



## MATHS

### BOOKS - CENGAGE MATHS (HINGLISH)

## VECTORS

#### Dpp 1 1

1. A line makes an angle  $\theta$  both with x-axis and y-axis. A possible range of  $\theta$  is

A.  $\left[0, \frac{\pi}{4}\right]$

B.  $\left[0, \frac{\pi}{2}\right]$

C.  $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$

D.  $\left[\frac{\pi}{6}, \frac{\pi}{3}\right]$

**Answer: C**



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2. A line segment has length 63 and direction ratios are 3, -2, 6. The components of the line vector are

A. -27, 18, 54

B. 27, -18, 54

C. 27, -18, 054

D. -7, -18, -54

Answer: B



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3. If  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are position vectors of A, B, and C respectively of  $\triangle ABC$  and if  $|\vec{a} - \vec{b}| = 4$ ,  $|\vec{b} - \vec{c}| = 2$ ,  $|\vec{c} - \vec{a}| = 3$ , then the distance between the centroid and incenter of  $\triangle ABC$  is

A. 1

B.  $\frac{1}{2}$

C.  $\frac{1}{3}$

D.  $\frac{2}{3}$

**Answer: C**



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4. Let  $O$  be an interior point of  $\triangle ABC$  such that  $\overrightarrow{OA} + 2\overrightarrow{OB} + 3\overrightarrow{OC} = 0$ . Then the ratio of area of  $\triangle ABC$  to area of  $\triangle AOC$  is

A. 2

B.  $\frac{3}{2}$

C. 3

D.  $\frac{5}{2}$

**Answer: C**

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5. In a three-dimensional coordinate system,  $P$ ,  $Q$ , and  $R$  are images of a point  $A(a, b, c)$  in the  $x - y$ ,  $y - z$  and  $z - x$  planes, respectively. If  $G$  is the centroid of triangle  $PQR$ , then area of triangle  $AOG$  is ( $O$  is the origin) a. 0 b.  $a^2 + b^2 + c^2$  c.  $\frac{2}{3}(a^2 + b^2 + c^2)$  d. none of these

A. 0

B.  $a^2 + b^2 + c^2$

C.  $\frac{2}{3}(a^2 + b^2 + c^2)$

D. none of these

**Answer: A**

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6. ABCDEF is a regular hexagon in the  $x$ - $y$  plane with vertices in the anticlockwise direction. If  $\vec{AB} = 2\hat{i}$ , then  $\vec{CD}$  is

A.  $\hat{i} + \sqrt{3}\hat{j}$

B.  $\hat{i} - \sqrt{3}\hat{j}$

C.  $-\hat{i} + \sqrt{3}\hat{j}$

D.  $\sqrt{3}\hat{i} - \hat{j}$

**Answer: C**



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7. Let position vectors of point A, B and C of triangle ABC represents be  $\hat{i} + \hat{j} + 2\hat{k}$ ,  $\hat{i} + 2\hat{j} + \hat{k}$  and  $2\hat{i} + \hat{j} + \hat{k}$ . Let  $l_1 + l_2$  and  $l_3$  be the length of perpendicular drawn from the orthocenter 'O' on the sides AB, BC and CA, then  $(l_1 + l_2 + l_3)$  equals

A.  $\frac{2}{\sqrt{6}}$

B.  $\frac{3}{\sqrt{6}}$

C.  $\frac{\sqrt{6}}{2}$

D.  $\frac{\sqrt{6}}{3}$

**Answer: C**



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8. If D, E and F are the mid-points of the sides BC, CA and AB respectively of a triangle ABC and  $\lambda$  is scalar, such that  $\vec{AD} + \frac{2}{3}\vec{BE} + \frac{1}{3}\vec{CF} = \lambda\vec{AC}$ , then  $\lambda$  is equal to

A.  $\frac{1}{2}$

B. 1

C.  $3/2$

D. 2

**Answer: A**



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9. If points  $(1,2,3)$ ,  $(0,-4,3)$ ,  $(2,3,5)$  and  $(1,-5,-3)$  are vertices of tetrahedron, then the point where lines joining the mid-points of opposite edges of concurrent is

