SCORE________________

Do one and only one problem from each section. Each question is worth 21 pts.

Section 1:

1. Differentiate implicitly to find the first partial derivatives of z. Remember we assume z is a function of both x and y.

$$x^2 + 2yz + z^2 = 1$$

2. Find the gradient of $f(x, y, z) = \cos(x^2 + y^2 + z)$ at the point $(1, -2, 4)$.

Section 2:

1. Verify the two planes $-3x + 6y + 7z = 1$ and $6x - 12y - 14z = 25$ are parallel and find the distance between them.

2. Find $\int_C e^x \, dx$, C is the arc of the curve $x = y^3$ from $(-1, -1)$ to $(1, 1)$.

Section 3:

1. Find the absolute maximum and minimum values of $f(x, y) = e^{-x^2-y^2}(x^2 + 2y^2)$ on the disk $D : \{(x, y) \,|\, x^2 + y^2 \leq 4\}$.

2. Evaluate the integral

$$\int_0^1 \int_0^{\sqrt{1-x^2}} \int_{\sqrt{x^2+y^2}}^{\sqrt{2-x^2-y^2}} xy \, dz \, dy \, dx$$

by changing to spherical coordinates.

Section 4:

1. Evaluate $\displaystyle\iint_R -2y \ln x \, dA$ where R is the region bounded by $y = 4-x^2$ and $y = 4-x$.

2. Evaluate $\displaystyle\iint_R (x^2+y^2)\, dA$ where R is the region bounded by $y = \sqrt{4-x^2}$ and $y = 0$.

Section 5:

1. Evaluate $\displaystyle\iiint_D y^2 z^2\, dV$ where D is bounded by the paraboloid $x = 1 - y^2 - z^2$ and the plane $x = 0$. See figure below.

2. Make a sketch of the vector field $\mathbf{F}(x, y) = -x\mathbf{i}$.