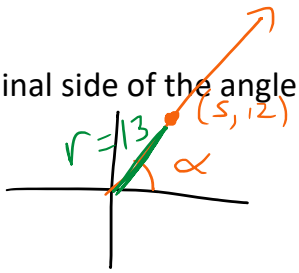
Warm-up!

A) The terminal side of the angle α passes through the point $(5,12)$. Find $\cos\alpha$.



$r = \sqrt{5^2+12^2} = \sqrt{169} = 13$

$\cos(\alpha) = \frac{x}{r} = \frac{5}{13}$

B) The terminal side of the angle β passes through the point $(7,24)$. Find $\tan\beta$.

$\tan\beta = \frac{y}{x} = \frac{24}{7}$

C) The terminal side of the angle θ passes through the point $(-4,3)$. Find $\sin\theta$.

$\sin\theta = \frac{y}{r} = \frac{3}{5}$

$r = \sqrt{(-4)^2+(3)^2} = 5$

Trig Functions, Day 3

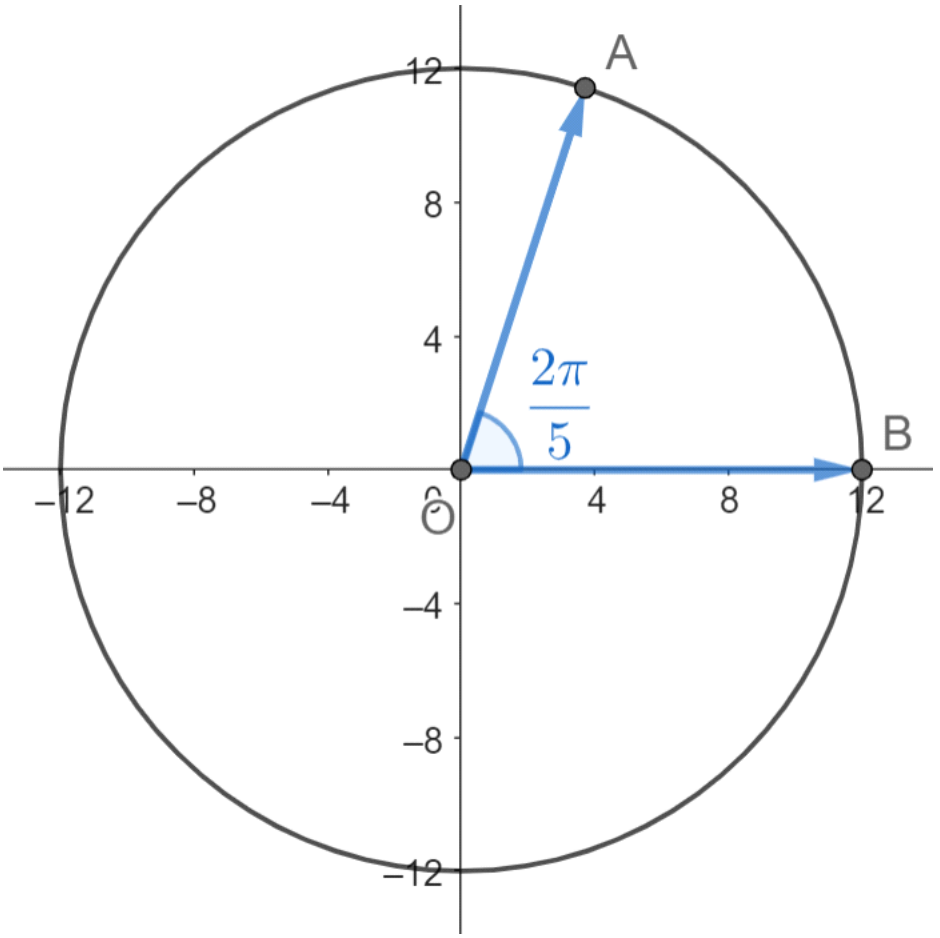
- Speed Quiz 1
- Unit Circle
- Evaluating Trig Functions

