1. Particle Equilibrium

The movement of a dot can be described by Newton's Second Law,

$$\sum_{k=1}^{n} \overrightarrow{F_k} = m\overline{a}$$

In Cartesian coordinate system x-y, it can be written as

$$\sum_{k=1}^{n} F_k \cos\theta_k \overrightarrow{i} + F_k \sin\theta_k \overrightarrow{j} = ma_x \overrightarrow{i} + ma_x \overline{j}$$

or separately as

$$\sum_{k=1}^{n} F_k \cos\theta_k = ma_x, \sum_{k=1}^{n} F_k \sin\theta_k = ma_y$$

where F_k is the magnitude of the k^{th} force, θ_k is the angle between the direction of the k^{th} force and coordinate axis or x axis, m is the mass of the dot and a_x, a_y are the acceleration projection in x, y direction.

In the following example, we have three forces, F_1, F_2 and F_3. Thus we have

$$F_1 \cos\theta_1 + F_2 \cos\theta_2 + F_3 \cos\theta_3 = ma_x$$
$$F_1 \sin\theta_1 + F_2 \sin\theta_2 + F_3 \sin\theta_3 = ma_y$$

By setting the magnitude and direction of each forces, we can see the movement of the dot.

If forces are set properly, the dot can remain in static equilibrium and thus will not move.