CHAPTER-10
VECTORS
01 MARK TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	If points A (60 î+ 3 ĵ), (40 î– 8 ĵ) and C (aî- 52ĵ) are collinear, then ‘a’ is equal to a) 40 b) -40 c) 20 d) -20	1
2.	The value of î. (ĵx k̂) + ĵ. (îx k̂) + k̂. (îx ĵ) is a) 0 b) -1 c) 1 d) 3	1
3.	If $\|\vec{a}\| = 2$, $\|\vec{b}\| = 5$ and $\|\vec{a} \times \vec{b}\| = 8$, find $\vec{a} \cdot \vec{b}$ a) 6 b)1 c)7 d)0	1
4.	Find the area of the ||gm whose adjacent sides are represented by the vectors $\vec{a}$ = 3 î+ ĵ-2 k̂ , $\vec{b}$ = î-3 ĵ+4 k̂ a)10 b) 10√3 c)8 d)12	1
5.	$\vec{a}$ is a unit vector and $(\vec{x} - \vec{a})(\vec{x} + \vec{a}) = 8$, then find $\|\vec{x}\|$ a)2 b)5 c)3 d)1	1
6.	If $\|\vec{a} \times \vec{b}\| = 4$, $\|\vec{a} \cdot \vec{b}\| = 2$, then $\|\vec{a}\|$ 2 $\|\vec{b}\|$ 2 is a) 6 b) 2 c) 20 d) 8	1
7.	If $\|\vec{a}\| = 2$, $\|\vec{b}\| = 7$ and $\vec{a} \times \vec{b}$ = 3 î + 2ĵ+ 6k̂ , find the angle between $\vec{a}$ and $\vec{b}$ a) π/6 b) π c) 0 d) none	1
8.	Find a vector of magnitude 3√2 units which makes an angle of π/4, π/2 with y and z-axes, respectively. a) ± 3î+ 3ĵ b) 3î- 3ĵ c) ± 5î+ 3ĵ d) none	1
9.	If points A (60 î+ 3 ĵ), (40 î– 8 ĵ) and C (aî- 52ĵ) are collinear, then ‘a’ is equal to a) 40 b) -40 c) 20 d) -20	1
10.	If $\vec{a}$ = 2 î+ 2 ĵ+3 k̂ , $\vec{b}$ = - î+ 2 ĵ+ k̂ , $\vec{c}$ = 3 î+ ĵ are such that $\vec{a} + \lambda \vec{b}$ is perpendicular to $\vec{c}$,then find the value of λ. a)9 b)8 c)5 d)1	1
11.	Let $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} + c\hat{k}$. The value of c if $\|\vec{a}\| = 5$ is (a)0 (b)$2\sqrt{3}$ (c) 1 (d)12	1
12.	If $\vec{a} = (2\hat{\imath} - 4\hat{\jmath} + 5\hat{k})$ then the value of h so that h$\vec{a}$ may be unit vector is (a)$\frac{1}{5}$ (b)$\frac{1}{\sqrt{3}}$ (c)$\frac{1}{3\sqrt{5}}$ (d)$\frac{1}{5\sqrt{3}}$	1
13.	If $\overrightarrow{AB} = (2\hat{\imath} + \hat{\jmath} - 3\hat{k})$ and A(1,2,-1) is the given point, then the coordinates of B are (a) (3,-3,4) (b) (3,3,4) (c) (-3,-3,-4) (d) (3,3,-4)	1
14.	If $\|\vec{a} \times \vec{b}\| = 4$, $\vec{a}.\vec{b} = 2$, then $\|\vec{a}\|^2\|\vec{b}\|^2 =$ (a)6 (b)20 (c)8 (d)2	1
15.	If $\vec{a}$ is any vector, then $\vec{a}.\vec{a}$ is (a)0 (b)≠0 (c)$\vec{0}$ (d) $\|\vec{a}\|^2$	1
16.	If $\vec{a}$ and $\vec{b}$ are two vectors of magnitude 3 and $\frac{2}{3}$ respectively such that $\vec{a}\times\vec{b}$ is a unit vector, then the angle between $\vec{a}$ and $\vec{b}$ is (a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{6}$ (d) $\frac{\pi}{8}$	1
17.	A vector of magnitude 9 units in the direction of the vector $(-2\hat{\imath}+\hat{\jmath}+2\hat{k})$ is	1

	(a)$(-3\hat{\imath}+6\hat{\jmath}+6\hat{k})$ (b)$(-6\hat{\imath}+3\hat{\jmath}+3\hat{k})$ (c)$(-6\hat{\imath}+3\hat{\jmath}+6\hat{k})$ (d)$(6\hat{\imath}+6\hat{\jmath}-3\hat{k})$	
18.	The value of $\hat{\imath}.(\hat{\jmath}\times\hat{k})+\hat{\jmath}.(\hat{\imath}\times\hat{k})+\hat{k}.(\hat{\imath}\times\hat{\jmath})$ is (a)-1 (b) 1 (c) -2 (d) 2	1
19.	If $\lvert\vec{a}\times\vec{b}\rvert^2+\lvert\vec{a}.\vec{b}\rvert^2=144$ and $\lvert\vec{a}\rvert=4$, then $\lvert\vec{b}\rvert$ is equal to (a)1 (b)2 (c)3 (d)4	1
20.	If $\vec{a}$ and $\vec{b}$ are two collinear vectors, then which of the following is incorrect? (a) $\vec{b}$ = h$\vec{a}$, for som scalar h (b) $\vec{a}=\pm\vec{b}$ (c)the respective components of $\vec{a}$ and $\vec{b}$ are proportional (d)both the vector $\vec{a}$ and $\vec{b}$ have same direction, but different magnitudes.	1
21.	The vector in the direction of the vector $\vec{a}=\hat{\imath}-\hat{2\jmath}+2\hat{k}$ that has a magnitude 9 is: (a) $\hat{\imath}-\hat{2\jmath}+2\hat{k}$ (b)$\frac{1}{3}(\hat{\imath}-\hat{2\jmath}+2\hat{k})$ (c) $3(\hat{\imath}-\hat{2\jmath}+2\hat{k})$ (d)$9\ \hat{\imath}-\hat{2\jmath}+2\hat{k}$	1
22.	The position vectors of the points *A*, *B*, *C* are $2\hat{\imath}+\hat{\jmath}-\hat{k}, 3\hat{\imath}-2\hat{\jmath}+\hat{k}\ and\ \hat{\imath}+4\hat{\jmath}-3\hat{k}$ respectively. These points : (a) form an isosceles triangle (b) form a right triangle (c) are collinear (d) form a scalene triangle	1
23.	The projection of the vector $\vec{a}=2\hat{\imath}-\hat{\jmath}+\hat{k}$ on $\vec{b}=\hat{\imath}-2\hat{\jmath}+\hat{k}$ is: (a) $\frac{\sqrt{5}}{2}$ (b) $\frac{5}{\sqrt{2}}$ (c) $\frac{\sqrt{5}}{6}$ (d) $\frac{\sqrt{6}}{5}$	1
24.	If θ is the angle between any two vectors $\vec{a}\ and\ \vec{b}$, then $\lvert\vec{a}\times\vec{b}\rvert=\lvert\vec{a}.\vec{b}\rvert$ when θ is: (a) $\frac{\pi}{3}$ (b)$\frac{\pi}{4}$ (c) $\frac{2\pi}{3}$ (d) none of these	1
25.	If $\hat{a},\hat{b},\hat{c}$ are mutually perpendicular unit vectors, then value of $\lvert\hat{a}+\hat{b}+\hat{c}\rvert$ is: (a) 1 (b) $\sqrt{2}$ (c) $\sqrt{3}$ (d) 2	1
26.	The vector $\vec{b}$ =3$\hat{\imath}$+4$\hat{k}$ is to be written as the sum of a vector α parallel to $\vec{a}=\hat{\imath}+\hat{\jmath}$ and a vector $\vec{\beta}$ perpendicular to $\vec{a}$. Then $\vec{\alpha}$ is: (a) $\frac{3}{2}(\hat{\imath}+\hat{\jmath})$ (b)$\frac{2}{3}(\hat{\imath}+\hat{\jmath})$ (c)$\frac{1}{2}(\hat{\imath}+\hat{\jmath})$ (d) $\frac{1}{3}(\hat{\imath}+\hat{\jmath})$	1
27.	If the position vectors of *P* and *Q* are $\hat{\imath}+3\hat{\jmath}-7\hat{k}\ and\ 5\hat{\imath}-2\hat{\jmath}+4\hat{k}$ then cosine of the angle between $\overrightarrow{PQ}$ and y-axis is: (a)$\frac{5}{\sqrt{162}}$ (b) $\frac{4}{\sqrt{162}}$ (c) $\frac{11}{\sqrt{162}}$ (d) $-\frac{5}{\sqrt{162}}$	1
28.	$\vec{a}$ and $\vec{b}$ are two unit vectors and θ is the angle between them then $cos\frac{\theta}{2}=$ (a)$\frac{1}{2}\lvert\vec{a}+\vec{b}\rvert$ (b) $\lvert\vec{a}+\vec{b}\rvert$ c) $\lvert\vec{a}-\vec{b}\rvert$ (d) $\frac{1}{2}\lvert\vec{a}-\vec{b}\rvert$	1
29.	$\vec{a},\vec{b}$, and $\vec{c}$ are three unit vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, then $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}=$ 3 (b) $-\frac{3}{2}$ (c) $\frac{3}{2}$ (d) 3	1
30.	**In the following questions, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choice as follows:** **a) Assertion and reason both are correct statements and reason is correct explanation for assertion.** **b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.** **c) Assertion is correct statement but reason is wrong statement.** **d) Assertion is wrong statement but reason is correct statement.**	1

