Pre-Calculus Notes Name: _____

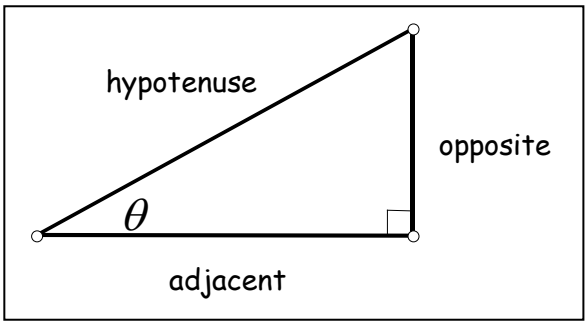
Section 4.3 – The 6 Trigonometric Functions

PART ONE: Definitions Using Right Triangles: **SOH-CAH-TOA**

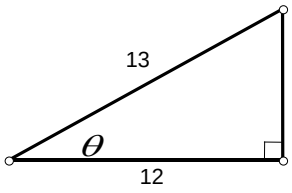
$$\sin\theta = \frac{opposite}{hypotenuse} \qquad \csc\theta = \frac{hypotenuse}{opposite}$$

$$\cos\theta = \frac{adjacent}{hypotenuse} \qquad \sec\theta = \frac{hypotenuse}{adjacent}$$

$$\tan\theta = \frac{opposite}{adjacent} \qquad \cot\theta = \frac{adjacent}{opposite}$$



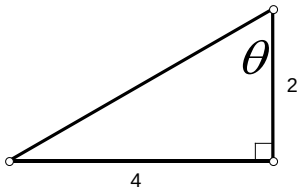
Example 1: Find the values of the six trigonometric functions of θ.



$\sin\theta =$ _____ $\cos\theta =$ _____ $\tan\theta =$ _____

$\csc\theta =$ _____ $\sec\theta =$ _____ $\cot\theta =$ _____

Example 2: Find the 6 trig. values of the angle shown. Give exact values, simplified.



$\sin\theta =$ _____ $\cos\theta =$ _____ $\tan\theta =$ _____

$\csc\theta =$ _____ $\sec\theta =$ _____ $\cot\theta =$ _____

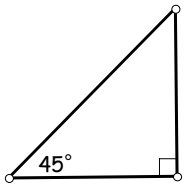
Example 3: Sketch a right triangle corresponding to the given trig. function and its value. Find the third side and the other trig. values.

$\sin\theta =$ _____ $\cos\theta = \frac{3}{5}$ $\tan\theta =$ _____

$\csc\theta =$ _____ $\sec\theta =$ _____ $\cot\theta =$ _____

You will need to have the following trig value <u>MEMORIZED</u> very "SOON".

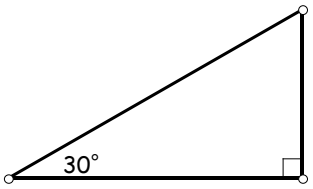
Example 4: Find the values of the six trigonometric functions of θ in a $45^\circ - 45^\circ - 90^\circ$ triangle.



$\sin 45^\circ =$ _____ $\cos 45^\circ =$ _____ $\tan 45^\circ =$ _____

$\csc 45^\circ =$ _____ $\sec 45^\circ =$ _____ $\cot 45^\circ =$ _____

Example 5: Find the values of the six trigonometric functions of θ in a $30^\circ - 60^\circ - 90^\circ$ triangle.



$\sin 30^\circ =$ _____ $\cos 30^\circ =$ _____ $\tan 30^\circ =$ _____

$\csc 30^\circ =$ _____ $\sec 30^\circ =$ _____ $\cot 30^\circ =$ _____

$\sin 60^\circ =$ _____ $\cos 60^\circ =$ _____ $\tan 60^\circ =$ _____

$\csc 60^\circ =$ _____ $\sec 60^\circ =$ _____ $\cot 60^\circ =$ _____

Could we summarize the above information into a single chart? Yes!!!!!!!!!!!!!!!

	$\frac{\pi}{6}$ or 30°	$\frac{\pi}{4}$ or 45°	$\frac{\pi}{3}$ or 60°
$\cos\theta$			
$\sin\theta$			
$\tan\theta$			

Example 6: Fill in the blanks with the angle measure or function value.

