Nishant Jindal

Vector → Saturdays 5:45PM.

3) $|\vec{AB}| = |\vec{b} - \vec{a}|$

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

$|\vec{AB}| = \sqrt{(b_1-a_1)^2 + (b_2-a_2)^2 + (b_3-a_2)^2}$

(4) $\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}$

here $\vec{a}$ is Linear Combination of $\hat{i}, \hat{j}, \hat{k}$

(5) $\vec{a} \parallel \vec{b} \Rightarrow$ $\boxed{\vec{a} = \lambda \vec{b}}$

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

$a_1 = \lambda b_1$ & $a_2 = \lambda b_2$ & $a_3 = \lambda b_3$

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

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

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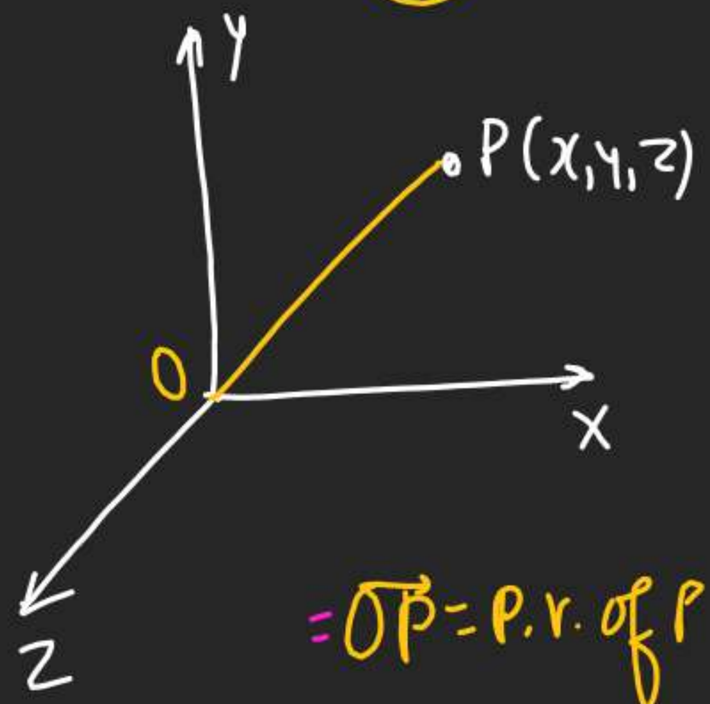
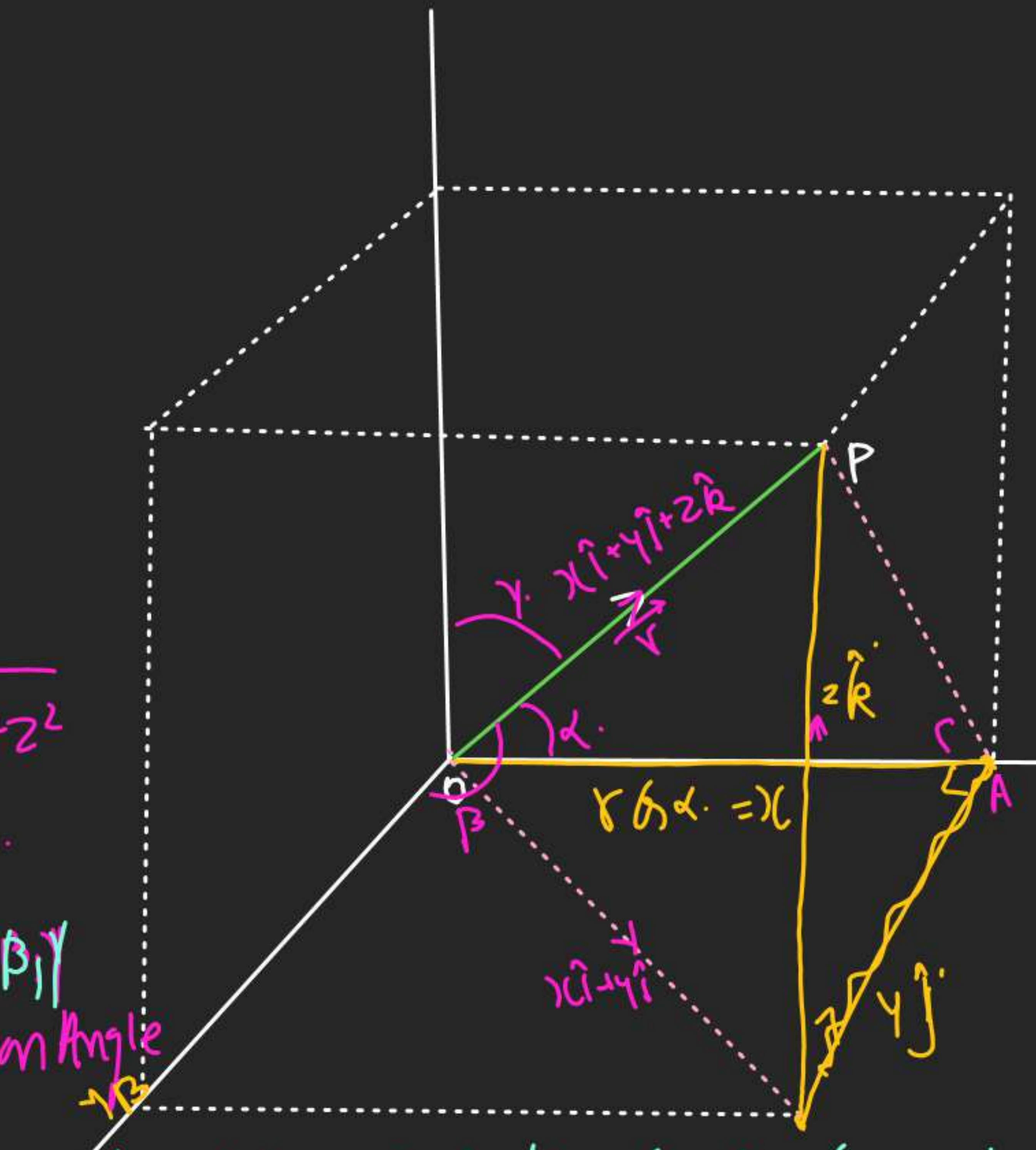
$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$




