1. Let $\vec{a} = \hat{j} - \hat{k}$ and $\vec{c} = \hat{i} - \hat{j} - \hat{k}$. Then the vector $\vec{b}$ satisfying $\vec{a} \times \vec{b} + \vec{c} = \vec{0}$ and $\vec{a} \cdot \vec{b} = 3$ is : **[AIEEE-2010]**

(1) $-\hat{i} + \hat{j} - 2\hat{k}$

(2) $2\hat{i} - \hat{j} + 2\hat{k}$

(3) $\hat{i} - \hat{j} - 2\hat{k}$

(4) $\hat{i} + \hat{j} - 2\hat{k}$

2. If the vectors $\vec{a} = \hat{i} - \hat{j} + 2\hat{k}$, $\vec{b} = 2\hat{i} + 4\hat{j} + \hat{k}$ and $\vec{c} = \lambda\hat{i} + \hat{j} + \mu\hat{k}$ are mutually orthogonal, then $(\lambda, \mu) =$ **[AIEEE-2010]**

(1) (–3, 2) (2) (2, –3)

(3) (–2, 3) (4) (3, –2)

3. If $\vec{a} = \frac{1}{\sqrt{10}}(3\hat{i} + \hat{k})$ and $\vec{b} = \frac{1}{7}(2\hat{i} + 3\hat{j} - 6\hat{k})$, then the value of $(2\vec{a} - \vec{b}).[(\vec{a} \times \vec{b}) \times (\vec{a} + 2\vec{b})]$ is :- **[AIEEE-2011]**

(1) 5 (2) 3

(3) – 5 (4) – 3

4. The vectors $\vec{a}$ and $\vec{b}$ are not perpendicular and $\vec{c}$ and $\vec{d}$ are two vectors satisfying : $\vec{b} \times \vec{c} = \vec{b} \times \vec{d}$ and $\vec{a}.\vec{d} = 0$. Then the vector $\vec{d}$ is equal to :- **[AIEEE-2011]**

(1) $\vec{b} + \left(\frac{\vec{b}.\vec{c}}{\vec{a}.\vec{b}}\right)\vec{c}$

(2) $\vec{c} - \left(\frac{\vec{a}.\vec{c}}{\vec{a}.\vec{b}}\right)\vec{b}$

(3) $\vec{b} - \left(\frac{\vec{b}.\vec{c}}{\vec{a}.\vec{b}}\right)\vec{c}$

(4) $\vec{c} + \left(\frac{\vec{a}.\vec{c}}{\vec{a}.\vec{b}}\right)\vec{b}$

5. If the vectors $p\hat{i} + \hat{j} + \hat{k}, \hat{i} + q\hat{j} + \hat{k}$ and $\hat{i} + \hat{j} + r\hat{k}$ $(p \neq q \neq r \neq 1)$ are coplanar, then the value of $pqr - (p + q + r)$ is : **[AIEEE-2011]**

(1) –2 (2) 2

(3) 0 (4) –1

6. Let $\vec{a}, \vec{b}, \vec{c}$ be three non-zero vectors which are pairwise non-collinear. If $\vec{a} + 3\vec{b}$ is collinear with $\vec{c}$ and $\vec{b} + 2\vec{c}$ is colliner with $\vec{a}$, then $\vec{a} + 3\vec{b} + 6\vec{c}$ is **[AIEEE-2011]**

(1) $\vec{a} + \vec{c}$ (2) $\vec{a}$

(3) $\vec{c}$ (4) $\vec{0}$

7. Let $\hat{a}$ and $\hat{b}$ be two unit vectors. If the vectors $\vec{c} = \hat{a} + 2\hat{b}$ and $\vec{d} = 5\hat{a} - 4\hat{b}$ are perpendicular to each other, then the angle between $\hat{a}$ and $\hat{b}$ is : **[AIEEE-2012]**

(1) $\frac{\pi}{4}$ (2) $\frac{\pi}{6}$ (3) $\frac{\pi}{2}$ (4) $\frac{\pi}{3}$

8. Let ABCD be a parallelogram such that $\overrightarrow{AB} = \vec{q}, \overrightarrow{AD} = \vec{p}$ and $\angle BAD$ be an acute angle. If $\vec{r}$ is the vector that coincides with the altitude directed from the vertex B to the side AD, then $\vec{r}$ is given by : **[AIEEE-2012]**

(1) $\vec{r} = -3\vec{q} + \frac{3(\vec{p} \cdot \vec{q})}{(\vec{p} \cdot \vec{p})}\vec{p}$

(2) $\vec{r} = 3\vec{q} - \frac{3(\vec{p} \cdot \vec{q})}{(\vec{p} \cdot \vec{p})}\vec{p}$