	Assertion(A): The area of parallelogram with diagonals $\vec{a}$ and $\vec{b}$ is $\lvert\vec{a} \times \vec{b}\rvert$. **Reason(R):** If $\vec{a}$ and $\vec{b}$ represent the adjacent sides of a triangle, then the area of a triangle, then the area of triangle can be obtained by evaluating $\lvert\vec{a} \times \vec{b}\rvert$.	
31.	Classify the following as scalar and vectors: (i) 20 kg weight (ii) $50m/s^2$.	1
32.	Find the position vector of the point which divides the join of the points $2\vec{a} - 3\vec{b}$ and $3\vec{a} - 2\vec{b}$ internally.	1
33.	Let $\vec{a} = \hat{\imath} + 2\hat{\jmath}$and $\vec{b} = 2\hat{\imath} + \hat{\jmath}$. Is $\lvert\vec{a}\rvert = \lvert\vec{b}\rvert$? Are the vectors equal ?	1
34.	Find the projection of the vector $7\hat{\imath} + \hat{\jmath} - 4\hat{k}$on $2\hat{\imath} + 6\hat{\jmath} + 3\hat{k}$.	1
35.	Find the value of p for which the vectors $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + 9\hat{k}$ and $\vec{b} = \hat{\imath} + p\hat{\jmath} + 3\hat{k}$ are (i) Perpendicular (ii) Parallel	1
36.	Find the angle between two vectors $\vec{a}$ *and* $\vec{b}$ having the same length $\sqrt{2}$ and their scalar product is -1.	1
37.	If $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$, find the value of $(\vec{r} \times \hat{\imath}).(\vec{r} \times \hat{\jmath}) + xy$.	1
38.	Find a unit vector perpendicular to both the vectors $\hat{\imath} - 2\hat{\jmath} + 3\hat{k}$ and $\hat{\imath} + 2\hat{\jmath} - \hat{k}$.	1
39.	If $\vec{a} = \hat{\imath} + 3\hat{\jmath} - 2\hat{k}$ and $\vec{b} = -\hat{\imath} + 3\hat{k}$ then find $\lvert\vec{a} \times \vec{b}\rvert$.	1
40.	Find $\hat{\imath}.\hat{\imath}, \hat{\jmath}.\hat{\jmath}, and\ \hat{k}.\hat{k}$ also find $\hat{\imath} \times \hat{\imath}, \hat{\jmath} \times \hat{\jmath}\ and\ \hat{k} \times \hat{k}$	1
41.	The value of expression $\lvert\vec{a} \times \vec{b}\rvert^2 + (\vec{a}.\vec{b})^2$ is (a)$\vec{a}.\vec{b}$ (b) $\lvert\vec{a}\rvert.\lvert\vec{b}\rvert$ (c) $\lvert\vec{a}\rvert^2\lvert\vec{b}\rvert^2$ (d) $(\vec{a}.\vec{b})$	1
42.	If is any non zero vector then $(\vec{a}.\hat{\imath})\hat{\imath} + (\vec{a}.\hat{\jmath})\hat{\jmath} + (\vec{a}.\hat{k})\hat{k}$ is equal to (a) $\vec{a}.\vec{b}$ (b) $\vec{a}$ (c) 0 (d) None of these	1
43.	The vector in the direction of the vector $(\hat{\imath} - 2\hat{\jmath} + 2\hat{k})$ has the magnitude 9 is (a) $(\hat{\imath} - 2\hat{\jmath} + 2\hat{k})$ (b) $\frac{\hat{\imath}-2\hat{\jmath}+2\hat{k}}{3}$ (c) $3(\hat{\imath} - 2\hat{\jmath} + 2\hat{k})$ (d) $9(\hat{\imath} - 2\hat{\jmath} + 2\hat{k})$	1
44.	The direction cosine of vector $\overrightarrow{BA}$,where the coordinates of A and B are (1,2,-1) and (3,4,0) respectively, are (a) -2,-2,-1 (b) $-\frac{2}{3}, -\frac{2}{3}, -\frac{1}{3}$ (c) 2,2,1 (d) $\frac{2}{3}, \frac{2}{3}, \frac{1}{3}$	1
45.	Angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitude $\sqrt{3}$ and 4 respectively and $\vec{a}.\vec{b} = 2\sqrt{3}$ is (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{2}$ (d) $\frac{5\pi}{2}$	1
46.	The value of p for which the vectors $2\hat{\imath} + p\hat{\jmath} + \hat{k}$ and $-4\hat{\imath} - 6\hat{\jmath} + 26\hat{k}$ are perpendicular to each other, is (a) 3 (b) -3 (c) $\frac{-17}{3}$ (d) $\frac{17}{3}$	1
47.	Two vectors $\vec{a}$ =A $\hat{\imath} + B\hat{\jmath} + C\hat{k}$ and $\vec{b}$=L$\hat{\imath} + M\hat{\jmath} + N\hat{k}$ are collinear if	1

	(a) AL + BM + CN= 0 (b) $\frac{A}{L} = \frac{B}{M} = \frac{C}{N}$ (c) A=L ,B=M , C=N (d) None of these	
48.	The value of $(\hat{\imath} \times \hat{\jmath}) \cdot \hat{\jmath} + (\hat{\jmath} \times \hat{\imath}) \cdot \hat{k}$ is (a) 2 (b) 0 (c) 1 (d) -1	1
49.	If $\mid \vec{a} \mid = 4$ and $-3 \leq \delta \leq 2$ then the range of $\mid \delta\vec{a} \mid$ is (a) $[0 , 8]$ (b) $[-12 , 8]$ (c) $[0 , 12]$ (d) $[8 , 12]$	1
50.	In $\Delta ABC, \overrightarrow{AB} = \hat{\imath} + \hat{\jmath} + 2\hat{k}$ and $\overrightarrow{AC} = 3\hat{\imath} - \hat{\jmath} + 4\hat{k}$ .If D is mid- point of BC ,then , $\overrightarrow{AD}$ is equal to (a) $4\hat{\imath} + 6\hat{k}$ (b) $2\hat{\imath} - 2\hat{\jmath} + 2\hat{k}$ (c) $\hat{\imath} - \hat{\jmath} + \hat{k}$ (d) $2\hat{\imath} + 3\hat{k}$	1

ANSWERS:

Q. NO	ANSWER	MARKS
1.	b	**1**
2.	d	**1**
3.	a	**1**
4.	b	**1**
5.	c	**1**
6.	c	**1**
7.	a	**1**
8.	a	**1**
9.	b	**1**
10.	b	**1**
11.	b	1
12.	c	1
13.	d	1
14.	b	1
15.	d	1
16.	c	1
17.	c	1
18.	b	1
19.	c	1
20.	d	1
21.	C. $3(\hat{\imath} - \widehat{2\jmath} + 2\hat{k})$	1
22.	A. form an isosceles triangle	1
23.	C. $\frac{\sqrt{5}}{6}$	1
24.	B. $\frac{\pi}{4}$	1
25.	C. $\sqrt{3}$	1
26.	A. $\frac{3}{2}(\hat{\imath} + \hat{\jmath})$	1
27.	D. $-\frac{5}{\sqrt{162}}$	1
28.	A. $\frac{1}{2}\left\| \vec{a} + \vec{b} \right\|$	1

29.	B. $-\frac{3}{2}$	1
30.	C. **Assertion is correct statement but reason is wrong statement.**	1
31.	(i) Scalar (ii) Vector	1
32.	$\frac{12}{5}\vec{a}-\frac{13}{5}\vec{b}$	1
33.	Magnitude is equal ($\sqrt{5}$) of both vectors but since components if the vectors are not equal both vectors are not same.	1
34.	8/7	1
35.	(i) P=-15 (ii) P=2/3	1
36.	$\frac{2\pi}{3}$	1
37.	0	1
38.	$4\sqrt{3}$	1
39.	$\sqrt{91}$	1
40.	1,1,1 AND 0,0,0	1
41.	(c)	1
42.	(b)	1
43.	(c)	1
44.	(b)	1
45.	(b)	1
46.	(a)	1
47.	(b)	1
48.	(d)	1
49.	(c)	1
50.	(d)	1

CHAPTER-10

VECTORS

02 MARKS TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three vectors such that $\|\vec{a}\| = 3$, $\|\vec{b}\| = 4$, $\|\vec{c}\| = 5$ and each one of them being perpendicular to the sum of the other two find $\|\vec{a} + \vec{b} + \vec{c}\|$	**2**
2.	If $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\vec{b} = -\hat{i} + \hat{k}$, $\vec{c} = 2\hat{j} - \hat{k}$ are three vectors, find the area of the parallelogram having diagonals $(\vec{a} + \vec{b})$ and $(\vec{b} + \vec{c})$	**2**
3.	Show that the points A($-2\hat{i}+3\hat{j}+5\hat{k}$), B ($\hat{i}+2\hat{j}+3\hat{k}$), C ($7\hat{i}-\hat{k}$) are collinear.	**2**
4.	If $\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$, $\vec{c} = 3\hat{i} + \hat{j}$ are such that $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$, then find the value of λ.	**2**
5.	If $\vec{p}$ and $\vec{q}$ are the unit vectors forming an angle of 300 , find the area of the parallelogram having $\vec{a} = \vec{p} + 2\vec{q}$ and $\vec{b} = 2\vec{p} + \vec{q}$ as its diagonals.	**2**
6.	Find the direction ratios and direction cosines of the vector $\vec{a} = (5\hat{\imath} - 3\hat{\jmath} + 4\hat{k})$.	2
7.	Write the value of p for $\vec{a} = 3\hat{\imath}+2\hat{\jmath}+9\hat{k}$ and $\vec{b} = \hat{\imath}+p\hat{\jmath}+3\hat{k}$ are parallel vectors.	2
8.	Find $\vec{a}.(\vec{b}\times\vec{c})$ if $\vec{a} = 2\hat{\imath}+\hat{\jmath}+3\hat{k}$, $\vec{b} = -\hat{\imath}+2\hat{\jmath}+\hat{k}$ and $\vec{c} = 3\hat{\imath}+\hat{\jmath}+2\hat{k}$.	2
9.	If $\vec{a} = x\hat{\imath}+2\hat{\jmath}-z\hat{k}$ and $\vec{b} = 3\hat{\imath}-y\hat{\jmath}+\hat{k}$ are two equal vectors, then write the value of y^x+5z.	2
10.	Find a unit vector parallel to the sum of the vectors $(\hat{\imath}+\hat{\jmath}+\hat{k})$ and $(2\hat{\imath}-3\hat{\jmath}+5\hat{k})$.	2
11.	$If\ \vec{a} = 2\hat{\imath} - 2\hat{\jmath} + \hat{k}$, $\vec{b} = 2\hat{\imath} + 3\hat{\jmath} + 6\hat{k}$ and $\vec{c} = -\hat{\imath} + 2\hat{k}$, then find the value of $\hat{a} - \hat{b} + 2\hat{c}$.	2
12.	The sum of two unit vectors is a unit vector. Show that the value of their difference is $\sqrt{3}$.	2
13.	Find a vector in the direction of $5\hat{\imath} - \hat{\jmath} + 2\hat{k}$ which has magnitude 8.	2
14.	Show that the vector $\hat{\imath} + \hat{\jmath} + \hat{k}$ is equally inclined to the axes OX, OY, OZ	2
15.	If $\|\vec{a}\| = 10, \|\vec{b}\| = 1$ and $\|\vec{a}.\vec{b}\| = 6$, then find $\|\vec{a} \times \vec{b}\|$	2
16.	Find a unit vector perpendicular to each of the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$, where $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}, \vec{b} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k}$.	2
17.	Prove that the points A,B and C with position vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ respectively are collinear if and only if $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} = 0$.	2
18.	Prove that $(\vec{a} - \vec{b}) \times (\vec{a} + \vec{b}) = 2(\vec{a} \times \vec{b})$	2
19.	If $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}$ and $\vec{b} = 4\hat{\imath} - 2\hat{\jmath} + 3\hat{k}$ and $\vec{c} = \hat{\imath} - 2\hat{\jmath} + \hat{k}$ find a vector of magnitude 6 units which is parallel to the vector $2\vec{a} - \vec{b} + 3\vec{c}$.	2
20.	Show that the points A,B and C with position vectors $\vec{a} = 3\hat{\imath} - 4\hat{\jmath} - 4\hat{k}, \vec{b} = 2\hat{\imath} - \hat{\jmath} + \hat{k}$ and $\vec{c} = \hat{\imath} - 3\hat{\jmath} - 5\hat{k}$ respectively from the vertices of a right angled triangle.	2
21.	For what value of a, the vectors $2\hat{\imath} - 3\hat{\jmath} + 4\hat{k}$ and $a\hat{\imath} + 6\hat{\jmath} - 8\hat{k}$ are collinear?	2
22.	Find unit vector perpendicular to both the vectors $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}$ and $\vec{b} = \hat{\imath} + \hat{\jmath}$.	2
23.	If $\vec{a} = 2, \vec{b} = \sqrt{3}$ and $\vec{a} . \vec{b} = \sqrt{3}$ find the angle between $\vec{a}$ and $\vec{b}$.	2
24.	If $\vec{p}$ is unit vector and $(\vec{x} - \vec{p}) \cdot (\vec{x} + \vec{p}) = 80$,then find $\|\vec{x}\|$.	2
25.	Show that the points A($-2\hat{\imath} + 3\hat{\jmath} + 5\hat{k}$),B($\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$), and C($7\hat{\imath} - \hat{k}$) are collinear.	2

ANSWERS:

