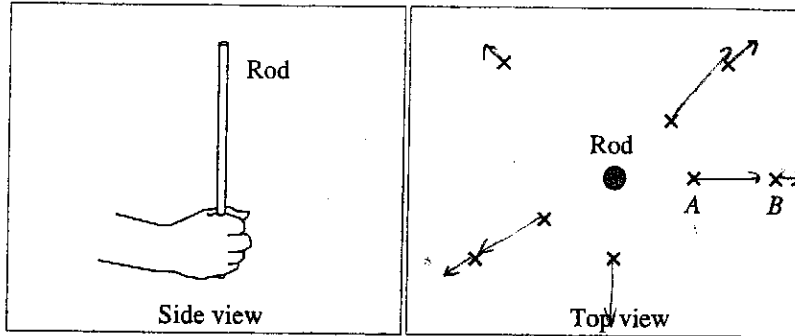


II. Electric field

A. In the tutorial *Charge*, you explored the region around a charged rod with a pith ball that had a charge of the same sign as the rod.



Sketch *vectors* at each of the marked points to represent the electric force exerted on the ball at that location.

How does the magnitude of the force exerted on the ball at point A compare to the magnitude of the force on the ball at point B?

$F_A > F_B$ because $F \propto 1/r^2$

B. Suppose that the charge, q_{test} , on the pith ball were halved.

Would the electric force exerted on the ball at each location change? If so, how? If not, explain why not.

Yes, $F \propto q_{test}$

Would the ratio \vec{F}/q_{test} change? If so, how? If not, explain why not.

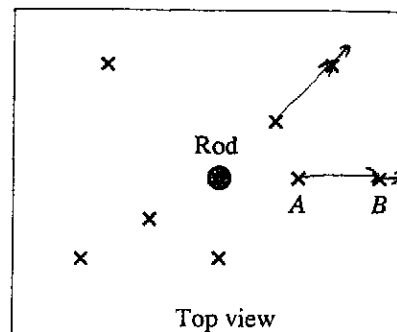
No $F' = F/2$
 $q_{test}' = q_{test}/2$ $\frac{F'}{q_{test}'} = \frac{F}{q}$ ~~does~~ not change

C. The quantity \vec{F}/q_{test} evaluated at any point is called the *electric field* \vec{E} at that point.

How does the magnitude of the electric field at point A compare to the magnitude of the electric field at point B? Explain.

$E_A > E_B$ $E = \frac{kQ_{rod}}{r^2} \propto 1/r^2$

D. Sketch *vectors* at each of the marked points to represent the electric field \vec{E} at that location.



Would the magnitude or the direction of the electric field at point A change if:

• the charge on the rod were increased? Explain.

Yes $E \propto Q_{rod}$

• the magnitude of the test charge were increased? Explain.

No E indep of q_{test}

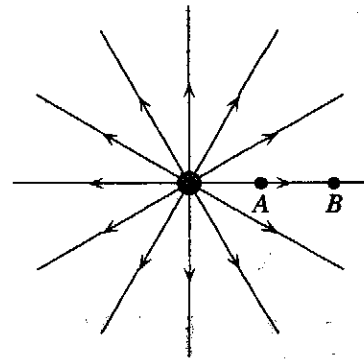
• the sign of the test charge were changed? Explain.

No, E is defined for positive q_{test}

The electric field is typically represented in two ways: by *vectors* or by *electric field lines*. In the vector representation, vectors are drawn at various points to indicate the direction and magnitude of the electric field at those points. In the *field line* representation, straight or curved lines are drawn so that the tangent to each point on the line is along the direction of the electric field at that point. Below, we explore how the field line representation can also reflect the magnitude of the electric field.

E. The diagram at right shows a two-dimensional top view of the electric field lines representing the electric field for a positively charged rod.

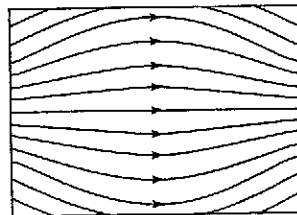
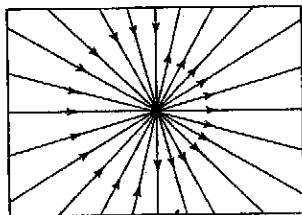
You determined previously that the magnitude of the electric field at point A was larger than the field at point B. What feature of the electric field lines reflects this information about the magnitude of the field?



density of field lines

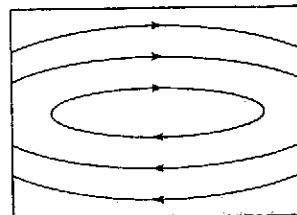
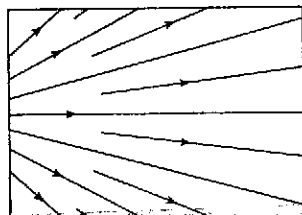
Consider the four field patterns shown. Assuming there are no charges in the regions shown, which of the patterns represent(s) a possible electrostatic field:

Lines must start on \oplus or end on \ominus (not both at the same time)



OK for lines to begin & end at ∞

Lines can't start out of nowhere.



Loops not allowed

1. (a)
2. (b)
3. (b) and (d)
4. (a) and (c)
5. (b) and (c)
6. some other combination
7. None of the above.