A.  $(1, -1, 2)$

B.  $(-1, 1, 2)$

C.  $(1,1,-2)$

D.  $(-1, 1, -2)$

**Answer: A**



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10. The unit vector parallel to the resultant of the vectors  $2\hat{i} + 3\hat{j} - \hat{k}$  and  $4\hat{i} - 3\hat{j} + 2\hat{k}$  is

A.  $\frac{1}{\sqrt{37}}(6\hat{i} + \hat{k})$

B.  $\frac{1}{\sqrt{37}}(6\hat{i} + \hat{j})$

C.  $\frac{1}{\sqrt{37}}(6\hat{i} + \hat{k})$

D. none of these

**Answer: A**



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11. ABCDEF is a regular hexagon. Find the vector  $\vec{AB} + \vec{AC} + \vec{AD} + \vec{AE} + \vec{AF}$  in terms of the vector  $\vec{AD}$

A. 1

B. 2

C. 3

D. none of these

**Answer: C**



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12. If  $\vec{a} + \vec{b} + \vec{c} = 0$ ,  $|\vec{a}| = 3$ ,  $|\vec{b}| = 5$ ,  $|\vec{c}| = 7$ , then find the angle between  $\vec{a}$  and  $\vec{b}$ .

A.  $\frac{\pi}{2}$

B.  $\frac{\pi}{3}$

C.  $\frac{\pi}{4}$

D.  $\frac{\pi}{6}$

**Answer: B**



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13. If sum of two unit vectors is a unit vector; prove that the magnitude of their difference is  $\sqrt{3}$

A.  $\sqrt{2}$

B.  $\sqrt{3}$

C. 1

D. none of these

**Answer: B**

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14. The position vectors of the points A, B, and C are  $\hat{i} + 2\hat{j} - \hat{k}$ ,  $\hat{i} + \hat{j} + \hat{k}$ , and  $2\hat{i} + 3\hat{j} + 2\hat{k}$  respectively. If A is chosen as the origin, then the position vectors B and C are

A.  $\vec{i} + 2\hat{k}, \hat{i} + \hat{j} + 3\hat{k}$

B.  $\hat{j} + 2\hat{k}, \hat{i} + \hat{j} + 3\hat{k}$

C.  $-\hat{j} + 2\hat{k}, \hat{i} - \hat{j} + 3\hat{k}$

D.  $-\hat{j} + 2\hat{k}, \hat{i} + \hat{j} + 3\hat{k}$

**Answer: D**

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15. Orthocenter of an equilateral triangle ABC is the origin O. If

$$\overrightarrow{OA} = \vec{a}, \overrightarrow{OB} = \vec{b}, \overrightarrow{OC} = \vec{c}, \text{ then } \overrightarrow{AB} + 2\overrightarrow{BC} + 3\overrightarrow{CA} =$$

A.  $3\vec{c}$

B.  $3\vec{a}$

C.  $\vec{0}$

D.  $3\vec{b}$

**Answer: B**



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16. If the position vectors of P and Q are  $\hat{i} + 2\hat{j} - 7\hat{k}$  and  $5\hat{i} - 3\hat{j} + 4\hat{k}$

respectively, the cosine of the angle between  $\overrightarrow{PQ}$  and z-axis is

A.  $\frac{4}{\sqrt{162}}$

B.  $\frac{11}{\sqrt{162}}$

C.  $\frac{5}{\sqrt{162}}$

$$D. -\frac{5}{\sqrt{162}}$$

**Answer: B**



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17. The non zero vectors  $\vec{a}$ ,  $\vec{b}$ , and  $\vec{c}$  are related by  $\vec{a} = 8\vec{b}$  and  $\vec{c} = -7\vec{b}$ . Then the angle between  $\vec{a}$  and  $\vec{c}$  is (A)  $\pi$  (B)  $0$  (C)  $\frac{\pi}{4}$  (D)  $\frac{\pi}{2}$

A.  $\frac{\pi}{4}$

B.  $\frac{\pi}{2}$

C.  $\pi$

D.  $0$

**Answer: C**



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18. The unit vector bisecting  $\vec{OY}$  and  $\vec{OZ}$  is

