LGS GROUP OF COLLEGES
A PROJECT OF LAHORE GRAMMAR SCHOOL

Sheet #

Name: M. Mujtaba Imtiaz Class: 12th Roll No.

Subject: Maths Test No. Date:

	A	B	C	D
1		●		
2		●		
3		●		
4				●

Marks Obtained

(i)

Given that

$$\underline{v} = -\underline{i} + \underline{j} + \underline{k}$$

$$|\underline{v}| = \sqrt{(-1)^2 + (1)^2 + (1)^2} = \sqrt{3}$$

So,

$$\hat{v} = \frac{-\underline{i} + \underline{j} + \underline{k}}{\sqrt{3}}$$

To find the required vector $\underline{u}$,

$$\underline{u} = \frac{-\underline{i} + \underline{j} + \underline{k}}{\sqrt{3}} \times 2$$

$$\underline{u} = \frac{-2\underline{i} + 2\underline{j} + 2\underline{k}}{\sqrt{3}} = \frac{-2\underline{i}}{\sqrt{3}} + \frac{2\underline{j}}{\sqrt{3}} + \frac{2\underline{k}}{\sqrt{3}}$$

(ii)

$$\underline{a} = \underline{i} - \underline{k} \implies |\underline{a}| = \sqrt{(1)^2 + (-1)^2} = \sqrt{2}$$

$$\underline{b} = \underline{j} + \underline{k} \implies |\underline{b}| = \sqrt{(1)^2 + (1)^2} = \sqrt{2}$$

$$\underline{a}\cdot\underline{b} = (\underline{i} - \underline{k})\cdot(\underline{j} + \underline{k}) = 0 + 0 - 1 = -1$$

Projection of $\underline{a}$ along $\underline{b}$ $= \dfrac{\underline{a}\cdot\underline{b}}{\underline{b}} = -1/\sqrt{2}$

Projection of $\underline{b}$ along $\underline{a}$ $= \dfrac{\underline{a}\cdot\underline{b}}{\underline{a}} = -1/\sqrt{2}$

(iii)

$\overrightarrow{AB}$ = P.V of B − P.V of A = $2\underline{i} + 0\underline{j} - (1\underline{i} - 1\underline{j})$

$\overrightarrow{AB} = 2\underline{i} - 1\underline{i} + 1\underline{j} = 1\underline{i} + 1\underline{j} = \underline{i} + \underline{j}$

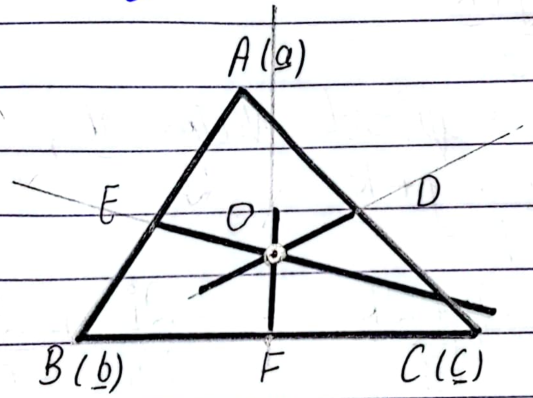
$\overrightarrow{CD}$ = P.V of D − P.V of C = $-2\underline{i} + 2\underline{j} - (-1\underline{i} + 3\underline{j})$

$\overrightarrow{CD} = -2\underline{i} + 2\underline{j} + 1\underline{i} - 3\underline{j} = -\underline{i} - \underline{j}$

So, P.V of $\overrightarrow{AB}$ + P.V of $\overrightarrow{CD}$ = $\underline{i} + \underline{j} - \underline{i} - \underline{j} = 0$

Long Ques:—

Q3:—



Let $\underline{a}$, $\underline{b}$ and $\underline{c}$ are the three vectors of the three vertices of the triangle respectively. Also, D, E and F are the mid-points of $\overline{AC}$, $\overline{AB}$ and $\overline{BC}$ respectively.

P.V of D = $\overrightarrow{OD} = \dfrac{\underline{a} + \underline{c}}{2}$

P.V of E = $\overrightarrow{OE} = \dfrac{\underline{a} + \underline{b}}{2}$

P.V of $F = \vec{OF} = \dfrac{\underline{b} + \underline{c}}{2}$

So, (specifying directions of sides)

$\vec{AB}$ = P.V of B − P.V of A

$\vec{AB} = \underline{b} - \underline{a}$

$\vec{BC}$ = P.V of C − P.V of B

$\vec{BC} = \underline{c} - \underline{b}$

$\vec{CA}$ = P.V of A − P.V of C

$\vec{CA} = \underline{a} - \underline{c}$

So, As we can see,

$\vec{OE} \perp \vec{AB} \Rightarrow \vec{OE} \cdot \vec{AB} = 0$

$\Rightarrow \dfrac{\underline{a} + \underline{b}}{2} \cdot (\underline{b} - \underline{a}) = 0$

$(\underline{b} + \underline{a}) \cdot (\underline{b} - \underline{a}) = 0$

$b^2 - a^2 = 0 \longrightarrow (1)$

Also,

$\vec{OF} \perp \vec{BC} \Rightarrow \vec{OF} \cdot \vec{BC} = 0$

So,

$\left(\dfrac{\underline{b} + \underline{c}}{2}\right) \cdot (\underline{c} - \underline{b}) = 0$

$(\underline{c} + \underline{b}) \cdot (\underline{c} - \underline{b}) = 0$

$c^2 - b^2 = 0 \longrightarrow (2)$

Adding eq (1) and eq (2)

$$\cancel{b^2} - a^2 + c^2 - \cancel{b^2} = 0$$

$$c^2 - a^2 = 0$$

$$\cancel{(c+a)(c-a) = 0}$$

~~Multiplying '$\frac{1}{2}$' on b/s~~

$$\cancel{\left(\frac{c+a}{2}\right) \cdot (c-a) = 0}$$

$$\cancel{\overline{OD} \cdot \overline{CA}}$$

So,

$$c^2 - a^2 = 0$$

$$a^2 - c^2 = 0$$

So,

multiplying '$\frac{1}{2}$' on b/s

$$\frac{1}{2}(a^2 - c^2) = 0$$

$$\frac{1}{2}(a+c) \cdot (a-c) = 0$$

$$\left(\frac{a+c}{2}\right) \cdot (a-c) = 0$$

$$\overrightarrow{OD} \cdot \overrightarrow{CA} = 0$$

$$\overrightarrow{OD} \perp \overrightarrow{CA}$$

Hence proved that the prependicular bisector of the sides of the triangle are concurrent.