MATH 253 Name: _____

Quiz 7 February 25, 2022

Instructions: Ten points total. Show all work for credit.

1. (5 pts.) Consider the implicitly defined surface given by equation

$$e^x = 5xyz$$

(a) Find a point $P = P\left(1, \frac{e}{10}, c\right)$ on the surface with x-coordinate equal to 1, and y-coordinate equal to $\frac{e}{10}$. (This means find c.)

Answer: The coordinates of P are $\left(1, \dfrac{e}{10}, \text{—}\right)$

(b) Using the point P found in the last part, find the equation of the tangent plane to the surface at $\left(1, \frac{e}{10}, c\right)$.

(continued on next page)

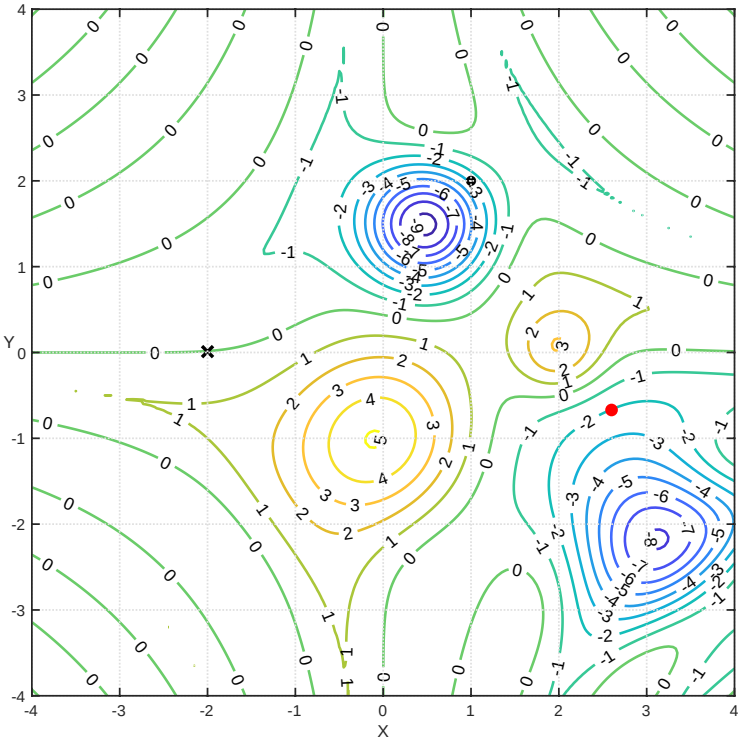
(c) Find the partial derivatives $\dfrac{\partial x}{\partial y}$ and $\dfrac{\partial z}{\partial y}$ for the surface $e^x = 5xyz$.

Answers: $\dfrac{\partial x}{\partial y} =$ $\dfrac{\partial z}{\partial y} =$

2. (3 pts.) Find the directional derivative of the function $f(x, y) = e^y \sin(x)$ at the point $\left(\frac{\pi}{3}, 0\right)$ in the direction of $\mathbf{v} = \langle 8, -6 \rangle$.

Is $f(x, y)$ increasing / decreasing / stable at $\left(\frac{\pi}{3}, 0\right)$ in the direction of $\mathbf{v}$? Explain.

3. (2 pts.) Consider the contour plot for the smooth function $z = f(x, y)$ displayed below.



(a) At the red point $(2.6, -0.7)$ shown, draw a vector pointing in the direction of $\nabla f(2.6, -0.7)$.

(b) Suppose a negatively charged particle is placed at the black X at $(-2, 0)$, and that $f(x, y)$ gives the charge of a plate in coulombs. Sketch the path of the negatively charged particle on the plate.