

Higher Order Derivatives

For each problem, find the indicated derivative with respect to x .

1) $f(x) = 4x^5 - 3x^4 + 4x^3$ Find $f^{(4)}$

$$f'(x) = 20x^4 - 12x^3 + 12x^2$$

$$f''(x) = 80x^3 - 36x^2 + 24x$$

$$f'''(x) = 240x^2 - 72x + 24$$

$$f^{(4)}(x) = 480x - 72$$

2) $f(x) = -5x^5 - x^3 + 5x^2$ Find $f^{(4)}$

$$f'(x) = -25x^4 - 3x^2 + 10x$$

$$f''(x) = -100x^3 - 6x + 10$$

$$f'''(x) = -300x^2 - 6$$

$$f^{(4)}(x) = -600x$$

3) $f(x) = 5x^5$ Find $f^{(4)}$

$$f'(x) = 25x^4$$

$$f''(x) = 100x^3$$

$$f'''(x) = 300x^2$$

$$f^{(4)}(x) = 600x$$

4) $f(x) = -5x^5 + 3x^3 + 4x$ Find f''

$$f'(x) = -25x^4 + 9x^2 + 4$$

$$f''(x) = -100x^3 + 18x$$

5) $f(x) = -2x^3$ Find f''

$$f'(x) = -6x^2$$

$$f''(x) = -12x$$

6) $f(x) = 5x^3$ Find f'''

$$f'(x) = 15x^2$$

$$f''(x) = 30x$$

$$f'''(x) = 30$$

7) $f(x) = -x^2 - 2x$ Find f'''

$$f'(x) = -2x - 2$$

$$f''(x) = -2$$

$$f'''(x) = 0$$

8) $f(x) = x^4 + 5x^2 - 4x$ Find $f^{(4)}$

$$f'(x) = 4x^3 + 10x - 4$$

$$f''(x) = 12x^2 + 10$$

$$f'''(x) = 24x$$

$$f^{(4)}(x) = 24$$

$$9) f(x) = -3x^{\frac{3}{5}} + 4\sqrt[3]{x} \quad \text{Find } f^{(4)}$$

$$f'(x) = -\frac{9}{5}x^{-2/5} + \frac{4}{3}x^{-2/3}$$

$$f''(x) = \frac{18}{25}x^{-7/5} - \frac{8}{9}x^{-5/3}$$

$$f'''(x) = -\frac{126}{125}x^{-12/5} + \frac{40}{27}x^{-8/3}$$

$$f^{(4)}(x) = \frac{1512}{625}x^{-17/5} - \frac{320}{81}x^{-11/3}$$

$$11) f(x) = -\frac{4x^{-1}}{x} - \frac{5x^{-5}}{x^5} \quad \text{Find } f''$$

$$f'(x) = 4x^{-2} + 25x^{-6}$$

$$f''(x) = -8x^{-3} - 150x^{-7}$$

$$13) f(x) = x^{\frac{1}{3}} + \frac{5x^{-1}}{x} + 4x^{-3} \quad \text{Find } f'''$$

$$f'(x) = \frac{1}{3}x^{-2/3} - 5x^{-2} - 12x^{-4}$$

$$f''(x) = -\frac{2}{9}x^{-5/3} + 10x^{-3} + 48x^{-5}$$

$$f'''(x) = \frac{10}{27}x^{-8/3} - 30x^{-4} - 240x^{-6}$$

$$15) f(x) = \frac{5x^{-5}}{x^5} \quad \text{Find } f''$$

$$f'(x) = -25x^{-6}$$

$$f''(x) = 150x^{-7}$$

$$10) f(x) = 3\sqrt[3]{x} - 4\sqrt[5]{x} - \frac{5x^{-1}}{x} \quad \text{Find } f'''$$

$$f'(x) = x^{-2/3} - \frac{4}{5}x^{-4/5} + 5x^{-2}$$

$$f''(x) = -\frac{2}{3}x^{-5/3} + \frac{16}{25}x^{-9/5} - 10x^{-3}$$

$$f'''(x) = \frac{10}{9}x^{-8/3} - \frac{144}{125}x^{-14/5} + 30x^{-4}$$

$$12) f(x) = 2x^4 + 4\sqrt[5]{x^2} + x^{-2} \quad \text{Find } f^{(4)}$$

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

$$f''(x) = 24x^2 - \frac{24}{25}x^{-8/5} + 6x^{-4}$$

$$f'''(x) = 48x + \frac{192}{125}x^{-13/5} - 24x^{-5}$$

$$f^{(4)}(x) = 48 - \frac{2496}{625}x^{-18/5} + 120x^{-6}$$

$$14) f(x) = 3x^2 - 5x^{-2} \quad \text{Find } f''$$

$$f'(x) = 6x + 10x^{-3}$$

$$f''(x) = 6 - 30x^{-4}$$

$$16) f(x) = x^5 + 3x^3 + \frac{4x^{-3}}{x^3} \quad \text{Find } f'''$$

$$f'(x) = 5x^4 + 9x^2 - 12x^{-4}$$

$$f''(x) = 20x^3 + 18x + 48x^{-5}$$

$$f'''(x) = 60x^2 + 18 - 240x^{-6}$$