chapter – 10 **Vector Algebra** 4 marks

(1) Show that the points $A(-2\hat{i}+3\hat{j}+5\hat{k})$, $B(\hat{i}+2\hat{j}+3\hat{k})$ and $C(7\hat{i}-\hat{k})$ are collinear

(2) Find the area of parallelogram whose adjacent sides are given by vectors $\vec{a} = \hat{i}-\hat{j}+3\hat{k}$ and $\vec{b} = 2\hat{i}-7\hat{j}+\hat{k}$

(3) Find a vector in the direction of vector $5\hat{i}-\hat{j}+2\hat{k}$ which has magnitude 8 unit

(4) Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitude $\sqrt{3}$ and 2 and such that $\vec{a}\cdot\vec{b} = \sqrt{6}$

(5) if $\vec{a}$, $\vec{b}$ and $\vec{c}$ are unit vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ then find the value of $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$.

(6) The scalar product of the vectors $\hat{i}+\hat{j}+\hat{k}$ with a unit vector along the sum of vectors $2\hat{i}+4\hat{j}-5\hat{k}$ and $\lambda\hat{i}+2\hat{j}+3\hat{k}$ is equal to one Find the value of λ

(7) Find the area of the triangle with vertices $A(1,1,2)$, $B(2,3,5)$ and $C(1,5,5)$

(8) Find the value of λ such that the vectors $\hat{i}-\hat{j}+\hat{k}$, $3\hat{i}+\hat{j}+2\hat{k}$ and $\hat{i}-\lambda\hat{j}+3\hat{k}$ are coplanar

(9) show that the four points $A(4,5,1)$ $B(0,-1,-1)$ $C(3,9,4)$ and $D(-4,4,4)$ are coplanar

(10) Find x if the four points $A(3,2,1)$ $B(4,x,5)$ $C(4,2,-2)$ and $D(6,5,-1)$ are coplanar.

(11) show that the $A(1,2,7)$ $B(2,6,3)$ and $C(3,10,-1)$ are collinear

(12) Find the angle θ between the vectors $\vec{a} = \hat{i}+\hat{j}-\hat{k}$ and $\vec{b} = \hat{i}-\hat{j}+\hat{k}$

(13) show that the four points A, B, C and D with position vectors $4\hat{i}+5\hat{j}+\hat{k}$, $-(\hat{j}+\hat{k})$, $3\hat{i}+9\hat{j}+4\hat{k}$ and $4(-\hat{i}+\hat{j}+\hat{k})$ are coplanar

(14) show that the vectors $\vec{a} = \hat{i}-2\hat{j}+3\hat{k}$ $\vec{b} = -2\hat{i}+3\hat{j}-4\hat{k}$ and $\vec{c} = \hat{i}-3\hat{j}+5\hat{k}$ are coplanar.

(15) Find the projection of the vector $\hat{i}+3\hat{j}+7\hat{k}$ on the vector $7\hat{i}-\hat{j}+8\hat{k}$

(16) Find $|\vec{a}|$ and $|\vec{b}|$ if $(\vec{a}+\vec{b})\cdot(\vec{a}-\vec{b}) = 8$ and $|\vec{a}| = 8|\vec{b}|$

(17) If $\vec{a} = 2\hat{i}+2\hat{j}+3\hat{k}$ $\vec{b} = -\hat{i}+2\hat{j}+\hat{k}$ and $\vec{c} = 3\hat{i}+\hat{j}$ such that $\vec{a}+\lambda\vec{b}$ is $\perp$ to $\vec{c}$ then find the value of λ

(18) show that the vectors $2\hat{i}-\hat{j}+\hat{k}$, $\hat{i}-3\hat{j}-5\hat{k}$ and $3\hat{i}-4\hat{j}-4\hat{k}$ form the vertices of a right angled triangle.

