

Question # 1

(i) $\underline{u} = 3\hat{i} + \hat{j} - \hat{k}$, $\underline{v} = 2\hat{i} - \hat{j} + \hat{k}$

$$|\underline{u}| = \sqrt{(3)^2 + (1)^2 + (-1)^2} = \sqrt{9+1+1} = \sqrt{11}$$

$$|\underline{v}| = \sqrt{(2)^2 + (-1)^2 + (1)^2} = \sqrt{4+1+1} = \sqrt{6}$$

$$\underline{u} \cdot \underline{v} = (3\hat{i} + \hat{j} - \hat{k}) \cdot (2\hat{i} - \hat{j} + \hat{k})$$

$$= (3)(2) + (1)(-1) + (-1)(1) = 6 - 1 - 1 = 4$$

Now $\underline{u} \cdot \underline{v} = |\underline{u}| |\underline{v}| \cos q$

$$\Rightarrow \cos q = \frac{\underline{u} \cdot \underline{v}}{|\underline{u}| |\underline{v}|} = \frac{4}{\sqrt{11} \times \sqrt{6}} \Rightarrow \boxed{\cos q = \frac{4}{\sqrt{66}}}$$

(ii) Do yourself as above

(iii) $\underline{u} = [-3, 5] = -3\hat{i} + 5\hat{j}$, $\underline{v} = [6, -2] = 6\hat{i} - 2\hat{j}$

Now do yourself as above

(iv) $\underline{u} = [1, -3, 1] = \hat{i} - 3\hat{j} + \hat{k}$, $\underline{v} = 2\hat{i} + 4\hat{j} + \hat{k}$ Now do yourself as (i)

Question # 2

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

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

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

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

Since $\underline{a} \cdot \underline{b} = |\underline{a}| |\underline{b}| \cos q$

So projection of $\underline{a}$ along $\underline{b} = |\underline{a}| \cos q = \frac{\underline{a} \cdot \underline{b}}{|\underline{b}|} = \frac{-1}{\sqrt{2}}$

Also projection of $\underline{b}$ along $\underline{a} = |\underline{b}| \cos q = \frac{\underline{a} \cdot \underline{b}}{|\underline{a}|} = \frac{-1}{\sqrt{2}}$

(ii) Do yourself as above

Question # 3

(i) Do yourself as (ii) below

(ii) $\underline{u} = a\hat{i} + 2a\hat{j} - \hat{k}$, $\underline{v} = \hat{i} + a\hat{j} + 3\hat{k}$

Since $\underline{u}$ and $\underline{v}$ are perpendicular therefore $\underline{u} \cdot \underline{v} = 0$

$$\Rightarrow (a\hat{i} + 2a\hat{j} - \hat{k}) \cdot (\hat{i} + a\hat{j} + 3\hat{k}) = 0$$

$$\Rightarrow (a)(1) + (2a)(a) + (-1)(3) = 0$$

$$\Rightarrow a + 2a^2 - 3 = 0 \Rightarrow 2a^2 + a - 3 = 0$$

$$\Rightarrow 2a^2 + 3a - 2a - 3 = 0 \Rightarrow a(2a + 3) - 1(2a + 3) = 0$$

$$\Rightarrow (2a + 3)(a - 1) = 0$$

$$\Rightarrow 2a + 3 = 0 \quad \text{or} \quad a - 1 = 0$$

$$\Rightarrow a = -\frac{3}{2} \quad \text{or} \quad a = 1$$

Question # 4

Given vertices: $A(1, -1, 0)$, $B(-2, 2, 1)$ and $C(0, 2, z)$

$$\overrightarrow{CA} = (1-0)\hat{i} + (-1-2)\hat{j} + (0-z)\hat{k} = \hat{i} - 3\hat{j} - z\hat{k}$$

$$\overrightarrow{CB} = (-2-0)\hat{i} + (2-2)\hat{j} + (1-z)\hat{k} = -2\hat{i} + (1-z)\hat{k}$$