(3) $\vec{r} = -\vec{q} + \left(\frac{\vec{p} \cdot \vec{q}}{\vec{p} \cdot \vec{p}}\right)\vec{p}$

(4) $\vec{r} = \vec{q} - \left(\frac{\vec{p} \cdot \vec{q}}{\vec{p} \cdot \vec{p}}\right)\vec{p}$

9. ABCD is a parallelogram. The position vectors of A and C are respectively, $3\hat{i}+3\hat{j}+5\hat{k}$ and $\hat{i}-5\hat{j}-5\hat{k}$. If M is the mid-point of the diagonal DB, then the magnitude of the projection of $\overrightarrow{OM}$ on $\overrightarrow{OC}$, where O is the origin is :-

[AIEEE-2012 (Online)]

(1) $\frac{7}{\sqrt{50}}$ (2) $7\sqrt{50}$ (3) $\frac{7}{\sqrt{51}}$ (4) $7\sqrt{51}$

10. If $\vec{a}=\hat{i}-2\hat{j}+3\hat{k}, \vec{b}=2\hat{i}+3\hat{j}-\hat{k}$ and $\vec{c}=\lambda\hat{i}+\hat{j}+(2\lambda-1)\hat{k}$ are coplanar vectors, then λ is equal to :- **[AIEEE-2012 (Online)]**

(1) 1 (2) 2
(3) –1 (4) 0

11. If $\vec{a}+\vec{b}+\vec{c}=\vec{0}, |\vec{a}|=3, |\vec{b}|=5$ and $|\vec{c}|=7$, then the angle between $\vec{a}$ and $\vec{b}$ is :- **[AIEEE-2012 (Online)]**

(1) $\frac{\pi}{3}$ (2) $\frac{\pi}{2}$ (3) $\frac{\pi}{6}$ (4) $\frac{\pi}{4}$

12. If $\vec{a}=\hat{i}-2\hat{j}+3\hat{k}, \vec{b}=2\hat{i}+3\hat{j}-\hat{k}$ and $\vec{c}=r\hat{i}+\hat{j}+(2r-1)\hat{k}$ are three vectors such that $\vec{c}$ is parallel to the plane of $\vec{a}$ and $\vec{b}$, then r is equal to :- **[AIEEE-2012 (Online)]**

(1) 0 (2) 2
(3) –1 (4) 1

13. A unit vector which is perpendicular to the vector $2\vec{i}-\vec{j}+2\vec{k}$ and is coplanar with the vectors $\vec{i}+\vec{j}-\vec{k}$ and $2\vec{i}+\vec{j}-\vec{k}$ is :-

[AIEEE-2012 (Online)]

(1) $\frac{3\vec{i}+2\vec{j}-2\vec{k}}{\sqrt{17}}$ (2) $\frac{2\hat{j}+\hat{k}}{\sqrt{5}}$

(3) $\frac{3\vec{i}+2\vec{j}+2\vec{k}}{\sqrt{17}}$ (4) $\frac{2\vec{i}+2\vec{j}-\vec{k}}{3}$

14. If $\vec{u}=\hat{j}+4\hat{k}, \vec{v}=\hat{i}-3\hat{k}$, and $\vec{w}=\cos\theta\,\hat{i}+\sin\theta\,\hat{j}$ are vectors in 3-dimensional space, then the maximum possible value of $|\vec{u}\times\vec{v}.\vec{w}|$ is :-

[AIEEE-2012 (Online)]

(1) $\sqrt{14}$ (2) 5
(3) 7 (4) $\sqrt{13}$

15. if the vectors $\overrightarrow{AB}=3\hat{i}+4\hat{k}$ and $\overrightarrow{AC}=5\hat{i}-2\hat{j}+4\hat{k}$ are the sides of a triangle ABC, then the length of the median through A is :

[JEE (Main)-2013]

(1) $\sqrt{18}$ (2) $\sqrt{72}$
(3) $\sqrt{33}$ (4) $\sqrt{45}$

16. If $\left[\vec{a}\times\vec{b}\ \vec{b}\times\vec{c}\ \vec{c}\times\vec{a}\right]=\lambda\left[\vec{a}\,\vec{b}\,\vec{c}\right]^2$ then λ is equal to:

[JEE (Main)-2014]

(1) 2 (2) 3
(3) 0 (4) 1

17. Let $\bar{a}$, $\bar{b}$ and $\bar{c}$ be non-zero vectors such that $(\bar{a}\times\bar{b})\times\bar{c}=\frac{1}{3}|\bar{b}||\bar{c}|\bar{a}$. If θ is the acute angle between the vectors $\bar{b}$ and $\bar{c}$, then $\sin\theta$ equals- **[JEE (Main)-2015]**