$= \vec{OP} =$ P.r. of P

1) $|\vec{r}| = |\vec{OP}| = \sqrt{x^2+y^2+z^2}$

2) Angle made by $\vec{r}$ from X, Y, Z Axes are $\alpha, \beta, \gamma$ known as Direction Angle




(3) here $x = |\vec{r}|\cos\alpha$

$y = |\vec{r}|\cos\beta$

$z = |\vec{r}|\cos\gamma$

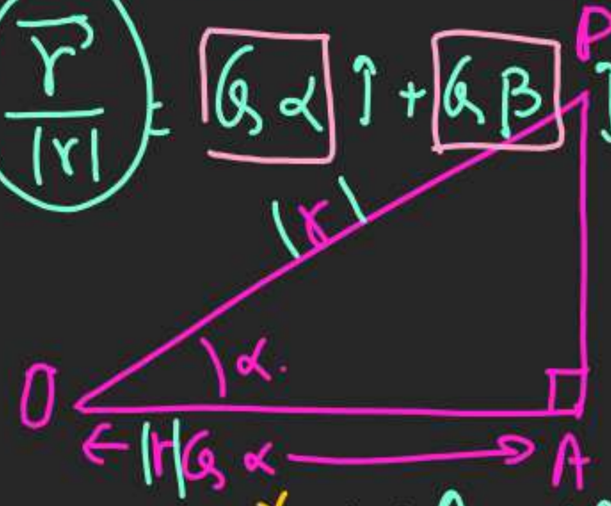
(4) $\alpha, \beta, \gamma \to$ D.A. then $\cos\alpha, \cos\beta, \cos\gamma$ are known as Direction Cosines

(5) $\vec{r} = \boxed{x}\hat{i} + \boxed{y}\hat{j} + \boxed{z}\hat{k}$

$\vec{r} = |\vec{r}|\cos\alpha\,\hat{i} + |\vec{r}|\cos\beta\,\hat{j} + |\vec{r}|\cos\gamma\,\hat{k}$

$\vec{r} = |\vec{r}|(\cos\alpha\,\hat{i} + \cos\beta\,\hat{j} + \cos\gamma\,\hat{k})$

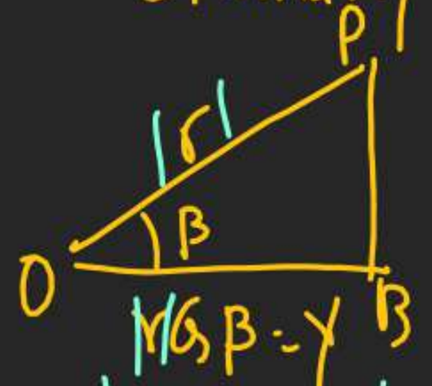
$\hat{r} = \frac{\vec{r}}{|\vec{r}|} = \boxed{\cos\alpha}\,\hat{i} + \boxed{\cos\beta}\,\hat{j} + \boxed{\cos\gamma}\,\hat{k}$




(6) Other names of D.C. are $l, m, n \Rightarrow l = \cos\alpha$, $m = \cos\beta$, $n = \cos\gamma$

(7) $\hat{r} = l\hat{i} + m\hat{j} + n\hat{k}$

Similarly $|\hat{r}| = \sqrt{l^2+m^2+n^2}$




$1 = \sqrt{l^2+m^2+n^2}$

$\Rightarrow \boxed{l^2+m^2+n^2 = 1}$

(8) $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ } here x, y, z are DA.

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$\alpha, \beta, \gamma = \text{D.A.}$

$\hat{r} = l\,\hat{i} + m\hat{j} + n\hat{k} \rightarrow l, m, n = \text{D.C.}$

& $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k} \rightarrow x, y, z = \text{D.R}(a, b, c)$

Q $\vec{r} = 3\hat{i} - 4\hat{j} + 5\hat{k}$

1) Dir. Ratios $= 3, -4, 5 = (a, b, c)$

2) Dir. Cosine के लिए make $\hat{r}$

$$\hat{r} = \frac{3\hat{i} - 4\hat{j} + 5\hat{k}}{\sqrt{3^2 + (-4)^2 + 5^2}} = \frac{3}{5\sqrt{2}}\hat{i} - \frac{4}{5\sqrt{2}}\hat{j} + \frac{5}{5\sqrt{2}}\hat{k}$$

$\therefore l, m, n = \frac{3}{5\sqrt{2}}, \frac{-4}{5\sqrt{2}}, \frac{5}{5\sqrt{2}}$

Q find angle made by $\vec{r} = \hat{i} - \hat{j} + \hat{k}$ from Z Axis

$\vec{r} = \hat{i} - \hat{j} + \hat{k} \qquad |r| = \sqrt{1^2 + (-1)^2 + 1^2} = \sqrt{3}$.

$\hat{r} = \frac{1}{\sqrt{3}}\hat{i} - \frac{1}{\sqrt{3}}\hat{j} + \frac{1}{\sqrt{3}}\hat{k}$

$\cos\alpha = l = \frac{1}{\sqrt{3}}, \quad m = -\frac{1}{\sqrt{3}}, \quad n = \frac{1}{\sqrt{3}}$

$\cos\beta = -\frac{1}{\sqrt{3}} \qquad n = \boxed{\cos\gamma = \frac{1}{\sqrt{3}}}$

angle made on Z Axis $= \gamma = \cos^{-1}\frac{1}{\sqrt{3}}$

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① Find Sum of Projection made by $\vec{r} = \hat{i}+\hat{j}+\hat{k}$ on Axes?

