Unit 5 - Week 4

Assignment 4

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-02-26, 23:59 IST.

Electric field due to line charge distribution

1) The electric field a distance z above one end of a straight line segment of length L that carries a uniform line charge λ may be expressed as ***4 points***

- $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{\lambda}{z}\left[\left(-1 + \frac{z}{\sqrt{z^2+L^2}}\right)\hat{x} + \left(\frac{L}{\sqrt{z^2+L^2}}\right)\hat{z}\right]$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{\lambda}{z}\left[\left(1 - \frac{z}{\sqrt{z^2+L^2}}\right)\hat{x} + \left(\frac{L}{\sqrt{z^2+L^2}}\right)\hat{z}\right]$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{\lambda}{z}\left[\left(1 - \frac{z^2}{\sqrt{z^2+L^2}}\right)\hat{x} + \left(\frac{L}{\sqrt{z^2+L^2}}\right)\hat{z}\right]$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{\lambda}{z}\left[\left(-1 + \frac{z}{\sqrt{z^2+L^2}}\right) + \left(\frac{L}{\sqrt{z^2+L^2}}\right)\right]\hat{z}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{\lambda}{z}\left[\left(-1 + \frac{z}{\sqrt{z^2+L^2}}\right)\hat{x} + \left(\frac{L}{\sqrt{z^2+L^2}}\right)\hat{z}\right]$

2) The electric field a distance z above the center of a square loop (side a) carrying uniform line charge λ is given as ***5 points***

- $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{\lambda az}{(z^2+a^2)\sqrt{z^2+a^2/2}}\hat{z}$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{4\lambda az}{(z^2+a^2)\sqrt{z^2+a^2/2}}\hat{z}$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{4\lambda az}{(z^2+a^2/4)\sqrt{z^2+a^2/2}}\hat{z}$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{4\lambda az}{(z^2+a^2/4)\sqrt{z^2+a^2/4}}\hat{z}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{4\lambda az}{(z^2+a^2/4)\sqrt{z^2+a^2/2}}\hat{z}$

3) The electric field a distance z above the center of a flat circular loop of radius r that carries a uniform line charge is expressed as ***5 points***

- $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{\lambda rz}{(z^2+r^2)\sqrt{z^2+r^2/2}}\hat{z}$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{\lambda(2\pi r)z}{r^2+z^2}\hat{z}$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{\lambda(\pi r^2)z}{(r^2+z^2)^{3/2}}\hat{z}$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{\lambda(2\pi r)z}{(r^2+z^2)^{3/2}}\hat{z}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{\lambda(2\pi r)z}{(r^2+z^2)^{3/2}}\hat{z}$

Gauss law in spherical coordinate system

Suppose the electric field in some region is found to be $\vec{E} = kr^3\hat{r}$, in spherical coordinates. k is a constant

4) The charge density ρ is ***3 points***

- $5\epsilon_0 kr^2$
- $\epsilon_0 kr^2$
- $5\epsilon_0 kr$
- $5\epsilon_0 kr^3$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$5\epsilon_0 kr^2$

5) The total charge contained in a sphere of radius R centered at the origin is ***4 points***

- $\frac{5}{4}\pi\epsilon_0 kR^5$
- $4\pi\epsilon_0 kR^5$
- $\pi\epsilon_0 kR^3$
- $4\pi\epsilon_0 kR^4$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$4\pi\epsilon_0 kR^5$

6) **Gauss law in sphere :** ***5 points***

A sphere of radius R carries a charge density proportional to the distance from the origin: $\rho = kr$, k is a constant. The electric field inside the sphere is

- $\vec{E} = \frac{1}{4\pi\epsilon_0}\pi kr^3\hat{r}$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\pi kR^2\hat{r}$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\pi kr^2\hat{r}$
- $\vec{E} = \frac{1}{4\epsilon_0}kR^4\hat{r}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\vec{E} = \frac{1}{4\pi\epsilon_0}\pi kr^2\hat{r}$

Spherical shell A thick spherical shell carries a charge density

$$\rho = \frac{k}{r^2} \quad (a \le r \le b)$$

7) The electric field in the region $r < a$ is ***2 points***

- $\vec{E} = 0$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\pi kr^3\hat{r}$
- $\vec{E} = \frac{k}{\epsilon_0}\left(\frac{b-a}{r^2}\right)\hat{r}$
- $\vec{E} = \frac{k}{\epsilon_0}\left(\frac{r-a}{r^2}\right)\hat{r}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\vec{E} = 0$

8) The electric field in the region $a < r < b$ is ***3 points***

- $\vec{E} = 0$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\pi kr^3\hat{r}$
- $\vec{E} = \frac{k}{\epsilon_0}\left(\frac{b-a}{r^2}\right)\hat{r}$
- $\vec{E} = \frac{k}{\epsilon_0}\left(\frac{r-a}{r^2}\right)\hat{r}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\vec{E} = \frac{k}{\epsilon_0}\left(\frac{r-a}{r^2}\right)\hat{r}$

9) The electric field in the region $r > b$ is ***3 points***

- $\vec{E} = 0$
- $\vec{E} = \frac{1}{4\pi\epsilon_0}\pi kr^3\hat{r}$
- $\vec{E} = \frac{k}{\epsilon_0}\left(\frac{b-a}{r^2}\right)\hat{r}$
- $\vec{E} = \frac{k}{\epsilon_0}\left(\frac{r-a}{r^2}\right)\hat{r}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\vec{E} = \frac{k}{\epsilon_0}\left(\frac{b-a}{r^2}\right)\hat{r}$