



MATHS

BOOKS - SAI MATHS (TELUGU ENGLISH)

ADDITION OF VECTORS AND PRODUCT OF VECTORS

Problems

1. If $\vec{a} = 2\hat{i} - 3\hat{j} + 5\hat{k}$, $\vec{b} = 3\hat{i} - 4\hat{j} + 5\hat{k}$ and $\vec{c} = 5\hat{i} - 3\hat{j} - 2\hat{k}$, then the volume of the parallelepiped with co-terminus edges $\vec{a} + \vec{b} + \vec{c}$, $\vec{c} + \vec{a}$ is

- A. 1
- B. 5
- C. 8
- D. 16

Answer: D



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2. The shortest distance between the skew line

$$\frac{x-3}{-1} = \frac{y-4}{2} = \frac{z+2}{1}, \frac{x-1}{1} = \frac{y+7}{3} = \frac{z+2}{2} \text{ is}$$

A. 6

B. 7

C. $3\sqrt{5}$

D. $\sqrt{35}$

Answer: D



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3. If the position vectors of the vertices of

$$\Delta ABC \text{ are } 3\hat{i} + 4\hat{j} - \hat{k}, \hat{i} + 3\hat{j} + \hat{k} \text{ and } 5(\hat{i} + \hat{j} + \hat{k}),$$

respectively. Then, the magnitude of the altitude from A onto the side BC is

A. $\frac{4}{3}\sqrt{5}$

B. $\frac{5}{3}\sqrt{5}$

C. $\frac{7}{3}\sqrt{5}$

D. $\frac{8}{3}\sqrt{5}$

Answer: A



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4. ABCD is a parallelogram and P is a point on the segment \overline{AD} dividing it internally in the ratio 3:1. The line \overline{BP} meets the diagonal AC in Q. Then AQ: QC=

A. 3:4

B. 4:3

C. 3:2

D. 2:3

Answer: A



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5. If M and N are the mid - points of the sides BC and CD respectively of a parallelogram ABCD, then $AM + AN$ equals

A. $\frac{4}{3} \overline{AC}$

B. $\frac{5}{3} \overline{AC}$

C. $\frac{3}{2} \overline{AC}$

D. $\frac{6}{5} \overline{AC}$

Answer: C



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6. P is the point of intersection of the diagonals of the parallelogram ABCD. If S is any point in the space and $\vec{SA} + \vec{SB} + \vec{SC} + \vec{SD} = \lambda \vec{SP}$, then $\lambda =$

A. 2

B. 4

C. 6

D. 8

Answer: B



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7. If m_1, m_2, m_3, m_4 are respectively the magnitudes of the vectors $\vec{a}_1 = 2\vec{i} - \vec{j} + \vec{k}$, $\vec{a}_2 = 3\vec{i} - 4\vec{j} - 4\vec{k}$, $\vec{a}_3 = -\vec{i} + \vec{j} - \vec{k}$, $\vec{a}_4 = -\vec{i} + 3\vec{j}$, then the correct order of m_1, m_2, m_3, m_4 is

A. $m_3 < m_1 < m_4 < m_2$

B. $m_3 < m_1 < m_2 < m_4$

C. $m_3 < m_4 < m_1 < m_2$

D. $m_3 < m_4 < m_2 < m_1$

Answer: A



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8. If $\bar{a}, \bar{b}, \bar{c}$ are unit vectors such that $\bar{a} + \bar{b} + \bar{c} = \bar{0}$ then the $\bar{a} \cdot \bar{b} + \bar{b} \cdot \bar{c} + \bar{c} \cdot \bar{a} =$

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

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

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

D. $-\frac{1}{2}$

Answer: B



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9. If $\vec{a} = 2\vec{i} + \vec{k}$, $\vec{b} = \vec{i} + \vec{j} + \vec{k}$, $\vec{c} = 4\vec{i} - 3\vec{j} + 7\vec{k}$ then the vector \vec{r} satisfying $\vec{r} \times \vec{b} = \vec{c} \times \vec{b}$ and $\vec{r} \cdot \vec{a} = 0$ is

