

Higher Order Derivatives

If $y = f(x)$ then the derivative of y with respect to x is denoted by:

$$f'(x) = \frac{dy}{dx} = y'$$

The second derivative is the derivative of the first derivative and is denoted by:

$$f''(x) = \frac{d^2y}{dx^2} = y''$$

The third derivative is the derivative of the second derivative and is denoted by:

$$f'''(x) = \frac{d^3y}{dx^3} = y'''$$

The n^{th} derivative ($n > 3$) is denoted by:

$$f^{(n)}(x) = \frac{d^{(n)}y}{dx^{(n)}} = y^{(n)}$$

1. Find the first four derivatives.

$$f(x) = 5x^4 - 3x^3 + 7x^2 - 5x + 3$$

2. Find $f'''(4)$ if $f(x) = \sqrt{x}$.

3. Find $f''(2)$ if $f(x) = x^2 + \frac{1}{x}$.

4. Find $f''(x)$ if $f(x) = \frac{2x-1}{3x+2}$.

5. Find y'' if $x^2 + y^2 = 16$.

6. Find y'' if $x^2 + xy = 5$.