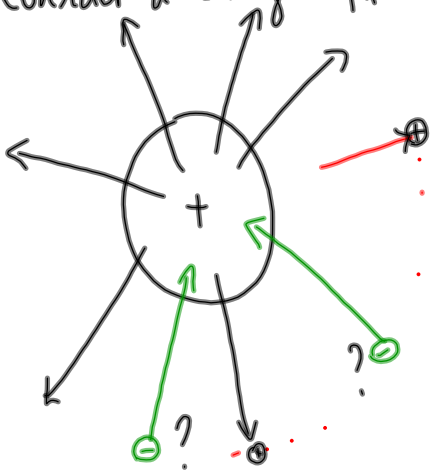
§14.2 Describing Fields

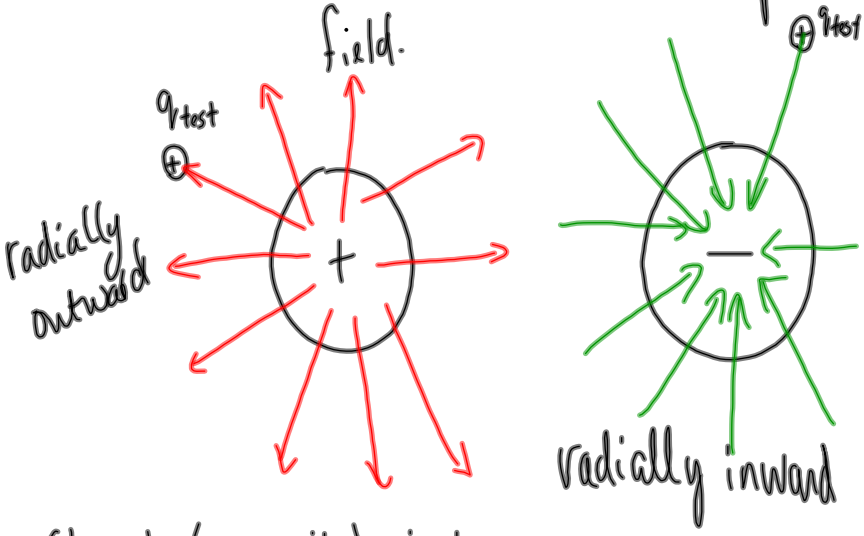
Consider a charged sphere



The electric field is due to all the force vectors acting on charge at certain distance from the source of the field.

What about the direction?

We use a positive test charge to determine the direction of the field.



Electric Field Strength (Intensity) is the force per unit charge:

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

Where $\vec{E}$ is the electric field intensity (N/C)

$\vec{F}_Q$ is the force acting on the charge (N)

q is the charge that experiences the force (C)

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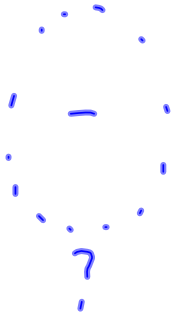
$q_{test} = +2.0 \times 10^{-9}\ C$

$\vec{F}_Q = 4.0 \times 10^{-9}\ N\ [W]$



a) $\vec{E} = ?$

b) $F_Q = ?$

$(q = +9.0 \times 10^{-6} C)$

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

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

$\vec{F}_Q = (9.0 \times 10^{-6} C)\left(2.0 \frac{N}{C}\ [W]\right)$

$\vec{F}_Q = 1.8 \times 10^{-5}\ N\ [W]$

$4.0 \times 10^{-9}\ N\ [W]$ ←

⊕
q_{test}
$+2.0 \times 10^{-9} C$

a) $\vec{E} = \dfrac{\vec{F}_Q}{q}$

$\vec{E} = \dfrac{4.0 \times 10^{-9}\ N\ [W]}{2.0 \times 10^{-9}\ C}$

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

Gravitational Field Intensity

The force of gravity per unit mass.

$$\vec{g} = \frac{\vec{F_g}}{m} \qquad (\vec{F_g} = m\vec{g})$$

Where $\vec{g}$ is the gravitational field strength (N/kg)

$\vec{F_g}$ is the force of gravity acting on the mass (N) — converts to m/s^2

m is the mass that experiences the force (kg)

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$m = 4.60\,kg$

$\vec{F_g} = 45.1\,N$ [towards the centre of planet]

a) $\vec{g} = ?$

b) What does it mean?

$$\vec{g} = \frac{\vec{F_g}}{m}$$

$$\vec{g} = \frac{45.1\,N\ [\text{towards the centre}]}{4.60\,kg}$$

$$\vec{g} = 9.80\ \frac{N}{kg}\ [\text{towards the centre}]$$

The planet is earth!

TO DO:

① PP/646-647 $(\vec{E})$

② PP/649 $(\vec{g})$