A. $\vec{i} + 8\vec{j} + 2\vec{k}$

B. $-8\vec{j} + 2\vec{k}$

C. $\vec{i} - 8\vec{j} - 2\vec{k}$

D. $-\vec{i} - 8\vec{j} + 2\vec{k}$

Answer: D



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10. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that

$|\vec{a}| = 1$, $|\vec{b}| = 2$, $|\vec{c}| = 3$, and $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{c} = \vec{c} \cdot \vec{a} = 0$, then $\left| \begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix} \right| =$

A. 0

B. 2

C. 3

D. 6

Answer: D



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11. If $\left[\bar{a} \times \bar{b} \times \bar{c} \bar{c} \times \bar{a} \right] = \lambda \left[\bar{a} \bar{b} \bar{c} \right]$, then $\lambda =$

A. 0

B. 1

C. 2

D. 3

Answer: B



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12. The Cartesian equation of the plane passing through the point $(3, -2, -1)$ and parallel to the vectors

$$\vec{b} = \vec{i} - 2\vec{j} + 4\vec{k} \text{ and } \vec{c} = 3\vec{i} + 2\vec{j} - 5\vec{k} \text{ is}$$

A. $2x - 17y - 8z + 63 = 0$

B. $3x + 17y + 8z - 36 = 0$

C. $2x + 17y + 8z + 36 = 0$

D. $3x - 16y + 8z - 63 = 0$

Answer: C



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13. The shortest distance between the skew lines

$$\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + t(\hat{i} + 3\hat{j} + 2\hat{k}) \text{ and}$$

$$\vec{r} = (4\vec{i} + 5\vec{j} + 6\vec{k}) + t(2\vec{i} + 3\vec{j} + \vec{k}) \text{ is}$$

A. \sqrt{b}

B. 3

C. $2\sqrt{3}$

D. $\sqrt{3}$

Answer: D



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14. If x, y, z are non-zero real numbers, $a = xi + 2j$, $b = yi + 3k$ and $c = xi + yi + zk$ are such that $a \times b = zi - 3j + k$ then $[a \ b \ c] =$

A. 3

B. 10

C. 9

D. 6

Answer: C



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15. If a, b and c are vectors with magnitudes 2, 3 and 4 respectively then the least upper bound of $|a - b|^2 + |b - c|^2 + |c - a|^2$ among the given values is

A. 96

B. 97

C. 87

D. 90

Answer: C



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16. The angle between the lines

$$\hat{r} = (2\hat{i} - 3\hat{j} + \hat{k}) + \lambda(\hat{i} + 4\hat{j} + 3\hat{k}) \text{ and } \hat{r} = (\hat{i} - \hat{j} + 2\hat{k}) + \mu(\hat{i} + 2\hat{j} + \hat{k})$$

is

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

B. $\cos^{-1}\left(\frac{9}{\sqrt{91}}\right)$

C. $\cos^{-1}\left(\frac{7}{\sqrt{84}}\right)$

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

Answer: A



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17. If a , b and c are non-coplanar vectors and if d is such that $d = \frac{1}{x}(a + b + c)$ and $a = \frac{1}{y}(b + c + d)$ where x and y are non-zero real numbers, then $\frac{1}{xy}(a + b + c + d) =$

A. $3c$

B. $-a$

C. 0

D. $2a$

Answer: C



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18. Three non-zero non-collinear vectors a , b , c are such that $a + 3b$ is collinear with c , while $3b + 2c$ is collinear with a . Then $a + 3b + 2c =$

A. 0

B. $2\hat{a}$

C. $3\hat{b}$

D. $4\hat{c}$

Answer: A



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19. The points whose position vectors are $2i + 3j + 4k$, $3i + 4j + 2k$ and $4i + 2j + 3k$ are the vertices of

- A. An isoscles triangle
- B. Right angled triangle
- C. Equilateral triangle
- D. Righta angled isosceles triangle

Answer: C

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20. P,Q,R and four point with the position vectors $3i - 4j + 5k$, $-4i + 5j + k$ and $-3i + 4j + 3k$, respectively. Then the line PQ meets the line RS at the point

- A. $3i+4j+3k$
- B. $-3i + 4j + 3k$
- C. $-i + 4j + k$
- D. $i + j + k$

Answer: B



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21.

