

Handout 7: Implicit Differentiation

Two new differentiation rules:

$$(a) \quad \frac{d}{dx}(e^x) = e^x$$

$$(b) \quad \frac{d}{dx}(\ln(x)) = \frac{1}{x}.$$

For each of the following equations, find $\frac{dy}{dx}$.

1. $x \cdot y + 3 \cdot y^2 = 4.$

2. $e^y + 7 \cdot y^2 = \ln(x).$

3. $\ln(y) + e^x = \frac{1}{y}$.

4. $\sin(x \cdot y) + x^2 - y^3 = \frac{x}{y}$

Answers

1. $\frac{dy}{dx} = \frac{-y}{x + 6 \cdot y}$. 2. $\frac{dy}{dx} = \frac{\frac{1}{x}}{e^y + 14 \cdot y}$. 3. $\frac{dy}{dx} = \frac{e^x}{\left(\frac{1}{y} + \frac{1}{y^2}\right)}$.

4. $\frac{dy}{dx} = \frac{-y \cdot \cos(x \cdot y) - 2x + \frac{1}{y}}{x \cdot \cos(x \cdot y) - 2y + \frac{x}{y^2}}$.