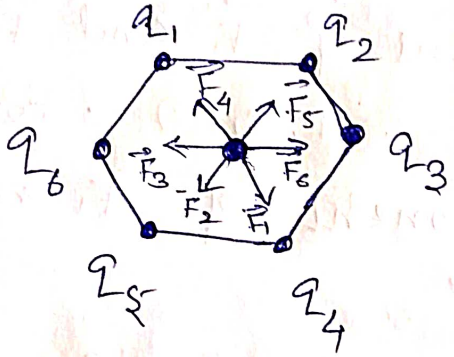
Problem: One charged particle is placed at centre and other six are at the vertices of the hexagon. If the particles carry equal charges and are arranged precisely at the centre and vertices of a hexagon, what is the net force on the central charge?

solution



Like charges repel, so the force on the central particle due to any one of the other charges will point directly away from that charges. Since all charges are equal and the distance from the centre to each vertex is the same, each of the force contributions from the outer six charges will have the same magnitude.

From figure it is clear that force vectors cancel pairwise:

$\vec{F}_1$ exactly balance $\vec{F}_4$

$\vec{F}_2$ " " $\vec{F}_5$

$\vec{F}_3$ " " $\vec{F}_6$

So, the net force on the central particle is zero.

Question for practices.

Q.1 (a) Twelve equal charges, q, are situated at the corners of a regular 12-sided polygon. What is the net force on a test charge Q at the center?

(b) Suppose one charge placed at 6 o'clock is removed. What is net force on Q.

Q. 2. Suppose 13 equal charges, q, are placed at the corners of a regular 13-sided polygon. What is the force on a test charge Q at the center?

Q.3 Three identical point charges are at the vertices of an equilateral triangle. A fourth, ~~identical~~ identical point charge is placed at the midpoint of one side of the triangle. As a result of the three electric force contribution from the vertex charges, the fourth charge

(a) Is in equilibrium and remains at rest.

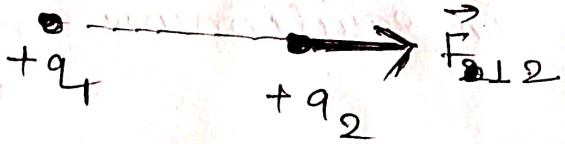
(b) Is pushed towards the center of triangle.

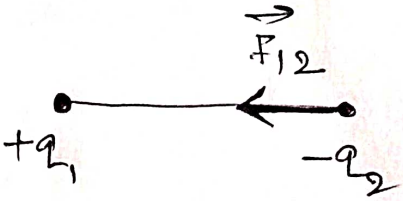
(c) Is pushed outside the triangle.

Problem - solving technique
(Application of Superposition Principle)

① To find the total electric force on one charge due to an arrangement of several other point charges. you need to calculate the vector sum of the individual electric forces.
The techniques for evaluating the vector sum of the electric force vectors of several charges are the same as for the sum of any other kind of vector.

② First draw a careful diagram for the force on a given charge due to other charge(s).
It may be easiest to put the tail of each contributing vector at charge acted upon, pointing away from the charge exerting the force for charges with like sign, and towards the charge exerting the force for unlike charges.





③ Use geometry to decompose each vector into its x and y (and, if necessary z) components. You can obtain total electric force in x, y and z direction by summing up x, y and z component of force.

The magnitude of net force can be calculated by $F = \sqrt{F_x^2 + F_y^2 + F_z^2}$