(1) $\frac{1}{3}$ (2) $\frac{\sqrt{2}}{3}$ (3) $\frac{2}{3}$ (4) $\frac{2\sqrt{2}}{3}$

18. Let $\vec{a},\vec{b}$ and $\vec{c}$ be three unit vectors such that $\vec{a}\times\left(\vec{b}\times\vec{c}\right)=\frac{\sqrt{3}}{2}\left(\vec{b}+\vec{c}\right)$. If $\vec{b}$ is not parallel to $\vec{c}$, then the angle between $\vec{a}$ and $\vec{b}$ is :-

[JEE (Main)-2016]

(1) $\frac{5\pi}{6}$ (2) $\frac{3\pi}{4}$ (3) $\frac{\pi}{2}$ (4) $\frac{2\pi}{3}$

19. Let $\vec{a}=2\hat{i}+\hat{j}-2\hat{k}$ and $\vec{b}=\hat{i}+\hat{j}$. Let $\vec{c}$ be a vector such that $|\vec{c}-\vec{a}|=3$, $|(\vec{a}\times\vec{b})\times\vec{c}|=3$ and the angle between $\vec{c}$ and $\vec{a}\times\vec{b}$ be 30º. Then $\vec{a}\cdot\vec{c}$ is equal to : **[JEE (Main)-2017]**

(1) $\frac{1}{8}$ (2) $\frac{25}{8}$

(3) 2 (4) 5

20. Let $\vec{u}$ be a vector coplanar with the vectors $\vec{a}=2\hat{i}+3\hat{j}-\hat{k}$ and $\vec{b}=\hat{j}+\hat{k}$. If $\vec{u}$ is perpendicular to $\vec{a}$ and $\vec{u}.\vec{b}$ = 24, then $|\vec{u}|^2$ is equal to- **[JEE (Main)-2018]**

(1) 315 (2) 256

(3) 84 (4) 336

21. Two adjacent sides of a parallelogram ABCD are given by $\overrightarrow{AB}=2\hat{i}+10\hat{j}+11\hat{k}$ and $\overrightarrow{AD}=-\hat{i}+2\hat{j}+2\hat{k}$

The side AD is rotated by an acute angle α in the plane of the parallelogram so that AD becomes AD'. If AD' makes a right angle with the side AB, then the cosine of the angle α is given by - **[IIT-2010]**

(1) $\frac{8}{9}$ (2) $\frac{\sqrt{17}}{9}$

(3) $\frac{1}{9}$ (4) $\frac{4\sqrt{5}}{9}$

22. Let $\vec{a}=\hat{i}+\hat{j}+\hat{k}, \vec{b}=\hat{i}-\hat{j}+\hat{k}$ and $\vec{c}=\hat{i}-\hat{j}-\hat{k}$ be three vectors. A vector $\vec{v}$ in the plane of $\vec{a}$ and $\vec{b}$, whose projection on $\vec{c}$ is $\frac{1}{\sqrt{3}}$, is given by **[IIT-2011]**

(1) $\hat{i}-3\hat{j}+3\hat{k}$ (2) $-3\hat{i}-3\hat{j}-\hat{k}$

(3) $3\hat{i}-\hat{j}+3\hat{k}$ (4) $\hat{i}+3\hat{j}-3\hat{k}$

***23.** The vector(s) which is/are coplanar with vectors $\hat{i}+\hat{j}+2\hat{k}$ and $\hat{i}+2\hat{j}+\hat{k}$, and perpendicular to the vector $\hat{i}+\hat{j}+\hat{k}$ is/are **[IIT-2011]**

(1) $\hat{j}-\hat{k}$ (2) $-\hat{i}+\hat{j}$

(3) $\hat{i}-\hat{j}$ (4) $-\hat{j}+\hat{k}$

24. Let $\vec{a}=-\hat{i}-\hat{k}, \vec{b}=-\hat{i}+\hat{j}$ and $\vec{c}=\hat{i}+2\hat{j}+3\hat{k}$ be three given vectors. If $\vec{r}$ is a vector such that $\vec{r}\times\vec{b}=\vec{c}\times\vec{b}$ and $\vec{r}.\vec{a}=0$, then the value of $\vec{r}.\vec{b}$ is **[IIT-2011]**