Now $\overrightarrow{CA}$ is $\perp$ to $\overrightarrow{CB}$ therefore $\overrightarrow{CA} \cdot \overrightarrow{CB} = 0$

$$\Rightarrow (\hat{i} - 3\hat{j} - z\hat{k}) \cdot (-2\hat{i} + (1-z)\hat{k}) = 0$$

$$\Rightarrow (1)(-2) + (-3)(0) + (-z)(1-z) = 0$$

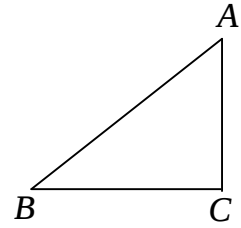
$$\Rightarrow -2 + 0 - z + z^2 = 0 \Rightarrow z^2 - z - 2 = 0$$

$$\Rightarrow z^2 - 2z + z - 2 = 0 \Rightarrow z(z-2) + 1(z-2) = 0$$

$$\Rightarrow (z-2)(z+1) = 0$$

$$\Rightarrow z-2=0 \quad \text{or} \quad z+1=0$$

$$\Rightarrow z=2 \quad \text{or} \quad z=-1$$

**Question # 5**

Suppose $\underline{v} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$

$$\text{Since } \underline{v} \cdot \hat{i} = 0 \Rightarrow (a_1\hat{i} + a_2\hat{j} + a_3\hat{k}) \cdot \hat{i} = 0$$

$$\Rightarrow a_1\hat{i} \cdot \hat{i} + a_2\hat{j} \cdot \hat{i} + a_3\hat{k} \cdot \hat{i} = 0$$

$$\Rightarrow a_1(1) + a_2(0) + a_3(0) = 0 \Rightarrow a_1 = 0$$

$$\text{Also } \underline{v} \cdot \hat{j} = 0 \Rightarrow (a_1\hat{i} + a_2\hat{j} + a_3\hat{k}) \cdot \hat{j} = 0$$

$$\Rightarrow a_1\hat{i} \cdot \hat{j} + a_2\hat{j} \cdot \hat{j} + a_3\hat{k} \cdot \hat{j} = 0$$

$$\Rightarrow a_1(0) + a_2(1) + a_3(0) = 0 \Rightarrow a_2 = 0$$

$$\text{Also } \underline{v} \cdot \hat{k} = 0 \Rightarrow (a_1\hat{i} + a_2\hat{j} + a_3\hat{k}) \cdot \hat{k} = 0$$

$$\Rightarrow a_1\hat{i} \cdot \hat{k} + a_2\hat{j} \cdot \hat{k} + a_3\hat{k} \cdot \hat{k} = 0$$

$$\Rightarrow a_1(0) + a_2(0) + a_3(1) = 0 \Rightarrow a_3 = 0$$

Hence

$$\underline{v} = (0)\hat{i} + (0)\hat{j} + (0)\hat{k} = 0$$

Question # 6 (i)

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

$$\text{Now } \underline{b} + \underline{c} = \hat{i} - 3\hat{j} + 5\hat{k} + 2\hat{i} + \hat{j} - 4\hat{k}$$

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

Hence $\underline{a}$, $\underline{b}$ and $\underline{c}$ form a triangle.

$$\text{Now } \underline{a} \cdot \underline{b} = (3\hat{i} - 2\hat{j} + \hat{k}) \cdot (\hat{i} - 3\hat{j} + 5\hat{k})$$

$$= (3)(1) + (-2)(-3) + (1)(5) = 4 + 6 + 5 = 15$$

$$\underline{b} \cdot \underline{c} = (\hat{i} - 3\hat{j} + 5\hat{k}) \cdot (2\hat{i} + \hat{j} - 4\hat{k})$$

$$= (1)(2) + (-3)(1) + (5)(-4) = 2 - 3 - 20 = -21$$

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

$$= (2)(3) + (1)(-2) + (-4)(1) = 6 - 2 - 4 = 0$$

Since $\underline{c} \cdot \underline{a} = 0$ therefore $\underline{c} \perp \underline{a}$

Hence $\underline{a}$, $\underline{b}$ and $\underline{c}$ represents sides of right triangle.

