MATH 242
FALL 2016
EXAM 3

NAME:

1. [10 pts.] Find an equation of the plane tangent to the surface given by $xy \sin z = 1$ at the point $(-2, -1, 5\pi/6)$.

2. [15 pts.] Use the Second Derivative Test to find the local extrema and saddle points, if any, of the function
$$f(x, y) = -x^3 + 4xy - 2y^2 + 1.$$

3. [15 pts.] Find the point on the curve $y = x^2$ nearest the line $y = x - 1$. Identify the point on the line.

4. [15 pts.] Use the Method of Lagrange Multipliers to find the maximum and minimum values of $f(x, y) = 2x + y + 10$ subject to the constraint $2(x - 1)^2 + 4(y - 1)^2 = 1$.

5. [10 pts.] Use a convenient order of integration to evaluate
$$\iint_R \frac{x}{(1 + xy)^2}\, dA, \quad R = \{(x, y) : 0 \le x \le 4,\ 1 \le y \le 3\}.$$

6. [10 pts.] Evaluate
$$\iint_R (x + y)\, dA,$$
where $R$ is the region in the first quadrant bounded by $x = 0$, $y = x^2$, and $y = 8 - x^2$.

7. [10 pts.] Use a double integral to find the volume of the solid in the first octant bounded by the coordinate planes and the surface $z = 1 - y - x^2$.

8. [10 pts.] Evaluate the improper iterated integral
$$\int_0^\infty \int_0^\infty e^{-x-y}\, dy\, dx$$

9. [10 pts.] Find the volume of the solid bounded by the paraboloids $z = x^2 + y^2$ and $z = 2 - x^2 - y^2$.

10. [10 pts.] Use a double integral and polar coordinates to find the area of the region bounded by the curve $r = 2 + \sin\theta$.