$$\text{Sum of Proj} = |r|\cos\alpha + |r|\cos\beta + |r|\cos\gamma.$$

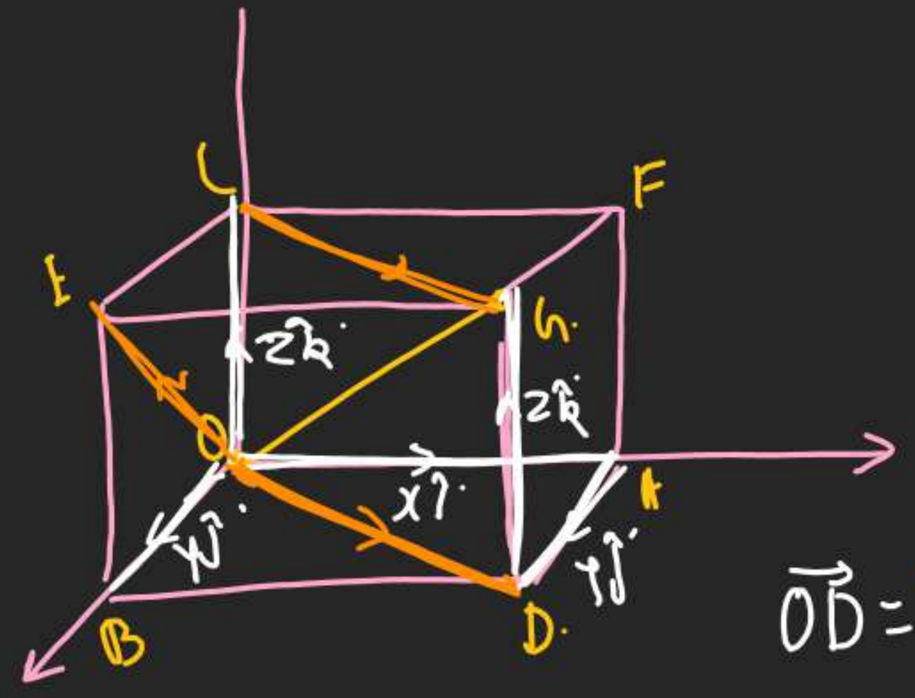
$$= |r|(\cos\alpha + \cos\beta + \cos\gamma)$$

$$\hat{r} = \frac{\hat{i}}{\sqrt{3}} + \frac{\hat{j}}{\sqrt{3}} + \frac{\hat{k}}{\sqrt{3}} \qquad |r| = \sqrt{3}.$$

$$\text{Sum} = \sqrt{3}\left(\frac{1}{\sqrt{3}}+\frac{1}{\sqrt{3}}+\frac{1}{\sqrt{3}}\right)$$

$$= \sqrt{3} \times \frac{3}{\sqrt{3}} = 3.$$

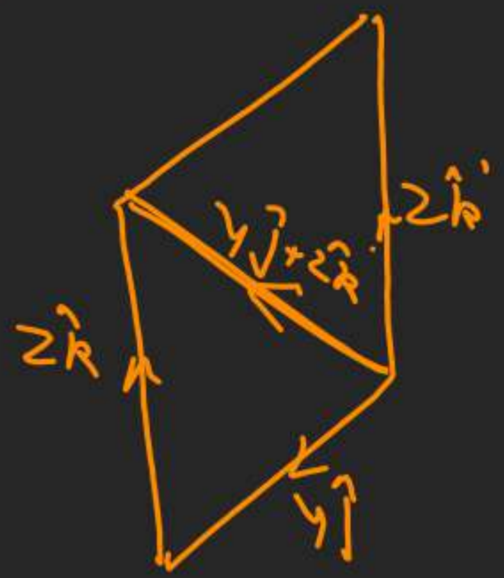
Q




$\vec{OD} = x\hat{i} + y\hat{j}$

$\vec{OE} = y\hat{j} + 2\hat{k}$

$\vec{CG} = \vec{OD} = x\hat{i} + y\hat{j}$



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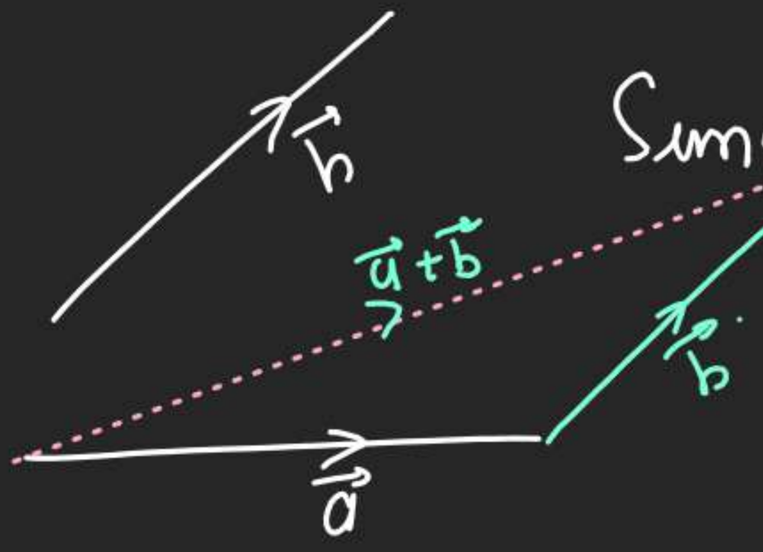
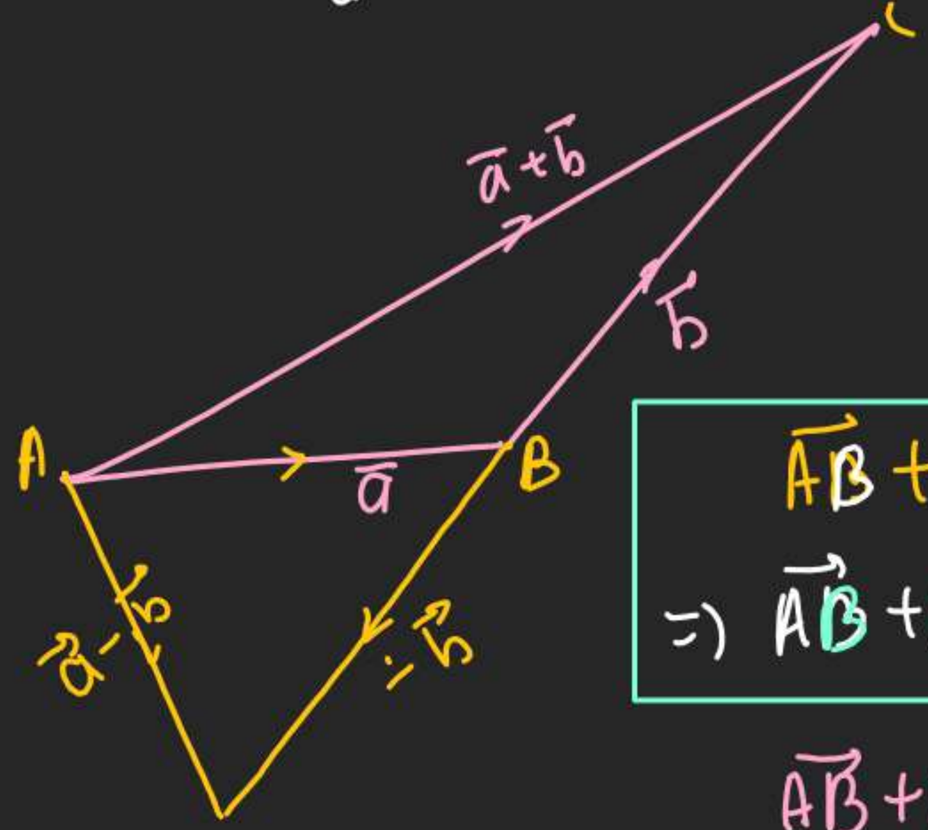
Q How triangle law works?