Question # 6(ii)

Given: $P(1,3,2)$, $Q(4,1,4)$ and $R(6,5,5)$

$$\overrightarrow{PQ} = (4-1)\hat{i} + (1-3)\hat{j} + (4-2)\hat{k} = 3\hat{i} - 2\hat{j} + 2\hat{k}$$

$$\overrightarrow{QR} = (6-4)\hat{i} + (5-1)\hat{j} + (5-4)\hat{k} = 2\hat{i} + 4\hat{j} + \hat{k}$$

$$\overrightarrow{RP} = (1-6)\hat{i} + (3-5)\hat{j} + (2-5)\hat{k} = -5\hat{i} - 2\hat{j} - 3\hat{k}$$

Now

$$\overrightarrow{PQ} + \overrightarrow{QR} + \overrightarrow{RP}$$

$$= 3\hat{i} - 2\hat{j} + 2\hat{k} + 2\hat{i} + 4\hat{j} + \hat{k} - 5\hat{i} - 2\hat{j} - 3\hat{k} = 0$$

Hence P, Q and R are vertices of triangle.

Now

$$\begin{aligned}\overrightarrow{PQ} \cdot \overrightarrow{QR} &= (3\hat{i} - 2\hat{j} + 2\hat{k}) \cdot (2\hat{i} + 4\hat{j} + \hat{k}) \\ &= (3)(2) + (-2)(4) + (2)(1) = 6 - 8 + 2 = 0\end{aligned}$$

$$\Rightarrow \overrightarrow{PQ} \perp \overrightarrow{QR}$$

Hence P, Q and R are vertices of right triangle.

Question # 7

Suppose a right triangle OAB . Let C be a midpoint of hypotenuse AB , then

$$\overrightarrow{CA} = -\overrightarrow{CB} \Rightarrow |\overrightarrow{CA}| = |\overrightarrow{CB}| \dots\dots\dots (i)$$

$$\text{Now } \overrightarrow{OA} = \overrightarrow{OC} + \overrightarrow{CA}$$

$$\overrightarrow{OB} = \overrightarrow{OC} + \overrightarrow{CB}$$

Since $\overrightarrow{OA} \perp \overrightarrow{OB}$ therefore $\overrightarrow{OA} \cdot \overrightarrow{OB} = 0$

$$\Rightarrow (\overrightarrow{OC} + \overrightarrow{CA}) \cdot (\overrightarrow{OC} + \overrightarrow{CB}) = 0$$

$$\Rightarrow (\overrightarrow{OC} - \overrightarrow{CB}) \cdot (\overrightarrow{OC} + \overrightarrow{CB}) = 0 \quad \because \overrightarrow{CA} = -\overrightarrow{CB}$$

$$\Rightarrow \overrightarrow{OC} \cdot (\overrightarrow{OC} + \overrightarrow{CB}) - \overrightarrow{CB} \cdot (\overrightarrow{OC} + \overrightarrow{CB}) = 0$$

$$\Rightarrow \overrightarrow{OC} \cdot \overrightarrow{OC} + \overrightarrow{OC} \cdot \overrightarrow{CB} - \overrightarrow{CB} \cdot \overrightarrow{OC} - \overrightarrow{CB} \cdot \overrightarrow{CB} = 0$$

$$\Rightarrow |\overrightarrow{OC}|^2 + \overrightarrow{OC} \cdot \overrightarrow{CB} - \overrightarrow{OC} \cdot \overrightarrow{CB} - |\overrightarrow{CB}|^2 = 0 \quad \because \overrightarrow{OC} \cdot \overrightarrow{CB} = \overrightarrow{CB} \cdot \overrightarrow{OC}$$