Homework: Unit Circle + Evaluating

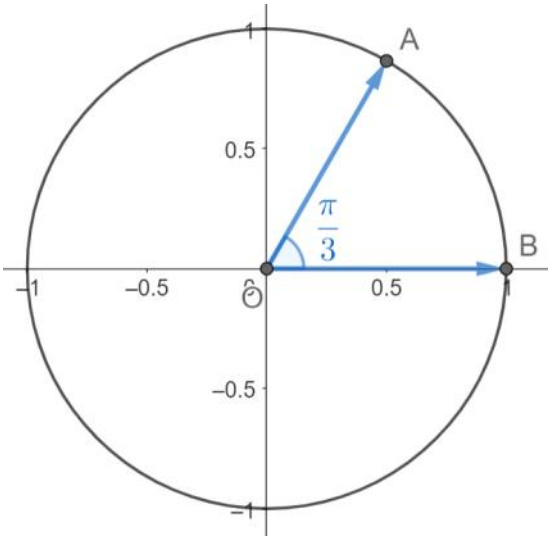
Speed Quiz 2 Next Class:

- 6 Trig Functions
- –, –, –, 0, –, π, ,
- 10 questions
- 5 minutes

Find the coordinates of the point where the angle $\frac{2\pi}{5}$ graphed in standard form intersects a circle with radius 12.



Find the coordinates of the point where the angle $\frac{\pi}{3}$ graphed in standard form intersects a circle with radius 1.



