

KEY

Section 7.5: The Other 4 Trigonometric Functions

Essential Question: What are the 6 trig functions and their relationships?

Other Trig Functions

tangent (tan) secant (sec)
cotangent (cot) cosecant (csc)

sin theta = y/r

cos theta = x/r

tan theta = y/x

csc theta = r/y

sec theta = r/x

cot theta = x/y

RECIPROCAL

sec theta and cos theta are reciprocals:

sec theta = 1/cos theta, cos theta = 1/sec theta

csc theta and sin theta are reciprocals:

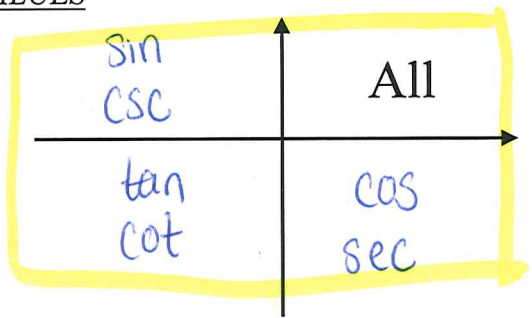
csc theta = 1/sin theta, sin theta = 1/csc theta

Since sin theta = y and cos theta = x...

tan theta = y/x = sin theta / cos theta

cot theta = x/y = cos theta / sin theta

POSITIVE TRIG VALUES



Example 1

Use a calculator to find the following. \*Check MODE

a) sin 27 degrees

.4540

b) tan 175 degrees

-.0875

c) sec 42 degrees

1/cos 42 degrees = 1.3456

d) cot 7 degrees

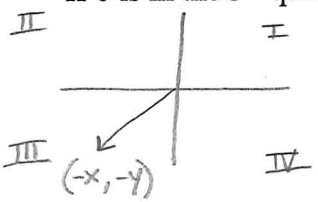
1/tan 7 degrees = 1.1475

e) csc(-1)

1/sin(-1) = -1.1884

Example 2

If theta is in the 3rd quadrant and tan theta = 5/12 find the other five trig functions.



tan theta = 5/12 = y/x, y = -5, x = -12

X^2 + y^2 = r^2, (-12)^2 + (-5)^2 = r^2, 169 = r^2, r = 13

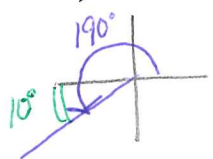
cot theta = 12/5, sin theta = -5/13, csc theta = -13/5, cos theta = -12/13, sec theta = -13/12

**Example 3**

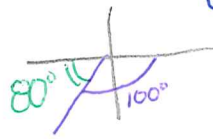
Express each of the following in term of a reference angle.

sin	csc	All	Pos values
tan	cot	cos	
		sec	

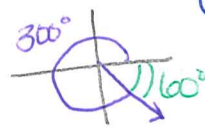
a)  $\sin 190^\circ = -\sin 10^\circ$



b)  $\sec(-100^\circ) = -\sec 80^\circ$



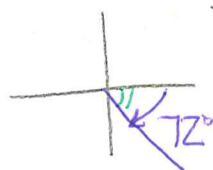
c)  $\tan 300^\circ = -\tan 60^\circ$



d)  $\csc 125^\circ = \csc 55^\circ$



e)  $\cos(-72^\circ) = \cos 72^\circ$



**Example 4**

Give the value of x (in radians) for which  $\sec(x)$  is: Change 'x' to 'theta'

a) 1

$\sec \theta = 1$   
 $\cos \theta \left( \frac{1}{\cos \theta} \right) = (1) \cos \theta$

$1 = \cos \theta$   
 when  $\theta = 2\pi \cdot n$  (multiples of  $2\pi$ )

b) 0

$\sec \theta = 0$   
 $\cos \theta \left( \frac{1}{\cos \theta} = 0 \right) \cos \theta$   
 $1 \neq 0$   
 Not possible

No Solution

c) undefined =  $\sec \theta$

$\frac{1}{\cos \theta} = \text{undef.}$   
 if  $\cos \theta = 0$  then  $\frac{1}{0} = \text{und.}$   
 $\theta = \frac{\pi}{2} \ \& \ \frac{3\pi}{2}$

$\theta = \frac{\pi}{2} + \pi n$

**Example 5**

Give the value of x (in radians) for which  $\tan(x)$  is:

a) 0

$\tan \theta = 0$   
 $\cos \theta \left( \frac{\sin \theta}{\cos \theta} = 0 \right) \cos \theta$   
 $\sin \theta = 0$   
 $\theta = \pi \ \& \ 2\pi \rightarrow \theta = \pi n$

b) 1

$\tan \theta = 1$   
 $\cos \theta \left( \frac{\sin \theta}{\cos \theta} = 1 \right) \cos \theta$   
 $\sin \theta = \cos \theta$   
 $\theta = \pi/4 \ \& \ 5\pi/4$   
 $\theta = \pi/4 + \pi n$

c) undefined

$\tan \theta = \text{und.}$   
 $\frac{\sin \theta}{\cos \theta} = \text{undefined}$   
 when  $\cos \theta = 0$   
 $\theta = \frac{\pi}{2} + \pi n$

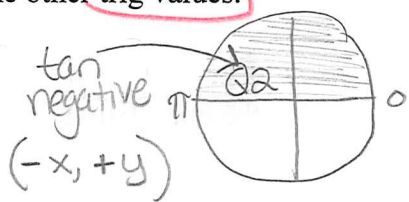
**Example 6**

Given  $\tan \theta = -3/4$  and  $0 < \theta < \pi$ , find the other trig values.

$\tan \theta = -\frac{3}{4} = \frac{y}{x}$

$x = -4$   
 $y = 3$   
 $r = ?$

$x^2 + y^2 = r^2$   
 $(-4)^2 + (3)^2 = r^2$   
 $16 + 9 = r^2$



$r^2 = 25$   
 $r = 5$   
 \* radius always positive

$\cot \theta = \frac{x}{y} = -\frac{4}{3}$   
 $\cos \theta = \frac{x}{r} = -\frac{4}{5} \quad \sec \theta = -\frac{5}{4}$   
 $\sin \theta = \frac{y}{r} = \frac{3}{5} \quad \csc \theta = \frac{5}{3}$

**Example 7**

→ No Decimals

Find the exact values.

a)  $\sec 150^\circ$

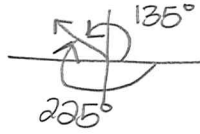
reciprocal of  $\cos 150^\circ$

$$\cos(150^\circ) = \frac{-\sqrt{3}}{2}$$

$$\sec 150^\circ = \frac{-2}{\sqrt{3}} = \boxed{\frac{-2\sqrt{3}}{3}}$$

b)  $\tan(-225^\circ)$

clockwise



$$= \tan 135^\circ = \frac{y}{x}$$

$$= \frac{\sqrt{3}/2}{-\sqrt{3}/2} = \boxed{-1}$$

c)  $\sec 180^\circ$

reciprocal  $\cos \theta$

$$\cos(180^\circ) = -1$$

$$\sec 180^\circ = \frac{1}{-1} = \boxed{-1}$$

d)  $\tan 90^\circ = \frac{y}{x}$

@  $90^\circ$  (0, 1)  
x y

$$= \frac{1}{0} = \boxed{\text{undefined}}$$

Section 7.5 Summary: