

9-4 derivatives

The derivative of the function $y = f(x)$ may also be denoted y' , $\frac{df}{dx}$, or $\frac{dy}{dx}$. If a function is preceded by a **differential operator** $\frac{d}{dx}$, it means to take the derivative of the function.

KeyConcept Power Rule for Derivatives

Words The power of x in the derivative is one less than the power of x in the original function, and the coefficient of the power of x in the derivative is the same as the power of x in the original function.

Symbols If $f(x) = x^n$ and n is a real number, then $f'(x) = nx^{n-1}$.

Solved example: Find the derivative of the function:

$$f(x) = x^9$$

$$\text{solution: } f'(x) = 9x^{9-1} = 9x^8$$

Practice: Find the derivative of each function:

$$f(x) = x^5$$

$$f(x) = x^3$$

$$f(x) = x^8$$

$$f'(x) =$$

$$f'(x) =$$

$$f'(x) =$$

Solved example: Find the derivative of the function:

$$f(x) = \frac{1}{x^8}$$

$$\text{solution: } \frac{1}{x^8} = x^{-8} \quad \text{so } f'(x) = -8x^{-8-1} = -8x^{-9} \quad \text{or } \frac{-8}{x^9}$$

Practice: Find the derivative of the function:

$$f(x) = \frac{1}{x^5}$$

$$f(x) = \frac{1}{x^7}$$

$$f(x) = \frac{1}{x^9}$$

$$f'(x) =$$

$$f'(x) =$$

$$f'(x) =$$

Solved example: Find the derivative of the function:

$$f(x) = \sqrt[5]{x^7}$$

$$\text{solution: } \sqrt[5]{x^7} = x^{\frac{7}{5}} \quad \text{so } f'(x) = \frac{7}{5}x^{\frac{7}{5}-1} = \frac{7}{5}x^{\frac{2}{5}} \quad \text{or } \frac{7}{5}\sqrt[5]{x^2}$$

Practice: Find the derivative of the function:

$$f(x) = \sqrt{x^3}$$

$$f(x) = \sqrt[5]{x^3}$$

$$f(x) = \sqrt[3]{x^4}$$

$$f'(x) =$$

$$f'(x) =$$

$$f'(x) =$$