Makeup Exam Spring 2009

EXAM I Physics 208

Name.....Section Number.....

USEFUL INFORMATION

For two point particles

$$\vec{F} = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}\hat{r}$$

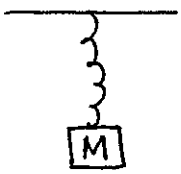
$$\int_{\vec{r}_1}^{\vec{r}_2} \vec{E}\cdot d\vec{r} = -[V(\vec{r}_2) - V(\vec{r}_1)]$$

$$d\vec{r} = dx\vec{i}_x + dy\vec{i}_y = dr\vec{i}_r + rd\theta\vec{i}_\theta$$

$$E_x = -\frac{dV}{dx} \qquad E_y = -\frac{dV}{dy}$$

DO NOT WASTE TIME ON COMPLICATED INTEGRALS

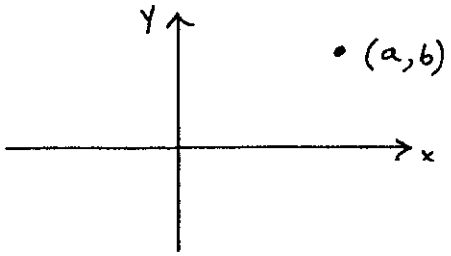
1. (25 points) A small block of mass M is hung from a spring, spring constant k. It has a charge Q. At equilibrium the spring is stretched by an amount $\frac{Mg}{2k}$. What electric field must be present?



2. (25 points) Suppose the Coulomb Force is not the one that really exists in nature but instead was given by

$$\vec{F} = \beta \frac{q_1 q_2}{r^6} \hat{r}$$

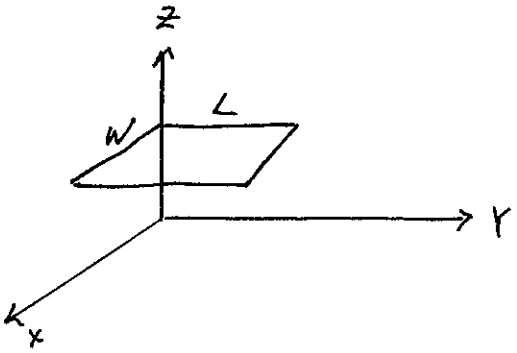
where β is a known constant. For this force find the electric potential function, V(x,y), for a charge Q located at the point $x = a, y = b$.



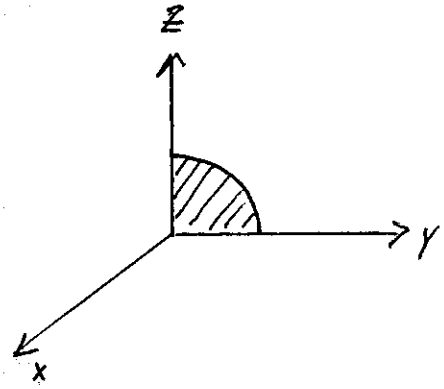
3. (25 points) Suppose there were an electric field given by

$$\vec{E} = \alpha \vec{i}_x + \beta x^2 \vec{i}_y.$$

a. What would be the electric flux through the L by W rectangle in the position shown?



b. What would be the electric flux through the shaded quarter of a circle of radius R in the position shown?



c. What would be the electric flux through the L by W rectangle in the position shown?