Derivatives

Product rule

$$(fg)' = f'g + fg'$$

Quotient rule

$$\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}, \qquad g \neq 0$$

Derivatives of simple functions

$$\frac{d}{dx}c = 0$$
$$\frac{d}{dx}x = 1$$
$$\frac{d}{dx}cx = c$$
$$\frac{d}{dx}|x| = \frac{x}{|x|} = \operatorname{sgn} x, \qquad x \neq 0$$
$$\frac{d}{dx}x^c = cx^{c-1} \qquad \text{where both } x^c \text{ and } cx^{c-1} \text{ are defined}$$
$$\frac{d}{dx}\left(\frac{1}{x}\right) = \frac{d}{dx}\left(x^{-1}\right) = -x^{-2} = -\frac{1}{x^2}$$
$$\frac{d}{dx}\left(\frac{1}{x^c}\right) = \frac{d}{dx}\left(x^{-c}\right) = -\frac{c}{x^{c+1}}$$
$$\frac{d}{dx}\sqrt{x} = \frac{d}{dx}x^{\frac{1}{2}} = \frac{1}{2}x^{-\frac{1}{2}} = \frac{1}{2\sqrt{x}}, \qquad x > 0$$

Derivatives of exponential and logarithmic functions

$$\frac{d}{dx}c^x = c^x \ln c, \qquad c > 0$$
$$\frac{d}{dx}e^x = e^x$$
$$\frac{d}{dx}\log_c x = \frac{1}{x \ln c}, \qquad c > 0, c \neq 1$$

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

Derivatives of trigonometric functions

$$\frac{d}{dx}\sin x = \cos x$$
$$\frac{d}{dx}\cos x = -\sin x$$
$$\frac{d}{dx}\tan x = \sec^2 x$$
$$\frac{d}{dx}\sec x = \tan x \sec x$$
$$\frac{d}{dx}\cot x = -\csc^2 x$$
$$\frac{d}{dx}\csc x = -\csc x \cot x$$
$$\frac{d}{dx}\arcsin x = \frac{1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}\arccos x = \frac{-1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}\arctan x = \frac{1}{1+x^2}$$
$$\frac{d}{dx}\operatorname{arcsec} x = \frac{1}{|x|\sqrt{x^2-1}}$$
$$\frac{d}{dx}\operatorname{arccot} x = \frac{-1}{1+x^2}$$
$$\frac{d}{dx}\operatorname{arccsc} x = \frac{-1}{|x|\sqrt{x^2-1}}$$