Q. NO	ANSWER	MARKS
1.	$\left\|\vec{a}+\vec{b}+\vec{c}\right\|^2=\left(\vec{a}+\vec{b}+\vec{c}\right).\left(\vec{a}+\vec{b}+\vec{c}\right)$ $=\vec{a}.\vec{a}+\vec{a}.\left(\vec{b}+\vec{c}\right)+\vec{b}.\vec{b}+\vec{b}.\left(\vec{a}+\vec{c}\right)+\vec{c}.\vec{c}+\left(\vec{a}+\vec{b}\right)$ $=\left\|\vec{a}\right\|^2+\left\|\vec{b}\right\|^2+\left\|\vec{c}\right\|^2$ $=9+16+25$ $=50$ $\left\|\vec{a}+\vec{b}+\vec{c}\right\|=\sqrt{50}$ $=5\sqrt{2}$	**2**
2.	It is given that $\vec{a}=2\hat{i}-3\hat{j}+\hat{k}, \vec{b}=-\hat{i}+\hat{k}, \vec{c}=2\hat{j}-\hat{k}$ $\therefore \vec{a}+\vec{b}=\left(2\hat{i}-3\hat{j}+\hat{k}\right)+\left(-\hat{i}+\hat{k}\right)=\hat{i}-3\hat{j}+2\hat{k}$ $\vec{b}+\vec{c}=\left(-\hat{i}+\hat{k}\right)+\left(2\hat{j}-k\right)=-\hat{i}+2\hat{j}$ We know that the area of parallelogram is $\frac{1}{2}\left\|\vec{d_1}\times\vec{d_2}\right\|$, where $\vec{d_1}$ and $\vec{d_2}$ are the diagonal vectors. Now, $\left(\vec{a}+\vec{b}\right)\times\left(\vec{b}+\vec{c}\right)=\begin{vmatrix}\hat{i} & \hat{j} & \hat{k}\\ 1 & -3 & 2\\ -1 & 2 & 0\end{vmatrix}=-4\hat{i}-2\hat{j}-\hat{k}$ $\therefore$ Area of the parallelogram having diagonals $\left(\vec{a}+\vec{b}\right)$ and $\left(\vec{b}+\vec{c}\right)$ $=\frac{1}{2}\left\|\left(\vec{a}+\vec{b}\right)\times\left(\vec{b}+\vec{c}\right)\right\|$ $=\frac{1}{2}\left\|-4\hat{i}-2\hat{j}-\hat{k}\right\|$ $=\frac{1}{2}\sqrt{(-4)^2+(-2)^2+(-1)^2}$ $=\frac{\sqrt{21}}{2}$ square units Thus, the required area of the parallelogram is $\frac{\sqrt{21}}{2}$ square units.	**2**

3.	We have vector AB = (1 + 2)i + (2 - 3)j + (3 - 5)k = 3i - j - 2k vector BC = (7 - 1)i + (0 - 2)j + (-1 - 3)k = 6i - 2j - 4k vector CA = (7 + 2)i + (0 - 3)j + (-1 - 5)k = 9i - 3j - 6k Now, $\|\text{vector AB}\|^2 = 14$, $\|\text{vector BC}\|^2 = 56$, $\|\text{vector CA}\|^2 = 126$ ⇒ |vector AB| = √14, |vector BC| = 2√14, |vector CA| = 3√14 ⇒ |vector CA| = | vector AB| + |vector BC| Hence the points A, B and C are collinear.	**2**
4.	**Ans:** $\vec{a}+\lambda\vec{b}=\left(2\hat{i}+2\hat{j}+3\hat{k}\right)+\lambda\left(-\hat{i}+2\hat{j}+\hat{k}\right)$ $=(2-\lambda)\hat{i}+(2+2\lambda)\hat{j}+(3+\lambda)\hat{k}$ $\left(\vec{a}+\lambda\vec{b}\right).\vec{c}=0\left[\because \vec{a}+\lambda\vec{b}\perp\vec{c}\right.$ $\left[(2-\lambda)\hat{i}+(2+2\lambda)\hat{j}+(3+\lambda)\hat{k}\right].\left(3\hat{i}+\hat{j}\right)=0$ $3(2-\lambda)+(2+2\lambda)=0$ $-\lambda=-8$ $\lambda=8$	**2**
5.	$\vec{a}=\hat{p}+2\,\hat{q}$ $\vec{b}=2\,\hat{p}+\hat{q}$ $\vec{a}\times\vec{b}=(\vec{p}+2\vec{q})\times(2\vec{p}+\vec{q})$ $=2\vec{p}\times\vec{p}+\vec{p}\times\vec{q}+4\vec{q}\times\vec{p}+2\vec{q}\times\vec{q}$ $=2(0)+\vec{p}\times\vec{q}-4\vec{p}\times\vec{q}+2(0)$ $=-3\vec{p}\times\vec{q}$ Area of the parallelogram $=\frac{1}{2}\left\|\vec{a}\times\vec{b}\right\|$ $=\frac{1}{2}\left\|-3(\vec{p}\times\vec{q})\right\|$ $=\frac{3}{2}\|\vec{p}\|\,\|\vec{q}\|\sin 30^o$ $=\frac{3}{2}(1)(1)\left(\frac{1}{2}\right)$ ($\because \vec{p}$ and $\vec{q}$ are unit vectors) $=\frac{3}{4}$ sq. units	**2**
6.	Given that $\vec{a} = (5\hat{\imath} - 3\hat{\jmath} + 4\hat{k})$ For any vector $\vec{a} = a_x\hat{\imath}+a_y\hat{\jmath}+a_z\hat{k}$ the direction ratios are represented as (a_x,a_y,a_z) The direction ratios are (5, -3, 4) $\|\vec{a}\| = \sqrt{25+9+16} = \sqrt{50} = 5\sqrt{2}$ ∴ The direction cosines are $= \frac{5}{5\sqrt{2}}, \frac{-3}{5\sqrt{2}}, \frac{4}{5\sqrt{2}} = \frac{1}{\sqrt{2}}, \frac{-3}{5\sqrt{2}}, \frac{4}{5\sqrt{2}}$	**2**

7.	*Given that* $\vec{a} = 3\hat{\imath}+2\hat{\jmath}+9\hat{k}$ and $\vec{b} = \hat{\imath}+p\hat{\jmath}+3\hat{k}$ Since these two vectors are parallel to each other, so the angle between them is $\theta = 0$. Therefore $\vec{a}\times\vec{b} = \lvert\vec{a}\rvert\lvert\vec{b}\rvert \sin\theta = \lvert\vec{a}\rvert\lvert\vec{b}\rvert \sin 0 = 0$ We know that $\vec{a}\times\vec{b} = (a_2b_3-b_2a_3)\hat{\imath} + (a_3b_1-a_1b_3)\hat{\jmath} + (a_1b_2-a_2b_1)\hat{k}$ $\therefore \vec{a}\times\vec{b} = 0$ $\Rightarrow (a_2b_3-b_2a_3)\hat{\imath} + (a_3b_1-a_1b_3)\hat{\jmath} + (a_1b_2-a_2b_1)\hat{k} = 0$ $\Rightarrow \hat{\imath}\,(6-9p) + \hat{\jmath}\,(9-9) + \hat{k}\,(3p-2) = 0$ $\Rightarrow -3\hat{\imath}\,(3p-2) + \hat{k}\,(3p-2) = 0$ $\Rightarrow 3p-2 = 0 \Rightarrow$ Thus $p = 2/3$	2
8.	Given that $\vec{a} = 2\hat{\imath} + \hat{\jmath} + 3\hat{k}$, $\vec{b} = -\hat{\imath} + 2\hat{\jmath} + \hat{k}$ and $\vec{c} = 3\hat{\imath} + \hat{\jmath} + 2\hat{k}$ To find $\vec{a}.(\vec{b}\times\vec{c})$ We know that $\vec{b}\times\vec{c} = \hat{\imath}(b_2c_3-c_2b_3) + \hat{\jmath}(c_1b_3-b_1c_3) + \hat{k}(b_1c_2-c_1b_2)$ Here $a_1=2, a_2=1, a_3=3, b_1=-1, b_2=2, b_3=1, c_1=3, c_2=1, c_3=2$ $\therefore \vec{b}\times\vec{c} = \hat{\imath}\,(4-1) + \hat{\jmath}(3+2) + \hat{k}(-1-6) = 3\hat{\imath} + 5\hat{\jmath} - 7\hat{k}$ Therefore, $\vec{a}.(\vec{b}\times\vec{c}) = (2\hat{\imath}+\hat{\jmath}+3\hat{k}).(3i+5\hat{\jmath}-7\hat{k}) = ((2\times3) + (1\times5) + (3\times(-7)) = 6+5-21$ $= -10$	2
9.	Given that $\vec{a} = x\hat{\imath} + 2\hat{\jmath} - z\hat{k}$ and $\vec{b} = 3\hat{\imath} - y\hat{\jmath} + \hat{k}$ are two equal vectors. $\therefore x = 3, y = -2$ and $z = -1$ $\therefore y^x+5z = (-2)^3 + 5(-1) = -8-5 = -13$	2
10.	Let $\vec{a} = (\hat{\imath}+\hat{\jmath}+\hat{k})$ and $\vec{b} = (2\hat{\imath}-3\hat{\jmath}+5\hat{k})$ $\vec{a}+\vec{b} = (\hat{\imath}+\hat{\jmath}+\hat{k}) + (2\hat{\imath}-3\hat{\jmath}+5\hat{k}) = 3\hat{\imath}-2\hat{\jmath}+6\hat{k}$ The unit vector parallel to the sum of the given vectors = $\frac{\vec{a}+\vec{b}}{\lvert\vec{a}+\vec{b}\rvert} = \frac{3\hat{\imath}-2\hat{\jmath}+6\hat{k}}{\sqrt{9+4+36}} = \frac{3\hat{\imath}-2\hat{\jmath}+6\hat{k}}{\sqrt{49}} =$ $\frac{3\hat{\imath}-2\hat{\jmath}+6\hat{k}}{7} = \frac{3}{7}\hat{\imath} - \frac{2}{7}\hat{\jmath} + \frac{6}{7}\hat{k}$	2
11.	$\lvert\hat{a}-\hat{b}+2\hat{c}\rvert = \sqrt{4+25+1} = \sqrt{30}$ $d.r = -\frac{2}{\sqrt{30}}.-\frac{5}{\sqrt{30}},-\frac{1}{\sqrt{30}}$	2
12.	$\lvert\vec{a}\rvert = 1, \lvert\vec{b}\rvert = 1, \lvert\vec{a}+\vec{b}\rvert = 1$ $(\lvert\vec{a}+\vec{b}\rvert)^2 + (\lvert\vec{a}-\vec{b}\rvert)^2 = 2\left\{\lvert\vec{a}\rvert^2 + \lvert\vec{b}\rvert^2\right\} = 4$ $(\lvert\vec{a}-\vec{b}\rvert)^2 = 3$ $\lvert\vec{a}-\vec{b}\rvert = \sqrt{3}$	2
13.	$\vec{a} = 5\hat{\imath} - \hat{\jmath} + 2\hat{k}, \quad \hat{a} = \frac{5\hat{\imath}-\hat{\jmath}+2\hat{k}}{\sqrt{30}}$ $Req\ vector = 8\hat{a} = 8.\frac{5\hat{\imath}-\hat{\jmath}+2\hat{k}}{\sqrt{30}}$	2
14.	$\lvert\vec{a}\rvert = \sqrt{1^2+1^2+1^2} = \sqrt{3}$ d.c = $(\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}})$ $cos\alpha = \frac{1}{\sqrt{3}}, cos\beta = \frac{1}{\sqrt{3}}, cos\gamma = \frac{1}{\sqrt{3}}$ $\alpha = \beta = \gamma$(where α, β, γ are the inclination of $\vec{a}\ with\ OX, OY, OZ$ resp.)	2
15.	$(\lvert\vec{a}.\vec{b}\rvert)^2 + (\lvert\vec{a}\times\vec{b}\rvert)^2 = \left\{\lvert\vec{a}\rvert^2.\lvert\vec{b}\rvert^2\right\}$ $(\lvert\vec{a}\times\vec{b}\rvert)^2 = 64$	2