(1) $\vec{A} = -2\hat{i}+3\hat{j}+5\hat{k}$ $\vec{B} = \hat{i}+2\hat{j}+3\hat{k}$ $\vec{C} = 7\hat{i}-\hat{k}$

$\vec{AB}$ = P.V of B − PV of A
$= \hat{i}+2\hat{j}+3\hat{k}+2\hat{i}-3\hat{j}-5\hat{k}$
$= 3\hat{i}-\hat{j}-2\hat{k}$

$\vec{AC}$ = P V of C − PV of A
$= 7\hat{i}-\hat{k}+2\hat{i}-3\hat{j}-5\hat{k}$
$\vec{AC} = 9\hat{i}-3\hat{j}-6\hat{k}$
$\vec{AC} = 3(3\hat{i}-\hat{j}-2\hat{k})$
$\vec{AC} = 3\vec{AB}$

$\vec{AB}$ and $\vec{AC}$ are parallel vectors but A is the common pt to both $\vec{AB}$ and $\vec{AC}$
$\therefore$ $\vec{AC}$ and $\vec{AB}$ are collinear vectors
$\Rightarrow$ A, B and C are collinear

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(2) $\vec{a} = \hat{i}-\hat{j}+3\hat{k}$ $\vec{b} = 2\hat{i}-7\hat{j}+\hat{k}$

$$\vec{a}\times\vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 3 \\ 2 & -7 & 1 \end{vmatrix}$$

$= \hat{i}(-1+21)-\hat{j}(1-6)+\hat{k}(-7+2)$
$= 20\hat{i}+5\hat{j}-5\hat{k}$

Area of llgm $= |\vec{a}\times\vec{b}| = \sqrt{(20)^2+(5)^2+(-5)^2} = \sqrt{400+25+25} = \sqrt{450}$
$= 15\sqrt{2}$ sq unit

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

$|\vec{a}| = \sqrt{(5)^2+(-1)^2+(2)^2} = \sqrt{25+1+4} = \sqrt{30}$

Also unit vector $= \hat{a} = \dfrac{\vec{a}}{|\vec{a}|} = \dfrac{5\hat{i}-\hat{j}+2\hat{k}}{\sqrt{30}}$

$\hat{a} = \dfrac{5}{\sqrt{30}}\hat{i} - \dfrac{\hat{j}}{\sqrt{30}} + \dfrac{2}{\sqrt{30}}\hat{k}$

Now a vector in the direction of $\vec{a}$ and having magnitude 8 units is

$= 8\hat{a}$

$= 8\left(\dfrac{5}{\sqrt{30}}\hat{i} - \dfrac{\hat{j}}{\sqrt{30}} + \dfrac{2}{\sqrt{30}}\hat{k}\right)$

$= \dfrac{40}{\sqrt{30}}\hat{i} - \dfrac{8}{\sqrt{30}}\hat{j} + \dfrac{16}{\sqrt{30}}\hat{k}$

(4) $|\vec{a}| = \sqrt{3}$ $|\vec{b}| = 2$ and $\vec{a}\cdot\vec{b} = \sqrt{6}$

let θ be the angle between vectors $\vec{a}$ and $\vec{b}$

$$\cos\theta = \frac{\vec{a}\cdot\vec{b}}{|\vec{a}||\vec{b}|}$$

$$\cos\theta = \frac{\sqrt{6}}{\sqrt{3}\cdot 2}$$

$$\cos\theta = \frac{\cancel{\sqrt{3}} \times \cancel{\sqrt{2}}}{\cancel{\sqrt{3}}\cdot \cancel{\sqrt{2}} \times \sqrt{2}}$$

$$\cos\theta = \frac{1}{\sqrt{2}}$$

$$\cancel{\cos}\theta = \cancel{\cos}\frac{\pi}{4}$$

$$\theta = \frac{\pi}{4}$$

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(5) Given $|\vec{a}| = |\vec{b}| = |\vec{c}| = 1$ $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vector so.

