MATH 242
FALL 2013
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 $S \subset \mathbb{R}^3$ 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.] Use a double integral to find the volume of the region bounded by the coordinate planes $x = 0$, $y = 0$, $z = 0$ and the plane $z = 12 - 2x - 3y$.

6. [10 pts.] Use a double integral to find the area of the region R bounded by the parabola $y = x^2$ and the line $y = x + 2$.

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 region that lies between the xy-plane and the surface

$$z = 25 - \sqrt{x^2 + y^2}.$$