$\cos\theta = \frac{x}{r}$ $\quad \sin\theta = \frac{y}{r}$

$\cos\frac{\pi}{3} = \frac{x}{1}$ $\quad \sin\frac{\pi}{3} = \frac{y}{1}$

$\cos\frac{\pi}{3} = x$ $\quad \sin\frac{\pi}{3} = y$

$\frac{1}{2} = x$ $\quad \frac{\sqrt{3}}{2} = y$

When you're on a circle with radius 1…

$$\sin\theta = \frac{y}{r} \qquad \csc\theta = \frac{r}{y}$$

$$\cos\theta = \frac{x}{r} \qquad \sec\theta = \frac{r}{x}$$

$$\tan\theta = \frac{y}{x} \qquad \cot\theta = \frac{x}{y}$$

$$r = \sqrt{x^2 + y^2}$$

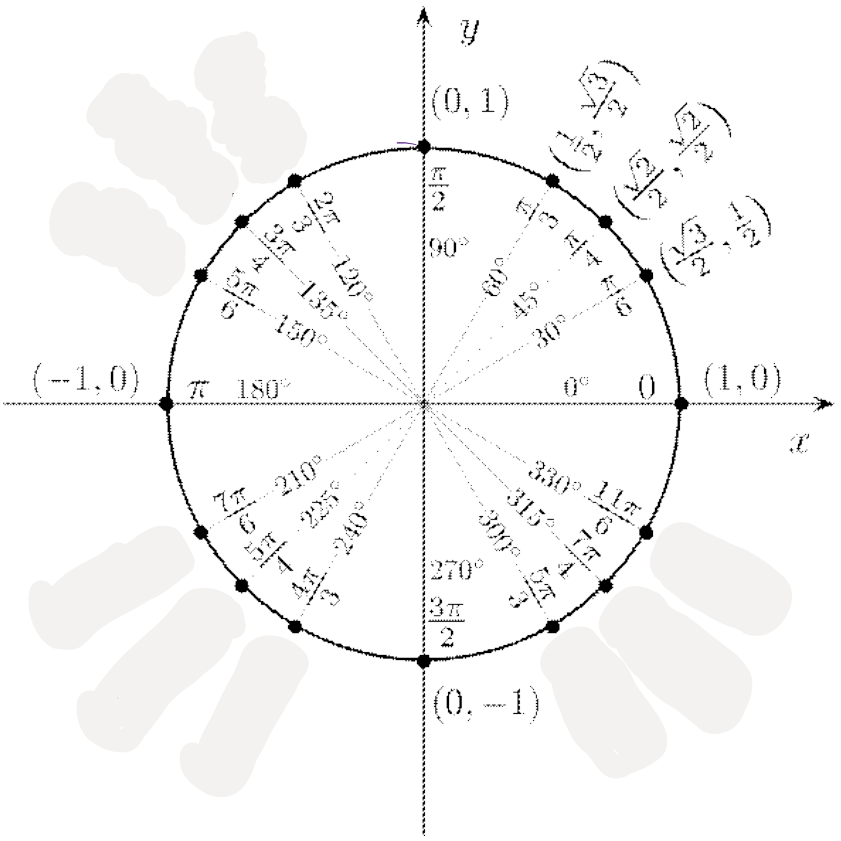
$r = 1$

The Unit Circle

$\cos\theta = x$

$\sin\theta = y$

$\tan\theta = \frac{y}{x}$



$\cos\left(\frac{\pi}{2}\right) = 0$

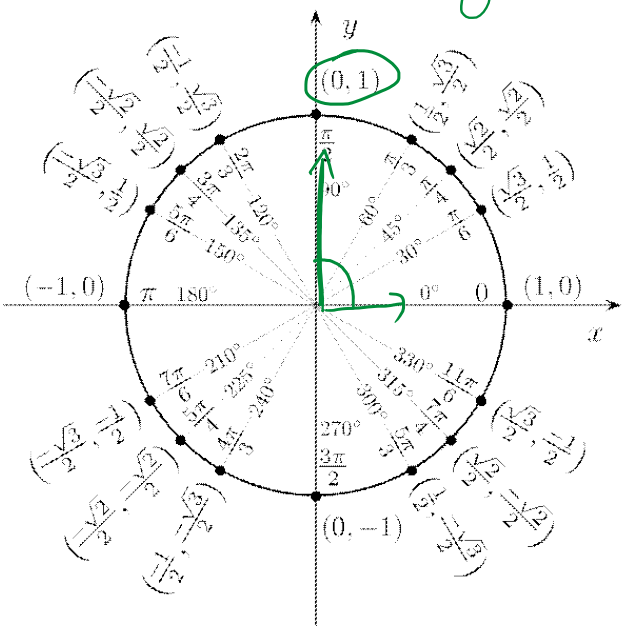
$\sin\left(\frac{\pi}{2}\right) = 1$

Quadrantal Angles

$\cos\theta = x$

$\sin\theta = y$

$\tan\theta = \frac{y}{x}$



$\frac{1}{0}$

$\cos(0) =$ 1

$\sin(0) =$ 0

$\tan(0) =$ 0

$\cos\left(\frac{\pi}{2}\right) =$ 0

$\sin\left(\frac{\pi}{2}\right) =$ 1

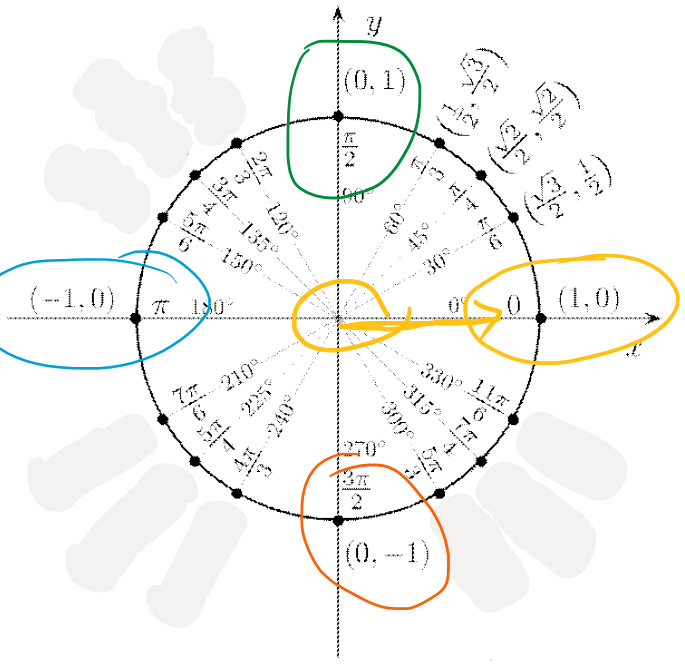
$\tan\left(\frac{\pi}{2}\right) =$ undefined

