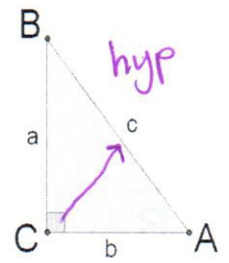
Trigonometry is the study of measurement of geometry specifically with right triangles. After Right Triangle Trigonometry, the study expands to other triangles as well. This year, we focus on right triangle Trigonometry.

Objectives:

- *I can set up all 6 trigonometric ratios. I know what SOH – CAH – TOA stands for*
- *I know that Sine and Cosine are complements of each other.*

$\angle A + \angle B = 90°$

The Pythagorean Theorem: Use the right triangle pictured below to find the missing side length.

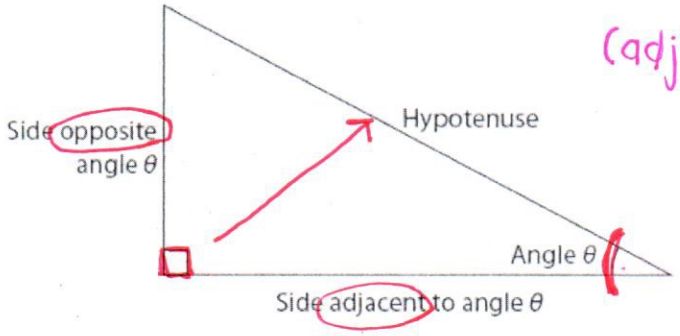


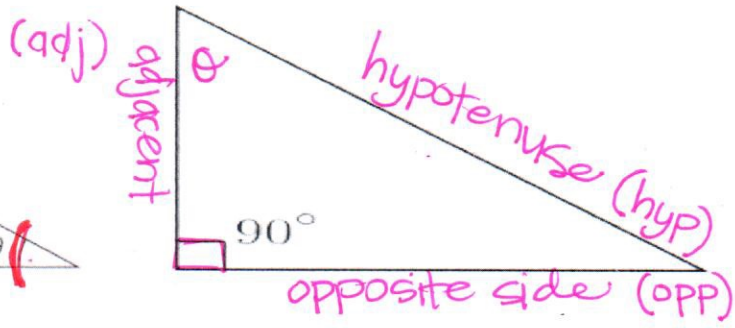
$a^2 + b^2 = c^2$

Where a & b are legs
And c is the hypotenuse

1. a=3, b=4; Find c.	2. a=7, c=25; Find b.	3. b=8, c=16; Find a.
$3^2+4^2=c^2$ $9+16=c^2$ $\sqrt{25}=\sqrt{c^2}$ $c=5$	$7^2+b^2=25^2$ $49+b^2=625$ $-49 \quad -49$ $\sqrt{b^2}=\sqrt{576}$ $b=24$	$a^2+8^2=16^2$ $a^2+64=256$ $-64 \quad -64$ $\sqrt{a^2}=\sqrt{192}$ $a=13.9$

The six trigonometric ratios:





Sine (sin)	***Cosine (cos)***	***Tangent (tan)***
$\sin\theta = \frac{opp}{hyp}$	$\cos\theta = \frac{adj}{hyp}$	$\tan\theta = \frac{opp}{adj}$
SOH	CAH	TOA

The reciprocals of these ratios have special names as well.

flip the ratio (fraction)

Cosecant (csc)	***Secant (sec)***	***Cotangent (cot)***
$\csc\theta = \frac{hyp}{opp}$	$\sec\theta = \frac{hyp}{adj}$	$\cot\theta = \frac{adj}{opp}$

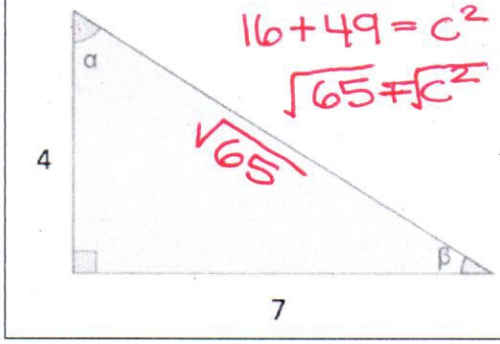
Note: When we are talking about side lengths we generally use variables like x, y, and z. When we are talking about angle measures we generally use the variables α, β, θ, and φ.

a, b, c

$\alpha - Alpha$ $\beta - Beta$ $\theta - Theta$ $\varphi - Phi$

α β θ φ

Example Set #1: Use the figure below to express each of the following as ratios. Make sure you use the Pythagorean Theorem to find the missing side.