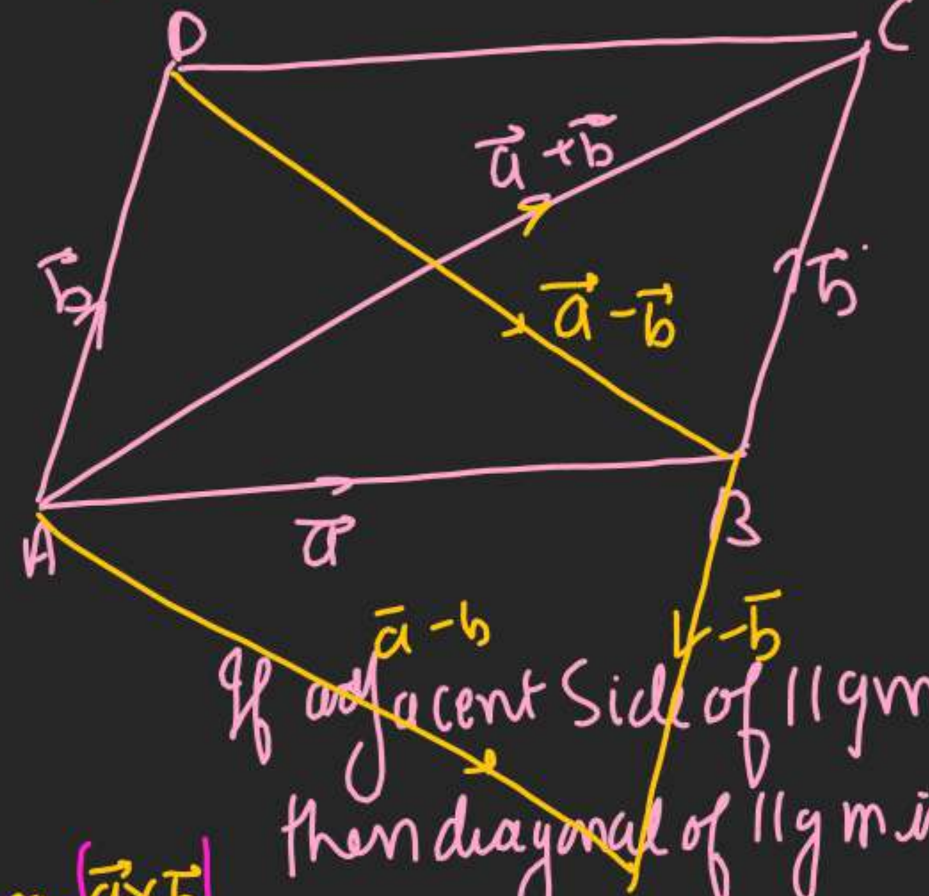

Sum of $\vec{a}+\vec{b}$ ?




$$\overrightarrow{AB}+\overrightarrow{BC}=\overrightarrow{AC}$$
$$\Rightarrow \overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{CA}=0$$

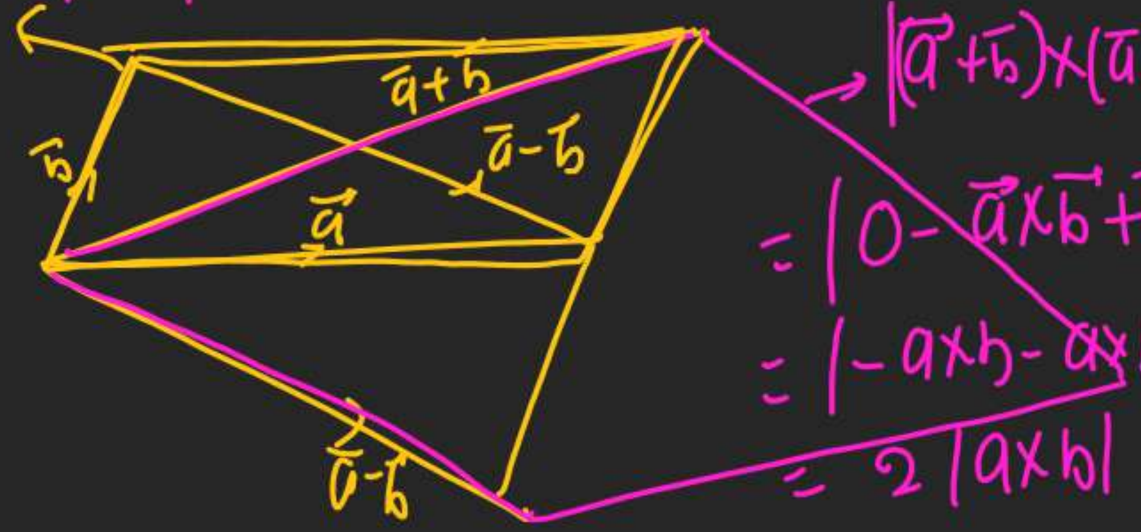
$$\overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{CD}+\overrightarrow{DE}+\overrightarrow{EA}=0$$

* Parallelogram law of addition.




