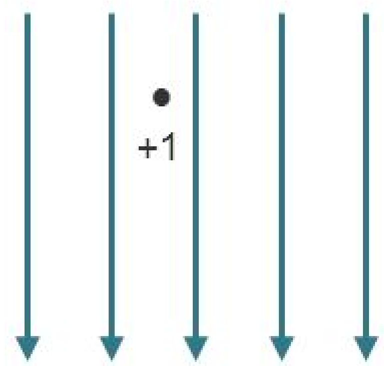
Electric Field Notes

- Point charge - theoretical charge small enough to test the force exerted by a charged particle without moving the particle
    - This doesn't actually exist, we just make it up to test electric fields. Think of dropping a stick into a river. The river is the electric field and the stick is like the point charge.
- Dipole - pair of opposite electric charges of equal magnitude
    - Since they are opposites, the field will flow from positive to negative.
- Electric field - the area around a charged object that can exert a force on other charged objects
    - A positive point charge dropped in will be pushed away in the direction of the arrows.
    - A negative point charge dropped in will be pulled in against the direction of the arrows.
- Question: The figure shows a positive charge placed in a uniform electric field.



  Is the force exerted on the +1 C charge directed up or down?
    - Down, a positive point charge will be pushed away in the direction of the arrows and the arrows are pointed down.
- Electric field strength
    - Formula: $$E = \frac{F_e}{q}$$
        - E = electric field
            - Unit: N/C
        - F = electric force
            - Unit: N
        - q = electric charge
            - Unit: C

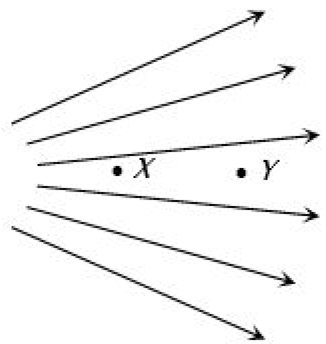
- Formula: $E = k\frac{q}{d^2}$
    - E = electric field
        - Unit: N/C
    - k = 8.99 x 10^{9}
    - q = electric charge
        - Unit: C
    - d = distance between two charged objects
        - Unit: m
- Both of these formulas will give you the strength of the electric field. The key is to use the one with the information you have been given in your problem.

- Question: A point charge is placed 3 m from a 4 μC charge. What is the strength of the electric field on the point charge at this distance? (Round to the nearest thousands.)
    - Given: k = 8.99 x 10^{9}

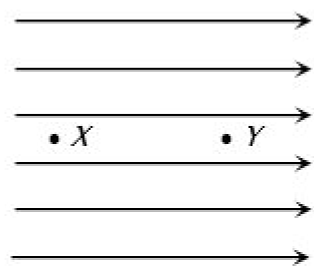
        q = 4 x 10^{-6} C

        d = 3 m
    - Unknown: E = ?
    - Equation: E = k $\frac{q}{d^2}$
    - Substitute: E = (8.99 x 10^{9}) $\frac{4x10^{-6}C}{(3m)^2}$
    - Solve: E = 4000 N/C
- You can use the same equations to solve for distances between charges.
    - d = $\sqrt{k\frac{q}{E}}$
- Electric field lines - drawings on a diagram of charged particles indicating the strength and direction of the flow of the field
    - Point away from a positive charge and toward a negative charge
    - Never cross
    - Can show the strength of a field by how close they are
        - Close = strong
        - Spread out = weak
- There are two types of field lines: non-uniform and uniform

- Non-uniform

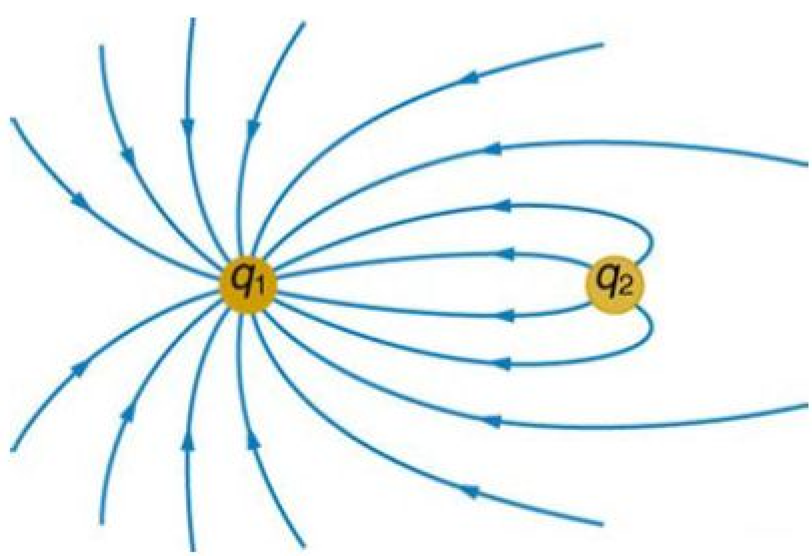


  - Some areas of the field are stronger and others are weaker
    - The lines are closer together around X and more spread out around Y
- Uniform



  - All areas of the field have the same strength
    - The lines are the same distance apart around X and Y

- Question: Look at the diagram of the electric field around points q_1 and q_2 below.



  - Based on the image, the charge of q_1 is _______ .
    - Negative, the field lines are pointing towards it.

- The charge of the blue circle is ________.
    - Positive, the field lines are pointing out from it.
- The strength of the electric field in between the two charges is _______ compared to the field outside the charges.
    - Stronger, the field lines are closer together.
- The force between the two charges is ________.
    - Attractive, the lines flow from q_1 to q_2.