	$\left\| \vec{a} \times \vec{b} \right\| = 8$	
16.	$-\frac{1}{\sqrt{6}}\hat{\imath} + \frac{2}{\sqrt{6}}\hat{\jmath} - \frac{1}{\sqrt{6}}\hat{k}$	2
17.	Proving $\overrightarrow{AB} \times \overrightarrow{BC} = 0, (\vec{b} - \vec{c}) \times (\vec{c} - \vec{b}) = 0$ and proceeding further to prove.	2
18.	Expanding and solving.	2
19.	$2\hat{\imath} - 4\hat{\jmath} + 4\hat{k}$	2
20.	$\left\|\overrightarrow{AB}\right\| = \sqrt{35}$, $\left\|\overrightarrow{BC}\right\| = \sqrt{41}$ *and* $\left\|\overrightarrow{CA}\right\| = \sqrt{6}$ and apply Pythagoras theorem.	2
21.	Let $\vec{A} = 2\,\hat{\imath} - 3\hat{\jmath} + 4\hat{k}$ $\vec{B} = a\hat{\imath} + 6\hat{\jmath} - 8\hat{k}$ $\vec{A}$ and $\vec{B}$ are collinear so , $\vec{A} = \lambda\vec{B}$ $\frac{2}{a} = \frac{-3}{6} = \frac{4}{-8}$ a= -4	2
22.	Unit vector perpendicular to $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}$ and $\vec{b} = \hat{\imath} + \hat{\jmath}$ is $\hat{n} = \frac{\vec{a} \times \vec{b}}{\|\vec{a} \times \vec{b}\|}$ … (i) $\vec{a} \times \vec{b} = \begin{bmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 1 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix} = -\hat{\imath} + \hat{\jmath}$ $\left\| \vec{a} \times \vec{b} \right\| = \sqrt{1+1} = \sqrt{2}$ From equation (i) $\hat{n} = \frac{\vec{a} \times \vec{b}}{\|\vec{a} \times \vec{b}\|} = \frac{1}{2}(-\hat{\imath} + \hat{\jmath})$	2
23.	We know that angle between $\vec{a}$ and $\vec{b}$ is given by $\cos\theta = \frac{\vec{a}.\vec{b}}{\|\vec{a}\|\|\vec{b}\|}$ $\cos\theta = \frac{\sqrt{3}}{2\sqrt{3}}$ $\cos\theta = \frac{1}{2}$ $\theta = \frac{\pi}{3}$	2
24.	It is given that $\vec{p}$ is unit vector and $(\vec{x} - \vec{p}) \cdot (\vec{x} + \vec{p}) = 80$ $\|\vec{x}\|^2 - \|\vec{p}\|^2 = 80$ $\|\vec{x}\|^2 = 80 + 1 = 81$ $\|\vec{x}\| = 9$	2
25.	Given points A$(-2\hat{\imath} + 3\hat{\jmath} + 5\hat{k})$ B$(\hat{\imath} + 2\hat{\jmath} + 3\hat{k})$ C$(7\hat{\imath} - \hat{k})$ $\overrightarrow{AB}$=P.V. of B – P.V. OF A $=(\hat{\imath} + 2\hat{\jmath} + 3\hat{k}) - (-2\hat{\imath} + 3\hat{\jmath} + 5\hat{k})$ $=(3\hat{\imath} - \hat{\jmath} - 2\hat{k})$ $\overrightarrow{BC}$=P.V. of C – P.V. of B $=(7\hat{\imath} - \hat{k}) - (\hat{\imath} + 2\hat{\jmath} + 3\hat{k})$	2

	$=(6\hat{\imath} - 2\hat{\jmath} - 4\hat{k})$ $\overrightarrow{BC}=2\,\overrightarrow{AB}$ $\overrightarrow{BC}$ is parallel to $\overrightarrow{AB}$. B is common. Hence A,B,C are collinear.	

CHAPTER-10

VECTORS

03 MARKS TYPE QUESTIONS

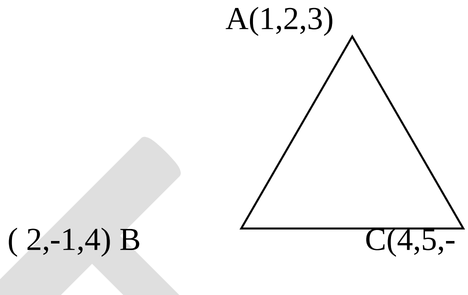
Q. NO	QUESTION	MARK
1.	The scalar product of the vector $\hat{\imath}+\hat{\jmath}+\hat{k}$ with a unit vector along the sum of vectors $2\hat{\imath}+4\hat{\jmath}-5\hat{k}$ and $\lambda\hat{\imath}+2\hat{\jmath}+3\hat{k}$ is equal to one. Find the value of λ.	**3**
2.	If $\vec{a}$, $\vec{b}$, $\vec{c}$ are unit vectors such that $\vec{a}+\vec{b}+\vec{c}=0$,then find the value of $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$	**3**
3.	If $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three vectors such that $\vec{a}+\vec{b}+\vec{c}=0$ and $\lvert\vec{a}\rvert = 3$, $\lvert\vec{b}\rvert = 5$, $\lvert\vec{c}\rvert = 7$ find the angle between $\vec{a}$ and $\vec{b}$	**3**
4.	If $\vec{a} = 3\hat{\imath}+4\hat{\jmath}+5\hat{k}$ and $\vec{b} = 2\hat{\imath}+\hat{\jmath}-4\hat{k}$, then express $\vec{b}$ in the form $\vec{b} = \vec{b}_1+\vec{b}_2$, where $\vec{b}_1$ is parallel to $\vec{a}$ and $\vec{b}_2$ is perpendicular to $\vec{a}$.	3
5.	If the sum of two unit vectors $\hat{a}$ and $\hat{b}$ is a unit vector, show that the magnitude of their difference is $\sqrt{3}$.	3
6.	Using vector show that the points A(-2,3,5), B(7,0,-1), C(-3,-2,-5) and D(3,4,7) are such that AB and CD intersect at P(1,2,3).	3
7.	$\vec{a} = \hat{\imath} + 2\hat{\jmath} - \hat{k}$, $\vec{b} = 3\hat{\imath} + \hat{\jmath} - 5\hat{k}$. Find a unit vector parallel to $\vec{a} - \vec{b}$	3
8.	Find the area of a parallelogram whose adjacent sides are given by vectors $\vec{a} = \hat{\imath} - \hat{\jmath} + 3\hat{k}$, $\vec{b} = 2\hat{\imath} - 7\hat{\jmath} + \hat{k}$.	3
9.	$p\hat{\imath} - 5\hat{\jmath} + 6\hat{k}$ and $2\hat{\imath} - 3\hat{\jmath} - q\hat{k}$ are collinear, find p, q	3
10.	Let the vectors $\vec{a}, \vec{b}, \vec{c}$ be given as $a_1\hat{\imath} + a_2\hat{\jmath} + a_3\hat{k}$, $b_1\hat{\imath} + b_2\hat{\jmath} + b_3\hat{k}$, $c_1\hat{\imath} + c_2\hat{\jmath} + c_3\hat{k}$. then show that $\vec{a} \times (\vec{b} + \vec{c}) = \vec{a} \times \vec{b} + \vec{a} \times \vec{c}$.	3
11.	If the position vectors of the vertices of a triangle are $\hat{\imath} + 2\hat{\jmath} + 3\hat{k}, 2\hat{\imath} + 3\hat{\jmath} + \hat{k}$ and $3\hat{\imath} + \hat{\jmath} + 2\hat{k}$, show that the triangle is an equilateral triangle.	3
12.	If vectors $\vec{a} = 2\hat{\imath} + 2\hat{\jmath} + 3\vec{k}, \vec{b} = -\hat{\imath} + 2\hat{\jmath} + \hat{k}$ and $\vec{c} = 3\hat{\imath} + \hat{\jmath}$ are such that $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$, then find the value of λ.	3
13.	If vectors vectors $\vec{a}$ =$2\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$, $\vec{b}$= $-\hat{\imath} + 2\hat{\jmath} + \hat{k}$ and $\vec{c}3\hat{\imath} + \hat{\jmath}=$ are such that $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$,then find the value of λ.	3
14.	For any vector $\vec{a}$,show that $\vec{a} = (\vec{a}\cdot\hat{\imath})\,\hat{\imath} + (\vec{a}\cdot\hat{\jmath})\,\hat{\jmath} + (\vec{a}\cdot\hat{k})\,\hat{k}$	3
15.	Using vectors find the area of triangle ABC with vertices A(1,2,3),B(2,-1,4) and C(4,5,-1).	3

ANSWERS:

Q. NO	ANSWER	MARKS
1.	**Ans:** $\bar{a} = 2\hat{i}+4\hat{j}-5\hat{k}$ $\bar{b} = \lambda\hat{i}+\hat{j}+3\hat{k}$ $\bar{a}+\bar{b} = (2+\lambda)\hat{i}+6\hat{j}-2\hat{k}$ **Unit vector along** $\bar{a}+\bar{b} = \frac{\bar{a}+\bar{b}}{\left\|\bar{a}+\bar{b}\right\|}$ $= \frac{(2+\lambda)\hat{i}+6\hat{j}-2\hat{k}}{\sqrt{(2+\lambda)^2+(6)^2+(-2)^2}}$ $= \frac{(2+\lambda)\hat{i}+6\hat{j}-2\hat{k}}{\sqrt{(2+\lambda)^2+40}}$ $ATQ\ \bar{c}.(\bar{a}+\bar{b}) = 1$ $(\hat{i}+\hat{j}+\hat{k}).\left(\frac{(2+\lambda)\hat{i}+6\hat{j}-2\hat{k}}{(2+\lambda)^2+40}\right) = 1$ $\frac{(2+\lambda)+6-2}{\sqrt{(2+\lambda)^2+40}} = 1$ $2+\lambda+4 = \sqrt{(2+\lambda)^2+40}$ *sq.both site* $\lambda^2+36+12\lambda = (2+\lambda)^2+40$ $\lambda = 1$	**3**
2.	**Ans:** $\left\|\bar{a}\right\| = 1, \left\|\bar{b}\right\| = 1, \left\|\bar{c}\right\| = 1,$ $\bar{a}+\bar{b}+\bar{c} = 0 \quad (Given)$ $\bar{a}.(\bar{a}+\bar{b}+\bar{c})$ $\bar{a}.\bar{a}+\bar{a}.\bar{b}+\bar{a}.\bar{c} = 0$ $(\bar{a})^2+\bar{a}.\bar{b}+\bar{a}.\bar{c} = 0$ $1+\bar{a}.\bar{b}+\bar{a}.\bar{c} = 0$ $\bar{a}.\bar{b}+\bar{a}.\bar{c} = -1 ------- (i)$ *similiorly* $\bar{b}.\bar{a}+\bar{b}.\bar{c} = -1 ------- (ii)$ *again* $\bar{c}.\bar{a}+\bar{c}.\bar{b} = -1 ------- (iii)$ *adding(i),(ii)and(iii)* $2(\bar{a}.\bar{b}+\bar{b}.\bar{c}+\bar{c}.\bar{a}) = -3 \qquad [\bar{a}.\bar{b} = \bar{b}.\bar{a}$ $\bar{a}.\bar{b}+\bar{b}.\bar{c}+\bar{c}.\bar{a} = -3/2$	**3**

