

Mathematics Review Course  
Summer 2023  
Problem Set 05

Ryan McWay

August 11th, 2023

**Note:** [Source] at the start of each problem denotes the source of the question. If there is no source, it is an original problem of my creation.

## Partial Derivatives

1. Find  $\frac{\partial f}{\partial x}$  and  $\frac{\partial f}{\partial y}$  for  $f(x, y) = \frac{\ln(xy)}{x+2y}$ .
2. Find  $\frac{\partial f}{\partial x}$ ,  $\frac{\partial f}{\partial y}$ , and  $\frac{\partial f}{\partial z}$  for  $f(x, y, z) = \frac{9^z}{x^2+zy}$ .

## Total Differentiation

3. Differentiate  $f(x, y, z) = 13x + 2y^2 + e^z$
4. Differentiate  $f(x, y, z) = (x + y^{1/2} + z^2)^3$

## Gradients

5. Find  $\nabla$  for  $f(x, y) = e^{5yx} + \frac{x}{y}$
6. Find  $\nabla$  for  $f(x, y) = \ln(x + y^2) - 8^x$
7. Find  $\nabla$  for  $f(x, y, z) = xy^2z^3 + 4xe^{y^2} - \ln(x - z)$

## Implicit Partial Differentiation

8.  $\frac{\partial}{\partial x}f(x, y(x)) = xy + x^2 - \ln(y)$
9.  $\frac{\partial}{\partial x}f(x, y(x)) = e^xy^{3/2}x^y$