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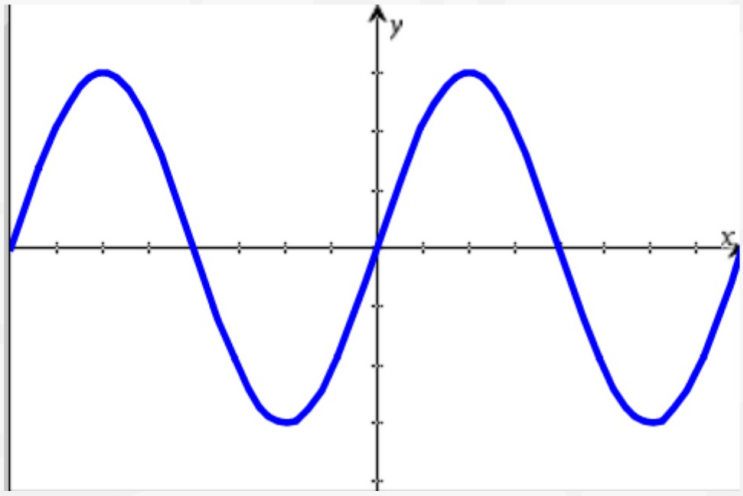
Given the graph of a function below. Sketch a graph of the first derivative and the second derivative.



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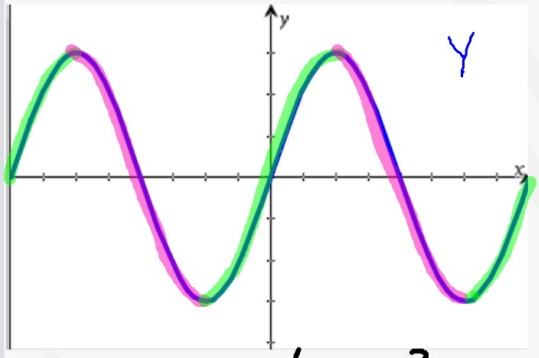
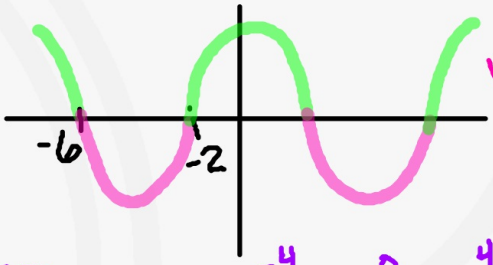
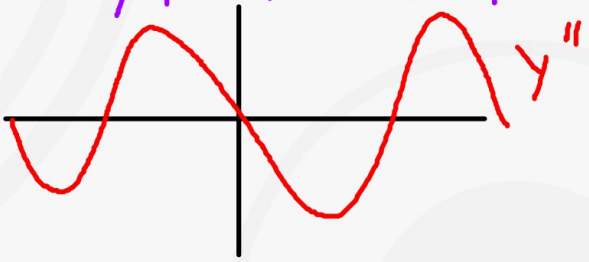


CP		-6	-2	
sign y'		+	-	
behav y		inc	dec	



CP		-4	0	4	
sign y''	-		+	-	+
behav y'	dec		inc	dec	inc



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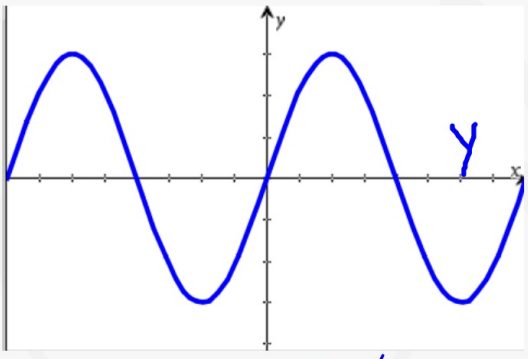
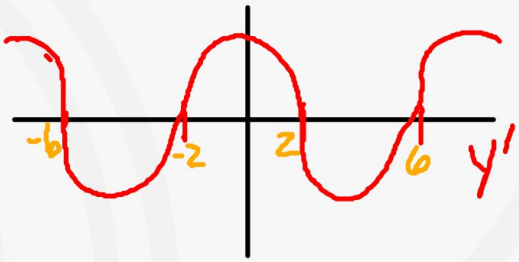
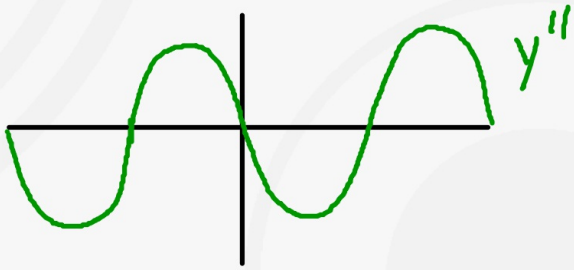