If

$\vec{a} \neq \vec{0}, \vec{b} \neq \vec{0}, \vec{c} \neq \vec{0}, \vec{a} \times \vec{b} = \vec{0}$ and $\vec{b} \times \vec{c} = \vec{0}$, then $\vec{a} \times$

is equal to

A. \vec{b}

B. \vec{a}

C. $\vec{0}$

D. $i+j+k$

Answer: C



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22. The shortest distance between the lines

$$r = 3i + 5j + 7k + \lambda(i + 2j + k) \text{ and } r = -i - j - k + \mu(7i - 6j + k)$$

is

A. $\frac{16}{5\sqrt{5}}$

B. $\frac{26}{5\sqrt{5}}$

C. $\frac{36}{5\sqrt{5}}$

D. $\frac{46}{5\sqrt{5}}$

Answer: D



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23. A unit vector coplanar with $i+j+3k$ and $i+3j+k$ and perpendicular to

$i+j+k$ is

A. $\frac{1}{\sqrt{2}}(j + k)$

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

C. $\frac{1}{\sqrt{2}}(j - k)$

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

Answer: C



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24. If \vec{a} and \vec{b} are two non-zero perpendicular vectors, then a vector y satisfying equations $\vec{a} \cdot \vec{y} = c$ (where c is scalar) and $\vec{a} \times \vec{y} = \vec{b}$ is

A. $|a|^2[ca - (a \times b)]$

B. $|a|^2[ca + (a \times b)]$

C. $\frac{1}{|a|^2}[ca - (a \times b)]$

D. $\frac{1}{|a|^2}[ca + (a \times b)]$

Answer: C



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25. $\vec{a} = i + j - 2h \Rightarrow \sum \{(a \times i) \times j\}^2$ is equal to

A. $\sqrt{6}$

B. 6

C. 36

D. $6\sqrt{6}$

Answer: B



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26. Let a, b and c be three non-coplanar vectors and let p, q and r be the

vector defined by $p = \frac{b \times c}{[abc]}$, $q = \frac{c \times a}{[abc]}$, $r = \frac{a \times b}{[abc]}$.

Then, $(a+b) \cdot p + (b+c) \cdot q + (c+a) \cdot r$ is equal to

A. 0

B. 1

C. 2

D. 3

Answer: D



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27. Let $\vec{a} = i + 2j + j$, $\vec{b} = i - j + k$, $\vec{c} = i + h - k$. A vector in the plane of \vec{a} and \vec{b} has projection $\frac{1}{\sqrt{3}}$ on \vec{c} . Then, one such vector is

A. $4i+j-4k$

B. $3i+j-3k$

C. $4i-j+4k$

D. $2i+j+2k$

Answer: D



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28. The point of intersection of the lines

$$l_1: r(t) = (i - 6j + 2k) + t(i + 2j + k)$$

$$l_2: R(u) = (4j + k) + u(2i + j + 2k) \text{ is}$$

A. (4,4,5)

B. (6,4,7)

C. (8,8,9)

D. (10,12,11)

Answer: C



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29. The vectors $AB = 3i - 2j + 2k$ and $BC = -i - 2k$ are the adjacent sides of a parallelogram. The angle between its diagonals is