3.	. **Ans:** $\vec{a}+\vec{b}+\vec{c}=0$ $\vec{a}+\vec{b}=-\vec{c}$ $(\vec{a}+\vec{b}).(-\vec{c})=-\vec{c}.(-\vec{c})$ $(\vec{a}+\vec{b}).(\vec{a}+\vec{b})=\vec{c}.\vec{c}$ $\lvert\vec{a}\rvert^2+2\vec{a}\vec{b}+\lvert\vec{b}\rvert^2=\lvert\vec{c}\rvert^2$ $\vec{a}.\vec{b}=\frac{49-9-25}{2}=\frac{15}{2}$ $\cos\theta=\frac{\vec{a}.\vec{b}}{\lvert\vec{a}\rvert\lvert\vec{b}\rvert}$ $=\frac{1}{2}$ $\theta=60$	**3**
4.	$\vec{b}_1$ is parallel to $\vec{a}$ $\Rightarrow \vec{b}_1$ = m$\vec{a}$ for some scalar m $\Rightarrow \vec{b}_1 = m(3\hat{\imath}+4\hat{\jmath}+5\hat{k}) = 3m\hat{\imath} + 4m\hat{\jmath} + 5m\hat{k}$ …..(i) If $\vec{b} = \vec{b}_1+\vec{b}_2$ $\Rightarrow \vec{b}_2 = \vec{b}-\vec{b}_1 = (2-3m)\hat{\imath} + (1-4m)\hat{\jmath} + (-4-5m)\hat{k}$ …..(ii) Also given that $\vec{b}_2$ is perpendicular to $\vec{a}$ $\Rightarrow \vec{b}_2.\vec{a} = 0$ $\Rightarrow 3(2 - 3m) + 4(1 - 4m) + 5(- 4 - 5m) = 0$ $\Rightarrow - 10 - 50m = 0$ $\Rightarrow m = -1/5$ Therefore, $\vec{b}_1 = -\frac{1}{5}(3\hat{\imath} + 4\hat{\jmath} + 5\hat{k})$ And $\vec{b}_2 = \frac{13}{5}\hat{\imath} + \frac{9}{5}\hat{\jmath} - 3\hat{k}$ $\therefore \vec{b} =(-\frac{3}{5}\hat{\imath} - \frac{4}{5}\hat{\jmath} - \hat{k}) + (\frac{13}{5}\hat{\imath} + \frac{9}{5}\hat{\jmath} - 3\hat{k}) = 2\hat{\imath} + \hat{\jmath} - 4\hat{k}$ is the required expression.	3
5.	Given $\hat{a}$ and $\hat{b}$ are unit vectors and $\hat{a}+\hat{b}$ is also a unit vector. $\Rightarrow \lvert\hat{a}\rvert = 1, \lvert\hat{b}\rvert = 1$ and $\lvert\hat{a}+\hat{b}\rvert = 1$ We have $\lvert\hat{a}+\hat{b}\rvert^2 = \lvert\hat{a}\rvert^2 + \lvert\hat{b}\rvert^2 + 2\hat{a}.\hat{b}$ $\Rightarrow 1 = 1 + 1 + 2\hat{a}.\hat{b} \Rightarrow 2\hat{a}.\hat{b} = -1$ Also we have, $\lvert\hat{a}-\hat{b}\rvert^2 = \lvert\hat{a}\rvert^2 + \lvert\hat{b}\rvert^2 - 2\hat{a}.\hat{b} \Rightarrow \lvert\hat{a}-\hat{b}\rvert^2 = 1 + 1 - (-1) = 3$ $\Rightarrow \lvert\hat{a}-\hat{b}\rvert = \sqrt{3}$ i.e., the magnitude of the difference is $\sqrt{3}$	3
6.	To prove P intersects $\overrightarrow{AB}$ and $\overrightarrow{CD}$, we have to show that A,P,B are collinear and C,P,D are collinear $\overrightarrow{AP} = (1+2)\hat{\imath} + (2-3)\hat{\jmath} + (3-5)\hat{k} = 3\hat{\imath} - \hat{\jmath} - 2\hat{k}$ $\overrightarrow{PB} = (7-1)\hat{\imath} + (0-2)\hat{\jmath} + (-1-3)\hat{k} = 6\hat{\imath} - 2\hat{\jmath} - 4\hat{k}$ $\Rightarrow \overrightarrow{PB} = 2(3\hat{\imath} - \hat{\jmath} - 2\hat{k})$ = 2AP $\Rightarrow$the vectors $\overrightarrow{AP}$ and $\overrightarrow{PB}$ are collinear.	3

	Since P is a common point to $\overrightarrow{AP}$ and $\overrightarrow{PB}$, the points A, P, B are collinear. Similarly, $\overrightarrow{CP}$ = (1+3) $\hat{\imath}$ + (2+2) $\hat{\jmath}$ + (3+5) $\hat{k}$ = $4\hat{\imath} + 4\hat{\jmath} + 8\hat{k}$ $\overrightarrow{PD}$ = (3-1) $\hat{\imath}$ + (4-2) $\hat{\jmath}$ + (7-3) $\hat{k}$ = $2\hat{\imath} + 2\hat{\jmath} + 4\hat{k}$ ⇒ $\overrightarrow{CP} = 2(2\hat{\imath} + 2\hat{\jmath} + 4\hat{k}) = 2\overrightarrow{PD}$ ⇒ the vectors $\overrightarrow{CP}$ and $\overrightarrow{PD}$ are collinear Since P is a common point to $\overrightarrow{CP}$ and $\overrightarrow{PD}$, the points C, P, D are collinear. i.e., P is a common point to $\overrightarrow{AB}$ and $\overrightarrow{CD}$ and so $\overrightarrow{AB}$ and $\overrightarrow{CD}$ intersect at P.	
7.	$\vec{a} - \vec{b} = -2\hat{\imath} + \hat{\jmath} + 4\hat{k}$ $req. vector\ parallel\ to\ \ \vec{a} - \vec{b} = \frac{\vec{a}-\vec{b}}{\lvert \vec{a}-\vec{b} \rvert} = \frac{-2\hat{\imath}+\hat{\jmath}+4\hat{k}}{\sqrt{21}}$	3
8.	$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 1 & -1 & 3 \\ 2 & -7 & 1 \end{vmatrix} = 20\hat{\imath} + 5\hat{\jmath} - 5\hat{k}$ $\lvert \vec{a} \times \vec{b} \rvert = 15\sqrt{2}$	3
9.	$p\hat{\imath} - 5\hat{\jmath} + 6\hat{k} = \alpha(2\hat{\imath} - 3\hat{\jmath} - q\hat{k})$ $\alpha = \frac{5}{3}$ on comparing $p = \frac{10}{3}, q = -\frac{18}{5}$	3
10.	For correct proof	3
11.	$\lvert\overrightarrow{AB}\rvert = \sqrt{6} = \lvert\overrightarrow{BC}\rvert = \lvert\overrightarrow{CA}\rvert$	3
12.	$\lambda = 8.$	3
13.	As $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$ $(\vec{a} + \lambda\vec{b}) \cdot \vec{c} = 0$ $((2-\lambda)\hat{\imath} + (2+2\lambda)\hat{\jmath} + (3+\lambda)\hat{k}) \cdot (3\hat{\imath} + \hat{\jmath}) = 0$ $3(2-\lambda) + (2+2\lambda) = 0$ $\lambda = 8$	
14.	Let $\vec{a} = l\hat{\imath} + m\hat{\jmath} + n\hat{k}$ $\vec{a} \cdot \hat{\imath} = (l\hat{\imath} + m\hat{\jmath} + n\hat{k}) \cdot \hat{\imath}$ = l $\vec{a} \cdot \hat{\jmath} = (l\hat{\imath} + m\hat{\jmath} + n\hat{k}) \cdot \hat{\jmath}$ = m $\vec{a} \cdot \hat{k} = (l\hat{\imath} + m\hat{\jmath} + n\hat{k}) \cdot \hat{k}$ = n RHS= $(\vec{a} \cdot \hat{\imath})\hat{\imath} + (\vec{a} \cdot \hat{\jmath})\hat{\jmath} + (\vec{a} \cdot \hat{k})\hat{k}$ $= l\hat{\imath} + m\hat{\jmath} + n\hat{k}$ $= \vec{a}$ =LHS	

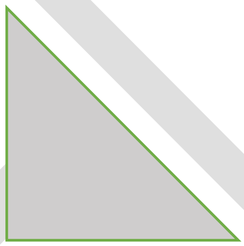
15.	We know that Area of triangle = $\frac{1}{2}\left\|\overrightarrow{BC} \times \overrightarrow{BA}\right\|$ $\overrightarrow{BC}$=(4-2) $\hat{\imath}$ +(5+1) $\hat{\jmath}$ + (-1-4) $\hat{k}$ =2 $\hat{\imath}$ + 6$\hat{\jmath}$ -5$\hat{k}$ $\overrightarrow{BA} = -\hat{\imath}$ + 3$\hat{\jmath}$ - $\hat{k}$  $\overrightarrow{BC} \times \overrightarrow{BA} = \begin{bmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 2 & 6 & -5 \\ -1 & 3 & -1 \end{bmatrix} = 9\hat{\imath}$ + 7$\hat{\jmath}$ +12 $\hat{k}$ $\left\| \overrightarrow{BC} \times \overrightarrow{BA} \right\| = \sqrt{81 + 49 + 144} = \sqrt{274}$ Area of triangle = $\frac{1}{2}\left\|\overrightarrow{BC} \times \overrightarrow{BA}\right\|$ $= \frac{1}{2}\sqrt{274}$ sq. units	

CHAPTER-10
VECTORS
04 MARKS TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	Team A,B,C went for playing a tug of war game. Teams A, B, C, have attached a rope to a mental ring and its trying to pull the ring into their own area(learn areas shown below). Team A pulls with force $F1=4\hat{i}+0\hat{j}$KN Team B →$F2= 2\hat{i}+4\hat{j}$KN Team C →$F3=-3\hat{i}-3\hat{j}$KN Based on the above information, answer the following. 1. Which team will win the game? a. Team B b. Team A c. Team C d. No one 2. What is the magnitude of the teams combined force? a. 7 KN b. 1.4 KN c. 1.5 KN d. 2 KN 3. In what direction is the ring getting pulled? a. 2.0 radian b. 2.5 radian c. 2.4 radian d. 3 radian 4. What is the magnitude of the forces of Team B? a. $2\sqrt{5}$ KN b. 6 KN c. 2 KN d. $\sqrt{6}$KN 5. How many KN force is applied by Team A? a. 5 KN b. 4 KN c. 2 KN d. 16 KN	4
2.	A class XII student appearing for a competitive examination was asked to attempt the following questions. Let a , b and c be three non zero vectors. 1. If a and b are such that | a + b | = | a − b | then a. a _|_ b b. a ||b c. a = b d. None of these 2. If -a = $\hat{i}-2\hat{j}$, -b =$2\hat{i}+\hat{j}+3\hat{k}$then evaluate (2-a + -b)·[(-a + -b)×(-a −2-b)] a. 0	4

