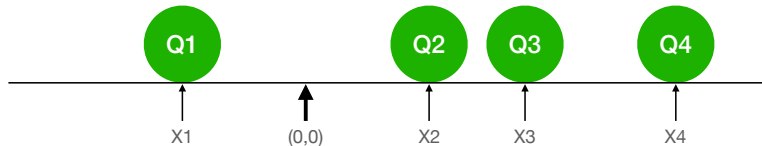


Homework 2

Due: Thursday, October 1

Electric field in one dimension

We want to write a program which will calculate the electric field at a point in space due to a number of electric charges. The charges are all arranged on the X-axis (see the figure). We want the electric field at the origin ($x=0$).



Write a C++ program to calculate the electric field of a charge configuration given an array of charges and x positions. Your program should:

1. Begin by prompting the user to input the charges (in nano Coulombs) and their positions (in mm). Loop continuously until the user enters a charge value of 0. Do not allow any charges at the origin ($x=0$).

Example:

```
Please enter values for q and x: -3 5
Please enter values for q and x: 2 4
Please enter values for q and x: 1 0
Cannot place charges at the origin!
Please enter values for q and x: 3 2
Please enter values for q and x: 0 0
Finished looping. Thank you!
```

Store these values in two arrays (one for the charge values, one for the position values). *Hint: In this case you do not know ahead of time how many charges there will be. Declare your array so that you will have enough space, say 100 doubles.*

2. Write a function to calculate the electric field of a single point charge. The equation for this is (given charge q in nC and position x in mm):

$$E = \frac{1}{1000} \frac{kq}{|x|^3} x$$

The function should accept q and x as arguments. $k = 9 \times 10^9 \text{ C}^2\text{N}^{-1}\text{m}^{-2}$ should be declared as a global constant

3. The total electric field is the sum of all the individual fields

$$E = \sum_{i=0}^{i=N} E_i = \frac{1}{1000} \frac{kq_0}{x_0^3} x_0 + \frac{1}{1000} \frac{kq_1}{x_1^3} x_1 + \frac{1}{1000} \frac{kq_2}{x_2^3} x_2 + \dots$$

Write a second function which does the following: accept the charge and x arrays as inputs, loop over the arrays and calculate the field of each charge (using the function you wrote earlier) and sum these values. In `main()`, call this function and print the end result to the user.