## Static Equilibrium:

* Object is in rest and in equilibrium
* Object has no velocity.

### Conditions for static Equilibrium.

1. Algebric sum of vertical forces = 0

$$\Sigma F_V = 0$$

2. Algebric sum of horizontal forces = 0

$$\Sigma F_H = 0$$

3. Algebric sum of Moments = 0

$$\Sigma M = 0$$

## Dynamic Equilibrium.

* Sum of vectorial forces is zero
* Object has a velocity.

### Equations of motion of linear system

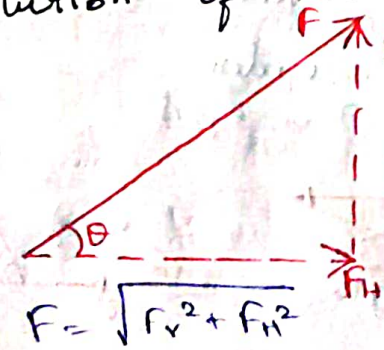
$$V = u + at$$

$$V^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

$s$ = linear displacement, m.
$u$ = initial velocity, m/s
$v$ = final velocity, m/s
$a$ = linear acceleration, $m/s^2$

### Resolution of forces:




Horizontal Component

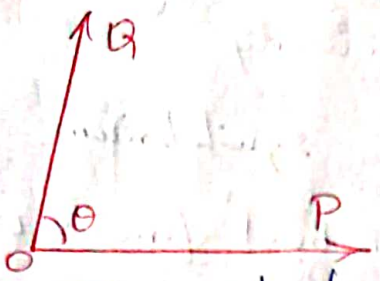
$$F_H = F\cos\theta$$

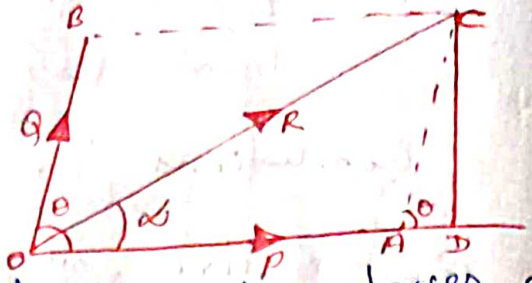
Vertical Component

$$F_V = F\sin\theta$$

$$F = \sqrt{F_V^2 + F_H^2}$$

# PARALLELOGRAM LAW OF FORCES:




It states that "if two forces acti simultaneously at a point be represented magnitude & direction by the two adjacent sides of a parallelogram, then the resultan of these two forces is represented in magni and direction by the diagonal of that parallelogram originating from the point.

$$\vec{R} = \vec{P} + \vec{Q}$$

Mathematically: $R = \sqrt{P^2 + Q^2 + (2PQ\cos\theta)}$

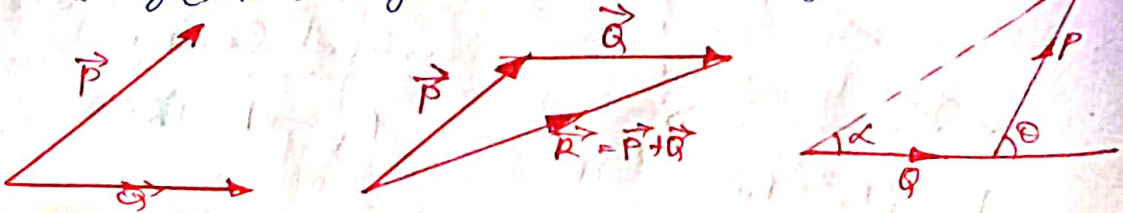
Inclination of the resultant force with force P

$$\alpha = \tan^{-1}\left[\frac{Q\sin\theta}{P + Q\cos\theta}\right]$$

# TRIANGULAR LAW OF FORCES:

* It states that if two forces acting at a point are represented by the two sides of a triangle taken in order, then their resultan force is represented by the third side of the triangle taken in opposite order.

* Fig ① rearranged as Fig ② or Fig ③

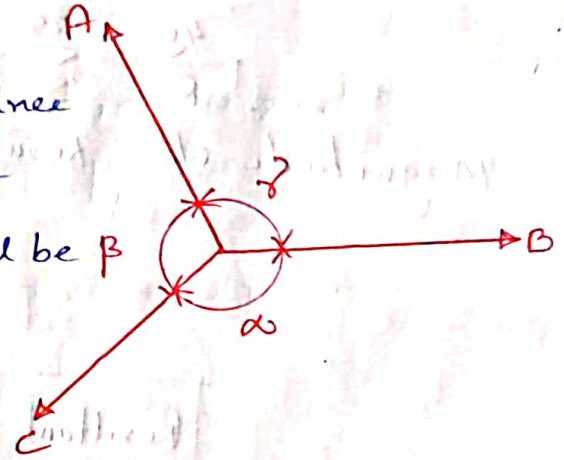


## POLYGON LAW OF FORCES:

It states that if a number of coplanar concurrent forces are represented in magnitude & direction by the sides of a polygon taken in an order, then the resultant force is represented by the closing side of the polygon taken in opposite order.

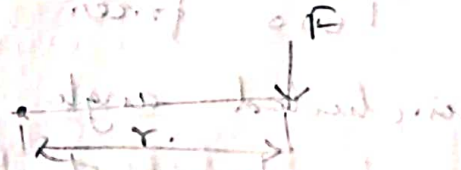

## LAMIS THEOREM:

It states that if three forces acting on a point at equilibrium, each force will be proportional to the ratio of Sine of the angle between the other two forces.




$$\frac{A}{\sin\alpha} = \frac{B}{\sin\beta} = \frac{C}{\sin\gamma}$$

Moment: Measure of rotation about a point.




$M = F \times r$

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A couple consists of 2 equal, non-collinear, parallel forces of opposite signs.