$4^2+7^2=c^2$

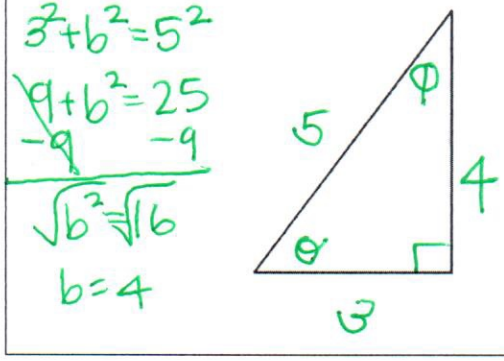
$16+49=c^2$

$\sqrt{65}=\sqrt{c^2}$

$\sqrt{65}$

$\sin\alpha = \frac{opp}{hyp} = \frac{7}{\sqrt{65}}$	$\csc\alpha = \frac{hyp}{opp} = \frac{\sqrt{65}}{7}$	$\sin\beta = \frac{opp}{hyp} = \frac{4}{\sqrt{65}}$	$\csc\beta = \frac{\sqrt{65}}{4}$
$\cos\alpha = \frac{adj}{hyp} = \frac{4}{\sqrt{65}}$	$\sec\alpha = \frac{hyp}{adj} = \frac{\sqrt{65}}{4}$	$\cos\beta = \frac{adj}{hyp} = \frac{7}{\sqrt{65}}$	$\sec\beta = \frac{\sqrt{65}}{7}$
$\tan\alpha = \frac{opp}{adj} = \frac{7}{4}$	$\cot\alpha = \frac{adj}{opp} = \frac{4}{7}$	$\tan\beta = \frac{opp}{adj} = \frac{4}{7}$	$\cot\beta = \frac{7}{4}$

Practice Set: Use the figure below to find each of the following trig ratios.



$3^2+b^2=5^2$

$9+b^2=25$

$-9 \quad -9$

$\sqrt{b^2}=\sqrt{16}$

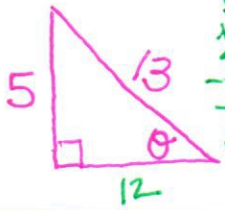
$b=4$

$\sin\theta = \frac{4}{5}$	$\csc\theta = \frac{5}{4}$	$\sin\varphi = \frac{3}{5}$	$\csc\varphi = \frac{5}{3}$
$\cos\theta = \frac{3}{5}$	$\sec\theta = \frac{5}{3}$	$\cos\varphi = \frac{4}{5}$	$\sec\varphi = \frac{5}{4}$
$\tan\theta = \frac{4}{3}$	$\cot\theta = \frac{3}{4}$	$\tan\varphi = \frac{3}{4}$	$\cot\varphi = \frac{4}{3}$

Example Set #2: Based on the given trigonometric ratio, sketch a triangle and find the rest of the missing trig ratios.

Given: $\sin\theta = \frac{5}{13}$ $\frac{opp}{hyp}$

Draw Triangle Here:



$5^2+b^2=13^2$

$25+b^2=169$

$-25 \quad -25$

$\sqrt{b^2}=\sqrt{144}$

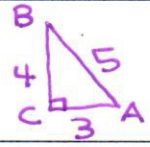
$b=12$

$\sin\theta = \frac{5}{13}$	$\csc\theta = \frac{13}{5}$	
$\cos\theta = \frac{12}{13}$	$\sec\theta = \frac{13}{12}$	
$\tan\theta = \frac{5}{12}$	$\cot\theta = \frac{12}{5}$	

Relationships about sine, cosine, and tangent:

If we have a right △

If $\angle A + \angle B = 90°$
Then $\sin A = \cos B$



$\sin A = \frac{4}{5}$

$\cos B = \frac{4}{5}$

$\tan\theta = \frac{\sin\theta}{\cos\theta}$

$\sin\theta = \frac{opp}{hyp}$

$\cos\theta = \frac{adj}{hyp}$

$\frac{\sin\theta}{\cos\theta} = \frac{\frac{opp}{hyp}}{\frac{adj}{hyp}} = \frac{opp}{adj} = \tan\theta$

Challenge Problems: Use the relationships we know about sine, cosine, and tangent to answer the questions.

1. If you know $\cos 61° = 0.485$, then what is $\sin 29°$?

check

$61°+29°=90°$ ✓

$\cos 61° = \sin 29°$

$\sin 29° = 0.485$

2. Fill in the blank:

If $\sin 60° = \frac{\sqrt{3}}{2}$, then $\cos(30°) = \frac{\sqrt{3}}{2}$

$60°+30°=90°$

3. If $\sin\theta = .882$ and $\cos\theta = .471$, what is $\tan\theta$?

$\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{0.882}{0.471}$

$\tan\theta = 1.9$