

1. Find $f'(x)$, $f''(x)$, $f'''(x)$, and $f^{(4)}$ for the following function: $f(x) = -4 - 3x + 2x^2 - 3x^3 + x^4$
2. Find $f'(x)$, $f''(x)$, $f'''(x)$, and $f^{(4)}$ for the following function: $f(x) = 4 + 2x - 2x^3 + 3x^4 + 5x^5$
3. Find $f'(x)$, $f''(x)$, $f'''(x)$, and $f^{(4)}$ for the following function: $f(x) = -4 + 3x + 5x^2$
4. Find $f'(x)$, $f''(x)$, $f'''(x)$, and $f^{(4)}$ for the following function: $f(x) = 4x + 5x^2 + 2x^3 + 3x^4$
5. Find $f'(x)$, $f''(x)$, $f'''(x)$, and $f^{(4)}$ for the following function: $f(x) = -1 + 3x - 4x^2 + 4x^3$
6. Find $f'(x)$, $f''(x)$, $f'''(x)$, and $f^{(4)}$ for the following function: $f(x) = -4x + 5x^2 - 2x^3 + 2x^4 - x^5 + 3x^6$
7. Find $f'(x)$, $f''(x)$, $f'''(x)$, and $f^{(4)}$ for the following function: $f(x) = 4 - 4x + 5x^2$
8. Find $f'(x)$, $f''(x)$, $f'''(x)$, and $f^{(4)}$ for the following function: $f(x) = -x + x^2 + x^3 - 3x^4 - x^5 + 4x^6$
9. Find $f'(x)$, $f''(x)$, $f'''(x)$, and $f^{(4)}$ for the following function: $f(x) = -x - 2x^2$
10. Find $f'(x)$, $f''(x)$, $f'''(x)$, and $f^{(4)}$ for the following function: $f(x) = 5x - 5x^2 - 5x^3$

- ANSWERS:
1. $f'(x) = -3 + 4x - 9x^2 + 4x^3$, $f''(x) = 4 - 18x + 12x^2$, $f'''(x) = -18 + 24x$, $f^{(4)}(x) = 24$
 2. $f'(x) = 2 - 6x^2 + 12x^3 + 25x^4$, $f''(x) = -12x + 36x^2 + 100x^3$, $f'''(x) = -12 + 72x + 300x^2$, $f^{(4)}(x) = 600$
 3. $f'(x) = 3 + 10x$, $f''(x) = 10$, $f'''(x) = 0$, $f^{(4)}(x) = 0$
 4. $f'(x) = 4 + 10x + 6x^2 + 12x^3$, $f''(x) = 10 + 12x + 36x^2$, $f'''(x) = 12 + 72x$, $f^{(4)}(x) = 72$
 5. $f'(x) = 3 - 8x + 10x^2$, $f''(x) = -8 + 20x$, $f'''(x) = 20$, $f^{(4)}(x) = 0$
 6. $f'(x) = -4 + 10x^2 + 8x^3 + 18x^4 + 18x^5$, $f''(x) = 20x + 24x^2 + 72x^3 + 90x^4$, $f'''(x) = 20 + 48x + 216x^2 + 360x^3$, $f^{(4)}(x) = 20 + 96x + 1080x^2$
 7. $f'(x) = 4 + 10x$, $f''(x) = 10$, $f'''(x) = 0$, $f^{(4)}(x) = 0$
 8. $f'(x) = 2 + 3x^2 + 12x^3 + 20x^4 + 25x^5$, $f''(x) = 6x + 24x^2 + 48x^3 + 100x^4$, $f'''(x) = 6 + 48x + 144x^2 + 400x^3$, $f^{(4)}(x) = 6 + 96x + 1200x^2$
 9. $f'(x) = -1 - 4x$, $f''(x) = -4$, $f'''(x) = 0$, $f^{(4)}(x) = 0$
 10. $f'(x) = 5 - 10x - 15x^2$, $f''(x) = -10 - 30x$, $f'''(x) = -30$, $f^{(4)}(x) = 0$

