<center>**Mathematics for Engineering Anaylisis I:**</center>

Due date Friday, October 29, 2004

Solve each of these problems. Write your steps very clearly and underline your answers. The grade from this will be averaged with the lower of your two test grades.

1. Let **a**= 3**i** -2 **j** +1**k**, **b**=2 **i**-4**j**-3**k** and **c**=−**i**+2 **j**+2**k**

a) If the terminal point of **b** is (-1,2,1), find its initial point.
b) Find the projection of **b** in the direction of **a**.
c) Find the area of the triangle whose adjacent sides are **a**, **b**.
d) Find the volume of the parallelepiped generated by **a**, **b** and **c**.

2. Find the equation of the plane containing $(1,0,2)$ and parallel to the line $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z+2}{4}$.

3. Find the distance from $(1,0,2$ to the plane $2x - 3y + 6z = 6$.

4. Let C be parameterized by $\mathbf{r}\,(t) = 2\cos t\,\mathbf{i} + 2\sin t\,\mathbf{j} + t\mathbf{k}$ for $0 \le t \le 2\pi$

a) Find a parametric equation of the tangent line to C at $t = \frac{\pi}{4}$.
b) Find the length of C.
c) Find the curvature of C.
d) Fnd the unit tangent, unit normal, and unit binormal.

5. Let $f(x,y,z) = ze^{xy}$
a) Find the gradient of f.
b) Find the directional derivative of f at $(0,1,1)$ in the direction of **a**= 3**i** -2 **j** +1**k**
c) Find the unit vector in the direction of which f decreases most rapidly.

5. Let $f(x,y) = x^3 - 3xy + y^2$. Use the second derivative test to locate and identify the local extreme values of f.

6. Use Lagrange Multipliers to find th maximum and minimum values of $f(x,y,z) = xy + xz + yz$ subject to the consrtaint conditions $x + y + z = 1$.