

Derivatives of Functions

Constant Product Rule

$$\frac{d}{dx}(a \times f(x)) = a \times f'(x), \quad a \in \mathbb{R}$$

Derivative of a Constant

$$\frac{d}{dx}(c) = 0, \quad c \in \mathbb{R}$$


Example

$$\frac{d}{dx}(101) = 0$$

Example

$$\frac{d}{dx}(-57.285) = 0$$

Derivative of Power Functions

$$\frac{d}{dx}(x^n) = nx^{n-1}, \quad n \in \mathbb{Q}$$


Example

$$\frac{d}{dx}(x^5) = 5x^4$$

Example

$$f(x) = 3x^2 \\ f'(x) = 3 \times 2x^{2-1} = 6x$$

Example

$$\frac{d(5x)}{dx} = 5 \times 1x^{1-1} = 5$$

Example

$$\frac{d}{dx}(x^{101}) = 101x^{100}$$

Example

$$y = x^{-4}$$

$$\frac{dy}{dx} = -4x^{-4-1} = -4x^{-5}$$

Example

$$f(x) = \frac{6}{x} = 6x^{-1}$$

$$f'(x) = 6 \times -1x^{-1-1} = -6x^{-2} = -\frac{6}{x^2}$$

Example

$$y = 3x^{\frac{7}{5}}$$

$$\frac{dy}{dx} = 3 \times \frac{7}{5}x^{\frac{7}{5}-1} = \frac{21}{5}x^{\frac{2}{5}}$$

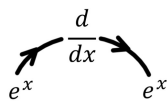
Example

$$y = 4\sqrt{x} = 4x^{\frac{1}{2}}$$

$$\frac{dy}{dx} = 4 \times \frac{1}{2}x^{\frac{1}{2}-1} = 2x^{-\frac{1}{2}} = \frac{2}{\sqrt{x}}$$

Derivative of Exponentials

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



Derivative of Logarithms

$$\frac{d}{dx}(\log_e(x)) = \frac{1}{x}$$

Example

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

Example

$$\frac{d}{dx}(-4 \log_e(x)) = -\frac{4}{x}$$

Derivative of Circular Functions

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

$$+ \sin(x) \downarrow \frac{d}{dx}$$

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

$$+ \cos(x) \downarrow \frac{d}{dx}$$

$$\frac{d}{dx}(\tan(x)) = \frac{1}{\cos^2(x)}$$

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

$$- \cos(x) \downarrow$$

Example

$$\frac{d}{dx}(3.4 \sin(x)) = 3.4 \cos(x)$$

Example

$$\frac{d}{dx}(-2 \cos(x)) = -(-2 \sin(x)) = 2 \sin(x)$$

Example

$$\frac{d}{dx}(9 \tan(x)) = \frac{9}{\cos^2(x)}$$