TRIG DERIVATIVES (See p. 152)

MEMORIZE THESE!

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

$$\frac{d}{dx}(\cos x) = -\sin x$$

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

$$\frac{d}{dx}(\sec x) = (\sec x)(\tan x)$$

$$\frac{d}{dx}(\csc x) = (-\csc x)(\cot x)$$

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

Which one has the minus sign?

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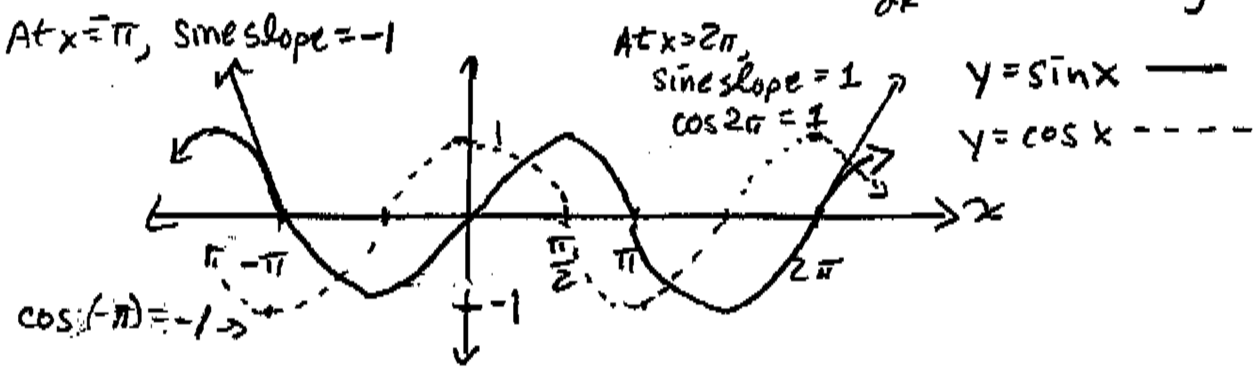
$$\frac{d}{dx}(\sin x) = \cos x$$

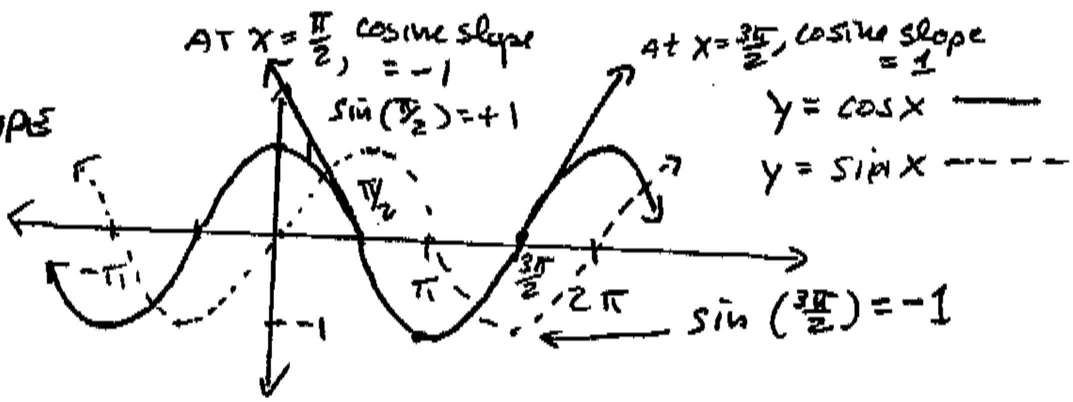
$$\frac{d}{dx}(\cos x) = -\sin x$$

You will mix these two up often. LEARN THEM RIGHT, RIGHT NOW!

