

Please show **all** your work! Answers without supporting work will not be given credit.
Write answers in spaces provided.

Name: _____

1. Let y be a function of x . Use implicit differentiation on the following expressions:

(a) [1 pt] $\frac{d}{dx}(xy)$

Solution: Note this is just a variation of the product rule.

$$\begin{aligned}\frac{d}{dx}(xy) &= \frac{d}{dx}(x) \cdot y + x \cdot \frac{d}{dx}(y) \\ &= \frac{dx}{dx} \cdot y + x \cdot \frac{dy}{dx} \\ &= 1 \cdot y + x \cdot \frac{dy}{dx} \\ &= y + x \cdot \frac{dy}{dx}\end{aligned}$$

(b) [1 pt] $\frac{d}{dx}\left(\frac{x}{y}\right)$

Solution: Note this is just a variation of the quotient rule.

$$\begin{aligned}\frac{d}{dx}\left(\frac{x}{y}\right) &= \frac{\frac{d}{dx}(x) \cdot y - x \cdot \frac{d}{dx}(y)}{y^2} \\ &= \frac{\frac{dx}{dx} \cdot y - x \cdot \frac{dy}{dx}}{y^2} \\ &= \frac{1 \cdot y - x \cdot \frac{dy}{dx}}{y^2} \\ &= \frac{y - x \cdot \frac{dy}{dx}}{y^2} \\ &= \frac{y}{y^2} - \frac{x}{y^2} \cdot \frac{dy}{dx} \\ &= \frac{1}{y} - \frac{x}{y^2} \cdot \frac{dy}{dx}\end{aligned}$$