

Basic Rules in Differentiation

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- **Power Rule:** For any function $f(x) = x^n$, the derivative is:

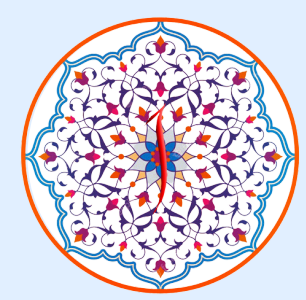
$$f'(x) = nx^{n-1}$$

- **Example:** $f(x) = x^3$, then $f'(x) = 3x^2$.

- **Sum Rule:** The derivative of a sum of functions is the sum of their derivatives:

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

- **Example:** if $f(x) = x^2 + x^3$, then $f'(x) = 2x + 3x^2$.



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- **Product Rule:** If you have two functions multiplied together, the derivative is

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

Example: If $f(x) = x^2$ and $g(x) = x^3$, then $\frac{d}{dx} [x^2 \cdot x^3] = 2x \cdot x^3 + x^2 \cdot 3x^2 = 5x^4$

- **Chain Rule:** For composite functions, the derivative is:

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

Example: If $f(x) = (2x + 1)^3$, let $g(x) = 2x + 1$. Then the derivative is $3(2x + 1)^2 \cdot 2 = 6(2x + 1)^2$.