $=$	

You Try with your partner:

Solve for the missing side using Pythagorean's theorem. $a^2 + b^2 = c^2$	$a =$ $b =$ $c =$
Sine θ = $\frac{Opposite}{Hypotenuse}$= Cosecant θ = $\frac{1}{sin\theta}$ $=$ Cosine θ =$\frac{Adjacent}{Hypotenuse}$ $=$ Secant θ =$\frac{1}{cosine\theta}$ $=$ $Tangent\theta = \frac{Opposite}{Adjacent}$= Cotangent θ =$\frac{1}{tangent\theta}$ $=$	

You Try SOLO

Solve for the missing side using Pythagorean's theorem. $a^2 + b^2 = c^2$	$a =$ $b =$ $c =$
Sine θ = $\frac{Opposite}{Hypotenuse}$= Cosecant θ = $\frac{1}{sin\theta} =$ Cosine θ =$\frac{Adjacent}{Hypotenuse} =$ Secant θ =$\frac{1}{cosine\theta} =$ $Tangent\theta = \frac{Opposite}{Adjacent}$= Cotangent θ =$\frac{1}{tangent\theta} =$	

Sometimes they don't even give you a picture!

I Do:

Find $sec\theta\ given\ \ cos = \frac{1}{3}$

Determine the relationship	$sec\theta = \dfrac{1}{\cos\theta}$
Plug in and solve	

I Do:

Find $cot\theta, given\ \ tan\theta = 1.75$

Determine the relationship	
Plug in and solve	

We Do:

Find $cot\theta, given\ \ tan\theta = 1.5$

Determine the relationship	
Plug in and solve	

You Do SOLO:

Find $cot\theta, given\ \ tan\theta = 3$

Determine the relationship	
Plug in and solve	

Exit Slip

1) **Find a positive and negative coterminal angle for 700°.**
2) **What are the 6 trig ratios for θ for the given triangle.**

3) If $\boldsymbol{cos\theta = \frac{1}{5}, what\ is\ sec\theta}$?