EXAM I Physics 208 SPRING 2013

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

USEFUL INFORMATION

For two point particles

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

$$Volume \quad of \quad a \quad sphere = \frac{4}{3}\pi r^3$$

$$Area \quad of \quad a \quad sphere = 4\pi r^2$$

$$d\vec{r} = dx\vec{i}_x + dy\vec{i}_y$$

$$d\vec{r} = dr\vec{i}_r + rd\theta\vec{i}_\theta$$

PLEASE DO NOT SPEND TIME DOING NON-TRIVIAL INTEGRALS

Only integrals like $\int kx^n dx$ are considered trivial

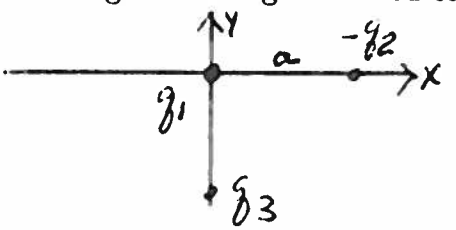
1.

2.

3.

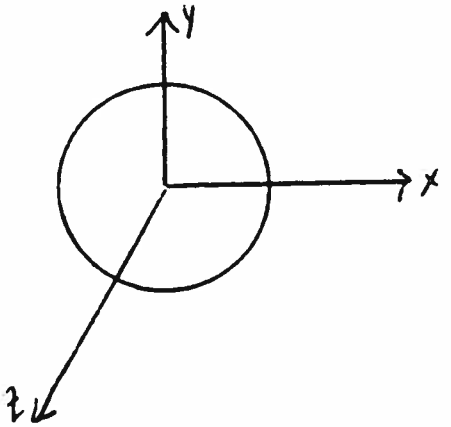
4.

1. (25 points) A positive and a negative charge are fixed on the x axis as shown.

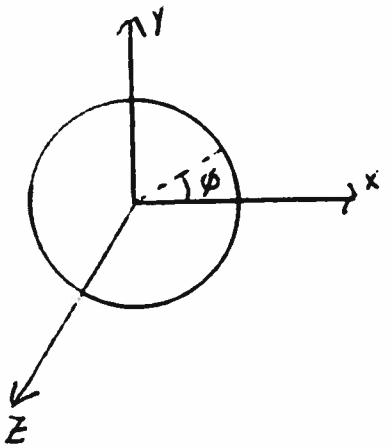


What would be the total force exerted by these charges on a third positive charge, q_3 placed at the point $x = 0$, $y = -b$?

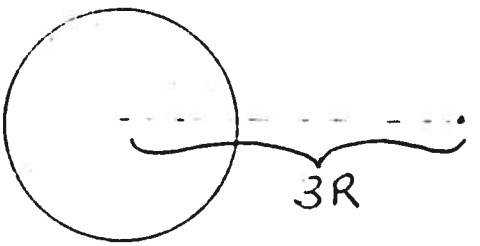
2. (25 points)An amount of charge Q is uniformly distributed along a circle of radius R which lies in the x, y plane. The center of the circle is at the origin. Find the electric field produced by the circle of charge at a point on the z axis given by $x = 0$, $y = 0$, and $z = L$. Hint: You might start by figuring out the direction of $\vec{E}$ at the point on the z axis.



Find the electric field produced by the circle of charge at a point on the z axis given by $x = 0$, $y = 0$, and $z = L$ if instead of the charge being uniformly spread over the circle there was a nonuniform charge per unit length on the circle given by $\lambda(\phi) = \lambda_0 \cos^2 \phi$ where λ_0 is a constant.

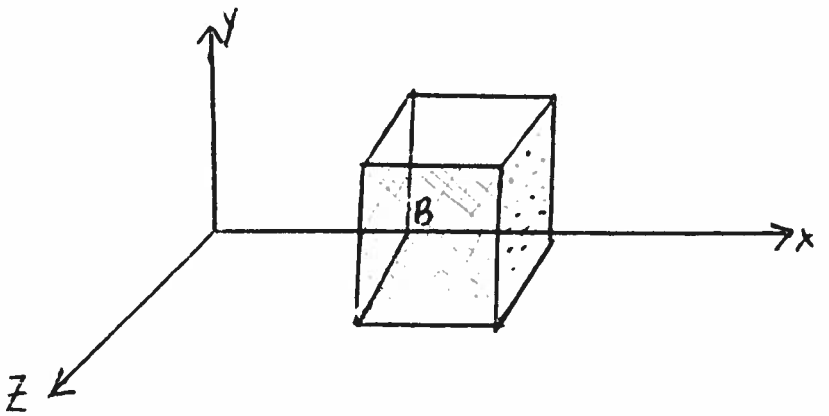


3. (25 points)A solid sphere of copper has been given a charge Q. The sphere has radius R. The electric field is measured and found to be zero inside the sphere and given by $|\vec{E}| = \frac{Q}{4\pi\epsilon_0 r^2}$ outside the sphere. Here r is the distance from the center of the sphere and the direction of $\vec{E}$ is radially out.



Find the difference in the electric potential between a point a distance $3R$ from the center of the sphere and a point at the center. Which point has the higher value of the electric potential?

1. (25 points)Consider a cubical surface, L on each edge. The bottom is in the x, z plane and the back corner is at $x = B$.



There is an electric field present given by

$$\vec{E} = c_1 x \vec{i}_x + c_2 y \vec{i}_y + c_3 x \vec{i}_z.$$

Here c_1, c_2, and c_3 are known constants.

a. Find the flux of $\vec{E}$ through the right hand (dotted) surface.

b. Find the flux of $\vec{E}$ through the front (shaded) surface.