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

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

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

D. None of these

Answer: C



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30. If p^{th}, q^{th}, r^{th} terms of a geometric progression are the positive numbers a, b, c respectively, then the angle between the vectors $(\log a^2)I + (\log b^2)j + (\log c^2)k$ and $(q - r)I + (r - p)j + (p - q)k$ is

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

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

C. $\frac{\sin^{-1}(1)}{\sqrt{a^2 + b^2 + c^2}}$

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

Answer: B



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31. The magnitude of the projection of the vector $a=4i-3j+2k$ on the line which makes equal angles with the coordinates axes is

A. $\sqrt{2}$

B. $\sqrt{3}$

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

D. $\frac{1}{\sqrt{2}}$

Answer: B



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32. If the vectors $i-2xj-2yk$ and $i+3xj+2yk$ are orthogonal to each other, then the locus of the point (x,y) is

A. A circle

B. An ellipse

C. A parabola

D. A straight line

Answer: A



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33. For any vector \vec{r} .

$i \times (\vec{r} \times i) + j \times (\vec{r} \times j) + k \times (\vec{r} \times k)$ is equal to

A. 0

B. $2r$

C. $3r$

D. $4r$

Answer: B



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34. If the vectors $AB = -3i + 4k$ and $AC = 5i - 2j + 4k$ are the sides of a triangle ABC, then the length of the median through A is

A. $\sqrt{14}$

B. $\sqrt{18}$

C. $\sqrt{25}$

D. $\sqrt{29}$

Answer: B



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35. If $|a| = 1$, $|b| = 2$ and the angle between a and b is 120° , then

$$\{(a + 3b) \times (3a - b)\}^2 =$$

A. 425

B. 375

C. 325

D. 300

Answer: D



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36. Let $v = 2i + j - k$ and $w = i + 3k$. If u is unit vector. Then the maximum value of the scalar triple product $[u \ v \ w]$ is

A. 1

B. $\sqrt{10} + \sqrt{6}$

C. $\sqrt{59}$

D. $\sqrt{60}$

Answer: C



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37.

Let

$\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{c} = \lambda\hat{i} + \hat{j} + (2\lambda - 1)\hat{k}$. If

\vec{c} is parallel to the plane containing \vec{a} , \vec{b} then λ is equal to

A. 0

B. 1

C. -1

D. 2

Answer: A

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38. If three unit vectors \vec{a} , \vec{b} , \vec{c} satisfy $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, then the angle between \vec{a} and \vec{b} is

A. $\frac{2\pi}{3}$ B. $\frac{5\pi}{6}$

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

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

Answer: A

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39. $(\bar{a} + 2\bar{b} - \bar{c})(\bar{a} - \bar{b}) \times (\bar{a} - \bar{b} - \bar{c})$ is equal to

A. $-\left[\bar{a}\bar{b}\bar{c}\right]$

B. $2\left[\bar{a}\bar{b}\bar{c}\right]$

C. $3\left[\bar{a}\bar{b}\bar{c}\right]$

D. $\bar{0}$

Answer: C

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40. If $\vec{u} = \vec{a} - \vec{b}$, $\vec{v} = \vec{a} + \vec{b}$, $|\vec{a}| = |\vec{b}| = 2$, then $|\vec{u} \times \vec{v}|$ is equal to

A. $2\sqrt{16 - (\vec{a} \cdot \vec{b})^2}$

B. $\sqrt{16 - (\vec{a} \cdot \vec{b})^2}$

C. $2\sqrt{4 - (\vec{a} \cdot \vec{b})^2}$

D. $\sqrt{4 - (\vec{a} \cdot \vec{b})^2}$

Answer: A



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41. If the angle θ between the vectors

$\vec{a} = 2x^2\hat{i} + 4x\hat{j} + \hat{k}$ and $\vec{b} = 7\hat{i} - 2\hat{j} + x\hat{k}$ is such that