If adjacent side of ||gm are $\vec{a}$ & $\vec{b}$ then diagonal of ||gm is $\vec{a}+\vec{b}$

Area $=|\vec{a}\times\vec{b}|$




$$|(\vec{a}+\vec{b})\times(\vec{a}-\vec{b})|$$
$$=|0-\vec{a}\times\vec{b}+\vec{b}\times\vec{a}-0|$$
$$=|-a\times b-a\times b|$$
$$=2|a\times b|$$

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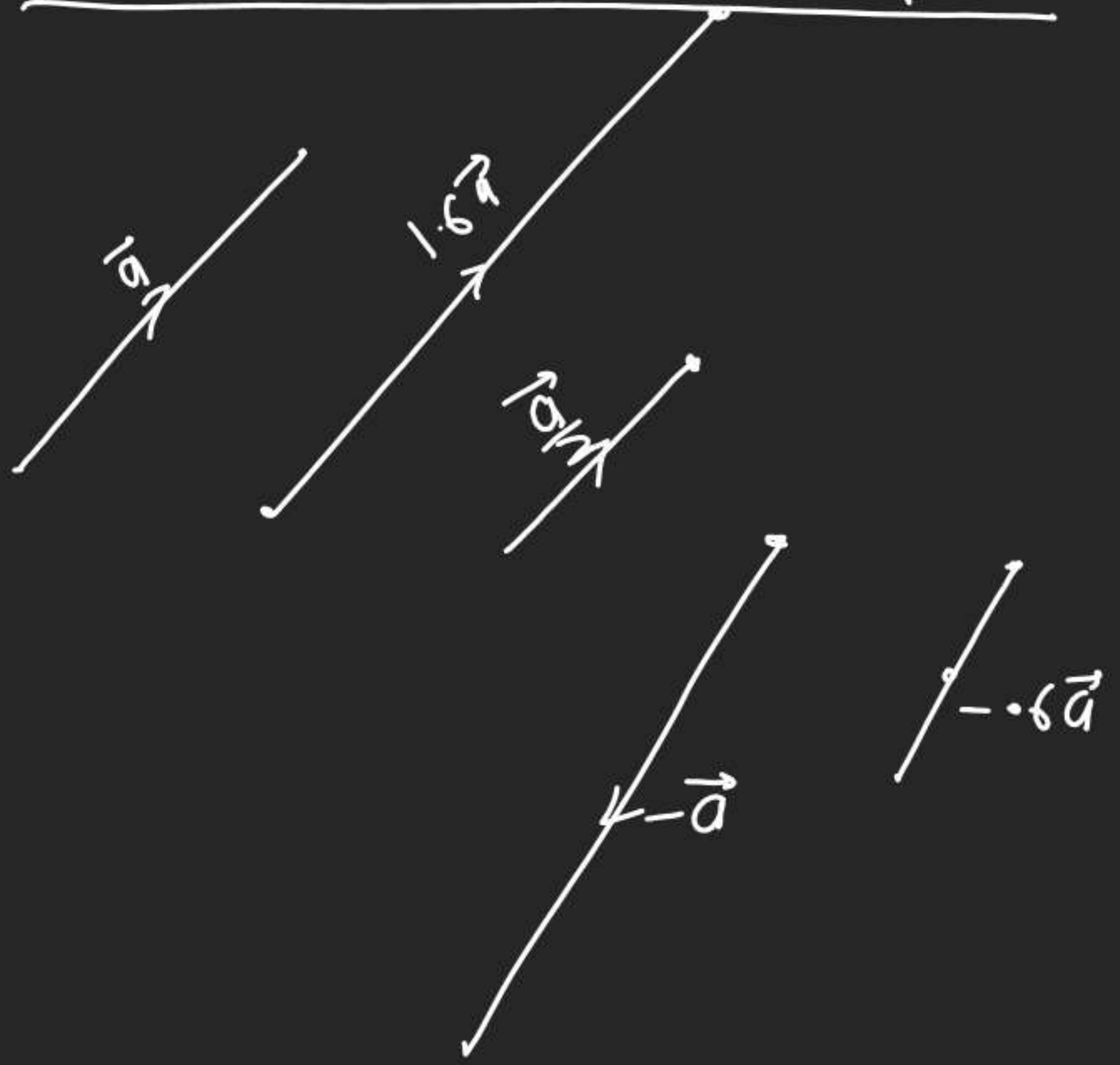
# Geometrical visualisation of $\lambda\vec{a}$



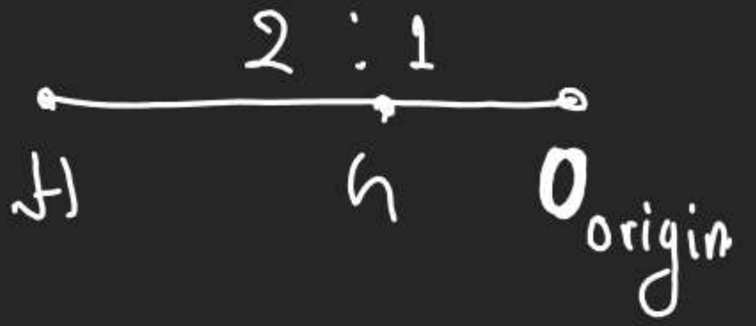

Q $\vec a = a_1\hat i + a_2\hat j + a_3\hat k$

$l, m, n = ?$

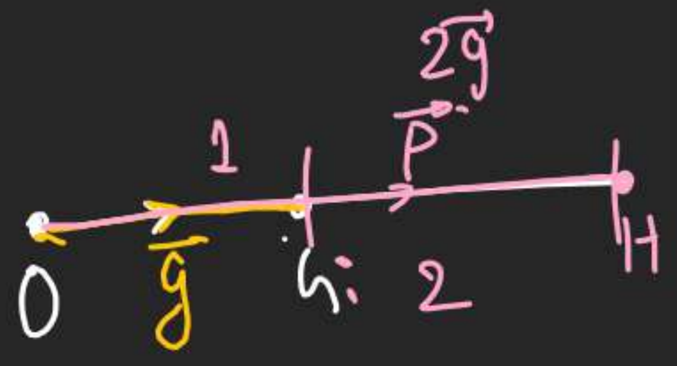
$\vec a = a_1\hat i + a_2\hat j + a_3\hat k$

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

$l = \frac{a_1}{|a|},\ m = \frac{a_2}{|a|},\ n = \frac{a_3}{|a|}$




Q Let $\vec p$ is p.v. of orthocentre (H) & $\vec g$ is p.v. of centroid (G) & circumcentre (O) is origin. If $\vec p = K\cdot\vec g$ then $K = ?$