CP		-6	-2	2	6	
Sign y'	+	−	+	−	+	
behav y	inc	dec	inc	dec	inc	



CP		-4	0	4	
Sign y''	−	+	−	+	
behav y'	dec	inc	dec	inc	



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Students will verbally explain how to find and apply the derivatives of trig functions

(using the words:
increasing, postive, quotient etc...)

$\frac{d}{dx}(\sin x)$	$= \cos x$
$\frac{d}{dx}(\cos x)$	$= -\sin x$
$\frac{d}{dx}(\tan x)$	$= \sec^2 x$

$\frac{d}{dx}(\cot x)$	$= -\csc^2 x$
$\frac{d}{dx}(\csc x)$	$= -\csc x \cot x$
$\frac{d}{dx}(\sec x)$	$= \sec x \tan x$

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

$$\frac{d}{dx}(\tan x) = \frac{d}{dx}\left(\frac{\sin x}{\cos x}\right)$$

$$= \frac{\cos x(\cos x) - (-\sin x)\sin x}{(\cos x)^2}$$

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

$$= (\sec x)^2$$

$\frac{d}{dx}(\sin x)$	$= \cos x$
$\frac{d}{dx}(\cos x)$	$= -\sin x$
$\frac{d}{dx}(\tan x)$	$= \sec^2 x$

$\frac{d}{dx}(\cot x)$	$= -\csc^2 x$
$\frac{d}{dx}(\csc x)$	$= -\cot x(\csc x)$
$\frac{d}{dx}(\sec x)$	$= \tan x(\sec x)$

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

$$\frac{d}{dx}(\tan x) = \frac{d}{dx}\left(\frac{\sin x}{\cos x}\right)$$

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

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

$$= \sec^2 x$$

$\frac{d}{dx}(\cot x)$	$= -\csc^2 x$
$\frac{d}{dx}(\csc x)$	$= -\csc x \cot x$
$\frac{d}{dx}(\sec x)$	$= \sec x \tan x$

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

$$\frac{d}{dx}(\sec x) = \frac{d}{dx}\left(\frac{1}{\cos x}\right) = \frac{d}{dx}\left((\cos x)^{-1}\right)$$

$$= -1(\cos x)^{-2}(-\sin x)$$

$$= \frac{1}{(\cos x)^2} \cdot \frac{\sin x}{1} = \frac{1}{\cos x} \cdot \frac{\sin x}{\cos x}$$

$$= \sec x (\tan x)$$

$\frac{d}{dx}(\cot x)$	$= -\csc^2 x$
$\frac{d}{dx}(\csc x)$	$= -\cot x (\csc x)$
$\frac{d}{dx}(\sec x)$	$= \tan x (\sec x)$

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

$$\frac{d}{dx}(\sec x) = \frac{d}{dx}\left(\frac{1}{\cos x}\right) = \frac{0(\cos x) - (-\sin x)(1)}{(\cos x)^2}$$

$$= \frac{\sin x}{(\cos x)^2} = \frac{\sin x}{\cos x} \cdot \frac{1}{\cos x} = \tan x (\sec x)$$

find $\frac{dy}{dx}$

$y = \cos x - 3\sin x$

$\frac{dy}{dx} = -\sin x - 3\cos x$

$y = \cos x(\tan x)$

$y' = -\sin x(\tan x) + \sec^2 x(\cos x)$

$y = 3x^2 \csc x$

$\frac{dy}{dx} = 6x(\csc x) + (-\csc x \cot x)3x^2$

$= 6x \csc x - 3x^2 \csc x \cot x$