MATH 242
FALL 2014
EXAM 3

NAME:

1. $\boxed{\text{10 pts.}}$ Consider the surface S given by $xy^2 + 3x - z^2 = 4$. Find an equation of the tangent plane to S at the point $(2, 1, -2)$.

2. $\boxed{\text{10 pts.}}$ 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. $\boxed{\text{15 pts.}}$ Find the critical points of

$$f(x, y) = 2xy - \frac{1}{2}(x^4 + y^4) + 1,$$

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

4. $\boxed{\text{10 pts.}}$ Evaluate the double integral

$$\iint_R \frac{y}{1 + x^2}\, dA,$$

where R is the region bounded by $y = 0$, $y = \sqrt{x}$, and $x = 4$.

5. $\boxed{\text{10 pts.}}$ 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. $\boxed{\text{10 pts.}}$ 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. $\boxed{\text{10 pts.}}$ Sketch the region

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

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

8. $\boxed{\text{10 pts.}}$ Use a double integral and polar coordinates to find the volume of the region that lies between the xy-plane and the surface

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