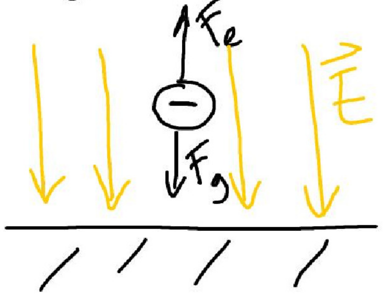
27.

$m = 0.012\,kg$

$q = -18\times10^{-6}\,C$



$\Sigma F = 0$

$F_e - F_g = 0$

$F_e = F_g$

$\frac{k q_1 q_2}{r^2} = mg$

$\vec{E} q = mg$

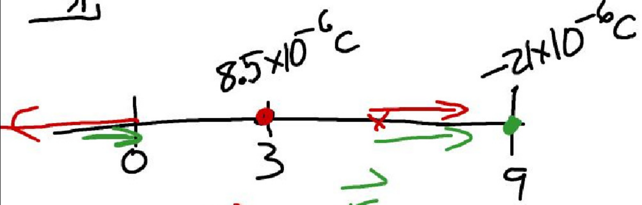
$\vec{E}(-18\times10^{-6}c) = (0.012)(9.8)$

$\vec{E} = -6533\,N/C$ Down

$\frac{F}{q} = \vec{E} = \frac{kq}{r^2}$

$\vec{F} = \vec{E} q$

31.



$\vec{E}_0 = \vec{E}_1 + \vec{E}_2$

$= \frac{(9\times10^9)(8.5\times10^{-6})}{(.03)^2} + \frac{(9\times10^9)(-21\times10^{-6})}{(.09)^2}$

$= 8.5\times10^7 + -2.33\times10^7$

$= 6.17\times10^7\,N/C$ in $-x$ dir.

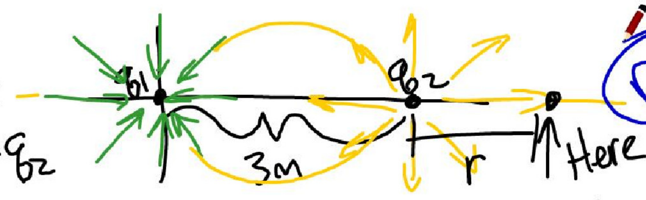
$\vec{E}_6 = \vec{E}_1 + \vec{E}_2$

$= \frac{k(8.5\times10^{-6})}{(.03)^2} + \frac{k(-21\times10^{-6})}{(.03)^2}$

29

$-16 \times 10^{-6}\,C = q_1$

$4.0 \times 10^{-6}\,C = q_2$



$r = 3$

Where $\vec{E} = 0$?

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

$= \frac{-kq_1}{(r+3)^2} + \frac{kq_2}{r^2}$

$0 = k\left[\frac{-16 \times 10^{-6}}{(r+3)^2} + \frac{4 \times 10^{-6}}{r^2}\right]$

$\frac{16 \times 10^{-6}}{r^2+6r+9} = \frac{4 \times 10^{-6}}{r^2}$

$(16 \times 10^{-6})r^2 = (4 \times 10^{-6})(r^2+6r+9)$

$r^2 = (.25)(r^2+6r+9)$

$r^2 = (.25)(r^2+6r+9)$

$r^2 = .25r^2 + 1.5r + 2.25$

$-r^2 \quad -r^2$

$0 = -0.75r^2 + 1.5r + 2.25$

↳ Solver, graph, or quadratic

$= -0.75(r^2 - 2r - 3)$

$-0.75(r-3)(r+1)$

(13) $\frac{F}{q} = E$

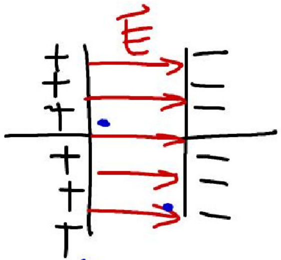
$F = (0)q$

$= 0\,N$

Capacitors

Devices that store Electricity/Energy in an electric field

– Parallel Plate



σ = charge per unit area (sigma)

on a capacitor

$$\vec{E} = \frac{\sigma}{\varepsilon_0}$$

$\vec{E}$ is same everywhere between capacitor plates!

Shielding

$\vec{E}$ inside a conductor, or inside an empty conducting shell is <u>0</u> everywhere

– All extra charge is on the surface.

E field lines enter/exit perpendicular to the surface of a conductor.