

Tarun Classes of Mathematics

IIT-JEE Mains | CBSE | PU-CET | NDA

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Vectors Algebra

Subjects : Maths

Previous Year Questions

Maths - Section A (MCQ.)

1. **Passage:** Let $\vec{a}, \vec{b}, \vec{c}, \vec{a} + \vec{b}, \vec{b} + \vec{c}, \vec{a} + \vec{b} + \vec{c}$ be unit vectors.

Question: What is the angle between $\vec{a}$ and $\vec{b}$?

- A) $\frac{\pi}{6}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{2}$ D) $\frac{2\pi}{3}$

2. **Passage:** Let $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{b} \times \vec{c} = \vec{a}$.

Question: Consider the following statements :

I. $\vec{a}, \vec{b}, \vec{c}$ are orthogonal in pairs.

II. $\vec{a}, \vec{b}, \vec{c}$ are unit vectors.

Which of the statements given above is/are correct ?

- A) I only B) II only C) Both I and II D) Neither I nor II

3. **Passage:** Let $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{b} \times \vec{c} = \vec{a}$.

Question: Consider the following statements :

I. $(\vec{a} \times \vec{b}) \cdot \vec{c} + (\vec{b} \times \vec{c}) \cdot \vec{a} = (\vec{c} \times \vec{a}) \cdot \vec{b}$

II. $\{(\vec{a} \times \vec{b}) \times (\vec{b} \times \vec{c})\} \cdot \vec{b} = 1$

Which of the statements given above is/are correct ?

- A) I only B) II only C) Both I and II D) Neither I nor II

4. **Passage:** Let $\vec{a}, \vec{b}, \vec{c}$ be unit vectors. Further, $\vec{a}$ is perpendicular to $\vec{b}$; $\vec{c}$ makes an angle $\frac{\pi}{3}$ with both $\vec{a}$ and $\vec{b}$; and $\vec{c} = p\vec{a} + q\vec{b} + r(\vec{a} \times \vec{b})$.

Question: What is the value of $(p + q)$?

- A) $\frac{1}{2}$ B) 1 C) $\frac{3}{2}$ D) 2

5. Let $\vec{a} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - \hat{k}$.

If $\vec{a} \times (\vec{b} \times \vec{a}) = \alpha\hat{i} - \beta\hat{j} + \gamma\hat{k}$, then what is the value of $\alpha + \beta + \gamma$?

- A) 8 B) 7 C) 6 D) 1

6. For any vector $\vec{r}$, what is $(\vec{r} \cdot \hat{i})(\vec{r} \times \hat{i}) + (\vec{r} \cdot \hat{j})(\vec{r} \times \hat{j}) + (\vec{r} \cdot \hat{k})(\vec{r} \times \hat{k})$ equal to?

- A) $\vec{0}$ B) $\vec{r}$ C) $2\vec{r}$ D) $3\vec{r}$

7. Let $\vec{a}$ and $\vec{b}$ are two vectors of magnitude 4 inclined at an angle $\frac{\pi}{3}$, then what is the angle between $\vec{a}$ and $\vec{a} - \vec{b}$?

