Higher Order Differentiation

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

1) $f(x) = x$ Find f''

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

3) $f(x) = 2x$ Find f''

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

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

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

7) $f(x) = 3x^3 + 4x^2$ Find f'''

Find the second derivative f''(x).

8) $f(x) = (-x^4 + 4) \cdot -4x^3$

9) $f(x) = (-3x^4 - 2) \cdot 2x^3$

10) $f(x) = (2x^5 - 4) \cdot -4x^3$

11) $f(x) = (x^2 + 4) \cdot -4x^2$

12) $f(x) = \dfrac{5}{2x^5 + 4}$

13) $f(x) = \dfrac{5x^3}{x^3 - 3}$

Higher Derivatives (… set 1)

Answer

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

1) $f(x) = x$ Find f''

$f''(x) = 0$

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

$f''(x) = -4$

3) $f(x) = 2x$ Find f''

$f''(x) = 0$

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

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

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

$f'''(x) = 300x^2 - 96x$

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

$f'''(x) = 0$

7) $f(x) = 3x^3 + 4x^2$ Find f'''

$f'''(x) = 18$

Find the second derivative f''(x).

8) $f(x) = (-x^4 + 4) \cdot -4x^3$

$f'(x) = 28x^6 - 48x^2$

9) $f(x) = (-3x^4 - 2) \cdot 2x^3$

$f'(x) = -42x^6 - 12x^2$

10) $f(x) = (2x^5 - 4) \cdot -4x^3$

$f'(x) = -64x^7 + 48x^2$

11) $f(x) = (x^2 + 4) \cdot -4x^2$

$f'(x) = -16x^3 - 32x$

12) $f(x) = \dfrac{5}{2x^5 + 4}$

$f'(x) = -\dfrac{25x^4}{2x^{10} + 8x^5 + 8}$

13) $f(x) = \dfrac{5x^3}{x^3 - 3}$

$f'(x) = -\dfrac{45x^2}{x^6 - 6x^3 + 9}$

Higher Derivatives (… set 1)

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

15) $f(x) = (-3x^4 - 2)^4$

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

17) $f(x) = (4x^5 + 5)^3$

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

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

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

20) $f(x) = 3x^4 - 5x^3 - x^2$ Find f'''

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

22) $f(x) = \frac{3}{x^2} + \frac{4}{x^3}$ Find f'''

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

Higher Derivatives (… set 1)

Answer

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

$f'(x) = -45x^2(-5x^3 + 4)^2$

15) $f(x) = (-3x^4 - 2)^4$

$f'(x) = -48x^3(-3x^4 - 2)^3$

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

$f'(x) = 40x(5x^2 - 3)^3$

17) $f(x) = (4x^5 + 5)^3$

$f'(x) = 60x^4(4x^5 + 5)^2$

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

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

$f^{(4)}(x) = 96$

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

$f''(x) = -18x + 4$

20) $f(x) = 3x^4 - 5x^3 - x^2$ Find f'''

$f'''(x) = 72x - 30$

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

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

22) $f(x) = \frac{3}{x^2} + \frac{4}{x^3}$ Find f'''

$f'''(x) = -\frac{72}{x^5} - \frac{240}{x^6}$

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

$f'''(x) = -120x^2 - \frac{72}{x^5}$

Higher Derivatives (… set 1)

Differentiate each function with respect to x.

24) $y = \left((-x^4 + 5)^4 - 2\right)^2$

25) $y = \left((2x^3 + 5)^4 + 2\right)^3$

26) $y = (x + 4)(3x^4 + 5)^5$

27) $y = (5x^3 + 3)^5$

28) $y = \dfrac{3x^4 + 5}{(-3x^2 - 1)^3}$

For each problem, find the equation of the line tangent to the function at the given point. Your answer should be in slope-intercept form.

29) $y = -\dfrac{x^2}{2x + 4}$ at $\left(2, -\dfrac{1}{2}\right)$

30) $y = -(x - 2)^{\frac{2}{3}}$ at $(3, -1)$

Higher Derivatives (… set 1)

Answer

Differentiate each function with respect to x.

24) $y = \left((-x^4 + 5)^4 - 2\right)^2$

$\frac{dy}{dx} = -32x^3(-x^4 + 5)^3\left((-x^4 + 5)^4 - 2\right)$

25) $y = \left((2x^3 + 5)^4 + 2\right)^3$

$\frac{dy}{dx} = 72x^2\left((2x^3 + 5)^4 + 2\right)^2 \cdot (2x^3 + 5)^3$

26) $y = (x + 4)(3x^4 + 5)^5$

$\frac{dy}{dx} = (3x^4 + 5)^4(63x^4 + 240x^3 + 5)$

27) $y = (5x^3 + 3)^5$

$\frac{dy}{dx} = 75x^2(5x^3 + 3)^4$

28) $y = \frac{3x^4 + 5}{(-3x^2 - 1)^3}$

$\frac{dy}{dx} = \frac{6x(3x^4 - 2x^2 + 15)}{(-3x^2 - 1)^4}$

For each problem, find the equation of the line tangent to the function at the given point. Your answer should be in slope-intercept form.

29) $y = -\frac{x^2}{2x + 4}$ at $\left(2, -\frac{1}{2}\right)$

$y = -\frac{3}{8}x + \frac{1}{4}$

30) $y = -(x - 2)^{\frac{2}{3}}$ at $(3, -1)$

$y = -\frac{2}{3}x + 1$