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Math :-

Assignment

Question #2 :-

(i)

magnitude $= 2$, parallel to $= -\underline{i}+\underline{j}+\underline{k}$

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

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

$\because$ Unit vector is $\parallel$ to $\underline{v} = \hat{v} = \dfrac{\underline{v}}{|\underline{v}|}$

$= \dfrac{1}{\sqrt{3}}(-\underline{i}+\underline{j}+\underline{k})$

$\because$ required vector $\parallel$ to $\underline{v} = \dfrac{2}{\sqrt{3}}(-i+j+k)$

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

(ii)

$\underline{a} = \underline{i} - \underline{k}$, $\underline{b} = \underline{j} + \underline{k}$

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

$= (1)(0) + (0)(1) + (-1)(1)$

$= -1$

$|\underline{a}| = \sqrt{(1)^2 + (0)^2 + (-1)^2}$

$= \sqrt{2}$

$|\underline{b}| = \sqrt{(0)^2 + (1)^2 + (1)^2}$

$= \sqrt{2}$

projection of a along b:

$\frac{\underline{a} \cdot \underline{b}}{|\underline{b}|} = \frac{-1}{\sqrt{2}}$

projection of b along a:

$\frac{\underline{a} \cdot \underline{b}}{|\underline{a}|} = \frac{-1}{\sqrt{2}}$

(iii)

Sum of Vector $\vec{AB}$ & $\vec{CD}$

$A(1,-1)$, $B(2,0)$, $C(-1,3)$, $D(-2,2)$

$\vec{OA} = \underline{i} - \underline{j}$, $\vec{OB} = 2\underline{i}$, $\vec{OC} = -\underline{i} + 3\underline{j}$, $\vec{OD} = -2\underline{i} + 2\underline{j}$

$\vec{AB} = \vec{OB} - \vec{OA}$

$= 2i - i + j$

$= \underline{i} + \underline{j}$

$\vec{CD} = \vec{OD} - \vec{OC}$

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

$= -\underline{i} - \underline{j}$

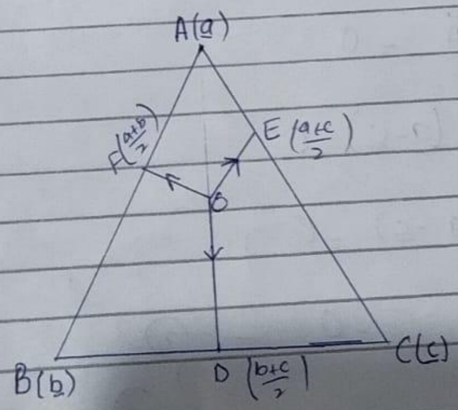
$\vec{AB} + \vec{CD} = \underline{i} + \underline{j} - \underline{i} - \underline{j}$

$= 0$

Question # 3:

Perpendicular bisector of sides of Δ are concurrent

Diagram :-



perp vectar of $A = \vec{OA} = \underline{a}$
perp vectar of $B = \vec{OB} = \underline{b}$
perp vector of $C = \vec{OC} = \underline{c}$

perp vector of Midpoint 'D' of $BC = \overline{OD} = \frac{b+c}{2}$

perp vector of Midpoint 'E' of $AC = \overline{OE} = \frac{a+c}{2}$

perp vector of Midpoint 'F' of $AB = \overline{OF} = \frac{a+b}{2}$

$\overline{BC} = \overline{OC} - \overline{OB} = c - b$
$\overline{CA} = \overline{OA} - \overline{OC} = a - c$
$\overline{AB} = \overline{OB} - \overline{OA} = b - a$

$\because \overline{OD} \perp \overline{BC}$ $\quad\because \overline{OE} \perp CA$ $\quad\because \overline{OF} \perp BA$

$\rightarrow$ $\overline{OD} \cdot \overline{BC} = 0$

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

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

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

$\underline{c}^2 - \underline{b}^2 = 0$ — (1)

$\rightarrow$ $\overline{OE} \cdot \overline{CA} = 0$

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

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

$\underline{a}^2 - \underline{c}^2 = 0$ — (2)

from eq ① and ②

$a^2 - b^2 = 0$

$-(b^2 - a^2) = 0$

$b^2 - a^2 = 0$

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

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

$\cancel{\overrightarrow{OF} \perp \overline{AB} = 0}$

$\overline{OF} \cdot \overline{AB} = 0$

$\overline{OF} \perp \overline{AB}$ $\cancel{= 0}$

Hence the perpendicular bisector of the Δ sides are concurrent.

Q # 1:-

1. D
2. B
3. C
4. D