

OPTIONAL: Implicit Differentiation Extra Practice

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

1) $3x^2 + 4x^3y^3 = 3y$

$$\frac{dy}{dx} = \frac{-2x - 4x^2y^3}{4x^3y^2 - 1}$$

2) $4x^2 = xy^2 + 3$

$$\frac{dy}{dx} = \frac{-y^2 + 8x}{2xy}$$

3) $x = y^2 + 1$

$$\frac{dy}{dx} = \frac{1}{2y}$$

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

$$\frac{dy}{dx} = -\frac{4x^2}{y^2}$$

5) $4y^2 = 5x^3 + 3y$

$$\frac{dy}{dx} = \frac{15x^2}{8y - 3}$$

6) $(y^3 + 3)^2 = x$

$$\frac{dy}{dx} = \frac{1}{6y^5 + 18y^2}$$

7) $5x^2 + 1 = \cos y^2$

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

8) $\sin y^2 = x^2 + 2$

$$\frac{dy}{dx} = \frac{x}{y \cos y^2}$$

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

9) $1 = 4x^3 + 5x^2y$ at $(-1, 1)$

$$\left. \frac{dy}{dx} \right|_{\substack{x=-1 \\ y=1}} = -\frac{2}{5}$$

10) $4x = 2x^3y + 2$ at $(-1, 3)$

$$\left. \frac{dy}{dx} \right|_{\substack{x=-1 \\ y=3}} = 7$$

For each problem, write the equation of the line tangent at the given point.

11) $-3y^3 + 2y = 5x^2$ at $(-2, -2)$

$$\left. \frac{dy}{dx} \right|_{x=-2y=-2} = \frac{10}{17}$$

$$y + 2 = \frac{10}{17}(x + 2)$$

12) $3x = 4y + y^2$ at $(-1, -3)$

$$\left. \frac{dy}{dx} \right|_{x=-1y=-3} = -\frac{3}{2}$$

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