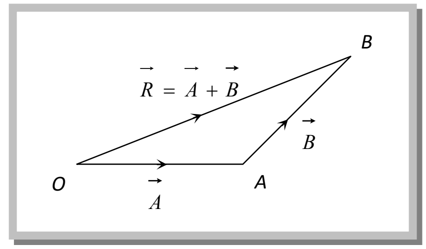
Triangle law of vector addition of two vectors.

If two non-zero vectors are represented by the two sides of a triangle taken in same order then the resultant is given by the closing side of triangle in opposite order. *i.e.* $\vec{R} = \vec{A} + \vec{B}$

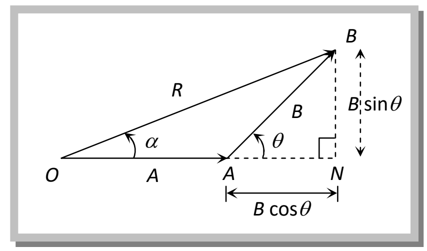
$\because \overrightarrow{OB} = \overrightarrow{OA} + \overrightarrow{AB}$



(1) **Magnitude of resultant vector**

In ΔABN $\cos\theta = \frac{AN}{B}$ $\therefore AN = B\cos\theta$

$\sin\theta = \frac{BN}{B}$ $\therefore BN = B\sin\theta$



In ΔOBN, we have $OB^2 = ON^2 + BN^2$

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

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

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

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

$\Rightarrow R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$

(2) **Direction of resultant vectors:** If θ is angle between $\vec{A}$ and $\vec{B}$, then

$|\vec{A} + \vec{B}| = \sqrt{A^2 + B^2 + 2AB\cos\theta}$

If $\vec{R}$ makes an angle α with $\vec{A}$, then in ΔOBN, then

$\tan\alpha = \frac{BN}{ON} = \frac{BN}{OA + AN}$

$\tan\alpha = \frac{B\sin\theta}{A + B\cos\theta}$