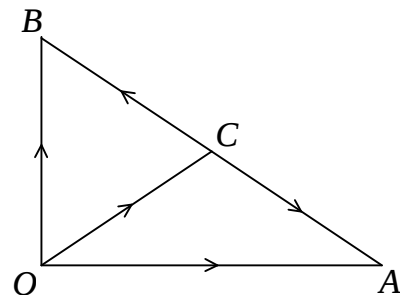
$$\Rightarrow |\overrightarrow{OC}|^2 - |\overrightarrow{CB}|^2 = 0$$

$$\Rightarrow |\overrightarrow{OC}|^2 = |\overrightarrow{CB}|^2 \Rightarrow |\overrightarrow{OC}| = |\overrightarrow{CB}| \dots\dots\dots (ii)$$

Combining (i) and (ii), we have

$$|\overrightarrow{OC}| = |\overrightarrow{CA}| = |\overrightarrow{CB}|$$

Hence midpoint of hypotenuse of right triangle is equidistant from its vertices.

**Question # 8**

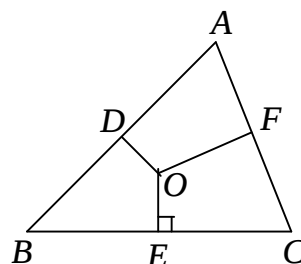
Let A, B and C be a vertices of a triangle having position vectors $\underline{a}$, $\underline{b}$ and $\underline{c}$ respectively.

Also consider D, E and F are midpoints of sides $\overline{AB}$, $\overline{BC}$ and $\overline{CA}$, then

$$\text{p.v of } D = \overrightarrow{OD} = \frac{\underline{a} + \underline{b}}{2}$$

$$\text{p.v of } E = \overrightarrow{OE} = \frac{\underline{b} + \underline{c}}{2}$$

$$\text{p.v of } F = \overrightarrow{OF} = \frac{\underline{c} + \underline{a}}{2}$$



Let right bisector on $\overline{AB}$ and $\overline{BC}$ intersect at point O , which is an origin.

Since $\overrightarrow{OD}$ is $\perp$ to $\overline{AB}$

Therefore $\overrightarrow{OD} \cdot \overline{AB} = 0$

$$\begin{aligned} \Rightarrow \left(\frac{\underline{a} + \underline{b}}{2} \right) \cdot (\underline{b} - \underline{a}) &= 0 \Rightarrow \frac{1}{2}(\underline{b} + \underline{a}) \cdot (\underline{b} - \underline{a}) = 0 \\ \Rightarrow (\underline{b} + \underline{a}) \cdot (\underline{b} - \underline{a}) &= 0 \Rightarrow \underline{a} \cdot (\underline{b} - \underline{a}) + \underline{b} \cdot (\underline{b} - \underline{a}) = 0 \\ \Rightarrow \underline{a} \cdot \underline{b} - \underline{a} \cdot \underline{a} + \underline{b} \cdot \underline{b} - \underline{b} \cdot \underline{a} &= 0 \\ \Rightarrow \underline{a} \cdot \underline{b} - |\underline{a}|^2 + |\underline{b}|^2 - \underline{a} \cdot \underline{b} &= 0 \quad \because \underline{a} \cdot \underline{b} = \underline{b} \cdot \underline{a} \\ \Rightarrow |\underline{b}|^2 - |\underline{a}|^2 &= 0 \dots\dots\dots (i) \end{aligned}$$

Also $\overrightarrow{OE}$ is $\perp$ to $\overline{BC}$

$$\text{Therefore } \overrightarrow{OE} \cdot \overline{BC} = 0 \Rightarrow \left(\frac{\underline{b} + \underline{c}}{2} \right) \cdot (\underline{c} - \underline{b}) = 0$$