Solutions:

$$1. f'(x) = \frac{d}{dx}(-4 - 3x + 2x^2 - 3x^3 + x^4) = -3 + 4x - 9x^2 + 4x^3 \quad \blacktriangleleft \text{Apply: } f'(x) = \frac{d}{dx}f(x)$$

$$f''(x) = \frac{d}{dx}(-3 + 4x - 9x^2 + 4x^3) = 4 - 18x + 12x^2 \quad \blacktriangleleft \text{Apply: } f''(x) = \frac{d}{dx}f'(x)$$

$$f'''(x) = \frac{d}{dx}(4 - 18x + 12x^2) = -18 + 24x \quad \blacktriangleleft \text{Apply: } f'''(x) = \frac{d}{dx}f''(x)$$

$$f^{(4)}(x) = \frac{d}{dx}(-18 + 24x) = 24 \quad \blacktriangleleft \text{Apply: } f^{(4)}(x) = \frac{d}{dx}f'''(x)$$

$$2. f'(x) = \frac{d}{dx}(4 + 2x - 2x^3 + 3x^4 + 5x^5) = 2 - 6x^2 + 12x^3 + 25x^4 \quad \blacktriangleleft \text{Apply: } f'(x) = \frac{d}{dx}f(x)$$

$$f''(x) = \frac{d}{dx}(2 - 6x^2 + 12x^3 + 25x^4) = -12x + 36x^2 + 100x^3 \quad \blacktriangleleft \text{Apply: } f''(x) = \frac{d}{dx}f'(x)$$

$$f'''(x) = \frac{d}{dx}(-12x + 36x^2 + 100x^3) = -12 + 72x + 300x^2 \quad \blacktriangleleft \text{Apply: } f'''(x) = \frac{d}{dx}f''(x)$$

$$f^{(4)}(x) = \frac{d}{dx}(-12 + 72x + 300x^2) = 72 + 600x \quad \blacktriangleleft \text{Apply: } f^{(4)}(x) = \frac{d}{dx}f'''(x)$$

$$3. f'(x) = \frac{d}{dx}(-4 + 3x + 5x^2) = 3 + 10x \quad \blacktriangleleft \text{Apply: } f'(x) = \frac{d}{dx}f(x)$$

$$f''(x) = \frac{d}{dx}(3 + 10x) = 10 \quad \blacktriangleleft \text{Apply: } f''(x) = \frac{d}{dx}f'(x)$$

$$f'''(x) = \frac{d}{dx}(10) = 0 \quad \blacktriangleleft \text{Apply: } f'''(x) = \frac{d}{dx}f''(x)$$

$$f^{(4)}(x) = \frac{d}{dx}(0) = 0 \quad \blacktriangleleft \text{Apply: } f^{(4)}(x) = \frac{d}{dx}f'''(x)$$

$$4. f'(x) = \frac{d}{dx}(4x + 5x^2 + 2x^3 + 3x^4) = 4 + 10x + 6x^2 + 12x^3 \quad \blacktriangleleft \text{Apply: } f'(x) = \frac{d}{dx}f(x)$$

$$f''(x) = \frac{d}{dx}(4 + 10x + 6x^2 + 12x^3) = 10 + 12x + 36x^2 \quad \blacktriangleleft \text{Apply: } f''(x) = \frac{d}{dx}f'(x)$$

$$f'''(x) = \frac{d}{dx}(10 + 12x + 36x^2) = 12 + 72x \quad \blacktriangleleft \text{Apply: } f'''(x) = \frac{d}{dx}f''(x)$$

$$f^{(4)}(x) = \frac{d}{dx}(12 + 72x) = 72 \quad \blacktriangleleft \text{Apply: } f^{(4)}(x) = \frac{d}{dx}f'''(x)$$

$$5. f'(x) = \frac{d}{dx}(-1 + 3x - 4x^2 + 4x^3) = 3 - 8x + 12x^2 \quad \blacktriangleleft \text{Apply: } f'(x) = \frac{d}{dx}f(x)$$

$$f''(x) = \frac{d}{dx}(3 - 8x + 12x^2) = -8 + 24x \quad \blacktriangleleft \text{Apply: } f''(x) = \frac{d}{dx}f'(x)$$

$$f'''(x) = \frac{d}{dx}(-8 + 24x) = 24 \quad \blacktriangleleft \text{Apply: } f'''(x) = \frac{d}{dx}f''(x)$$

$$f^{(4)}(x) = \frac{d}{dx}(24) = 0 \quad \blacktriangleleft \text{Apply: } f^{(4)}(x) = \frac{d}{dx}f'''(x)$$

$$6. f'(x) = \frac{d}{dx}(-4x + 5x^2 - 2x^3 + 2x^4 - x^5 + 3x^6) = -4 + 10x - 6x^2 + 8x^3 - 5x^4 + 18x^5 \quad \blacktriangleleft \text{Apply:}$$

