3.5 Derivatives of Trigonometric Functions Day 2

$f(x)$	$f'(x)$
$y = \sin x$	$y' = \cos x$
$y = \cos x$	$y' = -\sin x$
$y = \tan x$	$y' = \sec^2 x$
$y = \sec x$	$y' = \sec x \tan x$
$y = \csc x$	$y' = -\csc x \cot x$
$y = \cot x$	$y' = -\csc^2 x$

Find the derivative of each.

Ex 1) $y = \sec x = \frac{1}{\cos x}$ ($u = 1$, $v = \cos x$)

$$y' = \frac{\cos x \cdot 0 - 1(-\sin x)}{\cos^2 x}$$

$$y' = \frac{\sin x \cdot 1}{\cos x \cdot \cos x}$$

$$y' = \tan x \cdot \sec x$$

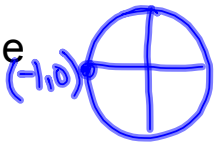
Ex 2) $y = \csc x = \frac{1}{\sin x}$ ($u = 1$, $v = \sin x$)

$$y' = \frac{\sin x \cdot 0 - 1 \cdot \cos x}{\sin^2 x}$$

$$y' = \frac{-\cos x \cdot 1}{\sin x \cdot \sin x}$$

$$y' = -\cot x \csc x$$

Ex 3) Which of the following is an equation of the normal line to $y = \sin x + \cos x$ at $x = \pi$?



$= \sin(\pi) + \cos(\pi) = 0 - 1 = -1$

A. $y = -x + \pi - 1$

B. $y = x - \pi - 1$

C. $y = x - \pi + 1$

D. $y = x + \pi + 1$

E. $y = x + \pi - 1$

$y' = \cos x - \sin x$

$= \cos\pi - \sin\pi$

$= -1 - 0$

$= -1 = m$ tangent

$1 = -m$ Normal

$(\pi, -1)$

$y + 1 = 1(x - \pi)$

$y = x - \pi - 1$

Ex 4) Find y'' if $y = x \sin x$ ($u \cdot v$)

A. $-x \sin x$

B. $x \cos x + \sin x$

C. $-x \sin x + 2 \cos x$

D. $x \sin x$

E. $-\sin x + \cos x$

$y' = u' \cdot v + \sin x \cdot 1$

$y'' = x(-\sin x) + 1(\cos x \cdot 1) + \cos x$

$= -x \sin x + 2 \cos x$

Ex 5) A body is moving in simple harmonic motion with position s = 3 + sin t. At which of the following times is the velocity zero?