and $\vec{a}+\vec{b}+\vec{c} = \vec{0}$

sq both side

$$(\vec{a}+\vec{b}+\vec{c})^2 = (\vec{0})^2$$

$$(\vec{a}+\vec{b}+\vec{c})\cdot(\vec{a}+\vec{b}+\vec{c}) = 0$$

$$\vec{a}\cdot\vec{a} + \vec{a}\cdot\vec{b} + \vec{a}\cdot\vec{c} + \vec{b}\cdot\vec{a} + \vec{b}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a} + \vec{c}\cdot\vec{b} + \vec{c}\cdot\vec{c} = 0$$

$$|\vec{a}|^2 + \vec{a}\cdot\vec{b} + \vec{c}\cdot\vec{a} + \vec{a}\cdot\vec{b} + |\vec{b}|^2 + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a} + \vec{b}\cdot\vec{c} + |\vec{c}|^2 = 0$$

$$1 + 2\vec{a}\cdot\vec{b} + 2\vec{b}\cdot\vec{c} + 2\vec{c}\cdot\vec{a} + 1 + 1 = 0$$

$$2(\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}) + 3 = 0$$

$$2(\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}) = -3$$

$$\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a} = -\frac{3}{2}$$

⑥ Let $\vec{a} = \hat{i}+\hat{j}+\hat{k}$, $\vec{b} = 2\hat{i}+4\hat{j}-5\hat{k}$ and $\vec{c} = \lambda\hat{i}+2\hat{j}+3\hat{k}$

$$\vec{b}+\vec{c} = (2+\lambda)\hat{i}+6\hat{j}-2\hat{k}$$

$$|\vec{b}+\vec{c}| = \sqrt{(2+\lambda)^2+(6)^2+(-2)^2} = \sqrt{(\lambda+2)^2+36+4} = \sqrt{(\lambda+2)^2+40}$$

A unit vector along $\vec{b}+\vec{c} = \dfrac{(2+\lambda)\hat{i}+6\hat{j}-2\hat{k}}{\sqrt{(\lambda+2)^2+40}}$

Also scalar product of $\hat{i}+\hat{j}+\hat{k}$ with above unit vector is 1

$$(\hat{i}+\hat{j}+\hat{k})\cdot\left(\frac{(2+\lambda)\hat{i}+6\hat{j}-2\hat{k}}{\sqrt{(\lambda+2)^2+40}}\right) = 1$$

$$\Rightarrow \frac{2+\lambda+6-2}{\sqrt{(\lambda+2)^2+40}} = 1$$

$$\lambda+6 = \sqrt{(\lambda+2)^2+40}$$

$$(\lambda+6)^2 = (\lambda+2)^2+40$$

$$\cancel{\lambda^2}+36+12\lambda = \cancel{\lambda^2}+4+4\lambda+40$$

$$12\lambda-4\lambda = 44-36$$

$$8\lambda = 8$$

$$\lambda = 1$$

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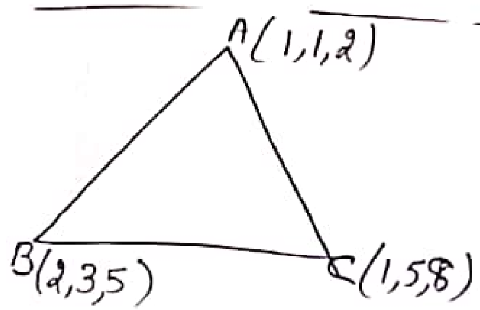
⑦ A triangl having vertices are $A(1,1,2)$ $B(2,3,5)$ and $C(1,5,8)$



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

$$\vec{B} = 2\hat{i}+3\hat{j}+5\hat{k}$$

$$\vec{C} = \hat{i}+5\hat{j}+8\hat{k}$$

$\vec{BA}$ = PV of $\vec{A}$ − PV of $\vec{B}$ = $\hat{i}+\hat{j}+2\hat{k}-2\hat{i}-3\hat{j}-5\hat{k} = -\hat{i}-2\hat{j}-3\hat{k}$

$\vec{BC}$ = PV of C − PV of B = $\hat{i}+5\hat{j}+8\hat{k}-2\hat{i}-3\hat{j}-5\hat{k} = -\hat{i}+2\hat{j}+0\hat{k}$

