Calculus III Final Exam May 12, 2014
Dr. Platte Name:______________________________________

1. (14 points) Find an equation for the tangent plane and equation of line perpendicular to the surface $z = 2x^2y + 3y^2$ at the point (2,-1, -5).

2. (14 points) Let $f(x,y,z) = x^2y - yz^3 + z$. Find the directional derivative of f(x, y, z) at (1, 1, 1) in direction of the vector **v** = **i** – **j** + **k** .

3. (14 points) Determine whether the following limit exist. If it exists explain why and then find its value. If it does not exist explain why!

$$\lim_{(x,y)\to(0,0)} \frac{xy}{4x^2 + y^2}$$

4. (14 points) Locate all relative maxima, relative minima, and saddle points, if any, for $f(x,y) = x^3 - 3xy + \frac{1}{2}y^2$.

5. (14 points)) Show the line integral below is independent of path and use the Fundamental Theorem for Line Integrals to evaluate.

$$\oint_{(-1,1)}^{(2,1)} (y^2 + 2xy)dx + (2xy + x^2)dy$$

6. (15 points) Using a double integral for surface area to find the surface area of the portion of the cylinder $x^2 + z^2 = 4$ that is above the rectangle R = {(x,y): $-2 \le x \le 2$, $0 \le y \le 3$}. Note: You must do as a double integral; however the answer can be determined by basic geometry methods.

7. (15 points) Use a double integral to find the volume of the solid bounded above by z = f(x,y) = xy and below by the region R in the xy plane bounded by $y = \frac{1}{2}x$ $and\ y = \sqrt{x}$.

8. (15 points) Evaluate the line integral (which is also work done) $\oint_C \mathbf{F}(\mathbf{r}) \cdot d\mathbf{r}$. Where **F(r)** = x^2**i** +xy**j** and C is the closed path from (0,0) to (1,4) along the curve $y = 4x^2$ and then along the line from (1,4) back to (0,0). Evaluate as a line integral, do not use Green's theorem.

9. (15 points) Find three positive real numbers whose sum is 48 and whose product is as large as possible. Use Calculus III methods not trial and error. You can do this without LaGrange multipliers, but it is probably easier to use that process.