Nishant Jindal

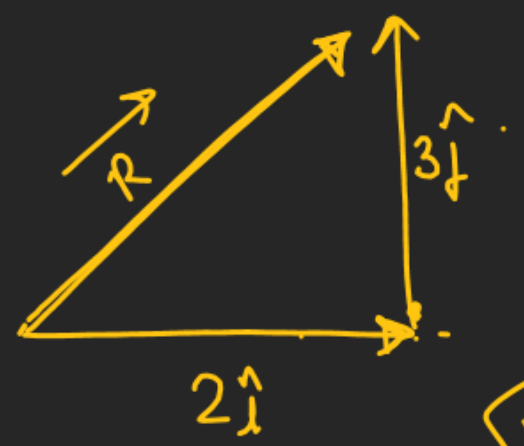
VECTOR

\#

$\vec{r}_1 = 2\hat{i}$

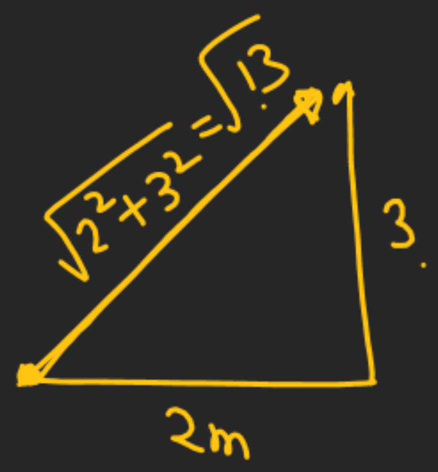
$\vec{r}_2 = 3\hat{j}$

$$\boxed{\vec{R} = \underbrace{2\hat{i}}_{x\text{-Component of } \vec{R}} + \underbrace{3\hat{j}}_{y\text{-Component of } \vec{R}}}$$



