

**Exercise 11**

Find  $dy/dx$  by implicit differentiation.

$$y \cos x = x^2 + y^2$$

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**Solution**

Differentiate both sides with respect to  $x$ .

$$\begin{aligned}\frac{d}{dx}(y \cos x) &= \frac{d}{dx}(x^2 + y^2) \\ \left[ \frac{d}{dx}(y) \right] \cos x + y \left[ \frac{d}{dx}(\cos x) \right] &= \frac{d}{dx}(x^2) + \frac{d}{dx}(y^2)\end{aligned}$$

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

$$y' \cos x - y \sin x = 2x + 2yy'$$

Solve for  $y'$ .

$$(\cos x - 2y)y' = 2x + y \sin x$$

$$y' = \frac{2x + y \sin x}{\cos x - 2y}$$