A.  $\frac{\vec{i} + \vec{j} + \vec{k}}{\sqrt{3}}$

B.  $\frac{\vec{i} - \vec{k}}{\sqrt{2}}$

C.  $\frac{\vec{j} + \vec{k}}{\sqrt{2}}$

D.  $\frac{-\vec{j} + \vec{k}}{\sqrt{2}}$

Answer: C



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19. A unit tangent vector at  $t=2$  on the curve  $x = t^2 + 2$ ,  $y = 4t - 5$  and  $z = 2t^2 - 6t$  is

A.  $\frac{1}{\sqrt{3}}(\vec{i} + \vec{j} + \vec{k})$

B.  $\frac{1}{3}(2\vec{i} + 2\vec{j} + \vec{k})$

C.  $\frac{1}{\sqrt{6}}(2\vec{i} + \vec{j} + \vec{k})$

D.  $\frac{1}{3}(\vec{i} + \vec{j} + \vec{k})$

**Answer: B**



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20. If  $\vec{a}$  and  $\vec{b}$  are position vectors of A and B respectively, then the position vector of a point C in  $\overline{AB}$  produced such that  $\overrightarrow{AC} = 2015 \overrightarrow{AB}$  is

A.  $2014 \vec{a} - 2015 \vec{b}$

B.  $2014 \vec{b} + 2015 \vec{a}$

C.  $2015 \vec{b} + 2014 \vec{a}$

D.  $2015 \vec{b} - 2014 \vec{a}$

**Answer: D**



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21. Let  $\vec{a} = (1, 1, -1)$ ,  $\vec{b} = (5, -3, -3)$  and  $\vec{c} = (3, -1, 2)$ . If  $\vec{r}$  is collinear with  $\vec{c}$  and has length  $\frac{|\vec{a} + \vec{b}|}{2}$ , then  $\vec{r}$  equals

A.  $\pm 3\vec{c}$

B.  $\pm \frac{3}{2}\vec{c}$

C.  $\pm \vec{c}$

D.  $\pm \frac{2}{3}\vec{c}$

**Answer: C**



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22. A line passes through the points whose position vectors are  $\hat{i} + \hat{j} - 2\hat{k}$  and  $\hat{i} - 3\hat{j} + \hat{k}$ . The position vector of a point on it at unit distance from the first point is

A.  $\frac{1}{5}(5\hat{i}\hat{j} - 7\hat{k})$

B.  $\frac{1}{5}(4\hat{i} + 9\hat{j} - 15\hat{k})$

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

D.  $\frac{1}{5}(\hat{i} - 4\hat{j} + 3\hat{k})$

**Answer: A**



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**23.** Three points A, B, and C have position vectors  $-2\vec{a} + 3\vec{b} + 5\vec{c}$ ,  $\vec{a} + 2\vec{b} + 3\vec{c}$  and  $7\vec{a} - \vec{c}$  with reference to an origin O. Answer the following questions?

Which of the following is true?

A.  $\vec{AC} = 2\vec{AB}$

B.  $\vec{AC} = -3\vec{AB}$

C.  $\vec{AC} = 3\vec{AB}$

D. None of these



**Answer: C**



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**24.** Three points A, B, and C have position vectors  $-2\vec{a} + 3\vec{b} + 5\vec{c}$ ,  $\vec{a} + 2\vec{b} + 3\vec{c}$  and  $7\vec{a} - \vec{c}$  with reference to an origin O. Answer the following questions?

Which of the following is true?

A.  $2\vec{OA} - 3\vec{OB} + \vec{OC} = \vec{0}$

B.  $2\vec{OA} + 7\vec{OB} + 9\vec{OC} = \vec{0}$

C.  $\vec{OA} + \vec{OB} + \vec{OC} = \vec{0}$

D. None of these

**Answer: A**



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25. Three points A, B, and C have position vectors  $-2\vec{a} + 3\vec{b} + 5\vec{c}$ ,  $\vec{a} + 2\vec{b} + 3\vec{c}$  and  $7\vec{a} - \vec{c}$  with reference to an origin O. Answer the following questions?

