

# Calculus and Linear Algebra II

## Quiz 3

**Instructions:**

- Do all the work on this quiz paper.
- Show your work, i.e., write down the steps of your solution cleanly and readable.
- Electronic devices and notes are not allowed.

**Name:** \_\_\_\_\_



**Problem 1 [7 points]**

Let  $f(x, y) = x \cos(y) - y^2$ .

(a) Compute the directional derivative of  $f$  at  $(0, 0)$  in direction  $(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}})$ .

(b) Now assume that  $x(t) = t^2$  and  $y(t) = t^2$ . Compute  $\frac{d}{dt}f(x(t), y(t))$ .

(c) Next, compute  $\frac{d}{dx} \int_0^{\pi/2} f(x, y) dy$ .

**Problem 1 (extra space)**

**Problem 2 [8 points]**

(a) Is the differential  $df = e^{-x+2y^2}(-dx + 4ydy)$  exact or inexact?

(b) List what different types of critical points there are for a function  $f : \mathbb{R}^n \rightarrow \mathbb{R}$ .

(c) Find all critical points of  $f(x, y) = e^{x^2-y^2}$ . What kind of critical points are they? (Try to answer by thinking about what this function looks like.)

(d) [Only if you are already done with the other problems and are bored.] Find all critical points of  $f(x, y) = xy(12 - 3x - 4y)$ .

**Problem 2 (extra space)**