$$|\vec{R}| = \sqrt{(2)^2 + (3)^2}$$

$$= \sqrt{13}$$



Nishant Jindal

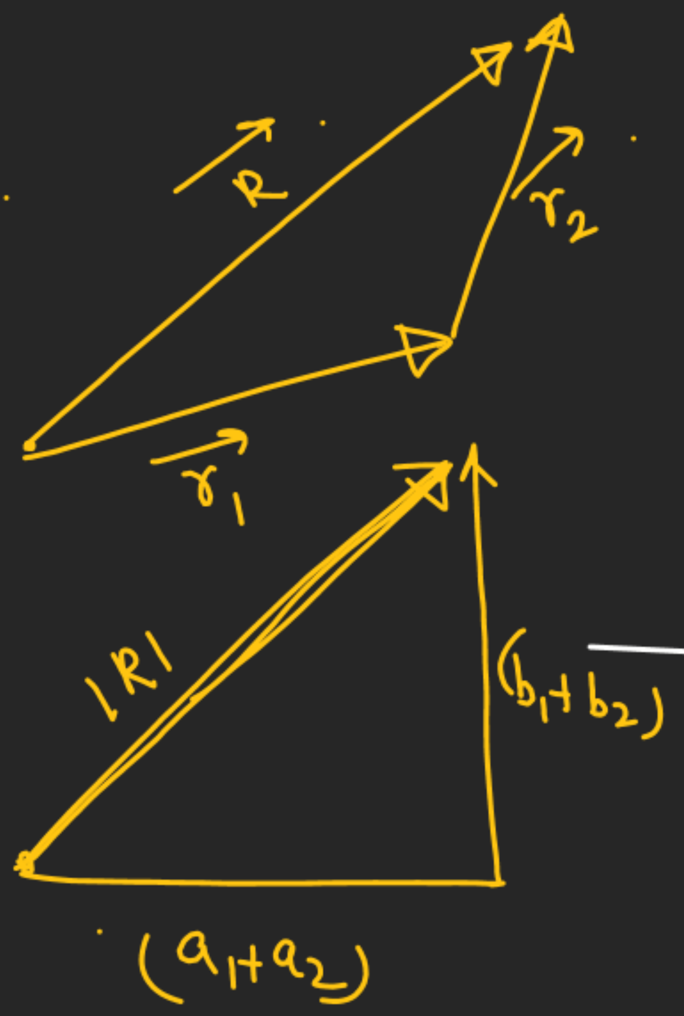
VECTOR

Addition of Vector

$$\vec{r}_1 = a_1\hat{i} + b_1\hat{j} + c_1\hat{k}$$

$$\vec{r}_2 = a_2\hat{i} + b_2\hat{j} + c_2\hat{k}.$$

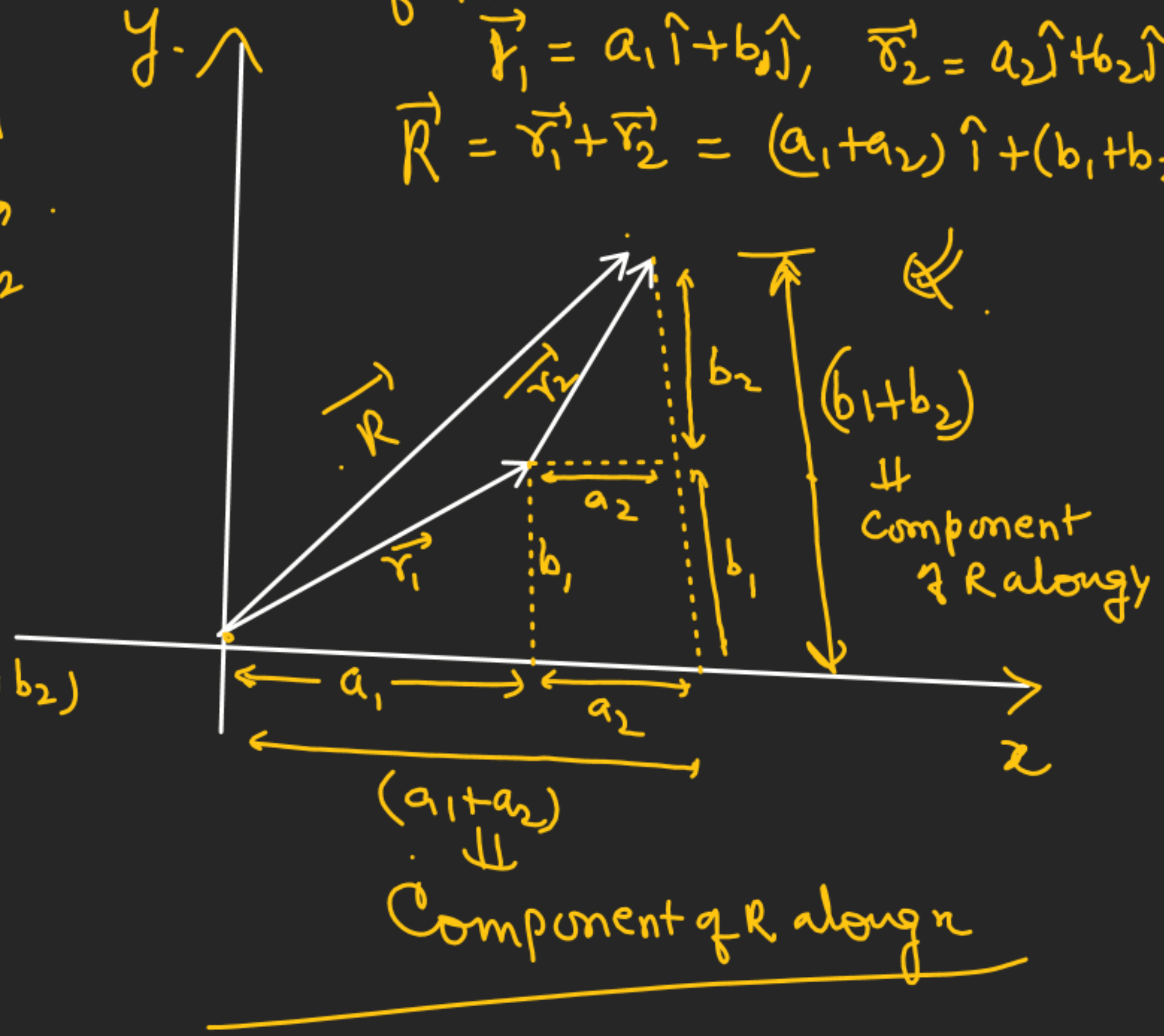
$$\vec{R} = (a_1+a_2)\hat{i} + (b_1+b_2)\hat{j} + (c_1+c_2)\hat{k}.$$