Quadrantal Angles

$\cos\theta = x$

$\sin\theta = y$

$\tan\theta = \frac{y}{x}$



$\cos(\pi) =$ -1

$\tan\left(\frac{3\pi}{2}\right)$ undefined

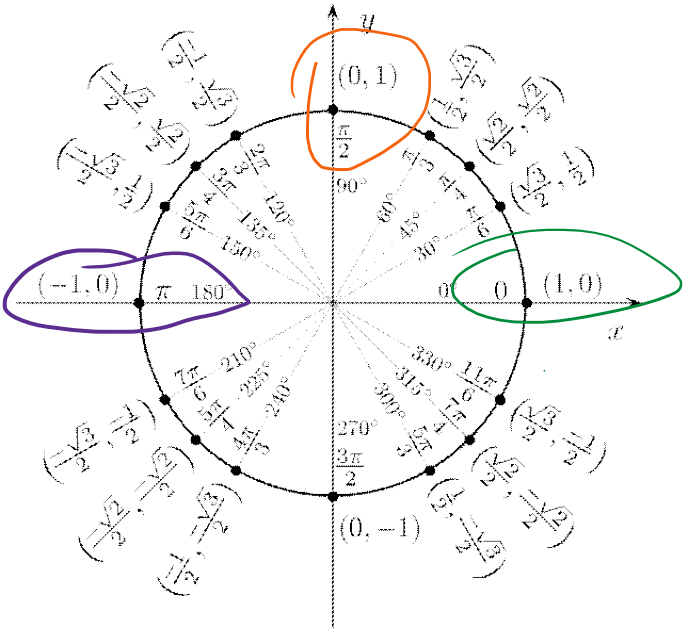
$\frac{y}{x}$ $\frac{-1}{0}$

$\sin(2\pi) =$ 0

$\sec\left(\frac{\pi}{2}\right)$ undefined $\frac{1}{0}$

$\cos\left(\frac{\pi}{2}\right) = 0$

Quadrantal Angles



$\cos(-\pi) =$ $\cos(\pi) = -1$

$\cot\left(\frac{5\pi}{2}\right) =$ $\cot\left(\frac{\pi}{2}\right) = \frac{0}{1} = 0$

$2 + \frac{1}{2}$

$\frac{x}{y}$

$\sec(2\pi) =$ $\sec(0) = 1$

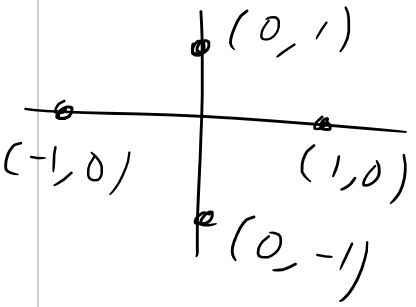
$\cos\theta = x$

$\sec\theta = \frac{1}{x}$

$\sin\left(-\frac{3\pi}{2}\right) =$ $\sin\left(\frac{\pi}{2}\right) = 1$

Quadrant 1 + Quadrantal Ratios w Reciprocal Functions

θ radian	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
$\sin(\theta)$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}=\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	0	-1	0
$\cos(\theta)$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}=\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	-1	0	1
$\tan(\theta)$	0	$\frac{1}{\sqrt{3}}=\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	Undefined	0	Undefined	0
$\csc(\theta)$	Undefined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}=\frac{2\sqrt{3}}{3}$	1	Undefined	-1	Undefined
$\sec(\theta)$	1	$\frac{2}{\sqrt{3}}=\frac{2\sqrt{3}}{3}$	$\sqrt{2}$	2	Undefined	-1	Undefined	1
$\cot(\theta)$	Undefined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}=\frac{\sqrt{3}}{3}$	0	Undefined	0	Undefined

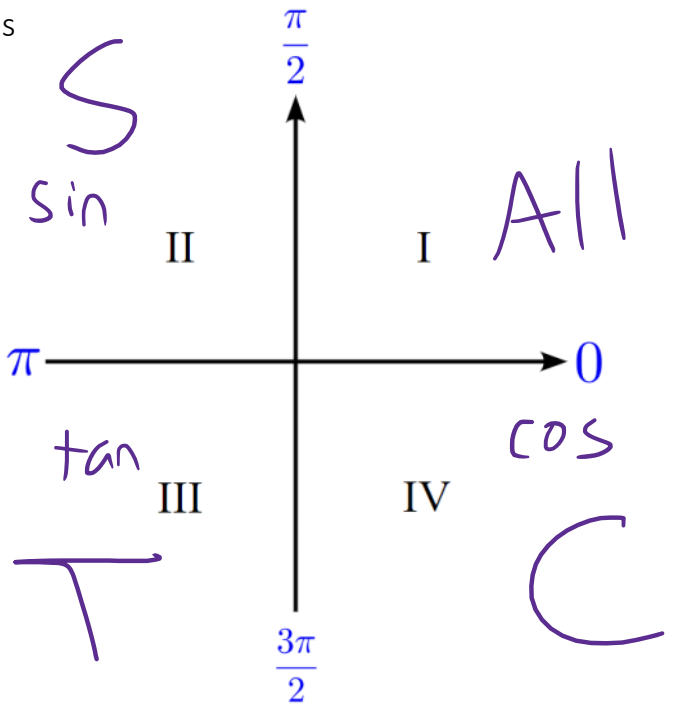


Signs of All Functions

$\cos\theta = x$

$\sin\theta = y$

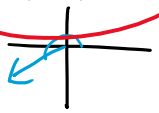
$\tan\theta = \frac{y}{x}$



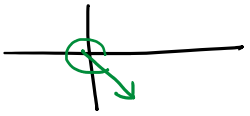
We'll start by marking off where each of the three trig functions are positive, then we'll mark off where the reciprocal functions are positive

Which of the following are negative? Circle them. Get rid of them. We don't need that negativity in our lives.