	b. 4 c. 3 d. 2 3. If a and b are unit vectors and θ be the angle between them then $\lvert \vec{a} - \vec{b} \rvert$ = a. $\sin^2\theta$ b. 2sin θ c. 2 cosθ d. $\cos^2\theta$ 4. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be unit vectors such that $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c} = 0$ and angle between $\vec{b}$ and $\vec{c}$ is π 6 then $\vec{a}$ = a. $2 (\vec{b} \times \vec{c})$ b. $-2 (\vec{b} \times \vec{c})$ c. $\pm 2 (\vec{b} \times \vec{c})$ d. $2 (\vec{b} \pm \vec{c})$ 5. The area of the parallelogram If -a = î−2ĵ, -b =2î+ĵ+3k̂as diagonals is a. 70 b. 35 c. √70/2 d. √70	
3.	Rohan is walking around a triangular park. The vertices of the park are given by the position vectors ($-\hat{j}-2\hat{k}$), ($3\hat{i}+\hat{j}+4\hat{k}$) and ($5\hat{i}+7\hat{j}+\hat{k}$). Show that the park is in right triangular shape. Also find its other two angles.	4
4.	On the week days, every morning Piya first drops her son to his school and then she goes to her office. Let her house, the school and the office are represented by the position vectors ($-2\vec{a}+3\vec{b}+5\vec{c}$), ($\vec{a}+2\vec{b}+3\vec{c}$) and ($7\vec{a}-\vec{c}$). Show that for any $\vec{a}$, $\vec{b}$ and $\vec{c}$ the house, the school and the office are on the same straight path.	4
5.	$\vec{a}$, $\vec{b}$, and $\vec{c}$ are mutually perpendicular vectors of equal magnitudes, show that the vector $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to $\vec{a}$, $\vec{b}$, and $\vec{c}$.	4
6.	Show that points $(2, -1, 3), (3, -5, 1)\ and\ (-1, 11, 9)$ are collinear by vector method	4
7.	Using vectors find the area of a triangle ABC with vertices A(1,2,3), B=(2,-1,4) and C(4,5,-1).	4
8.	Dot product of a vector with vectors $\hat{\imath} - \hat{\jmath} + \hat{k}$, $2\hat{\imath} + \hat{\jmath} - 3\hat{k}$ and $\hat{\imath} + \hat{\jmath} + \hat{k}$ are respectively 4,0 and 2. Find the vectors.	4
9.	Two vectors $\hat{\jmath} + \hat{k}$ and $3\hat{\imath} - \hat{\jmath} + 4\hat{k}$, represent the two sides vectors AB and AC respectively of triangle ABC . Find the length of the median through A.	4
10.	Show that each of the given three vectors is a unit vector $\frac{1}{7}(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$,$\frac{1}{7}(3\hat{\imath} - 6\hat{\jmath} + 2\hat{k})$, $\frac{1}{7}(6\hat{\imath} + 2\hat{\jmath} - 3\hat{k})$.Also show that they are mutually perpendicular to each other.	4

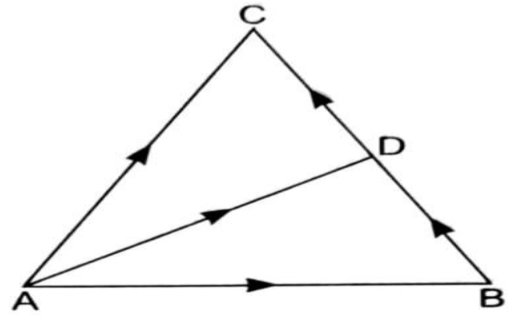
ANSWERS:

Q. NO	ANSWER	MARKS
1	1. a. Team B 2. b. 1.4 KN 3. c. 2.4 KN 4. a. 2√5 KN 5. b. 4 KN	**4**
2	1. a 2. A 3. B 4. C 5.C	**4**
3	Let the position vectors of the vertices A, B and C of the triangular park is $\vec{a} = 0\hat{\imath} - \hat{\jmath} - 2\hat{k}$ $\vec{b} = 3\hat{\imath} + \hat{\jmath} + 4\hat{k}$ and $\vec{c} = 5\hat{\imath} + 7\hat{\jmath} + \hat{k}$ $\overrightarrow{AB} = \vec{b} - \vec{a} = (3\hat{\imath}+\hat{\jmath}+4\hat{k}) - (0\hat{\imath}-\hat{\jmath}-2\hat{k}) = 3\hat{\imath} + 2\hat{\jmath} + 6\hat{k}$ $\overrightarrow{BC} = \vec{c} - \vec{b} = (5\hat{\imath}+7\hat{\jmath}+\hat{k}) - (3\hat{\imath}+\hat{\jmath}+4\hat{k}) = 2\hat{\imath} + 6\hat{\jmath} - 3\hat{k}$ $\overrightarrow{CA} = \vec{a} - \vec{c} = (0\hat{\imath}-\hat{\jmath}-2\hat{k}) - (5\hat{\imath}+7\hat{\jmath}+\hat{k}) = -5\hat{\imath} - 8\hat{\jmath} - 3\hat{k}$  $\lvert\overrightarrow{AB}\rvert = \sqrt{(9+4+36)} = \sqrt{49} = 7$ $\lvert\overrightarrow{BC}\rvert = \sqrt{(4+36+9)} = \sqrt{49} = 7$ $\lvert\overrightarrow{CA}\rvert = \sqrt{(25+64+9)} = \sqrt{98} = 7\sqrt{2}$ $\cos\theta = \frac{\overrightarrow{AB}.\overrightarrow{BC}}{\lvert\overrightarrow{AB}\rvert\lvert\overrightarrow{BC}\rvert} = \frac{(3\hat{\imath}+2\hat{\jmath}+6\hat{k}).(2\hat{\imath}+6\hat{\jmath}-3\hat{k})}{7\times7} = \frac{6+12-18}{49} = 0$ $\therefore \theta = \frac{\pi}{2}$ Therefore, the park is in right triangular shape. Again, $\cos\alpha = \frac{\overrightarrow{CA}.\overrightarrow{AB}}{\lvert\overrightarrow{CA}\rvert\lvert\overrightarrow{AB}\rvert} = \frac{(-5\hat{\imath}-8\hat{\jmath}-3\hat{k}).(3\hat{\imath}+2\hat{\jmath}+6\hat{k})}{7\sqrt{2}\times7} = \frac{-15-16-18}{49\sqrt{2}} = \left\lvert\frac{-1}{\sqrt{2}}\right\rvert$ $\therefore \alpha = \frac{\pi}{4}$ Hence the third angle is $\pi - (\frac{\pi}{2} + \frac{\pi}{4}) = \frac{\pi}{4}$ Therefore the other two angles are $\frac{\pi}{4}, \frac{\pi}{4}$ i.e., 45° and 45°	4
4	The position vectors of the house, the school and the office are $\vec{A} = (-2\vec{a}+3\vec{b}+5\vec{c})$, $\vec{B} = (\vec{a}+2\vec{b}+3\vec{c})$ and $\vec{C} = (7\vec{a}-\vec{c})$ $\overrightarrow{AB} = \vec{B} - \vec{A} = (\vec{a}+2\vec{b}+3\vec{c}) - (-2\vec{a}+3\vec{b}+5\vec{c}) = 3\vec{a} - \vec{b} - 2\vec{c}$ $\overrightarrow{AC} = \vec{C} - \vec{A} = (7\vec{a}-\vec{c}) - (-2\vec{a}+3\vec{b}+5\vec{c}) = 9\vec{a} - 3\vec{b} - 6\vec{c}$ To prove that $\vec{A}$, $\vec{B}$, $\vec{C}$ are collinear we need to prove that $\overrightarrow{AB} \times \overrightarrow{AC} = 0$ We know that $\vec{a}\times\vec{b} = (a_2b_3-b_2a_3)\hat{\imath} + (a_3b_1-a_1b_3)\hat{\jmath} + (a_1b_2-a_2b_1)\hat{k}$	4

	$\therefore\ \overrightarrow{AB} \times \overrightarrow{AC}$ $= (3\vec{a} - \vec{b} - 2\vec{c}\,) \times (9\vec{a} - 3\vec{b} - 6\vec{c})$ $= (6-6)\vec{a} + (-18+18)\vec{b} + (-9+9)\vec{c}$ $= 0$ $\therefore \vec{A}\ ,\vec{B}\ ,\vec{C}$ are collinear Hence the house, the school and the office are on the same straight path.	
5	Since $\vec{a}, \vec{b}$, and $\vec{c}$ are mutually perpendicular vectors of equal magnitudes So, $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a} = 0$ and $\lvert\vec{a}\rvert = \lvert\vec{b}\rvert = \lvert\vec{c}\rvert$ Let $\alpha, \beta, and\ \gamma = inclination\ of\ \vec{a} + \vec{b} + \vec{c}\ with\ \vec{a}, \vec{b}$, and $\vec{c}\ resp.$ Then $cos\alpha = \frac{\lvert\vec{a}\rvert}{\lvert\vec{a}+\vec{b}+\vec{c}\rvert}, cos\beta = \frac{\lvert\vec{b}\rvert}{\lvert\vec{a}+\vec{b}+\vec{c}\rvert}, cos\gamma = \frac{\lvert\vec{c}\rvert}{\lvert\vec{a}+\vec{b}+\vec{c}\rvert}$ so $\cos\alpha = \cos\beta = \cos\gamma \rightarrow\ \alpha = \beta = \gamma$	4
6	Let , $A(2,-1,3), B(3,-5,1)\ and\ C(-1,11,9)$ $\overrightarrow{OA} = (2\hat{\imath} - \hat{\jmath} + 3\hat{k}), \overrightarrow{OB} = (3\hat{\imath} - 5\hat{\jmath} + \hat{k}), \overrightarrow{OC} = (-\hat{\imath} + 11\hat{\jmath} + 9\hat{k})$ $\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = (3\hat{\imath} - 5\hat{\jmath} + \hat{k}) - (2\hat{\imath} - \hat{\jmath} + 3\hat{k}) = (\hat{\imath} - 4\hat{\jmath} - 2\hat{k})$ Similarly, $\overrightarrow{BC} = \overrightarrow{OC} - \overrightarrow{OB} = (-\hat{\imath} + 11\hat{\jmath} + 9\hat{k}) - (3\hat{\imath} - 5\hat{\jmath} + \hat{k}) = (-4\hat{\imath} + 16\hat{\jmath} + 8\hat{k}) =$ $-4\left((\hat{\imath} - 4\hat{\jmath} - 2\hat{k})\right) = -\overrightarrow{AB}$ $\overrightarrow{AB}, \overrightarrow{BC}$ are collinear ⋙ $A, B\ and\ C\ are\ collinear.$	4
7	$area = \frac{1}{2}\lvert\overrightarrow{AB} \times \overrightarrow{BA}\rvert = \frac{1}{2}\sqrt{274}.$	4
8	Forming three equations $x - y + z = 4, 2x + y - 3z = 0$ and $x + y + z = 2$ and solving to find the vector $2\hat{\imath} - \hat{\jmath} + \hat{k}$.	4

9

1. Given $\overrightarrow{AB} = \hat{j} + \hat{k}$, $\overrightarrow{AC} = 3\hat{i} - \hat{j} + 4\hat{k}$



Using triangle law of vectors

$$\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC} \Rightarrow \overrightarrow{BC} = \overrightarrow{AC} - \overrightarrow{AB}$$

$$\Rightarrow \overrightarrow{BC} = 3\hat{i} - \hat{j} + 4\hat{k} - \hat{j} - \hat{k} = 3\hat{i} - 2\hat{j} + 3\hat{k}$$

Also $\overrightarrow{BD} = \frac{1}{2}\overrightarrow{BC}$ [D is mid–point of BC

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

In ΔABD, applying triangle law of vectors

$$\overrightarrow{AD} = \overrightarrow{AB} + \overrightarrow{BD}$$

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

Length of median

$$= |\overrightarrow{AD}| = \sqrt{\frac{9}{4} + \frac{25}{4}} = \frac{1}{2}\sqrt{34} \text{ units}$$

4

1

Let, $\vec{a} = \frac{1}{7}(2\hat{i} + 3\hat{j} + 6\hat{k})$;

$\vec{b} = \frac{1}{7}(3\hat{i} - 6\hat{j} + 2\hat{k})$; $\vec{c} = \frac{1}{7}(6\hat{i} + 2\hat{j} - 3\hat{k})$

