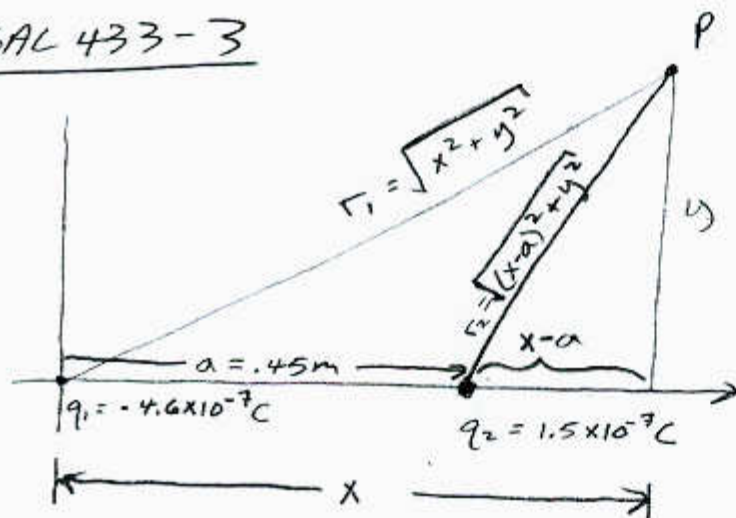


SAL 433-3



$$\phi = \frac{kq_1}{r_1} + \frac{kq_2}{r_2}$$

$$\phi = \frac{kq_1}{\sqrt{x^2 + y^2}} + \frac{kq_2}{\sqrt{(x-a)^2 + y^2}}$$

$$\phi = \frac{k(-4.6 \times 10^{-7}\text{C})}{\sqrt{x^2 + y^2}} + \frac{k(1.5 \times 10^{-7}\text{C})}{\sqrt{(x-0.45\text{m})^2 + y^2}}$$

$$E_x = -\frac{\partial \phi}{\partial x}$$

$$E_x = -\frac{\partial}{\partial x} \left\{ kq_1(x^2 + y^2)^{-\frac{1}{2}} + kq_2[(x-a)^2 + y^2]^{-\frac{1}{2}} \right\}$$

$$E_x = -\left\{ kq_1(-\frac{1}{2})(x^2 + y^2)^{-\frac{3}{2}} 2x + kq_2(-\frac{1}{2})[(x-a)^2 + y^2]^{-\frac{3}{2}} 2(x-a) \right\}$$

$$E_x = \frac{kq_1 x}{(x^2 + y^2)^{3/2}} + \frac{kq_2 (x-a)}{[(x-a)^2 + y^2]^{3/2}}$$

At $(0.45\text{m}, 0.50\text{m})$:

$$E_x = \frac{8.99 \times 10^9 \frac{\text{N}\cdot\text{m}^2}{\text{C}^2} (-4.6 \times 10^{-7}\text{C}) (0.45\text{m})}{[(0.45\text{m})^2 + (0.50\text{m})^2]^{3/2}} + \frac{8.99 \times 10^9 \frac{\text{N}\cdot\text{m}^2}{\text{C}^2} (1.5 \times 10^{-7}\text{C}) (0.95\text{m} - 0.45\text{m})}{[(0.45\text{m} - 0.45\text{m})^2 + (0.50\text{m})^2]^{3/2}}$$

(cont.)

(SAC 433-3 page 2)

$$E_x = -6.1 \frac{\text{kN}}{\text{C}}$$

$$E_y = -\frac{\partial \Phi}{\partial y}$$

$$= -\frac{\partial}{\partial y} \left\{ kq_1 (x^2 + y^2)^{-\frac{1}{2}} + kq_2 [(x-a)^2 + y^2]^{-\frac{1}{2}} \right\}$$

$$= -\left\{ kq_1 \left(-\frac{1}{2}\right) (x^2 + y^2)^{-\frac{3}{2}} 2y + kq_2 \left(-\frac{1}{2}\right) [(x-a)^2 + y^2]^{-\frac{3}{2}} 2y \right\}$$

$$E_y = \frac{kq_1 y}{(x^2 + y^2)^{3/2}} + \frac{kq_2 y}{[(x-a)^2 + y^2]^{3/2}}$$

At (0.45m, 0.50m):

$$E_y = \frac{8.99 \times 10^9 \frac{\text{N} \cdot \text{m}^2}{\text{C}^2} (-4.6 \times 10^{-7} \text{C}) \cdot 0.50 \text{m}}{[(0.45 \text{m})^2 + (0.50 \text{m})^2]^{3/2}} + \frac{8.99 \times 10^9 \frac{\text{N} \cdot \text{m}^2}{\text{C}^2} (1.5 \times 10^{-7} \text{C}) \cdot 0.50 \text{m}}{[(0.45 \text{m} - 0.45 \text{m})^2 + (0.50 \text{m})^2]^{3/2}}$$

$$E_y = -1.4 \frac{\text{kN}}{\text{C}}$$

$$\vec{E} = E_x \hat{i} + E_y \hat{j}$$

$$\boxed{\vec{E} = -6.1 \frac{\text{kN}}{\text{C}} \hat{i} - 1.4 \frac{\text{kN}}{\text{C}} \hat{j}}$$