

## CLASS EXERCISE #2 - 14 June 2005

The diagram below shows three charges which are identical in magnitude (same number of coulombs), one of which is positive and the other two negative ( $\oplus$  is positive,  $\ominus$  is negative). The middle charge is exactly halfway between the other two charges. Suppose the force between the two charges at the ends is 12 N.

Determine the magnitude of all the forces acting on each charge and show the direction of these forces on your diagram. Determine the direction and magnitude of the net force on each charge.



The positive charge is attracted towards each of the negative charges; the one that is nearer contributes 4 times as large a force as the one that is twice as far away, so these forces are 48 N and 12 N, respectively, both to the right, for a net force of 60 N to the right.

The middle negative charge is attracted towards the positive charge on the left and repelled by the negative charge on the right; these forces are the same magnitude of 48 N and both point to the left. The net force is then 96 N to the left.

The negative charge on the right is repelled by the middle negative charge but attracted by the positive charge at the left; since the repulsion is 4 times as great in magnitude, these forces have magnitudes 48 N and 12 N, respectively, and the net force is 36 N to the right.

Note that the sum of the three net forces is zero (60 N right plus 96 N left plus 36 N right), as required by Newton's third law.