Math 208 (Exam 1) **Name** ____________________________.

1. (12 points) Find the partial derivative $f_x(x, y)$ for each of the following:

   (a) $f(x, y) = \frac{2x-3y}{x+y}$

   (b) $f(x, y) = x^3 \sin(x^3 y^2 + 4x^2)$

   (c) $f(x, y) = e^{x^2+4x+10}$

2. (14 points) Corresponding to $x = 1$, $y = -1$, find an equation of the tangent plane to the surface $z = f(x, y) = x^2 y + x^2 + y^3$ and find a parametric representation of the normal line.

3. (15 points) Given $\vec{a} =< 2, 3, 1 >$ and $\vec{b} =< 1, -1, 2 >$.

(a) Find $\|2\vec{a} - 3\vec{b}\|$

(b) Find the angle between $\vec{a}$ and $\vec{b}$

(c) Find the vector projection of $\vec{b}$ on $\vec{a}$.

4. (14 points) Find all values of the constant c so that the vectors $\vec{a} =< c, 2, 4 >$ and $\vec{b} =< c, 5c, 4 >$ are orthogonal. Then find all values of c so that $\vec{a}$ and $\vec{b}$ are parallel.

5. (14 points) Find an equation of the plane passing through the point $A = (1, 2, 3)$ and perpendicular to the line of intersection of the planes $x + 2y + 3z = 4$ and $2x - y + z = 9$.

6. (17 points) Find parametric representations for each of the curves in (a), (b), and (c):

(a) $y = x^2 - 2x + 7$, $-1 \leq x \leq 1$

(b) $\frac{x^2}{9} + \frac{y^2}{25} = 1$

(c) The line segment from the point $(1, 2, 3)$ to the point $(2, -1, 4)$.

(d) Find the area of the triangle with vertices $(2, 3, 1)$, $(1, 0, 4)$ and $(-1, 1, 2)$.

7. (14 points) By finding an appropriate linear approximation of $f(x, y) = (x^2 + y^2)^{\frac{3}{2}}$, approximate $f(4.1, 3.2)$.