Similarly solving as above, we get

$$|\underline{c}|^2 - |\underline{b}|^2 = 0 \dots\dots\dots (ii)$$

Adding (i) and (ii), we have

$$\begin{aligned} |\underline{b}|^2 - |\underline{a}|^2 + |\underline{c}|^2 - |\underline{b}|^2 &= 0 + 0 \\ \Rightarrow |\underline{c}|^2 - |\underline{a}|^2 &= 0 \\ \Rightarrow (\underline{c} + \underline{a}) \cdot (\underline{c} - \underline{a}) &= 0 \\ \Rightarrow \left(\frac{\underline{c} + \underline{a}}{2} \right) \cdot (\underline{c} - \underline{a}) &= 0 \\ \Rightarrow \overrightarrow{OF} \cdot \overline{AC} &= 0 \Rightarrow \overrightarrow{OF} \text{ is } \perp \text{ to } \overline{AC} \end{aligned}$$

i.e. $\overrightarrow{OF}$ is also right bisector of $\overline{AC}$.

Hence perpendicular bisector of the sides of the triangle are concurrent.

Question # 9

Consider A, B and C are vertices of triangle having position vectors $\underline{a}, \underline{b}$ and $\underline{c}$ respectively. Let altitude on $\overline{AB}$ and $\overline{BC}$ intersect at origin $O(0,0)$.

Since $\overrightarrow{OC}$ is perpendicular to $\overline{AB}$

$$\begin{aligned} \Rightarrow \overrightarrow{OC} \cdot \overline{AB} &= 0 \\ \Rightarrow \underline{c} \cdot (\underline{b} - \underline{a}) &= 0 \\ \Rightarrow \underline{c} \cdot \underline{b} - \underline{c} \cdot \underline{a} &= 0 \dots\dots\dots (i) \end{aligned}$$

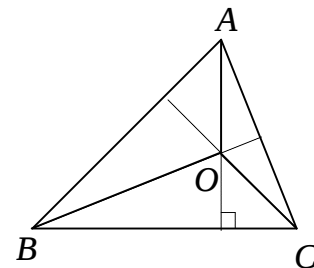
Also $\overrightarrow{OA}$ is perpendicular to $\overline{BC}$

$$\begin{aligned} \Rightarrow \overrightarrow{OA} \cdot \overline{BC} &= 0 \\ \Rightarrow \underline{a} \cdot (\underline{c} - \underline{b}) &= 0 \\ \Rightarrow \underline{a} \cdot \underline{c} - \underline{a} \cdot \underline{b} &= 0 \dots\dots\dots (ii) \end{aligned}$$

Adding (i) and (ii)

$$\begin{aligned} \underline{c} \cdot \underline{b} - \underline{c} \cdot \underline{a} + \underline{a} \cdot \underline{c} - \underline{a} \cdot \underline{b} &= 0 + 0 \\ \Rightarrow \underline{c} \cdot \underline{b} - \underline{c} \cdot \underline{a} + \underline{c} \cdot \underline{a} - \underline{a} \cdot \underline{b} &= 0 \quad \because \underline{a} \cdot \underline{c} = \underline{c} \cdot \underline{a} \\ \Rightarrow \underline{c} \cdot \underline{b} - \underline{a} \cdot \underline{b} &= 0 \\ \Rightarrow (\underline{c} - \underline{a}) \cdot \underline{b} &= 0 \\ \Rightarrow \overrightarrow{AC} \cdot \overrightarrow{OB} &= 0 \quad \because \overrightarrow{AC} = \underline{c} - \underline{a} \\ \Rightarrow \overrightarrow{AC} &\text{ is perpendicular to } \overrightarrow{OB}. \end{aligned}$$

Hence altitude of the triangle are concurrent.



Question # 10

Consider a semicircle having centre at origin $O(0,0)$ and A, B are end points of diameter having position vectors $\underline{a}, -\underline{a}$ respectively. Let C be any point on a circle having position vector $\underline{c}$.

