

Derivative Rules

Constant Rule (k is any real number):

$$f(x) = k$$

$$f'(x) = 0$$

Power Rule (n is any real number):

$$f(x) = x^n$$

$$f'(x) = n \cdot x^{n-1}$$

Constant times a function (k is any real number):

$$f(x) = k \cdot g(x)$$

$$f'(x) = k \cdot g'(x)$$

Sum or Difference Rule:

$$f(x) = u(x) \pm v(x)$$

$$f'(x) = u'(x) \pm v'(x)$$

Product Rule:

$$f(x) = u(x) \cdot v(x)$$

$$f'(x) = u(x) \cdot v'(x) + v(x) \cdot u'(x)$$

Quotient Rule:

$$f(x) = \frac{u(x)}{v(x)} \quad v(x) \neq 0$$

$$f'(x) = \frac{v(x) \cdot u'(x) - u(x) v'(x)}{[v(x)]^2}$$

Chain Rule:

If $y = f(u)$ and $u = g(x)$ then $y = f(u) = f[g(x)]$ and

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

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

Generalized Power Rule (n is any real number):

$$y = [g(x)]^n$$

$$y' = n \cdot [g(x)]^{n-1} \cdot g'(x)$$

Exponential Function (a is any positive real number except for 1):

$$y = a^{g(x)}$$

$$y = e^{g(x)}$$

$$y' = (\ln a) \cdot a^{g(x)} \cdot g'(x) \quad y' = e^{g(x)} \cdot g'(x)$$

Logarithmic Function (a is any positive real number except for 1):

$$y = \log_a |g(x)| \quad y = \ln |g(x)|$$

$$y' = \frac{1}{\ln a} \cdot \frac{g'(x)}{g(x)} \quad y' = \frac{g'(x)}{g(x)}$$