Area of ΔABC = $\frac{1}{2}|\vec{BA}\times\vec{BC}| = \frac{1}{2}\left\|\begin{matrix} \hat{i} & \hat{j} & \hat{k} \\ -1 & -2 & -3 \\ -1 & 2 & 0 \end{matrix}\right\|$

$$= \frac{1}{2}|\hat{i}(0+6)-\hat{j}(0-3)+\hat{k}(-2-2)|$$

$$= \frac{1}{2}|6\hat{i}+3\hat{j}+4\hat{k}| = \frac{1}{2}\sqrt{36+9+16} = \frac{1}{2}\sqrt{61} \text{ sq unit}$$

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(8) Let $\vec{a} = \hat{i} - \hat{j} + \hat{k}$ $\quad \vec{b} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{c} = \hat{i} - \lambda\hat{j} + 3\hat{k}$

Since vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ are coplanar

$$\therefore \quad [\vec{a}\ \vec{b}\ \vec{c}] = 0$$

$$\begin{vmatrix} 1 & -1 & 1 \\ 3 & 1 & 2 \\ 1 & -\lambda & 3 \end{vmatrix} = 0$$

$$1(3+2\lambda) - (-1)(9-2) + 1(-3\lambda - 1) = 0$$

$$3 + 2\lambda + 7 - 3\lambda - 1 = 0$$

$$-\lambda + 9 = 0$$

$$-\lambda = -9$$

$$\lambda = 9$$

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(9) Let $\vec{A} = 4\hat{i} + 5\hat{j} + \hat{k}$, $\vec{B} = 0\hat{i} - \hat{j} - \hat{k}$, $\vec{C} = 3\hat{i} + 9\hat{j} + 4\hat{k}$ $\quad \vec{D} = -4\hat{i} + 4\hat{j} +$

$\vec{AB}$ = PV of B − PV of A $= 0\hat{i} - \hat{j} - \hat{k} - 4\hat{i} - 5\hat{j} - \hat{k} = -4\hat{i} - 6\hat{j} - 2\hat{k}$

$\vec{AC}$ = PV of C − PV of A $= 3\hat{i} + 9\hat{j} + 4\hat{k} - 4\hat{i} - 5\hat{j} - \hat{k} = -\hat{i} + 4\hat{j} + 3\hat{k}$

$\vec{AD}$ = PV of D − PV of A $= -4\hat{i} + 4\hat{j} + 4\hat{k} - 4\hat{i} - 5\hat{j} - \hat{k} = -8\hat{i} - \hat{j} + 3\hat{k}$

$$[\vec{AB}\ \vec{AC}\ \vec{AD}] = \begin{vmatrix} -4 & -6 & -2 \\ -1 & 4 & 3 \\ -8 & -1 & 3 \end{vmatrix}$$

$$= -4(12+3) - (-6)(-3+24) + (-2)(1+32)$$

$$= -4(15) + 6(21) - 2(33)$$

$$= -60 + 126 - 66$$

$$= 126 - 126$$

$$= 0$$

$\Rightarrow$ $\vec{AB}$, $\vec{AC}$ and $\vec{AD}$ are coplanar points

$\Rightarrow$ Points A, B, C and D are coplanar

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(10) Given $A(3,2,1)$ $B(4,x,5)$ $C(4,2,-2)$ and $D(6,5,-1)$ are coplanar

$\vec{A} = 3\hat{i}+2\hat{j}+\hat{k}$ $\vec{B} = 4\hat{i}+x\hat{j}+5\hat{k}$ $\vec{C} = 4\hat{i}+2\hat{j}-2\hat{k}$ $\vec{D} = 6\hat{i}+5\hat{j}-\hat{k}$

$\vec{AB}$ = P.V of B − P.V of A $= 4\hat{i}+x\hat{j}+5\hat{k}-3\hat{i}-2\hat{j}-\hat{k} = \hat{i}+(x-2)\hat{j}+4\hat{k}$

$\vec{AC}$ = P.V of C − P.V of A $= 4\hat{i}+\cancel{2\hat{j}}-2\hat{k}-3\hat{i}-\cancel{2\hat{j}}-\hat{k} = \hat{i}+0\hat{j}-3\hat{k}$