$\sin\left(\frac{7\pi}{6}\right)$

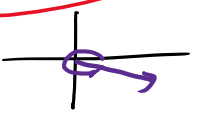


$\cos\left(\frac{7\pi}{4}\right)$



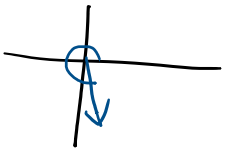
$\tan\left(\frac{5\pi}{4}\right)$

$\csc\left(\frac{11\pi}{6}\right)$

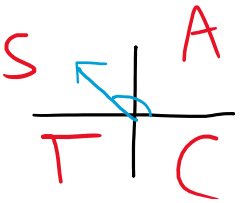


$\cot\left(\frac{5\pi}{3}\right)$

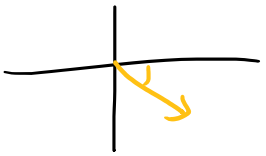
X −
Y −



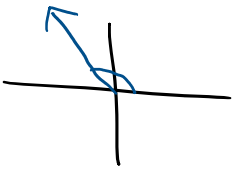
$\tan\left(\frac{3\pi}{4}\right)$



$\sec\left(-\frac{\pi}{4}\right)$



$\sin\left(\frac{2\pi}{3}\right)$



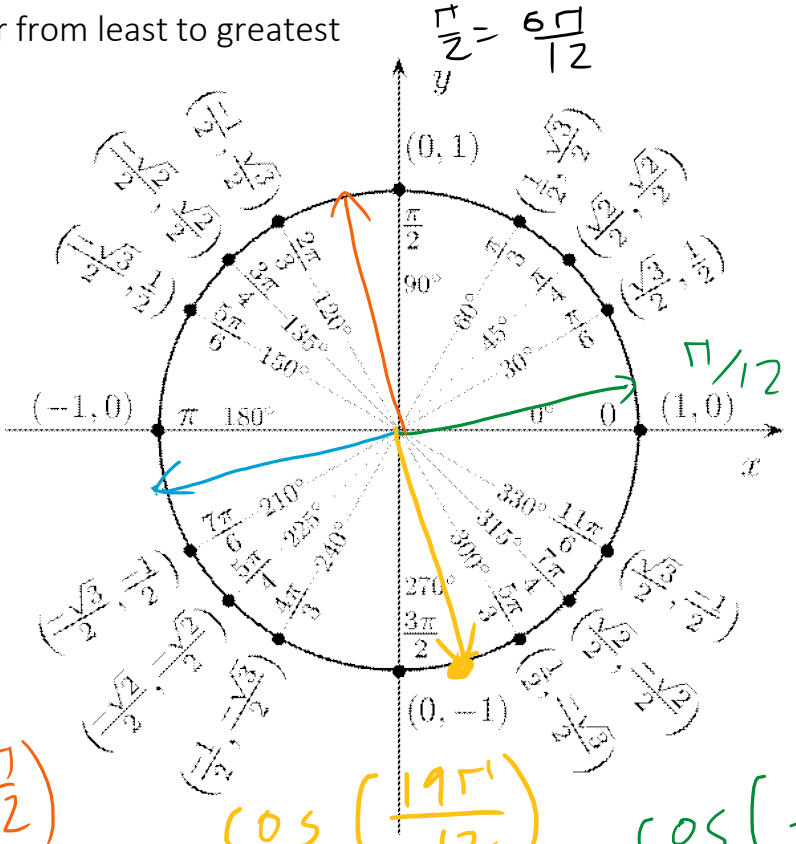
Put the following four trig ratios in order from least to greatest

$\cos\left(\frac{\pi}{12}\right)$

$\cos\left(\frac{7\pi}{12}\right)$ ← negative

$\cos\left(\frac{13\pi}{12}\right)$ ← negative

$\cos\left(\frac{19\pi}{12}\right)$



$\cos\left(\frac{13\pi}{12}\right)$ $\cos\left(\frac{7\pi}{12}\right)$ $\cos\left(\frac{19\pi}{12}\right)$ $\cos\left(\frac{\pi}{12}\right)$