$90^\circ < \theta < 180^\circ$, then x lies in the interval

A. $\left(0, \frac{1}{2}\right)$

B. $\left(\frac{1}{2}, 1\right)$

C. $\left(1, \frac{3}{2}\right)$

D. $\left(\frac{1}{2}, \frac{3}{2}\right)$

Answer: A



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42. Let OA , OB , OC be the co-terminal edges of a rectangular parallelepiped of volume V and let p be the vertex opposite to O . Then,

$\left[\overrightarrow{AP}\overrightarrow{BP}\overrightarrow{CP}\right]$ is equal to

A. $2V$

B. $12V$

C. $3\sqrt{3}V$

D. 0

Answer: A



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43. In a quadrilateral ABCD, the point P divides DC in the ratio 1:2 and Q is the mid point of AC. If $\vec{AB} + 2\vec{AD} + \vec{BC} - 2\vec{DC} = k\vec{PQ}$ then k is equal to

A. -6

B. -4

C. 6

D. 4

Answer: A



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

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

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

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

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

Answer: B

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45. If m_1, m_2, m_3, m_4 are respectively the magnitudes of the vectors

$$\bar{a}_1 = 2\bar{i} - \bar{j} + \bar{k}, \bar{a}_2 = 3\bar{i} - 4\bar{j} - 4\bar{k}, \bar{a}_3 = -\bar{i} + \bar{j} - \bar{k}, \bar{a}_4 = -\bar{i} + 3\bar{j}$$

, then the correct order of m_1, m_2, m_3, m_4 is

A. $m_3 < m_1 < m_4 < m_2$

B. $m_3 < m_1 < m_2 < m_4$

C. $m_3 < m_4 < m_1 < m_2$

D. $m_3 < m_4 < m_2 < m_1$

Answer: A

46. Suppose $\vec{a} = \lambda\hat{i} - 7\hat{j} + 3\hat{k}$, $\vec{b} = \lambda\hat{i} + \hat{j} + 2\lambda\hat{k}$. If the angle between \vec{a} and \vec{b} is greater than 90° then λ satisfies the inequality

A. $-7 < \lambda < 1$

B. $\lambda > 1$

C. $1 < \lambda < 7$

D. $-5 < \lambda < 1$

Answer: A

47. The volume of the tetrahedron having the edges $\hat{i} + 2\hat{j} - \hat{k}$, $\hat{i} + \hat{j} + \hat{k}$, $\hat{i} - \hat{j} + \lambda\hat{k}$ as coterminous, is $\frac{2}{3}$ cubic unit. Then λ equals

A. 1

B. 2

C. 3

D. 4

Answer: A



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48. The position vectors of P and Q are respectively \vec{a} and \vec{b} . If R is a point on \overline{PQ} such that $\vec{PR} = 5\vec{PQ}$, then the position vector of R is

A. $5\vec{b} - 4\vec{a}$

B. $5\vec{b} + 4\vec{a}$

C. $4\vec{b} - 5\vec{a}$

D. $4\vec{b} + 5\vec{a}$

Answer: A

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49. If the points with position vectors $60\hat{i} + 3\hat{j}$, $40\hat{i} - 8\hat{j}$ and $a\hat{i} - 52\hat{j}$ are collinear, then a is equal to

A. -40

B. -20

C. 20

D. 40

Answer: A

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50. If the points vectors of A, B and C are respectively $2\hat{i} - \hat{k} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$ and $3\hat{i} - 4\hat{j} - 4\hat{k}$, then $\cos^2 A$ is equal to

A. 0

B. $\frac{6}{41}$

C. $\frac{35}{41}$

D. 1

Answer: C

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51. If $\vec{a} = \hat{i} + \hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$, $\vec{c} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{d} = \hat{i} - \hat{j} - \hat{k}$,

then match the following columns

Column I	Column II
(A) $\vec{a} \cdot \vec{b}$	1. $\vec{a} \cdot \vec{d}$
(B) $\vec{b} \cdot \vec{c}$	2. 3
(C) $[\vec{a} \ \vec{b} \ \vec{c}]$	3. $\vec{b} \cdot \vec{d}$
(D) $\vec{b} \times \vec{c}$	4. $2\hat{i} - 2\hat{k}$
	5. $2\hat{j} + 2\hat{k}$
	6. 4

A.

