First & Last Name: ____________________ Student ID: ____________

Math 2310 Multivariable Calculus III Quiz 3 version b

Instructions: No notes or calculators are allowed. Please box your final answer.

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1. (6 pts) Find an equation of the plane tangent to the surface $4e^{xy} - z = 0$ at the point $(13, 0, 4)$. (Show all work on this paper.)

Solution: (Taken from MML Sec 15.6 Problem 5. For more practice, do Problems 1, 3, 4, 6, 7.)

Let $F(x, y, z) = 4e^{xy} - z$, and compute the partial derivatives at the point $P_0 = (13, 0, 4)$:

$$\begin{aligned} F_x &= 4ye^{xy} & F_x(P_0) &= 0 \\ F_y &= 4xe^{xy} & F_y(P_0) &= 4(13)e^0 = 4(13) \\ F_z &= -1 & F_z(P_0) &= -1 \end{aligned}$$

An equation of the plane tangent to the surface $F(x, y, z) = 0$ at $P_0(a, b, c)$ is

$$F_x(P_0)(x - a) + F_y(P_0)(y - b) + F_z(P_0)(z - c) = 0,$$

so an answer is

$$0(x - 13) + 4(13)(y - 0) - 1(z - 4) = 0 \text{ or } \boxed{4(13)y - z + 4 = 0} \text{ or } \boxed{z = 4(13)y + 4}$$

2. (1 pt) If $f_x(4,5) = 0$ and $f_y(4,5) = 0$, does it follow that f has a local maximum or local minimum at $(4,5)$? Explain.

◯ Yes. The tangent plane to f at $(4,5)$ is horizontal. This indicates the presence of a local maximum or a local minimum at $(4,5)$.

◯ Yes. The point $(4,5)$ is a critical point and must be a local maximum or local minimum.

◯ No. One (or both) of f_x and f_y must also not exist at $(4,5)$ to be sure that f has a local maximum or local minimum at $(4,5)$.

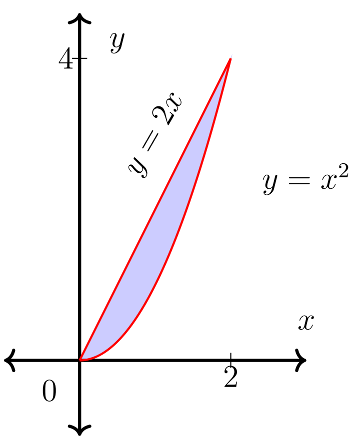
◯ No. It follows that $(4,5)$ is a critical point of f, and $(4,5)$ is a candidate for a local maximum or local minimum.

(Fill in the circle next to the correct answer. There is only one correct answer.)

Solution: (From MML Section 15.7 Problem 1)
Last choice:
No. It follows that $(4,5)$ is a critical point of f, and $(4,5)$ is a candidate for a local maximum or local minimum.

3. (3 pts) Reverse the order of integration in

$$\int_0^4 \int_{y/2}^{\sqrt{y}} f(x,y)\, dx\, dy$$



Solution:

$$\int_0^2 \int_{x^2}^{2x} f(x,y)\, dy\, dx$$

(Taken from MML 16.2 Problem 11. For similar problems, see also Problems 1, 6, 8, 12, 13.)