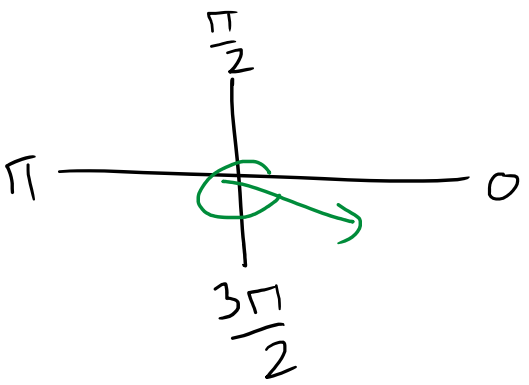
Obtuse/Large/Negative Angles

We can evaluate trig functions of obtuse/large/negative angles by…

1) Find the reference angle
2) Apply the trig function to the reference angle
3) Stick on a negative if it's supposed to be negative based on the quadrant

Example: $\sin\left(\frac{11\pi}{6}\right) = -\sin\left(\frac{\pi}{6}\right) = -\frac{1}{2}$

$\frac{11\pi}{6}$ vs $\frac{12\pi}{6}$



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1) Find the reference angle
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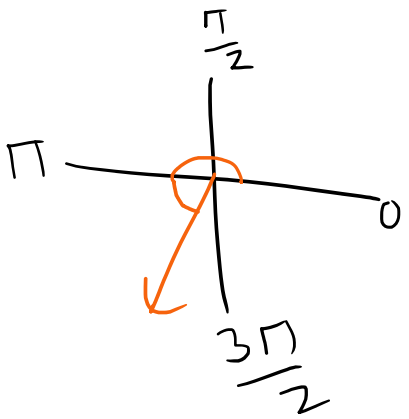
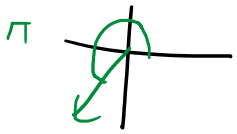
Example: $\tan\left(\frac{4\pi}{3}\right)$ = + $\tan\left(\frac{\pi}{3}\right) = \sqrt{3}$

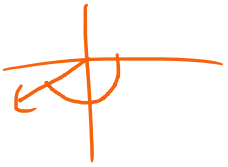


Evaluate

A) $\sin\left(\frac{4\pi}{3}\right)$ $= -\sin\left(\frac{\pi}{3}\right)$ $= -\frac{\sqrt{3}}{2}$



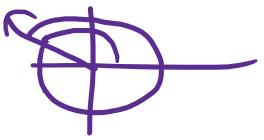
B) $\cos\left(-\frac{5\pi}{6}\right)$ $= -\cos\left(\frac{\pi}{6}\right)$ $-\frac{\sqrt{3}}{2}$



C) $\sin\left(\frac{3\pi}{4}\right)$ $= +\sin\left(\frac{\pi}{4}\right)$ $= \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

$\frac{0\pi}{4}$ $\frac{3\pi}{4}$ $\frac{4\pi}{4}$

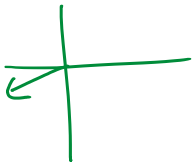
D) $\tan\left(\frac{11\pi}{4}\right)$ $= -\tan\left(\frac{\pi}{4}\right)$ $= -1$



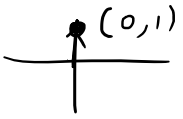
$\frac{11\pi}{4}$ $\xrightarrow{-2\pi}$ $\frac{3\pi}{4}$

Evaluate

E) $\sec\left(\frac{7\pi}{6}\right) =$ $-\sec\left(\frac{\pi}{6}\right)$ $= -\frac{2}{\sqrt{3}} = -\frac{2\sqrt{3}}{3}$



F) $\csc\left(-\frac{2\pi}{3}\right)$ $= -\csc\left(\frac{\pi}{3}\right)$ $= -\frac{2}{\sqrt{3}} = -\frac{2\sqrt{3}}{3}$



G) $\cot\left(\frac{17\pi}{2}\right) = \cot\left(\frac{\pi}{2}\right) = \frac{0}{1} = 0$

$\cot\theta = \frac{x}{y}$

$\frac{17\pi}{2} - 2\pi = \frac{13\pi}{2}$

$\frac{9\pi}{2}$

$\frac{5\pi}{2}$

$\frac{\pi}{2}$

H) $\cos(7\pi) = \cos(\pi) = -1$

$7\pi \curvearrowright 5\pi \curvearrowright 3\pi \curvearrowright \pi$

Evaluate

$\cos\left(-\frac{7\pi}{6}\right)$

$\csc\left(\frac{3\pi}{2}\right)$

$\tan\left(\frac{5\pi}{4}\right)$

$\cot\left(\frac{16\pi}{3}\right)$