**NAME:** **Section:**

MATH 251 (4-6), Dr. Z. , Mid-Term #1, 12:00-1:20pm , Thu., Oct. 12, 2006

1. Find an equation for the plane that passes through the point

$$(-1, 2, 1)$$

and contains the line of intersection of the planes

$$x + y - z = 2 \quad , \quad 2x - y + 3z = 1 \quad .$$

2. Determine whether the planes are parallel, perpendicular or neither. If neither find the angle between them.

$$x + 4y - 3z = 1 \quad , \quad -3x + 6y + 7z = 4 \quad .$$

3. Find the arclength of the curve

$$\mathbf{r}(t) = \langle\, 2\sqrt{2}\,t\,,\, e^{2t}\,,\, e^{-2t}\,\rangle \quad , \quad 0 \le t \le 1 \quad .$$

4. A particle of mass 100 kg is moving thanks to a force

$$\mathbf{F} = \langle 100, 200, 100 \rangle \quad .$$

At $t = 0$, it is at the point $(1, 2, 3)$ moving at a velocity $\langle\, 1\, ,\, 2\, ,\, -1 \rangle$. Find its position at $t = 5$.

5. Find the following limit, if it exists, or show that it does not exist:

$$\lim_{(x,y)\to(0,0)} \frac{x^5 + y^5}{(x^2 + y^2)^2} \quad .$$

6. Find an equation for the tangent plane of the surface

$$z = \frac{1}{\sqrt{x+y}}$$

at $(2, 2, 1/2)$.

7. Use the chain rule to find $\frac{\partial w}{\partial s}$ and $\frac{\partial w}{\partial t}$, if

$$w = x^3 y^2 \quad , \quad x = s^2 t + 1 \quad , \quad y = t^2 s + 3 \quad .$$

8. Find the directional derivative of the function

$$g(x, y, z) = (x + 2y + 3z)^{3/2}$$

at the point $(-1, 1, 1)$, in the direction of the vector $\langle 1, 2, 2 \rangle$.

9. Use implicit differentiation to find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ if

$$x^2 + y^2 + z^2 = 3xyz \quad .$$

10. Find the linearization, $L(x, y)$, of

$$f(x, y) = x\cos(3x - 2y)$$

at the point $(2, 3)$.