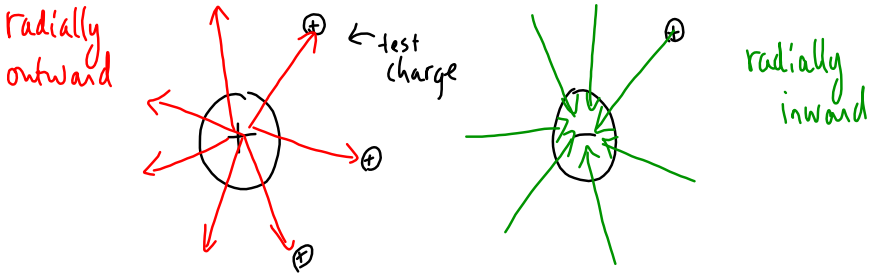
Chapter 14 - Describing Fields

Coulomb's Law (Electrostatic Force) $F_q = \frac{kq_1q_2}{r^2}$ $\left(k = 9.0\times10^9 \frac{N\cdot m^2}{C^2}\right)$

* do not signs on charges in formula
* magnitude only
* DRAW a FBD + show forces based on attractive/repulsive + find F_{net} (vector addition diagram OR x-y chart)

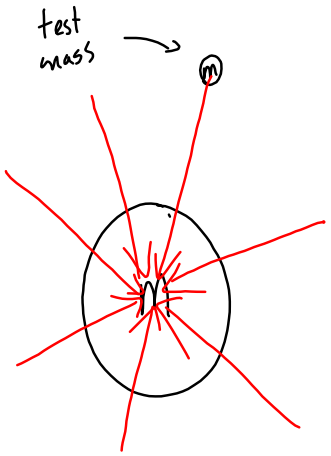
Electric Field Strength/Intensity $\vec{E} = \frac{\vec{F}_q}{q}$

* direction is based on the force acting a positive test charge.



* anything with a charge will produce an electric field. Other charges experience the field.

Gravitational Field Strength/Intensity $\vec{g} = \frac{\vec{F}_g}{m}$



Any mass will produce a gravitational field and any other mass will experience that field

Fields near point sources

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

$$|\vec{E}| = \frac{\frac{kQq}{r^2}}{q}$$

$$|\vec{E}| = \frac{kQ}{r^2}$$ ← the source charge.

* magnitude of the electric field intensity
* direction is based on a positive test charge (radially inward/outward)

$$\vec{g} = \frac{\vec{F}_g}{m}$$

$$|\vec{g}| = \frac{\frac{GMm}{r^2}}{m}$$

$$|\vec{g}| = \frac{GM}{r^2}$$ ← the source mass

* magnitude of the gravitational field intensity
* direction is <u>always</u> radially inward.

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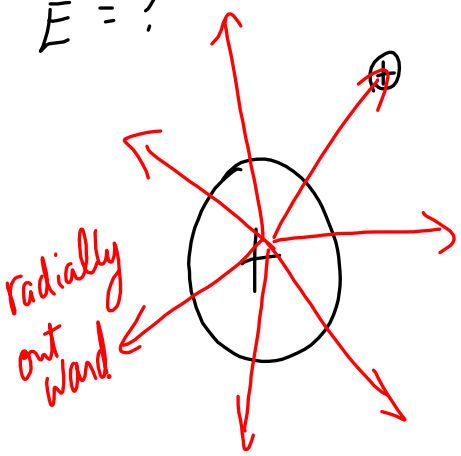
$Q = +2.0 \times 10^{-6}\ C$ (source)

$r = 30.0\ cm$

$\vec{E} = ?$



$$|\vec{E}| = \frac{kQ}{r^2}$$

do not put sign on

$$|\vec{E}| = \frac{\left(9.0 \times 10^{9}\ \frac{N \cdot m^2}{C^2}\right)\left(2.0 \times 10^{-6}\ C\right)}{(0.300\ m)^2}$$

$$|\vec{E}| = 2.0 \times 10^{5}\ \frac{N}{C}$$

$$\vec{E} = 2.0 \times 10^{5}\ \frac{N}{C}\ [\text{radially outward}]$$

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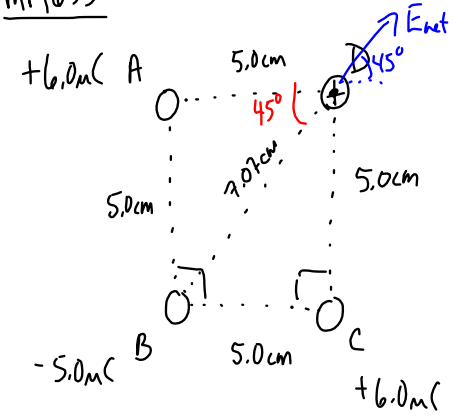
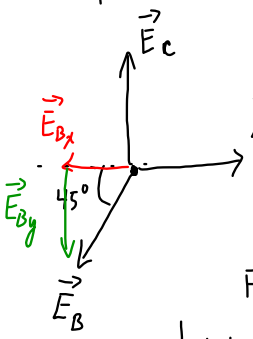


Place a positive test charge at D:



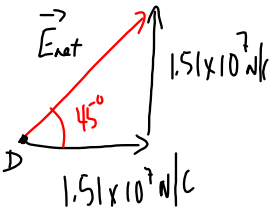
Draw a FBD.

What is the net field?

$$|\vec{E}_A| = |\vec{E}_C| = \frac{kQ}{r^2} = \frac{\left(9.0\times10^9 \frac{N\cdot m^2}{C^2}\right)\left(6.0\times10^{-6}C\right)}{(0.050m)^2} = 2.16\times10^7 N/C$$

$$|\vec{E}_B| = \frac{\left(9.0\times10^9 \frac{N\cdot m^2}{C^2}\right)\left(5.0\times10^{-6}C\right)}{(0.0707m)^2} = 9.0\times10^6 N/C$$

	x	y
E_A	$+2.16\times10^7$ N/C	0
E_B	$-(9.0\times10^6$ N/C$)\cos45^\circ$ -6.37×10^6 N/C	$-(9.0\times10^6$ N/C$)\sin45^\circ$ -6.37×10^6 N/C
E_C	0	$+2.16\times10^7$ N/C
E_{net}	1.51×10^7 N/C	1.51×10^7 N/C



$$\vec{E}_{net} = 2.1\times10^7 N/C \text{ [45° CCW from + x-axis)}$$

TO DO

1. PP|655 (electric field)
2. MP|657 (look over) } (gravitational field)
3. PP|658
4. Assignment p684|18-25 (due Friday)