
Common Calculus Mistakes

Implicit Differentiation

The Goal

Find dy/dx , where x and y are related by the equation

$$x^2y + 2xy^2 = 0$$

The Mistake

Find the mistake:

$$\begin{aligned}x^2y + 2xy^2 = 0 &\implies \left(2xy + x^2\frac{dy}{dx}\right) + \left(2y^2 + 2xy\frac{dy}{dx}\right) = 0 \\ &\implies (x^2 + 2xy)\frac{dy}{dx} = -2xy - 2y^2 \implies \frac{dy}{dx} = \frac{-2xy - 2y^2}{x^2 + 2xy}\end{aligned}$$

Need a hint? Look carefully at the red part:

$$\begin{aligned}x^2y + 2xy^2 = 0 &\implies \left(2xy + x^2\frac{dy}{dx}\right) + \left(2y^2 + \color{red}{2xy}\frac{dy}{dx}\right) = 0 \\ &\implies (x^2 + 2xy)\frac{dy}{dx} = -2xy - 2y^2 \implies \frac{dy}{dx} = \frac{-2xy - 2y^2}{x^2 + 2xy}\end{aligned}$$

The Correction

$$\begin{aligned}x^2y + 2xy^2 = 0 &\implies \left(2xy + x^2\frac{dy}{dx}\right) + \left(2y^2 + \color{blue}{2x2y}\frac{dy}{dx}\right) = 0 \\ &\implies (x^2 + 4xy)\frac{dy}{dx} = -2xy - 2y^2 \implies \frac{dy}{dx} = \frac{-2xy - 2y^2}{x^2 + 4xy}\end{aligned}$$

An Explanation

The derivative of y^2 with respect to x was incorrectly computed to be y times dy/dx instead of $2y$ times dy/dx .

[<-- Back](#)