MATH 233 **FALL 2004**

HOMEWORK # 9

(Due : Thursday 12/12 , before 5 PM . Bring it to class or to the Math Office)

1) Find the **gradient vector field** for the function $f(x, y, z) = e^z - ln(x^2 + y^2)$.

2) Find a formula for the vector field $\mathbf{F} = M(x,y)\,\mathbf{i} + N(x,y)\,\mathbf{j}$, given the fact that for all points (x,y) , **F** points towards the origin , and $|\mathbf{F}| = \frac{10}{x^2+y^2}$.
(The region is all points except (0 , 0) .)

3) Find the **work done** by the **force** $\mathbf{F} = 2y\,\boldsymbol{i} + 3x\,\boldsymbol{j} + (x + y)\,\boldsymbol{k}$ in moving object along the curve $\mathbf{r}(t) = \cos(t)\,\mathbf{i} + \sin(t)\,\mathbf{j} + \frac{t}{6}\,\mathbf{k}$ where $0 \leq t \leq 2\pi$.

4) Evaluate $\int_C \boldsymbol{F} \cdot \boldsymbol{T}\, ds$, where $\mathbf{F} = x^2\,\boldsymbol{i} - y\,\boldsymbol{j}$ and C is the curve $y = x^2$, from (4 , 2) to (1 , − 1) .

5) Find the **flow** of the velocity vector field $\mathbf{F} = (x + y)\,\boldsymbol{i} - (x^2 + y^2)\,\boldsymbol{j}$, along the curve $C = C_1 \cup C_2$, where C_1 is the line segment from (1,0) to (0 , − 1) and C_2 is the line segemst from (0 , − 1) to (− 1 , 0) .

6) Sketch the vector field $\mathbf{F} = -\frac{y}{\sqrt{x^2+y^2}}\,\boldsymbol{i} + \frac{x}{\sqrt{x^2+y^2}}\,\boldsymbol{j}$, at the 8 points on the circle $x^2 + y^2 = 4$, each point $\frac{\pi}{4}$ radians apart , starting with (2 , 0) . In the sketch indicate at each vector the $\mathbf{i}^{th}$ and $\mathbf{j}^{th}$ components of the vector .