Clearly radius of semicircle $= |\underline{a}| = |-\underline{a}| = |\underline{c}|$

Now $\overrightarrow{AC} = \underline{c} - \underline{a}$

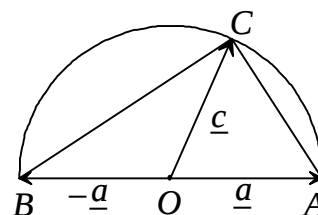
$\overrightarrow{BC} = \underline{c} - (-\underline{a}) = \underline{c} + \underline{a}$

Consider

$$\begin{aligned}\overrightarrow{AC} \cdot \overrightarrow{BC} &= (\underline{c} - \underline{a}) \cdot (\underline{c} + \underline{a}) \\ &= \underline{c} \cdot (\underline{c} + \underline{a}) - \underline{a} \cdot (\underline{c} + \underline{a}) \\ &= \underline{c} \cdot \underline{c} + \underline{c} \cdot \underline{a} - \underline{a} \cdot \underline{c} - \underline{a} \cdot \underline{a} \\ &= |\underline{c}|^2 + \underline{a} \cdot \underline{c} - \underline{a} \cdot \underline{c} + |\underline{a}|^2 \quad \because \underline{a} \cdot \underline{c} = \underline{c} \cdot \underline{a} \\ &= |\underline{c}|^2 - |\underline{a}|^2 \\ &= |\underline{c}|^2 - |\underline{c}|^2 = 0 \quad \because |\underline{a}| = |\underline{c}|\end{aligned}$$

This show $\overrightarrow{AC}$ is $\perp$ to $\overrightarrow{BC}$ i.e. $\angle ACB = 90^\circ$

Hence angle in a semi circle is a right angle.

**Question # 11**

Consider two unit vectors $\underline{\hat{a}}$ and $\underline{\hat{b}}$ making angle a and $-b$ with +ive x -axis.

Then $\underline{\hat{a}} = OA = \cos a \underline{\hat{i}} + \sin a \underline{\hat{j}}$

and $\underline{\hat{b}} = OB = \cos(-b) \underline{\hat{i}} + \sin(-b) \underline{\hat{j}}$
 $= \cos b \underline{\hat{i}} - \sin b \underline{\hat{j}}$

Now

$$\underline{\hat{a}} \cdot \underline{\hat{b}} = (\cos a \underline{\hat{i}} + \sin a \underline{\hat{j}}) \cdot (\cos b \underline{\hat{i}} - \sin b \underline{\hat{j}})$$

$$\Rightarrow \underline{\hat{a}} \cdot \underline{\hat{b}} = \cos a \cos b - \sin a \sin b \quad \dots\dots\dots(i)$$

But we have $\angle AOB = a + b$

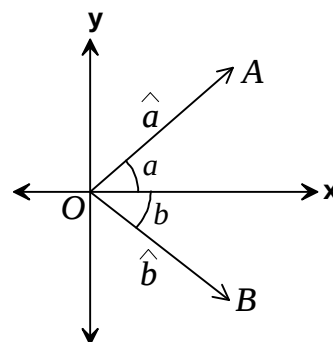
$$\Rightarrow \underline{\hat{a}} \cdot \underline{\hat{b}} = |\underline{\hat{a}}| |\underline{\hat{b}}| \cos(a + b)$$

$$= (1)(1) \cos(a + b) \quad \because |\underline{\hat{a}}| = |\underline{\hat{b}}| = 1$$

$$\Rightarrow \underline{\hat{a}} \cdot \underline{\hat{b}} = \cos(a + b) \quad \dots\dots\dots(ii)$$