$|\vec{a}| = \frac{1}{7}\sqrt{4+9+36} = 1$; $|\vec{b}| = \frac{1}{7}\sqrt{9+36+4} = 1$;

$|\vec{c}| = \frac{1}{7}\sqrt{36+4+9} = 1$

$$\vec{a}\cdot\vec{b} = \frac{1}{49}(6 - 18 + 12) = 0,$$

$$\vec{b}\cdot\vec{c} = \frac{1}{49}(3\hat{i} - 6\hat{j} + 2\hat{k})\cdot(6\hat{i} + 2\hat{j} - 3\hat{k})$$

$$= \frac{1}{49}(18 - 12 - 6) = 0$$

$$\vec{c}\cdot\vec{a} = \frac{1}{49}(6\hat{i} + 2\hat{j} - 3\hat{k})(2\hat{i} + 3\hat{j} + 6\hat{k})$$

$$= \frac{1}{49}(12 + 6 - 18) = 0$$

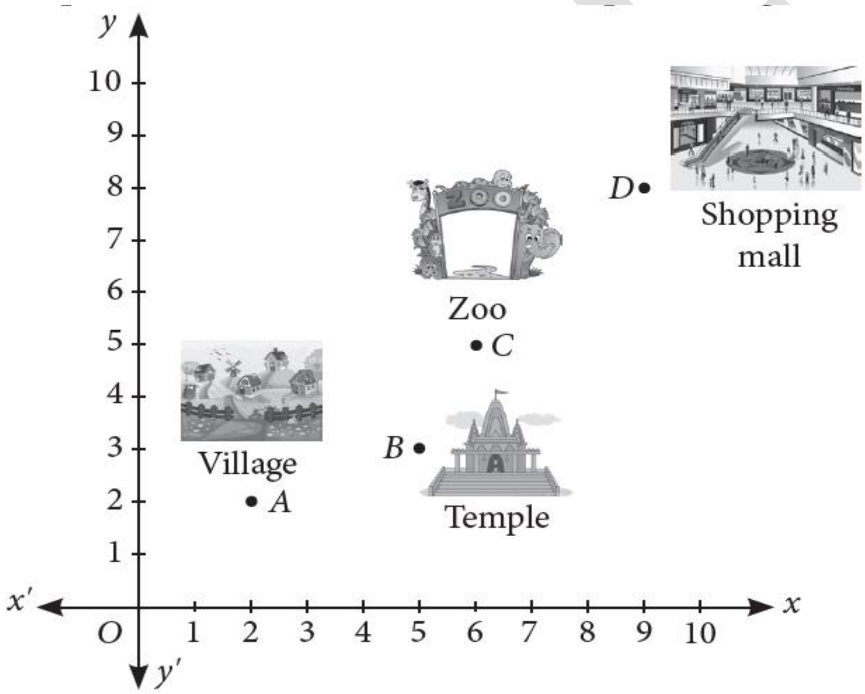
Hence, the given vectors are mutually perpendicular to each other.

4

CHAPTER-10

VECTORS

05 MARKS TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	Let $\vec{a}$ = $\hat{\imath}$ +4j +2 $\hat{k}$, $\vec{b}$ = 3$\hat{\imath}$ - 2j +7 $\hat{k}$ and $\vec{c}$ = 2$\hat{\imath}$ -j +4 $\hat{k}$, find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and $\vec{c}$. $\vec{d}$ = 15	**5**
2.	If $\vec{a}$, , $\vec{b}$ and $\vec{c}$ are mutually perpendicular vectors of equal magnitudes show that the vector $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to the $\vec{a}$, , $\vec{b}$ and $\vec{c}$.	**5**
3.	Find the position vector of the point which divides the join of the points (2$\vec{a}$-3$\vec{b}$) and (3$\vec{a}$-2$\vec{b}$) in the ratio, (i) internally, (ii) externally.	5
4.	Find the area of the parallelogram whose diagonals are represented by the vectors $\vec{d}_1$ = 3$\hat{\imath}$+$\hat{\jmath}$-2$\hat{k}$ and $\vec{d}_2$ = $\hat{\imath}$-3$\hat{\jmath}$+4$\hat{k}$	5
5.	**CSB1:** Ishaan left from his village on weekend. First, he travelled up to temple. After this, he left for the zoo. After this he left for shopping in a mall. The positions of Ishaan at different places is given in the following graph.  Based on the above information, answer the following questions. **(i)** Position vector of B is (a) $3\hat{\imath} + 5\hat{\jmath}$ (b) $5\hat{\imath} + 3\hat{\jmath}$ (c) $-5\hat{\imath} - 3\hat{\jmath}$ (d) $-5\hat{\imath} + 3\hat{\jmath}$ **(ii)** Position vector of D is (a) $5\hat{\imath} + 3\hat{\jmath}$ (b) $3\hat{\imath} + 5\hat{\jmath}$ (c) $8\hat{\imath} + 9\hat{\jmath}$ (d) $9\hat{\imath} + 8\hat{\jmath}$ **(iii)** Find the vector $\overrightarrow{BC}$ in terms of $\hat{\imath}, \hat{\jmath}$ (a) $\hat{\imath} - 2\hat{\jmath}$ (b) $\hat{\imath} + 2\hat{\jmath}$ (c) $\widehat{2\imath} + \hat{\jmath}$ (d) $2\hat{\imath} - \hat{\jmath}$ **(iv)** Length of vector $\overrightarrow{AD}$ is (a) $\sqrt{67}$ units (b) $\sqrt{85}$ units (c) 90 units (d) 100 units **(v)** If $\vec{M} = 4j + 3k$, then its unit vector is (a) $\frac{4}{5}\hat{\imath} + \frac{3}{5}\hat{\jmath}$ (b) $\frac{4}{5}\hat{\imath} - \frac{3}{5}\hat{\jmath}$ (c) $-\frac{4}{5}\hat{\imath} + \frac{3}{5}\hat{\jmath}$ (d) $-\frac{4}{5}\hat{\imath} - \frac{3}{5}\hat{\jmath}$	5
6.	**CSB2:**	5

<table>
<tr>
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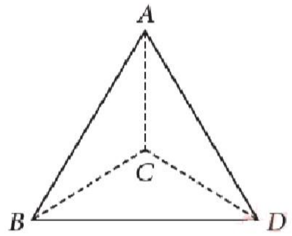
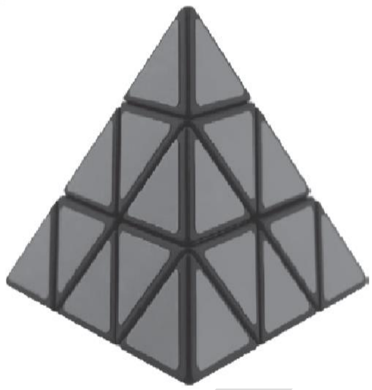
<td>A building is to be constructed in the form of a triangular pyramid, $ABCD$ as shown in the figure.



Let its angular points are $A(0, 1, 2)$, $B(3, 0, 1)$, $C(4, 3, 6)$ and $D(2, 3, 2)$ and G be the point of intersection of the medians of ΔBCD.
Based on the above information, answer the following questions.
(i) The coordinates of point G are
(a) (2, 3, 3) (b) (3, 3, 2) (c) (3, 2, 3) (d) (0, 2, 3)
(ii) The length of vector $\overrightarrow{AG}$ is
(a) $\sqrt{17}$ units (b) $\sqrt{11}$ units (c) $\sqrt{13}$ units (d) $\sqrt{19}$ units
(iii) Area of ΔABC (in sq. units) is
(a) $\sqrt{10}$ (b) $2\sqrt{10}$ (c) $3\sqrt{10}$ (d) $5\sqrt{10}$
(iv) The sum of lengths of $\overrightarrow{AB}$ and $\overrightarrow{AC}$ is
(a) 5 units (b) 9.32 units (c) 10 units (d) 11 units
(v) The length of the perpendicular from the vertex D on the opposite face is
(a) $\frac{6}{\sqrt{10}}$ units (b) $\frac{2}{\sqrt{10}}$ units (c) $\frac{3}{\sqrt{10}}$ units (d) $8\sqrt{10}$ units</td>
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<tr>
<td>7.</td>
<td>Two vectors $\hat{j}+\hat{k}$and $3\hat{\imath}-\hat{j}+4\hat{k}$, represent the two side vectors $\overrightarrow{AB}$ and $\overrightarrow{AC}$ respectively of a triangle ABC. Find the length of the median through A.</td>
<td>5</td>
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<tr>
<td>8.</td>
<td>Let $\vec{a}=4\hat{\imath}+5\hat{j}-\hat{k}, \vec{b}=\hat{\imath}-4\hat{j}+5\hat{k}$ and $\vec{c}=3\hat{\imath}+\hat{j}-\hat{k}$. find the vector $\vec{d}$ which is perpendicular to both $\vec{c}$ and $\vec{b}$ and $\vec{d}.\vec{a}=21$.</td>
<td>5</td>
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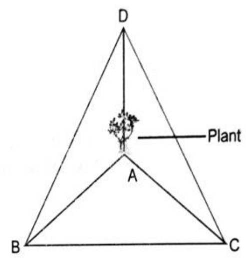
<tr>
<td>9.</td>
<td>Read the following passage and answer the following questions
A person purchased an air plant , plant holder which is in shape of tetrahedron .Let A,B,C, D be the co-ordinates of the air plant holder where A(1,2,3),B(3,2,1),C(2,1,2),D(3,4,3).
(i)Find the vector $\overrightarrow{AB}$.


(ii)Find the vector $\overrightarrow{CD}$.
(iii)Find the unit vector along $\overrightarrow{BC}$ vector.
(iv)Find the area Δ BCD.</td>
<td>5(1+1 +1+2)</td>
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<tr>
<td>10.</td>
<td>Show that area of the parallelogram whose diagonals are given by $\vec{a}$ and $\vec{b}$ is $|\vec{a}\times\vec{b}|/2$.

