

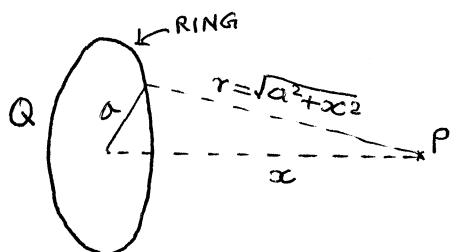
PHY 212 General Physics II - Electricity, Magnetism and Light  
Summer 2007

Quiz 3 Thursday, July 12

Name: WORKED OUT COPY

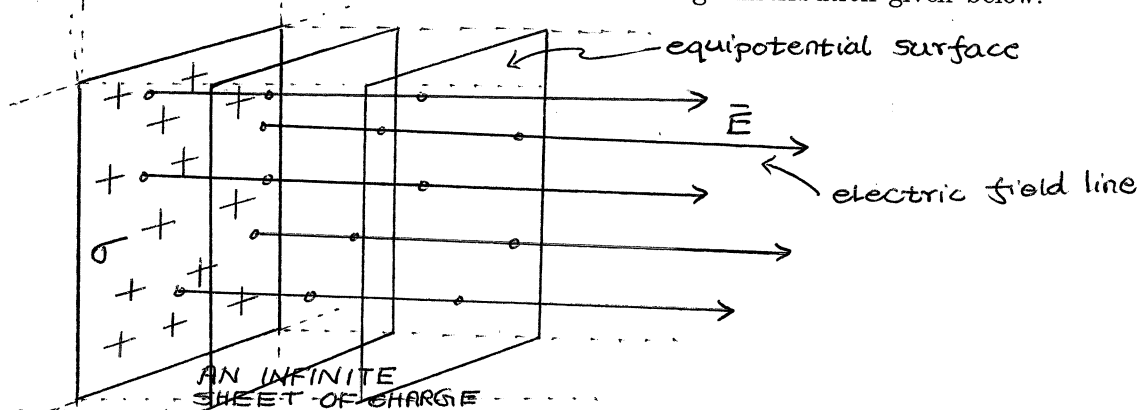
1. (5 points) **Potential Due to a Ring of Charge** Electric charge is distributed uniformly around a thin ring of radius  $a$ , with total charge  $Q$ . Find the potential at point  $P$  on the ring axis at a distance  $x$  from the center of the ring. (Hint:

$$V = \frac{1}{4\pi\epsilon_0} \int \frac{dq}{r}$$



$$\begin{aligned} V &= \frac{1}{4\pi\epsilon_0} \int \frac{dq}{r} \\ &= \frac{1}{4\pi\epsilon_0} \frac{1}{\sqrt{a^2+x^2}} \int dq \\ &= \frac{1}{4\pi\epsilon_0} \frac{Q}{\sqrt{a^2+x^2}} \end{aligned}$$

2. (5 points) **Equipotential Surfaces and Electric Field Lines** Draw equipotential surfaces and electric field lines for the charge distribution given below:



3. (5 points) In a certain region of space the potential is given by  $V(x, y, z) = A + Bx + Cy^2 + Dz^3$ , where  $A, B, C$  and  $D$  are constants. What is the electric field in this region? (Hint:  $\vec{E} = -\vec{\nabla}V$ )

$$\vec{E} = -\vec{\nabla}V = -\left(\hat{i} \frac{\partial V}{\partial x} + \hat{j} \frac{\partial V}{\partial y} + \hat{k} \frac{\partial V}{\partial z}\right)$$

$$\frac{\partial V}{\partial x} = B$$

$$\frac{\partial V}{\partial y} = 2Cy$$

$$\frac{\partial V}{\partial z} = 3Dz^2$$

$$\therefore \vec{E} = -B\hat{i} - 2Cy\hat{j} - 3Dz^2\hat{k}$$