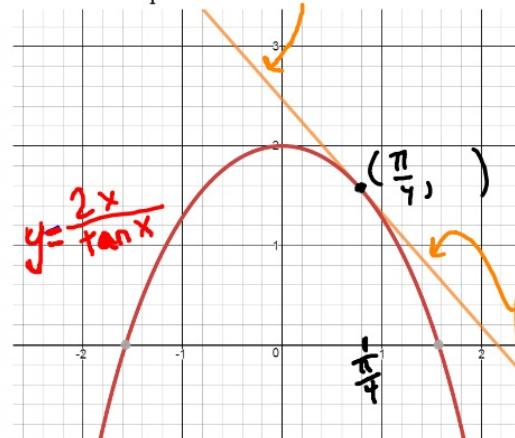


Good afternoon: warm up in notebooks
Write the equation of this line.



$$y - y_1 = m(x - \frac{\pi}{4})$$

$$y(\frac{\pi}{4}) = \frac{2(\frac{\pi}{4}) - \frac{\pi}{2}}{\tan(\frac{\pi}{4})} \frac{\pi/2}{1}$$

$$= \frac{\pi}{2}$$

$$y - \frac{\pi}{2} = (2 - \pi)(x - \frac{\pi}{4})$$

$$y = \frac{2x}{\tan x} \quad f \quad f: 2x \quad g: \tan x$$

$$f' = 2 \quad g' = \sec^2 x$$

$$\frac{dy}{dx} = \frac{f'g - fg'}{g^2} \rightarrow \frac{2 \cdot \tan x - 2x \cdot \sec^2 x}{\tan^2 x}$$

$$\left. \frac{dy}{dx} \right|_{x=\frac{\pi}{4}} = \frac{2 \cdot \tan \frac{\pi}{4} - 2 \cdot \frac{\pi}{4} \sec^2 \frac{\pi}{4}}{\tan^2 \frac{\pi}{4}}$$

$$\left. \frac{dy}{dx} \right|_{x=\frac{\pi}{4}} = \frac{2 - \frac{\pi}{2}}{1}$$

CORRECTION to notes and booklet (sorry -_-)

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

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

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

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

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

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

NOTE CORRECTION
FROM CLASS

NOTES

Show that the derivative of $y = \sec(x)$ is $y' = \sec(x)\tan(x)$.

$$y = \sec(x) = \frac{1}{\cos(x)}$$

f g

$$\left\{ \begin{array}{l} f'g - fg' \\ g^2 \end{array} : \begin{array}{ll} f: 1 & g: \cos(x) \\ f': 0 & g': -\sin(x) \end{array} \right\}$$

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

$$\frac{\sin x}{\cos^2 x} \rightarrow \boxed{\frac{\sin x \cdot 1}{\cos x \cdot \cos x}}$$

$\tan \cdot \sec$

$$\cancel{\sec(x) \cdot \tan(x)}$$

Q.E.D.

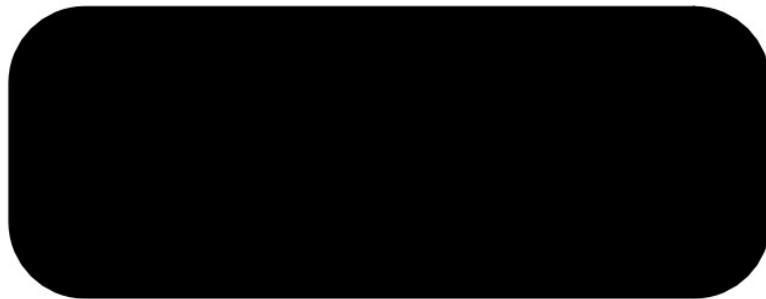


The Chain Rule (one of the most important in calculus!)

How do you take the derivative of $y=\sin(3x^2-2)$?

Is it..... $dy/dx = \cos(3x^2-2)$??

Let's look at it graphically.
bit.ly/chainrule02



So, no, the derivative is not so simple.

First, note that $y=\sin(3x^2-2)$ is a *composite function*

REVIEW

Suppose $f(x) = \underline{x^2}$ and $\underline{g(x)} = 5x-3$



1. Find $f(g(x))$ (don't simplify) $(5x-3)^2$

2. Simplify $f(g(x))$ $25x^2 - 30x + 9$

3. Find $\frac{d}{dx} f(g(x))$ $50x - 30$.

So, if $f = x^2$ and $g = 5x - 3$

$$f(g(x)) = (5x - 3)^2 = 25x^2 - 30x + 9$$

Derivative of $f(g(x))$ would be $50x - 30$

$$\begin{aligned} & 50x - 30 \\ & \underline{10(5x - 3)} \\ & 2 \cdot 5(5x - 3)^1 \\ & 2(5x - 3)^1 \cdot 5 \end{aligned}$$



The Chain Rule

(booklet)

$$\frac{d}{dx} [f(g(x))] = f'(g(x)) * g'(x)$$



$$\frac{d}{dx} \sin(3x^2 - 2) = \cos(3x^2 - 2) \cdot 6x$$

$$6x \cdot \cos(3x^2 - 2)$$



Find $f'(x)$ for $f(x) = (5x-3)^2$

$$\frac{d}{dx} x^2 = 2x^1$$

$$f' = 2(5x-3)^1 \cdot 5$$

$10(5x-3)$

$$f(x) = (2x-5)^{100}$$

$$f' = 100(2x-5)^{99} \cdot 2$$

$$200(2x-5)^{99}$$



Find the derivative function

$$y = [\cos(4x-3)]^{50}$$

$$y' = \underline{50} \underline{[\cos(4x-3)]^{49}} - \sin(\underline{4x-3}) \cdot \underline{4}$$

$$y' = -200 \sin(4x-3) \cdot (\cos(4x-3))^{49}.$$



24. If $f(x) = (x^2 - 2x - 1)^{\frac{2}{3}}$, then $f'(0)$ is

(A) $\frac{4}{3}$

(B) 0

(C) $-\frac{2}{3}$

(D) $-\frac{4}{3}$

(E) -2

$$f' \equiv \frac{2}{3} \left(\underbrace{x^2 - 2x - 1}_{\text{original function}} \right)^{-\frac{1}{3}} (2x - 2)$$

$$f'(0) \equiv \frac{2}{3} \left(0^2 - 2 \cdot 0 - 1 \right)^{-\frac{1}{3}} (2 \cdot 0 - 2)$$

$$\frac{2}{3} \left(\cancel{-1} \right)^{-\frac{1}{3}} (-2)$$

$$\frac{4}{3}$$

HW due Friday

frontside: #1-10 pick 5

backside: #451-467 pick any 8