B divided AC in ratio

A. 2 : 1

B. 2 : 3

C. 2 : - 3

D. 1 : 2

**Answer: B**



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**Dpp 2 4**

$$1. \vec{a} = 2\vec{i} + \vec{j} + \vec{k}, \vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k},$$

$$\vec{a} \times \vec{b} = 5\hat{i} + 2\hat{j} - 12\hat{k}, \vec{a} \cdot \vec{b} = 11, \text{ then } b_1 + b_2 + b_3 =$$

A. 3

B. 5

C. 7

D. 9

**Answer: B**

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2. If  $\vec{a}, \vec{b}, \vec{c}, \vec{d}$  are unit vectors such that  $\vec{a} \cdot \vec{b} = \frac{1}{2}, \vec{c} \cdot \vec{d} = \frac{1}{2}$  and angle between  $\vec{a} \times \vec{b}$  and  $\vec{c} \times \vec{d}$  is  $\frac{\pi}{6}$  then the value of

$$\left| \left[ \begin{matrix} \vec{a} & \vec{b} & \vec{d} \end{matrix} \right] \vec{c} - \left[ \begin{matrix} \vec{a} & \vec{b} & \vec{c} \end{matrix} \right] \vec{d} \right| =$$

A.  $3/2$

B.  $3/4$

C.  $3/8$

D. 2

Answer: C



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3. If  $\vec{a}, \vec{b}, \vec{c}, \vec{d}$  be vectors such that

$$\left[ \vec{a} \vec{b} \vec{c} \right] = 2$$

and

$$\left( \vec{a} \times \vec{b} \right) \times \left( \vec{c} \times \vec{d} \right) + \left( \vec{b} \times \vec{c} \right) \times \left( \vec{c} \times \vec{d} \right) + \left( \vec{c} \times \vec{a} \right) \times \left( \vec{c} \times \vec{d} \right) + \left( \vec{d} \times \vec{a} \right) \times \left( \vec{c} \times \vec{d} \right) + \left( \vec{d} \times \vec{b} \right) \times \left( \vec{c} \times \vec{d} \right) = \mu \left( \vec{a} \times \vec{b} \right) \times \left( \vec{c} \times \vec{d} \right)$$

Then the value of  $\mu$  is

A. 0

B. 1

C. 3

D. 4

Answer: D



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$$4. \text{ Let } (\hat{p} \times \vec{q}) \times (\hat{p} \cdot \vec{q}) \vec{p} \\ = (x^2 + y^2) \vec{q} + (14 - 4x - 6y) \vec{p}$$

Where  $\hat{p}$  and  $\hat{q}$  are two non-collinear vectors  $\vec{p}$  is unit vector and  $x, y$  are scalars. Then the value of  $(x + y)$  is

A. 4

B. 5

C. 6

D. 7

**Answer: B**



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5. If  $\vec{a}, \vec{b}, \vec{c}$  are three on-coplanar vectors such that  $\vec{a} \times \vec{b} = \vec{c}, \vec{b} \times \vec{c} = \vec{a}, \vec{c} \times \vec{a} = \vec{b}$ , then the value of  $|\vec{a}| + |\vec{b}| + |\vec{c}|$  is

A.  $1/3$

B. 1

C. 3

D. 6

**Answer: C**



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6. Let  $\hat{a}$  and  $\hat{b}$  be two unit vectors such that  $\hat{a} \cdot \hat{b} = \frac{1}{3}$  and  $\vec{a} \times \vec{b} = \vec{c}$ ,

Also  $\vec{F} = \alpha\hat{a} + \beta\hat{b} + \lambda\hat{c}$ ,

where,  $\alpha, \beta, \lambda$  are scalars. If  $\alpha = k_1(\hat{F} \cdot \hat{a}) - k_2(\hat{F} \cdot \hat{b})$  then the value of