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

$$f''(x) = \frac{d}{dx}(-4 + 10x - 6x^2 + 8x^3 - 5x^4 + 18x^5) = 10 - 12x + 24x^2 - 20x^3 + 90x^4 \quad \blacktriangleleft \text{Apply: } f''(x) = \frac{d}{dx}f'(x)$$

$$f'''(x) = \frac{d}{dx}(10 - 12x + 24x^2 - 20x^3 + 90x^4) = -12 + 48x - 60x^2 + 360x^3 \quad \blacktriangleleft \text{Apply: } f'''(x) = \frac{d}{dx}f''(x)$$

$$f^{(4)}(x) = \frac{d}{dx}(-12 + 48x - 60x^2 + 360x^3) = 48 - 120x + 1080x^2 \quad \blacktriangleleft \text{Apply: } f^{(4)}(x) = \frac{d}{dx}f'''(x)$$

$$7. f'(x) = \frac{d}{dx}(4 - 4x + 5x^2) = -4 + 10x \quad \blacktriangleleft \text{Apply: } f'(x) = \frac{d}{dx}f(x)$$

$$f''(x) = \frac{d}{dx}(-4 + 10x) = 10 \quad \blacktriangleleft \text{Apply: } f''(x) = \frac{d}{dx}f'(x)$$

$$f'''(x) = \frac{d}{dx}(10) = 0 \quad \blacktriangleleft \text{Apply: } f'''(x) = \frac{d}{dx}f''(x)$$

$$f^{(4)}(x) = \frac{d}{dx}(0) = 0 \quad \blacktriangleleft \text{Apply: } f^{(4)}(x) = \frac{d}{dx}f'''(x)$$

$$8. f'(x) = \frac{d}{dx}(-x + x^2 + x^3 - 3x^4 - x^5 + 4x^6) = -1 + 2x + 3x^2 - 12x^3 - 5x^4 + 24x^5 \quad \blacktriangleleft \text{Apply: } f'(x) = \frac{d}{dx}f(x)$$

$$f''(x) = \frac{d}{dx}(-1 + 2x + 3x^2 - 12x^3 - 5x^4 + 24x^5) = 2 + 6x - 36x^2 - 20x^3 + 120x^4 \quad \blacktriangleleft \text{Apply: } f''(x) = \frac{d}{dx}f'(x)$$

$$f'''(x) = \frac{d}{dx}(2 + 6x - 36x^2 - 20x^3 + 120x^4) = 6 - 72x - 60x^2 + 480x^3 \quad \blacktriangleleft \text{Apply: } f'''(x) = \frac{d}{dx}f''(x)$$

$$f^{(4)}(x) = \frac{d}{dx}(6 - 72x - 60x^2 + 480x^3) = -72 - 120x + 1440x^2 \quad \blacktriangleleft \text{Apply: } f^{(4)}(x) = \frac{d}{dx}f'''(x)$$

$$9. f'(x) = \frac{d}{dx}(-x - 2x^2) = -1 - 4x \quad \blacktriangleleft \text{Apply: } f'(x) = \frac{d}{dx}f(x)$$

$$f''(x) = \frac{d}{dx}(-1 - 4x) = -4 \quad \blacktriangleleft \text{Apply: } f''(x) = \frac{d}{dx}f'(x)$$

$$f'''(x) = \frac{d}{dx}(-4) = 0 \quad \blacktriangleleft \text{Apply: } f'''(x) = \frac{d}{dx}f''(x)$$

$$f^{(4)}(x) = \frac{d}{dx}(0) = 0 \quad \blacktriangleleft \text{Apply: } f^{(4)}(x) = \frac{d}{dx}f'''(x)$$

$$10. f'(x) = \frac{d}{dx}(5x - 5x^2 - 5x^3) = 5 - 10x - 15x^2 \quad \blacktriangleleft \text{Apply: } f'(x) = \frac{d}{dx}f(x)$$

$$f''(x) = \frac{d}{dx}(5 - 10x - 15x^2) = -10 - 30x \quad \blacktriangleleft \text{Apply: } f''(x) = \frac{d}{dx}f'(x)$$

$$f'''(x) = \frac{d}{dx}(-10 - 30x) = -30 \quad \blacktriangleleft \text{Apply: } f'''(x) = \frac{d}{dx}f''(x)$$

$$f^{(4)}(x) = \frac{d}{dx}(-30) = 0 \quad \blacktriangleleft \text{Apply: } f^{(4)}(x) = \frac{d}{dx}f'''(x)$$