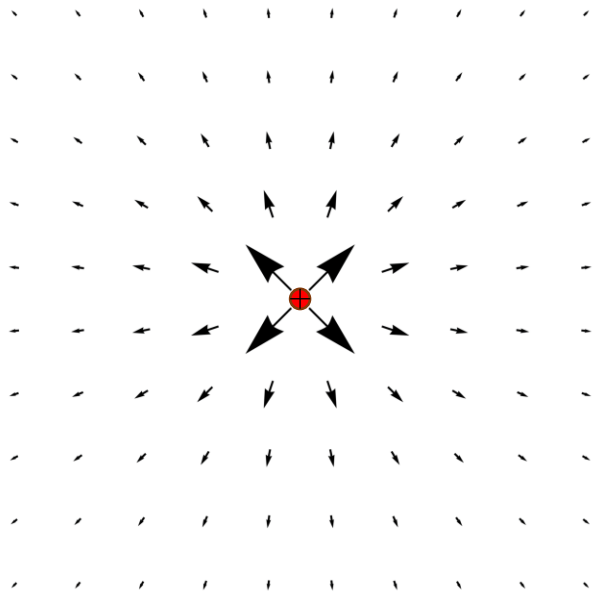
Electric field

Similar to a way in which a fire changes the temperature of its surroundings, an electric charge changes the space by creating an **electric field**. The electric field tells us the force that a positive test charge would feel if it were placed in each point in space. The force at each point is defined by Coulomb's law. Moreover, since forces are vectors, the electric field is what we call a **vector field**.

The simplest case is the electric field produced by a positive charge:

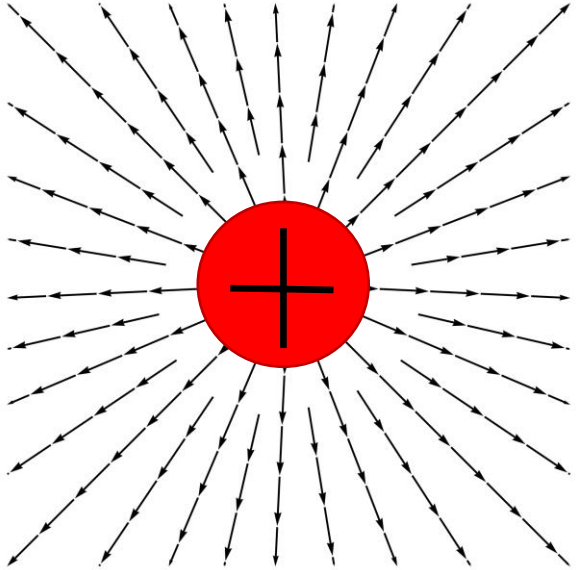


Positive charge

Electric field lines

In order to simplify the visualization of the electric field, we can draw **electric field lines**:

Positive charge



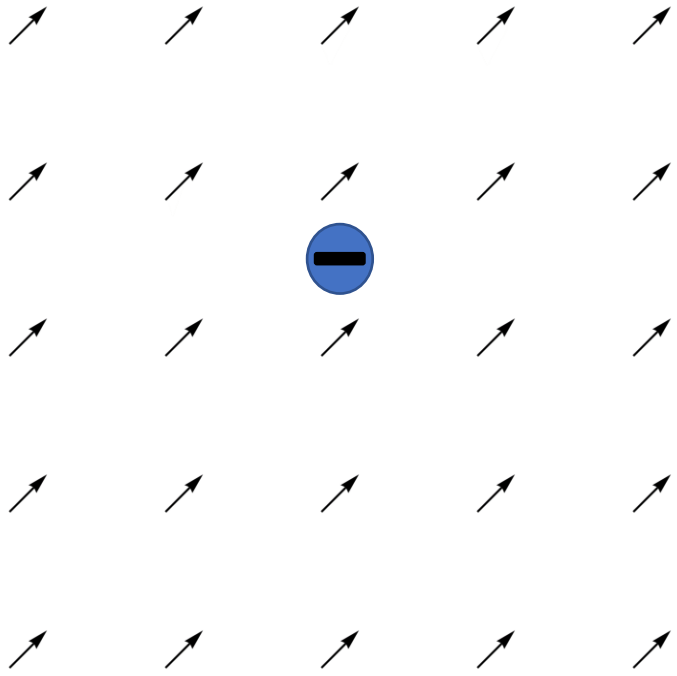
In this case, the direction in which our test charge moves is tangent to each line, and the strength of the force is proportional to the "density of lines".

The electric field is a property of the space around us that determines the force (per unit of charge) that a charged particle would feel if it was positioned there. Therefore, if we know the electric field $\vec{E}$, we can get the force $\vec{F}$ acting on a particle with charge q_1 as follows:

$$\vec{F} = q_1 \vec{E}$$

Homework

Problem 1. A negatively charged ball is placed in a constant electric field that is pointing at 45 ˚(as shown below). Find the force that the ball feels if it has a charge of -5C and the magnitude of the electric field is E = 2.5 N/C, and sketch the force vector. There is no gravity or any other force acting on the ball.



Hint: We defined the electric field as the force per unit charge that a charged particle would feel if placed in the electric field. Therefore, $F = q_1 \times E$

Problem 2. Suppose now that a positively charged ball is placed 5m above the surface of the Earth, where it also feels the force of gravity. It has a mass of 5 Kg, and it has a positive charge of 5 C. We turn on an electric field that is pointing upwards. Find the required magnitude of the electric field such that the ball will remain in its same position.