$2(k_1 + k_2)$  is

A.  $2\sqrt{3}$

B.  $\sqrt{3}$

C. 3

D. 1

Answer: C



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7. Let  $\vec{a}$  and  $\vec{c}$  be unit vectors inclined at  $\pi/3$  with each other. If  $(\vec{a} \times (\vec{b} \times \vec{c})) \cdot (\vec{a} \times \vec{c}) = 5$ , then  $[\vec{a} \vec{b} \vec{c}]$  is equal to

A.  $-10$

B.  $-5$

C.  $-20$

D. none of these

Answer: A



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8. if  $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$ ,  $\vec{b} = \hat{i} + 2\hat{j} + 2\hat{k}$  and  $|\vec{c}| = 1$

Such that  $[\vec{a} \times \vec{b} \vec{b} \times \vec{c} \vec{c} \times \vec{a}]$  has maximum value, then the value

of  $\left| \left( \vec{a} \times \vec{b} \right) \times \vec{c} \right|^2$  is

A. 0

B. 1

C.  $\frac{4}{3}$

D. none of these

**Answer: A**



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9. If the angles between the vectors  $\vec{a}$  and  $\vec{b}$ ,  $\vec{b}$  and  $\vec{c}$ , and  $\vec{c}$  and  $\vec{a}$  are respectively  $\frac{\pi}{6}$ ,  $\frac{\pi}{4}$  and  $\frac{\pi}{3}$ , then the angle the vector  $\vec{a}$  makes with the plane containing  $\vec{b}$  and  $\vec{c}$ , is

A.  $\cos^{-1} \sqrt{1 - \sqrt{2/3}}$

B.  $\cos^{-1} \sqrt{2 - \sqrt{3/2}}$

C.  $\cos^{-1} \sqrt{\sqrt{3/2} - 1}$



$$D. \cos^{-1} \sqrt{\sqrt{2/3}}$$

**Answer: B**

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10. Let  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  be three vectors having magnitudes 1, 1 and 2 respectively. If  $\vec{a} \times (\vec{a} \times \vec{c}) + \vec{b} = \vec{0}$  then the acute angle between  $\vec{a}$  and  $\vec{c}$  is

A.  $\pi/4$

B.  $\pi/6$

C.  $\pi/3$

D.  $\pi/2$

**Answer: B**

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11. If  $\vec{a}, \vec{b}, \vec{c}$  are non coplanar vectors and  $\vec{p}, \vec{q}, \vec{r}$  are reciprocal vectors, then

$(l\vec{a} + m\vec{b} + n\vec{c}) \cdot (l\vec{p} + m\vec{q} + n\vec{r})$  is equal to

A.  $l^2 + m^2 + n^2$

B.  $lm+mn+nl$

C. 0

D. None of these

**Answer: A**



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12. Let  $\vec{a} = \hat{i} - 3\hat{j} + 4\hat{k}$ ,  $\vec{B} = 6\hat{i} + 4\hat{j} - 8\hat{k}$ ,  $\vec{C} = 5\hat{i} + 2\hat{j} + 5\hat{k}$  and a vector  $\vec{R}$  satisfies  $\vec{R} \times \vec{B} = \vec{C} \times \vec{B}$ ,  $\vec{R} \cdot \vec{A} = 0$ , then the value of

$$\frac{|\vec{B}|}{|\vec{R} - \vec{C}|}$$
 is

A. 1

B. 2

C. 3

D. 4

**Answer: B**



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13. The volume of the parallelepiped whose coterminous edges are represented by the vectors  $2\vec{b} \times \vec{c}$ ,  $3\vec{c} \times \vec{a}$  and  $4\vec{a} \times \vec{b}$  where

$$\vec{a} = (1 + \sin \theta)\hat{i} + \cos \theta \hat{j} + \sin 2\theta \hat{k},$$

$$\vec{b} = \sin\left(\theta + \frac{2\pi}{3}\right)\hat{i} + \cos\left(\theta + \frac{2\pi}{3}\right)\hat{j} + \sin\left(2\theta + \frac{4\pi}{3}\right)\hat{k},$$

$$\vec{c} = \sin\left(\theta - \frac{2\pi}{3}\right)\hat{i} + \cos\left(\theta - \frac{2\pi}{3}\right)\hat{j} + \sin\left(2\theta - \frac{4\pi}{3}\right)\hat{k} \text{ is } 18 \text{ cubic}$$

units, then the values of  $\theta$ , in the interval  $\left(0, \frac{\pi}{2}\right)$ , is/are