- A) $\frac{\pi}{2}$ B) $\frac{\pi}{3}$ C) $\frac{\pi}{4}$ D) $\frac{\pi}{6}$

8. For what value of the angle between the vectors $\vec{a}$ and $\vec{b}$ is the quantity $|\vec{a} \times \vec{b}| + \sqrt{3}|\vec{a} \cdot \vec{b}|$ maximum?
 A) 0° B) 30° C) 45° D) 60°
9. Let θ be the angle between two unit vectors $\vec{a}$ and $\vec{b}$. If $\vec{a} + 2\vec{b}$ is perpendicular to $5\vec{a} - 4\vec{b}$, then what is $\cos \theta + \cos 2\theta$ equal to?
 A) 0 B) $\frac{1}{2}$ C) 1 D) $\frac{\sqrt{3}+1}{2}$
10. What is $3\alpha + 2\beta$ equal to if $(2\hat{i} + 6\hat{j} + 27\hat{k}) \times (\hat{i} + \alpha\hat{j} + \beta\hat{k})$ is a null vector?
 A) 36 B) 33 C) 30 D) 27
11. Let ABCDEF be a regular hexagon. If $\overrightarrow{AD} = m\overrightarrow{BC}$ and $\overrightarrow{CF} = n\overrightarrow{AB}$, then what is mn equal to?
 A) -4 B) -2 C) 2 D) 4
12. The vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are of the same length. If taken pairwise, they form equal angles. If $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = \hat{j} + \hat{k}$, then what can $\vec{c}$ be equal to?
 A. $\hat{i} + \hat{k}$
 B. $\frac{-\hat{i} + 4\hat{j} - \hat{k}}{3}$
 Select the correct answer using the code given below.
 A) A only B) B only C) Both A and B D) Neither A nor B
13. Paragraph:
 Let $\vec{a} = 3\hat{i} + 3\hat{j} + 3\hat{k}$ and $\vec{c} = \hat{j} - \hat{k}$. Let $\vec{b}$ be such that $\vec{a} \cdot \vec{b} = 27$ and $\vec{a} \times \vec{b} = 9\vec{c}$
Question:
 What is $\vec{b}$ equal to?
 A) $3\hat{i} + 4\hat{j} + 2\hat{k}$ B) $5\hat{i} + 2\hat{j} + 2\hat{k}$ C) $5\hat{i} - 2\hat{j} + 6\hat{k}$ D) $3\hat{i} + 3\hat{j} + 4\hat{k}$
14. Paragraph:
 Let $\vec{a} = 3\hat{i} + 3\hat{j} + 3\hat{k}$ and $\vec{c} = \hat{j} - \hat{k}$. Let $\vec{b}$ be such that $\vec{a} \cdot \vec{b} = 27$ and $\vec{a} \times \vec{b} = 9\vec{c}$
Question:
 What is the angle between $(\vec{a} + \vec{b})$ and $\vec{c}$?
 A) $\frac{\pi}{2}$ B) $\frac{\pi}{3}$ C) $\frac{\pi}{4}$ D) $\frac{\pi}{6}$
15. What is the length of projection of the vector $\hat{i} + 2\hat{j} + 3\hat{k}$ on the vector $2\hat{i} + 3\hat{j} - 2\hat{k}$?
 A) $\frac{1}{\sqrt{17}}$ B) $\frac{2}{\sqrt{17}}$ C) $\frac{3}{\sqrt{17}}$ D) $\frac{2}{\sqrt{14}}$
16. If $(\vec{a} \times \vec{b})^2 + (\vec{a} \cdot \vec{b})^2 = 144$ and $|\vec{b}| = 4$, then what is the value of $|\vec{a}|$?
 A) 3 B) 4 C) 5 D) 6
17. If θ is the angle between vectors $\vec{a}$ and $\vec{b}$ such that $\vec{a} \cdot \vec{b} \geq 0$, then which one of the following is correct?
 A) $0 \leq \theta \leq \pi$ B) $\frac{\pi}{2} \leq \theta \leq \pi$ C) $0 \leq \theta \leq \frac{\pi}{2}$ D) $0 < \theta < \frac{\pi}{2}$
18. Consider the following in respect of the vectors
 $\vec{a} = (0, 1, 1)$ and $\vec{b} = (1, 0, 1)$:
 1. The number of unit vectors perpendicular to both $\vec{a}$ and $\vec{b}$ is only one.
 2. The angle between the vectors is $\frac{\pi}{3}$.
 Which of the statement given above is/are correct?
 A) 1 only B) 2 only C) both 1 and 2 D) Neither 1 nor 2
19. The vectors $60\hat{i} + 3\hat{j}$, $40\hat{i} - 8\hat{j} + \beta\hat{k}$ and $52\hat{j}$ are collinear if:
 A) $\beta = 20$ B) $\beta = 40$ C) $\beta = -40$ D) $\beta = 26$

