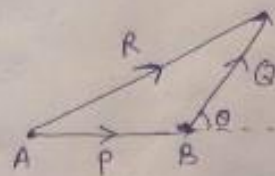
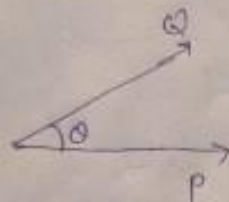


## RESOLUTION OF FORCES

(15)

### Triangle Law of Forces :-

if two forces acting simultaneously on a body are represented by the sides of a triangle taken in order, their resultant is represented by the closing side of the triangle taken in the opposite order.



$$\frac{F_1}{\sin \alpha} = \frac{F_2}{\sin \beta} = \frac{F_3}{\sin \gamma}$$

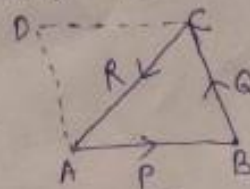
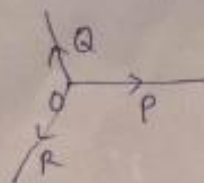


$$F_1^2 = F_2^2 + F_3^2 - 2F_2F_3 \cos \alpha$$

$$F_2^2 = F_1^2 + F_3^2 - 2F_1F_3 \cos \beta$$

$$F_3^2 = F_1^2 + F_2^2 - 2F_1F_2 \cos \gamma$$

The triangle law of forces is often stated as follows:  
"if a system of three forces acting upon a body can be represented in magnitude and direction by the sides of a triangle, taken in order, then the system will be in equilibrium."



$$\vec{AB} + \vec{BC} = \vec{AC}$$

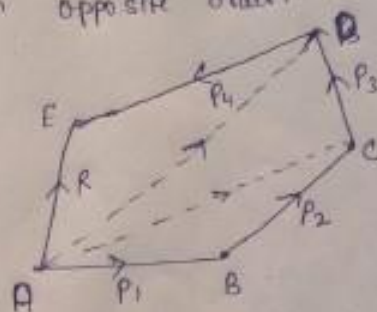
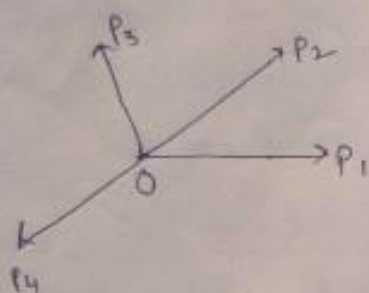
$$P + Q = -\vec{CA} = -R$$

Resultant of P, Q and R =  $-R + R = 0$

hence the system is in equilibrium.

### Polygon Law of Forces :-

if a number of concurrent forces acting simultaneously on a body are represented in magnitude and direction by the sides of a polygon, taken in order, then the resultant is represented in magnitude and direction by the closing side of the polygon, taken in opposite order.



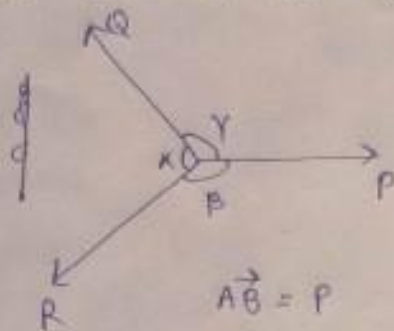
$$\vec{AC} = \vec{AB} + \vec{BC}$$

$$\vec{AD} = \vec{AC} + \vec{CD} = \vec{AB} + \vec{BC} + \vec{CD}$$

$$\vec{AE} = \vec{AD} + \vec{DE} = \vec{AB} + \vec{BC} + \vec{CD} + \vec{DE}$$

$$\boxed{R = P_1 + P_2 + P_3 + P_4}$$

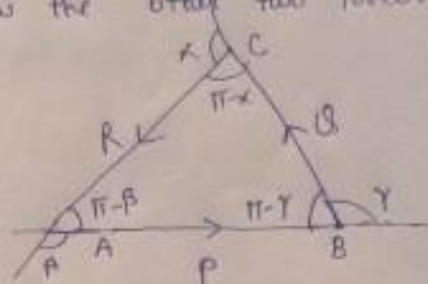
Lami's Theorem :- if a body is in equilibrium under the action of three forces, then each force is proportional to the sine of the angle b/w the other two forces.



$$\vec{AB} = P$$

$$\vec{BC} = Q$$

$$\vec{CA} = R$$



Applying Sine rule for the triangle ABC

$$\frac{AB}{\sin(\pi - \alpha)} = \frac{BC}{\sin(\pi - \beta)} = \frac{CA}{\sin(\pi - \gamma)}$$

$$\frac{P}{\sin \alpha} = \frac{Q}{\sin \beta} = \frac{R}{\sin \gamma}$$

However for the validity of Lami's Theorem to hold good

- The forces keep the body in equilibrium.
- The three forces acting on the body are non-parallel
- The forces are concurrent
- The forces are either directed towards or away from the point of concurrence.