

Higher Derivatives (3.5)

Second Derivatives: Find the first and second derivatives of the function.

1. $g(x) = \frac{2x+1}{x-1}$

$$g'(x) = \frac{2(x-1) - (2x+1)}{(x-1)^2}$$

$$g'(x) = \frac{2x-2-2x-1}{(x-1)^2}$$

$$g'(x) = \frac{-3}{(x-1)^2}$$

$$g''(x) = -3(x-1)^{-2}$$

$$g''(x) = 6(x-1)^{-3}$$

$$g''(x) = \frac{6}{(x-1)^3}$$

2. $f(v) = 2 \sin v + 4v$

$$f'(v) = 2 \cos v + 4$$

$$f''(v) = -2 \sin v$$

Higher Derivatives: Find the following higher derivatives.

3. Find y''' $y = \frac{2x}{x+3}$

$$y' = \frac{2(x+3) - 2x}{(x+3)^2}$$

$$y' = \frac{2x+6-2x}{(x+3)^2}$$

$$y' = \frac{6}{(x+3)^2} = 6(x+3)^{-2}$$

$$y'' = -12(x+3)^{-3}$$

$$y''' = 36(x+3)^{-4}$$

$$y''' = \frac{36}{(x+3)^4}$$

4. If $g(x) = \sqrt{x+2}$, find $g'''(2)$

$$\frac{dg^3}{d^3x} \Big|_{x=2}$$

$$g'(x) = \frac{1}{2}(x+2)^{-1/2}$$

$$g''(x) = -\frac{1}{4}(x+2)^{-3/2}$$

$$g'''(x) = \frac{3}{8}(x+2)^{-5/2}$$

$$g'''(2) = \frac{3}{8}(4)^{-5/2}$$

$$g'''(2) = \frac{3}{8} \left(\frac{1}{32} \right) = \frac{3}{256}$$