A.  $\frac{\pi}{9}$

B.  $\frac{2\pi}{9}$

C.  $\frac{\pi}{3}$

D.  $\frac{4\pi}{9}$

Answer: A::B::D

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14. Let  $\vec{a}$  and  $\vec{b}$  be two non-zero perpendicular vectors. A vector  $\vec{r}$  satisfying the equation  $\vec{r} \times \vec{b} = \vec{a}$  can be

A.  $\vec{b} - \frac{\vec{a} \times \vec{b}}{|\vec{b}|^2}$

B.  $2\vec{b} - \frac{\vec{a} \times \vec{b}}{|\vec{b}|^2}$

C.  $|\vec{a}| |\vec{b}| - \frac{\vec{a} \times \vec{b}}{|\vec{b}|^2}$

D.  $|\vec{b}| |\vec{b}| - \frac{\vec{a} \times \vec{b}}{|\vec{b}|^2}$

Answer: A::B::C::D

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15. If  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  are three non-zero vectors, then which of the following statement(s) is/are true?

A.  $\vec{a} \times (\vec{b} \times \vec{c}), \vec{b} \times (\vec{c} \times \vec{a}), (\vec{c} \times \vec{a}), \vec{c} \times (\vec{a} \times \vec{b})$

form a right handed system

B.  $\vec{c}, (\vec{a} \times \vec{b}) \times \vec{c}, \vec{a} \times \vec{b}$  form a right handed system

C.  $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a} < 0$  if  $\vec{a} + \vec{b} + \vec{c} = \vec{0}$

D.  $\frac{(\vec{a} \times \vec{b}) \cdot (\vec{b} \times \vec{c})}{(\vec{b} \times \vec{c}) \cdot (\vec{a} \times \vec{c})} = -1$  if  $\vec{a} + \vec{b} + \vec{c} = \vec{0}$

Answer: B::C::D



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16. Vectors  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  are three unit vectors and  $\vec{c}$  is equally inclined to both  $\vec{a}$  and  $\vec{b}$ . Let

$$\vec{a} \times (\vec{b} \times \vec{c}) + \vec{b} \times (\vec{c} \times \vec{a})$$

$$= (4 + x^2) \vec{b} - (4x \cos^2 \theta) \vec{a},$$

then  $\vec{a}$  and  $\vec{b}$  are non-collinear vectors,  $x > 0$

A.  $x = 2$

B.  $\theta = 0^\circ$

C.  $\theta = x$

D.  $x = 4$

**Answer: A::B::C**



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17. If  $\vec{a}$  and  $\vec{b}$  are unequal unit vectors such that  $(\vec{a} - \vec{b}) \times \left[ (\vec{b} + \vec{a}) \times (2\vec{a} + \vec{b}) \right] = \vec{a} + \vec{b}$ , then angle  $\theta$  between  $\vec{a}$  and  $\vec{b}$  can be

A.  $\frac{\pi}{2}$

B. 0

C.  $\pi$

D.  $\frac{\pi}{4}$

**Answer: A:C**



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18.  $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$ ,  $\vec{b} = \hat{i} - \hat{j} + \hat{k}$  and non zero vector  $\vec{c}$  are such that  $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \vec{a} \times \left(\vec{b} \times \vec{c}\right)$ .