Comparing (i) and (ii), we have

$$\cos(a + b) = \cos a \cos b - \sin a \sin b$$

**Question # 12**

Consider $\underline{a}, \underline{b}$ and $\underline{c}$ are vectors along the sides of triangle BC, CA and AB ,

also let $|\underline{a}| = a$, $|\underline{b}| = b$ and $|\underline{c}| = c$

then form triangle,

$$\underline{a} + \underline{b} + \underline{c} = 0 \quad \dots\dots\dots(i)$$

$$(i) \Rightarrow \underline{b} = -\underline{a} - \underline{c}$$

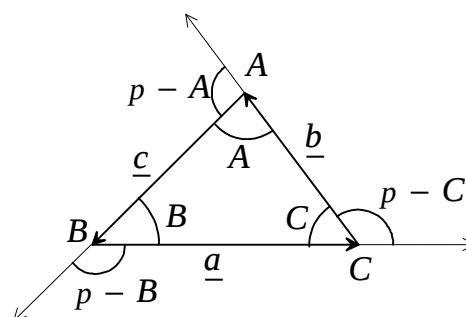
Taking dot product of above with $\underline{b}$, we have

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

$$|\underline{b}|^2 = -\underline{a} \cdot \underline{b} - \underline{c} \cdot \underline{b}$$

$$= -|\underline{a}| |\underline{b}| \cos(p - C) - |\underline{c}| |\underline{b}| \cos(p - A)$$

$$= |\underline{a}| |\underline{b}| \cos C + |\underline{c}| |\underline{b}| \cos A \quad \because \cos(p - B) = -\cos B$$



$$\Rightarrow b^2 = ab \cos C + cb \cos A$$

$$\Rightarrow b = a \cos C + c \cos A \quad \div \text{ing by } b$$

(ii) From equation (i)

$$\underline{c} = -\underline{a} - \underline{b}$$

Taking dot product of above equation with $\underline{c}$.

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

Now do yourself as above.

(iii) From equation (i)

$$\underline{b} = -\underline{a} - \underline{c}$$

Taking dot product of above equation with $\underline{b}$

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

$$= (-\underline{a} - \underline{c}) \cdot (-\underline{a} - \underline{c}) \quad \because \underline{b} = -\underline{a} - \underline{c}$$

$$|\underline{b}|^2 = -\underline{a} \cdot (-\underline{a} - \underline{c}) - \underline{c} \cdot (-\underline{a} - \underline{c})$$

$$= \underline{a} \cdot \underline{a} + \underline{a} \cdot \underline{c} + \underline{c} \cdot \underline{a} + \underline{c} \cdot \underline{c}$$

$$= \underline{a} \cdot \underline{a} + \underline{a} \cdot \underline{c} + \underline{a} \cdot \underline{c} + \underline{c} \cdot \underline{c} \quad \because \underline{a} \cdot \underline{b} = \underline{b} \cdot \underline{a}$$

$$= \underline{a} \cdot \underline{a} + 2\underline{a} \cdot \underline{c} + \underline{c} \cdot \underline{c}$$

$$= |\underline{a}|^2 + 2|\underline{a}||\underline{c}|\cos(p - B) + |\underline{c}|^2$$

$$\Rightarrow b^2 = a^2 + ac(-\cos B) + c^2 \quad \because \cos(p - B) = -\cos B$$

Hence
$$b^2 = c^2 + a^2 - 2ca \cos B$$

(iv) From equation (i)

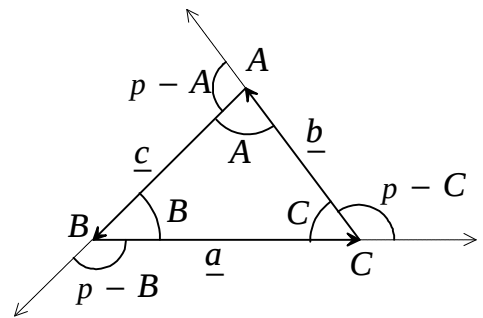
$$\underline{c} = -\underline{a} - \underline{b}$$

Taking dot product of above equation with $\underline{c}$

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

$$= (-\underline{a} - \underline{b}) \cdot (-\underline{a} - \underline{b}) \quad \because \underline{c} = -\underline{a} - \underline{b}$$

Now do yourself as above (iii)



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