The sine slope vs. Cosine x (THEY ARE EQUAL: $\frac{d}{dx}(\sin x) = \cos x$)



THE COSINE SLOPE VS. Sine x



(THEY ARE OPPOSITE: $\frac{d}{dx}(\cos x) = -\sin x$)

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n animation

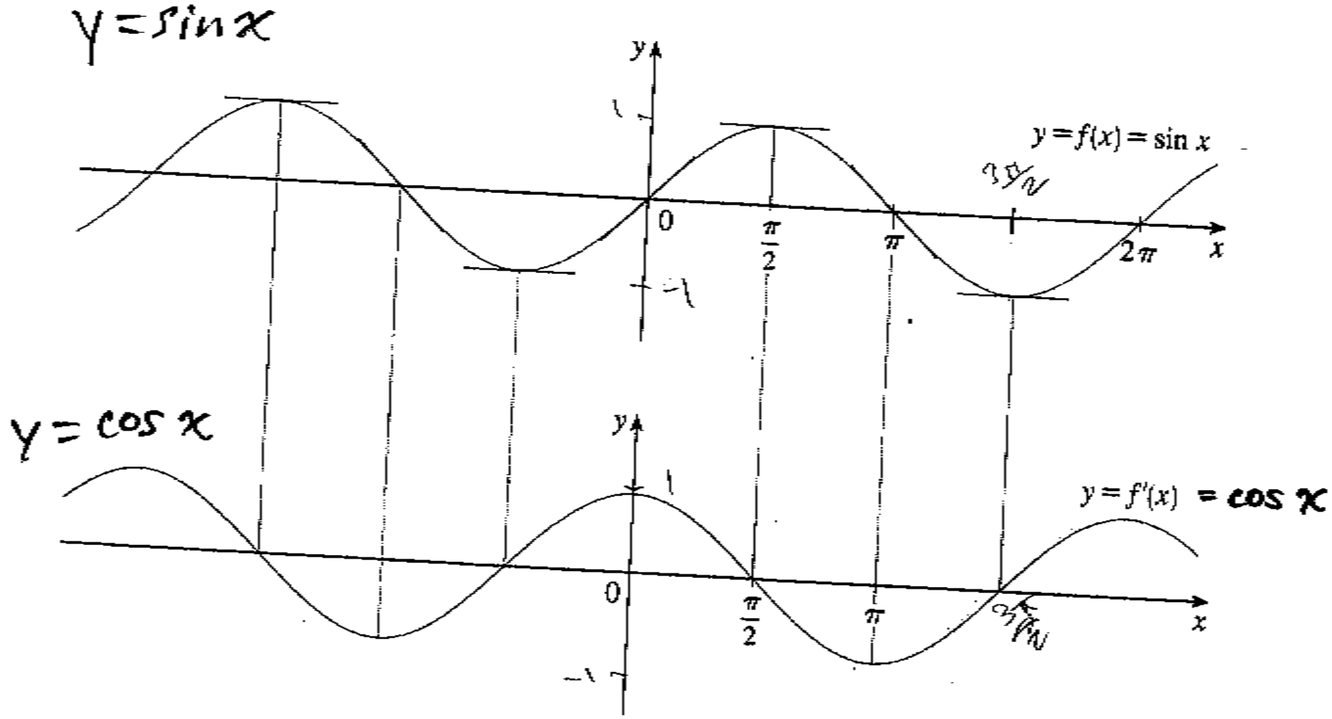

FIGURE 1

Let's try to confirm our guess that if $f(x) = \sin x$, then $f'(x) = \cos x$. From the definition of a derivative, we have

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \to 0} \frac{\sin(x+h) - \sin x}{h}$$

rmula for sine

$$= \lim \frac{\sin x \cos h + \cos x \sin h - \sin x}{}$$

To recall

$$\frac{d}{dx}(\tan x) \text{ and } \frac{d}{dx}(\sec x),$$

use the identifies:

$$\tan x = \frac{\sin x}{\cos x} \text{ and } \sec x = \frac{1}{\cos x}$$

together with the QUOTIENT FORMULA:

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

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

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

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

$$= \left(\frac{1}{\cos x}\right)^2 = (\sec x)^2 = \underline{\sec^2 x}$$

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DERIVE

$$\frac{d}{dx}(\sec x) = \sec x \tan x$$

for yourself using the identities and the Quotient formula