

24th of September, 2008

1. An infinitely long solid cylinder that carries a uniform electric charge is rotating about its axis. Find the magnetic field.
2. Show that the first non-vanishing electrostatic multipole term does not depend on the choice of origin of the coordinate system.
3. Find the resistance of the infinite resistor ladder of figure 1! (The ladder is built of identical resistors of resistance  $R$ .)

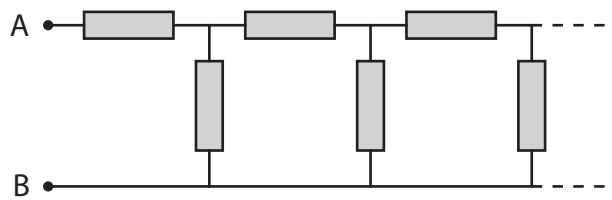


Figure 1: Find the resistance between points  $A$  and  $B$ .

4. Find the resistance between two neighbouring points in a square grid made of resistors (fig. 2). All resistors have resistance  $R$ .

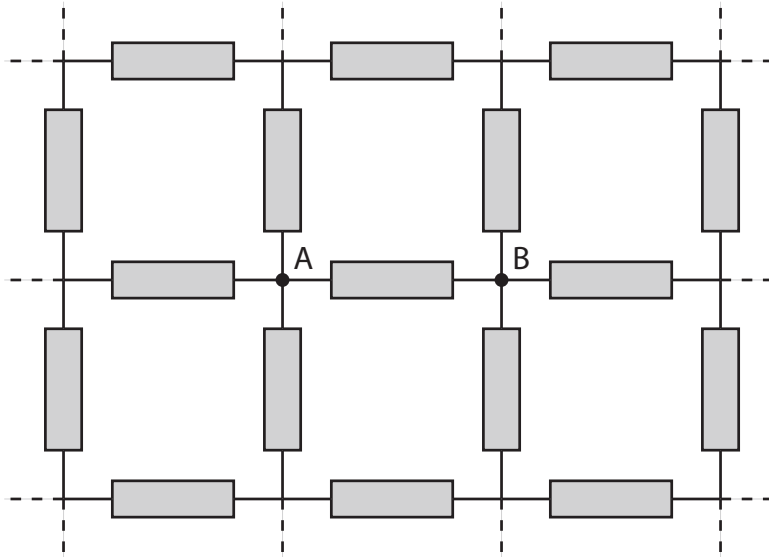


Figure 2: Find the resistance between points  $A$  and  $B$ .

5. (a) Calculate the repulsive force acting on the unit length of two infinitely long and parallel electrically charged wires.
- (b) Suppose that both wires are moving with constant speed, their velocity vector  $\mathbf{v}$  being parallel to themselves. Calculate the forces again, taking into account the magnetic interactions.

Shouldn't the two results be the same? After all, we are viewing the *same setup* from two different inertial reference frames.