$s' = v = \cos t = 0$

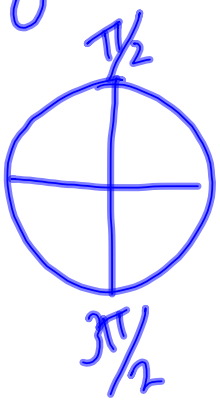
A. t = 0

B. t = π/4

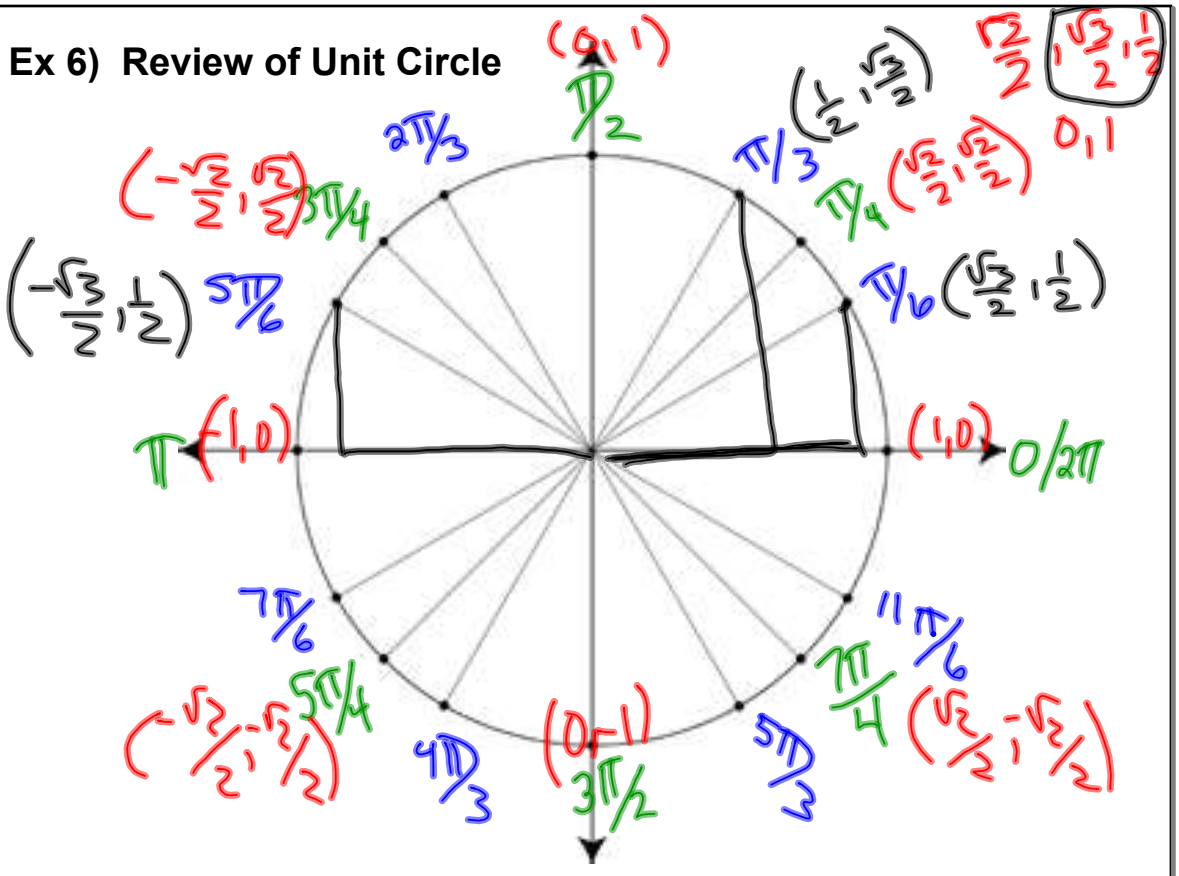
C. t = π/2

D. t = π

E. none of these

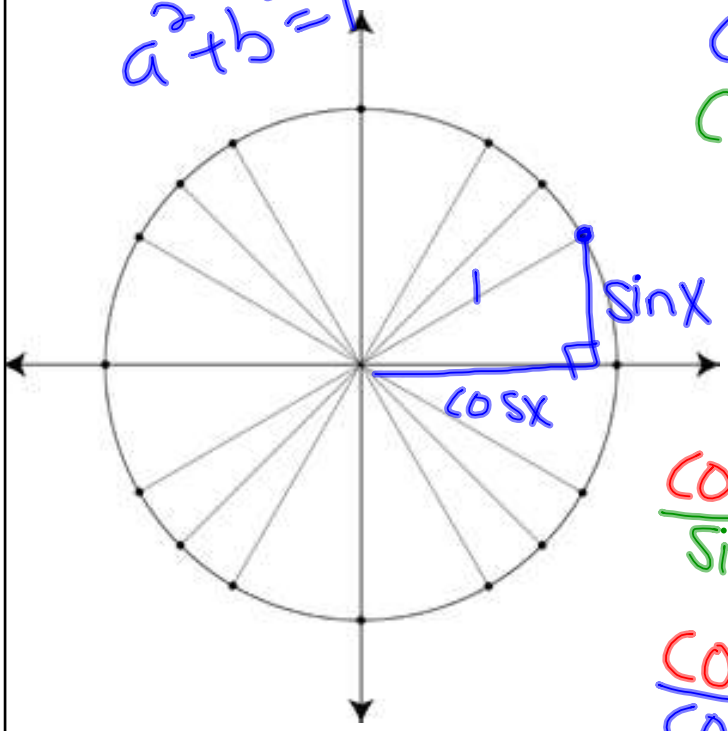


Ex 6) Review of Unit Circle



Pythagorean Identities

$a^2+b^2=1$



$\cos^2x+\sin^2x=1$

$\cot^2x+1=\csc^2x$

$1+\tan^2x=\sec^2x$

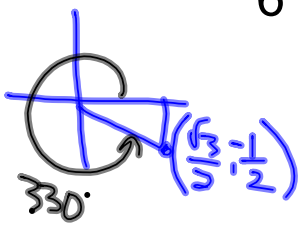
$\frac{\cos^2x}{\sin^2x}+\frac{\sin^2x}{\sin^2x}=\frac{1}{\sin^2x}$

$\frac{\cos^2x}{\cos^2x}+\frac{\sin^2x}{\cos^2x}=\frac{1}{\cos^2x}$

Ex 9) $\csc x=\frac{1}{\sin x}$

$\csc\frac{11\pi}{6}=\frac{1}{-\frac{1}{2}}=-2$

$\frac{11\pi}{6}\cdot\frac{180}{\pi}$



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

$\cot\frac{7\pi}{4}=\frac{\frac{\sqrt{2}}{2}}{-\frac{\sqrt{2}}{2}}=-1$

$\tan\frac{5\pi}{4}=1$

$\tan\theta=\frac{y}{x}=\frac{-\sqrt{2}/2}{-\sqrt{2}/2}$

$\sec\frac{7\pi}{6}=\frac{1}{\frac{-\sqrt{3}}{2}}=\frac{-2}{\sqrt{3}}=-\frac{2\sqrt{3}}{3}$

$\left(-\frac{\sqrt{3}}{2},-\frac{1}{2}\right)$

$\frac{1}{\cos x}=\frac{1}{x}$