

# BASIC RULES

COMPARE

# CHAIN RULES

①  $y = x^n$

$$\frac{dy}{dx} = n(x)^{n-1}$$

②  $y = \frac{1}{x} = (x)^{-1}$

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

$$\frac{dy}{dx} = \frac{1}{x^2}$$

③  $y = \sqrt{x} = x^{\frac{1}{2}}$

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

$$\frac{dy}{dx} = \frac{1}{2\sqrt{x}}$$

④  $y = \sqrt[3]{x} = x^{\frac{1}{3}}$

$$\frac{dy}{dx} = \frac{1}{3}x^{-\frac{2}{3}}$$

$$\frac{dy}{dx} = \frac{1}{3x^{\frac{2}{3}}} = \frac{1}{3\sqrt[3]{x^2}}$$

⑤  $y = 2^x$

$$\frac{dy}{dx} = (\ln 2) 2^x$$

⑥  $y = e^x$

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

①  $y = (\text{cloud})^n$

$$\frac{dy}{dx} = n(\text{cloud})^{n-1} \cdot \frac{d(\text{cloud})}{dx}$$

②  $y = \frac{1}{\text{cloud}} = (\text{cloud})^{-1}$

$$\frac{dy}{dx} = -1(\text{cloud})^{-2} \cdot \frac{d(\text{cloud})}{dx}$$

$$\frac{dy}{dx} = \frac{-1}{\text{cloud}^2} \cdot \frac{d(\text{cloud})}{dx}$$

③  $y = \sqrt{\text{cloud}} = (\text{cloud})^{\frac{1}{2}}$

$$\frac{dy}{dx} = \frac{1}{2}(\text{cloud})^{-\frac{1}{2}} \cdot \frac{d(\text{cloud})}{dx}$$

$$\frac{dy}{dx} = \frac{1}{2\sqrt{\text{cloud}}} \cdot \frac{d(\text{cloud})}{dx}$$

④  $y = \sqrt[3]{\text{cloud}}$

$$\frac{dy}{dx} = \frac{1}{3}(\text{cloud})^{-\frac{2}{3}} \cdot \frac{d(\text{cloud})}{dx}$$

$$\frac{dy}{dx} = \frac{1}{3(\text{cloud})^{\frac{2}{3}}} \cdot \frac{d(\text{cloud})}{dx}$$

⑤  $y = 2^{\text{cloud}}$

$$\frac{dy}{dx} = \ln 2 \cdot 2^{\text{cloud}} \cdot \frac{d(\text{cloud})}{dx}$$

⑥  $y = e^{\text{cloud}}$

$$\frac{dy}{dx} = e^{\text{cloud}} \cdot \frac{d(\text{cloud})}{dx}$$



# CHAIN RULE EXAMPLES.

$$\textcircled{1} \quad y = (5x^3 - 7x^2 + x)^{25}$$

$$\frac{dy}{dx} = 25 (5x^3 - 7x^2 + x)^{24} \cdot (15x^2 - 14x)$$

$$\textcircled{2} \quad y = \frac{1}{(e^x - 2x)} = (e^x - 2x)^{-1}$$

$$\frac{dy}{dx} = -1 (e^x - 2x)^{-2} \cdot (e^x - 2)$$

$$\frac{dy}{dx} = \frac{-1}{(e^x - 2x)^2} \cdot (e^x - 2)$$

$$\frac{dy}{dx} = \frac{-(e^x - 2)}{(e^x - 2x)^2}$$

$$\textcircled{3} \quad y = \sqrt{5^x + 9x} = (5^x + 9x)^{\frac{1}{2}}$$

$$\frac{dy}{dx} = \frac{1}{2} (5^x + 9x)^{-\frac{1}{2}} \cdot (\ln 5 \cdot 5^x + 9)$$

$$\frac{dy}{dx} = \frac{(\ln 5 \cdot 5^x + 9)}{2 \sqrt{5^x + 9x}}$$

$$\textcircled{4} \quad y = \sqrt[3]{4x^3 - 3x^2} = (4x^3 - 3x^2)^{\frac{1}{3}}$$

$$\frac{dy}{dx} = \frac{1}{3} (4x^3 - 3x^2)^{-\frac{2}{3}} \cdot (12x^2 - 6x)$$

$$\frac{dy}{dx} = \frac{(12x^2 - 6x)}{3 \sqrt[3]{(4x^3 - 3x^2)^2}}$$

$$\textcircled{5} \quad y = 2^{7x^3 - 5x^2}$$

$$\frac{dy}{dx} = (\ln 2) 2^{7x^3 - 5x^2} \cdot (21x^2 - 10x)$$

$$\textcircled{6} \quad y = e^{\sqrt{x} + 2x}$$

$$\frac{dy}{dx} = (e^{\sqrt{x} + 2x}) \cdot \left( \frac{1}{2\sqrt{x}} + 2 \right)$$

$$\frac{dy}{dx} = (e^{\sqrt{x} + 2x}) \left( \frac{1 + 4\sqrt{x}}{2\sqrt{x}} \right)$$

$$\frac{dy}{dx} = \frac{(e^{\sqrt{x} + 2x}) (1 + 4\sqrt{x})}{2\sqrt{x}}$$