Power Rule:

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

Constant Multiple Rule:

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

Sum & Difference:

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

Product Rule:

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

Quotient Rule:

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

Chain Rule:

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

Trig Functions:

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

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

$$f(x) = (5x)[\sin(x^2)]$$

$$f'(x) = (5x)'[\sin(x^2)] + (5x)[\sin(x^2)]'$$

$$= 5\sin(x^2) + (5x)\cdot\cos(x^2)\cdot 2x$$

$$= 5\sin(x^2) + 10x^2\cos(x^2)$$

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

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

$$= -150x^4 \cos(3\cos 2x^5)\sin(2x^5)$$

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

$$f(x) = [x(\sin x)][(x-1)^{1/2}]$$

$$f'(x) = [x(\sin x)]'[(x-1)^{1/2}] + [x(\sin x)][(x-1)^{1/2}]'$$

$$= [1 \cdot \sin x + x \cdot \cos x]\sqrt{x-1} + (x\sin x) \cdot \frac{1}{2}(x-1)^{-1/2} \cdot 1$$

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

$f^2(x) = [f(x)]^2$

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

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

$f(x) = [5\cos(2x)]\sqrt{x^2+3}$

$f(x) = \dfrac{\cot(x^3)}{5x^{2/3} - 4x^5 + 3x}$

$f(x) = \sqrt[3]{\tan(4-x^2)}$

$f(x) = x\sqrt{x}\sec(3x^{-4})$

$f(x) = \dfrac{9\sqrt{2x-1}}{\csc 5x - 3}$

$f(x) = 6\sin^2\left(x\sqrt{1-x^3}\right)$

$f(x) = (2x^{-3})\sec\sqrt{9x-\cos x}$