Answer on Question #39536, Physics, Atomic Physics
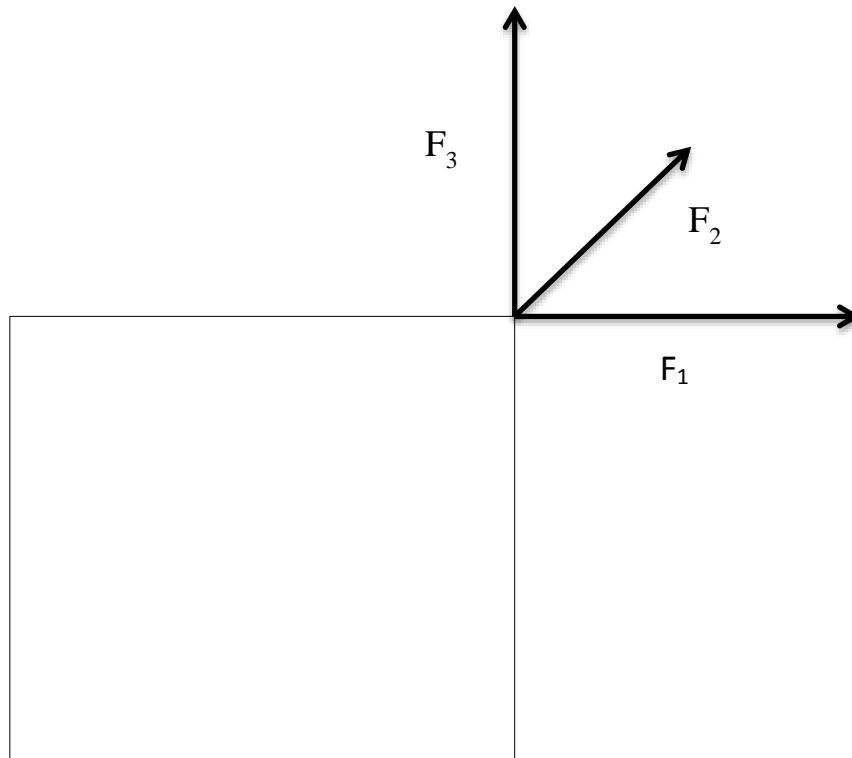
Question:

Determine the magnitude of the force on each charge of A charge of 4.85mC is placed at each corner of a square 0.100 m on a side.

Answer:

Coulomb's law states that the electrical force between two charged objects is directly proportional to the product of their charges (and inversely proportional to the square of the distance between them):

$$\vec{F}(r) = k\frac{q_1 q_2}{r^2}\vec{e_r}$$

Total force equals:

$$\vec{F} = \vec{F_1} + \vec{F_2} + \vec{F_3}$$

Magnitude of F_1 and F_3 equals:

$$F_1 = F_3 = \frac{kq^2}{a^2}$$

Magnitude of F_2 equals:

$$F_2 = \frac{kq^2}{(\sqrt{2}a)^2} = \frac{kq^2}{2a^2}$$

Total force directed along F_2, therefore:

$$F = F_2 + F_1 \sin 45° + F_3 \sin 45° = \frac{kq^2}{2a^2} + \frac{1}{\sqrt{2}} 2 \frac{kq^2}{a^2} = \left(\frac{1}{2} + \sqrt{2}\right) \frac{kq^2}{a^2}$$
$$= 4.05 * 10^7 \ N$$

Answer: $4.05 \cdot 10^7 \ N$