Chain Rule

These are composition functions:

$$h(x) = (3x - 2)^3$$

$$h(x) = \sqrt{3x - 2}$$

$$h(x) = \frac{1}{3x - 2}$$

$$h(x) = e^{3x-2}$$

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

Ex. $f(x) = (4x^2 + 1)^7$

$$f'(x) = 7(4x^2+1)^6 \cdot 8x = 56x(4x^2+1)^6$$

Ex. $g(x) = e^{7x}$

$$g'(x) = e^{7x} \cdot 7$$

Ex. If $y = \sin^2\theta$, find $\frac{dy}{d\theta}$.

$= (\sin\theta)^2$

$y' = 2\sin\theta \cdot \cos\theta = \sin 2\theta$

$\frac{x}{2} = \frac{1}{2}x$

Ex. $f(x) = \sec\left(\frac{x}{2}\right)$

$f'(x) = \sec\left(\frac{x}{2}\right)\tan\left(\frac{x}{2}\right) \cdot \frac{1}{2}$

Pract. $f(x) = \cos(x^2 + 1)$

$f'(x) = -\sin(x^2+1) \cdot 2x$

Pract. $f(x) = \sqrt{3x^2 + 8x - 2}$

$f'(x) = \frac{1}{2}(3x^2+8x-2)^{-1/2}(6x+8) = \frac{3x+4}{\sqrt{3x^2+8x-2}}$

Pract. $f(x) = \frac{1}{x^2+x^4} = (x^2+x^4)^{-1}$

$f'(x) = -(x^2+x^4)^{-2}(2x+4x^3)$

Ex. $f(x) = x\tan(-x^2)$

$f'(x) = x \cdot \sec^2(-x^2)(-2x) + \tan(-x^2) \cdot 1$

Ex. $f(x) = e^{(5x^3-2x)^7}$

$f'(x) = e^{(5x^3-2x)^7} \cdot 7(5x^3-2x)^6(15x^2-2)$

A turducken is a dish consisting of a chicken stuffed into a duck, which itself is stuffed into a turkey.