Then vector  $\vec{c}$  may be given as

A.  $4\hat{i} + 2\hat{j} + 4\hat{k}$

B.  $4\hat{i} - 2\hat{j} + 4\hat{k}$

C.  $\hat{i} + \hat{j} + \hat{k}$

D.  $\hat{i} - 4\hat{j} + \hat{k}$

**Answer: A**



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19. Volume of parallelogram whose adjacent sides are given by

$\vec{a}, \vec{b}, \vec{b} \times \vec{c}$  is,

A. 18

B. 54

C. 12

D. 36

**Answer: D**



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20. A vector along the bisector of angle between the vectors  $\vec{b}$  and  $\vec{c}$  is,

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

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

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



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

**Answer: A**



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## Question Bank

1. If  $\vec{a}$ ,  $\vec{b}$  and  $\vec{c}$  are mutually perpendicular unit vectors such that  $x\vec{a} - y\vec{b} + \vec{c} - 2\hat{i} = \vec{0}$ ,  $x, y \in R$ , then the value of  $x^2 + y^2$  is



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2. Let  $\vec{a}$  and  $\vec{b}$  be two vectors such that  $|\vec{a}| = 1$  and  $\vec{a} \cdot (\vec{b} \times (\vec{a} \times \vec{b})) = 8$ . If the angle between  $\vec{a}$  and  $\vec{b}$  is  $\cos^{-1}\sqrt{2}$ , then magnitude of  $\vec{b}$  is



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3. Given  $f^2(x) + g^2(x) + h^2(x) \leq 9$  and  $U(x) = 3f(x) + 4g(x) + 10h(x)$ , where  $f(x), g(x)$  and  $h(x)$  are continuous  $\forall x \in R$ . If maximum value of  $U(x)$  is  $\sqrt{N}$ , then find  $N$ .

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4. Vectors  $\vec{a}$  and  $\vec{b}$  make an angle  $\theta = \frac{2\pi}{3}$ . If  $|\vec{a}| = 1$ ,  $|\vec{b}| = 2$  then  $(\vec{a} + 3\vec{b}) \times (3\vec{a} - \vec{b})^2 =$

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5. If  $\vec{a}$  and  $\vec{b}$  are non zero, non collinear vectors, and the linear combination  $(2x - y)\vec{a} + 4\vec{b} = 5\vec{a} + (x - 2y)\vec{b}$  holds for real  $x$  and  $y$  then  $x + y$  has the value equal to

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6. Let  $\vec{u}, \vec{v}, \vec{w}$  be such that  $|\vec{u}| = 1, |\vec{v}| = 2, |\vec{w}| = 3$ . If the projection of  $\vec{v}$  along  $\vec{u}$  is equal to that of  $\vec{w}$  along  $\vec{u}$  and vectors  $\vec{v}, \vec{w}$  are perpendicular to each other then  $|\vec{u} - \vec{v} + \vec{w}|$  equals

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7. Given three vectors  $\vec{a}, \vec{b}$  and  $\vec{c}$  each two of which are non collinear. Further if  $(\vec{a} + \vec{b})$  is collinear with  $\vec{c}$ ,  $(\vec{b} + \vec{c})$  is collinear with  $\vec{a}$  and  $|\vec{a}| = |\vec{b}| = |\vec{c}| = \sqrt{2}$ . Then the absolute value of  $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$ :

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8. Let  $\vec{u} = \hat{i} + \hat{j}, \vec{v} = \hat{i} - \hat{j}$  and  $\vec{w} = n\hat{i} + n2\hat{j} + n3\hat{k}$ . If  $n$  is a unit vector such that  $\vec{u} \cdot \vec{n} = 0$  and  $\vec{v} \cdot \vec{n} = 0$ , then  $|\vec{w} \cdot \vec{n}|$  is equal to

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9. If the three points with position vectors  $(1, a, b)$ ,  $(a, 2, b)$  and  $(a, b, 3)$  are collinear in space, then the value of  $a + b$  is

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10. The number of vectors of unit length perpendicular to vectors  $\vec{a} = (1, 1, 0)$  and  $\vec{b} = (0, 1, 1)$  is

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11. If  $\vec{p}$  and  $\vec{q}$  are two diagonals of a quadrilateral such that  $|\vec{p} - \vec{q}| = \vec{p} \cdot \vec{q}$ ,  $|\vec{p}| = 1$ ,  $|\vec{q}| = \sqrt{2}$ , then the area of quadrilateral is equal to

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12. If  $\vec{a}$ ,  $\vec{b}$  are any two perpendicular vectors of equal magnitude and  $|3\vec{a} + 4\vec{b}| + |4\vec{a} - 3\vec{b}| = 20$ , then  $|\vec{a}|$  equals