$\vec{OH} = 3\vec g$

$\vec p = 3\vec g$

$\boxed{K = 3}$

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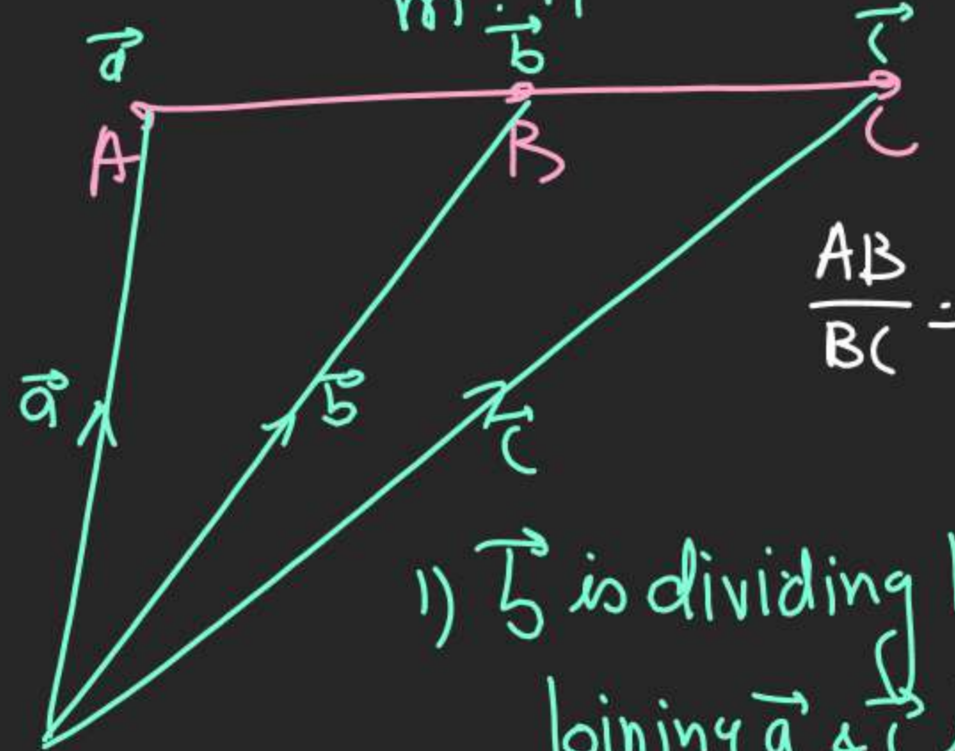
# Section Formula.

Same like St. line (2D)

1) Internal Div.

$m : n$



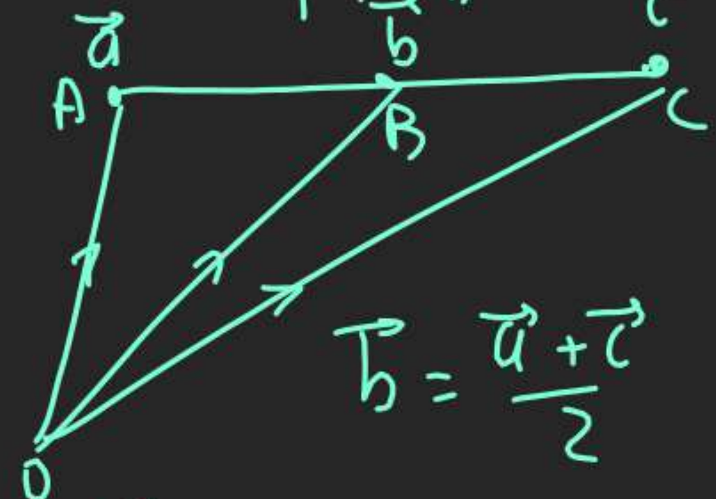

$$\frac{AB}{BC} = \frac{m}{n}.$$

1) $\vec{b}$ is dividing line joining $\vec{a}$ & $\vec{c}$ in Ratio $m:n$.

2) $\vec{b} = \dfrac{m\vec{c} + n\vec{a}}{m+n}.$

## 2) Mid Pt. Formula

$1 : 1$




$$\vec{b} = \frac{\vec{a} + \vec{c}}{2}$$

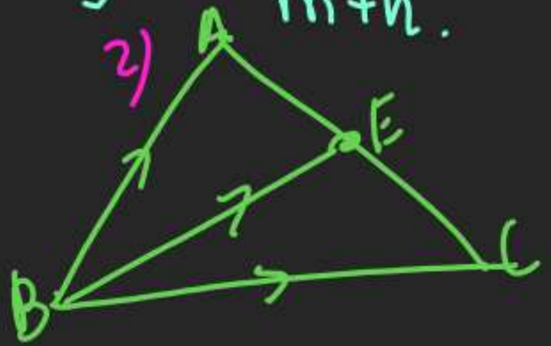
Sundar Jbab $\rightarrow$ $\vec{OB} = \dfrac{\vec{OA} + \vec{OC}}{2}$

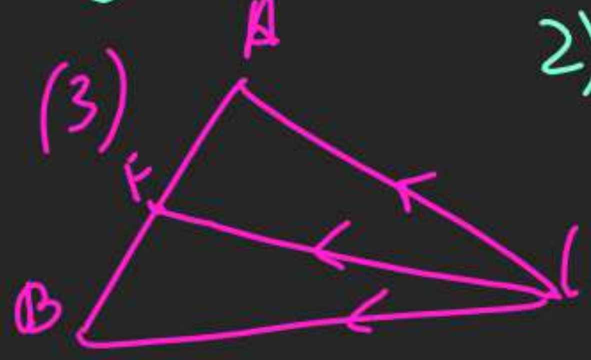
Ati Sundar $\rightarrow$ $\boxed{\vec{OA} + \vec{OC} = 2\vec{OB}}$