(1) 8 (2) 9

(3) 6 (4) None of these

25. If $\vec{a}$ and $\vec{b}$ are vectors such that $|\vec{a}+\vec{b}|=\sqrt{29}$ and $\vec{a}\times(2\hat{i}+3\hat{j}+4\hat{k})=(2\hat{i}+3\hat{j}+4\hat{k})\times\vec{b}$, then a possible value of $(\vec{a}+\vec{b}).(-7\hat{i}+2\hat{j}+3\hat{k})$ is **[IIT-2012]**

(1) 0 (2) 3

(3) 4 (4) 8

26. If $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vectors satisfying $|\vec{a}-\vec{b}|^2+|\vec{b}-\vec{c}|^2+|\vec{c}-\vec{a}|^2=9$, then $|2\vec{a}+5\vec{b}+5\vec{c}|$ is **[IIT-2012]**

27. Let $\overrightarrow{PR}=3\hat{i}+\hat{j}-2\hat{k}$ and $\overrightarrow{SQ}=\hat{i}-3\hat{j}-4\hat{k}$ determine diagonals of a parallelogram PQRS and $\overrightarrow{PT}=\hat{i}+2\hat{j}+3\hat{k}$ be another vector. Then the volume of the parallelepiped determined by the vectors $\overrightarrow{PT}, \overrightarrow{PQ}$ and $\overrightarrow{PS}$ is **[JEE-Advanced 2013]**

(1) 5 (2) 20

(3) 10 (4) 30

28. Match List-I with List-II and select the correct answer using the code given below the lists.

	List-I		List-II
P.	Volume of parallelepiped determined by vectors $\vec{a},\vec{b}$ and $\vec{c}$ is 2. Then the volume of the parallelepiped determined by vectors $2\left(\vec{a}\times\vec{b}\right),3\left(\vec{b}\times\vec{c}\right)$ and $\left(\vec{c}\times\vec{a}\right)$ is	1.	100
Q.	Volume of parallelepiped determined by vectors $\vec{a},\vec{b}$ and $\vec{c}$ is 5. Then the volume of the parallelepiped determined by vectors $3\left(\vec{a}+\vec{b}\right),\left(\vec{b}+\vec{c}\right)$ and $2\left(\vec{c}+\vec{a}\right)$ is	2.	30
R	Area of a triangle with adjacent sides determined by vectors $\vec{a}$ and $\vec{b}$ is 20. Then the area of the triangle with adjacent sides determined by vectors $\left(2\vec{a}+3\vec{b}\right)$ and $\left(\vec{a}-\vec{b}\right)$ is S.	3.	24
S	Area of a parallelogram with adjacent sides determined by vectors $\vec{a}$ and $\vec{b}$ is 30. Then the area of the parallelogram with adjacent sides determined by vectors $\left(\vec{a}+\vec{b}\right)$ and $\vec{a}$ is	4.	60

[JEE-Advanced 2013]

Codes :

	P	Q	R	S
(1)	4	2	3	1
(2)	2	3	1	4
(3)	3	4	1	2
(4)	1	4	3	2

***29.** Let $\vec{x},\vec{y}$ and $\vec{z}$ be three vectors each of magnitude $\sqrt{2}$ and the angle between each pair of them is $\frac{\pi}{3}$. If $\vec{a}$ is a nonzero vector perpendicular to $\vec{x}$ and $\vec{y}\times\vec{z}$ and $\vec{b}$ is nonzero vector perpendicular to $\vec{y}$ and $\vec{z}\times\vec{x}$, then **[JEE(Advanced)-2014]**

(1) $\vec{b}=(\vec{b}.\vec{z})(\vec{z}-\vec{x})$

(2) $\vec{a}=(\vec{a}.\vec{y})(\vec{y}-\vec{z})$

(3) $\vec{a}.\vec{b}=-(\vec{a}.\vec{y})(\vec{b}.\vec{z})$

(4) $\vec{a}=(\vec{a}.\vec{y})(\vec{z}-\vec{y})$

30. Let $\vec{a},\vec{b}$, and $\vec{c}$ be three non-coplanar unit vectors such that the angle between every pair of them is $\frac{\pi}{3}$. If $\vec{a}\times\vec{b}+\vec{b}\times\vec{c}=p\vec{a}+q\vec{b}+r\vec{c}$, where p,q and r are scalars, then the value of $\frac{p^2+2q^2+r^2}{q^2}$ is

[JEE(Advanced)-2014]

* **Marked Questions are multiple answer**

PREVIOUS YEARS QUESTIONS				**ANSWER KEY**						Exercise-II
Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**1**	**1**	**3**	**2**	**1**	**4**	**4**	**3**	**3**	**4**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**1**	**1**	**1**	**2**	**3**	**4**	**4**	**1**	**3**	**4**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**2**	**3**	**1,4**	**2**	**3**	**3**	**3**	**3**	**1,2,3**	**4**