If $\vec{R}$ is two dimensional.

$$\vec{r}_1 = a_1\hat{i} + b_1\hat{j}, \quad \vec{r}_2 = a_2\hat{i} + b_2\hat{j}.$$

$$\vec{R} = \vec{r}_1 + \vec{r}_2 = (a_1+a_2)\hat{i} + (b_1+b_2)\hat{j}$$



Nishant Jindal

VECTOR

$\vec{A} = (\hat{i} - 2\hat{j} + 3\hat{k})$ ✓

$\vec{B} = (5\hat{i} + \hat{j} - \hat{k})$ ✓

Find $|\vec{A} + 2\vec{B}| =$

$\boxed{|\vec{A}| + 2|\vec{B}| = ??}$

Scalar

No No.

$|\vec{A}| = \sqrt{(1)^2 + (-2)^2 + (3)^2}$

$= \sqrt{14}$

$|\vec{B}| = \sqrt{(5)^2 + (1)^2 + (-1)^2}$

$= \sqrt{27}$

$\vec{A} + 2\vec{B} = (\hat{i} - 2\hat{j} + 3\hat{k}) + 2(5\hat{i} + \hat{j} - \hat{k})$

$= \hat{i} - 2\hat{j} + 3\hat{k} + 10\hat{i} + 2\hat{j} - 2\hat{k}$

$= 11\hat{i} + \hat{k}$ ✓

$|\vec{A} + 2\vec{B}| = \sqrt{(11)^2 + (1)^2}$

$= \sqrt{121 + 1}$

$= \sqrt{122}$ ✓

$|\vec{A}| + 2|\vec{B}| = (\sqrt{14} + 2\sqrt{27})$

Nishant Jindal

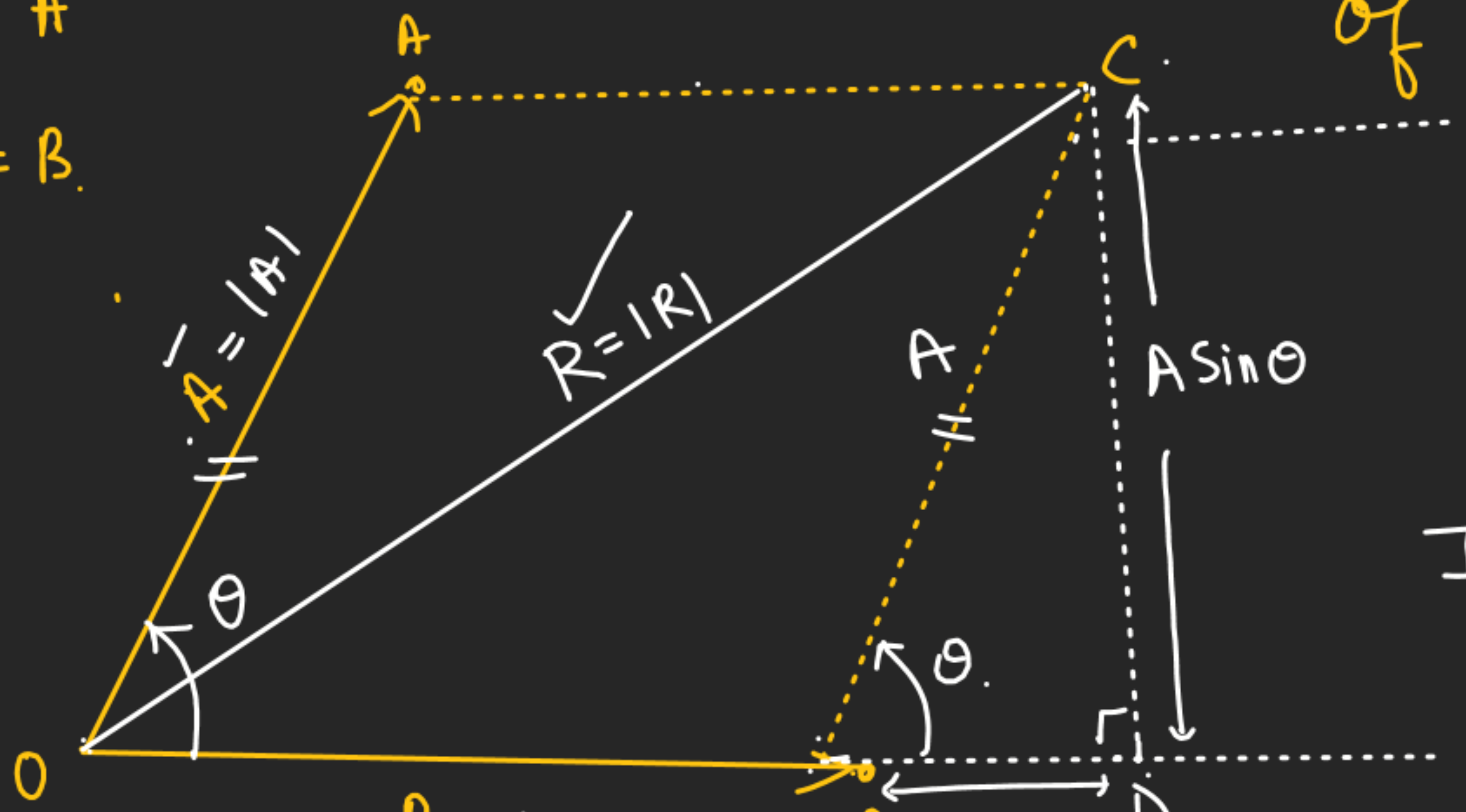
VECTOR

4 Parallelogram law of vector addition :→

