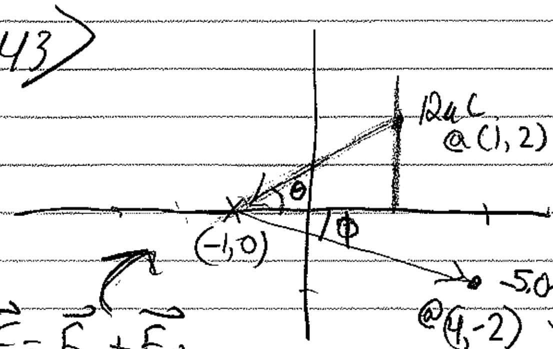
43)



$\vec{E} = \vec{E}_1 + \vec{E}_2$

$E_1 = \frac{kq}{r^2} = \frac{(8.99\times10^9 \, N\cdot m^2/C^2)(12\mu C)}{r^2}$

$E_2 = \frac{kq}{r^2} = \frac{(8.99\times10^9 \, Nm^2/C^2)(12\mu C)}{r^2}$

$\theta = \tan^{-1}\left(\frac{2}{2}\right) = 45^\circ$

$\phi = \tan^{-1}\left(\frac{2}{5}\right) = 21.8^\circ \rightarrow 22^\circ$

@(-1,0), $E_1 = \frac{(8.99\times10^9)(12\mu C)}{(2^2+2^2)m}\left[-\cos(45)\hat{i} - \sin(45)\hat{j}\right]$ ← Negative

$= (-9535.3 \, \tfrac{N}{C}\hat{i} - 9535.3 \, \tfrac{N}{C}\hat{j})$

@(-1,0), $E_2 = \frac{(8.99\times10^9)(-5.0\mu C)}{(5^2+(-2)^2)m}\left[+\cos(22)\hat{i} - \sin(22)\hat{j}\right]$

$= (1437 \, \tfrac{N}{C})\hat{i} - (580 \, \tfrac{N}{C}\hat{j})$

$E_{Tot} = (-9535 \, \tfrac{N}{C} + 1137 \, \tfrac{N}{C})\hat{i} + (-9535 \, \tfrac{N}{C} - 580 \, \tfrac{N}{C})\hat{j}$

$= -8098 \, \tfrac{N}{C}\hat{i} - 10116 \, \tfrac{N}{C}\hat{j}$

(a) **or $13 \, \frac{kN}{C}$ @ 231°**

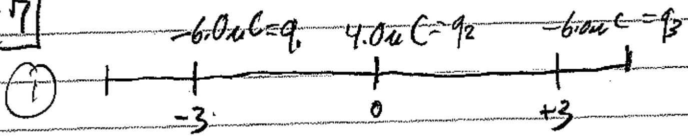
(b) $F_e = eE_{Tot} = 1.602\times10^{-19} C \left(13 \, \frac{kN}{C}\right) = 2.1\times10^{-15} N$ @ 231°

-180

51°

Chapter 21, {27, 43, 53}; Chapter 22: {33}

27

① 

$F_{q_1} = ?$ ← Picture + Summary of what is being asked.

② $F_{q_1} = F_{12} + F_{13}$ ← Superposition

3a $F_{12} = K\frac{q_1 q_2}{r^2} = K\frac{(-6.0\mu C)(4.0\mu C)}{(3)^2} = -0.024\ N$ ← Attractive force

$K = 8.99 \times 10^9\ N \cdot m^2/C^2$

3b $F_{13} = K\frac{q_1 q_3}{r^2} = K\frac{(-6.0\mu C)(-6.0\mu C)}{(3-(-3))^2} = 0.009\ N$ ← Not Negative means repulsive

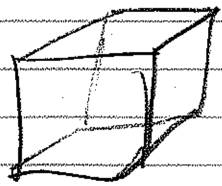
$(3-(-3))^2$ ← 6^2

④ $F_{q_1} = -0.024N + 0.009N = -0.015\ N$

{Since the problem takes place all along the x-axis, we can leave the $\hat{i}$ off of our answer as it is implied.}

Chapter 22, #33

$$\Phi = \oint E \, dA = \frac{q_{enc}}{\epsilon_0} \qquad \epsilon_0 = 8.85 \times 10^{-12} \frac{C^2}{N \cdot m^2}$$



6 sides to cube,
each side has $\Phi_s = -1.50 \, kN \cdot m^2/C$

$$\text{Total } \Phi = 6\Phi_s = 6(-1.50 \, kN \cdot m^2/C)$$

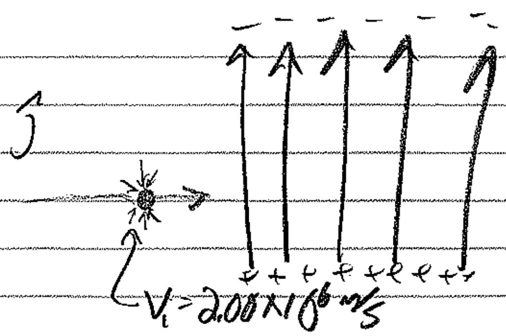
$$= -9 \, kN \cdot m^2/C$$

$$q_{enc} = \Phi \epsilon_0 = -9 \frac{kN \, m^2}{C} \left(8.85 \times 10^{-12} \frac{C^2}{N \cdot m^2}\right)$$

$$= -7.97 \times 10^{-8} \, C$$

21.53

$E = 300 \frac{N}{C} \hat{j}$



(a) $F_E = e\, 300 \frac{N}{C} = (-1.602 \times 10^{-19} C)(300 \frac{N}{C}) = 4.8 \times 10^{-17} N (-\hat{j})$

$m_e = 9.11 \times 10^{-31}$ kg , $F = ma$

$a = F/m = \frac{4.8 \times 10^{-17} (-\hat{j})}{9.11 \times 10^{-31} kg}$

$= 5.3 \times 10^{13} \frac{m}{s^2} (-\hat{j})$

or

$-5.3 \times 10^{13} \frac{m}{s^2} \hat{j}$

(b) X velocity unchanged since F_E is only in y direction.

$\Delta x = V \Delta t \rightarrow 0.10 m = 2.00 \times 10^6 \frac{m}{s} \Delta t$

$\Delta t = 5 \times 10^{-8} s$

(c) What is V_y after Δt?

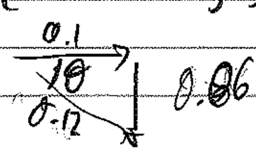
$V_f = V_i + at = 0 - 5.3 \times 10^{13} \frac{m}{s^2} (5 \times 10^{-8} s)$

$= 2,659000 \frac{m}{s}$

and

$y_f = y_i + V_i t + \frac{1}{2} a t^2$

$y_f = 0 + 0 + \frac{1}{2}(-5.3 \times 10^{13} \frac{m}{s^2})(5 \times 10^{-8} s)^2 = \frac{0.1325 m}{2} = 0.06 m$



$\rightarrow \theta = 33.5°$