EXAM I Physics 208 SPRING 2016

Last Name.....First.....Section Number.....

USEFUL INFORMATION

For two point particles

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

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

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

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

PLEASE DO NOT SPEND TIME DOING NON-TRIVIAL INTEGRALS

Only integrals like $\int kx^n dx$ or $\int \sin\theta d\theta$ or $\int \cos\theta d\theta$ are considered trivial

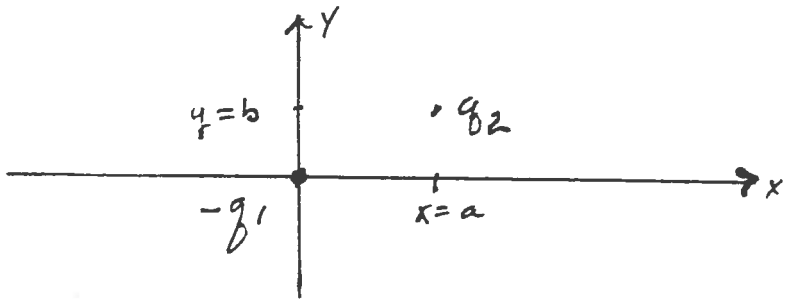
1.

2.

3.

4.

1. (25 points) Two charges are fixed at the positions shown.



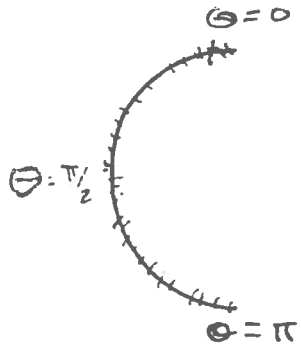
The distances a and b are known. The charge at the origin is negative, $-q_1$. The charge q_2 at $x = a, y = b$ is positive. Find the force that would be exerted on a charge q_3 if it were placed at an arbitrary point x, y.

Law

Application

Result

2. (25 points)The is a charged semi-circle of radius R. From $\theta = 0$ to $\theta = \frac{\pi}{2}$ there is a charge Q_1 uniformly distributed. From $\theta = \frac{\pi}{2}$ to $\theta = \pi$ the charge is not uniformly distributed but instead the charge per unit length is a function of θ given by $\lambda(\theta) = \lambda_0 \frac{\theta}{\pi}$. Find the electric field at the center of the semi-circle.

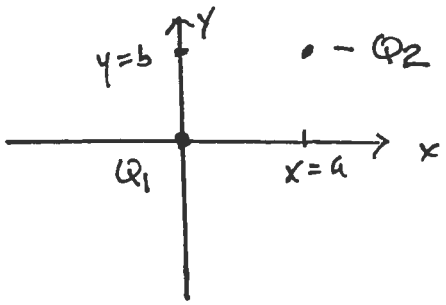


Law

Application

Result

3. (25 points)A positive point charge, Q_1, is located at the origin and a negative point charge, $-Q_2$, is located at $x = a, y = b$. Find the difference in the total electric potenial function at the two points $x = 0, y = 2b$ and $x = 0, y = -2b$.



Law

Application

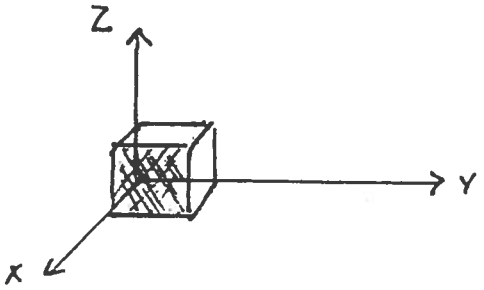
Result

4. (25 points)A cube with sides of length a is located with one corner at the origin. First find the flux of $\vec{E}$ through the shaded side of the cube if the electric field is given by

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

where α and β are known constants. Then find the flux through the shaded side of the cube if the electric field is given by

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



Law

Application

Result