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13. The perpendicular distance of the point whose position vector is  $(1, 3, 5)$  from the line  $\vec{r} = \hat{i} + 2\hat{j} + 3\hat{k} + \lambda(\hat{i} + 2\hat{j} + 2\hat{k})$  is equal to



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14. If two sides of a triangle  $ABC$  are represented by vectors  $\vec{a}$  and  $(\vec{a} \times \vec{b}) \times \vec{a}$  then maximum value of  $(\sin 2A + \sin 2B + \sin 2C)$ , is



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15. If  $|\vec{a}| = |\vec{b}| = |\vec{c}| = 2$  and  $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{c} = \vec{c} \times \vec{a} = 2$ , then  $\left[ \vec{a} \vec{b} \vec{c} \right] \cos 45^\circ$  is equal to



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16. Let  $\vec{a} = -\hat{i} + \hat{j} + \hat{k}$ ,  $\vec{b} = 2\hat{i} + \hat{k}$  and vector  $\vec{c}$  satisfying conditions

(i)  $\left[ \vec{a} \ \vec{b} \ \vec{c} \right] = 0$

(ii).  $\vec{b} \cdot \vec{c} = 0$

(iii)  $\vec{a} \cdot \vec{c} = 7$

Then the value of  $\frac{2}{7}|\vec{c}|^2$  is equal to

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17. If three points  $(2\vec{p} - \vec{q} + 3\vec{r})$ ,  $(\vec{p} - 2\vec{q} + \alpha\vec{r})$  and  $(\beta\vec{p} - 5\vec{q})$  (where  $\vec{p}$ ,  $\vec{q}$ ,  $\vec{r}$  are non-coplanar vectors) are collinear, then the value of  $\frac{1}{\alpha + \beta}$  is

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18. If  $|\vec{\alpha}| = |\vec{\beta}| = |\vec{\alpha} + \vec{\beta}| = 4$ , then the value of  $|\vec{\alpha} - \vec{\beta}|$  is

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19. If  $\vec{a}$ ,  $\vec{b}$ ,  $\vec{c}$  are unit vectors such that  $\vec{a} + \sqrt{2}\vec{b} + \vec{c} = 0$  then the value of  $\left[ 2\vec{a} + 3\vec{b} - 2\vec{c} \text{ mid} \right]$  (where  $[\cdot]$  denotes greatest integer function) will be

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20. Let  $\vec{a}$  and  $\vec{b}$  be two unit vectors then maximum value of  $\frac{|\vec{a} + \vec{b}|^2 - |\vec{a} - \vec{b}|^2}{|\vec{a} + \vec{b}|^2 + |\vec{a} - \vec{b}|^2}$  is equal to

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21. If the vectors  $(1-x)\hat{i} + \hat{j} + \hat{k}$ ,  $\hat{i} + (1-y)\hat{j} + \hat{k}$  and  $\hat{i} + \hat{j} + (1-z)\hat{k}$  are coplanar vectors, then value of  $\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$  is  $(x, y, z$  are non zero numbers)

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22. If  $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ ,  $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ ,  $\vec{c} = \hat{i} + 2\hat{j} - \hat{k}$ , then the

value of 
$$\begin{vmatrix} \vec{a} \cdot \vec{a} & \vec{a} \cdot \vec{b} & \vec{a} \cdot \vec{c} \\ \vec{b} \cdot \vec{a} & \vec{b} \cdot \vec{b} & \vec{b} \cdot \vec{c} \\ \vec{c} \cdot \vec{a} & \vec{c} \cdot \vec{b} & \vec{c} \cdot \vec{c} \end{vmatrix} =$$



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23. If  $\vec{a} = 3\hat{i} - \hat{j} + \hat{k}$ ,  $\vec{b} = 2\hat{i} - 3\hat{j} - \hat{k}$ ,  $\vec{c}$  and  $\vec{d} = 2\hat{j} + \hat{k}$ , then the value of  $\vec{d} \cdot \left( \vec{a} \times \vec{b} \times \left( \vec{c} \times \vec{d} \right) \right)$  equals



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