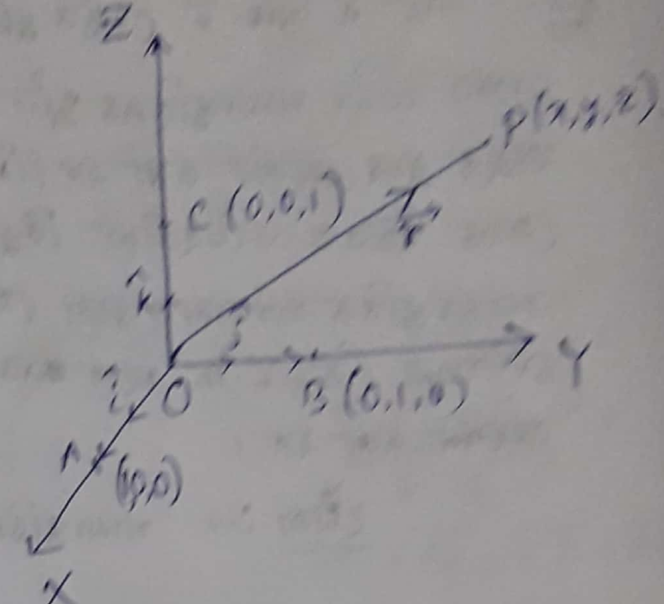
ভেক্টরের উপাংশ (Component of vectors):



$|\vec{OA}| = 1$

$|\vec{OB}| = 1$

$|\vec{OC}| = 1$

$\vec{OA}$, $\vec{OB}$ and $\vec{OC}$ are called unit vector (একক ভেক্টর) in the direction of OX, OY & OZ.

Also,
$\vec{OA} = \hat{i}$

$\vec{OB} = \hat{j}$

$\vec{OC} = \hat{k}$.

Now, it is clear that, (ভেক্টর যোগের সূত্র থেকে)

$$\vec{OP} = x\hat{i} + y\hat{j} + z\hat{k}$$

or, $\boxed{\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}} \Rightarrow |\vec{r}| = \sqrt{x^2+y^2+z^2}$
(By Pythagoras theorem)

$\vec{r}$ ভেক্টরের উপাংশ অর্থাৎ (Component vector) বলে।

Also, $\begin{cases} x, y, z \text{ are scalar component (স্কেলার উপাংশ) of } \vec{r}. \\ x\hat{i}, y\hat{j}, z\hat{k} \text{ are vector component (ভেক্টর উপাংশ) of } \vec{r}. \end{cases}$

৪. ধৰাঁ (Let)

$$\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$$

$$\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$$

$\therefore$ (i) $\vec{a} + \vec{b} = (a_1\hat{i} + a_2\hat{j} + a_3\hat{k}) + (b_1\hat{i} + b_2\hat{j} + b_3\hat{k})$

$= (a_1 + b_1)\hat{i} + (a_2 + b_2)\hat{j} + (a_3 + b_3)\hat{k}$

(ii) $\vec{a} - \vec{b} = (a_1 - b_1)\hat{i} + (a_2 - b_2)\hat{j} + (a_3 - b_3)\hat{k}$

(iii) $\vec{a}$ & $\vec{b}$ are equall $\underbrace{\text{if and if}}_{\text{(iff)}}$ (যদি আৰু যদিহে)

$a_1 = b_1$, $a_2 = b_2$, $a_3 = b_3$.

(iv) $\lambda\vec{a} = (\lambda a_1)\hat{i} + (\lambda a_2)\hat{j} + (\lambda a_3)\hat{k}$

Again we get

(i) $k\vec{a} + m\vec{a} = (k+m)\vec{a}$, k, m are scalar.

(ii) $k(m\vec{a}) = (km)\vec{a}$

(iii) $k(\vec{a} + \vec{b}) = k\vec{a} + k\vec{b}$.

নোট (Note):

$\vec{a}$ and $\vec{b}$ are colinear (একরেখীয়) iff (যদি কেবল যদি)

$$\boxed{\vec{b} = \lambda \vec{a}}$$

$$\Leftrightarrow \quad b_1\hat{i} + b_2\hat{j} + b_3\hat{k} = \lambda(a_1\hat{i} + a_2\hat{j} + a_3\hat{k})$$

$$\Leftrightarrow \quad b_1\hat{i} + b_2\hat{j} + b_3\hat{k} = (\lambda a_1)\hat{i} + (\lambda a_2)\hat{j} + (\lambda a_3)\hat{k}$$

$$\Leftrightarrow \quad b_1 = \lambda a_1, \quad b_2 = \lambda a_2, \quad b_3 = \lambda a_3$$

$$\Leftrightarrow \quad \frac{b_1}{a_1} = \frac{b_2}{a_2} = \frac{b_3}{a_3} = \lambda$$

[Ex. 10.2]

Ex ④ of the vectors $2\hat{i}+3\hat{j}$ and $x\hat{i}+y\hat{j}$ are equal, find the value of x and y.

Solⁿ: given, (দেওয়া আছে)

$$2\hat{i}+3\hat{j} = x\hat{i}+y\hat{j}$$

$$\Rightarrow \begin{cases} 2 = x \\ 3 = y \end{cases} \quad \leftarrow \text{Ans.}$$

Scanned with CamScanner

Exercise 10.2

Q. No. 7 $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$ ভেক্টৰটোৰ দিশত একক vector উলিওৱা।

[Find the unit vector in the direction of the vector $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$.]

Sol^n: Given

$$\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$$

$\vec{a}$-ৰ দিশত একক ভেক্টৰ (unit vector in the direction of $\vec{a}$)

$$\hat{a} = \frac{\vec{a}}{|\vec{a}|}$$

$$= \frac{\hat{i} + \hat{j} + 2\hat{k}}{|\hat{i} + \hat{j} + 2\hat{k}|}$$

$$= \frac{\hat{i} + \hat{j} + 2\hat{k}}{\sqrt{1^2 + 1^2 + 2^2}} = \frac{\hat{i} + \hat{j} + 2\hat{k}}{\sqrt{6}}$$

$$\Rightarrow \hat{a} = \frac{1}{\sqrt{6}}\hat{i} + \frac{1}{\sqrt{6}}\hat{j} + \frac{2}{\sqrt{6}}\hat{k} \leftarrow \text{Ans}$$

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(9) Let, $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}$ & $\vec{b} = -\hat{i} + \hat{j} - \hat{k}$. Then find unit vector in the direction of $\vec{a} + \vec{b}$.

Sol^n: $\vec{a} + \vec{b} = (2\hat{i} - \hat{j} + 2\hat{k}) + (-\hat{i} + \hat{j} - \hat{k})$

$$= \hat{i} + \hat{k}$$

$\therefore$ unit vector in the direction of $\vec{a} + \vec{b}$

($\vec{a} + \vec{b}$-ৰ দিশত একক ভেক্টৰ)

$$= \frac{\vec{a} + \vec{b}}{|\vec{a} + \vec{b}|} = \frac{\hat{i} + \hat{k}}{\sqrt{1^2 + 1^2}} = \frac{\hat{i} + \hat{k}}{\sqrt{2}} = \frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{k} \leftarrow \text{Ans}$$