20. Consider the following statements :
1. Dot product over vector addition is distributive
 2. Cross product over vector addition is distributive
 3. Cross product of vectors is associative
- Which of the above statements is/are correct?
- A) 1 only B) 2 only C) 1 and 2 only D) 1, 2 and 3
21. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be unit vectors lying on the same plane. What is $\{(3\vec{a} + 2\vec{b}) \times (5\vec{a} - 4\vec{c})\} \cdot (\vec{b} + 2\vec{c})$ equal to?
- A) -8 B) -32 C) 8 D) 0
22. Let $\vec{a}, \vec{b}, \vec{c}$ be three non-zero vectors such that $\vec{a} \times \vec{b} = \vec{c}$. Consider the following statements :
1. $\vec{a}$ is unique if $\vec{b}$ and $\vec{c}$ are given
 2. $\vec{c}$ is unique if $\vec{a}$ and $\vec{b}$ are given
- Which of the above statements is/are correct?
- A) 1 only B) 2 only C) Both 1 and 2 D) Neither 1 nor 2
23. Let $\vec{a}$ and $\vec{b}$ are two unit vectors such that $\vec{a} + 2\vec{b}$ and $5\vec{a} - 4\vec{b}$ are perpendicular. What is the angle between $\vec{a}$ and $\vec{b}$?
- A) $\frac{\pi}{6}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{3}$ D) $\frac{\pi}{2}$
24. What are the values of x for which the angle between the vectors $2x^2\hat{i} + 3x\hat{j} + \hat{k}$ and $\hat{i} - 2\hat{j} + x^2\hat{k}$ is obtuse?
- A) $0 < x < 2$ B) $x < 0$ C) $x > 2$ D) $0 \leq x \leq 2$
25. The position vectors of vertices A, B and C of triangle ABC are respectively $\hat{j} + \hat{k}, 3\hat{i} + \hat{j} + 5\hat{k}$ and $3\hat{j} + 3\hat{k}$. What is angle C equal to?
- A) $\frac{\pi}{6}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{3}$ D) $\frac{\pi}{2}$
26. If $4\hat{i} + \hat{j} - 3\hat{k}$ and $p\hat{i} + q\hat{j} - 2\hat{k}$ are collinear vectors, then what are the possible values of p and q respectively?
- A) $4, 1$ B) $1, 4$ C) $\frac{8}{3}, \frac{2}{3}$ D) $\frac{2}{3}, \frac{8}{3}$
27. If are the position vectors of the vertices A, B, C respectively of a triangle ABC and G is the centroid of the triangle, then what is equal to?
- A) $\frac{\vec{a} + \vec{b} + \vec{c}}{3}$ B) $\frac{2\vec{a} - \vec{b} - \vec{c}}{3}$
- C) $\frac{\vec{b} + \vec{c} - 2\vec{a}}{3}$ D) $\frac{\vec{a} - 2\vec{b} - 2\vec{c}}{3}$
28. Let $\vec{a}$ and $\vec{b}$ be two unit vectors such that $|\vec{a} - \vec{b}| < 2$. If 2θ is the angle between $\vec{a}$ and $\vec{b}$, then which one of the following is correct?
- A) $0 < \sin \theta < 1$ only B) $-\frac{1}{2} < \sin \theta < \frac{1}{2}$ only C) $-1 < \sin \theta < 0$ only D) $-1 < \sin \theta < 1$
29. $PQRS$ is a parallelogram. If $\vec{PR} = \vec{a}$ and $\vec{QS} = \vec{b}$, then what is $\vec{PQ}$ equal to?
- A) $\vec{a} + \vec{b}$ B) $\vec{a} - \vec{b}$ C) $\frac{\vec{a} + \vec{b}}{2}$ D) $\frac{\vec{a} - \vec{b}}{2}$
30. If $\vec{a}, \vec{b}$ and $\vec{c}$ are coplanar, then what is $(2\vec{a} \times 3\vec{b}) \cdot 4\vec{c} + (5\vec{b} \times 3\vec{c}) \cdot 6\vec{a}$ equal to?
- A) 114 B) 66 C) 0 D) -66
31. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be unit vectors such that $\vec{a} \times \vec{b}$ is perpendicular to $\vec{c}$. If θ is the angle between $\vec{a}$ and $\vec{b}$ then which of the following is/are correct?
1. $\vec{a} \times \vec{b} = \sin \theta \vec{c}$
 2. $\vec{a} \cdot (\vec{b} \times \vec{c}) = 0$
- Select the correct answer using the code given below.

