

## Higher Order Derivatives

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

1)  $y = -x^2$  Find  $\frac{d^2y}{dx^2}$

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

3)  $y = -4x$  Find  $\frac{d^3y}{dx^3}$

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

5)  $y = -5x^4$  Find  $\frac{d^4y}{dx^4}$

6)  $y = 3x^5 - 2x$  Find  $\frac{d^3y}{dx^3}$

7)  $y = -2x^3 - 4x^{-3}$  Find  $\frac{d^3y}{dx^3}$

8)  $y = -x^2 + 2\sqrt[5]{x^2}$  Find  $\frac{d^3y}{dx^3}$

**Critical thinking questions. Find the indicated derivatives with respect to  $x$ .**

9)  $y = 99x^{99}$  Find  $\frac{d^{100}y}{dx^{100}}$

10)  $f(x) = x^{99}$  Find  $f^{(99)}$

## Higher Order Derivatives

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

1)  $y = -x^2$  Find  $\frac{d^2y}{dx^2}$

$$\frac{d^2y}{dx^2} = -2$$

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

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

3)  $y = -4x$  Find  $\frac{d^3y}{dx^3}$

$$\frac{d^3y}{dx^3} = 0$$

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

$$f'''(x) = 120x$$

5)  $y = -5x^4$  Find  $\frac{d^4y}{dx^4}$

$$\frac{d^4y}{dx^4} = -120$$

6)  $y = 3x^5 - 2x$  Find  $\frac{d^3y}{dx^3}$

$$\frac{d^3y}{dx^3} = 180x^2$$

7)  $y = -2x^3 - 4x^{-3}$  Find  $\frac{d^3y}{dx^3}$

$$\frac{d^3y}{dx^3} = -12 + \frac{240}{x^6}$$

8)  $y = -x^2 + 2\sqrt[5]{x^2}$  Find  $\frac{d^3y}{dx^3}$

$$\frac{d^3y}{dx^3} = \frac{96}{125x^{\frac{13}{5}}}$$

**Critical thinking questions. Find the indicated derivatives with respect to  $x$ .**

9)  $y = 99x^{99}$  Find  $\frac{d^{100}y}{dx^{100}}$

The 99th derivative is a constant, so 100th derivative is 0.

10)  $f(x) = x^{99}$  Find  $f^{(99)}$

99! (Made easy by factorial notation)