Function	θ in degrees	θ in radians	Value
sec			$\sqrt{2}$
tan	45°		
cos		$\frac{\pi}{3}$	
csc			2

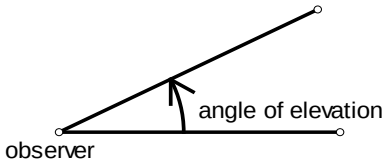
Now let's do these on the CALCULATOR…

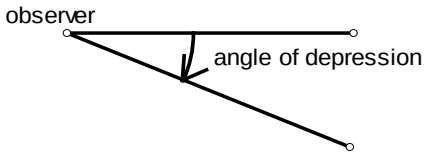
Example 2: Calculate to 4 decimal places.

a. $\sin 25^\circ$	b. $\cos 32.4^\circ$	c. $\tan 40^\circ 15' 10''$
d. $\csc 85^\circ$	e. $\sec 75^\circ 30'$	f. $\cot 56.27^\circ$

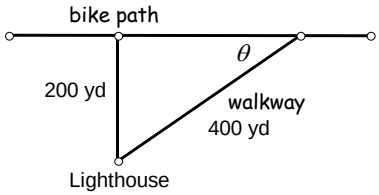
Applications – Solving Right Triangles

Do you remember angle of elevation and angle of depression?

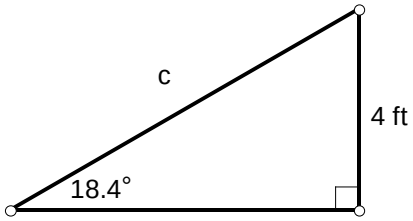




Example 3:

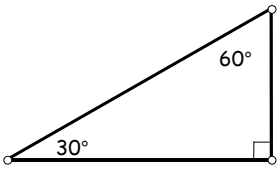
A surveyor is standing 115 feet from the base of the Washington Monument. The surveyor measures the angle of elevation to the top of the monument as 78.3°. How tall is the Washington Monument?	An historic lighthouse is 200 yards from a bike path along the lake. A walkway to the lighthouse is 400 yards long. Find the acute angle between the bike path and the walkway. 

Example 5: Solve for c.



PART TWO: Let's talk now about the topic of "CO-FUNCTIONS".

Think about the $30^\circ - 60^\circ - 90^\circ$ triangle.



sin 30° = _____ ⟷ cos 60° = _____

tan 30° = _____ ⟷ cot 60° = _____

sec 30° = _____ ⟷ csc 60° = _____

WHY are those values equal? _____

WHEN will those function values be equal? _____

In general, it can be shown from the right triangle definitions that **co-functions of complementary angles are equal**. That is, if θ is an acute angle, the following relationships are true:

$$\sin\theta = \cos\left(90^\circ - \theta\right) \text{ or } \cos\left(\frac{\pi}{2} - \theta\right)$$

$$\tan\theta = \cot\left(90^\circ - \theta\right) \text{ or } \cot\left(\frac{\pi}{2} - \theta\right)$$

$$\sec\theta = \csc\left(90^\circ - \theta\right) \text{ or } \csc\left(\frac{\pi}{2} - \theta\right)$$

So, let's try this again. What functions are CO-FUNCTIONS?

_____ AND _____ **_____ AND _____** **_____ AND _____**

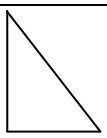
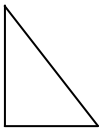
WHEN will the co-function values be equal? _____

We also need to start looking at some of the TRIG. IDENTITIES.

Look at the following and discuss WHY they are true.

Fundamental Identities:	
Reciprocal Identities:	**Quotient Identities:**
$\sin\theta = \frac{1}{\csc\theta}$; $\csc\theta = \frac{1}{\sin\theta}$ $\cos\theta = \frac{1}{\sec\theta}$; $\sec\theta = \frac{1}{\cos\theta}$ $\tan\theta = \frac{1}{\cot\theta}$; $\cot\theta = \frac{1}{\tan\theta}$	$\tan\theta = \frac{\sin\theta}{\cos\theta}$ $\cot\theta = \frac{\cos\theta}{\sin\theta}$

Example 1: Use **CO-FUNCTIONS** and **TRIG IDENTITIES** to find the other values.

If $\sec\theta = 5$  and $\tan\alpha = 2\sqrt{6}$,  then find the following…

a. $\cos\theta$

b. $\cot\alpha$

c. $\csc(90^\circ - \theta)$

d. $\cot\left(90^\circ - \alpha\right)$

e. $\csc\theta$

f. $\tan(90^\circ - \alpha)$