- A) 1 only B) 2 only C) Both 1 and 2 D) Neither 1 nor 2

32. If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}| = 4$, then which one of the following is correct?

- A) $\vec{a}$ and $\vec{b}$ must be unit vectors. B) $\vec{a}$ must be parallel to $\vec{b}$.
C) $\vec{a}$ must be perpendicular to $\vec{b}$. D) $\vec{a}$ must be equal to $\vec{b}$.

33. The coordinates of three consecutive vertices of a parallelogram $ABCD$ are $A(1, 3)$, $B(-1, 2)$ and $C(3, 5)$. What is the area of the parallelogram?

- A) 1 square unit B) $\frac{3}{2}$ square units C) 2 square units D) $\frac{5}{2}$ square units

34. If $\vec{a} + 3\vec{b} = 3\hat{i} - \hat{j}$ and $2\vec{a} + \vec{b} = \hat{i} - 2\hat{j}$, then what is the angle between $\vec{a}$ and $\vec{b}$?

- A) 0 B) $\frac{\pi}{6}$ C) $\frac{\pi}{3}$ D) $\frac{\pi}{2}$

35. If $(\vec{a} + \vec{b})$ is perpendicular to $\vec{a}$ and magnitude of $\vec{b}$ is twice that of $\vec{a}$, then what is the value of $(4\vec{a} + \vec{b}) \cdot \vec{b}$ equal to?

- A) 0 B) 1 C) $8|\vec{a}|^2$ D) $8|\vec{b}|^2$

36. A vector $\vec{r} = a\hat{i} + b\hat{j}$ is equally inclined to both x and y axes. If the magnitude of the vector is 2 units, then what are the values of a and b respectively?

- A) $\frac{1}{2}, \frac{1}{2}$ B) $\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ C) $\sqrt{2}, \sqrt{2}$ D) 2, 2

37. If the position vectors of A and B are $(\sqrt{2} - 1)\hat{i} - \hat{j}$ and $\hat{i} + (\sqrt{2} + 1)\hat{j}$ respectively, then what is the magnitude of $\vec{AB}$?

- A) $2\sqrt{2}$ B) $3\sqrt{2}$ C) $2\sqrt{3}$ D) $3\sqrt{3}$

38. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors such that $\vec{a}, \vec{b}$ and $\vec{c}$ are coplanar. Which of the following is /are correct?

1. $(\vec{a} \times \vec{b}) \times \vec{c}$ is coplanar with $\vec{a}$ and $\vec{b}$
2. $(\vec{a} \times \vec{b}) \times \vec{c}$ is perpendicular to $\vec{a} \times \vec{b}$

Select the correct answer using the code given below.

- A) 1 only B) 2 only C) Both 1 and 2 D) Neither 1 nor 2

39. If $\hat{a}$ is a unit vector in the xy -plane making an angle 30° with the positive x -axis, then what is $\hat{a}$ equal to?

- A) $\frac{\sqrt{3}\hat{i} + \hat{j}}{2}$ B) $\frac{\sqrt{3}\hat{i} - \hat{j}}{2}$
C) $\frac{\hat{i} + \sqrt{3}\hat{j}}{2}$ D) $\frac{\hat{i} - \sqrt{3}\hat{j}}{2}$

40. If $|\vec{a} \times \vec{b}|^2 + |\vec{a} \cdot \vec{b}|^2 = 144$ and $|\vec{a}| = 4$, then what is $|\vec{b}|$ equal to?

