

Assignment

Date _____ Period _____

Differentiate each function with respect to x .

1) $y = (-5x^3 + 2)^2$

$$\begin{aligned}\frac{dy}{dx} &= 2(-5x^3 + 2) \cdot -15x^2 \\ &= -30x^2(-5x^3 + 2)\end{aligned}$$

2) $y = (2x^2 - 1)^3$

$$\begin{aligned}\frac{dy}{dx} &= 3(2x^2 - 1)^2 \cdot 4x \\ &= 12x(2x^2 - 1)^2\end{aligned}$$

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

$$\begin{aligned}\frac{dy}{dx} &= 4(4x^3 + 3)^3 \cdot 12x^2 \\ &= 48x^2(4x^3 + 3)^3\end{aligned}$$

4) $y = (3x^2 - 2)^4$

$$\begin{aligned}\frac{dy}{dx} &= 4(3x^2 - 2)^3 \cdot 6x \\ &= 24x(3x^2 - 2)^3\end{aligned}$$

5) $y = \cos 3x^5$

$$\begin{aligned}\frac{dy}{dx} &= -\sin 3x^5 \cdot 15x^4 \\ &= -15x^4 \sin 3x^5\end{aligned}$$

6) $y = \sin 4x^4$

$$\begin{aligned}\frac{dy}{dx} &= \cos 4x^4 \cdot 16x^3 \\ &= 16x^3 \cos 4x^4\end{aligned}$$

7) $y = \cos x^5$

$$\begin{aligned}\frac{dy}{dx} &= -\sin x^5 \cdot 5x^4 \\ &= -5x^4 \sin x^5\end{aligned}$$

8) $y = \cos 5x^2$

$$\begin{aligned}\frac{dy}{dx} &= -\sin 5x^2 \cdot 10x \\ &= -10x \sin 5x^2\end{aligned}$$

9) $y = 2x^5(5x^2 + 2)$

$$\begin{aligned}\frac{dy}{dx} &= 2x^5 \cdot 10x + (5x^2 + 2) \cdot 10x^4 \\ &= 70x^6 + 20x^4\end{aligned}$$

10) $y = (4x^2 + 5) \cdot 2x^4$

$$\begin{aligned}\frac{dy}{dx} &= (4x^2 + 5) \cdot 8x^3 + 2x^4 \cdot 8x \\ &= 48x^5 + 40x^3\end{aligned}$$

$$11) y = \frac{2}{5x^2 + 5}$$

$$\begin{aligned} \frac{dy}{dx} &= -\frac{2 \cdot 10x}{(5x^2 + 5)^2} \\ &= -\frac{4x}{5x^4 + 10x^2 + 5} \end{aligned}$$

$$12) y = \frac{3}{x^3 - 4}$$

$$\begin{aligned} \frac{dy}{dx} &= -\frac{3 \cdot 3x^2}{(x^3 - 4)^2} \\ &= -\frac{9x^2}{x^6 - 8x^3 + 16} \end{aligned}$$

For each problem, use implicit differentiation to find $\frac{dy}{dx}$ in terms of x and y .

$$13) 5x^2 = -2y^3 + 5$$

$$\frac{dy}{dx} = -\frac{5x}{3y^2}$$

$$14) -3y^3 + 3y^2 = x$$

$$\frac{dy}{dx} = \frac{1}{-9y^2 + 6y}$$

$$15) 3x + 3x^2y^2 = 3y^3$$

$$\frac{dy}{dx} = \frac{-1 - 2xy^2}{2yx^2 - 3y^2}$$

$$16) xy = x^2 + 5y^2$$

$$\frac{dy}{dx} = \frac{2x - y}{x - 10y}$$

For each problem, use implicit differentiation to find $\frac{dy}{dx}$ at the given point.

$$17) 4 = 3x^2 - y^3 \text{ at } (-2, 2)$$

$$\left. \frac{dy}{dx} \right|_{\substack{x=-2 \\ y=2}} = -1$$

$$18) y^2 + 3 = x^2 \text{ at } (2, 1)$$

$$\left. \frac{dy}{dx} \right|_{\substack{x=2 \\ y=1}} = 2$$

For each problem, use implicit differentiation to find $\frac{d^2y}{dx^2}$ in terms of x and y .

$$19) 3 = 3x^2 + 3y^2$$

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

$$20) 2x^3 - 5y^2 = 3$$

$$\frac{d^2y}{dx^2} = \frac{30xy^2 - 9x^4}{25y^3}$$