Answer on Question#39809 – Physics – Electromagnetism

Three charges +3q, +q and Q are placed on a straight line with equal separation. In order to make the net force on q to be zero, the value of Q will be=?

Solution:
To calculate net force, we simply calculate the forces on $+q$ due to $+3q$ and Q separately and then add these forces together. In each case, the force exerted by one charge on another charge can be calculated from Coulomb's law.

$$\bar{F}_{net} = \bar{F}_{3q,q} + \bar{F}_{Q,q}$$

$$x: F_{net} = F_{3q,q} - F_{Q,q} = 0 \quad (1)$$

$$F_{3q,q} = k\frac{3q \cdot q}{r^2} \quad (2)$$

$$F_{Q,q} = k\frac{Q \cdot q}{r^2} \quad (3)$$

$$(3) and (2) in (1):$$

$$k\frac{3q \cdot q}{r^2} - k\frac{Q \cdot q}{r^2} = 0$$

$$Q = +3q$$

Answer: the value of Q will be $+3q$.