Let, OA, and OB be the adjacent sides of a parallelogram.

$|\vec{OA}| = A$

$|\vec{OB}| = B.$



$B = |B|$

$$\boxed{\vec{A} + \vec{B} = \vec{R}}$$

$|\vec{R}|$

For parallelogram

$OA = BC = A.$

In $\triangle CBD$

$\sin\theta = \frac{CD}{BC} = \frac{CD}{A}$

$CD = A\sin\theta.$

$\cos\theta = \frac{BD}{BC} \rightarrow BD = A\cos\theta$

In $\triangle OCD$.

$OC^2 = OD^2 + CD^2 = (OB + BD)^2 + CD^2$

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

VECTOR

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

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

$$R^2 = A^2(\underline{\cos^2\theta + \sin^2\theta}) + B^2 + 2AB\cos\theta$$

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

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

→ Magnitude of resultant parallel

$(\cos\theta)_{max} = +1$ | $(\cos\theta)_{min} = -1$

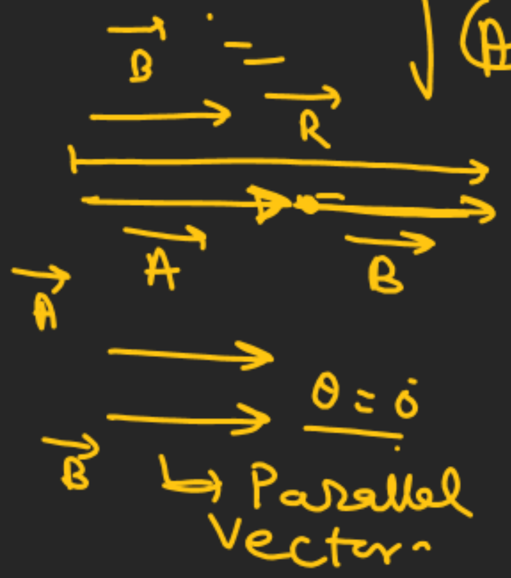
$\theta = 0°$ | $\theta = 180° / \pi$

For (R_{max}), $\cos\theta$ should be max.

