Rules so far

$$\frac{d}{dx} x^n = n x^{n-1} \qquad n = \ldots -2, -1, 0, 1, 2, \ldots$$

$$\frac{d}{dx} x^a = a x^{a-1} \qquad x > 0, \quad a: \text{any real number}$$

$$\frac{d}{dx} e^x = e^x$$

Rules so far

Constant multiple:

$$\frac{d}{dx} c f(x) = c \cdot \frac{d}{dx} f(x) = c \cdot f'(x)$$

$$\frac{d}{dx} 7e^x = 7 \frac{d}{dx} e^x = 7e^x$$

Sum

$$\frac{d}{dx}\big(f(x) + g(x)\big) = \frac{d}{dx} f(x) + \frac{d}{dx} g(x)$$

$$\frac{d}{dx}\left(x^4 + x^{1/2}\right) = \frac{d}{dx} x^4 + \frac{d}{dx} x^{1/2} = 4x^3 + \frac{1}{2} x^{-1/2}$$

Rules so far

Product

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

$$\frac{d}{dx}\left[x^2 e^x\right] = 2x e^x + x^2 e^x$$

Quotient

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

$$\frac{d}{dx}\left[\frac{3x}{1+x^2}\right] = \frac{3\cdot(1+x^2) - 3x\,(2x)}{(1+x^2)^2}$$

Rules so far

Quotient

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

Reciprocal/Inverse

$$\frac{d}{dx}\frac{1}{g(x)} = \frac{-g'(x)}{g(x)^2}$$

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

Rules so far

Quotient

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

Reciprocal/Inverse

$$\frac{d}{dx}\frac{1}{g(x)} = \frac{-g(x)}{g'(x)^2}$$

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

Rules so far

- $\frac{d}{dx} x^n = n x^{n-1}$ $\left(\frac{d}{dx} x^a = a x^{a-1} \quad x > 0 \right)$
- $\frac{d}{dx} e^x = e^x$
- Constant Mult. $\frac{d}{dx} c\, f(x) = c\, f'(x)$
- Sum $\frac{d}{dx} [f(x) + g(x)] = f'(x) + g'(x)$
- Product $\frac{d}{dx} f(x) g(x) = f'(x) g(x) + f(x) g'(x)$
- Quotient $\frac{d}{dx} \frac{f(x)}{g(x)} = \frac{f'(x) g(x) - f(x) g'(x)}{[g(x)]^2}$

Two New Rules

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

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

Today: trust me! (next time, some justification).