Assignments for the Week of Sept 12:

- Read 2.3-2.4
- 45 minutes of Khan Academy
- Due Wed. 21 Sept:
  2.3 #1-53 odd; 63-85 odd; 91-105 odd; 111-115 odd

Power Rule:

$$\frac{d}{dx}[x^n] = nx^{n-1}$$

d/dx [c]=0

Product Rule:

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

Constant Multiple Rule:

$$\frac{d}{dx}[cf(x)] = c\frac{d}{dx}[f(x)]$$

Quotient Rule:

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x) - f(x)g'(x)}{g^2(x)}$$

Sum & Difference:

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

Chain Rule:

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

Trig Functions:

$$\frac{d}{dx}[\sin x] = \cos x \qquad \frac{d}{dx}[\tan x] = \sec^2 x \qquad \frac{d}{dx}[\sec x] = \sec x \tan x$$

$$\frac{d}{dx}[\cos x] = -\sin x \qquad \frac{d}{dx}[\cot x] = -\csc^2 x \qquad \frac{d}{dx}[\csc x] = -\csc x \cot x$$

2.3 Product & Quotient Rules

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

$$\boxed{(fg)' = f'g + fg'}$$

$$\left[\frac{f}{g}\right]' = \frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$$

"low dee high less high dee low,
draw the line and square below"

$$\boxed{\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}}$$

Find the slope of the tangent line at the given point.

$f(x) = 3x - \sin x \quad ; (\pi, 3\pi)$

$f'(x) = 3 - \cos x$

$m = f'(\pi) = 3 - \cos\pi$

$= 3 - (-1) = \boxed{4}$

Find the equation of the tangent line at the given point.

$f(x) = 2x^3 + \sin x - 2x \quad ; (0,0)$

$f'(x) = 6x^2 + \cos x - 2$

$m = f'(0) = 6(0)^2 + \cos(0) - 2$

$= 0 + 1 - 2 = -1$

$y - y_1 = m(x - x_1)$

$y - 0 = -1(x - 0)$

$\boxed{y = -x}$

Find the equation of the tangent line at the given point.

$f(x) = \frac{1}{x+1} \quad ; (0,1)$

$$f'(x) = \frac{(x+1)(1)' - (1)(x+1)'}{(x+1)^2}$$

$$= \frac{0 - 1}{(x+1)^2} = \frac{-1}{(x+1)^2}$$

$m = f'(0) = \frac{-1}{(0+1)^2} = -1$

$y - 1 = -1(x - 0)$

$\boxed{y = -x + 1}$

2.4 - The Chain Rule

$$[f(g(x))]' = f'(g(x)) \cdot g'(x)$$

$$[h(g(f(x)))]' = h'[g(f(x))] \cdot g'[f(x)] \cdot f'(x)$$

$$f(x) = \sin\left(x^5 - 3x^2\right)$$

$$f'(x) = \left[\cos\left(x^5 - 3x^2\right)\right] \cdot \left(5x^4 - 6x\right)$$

$$f(x) = \cos\left[5\sin(7x)\right]$$

$$f'(x) = \left(-\sin\left[5\sin(7x)\right]\right) \cdot \left(5\cos(7x)\right) \cdot 7$$

$$f(x) = (5x)\left(\sin(x^2)\right)$$

$$f'(x) = \boxed{(5)\left(\sin(x^2)\right) + (5x) \cdot \underbrace{\left(\cos(x^2)\right)(2x)}_{\left(\sin(x^2)\right)'}}$$

$$f(x) = 5\sin\left(3\cos 2x^5\right)$$

$$f'(x) = \left[5\cos\left(3\cos 2x^5\right)\right] \cdot \left[-3\sin 2x^5\right] \cdot \left(10x^4\right)$$

$$f(x) = (x)(\sin x)(\sqrt{x-1})$$

$$= (x\sin x)\left((x-1)^{1/2}\right)$$

$$f'(x) = (x \cdot \sin x)'\left((x-1)^{1/2}\right) + (x\sin x)\left((x-1)^{1/2}\right)'$$

$$= \boxed{\left(1\cdot\sin x + x\cdot\cos x\right)\left((x-1)^{1/2}\right) + (x\sin x)\left(\tfrac{1}{2}(x-1)^{-1/2}\cdot 1\right)}$$

$$f(x) = \sec^2(\sin(3x)) = [\sec(\sin(3x))]^2$$

$$\boxed{f'(x) = 2\sec(\sin(3x)) \cdot \sec(\sin(3x))\tan(\sin(3x)) \cdot \cos(3x) \cdot 3}$$

$$f(x) = \cos\left(\sqrt{\tan^2 x - 2x}\right)$$

$$= \cos\left[\left((\tan x)^2 - 2x\right)^{1/2}\right]$$

$$f'(x) = -\sin\left(\sqrt{\tan^2 x - 2x}\right) \cdot \frac{1}{2}\left(\tan^2 x - 2x\right)^{-1/2} \cdot \left(2\tan x \cdot \sec^2 x - 2\right)$$