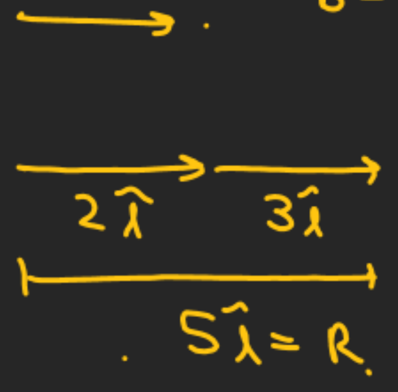
$\cos\theta = +1 \Rightarrow \theta = 0$

$$R_{max} = \sqrt{A^2 + B^2 + 2AB}$$

$$= \sqrt{(A+B)^2} = (A+B)$$



$\vec{A} = 2\hat{i}$ $\vec{B} = 3\hat{i}$



Co-linear vectors

Nishant Jindal

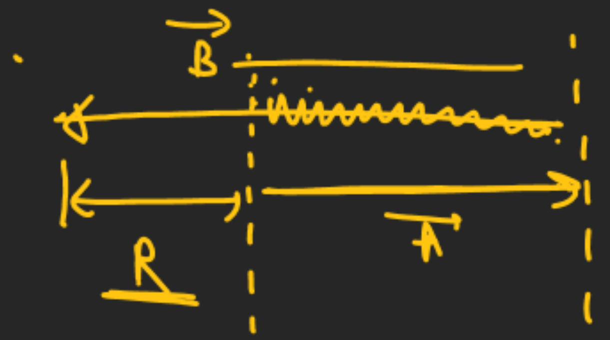
VECTOR

R_{min}. $(\cos\theta)_{min} = -1$, $\theta = 180^\circ$

$$R_{min} = \sqrt{A^2 + B^2 + 2AB\cos 180^\circ}$$

$$= \sqrt{A^2 + B^2 - 2AB}$$

$$= \sqrt{(A-B)^2} = (A-B)$$



$\vec{B} = -5\hat{i}$

$\vec{A} = 3\hat{i}$

$\vec{R} = -2\hat{i}$

H.W $\sin\theta, \cos\theta$

$\theta = 0^\circ$

$\theta = 30^\circ$

$\theta = 45^\circ$

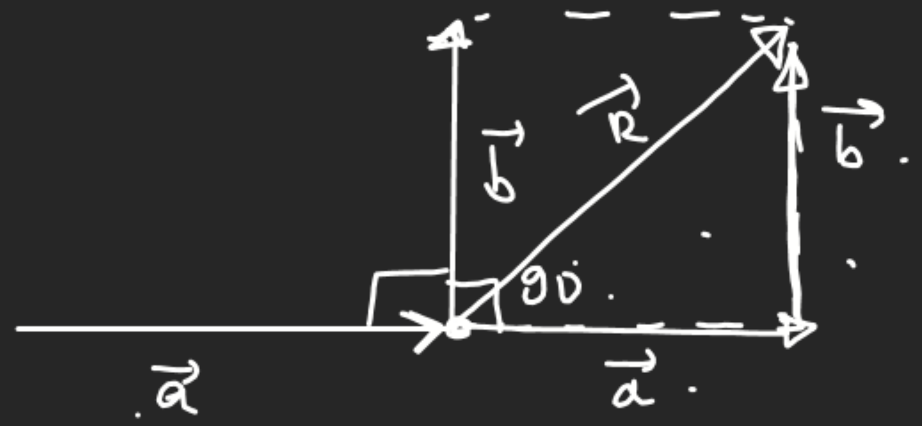
$\theta = 90^\circ$

$\theta = 120^\circ$

$\theta = 270^\circ$

$\theta = 360^\circ$

if $\theta = 90^\circ$, $\boxed{\cos 90^\circ = 0}$



$\vec{R} = \vec{a} + \vec{b}$

$$|\vec{R}| = \sqrt{A^2 + B^2 + 2AB\cos 90^\circ}$$

$$\boxed{|\vec{R}| = \sqrt{a^2 + b^2}}$$

Angle between the vector