(i)Also find the area of parallelogram, whose diagonals are $2\hat{\imath}-\hat{j}+\hat{k}$ and $\hat{\imath}+3\hat{j}-\hat{k}$.</td>
<td>5(3+ 2)</td>
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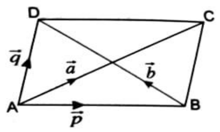
</table>

<u>**ANSWERS:**</u>

Q. NO	ANSWER	MARKS
1.	$\vec{d}$ is $\perp$ to $\vec{a}$ and $\vec{b}$ So, we take the cross product of $\vec{a}$ and $\vec{b}$ i.e. $(\hat{i} + 4\hat{j} + 2\hat{k}) \times (3\hat{i} - 2\hat{j} + 7\hat{k})$ $= 0 - 2\hat{i} \times \hat{j} + 7\hat{i} \times \hat{k} + 12\hat{j} \times \hat{i} - 0 + 28\hat{j} \times \hat{k} +$ $6\hat{k} \times \hat{i} - 4\hat{k} \times \hat{j} + 0$ $= -2\hat{k} - 7\hat{j} - 12\hat{k} + 28\hat{i} + 6\hat{j} + 4\hat{i}$ $= 32\hat{i} - \hat{j} - 14\hat{k}$ $\vec{d}$ would be a multiple of the obtained cross product, such that $\vec{c}.\vec{d} = 15$ $\Rightarrow (2\hat{i} - \hat{j} + 4\hat{k}).(32\lambda\hat{i} - \lambda\hat{j} - 14\lambda\hat{k}) = 15$ $\Rightarrow 64\lambda + \lambda - 56\lambda = 15$ $\therefore 9\lambda = 15$ $\therefore \lambda = \frac{5}{3}$ $\therefore \vec{d} = \frac{160\hat{i} - 5\hat{j} - 70\hat{k}}{3}$	**5**
2.	To prove: $\overline{a} + \overline{b} + \overline{c}$ is equally inclined to $\overline{a}, \overline{b}$ and $\overline{c}$. Given: $\overline{a}.\overline{b} = \overline{b}.\overline{c} = \overline{a}.\overline{c} = 0$ Angle between: $\overline{a} + \overline{b} + \overline{c}$ and $\overline{a}$: $\cos\theta_1 = \frac{(\overline{a} + \overline{b} + \overline{c}).\overline{a}}{\lvert\overline{a} + \overline{b} + \overline{c}\rvert . \lvert\overline{a}\rvert}$ $\Longrightarrow \cos\theta_1 = \frac{\lvert\overline{a}\rvert^2 + \overline{a}.\overline{b} + \overline{a}.\overline{c}}{\lvert\overline{a} + \overline{b} + \overline{c}\rvert . \lvert\overline{a}\rvert}$ $\Longrightarrow \cos\theta_1 = \frac{\lvert\overline{a}\rvert^2 + 0 + 0}{\lvert\overline{a} + \overline{b} + \overline{c}\rvert . \lvert\overline{a}\rvert}$ $= \frac{\lvert\overline{a}\rvert}{\lvert\overline{a} + \overline{b} + \overline{c}\rvert}$ Angle between $\overline{a} + \overline{b} + \overline{c}$ and $\overline{b}$ $\Longrightarrow \cos\theta_2 = \frac{(\overline{a} + \overline{b} + \overline{c}).\overline{b}}{\lvert\overline{a} + \overline{b} + \overline{c}\rvert . \lvert\overline{b}\rvert}$ $= \frac{\overline{a}.\overline{b} + \lvert\overline{b}\rvert^2 + \overline{b}.\overline{c}}{\lvert\overline{a} + \overline{b} + \overline{c}\rvert . \lvert\overline{b}\rvert}$ $= \frac{0 + \lvert\overline{b}\rvert^2}{\lvert\overline{a} + \overline{b} + \overline{c}\rvert . \lvert\overline{b}\rvert}$	**5**

	$= \frac{\lvert\bar{b}\rvert}{\lvert\bar{a}+\bar{b}+\bar{c}\rvert}$ Angle between $\bar{a}+\bar{b}+\bar{c}$ and $\bar{c}$: $\Longrightarrow \quad \cos\theta_3 = \frac{(\bar{a}+\bar{b}+\bar{c}).\bar{c}}{\lvert\bar{a}+\bar{b}+\bar{c}\rvert\,.\lvert\bar{c}\rvert}$ $= \frac{\bar{a}.\bar{c}+\bar{b}.\bar{c}+\lvert\bar{c}\rvert^2}{\lvert\bar{a}+\bar{b}+\bar{c}\rvert\,.\lvert\bar{c}\rvert}$ $= \frac{0+0+\lvert\bar{c}\rvert^2}{\lvert\bar{a}+\bar{b}+\bar{c}\rvert\,.\lvert\bar{c}\rvert}$ $= \frac{\lvert\bar{c}\rvert}{\lvert\bar{a}+\bar{b}+\bar{c}\rvert}$ $\because \lvert\bar{a}\rvert = \lvert\bar{b}\rvert = \lvert\bar{c}\rvert = p(\text{let})$ $\therefore \cos\theta_1 = \cos\theta_2 = \cos\theta_3 = \frac{p}{\lvert\bar{a}+\bar{b}+\bar{c}\rvert}$ Hence proved.	
3.	$\vec{A} = 2\vec{a}-3\vec{b}$ $\vec{B} = 3\vec{a}-2\vec{b}$ The point dividing a line joining points a and b in a ratio m:n internally or externally is given by $\frac{m\vec{b}+n\vec{a}}{m+n}$ and $\frac{m\vec{b}-n\vec{a}}{m-n}$ respectively. ∴ The position vector of the point dividing the line internally in the ratio 2:3 is $\frac{2\times(3\vec{a}-2\vec{b})+3\times(2\vec{a}-3\vec{b})}{2+3}$ $= \frac{12}{5}\vec{a} - \frac{13}{5}\vec{b}$ And the position vector of the point dividing the line internally in the ratio 2:3 is $\frac{2\times(3\vec{a}-2\vec{b})-3\times(2\vec{a}-3\vec{b})}{2-3}$ $= -5\vec{b}$	5
4.	Diagonals are represented by the vectors $\vec{d}_1 = 3\hat{\imath}+\hat{\jmath}-2\hat{k}$ and $\vec{d}_2 = \hat{\imath}-3\hat{\jmath}+4\hat{k}$. Let $\vec{a}$ and $\vec{b}$ be two adjacent sides of the parallelogram. Thus, $\vec{a}+\vec{b} = 3\hat{\imath}+\hat{\jmath}-2\hat{k}$ and $\vec{a}-\vec{b} = \hat{\imath}-3\hat{\jmath}+4\hat{k}$ Which gives $\vec{a} = 2\hat{\imath}-\hat{\jmath}+\hat{k}$ and $\vec{b} = \hat{\imath}+2\hat{\jmath}-3\hat{k}$ The area of the parallelogram $\lvert\vec{a}\times\vec{b}\rvert = (a_2b_3-b_2a_3)\hat{\imath} + (a_3b_1-a_1b_3)\hat{\jmath} + (a_1b_2-a_2b_1)\hat{k}$ Here $a_1=2$, $a_2=-1$, $a_3=1$, $b_1=1$, $b_2=2$, $b_3=-3$ $\therefore \vec{a}\times\vec{b} = (3-2)\,\hat{\imath} + (1+6)\,\hat{\jmath} + (4+1)\hat{k} = \hat{\imath} + 7\hat{\jmath} + 5\hat{k}$ $\Rightarrow \lvert\vec{a}\times\vec{b}\rvert = \sqrt{1+49+25} = \sqrt{75} = 5\sqrt{3}$ Hence area = $5\sqrt{3}$ sq. units	5

5.	**b** **d** **b** **b** **a**	5
6.	**c** **b** **c** **b** **a**	5
7.	Using triangle law of addition $$\overrightarrow{AB}+\overrightarrow{BC}=\overrightarrow{CA}\overrightarrow{bd}=\frac{1}{2}\overrightarrow{BC}\overrightarrow{AD}=\overrightarrow{AB}+\overrightarrow{BD}$$ And solving $\lvert\overrightarrow{AD}\rvert=\frac{1}{2}\sqrt{34}$	5
8.	$\frac{1}{3}(-i+16j+13k).$	5
9.	As coordinates of A,B,C are : A(1,2,3), B(3,2,1), C(2,1,2), D(3,4,3). (i) $\overrightarrow{AB}=\overrightarrow{OB}$ - $\overrightarrow{OA}$ =(3-1)) $\hat{\imath}$+(2-2)) $\hat{\jmath}$ +(1-3) $\hat{k}$ = 2 $\hat{\imath}$ - 2 $\hat{k}$ Similarly find $\overrightarrow{CD}$ (ii) $\overrightarrow{CD}=\overrightarrow{OD}-\overrightarrow{OC}$ =$\hat{\imath}+3\hat{\jmath}+\hat{k}$ (*a*) $\because \overrightarrow{BC}=\overrightarrow{OC}-\overrightarrow{OB}=(2-3)\hat{i}+(1-2)\hat{j}+(2-1)\hat{k}=-\hat{i}-\hat{j}+\hat{k}$ $\because \widehat{BC}=\frac{\overrightarrow{BC}}{\lvert\overrightarrow{BC}\rvert}=\frac{-\hat{i}-\hat{j}+\hat{k}}{\sqrt{(-1)^2+(-1)^2+1^2}}=\frac{-\hat{i}-\hat{j}+\hat{k}}{\sqrt{3}}$ $=-\frac{1}{\sqrt{3}}\hat{i}-\frac{1}{\sqrt{3}}\hat{j}+\frac{1}{\sqrt{3}}\hat{k}$ Which is a unit vector along $\overrightarrow{BC}$.) (*b*) $\because \overrightarrow{BC}=-\hat{i}-\hat{j}+\hat{k}$ $\overrightarrow{BD}=\overrightarrow{OD}-\overrightarrow{OB}=(3-3)\hat{i}+(4-2)\hat{j}+(3-1)\hat{k}$ $=2\hat{j}+2\hat{k}$ $\because \overrightarrow{BC}$ and $\overrightarrow{BD}$ are adjacent sides of ΔBCD. $=\overrightarrow{BC}\times\overrightarrow{BD}=\begin{vmatrix}\hat{i}&\hat{j}&\hat{k}\\-1&-1&1\\0&2&2\end{vmatrix}=\hat{i}(-2-2)-\hat{j}(-2-0)+k(-2+0)=-4\hat{i}+2\hat{j}-2\hat{k}$ $\therefore$ Area of $\Delta BCD=\frac{1}{2}\lvert\overrightarrow{BC}\times\overrightarrow{BD}\rvert$ $=\frac{1}{2}\sqrt{(-4)^2+2^2+(-2)^2}=\frac{1}{2}\times\sqrt{16+4+4}$ $=\frac{1}{2}\sqrt{24}=\frac{1}{2}\times 2\sqrt{6}=\sqrt{6}$ sq. units	5

10.	Let $ABCD$ be a parallelogram such that $\overrightarrow{AB} = \vec{p}, \overrightarrow{AD} = \vec{q} \Rightarrow \overrightarrow{BC} = \vec{q}$  By triangle law of addition, we get $\overrightarrow{AC} = \vec{p} + \vec{q} = \vec{a}$ [say] ...(*i*) Similarly, $\overrightarrow{BD} = -\vec{p} + \vec{q} = \vec{b}$ [say] ...(*ii*) On adding equation (*i*) and (*ii*), we get $\vec{a} + \vec{b} = 2\vec{q} \Rightarrow \vec{q} = \frac{1}{2}(\vec{a} + \vec{b})$ On subtracting equation (*ii*) from equation (*i*), we get $\vec{a} - \vec{b} = 2\vec{p} \Rightarrow \vec{p} = \frac{1}{2}(\vec{a} - \vec{b})$ Now, $\vec{p} \times \vec{q} = \frac{1}{4}(\vec{a} - \vec{b}) \times (\vec{a} + \vec{b})$ $= \frac{1}{4}(\vec{a} \times \vec{a} + \vec{a} \times \vec{b} - \vec{b} \times \vec{a} - \vec{b} \times \vec{b})$ $= \frac{1}{4}[\vec{a} \times \vec{b} + \vec{a} \times \vec{b}]$ $[\because \vec{a} \times \vec{a} = 0 = \vec{b} \times \vec{b}]$ $= \frac{1}{2}(\vec{a} \times \vec{b})$ So, area of a parallelogram $ABCD = \lvert\vec{p} \times \vec{q}\rvert = \frac{1}{2}\lvert\vec{a} \times \vec{b}\rvert$ Now, area of a parallelogram, whose diagonals are $2\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} + 3\hat{j} - \hat{k}$. $= \frac{1}{2}\lvert(2\hat{i} - \hat{j} + \hat{k}) \times (\hat{i} + 3\hat{j} - \hat{k})\rvert$ $= \frac{1}{2}\left\lvert\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -1 & 1 \\ 1 & 3 & -1 \end{vmatrix}\right\rvert = \frac{1}{2}\lvert[\hat{i}(1-3) - \hat{j}(-2-1) + \hat{k}(6+1)]\rvert$ $= \frac{1}{2}\lvert -2\hat{i} + 3\hat{j} + 7\hat{k}\rvert = \frac{1}{2}\sqrt{4+9+49}$ $= \frac{1}{2}\sqrt{62}$ sq. units	5

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