$\vec{AD}$ = P.V of D − P.V of A $= 6\hat{i}+5\hat{j}-\hat{k}-3\hat{i}-2\hat{j}-\hat{k} = 3\hat{i}+3\hat{j}-2\hat{k}$

Since points A, B, C and D are coplanar

vectors $\vec{AB}$, $\vec{AC}$ and $\vec{AD}$ are coplanar

then $[\vec{AB}\ \vec{AC}\ \vec{AD}] = 0$

$$\begin{vmatrix} 1 & x-2 & 4 \\ 1 & 0 & -3 \\ 3 & 3 & -2 \end{vmatrix} = 0$$

$1(0+9)-(x-2)(-2+9)+4(3-0)=0$

$9-(x-2)(7)+12=0$

$9-7x+14+12=0$

$-7x+35=0$

$\cancel{-}7x=\cancel{-}35$

$x=5$

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(11) Given $A(1,2,7)$ $B(2,6,3)$ and $C(3,10,-1)$

$\vec{A} = \hat{i}+2\hat{j}+7\hat{k}$ $\vec{B} = 2\hat{i}+6\hat{j}+3\hat{k}$ $\vec{C} = 3\hat{i}+10\hat{j}-\hat{k}$

$$[\vec{A}\ \vec{B}\ \vec{C}] = \begin{vmatrix} 1 & 2 & 7 \\ 2 & 6 & 3 \\ 3 & 10 & -1 \end{vmatrix}$$

$= 1(-6-30)-2(-2-9)+7(20-18)$

$= -36-2(-11)+7(2)$

$= -36+22+14$

$= -36+36 = 0$

Hence A, B and C are coplanar points

(12) Given $\vec{a} = \hat{i}+\hat{j}-\hat{k}$ $\vec{b} = \hat{i}-\hat{j}+\hat{k}$

θ be the angle between $\vec{a}$ and $\vec{b}$

$$\cos\theta = \frac{\vec{a}\cdot\vec{b}}{|\vec{a}|\,|\vec{b}|}$$

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

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

$$\cos\theta = \frac{(\hat{i}+\hat{j}-\hat{k})\cdot(\hat{i}-\hat{j}+\hat{k})}{\sqrt{3}\cdot\sqrt{3}}$$

$$\cos\theta = \frac{\cancel{1}-\cancel{1}-1}{3}$$

$$\cos\theta = -\frac{1}{3}$$

$$\theta = \cos^{-1}\left(\frac{-1}{3}\right)$$

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(13) Same as (9) question

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(14) Given $\vec{a} = \hat{i}-2\hat{j}+3\hat{k}$ $\vec{b} = -2\hat{i}+3\hat{j}-4\hat{k}$ $\vec{c} = \hat{i}-3\hat{j}+5\hat{k}$

$$[\vec{a}\ \vec{b}\ \vec{c}] = \begin{vmatrix} 1 & -2 & 3 \\ -2 & 3 & -4 \\ 1 & -3 & 5 \end{vmatrix}$$

$$= 1(15-12)-(-2)(-10+4)+3(6-3)$$

$$= 3+2(-6)+3(3)$$

$$= 3-12+9$$

$$= 12-12 = 0$$

Hence $\vec{a}$, $\vec{b}$ and $\vec{c}$ are coplanar

(15) Let $\vec{a} = \hat{i}+3\hat{j}+7\hat{k}$ $\vec{b} = 7\hat{i}-\hat{j}+8\hat{k}$

Projection of vector $\vec{a}$ on vector $\vec{b}$

$$= \frac{\vec{a}\cdot\vec{b}}{|\vec{b}|}$$

$$= \frac{(\hat{i}+3\hat{j}+7\hat{k})\cdot(7\hat{i}-\hat{j}+8\hat{k})}{\sqrt{(7)^2+(-1)^2+(8)^2}}$$

$$= \frac{7-3+56}{\sqrt{49+1+64}} = \frac{60}{\sqrt{114}}$$

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(16) Given $(\vec{a}+\vec{b})\cdot(\vec{a}-\vec{b}) = 8$