{1 diag मे 3 diag सोचना

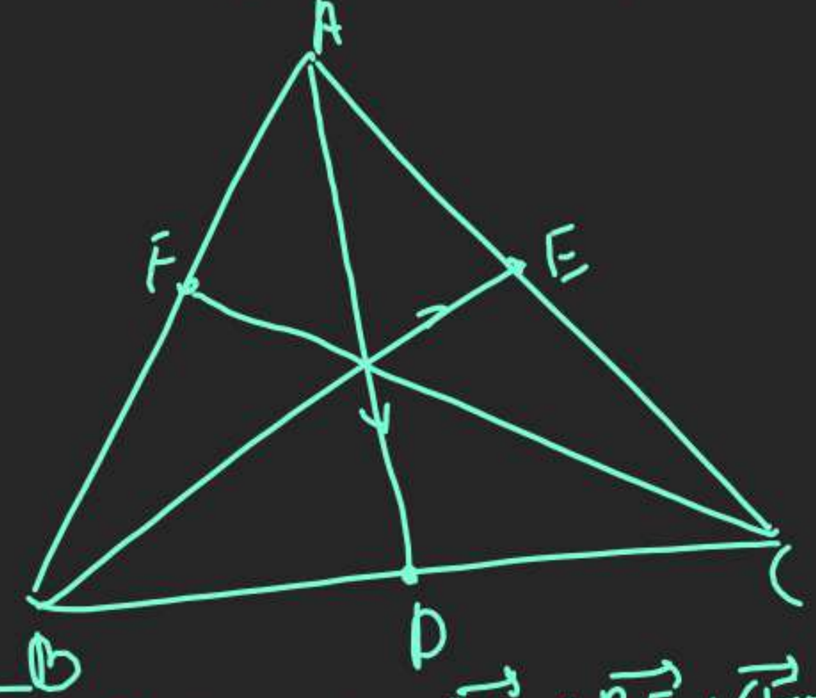
(1)


सोचो A से




Q P.T. Sum of 3 vectors determined by Medians of $\Delta$ directed from Vertices = Zero




To prove $\rightarrow$ $\vec{AD} + \vec{BE} + \vec{CF} = 0$

$$\cancel{\vec{AB}} + \cancel{\vec{AC}} = 2\vec{AD}$$
$$\cancel{\vec{BA}} + \cancel{\vec{BC}} = 2\vec{BE}$$
$$\cancel{\vec{CB}} + \cancel{\vec{CA}} = 2\vec{CF}$$

$$0 = 2(AD + BE + CF)$$

H.P.

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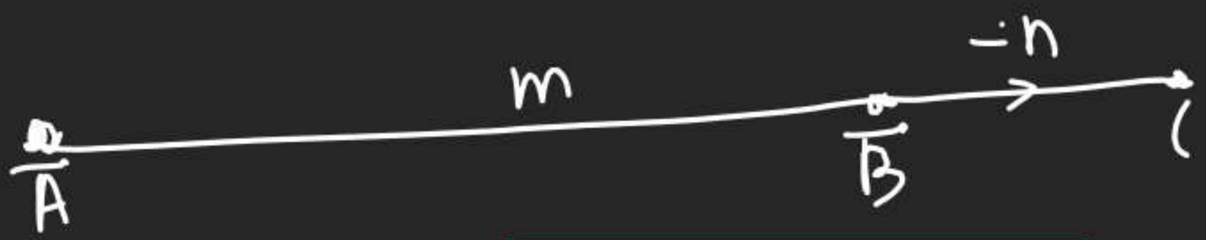
## (3) External Division

[Chataayi Ka Phool]

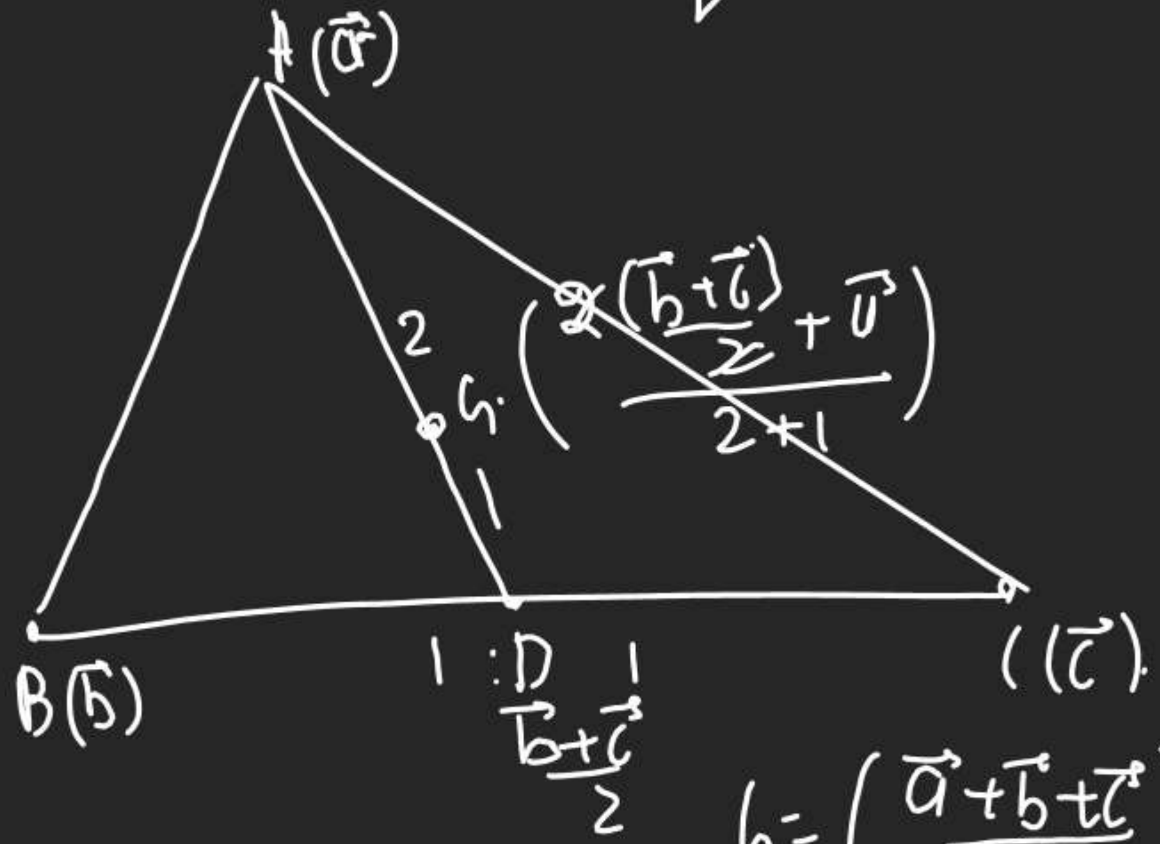
1) AC को B Externally divide करता है।


2) $\frac{AB}{BC} = \frac{m}{n}$.




$$\boxed{\vec{b} = \frac{m\vec{c} - n\vec{a}}{m-n}}$$

Q Find vector value of Centroid.




