

Homework 1

Name: _____

1. Two charged objects are placed 40cm ($4.0 \times 10^{-1}\text{m}$) apart. One of the objects has a known charge of $1\mu\text{C}$ ($1 \times 10^{-6}\text{C}$). The other object's charge is unknown. The electric force, F_e , between them is measured to be 0.5N .
 - (a) Using Coulomb's Law, calculate the charge of the unknown object. (The value of Coulomb's constant, k_e is known to be $9 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2}$.)
 - (b) Calculate the electric field due to the $1\mu\text{C}$ charge.
 - (c) Using you answer in a) and b), show that the field created by the $1\mu\text{C}$ creates in turn a force on the second charge which is equal to 0.5N

2. Compute the following (the lists on the last points are vectors, the last operation is a dot product):

(a) $\frac{5}{4} + \frac{2}{9} =$

(d) $\frac{a}{b} - \frac{c}{d}$

(b) $\frac{7}{8} \times \frac{1}{3} =$

(e) $(2, 5, 4) + (1, 3, 1) =$

(c) $\frac{7}{8} \div \frac{1}{3} =$

(f) $(0, 4, 2) \cdot (10, 0, 0) =$

3. Solve the following:

(a)

$$2x - 3y = 9$$

$$3x + 4y = -29$$

(b)

$$8p - 6q = 56$$

$$6p + 4q = -9$$

4. Compute the cross product (remember to include direction and magnitude), between vectors

$$a = \begin{pmatrix} 4 \\ 0 \\ 0 \end{pmatrix}$$

, and

$$b = \begin{pmatrix} 8 \\ 8 \\ 0 \end{pmatrix}$$

The angle between these vectors is $\frac{\pi}{4}$ and $\sin(\frac{\pi}{4}) = \frac{1}{\sqrt{2}}$.

5. The discussion of fields has many new concepts. Read again your notebook and make sure you understand everything we discussed: definition of fields, relation to forces (i.e. why we need fields), field line rules and differences between magnetic and electric fields.