- A) 3 B) 4 C) 6 D) 8

41. Two adjacent sides of a parallelogram are $2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\hat{i} - 2\hat{j} - 3\hat{k}$. What is the magnitude of dot product of vectors which represent its diagonals?

- A) 21 B) 25 C) 31 D) 36

42. The sine of the angle between vectors $\vec{a} = 2\hat{i} - 6\hat{j} - 3\hat{k}$ and $\vec{b} = 4\hat{i} + 3\hat{j} - \hat{k}$

- A) $\frac{1}{\sqrt{26}}$ B) $\frac{5}{\sqrt{26}}$ C) $\frac{5}{26}$ D) $\frac{1}{26}$

43. If $|\vec{a}| = 7$, $|\vec{b}| = 11$ and $|\vec{a} + \vec{b}| = 10\sqrt{3}$, then $|\vec{a} - \vec{b}|$ is equal to

- A) 40 B) 10 C) $4\sqrt{10}$ D) $2\sqrt{10}$

44. Paragraph:

Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ and $|\vec{a}| = 10, |\vec{b}| = 6$ and $|\vec{c}| = 14$.

Question:

What is $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$ equal to?

- A) -332 B) -166 C) 0 D) 166

45. Let $\hat{a}, \hat{b}$ be two unit vectors and θ be the angle between them.

What is $\cos\left(\frac{\theta}{2}\right)$ equal to?

- A) $\frac{|\hat{a}-\hat{b}|}{2}$ B) $\frac{|\hat{a}+\hat{b}|}{2}$ C) $\frac{|\hat{a}-\hat{b}|}{4}$ D) $\frac{|\hat{a}+\hat{b}|}{4}$

46. If $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{b} = 3\hat{i} + 2\hat{j} - \lambda\hat{k}$ are perpendicular, then what is the value of λ ?

- A) 2 B) 3 C) 4 D) 5

47. If $\vec{a} + 2\vec{b} + 3\vec{c} = \vec{0}$ and $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} = \lambda(\vec{b} \times \vec{c})$, then what is the value of λ ?

- A) 2 B) 3 C) 4 D) 6

48. A unit vector perpendicular to each of the vectors $2\hat{i} - \hat{j} + \hat{k}$ and $3\hat{i} - 4\hat{j} - \hat{k}$ is

- A) $\frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} - \frac{1}{\sqrt{3}}\hat{k}$
B) $\frac{1}{\sqrt{2}}\hat{i} + \frac{1}{2}\hat{j} + \frac{1}{2}\hat{k}$
C) $\frac{1}{\sqrt{3}}\hat{i} - \frac{1}{\sqrt{3}}\hat{j} - \frac{1}{\sqrt{3}}\hat{k}$
D) $\frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} + \frac{1}{\sqrt{3}}\hat{k}$

49. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, then which of the following is/are correct?

1. $\vec{a}, \vec{b}, \vec{c}$ are coplanar.
2. $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$

Select the correct answer using the code given below.

- A) 1 only B) 2 only C) Both 1 and 2 D) Neither 1 nor 2

50. If the magnitude of difference of two unit vectors is $\sqrt{3}$, then the magnitude of sum of the two vectors is

- A) 1/2 unit B) 1 unit C) 2 unit D) 3 unit

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Vectors Algebra

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Previous Year Questions

Maths - Section A (MCQ.)

1 - D	2 - A	3 - D	4 - B	5 - D	6 - A	7 - B	8 - B	9 - A	10 - A
11 - A	12 - C	13 - B	14 - A	15 - B	16 - A	17 - B	18 - B	19 - C	20 - C
21 - D	22 - B	23 - C	24 - A	25 - D	26 - C	27 - C	28 - D	29 - D	30 - A
31 - B	32 - C	33 - C	34 - D	35 - A	36 - C	37 - C	38 - C	39 - A	40 - A
41 - C	42 - B	43 - D	44 - B	45 - B	46 - B	47 - D	48 - A	49 - C	50 - B