$$G = \left(\frac{\vec{a}+\vec{b}+\vec{c}}{3}\right)$$

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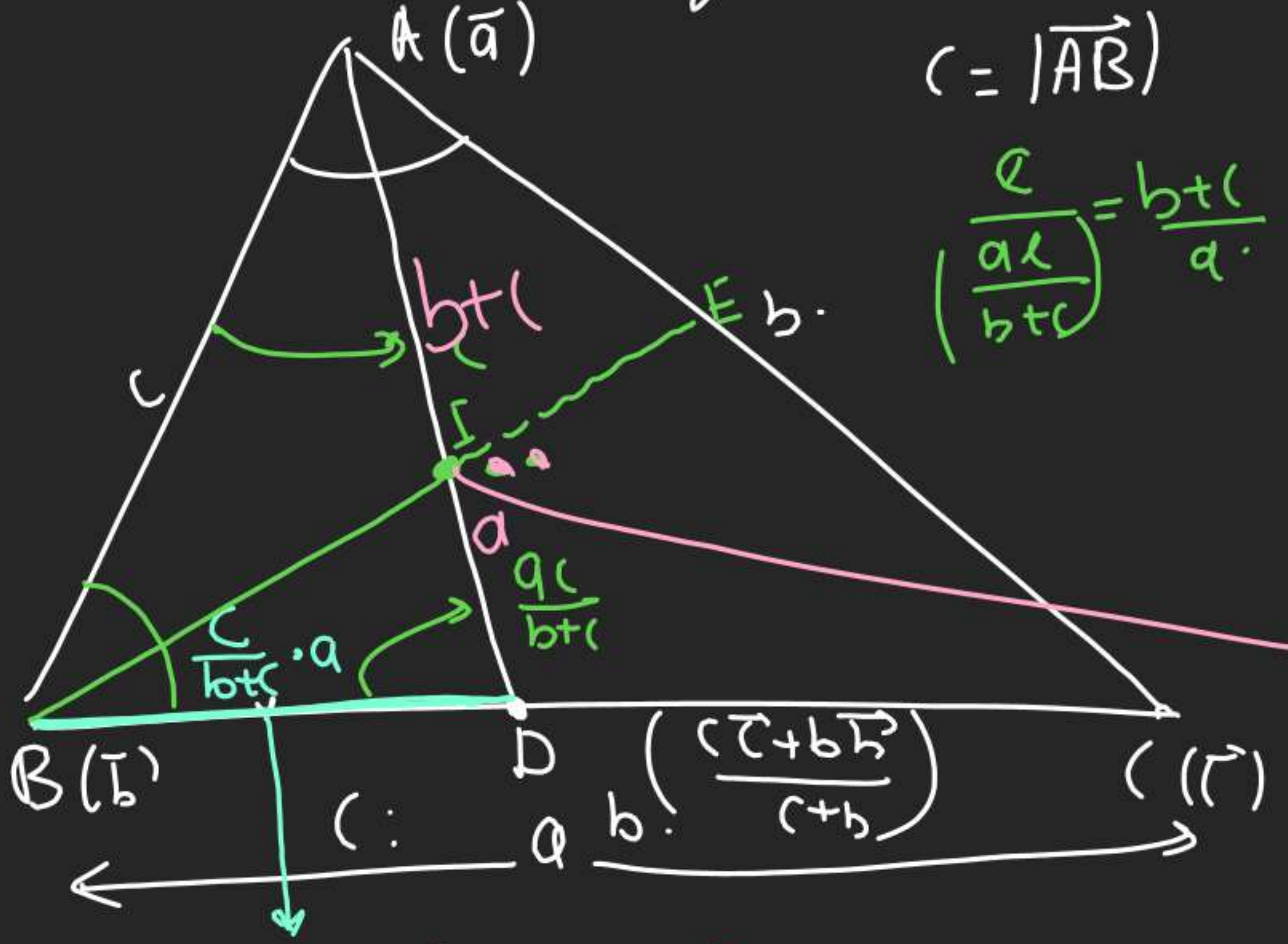
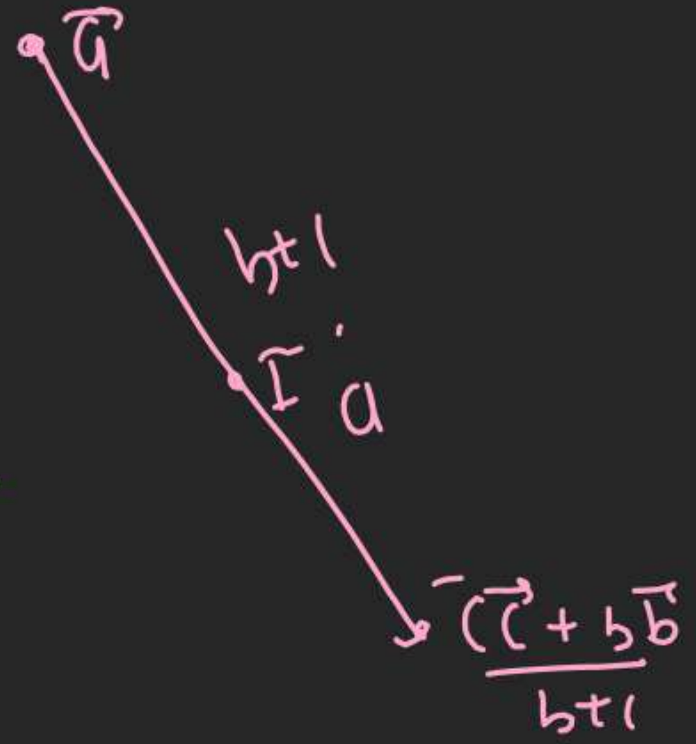
Q Find vector value of Incentre.




a का (Ratio वाला Part.

$$= \frac{c}{b+c} \times a$$




$$I = \frac{(b+c)\left(\frac{c\vec{c}+b\vec{b}}{b+c}\right) + a\vec{a}}{b+c+a}$$

$$I = \left(\frac{a\vec{a}+b\vec{b}+c\vec{c}}{a+b+c}\right)$$

$$I = \left(\frac{|BC|\,\vec{a} + |AC|\,\vec{b} + |AB|\,\vec{c}}{|AB|+|BC|+|CA|}\right)$$

DPP 1

half try करके देना