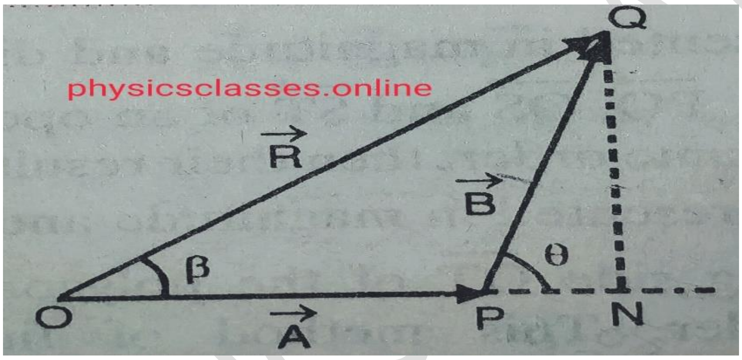
ADDITION OF VECTOR – Vectors can not be added by simple laws of algebra.

Rules of geometric addition of vectors -

(i) ***For the addition of two vectors*** – *For the addition of two vectors represent these two vectors by arrowed lines using the same scale . Displace the second vector as its coincide with the head of first vector , then the single vector drawn from the tail of the first vector to the head of the second vector represent their resultant (addition) vector.* the addition of two vectors can be obtained using **Triangle law** or **parallelogram law** of vector addition

(ii) ***For the addition of three or more vectors*** – Represent these vectors by arrowed lines using the same scale . Displace these vectors such that the head of the first vector coincide with the tail of the second vector and head of second coincide with the tail of third vector and so on , then the single vector drawn from the tail of the first to the head of the last represent their resultant vector. The addition of three or more vectors can be found using **polygon law** of vector addition.

Triangle law of vector addition- ***It states that if two vectors acting on a particle represented by two sides of a triangle in same order , then the third side in opposite order gives the resultant vector.***



let two vectors $\vec{A}$ and $\vec{B}$ inclined at an angle θ acting on a particle represented by sides $\overrightarrow{OP}$ and $\overrightarrow{PQ}$ of triangle OPQ taken in the same order as shown in fig. then from triangle law of vector addition $\overrightarrow{OQ}$ represents the resultant vector .

calculation for magnitude of resultant $\vec{R}$ – Drawn QP perpendicular to OP produced , PO=A and PQ=B ; OQ=R, <NOP=θ , From triangle OPQ PN/PQ= cosθ or PN= PQ cosθ = Bcosθ , similarly QN= B sinθ ; then in right angled triangle ONQ, we have

$OQ^2 = ON^2 + NQ^2$,

$OQ^2 = (OP+PN)^2 + NQ^2$,

$R^2 = (A + B\cos\theta)^2 + (B\sin\theta)^2$

$R^2 = A^2 + B^2\cos^2\theta + 2AB\cos\theta + B^2\sin^2\theta$

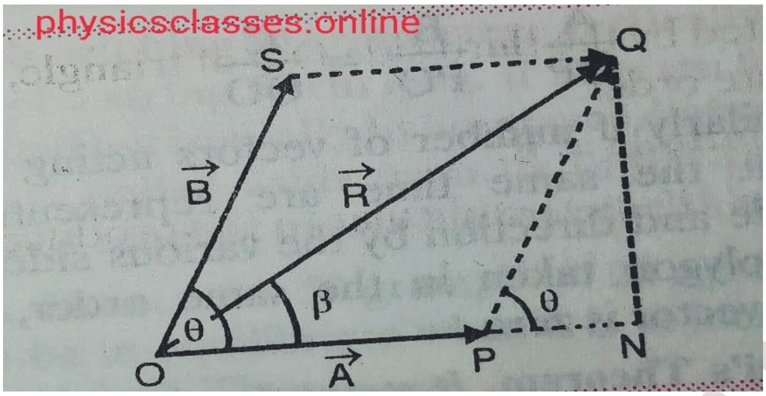
$R^2 = A^2 + B^2 + 2AB\cos\theta$

R= $\sqrt{A2 + B2 + 2ABcos\theta}$

Direction of $\vec{R}$ - Let the resultant R makes an angle β with the vector $\vec{A}$ then

Tan β = Bsin θ/(A+Bcosθ) with vector $\vec{A}$.

<u>**Parallelogram law of vector addition-**</u> ***It states that if two vectors acting on a particle represented by two adjacent side of the parallelogram in same order then their corresponding diagonal gives the resultant vector***



calculation for magnitude of resultant $\vec{R}$ – Drawn QP perpendicular to OP produced , PO=A and PQ=B ; OQ=R, <NOP=θ , From triangle ONQ PN/PQ= cosθ or PN= PQ cosθ = Bcosθ , similarly QN= B sinθ ; then in right angled triangle ONQ, we have

$OQ^2 = ON^2 + NQ^2$,

$OQ^2 = (OP+PN)^2 + NQ^2$,

$R^2 = (A + B\cos\theta)^2 + (B\sin\theta)^2$

$R^2 = A^2 + B^2\cos^2\theta + 2AB\cos\theta + B^2\sin^2\theta$

$R^2 = A^2 + B^2 + 2AB\cos\theta$

R= $\sqrt{A2 + B2 + 2ABcos\theta}$

Direction of $\vec{R}$ - Let the resultant R makes an angle β with the vector $\vec{A}$ then

Tan β = Bsin θ/(A+Bcosθ) with vector $\vec{A}$.