

1. Find dy/dx if $y \sin(x) = x^2 - y^2$.

$$\frac{d}{dx} (y \sin(x)) = \frac{d}{dx} (x^2 - y^2)$$

$$\frac{dy}{dx} \sin(x) + y \cos(x) = 2x - 2y \frac{dy}{dx}$$

$$\frac{dy}{dx} [\sin(x) - 1] = 2x - y \cos(x)$$

$$\frac{dy}{dx} = \frac{2x - y \cos(x)}{\sin(x) - 1}$$

2. Find d^2y/dx^2 if $x^2 - 2y^2 = 2$.

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

$$2x - 4y \frac{dy}{dx} = 0$$

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

$$\frac{d^2y}{dx^2} = \frac{d}{dx} \left(\frac{x}{2y} \right) = \frac{\left(\frac{d}{dx} x \right) y - x \frac{d}{dx} y}{2y^2}$$

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