MATH 242
FALL 2018
EXAM 3

NAME:

1. Consider the surface S given by $f(x, y) = (x + y)e^{xy}$.

   (a) [10 pts.] Find an equation of the tangent plane to S at the point $(2, 0, 2)$.

   (b) [5 pts.] Use the tangent plane to estimate the value of $f(1.95, 0.05)$.

2. [15 pts.] Find the points at which the surface $S \subseteq \mathbb{R}^3$ given by

$$x^2 + y^2 - z^2 - 2x + 2y + 3 = 0$$

   has horizontal tangent planes.

3. [15 pts.] Find the critical points of

$$f(x, y) = 10 - x^3 - y^3 - 3x^2 + 3y^2,$$

   then determine whether each critical point corresponds to a local maximum, local minimum, or saddle point.

4. [10 pts.] Evaluate the double integral over the region R, choosing a convenient order of integration:

$$\iint_R x^5 e^{x^3 y} \, dA, \quad R = \{(x, y) : 0 \le x \le \ln 2, \, 0 \le y \le 1\}.$$

5. [10 pts.] Evaluate the integral

$$\iint_R y^2 \, dA,$$

   where R is the region bounded by $x = 1$, $y = 2x + 2$, and $y = -x - 1$.

6. [10 pts.] Use a double integral to find the area of the region R in the first quadrant bounded by $y = e^x$ and the line $x = \ln 2$.

7. [10 pts.] Sketch the region

$$R = \{(x, y) : x^2 + y^2 \le 25, \, y \le 0\},$$

   then evaluate the integral $\iint_R 2xy \, dA$ using polar coordinates.

8. [10 pts.] Use a double integral and polar coordinates to find the volume of the solid bounded by the paraboloids $z = 2x^2 + y^2$ and $z = 27 - x^2 - 2y^2$.