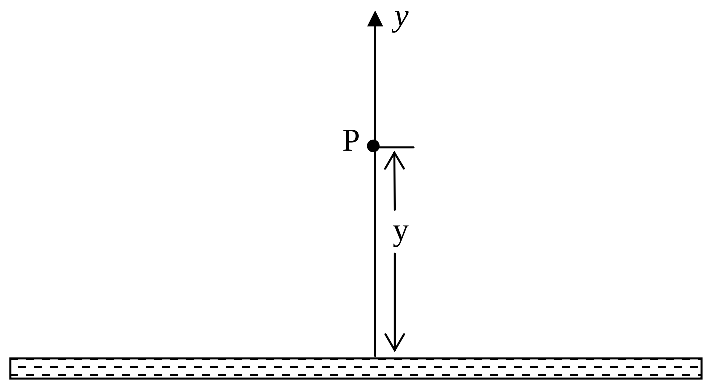
$$\varepsilon_o = 8.85 \times 10^{-12} \frac{C^2}{Nm^2}$$

$$k = \frac{1}{4\pi\varepsilon_o} = 8.99 \times 10^9 \frac{Nm^2}{C^2}$$

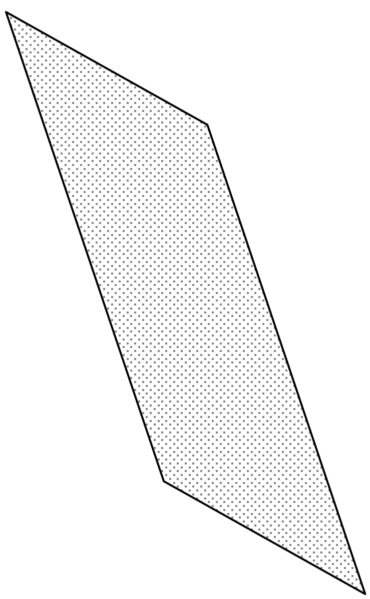
Chapter 24 Examples

Gauss' Law

1) (a) Find the **magnitude and direction** of the Electric Field at a point *P* near a very long thin charged rod, a distance *y* from the rod. The rod has negative charge uniformly distributed with density, λ.



(b) An infinite but thin sheet of **positive** charge contains uniform charge per unit area, σ. Calculate the magnitude of the electric field due to the sheet of charge.



Chapter 24 Examples (continued)

2) A solid, non-conducting sphere of radius R contains a non-uniform charge distribution of (+5r) $\mathit{Coulombs}/\mathit{meter}^4$. Determine the electric field at a radius, d, from the sphere's center where

[For full credit, you must draw and label all differential quantities relevant to your calculations (e.g. dq, dA, dV, dx, dr, etc).]

(a) $d > R$.
(b) $0 < d < R$.

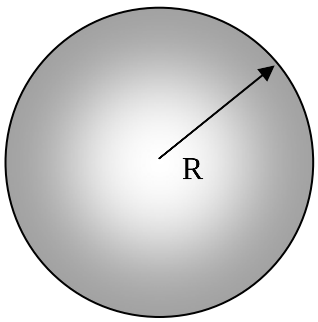


Figure for part (a)

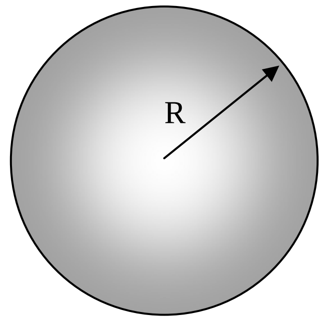


Figure for part (b)

Chapter 24 Examples (continued)

3) A thick non-conducting **cylindrical shell** with length *L*, inner radius *c* and outer radius ***d*** contains uniformly distributed positive charge with a total charge +Q. The cross section is seen below. **Using Gauss' Law,** determine the **electric field magnitude and direction** a distance ***R*** from the cylinder's center for the following regions (neglect end effects):

(a) $R<c$ **electric field magnitude and direction**
(b) $c<R\leq d$ **electric field magnitude and direction**
(c) $R>d$ **electric field magnitude and direction**

NOTE: In order to receive full credit you must do the following:
- show all of your work
- draw and label all variables used in your calculations
- draw and label your Gaussian surface.