Coulomb's Law

$$F_Q = \frac{kq_1q_2}{r^2}$$

- electric charges
- attractive or repulsive
- inverse square law $\left(F \propto \frac{1}{r^2}\right)$
- DO NOT PUT SIGNS ON THE CHARGES!!!

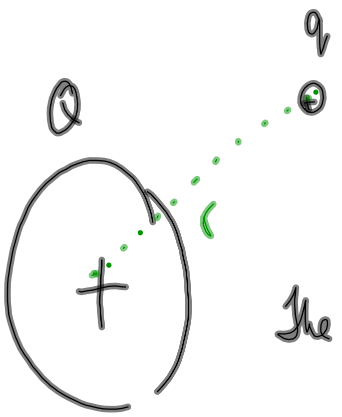
Newton's Law of Universal Gravitation

$$F_g = \frac{Gm_1m_2}{r^2}$$

- masses
- ALWAYS attractive
- inverse square law $\left(F \propto \frac{1}{r^2}\right)$

§14-2 Describing Fields

Consider the force between two charged particles:



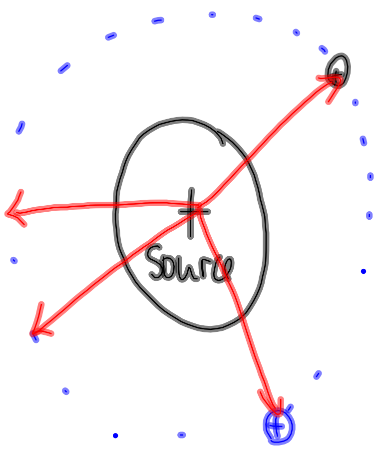
$$F_Q = \frac{kQq}{r^2} \quad \text{(repulsive)}$$

The force acting on q per unit charge is:

$$|\vec{E}| = \frac{|\vec{F_Q}|}{q} \quad \text{(electric field intensity)}$$

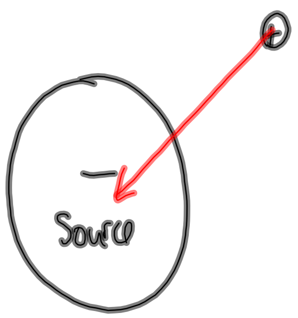
↑ magnitude of the field

Direction is determined by placing a <u>positive test charge</u> in the field.



← experienced a repulsive force.

The field for a positive "Source" charge is <u>radially outward</u>.



There is an <u>attractive</u> force on the positive test charge.

=> the field for a negative Source charge is radially inward.

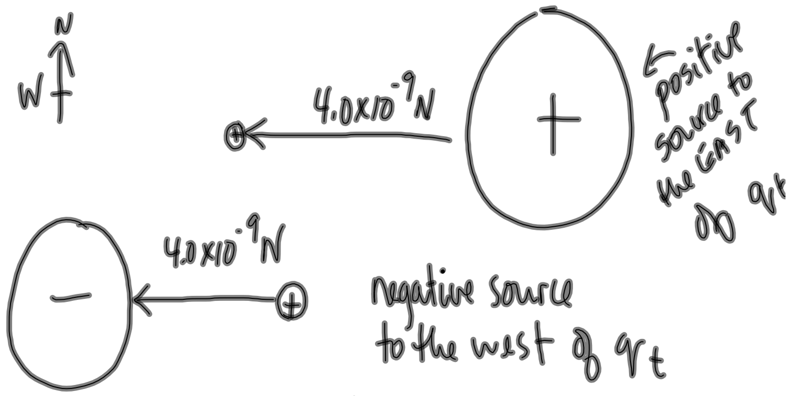
mp|645

$q_t = +2.0\times10^{-9}\,C$

$\vec{F} = 4.0\times10^{-9}\,N\ [W]$

a) $\vec{E} = ?$ (field intensity)

b) What force would act on $+9.0\times10^{-6}\,C$ at same location



a) $\vec{E} = \dfrac{\vec{F}}{q_t}$

$\vec{E} = \dfrac{4.0\times10^{-9}\,N}{2.0\times10^{-9}\,C}\ [W]$

$\vec{E} = 2.0\,\frac{N}{C}\ [W]$

A charge of +1C would experience a force of 2.0N [W] at this location

NOTE: If you place a negative charge at this location, it would experience a force to the EAST!

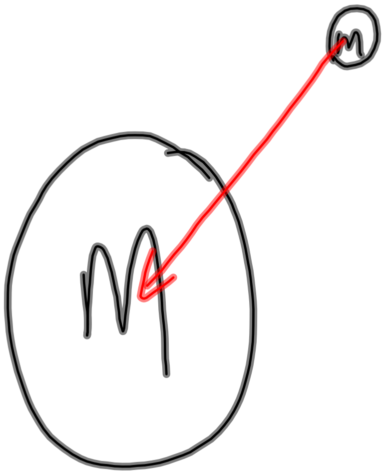
b) $\vec{E} = \dfrac{\vec{F}}{q}$

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

$\vec{F} = (9.0\times10^{-6}\,N)\left(2.0\frac{N}{C}\ [W]\right)$

Gravitational Field Intensity

The force experienced by 1 kg of mass at a specific location



- always attractive
- always radially inward

$$\vec{g} = \frac{\vec{F}_g}{m} \qquad \text{recall: } (\vec{F}_g = m\vec{g})$$

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$m = 4.60\,kg$

$F_g = 45.1\,N$

$g = ?$

$$g = \frac{45.1\,N}{4.60\,kg}$$

$$g = 9.80\,\frac{N}{kg}$$

TO DO:

PP|646 ($\vec{E}$)

PP|648 ($\vec{g}$)