$$\vec{a}\cdot\vec{a} - \vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{a} - \vec{b}\cdot\vec{b} = 8$$

$$|\vec{a}|^2 - \cancel{\vec{a}\cdot\vec{b}} + \cancel{\vec{a}\cdot\vec{b}} - |\vec{b}|^2 = 8 \qquad [\vec{a}\cdot\vec{b} = \vec{b}\cdot\vec{a}]$$

$$|\vec{a}|^2 - |\vec{b}|^2 = 8 \longrightarrow (1)$$

But $|\vec{a}| = 8|\vec{b}| \longrightarrow (2)$

So eq (1)

$$(8|\vec{b}|)^2 - |\vec{b}|^2 = 8$$

$$64|\vec{b}|^2 - |\vec{b}|^2 = 8$$

$$63|\vec{b}|^2 = 8$$

$$|\vec{b}|^2 = \frac{8}{63}$$

$$|\vec{b}| = \sqrt{\frac{8}{63}} = \frac{2\sqrt{2}}{\sqrt{63}} = \frac{2\sqrt{2}}{3\sqrt{7}}$$

Putting $|\vec{b}|$ in eq (2)

$$|\vec{a}| = 8\left(\frac{2\sqrt{2}}{\sqrt{63}}\right) = \frac{16\sqrt{2}}{\sqrt{63}} = \frac{16\sqrt{2}}{3\sqrt{7}}$$

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(17) Given $\vec{a} = 2\hat{i}+2\hat{j}+3\hat{k}$ $\vec{b} = -\hat{i}+2\hat{j}+\hat{k}$ $\vec{c} = 3\hat{i}+\hat{j}$

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

it is given that $(\vec{a}+\lambda\vec{b}) \perp \vec{c}$

$$(\vec{a}+\lambda\vec{b})\cdot\vec{c} = 0$$
$$[(2-\lambda)\hat{i}+(2+2\lambda)\hat{j}+(3+\lambda)\hat{k}]\cdot[3\hat{i}+\hat{j}] = 0$$
$$3(2-\lambda)+(2+2\lambda)+(3+\lambda)0 = 0$$
$$6-3\lambda+2+2\lambda+0 = 0$$
$$8-\lambda = 0$$
$$\cancel{-}\lambda = \cancel{-}8$$
$$\lambda = 8$$

(18) Let the position vector of the vertices A, B and C be $2\hat{i}-\hat{j}+\hat{k}$, $\hat{i}-3\hat{j}-5\hat{k}$ and $3\hat{i}-4\hat{j}-4\hat{k}$

$\vec{AB}$ = PV of B − PV of A = $\hat{i}-3\hat{j}-5\hat{k}-2\hat{i}+\hat{j}-\hat{k} = -\hat{i}-2\hat{j}-6\hat{k}$

$\vec{BC}$ = PV of C − PV of B = $3\hat{i}-4\hat{j}-4\hat{k}-\hat{i}+3\hat{j}+5\hat{k} = 2\hat{i}-\hat{j}+\hat{k}$

$\vec{CA}$ = PV of A − PV of C = $2\hat{i}-\hat{j}+\hat{k}-3\hat{i}+4\hat{j}+4\hat{k} = -\hat{i}+3\hat{j}+5\hat{k}$

$$\vec{AB}+\vec{BC}+\vec{CA} = \cancel{-\hat{i}}\cancel{-2\hat{j}}\cancel{-6\hat{k}}\cancel{+2\hat{i}}\cancel{-\hat{j}}\cancel{+\hat{k}}\cancel{-\hat{i}}\cancel{+3\hat{j}}\cancel{+5\hat{k}}$$
$$= 0\hat{i}+0\hat{j}+0\hat{k} = 0$$

A, B and C are vertices of ΔABC

Also $\vec{BC}\cdot\vec{CA} = (2\hat{i}-\hat{j}+\hat{k})\cdot(-\hat{i}+3\hat{j}+5\hat{k})$
$$= -2-3+5$$
$$= 5-5 = 0$$
$$\vec{BC} \perp \vec{CA}$$

∴ ABC are the right angled triangle

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