A	B	C	D	
a	3	1	2	6

B.

A	B	C	D	
b	3	1	6	5

- C.

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
<i>c</i>	1	3	2	6
- D.

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
<i>d</i>	1	3	6	4

Answer: B

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52. Let \bar{a} be a unit vector $\bar{b} = 2\hat{i} + \hat{j} - \hat{k}$ and $\bar{c} = \hat{i} + 3\hat{k}$. Then maximum value of $\left[\bar{a} \bar{b} \bar{c} \right]$ is

- A. -1
- B. $\sqrt{10} + \sqrt{6}$
- C. $\sqrt{10} - \sqrt{6}$
- D. $\sqrt{59}$

Answer: D

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53. Let $a = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$

Assertion (A) The identity

$$\left|\vec{a} \times \hat{i}\right|^2 + \left|\vec{a} \times \hat{j}\right|^2 + \left|\vec{a} \times \hat{k}\right|^2 = 2\left|\vec{a}\right|^2 \text{ holds for } \vec{a}.$$

Reason (R) $\vec{a} \times \hat{i} = a_3\hat{j} - a_2\hat{k}$,

$$\vec{a} \times \hat{j} = a_1\hat{k} - a_3\hat{i},$$

$$\vec{a} \times \hat{k} = a_2\hat{i} - a_1\hat{j}$$

- A. Both A and R are true and R is the correct explanation of (A)
- B. Both A and R are true and R is not the correct explanation of (A)
- C. (A) is true but (R) is false
- D. A is false but R is true

Answer: A



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54. If the point whose position vectors are $2\hat{i} + \hat{j} + \hat{k}$, $6\hat{i} - \hat{j} + 2\hat{k}$ and $14\hat{i} - 5\hat{j} + p\hat{k}$ collinear, then the value of

p is

A. 2

B. 4

C. 6

D. 8

Answer: B



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55. The ratio in which $i + 2j + 3k$ divides the join of $-2i + 3j + 5k$ and $7i - k$ is

A. 1 : 2

B. 2 : 3

C. 3 : 4

D. 1 : 4

Answer: A



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56. If $\vec{a} = \hat{i} - \hat{j} - \hat{k}$ and $\vec{b} = \lambda\hat{i} - 3\hat{j} + \hat{k}$ and the orthogonal projection of \vec{b} on \vec{a} is $\frac{4}{3}(\hat{i} - \hat{j} - \hat{k})$, then λ is equal to

A. 0

B. 2

C. 12

D. -1

Answer: B



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57. The volume (in cubic unit) of the tetrahedron with edges $\hat{i} + \hat{j} + \hat{k}$, $\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} - 2\hat{j} - \hat{k}$ is

A. 4

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

C. $\frac{1}{6}$

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

Answer: B



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58. If $a + b + c = 0$ and $|a| = 3$, $|b| = 4$ and $|c| = \sqrt{37}$ the angle between a and b is

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

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

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

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

Answer: D



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59. The position vector of a point lying on the line joining the points whose position vectors are $\hat{i} + \hat{j} - \hat{k}$ and $\hat{i} - \hat{j} + \hat{k}$ is

A. \hat{j}

B. \hat{i}

C. \hat{k}

D. $\hat{0}$

Answer: B



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60. If $\hat{i} - 2\hat{j}, 3\hat{j} + 4\hat{k}$ and $\lambda\hat{i} + 3\hat{j}$ are coplanar, then λ is equal to

A. -1

B. $1/2$

C. $-3/2$

D. 2

Answer: C



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61. If the volume of parallelepiped with conterminus edges $4\hat{i} + 5\hat{j} + \hat{k}$, $-\hat{j} + \hat{k}$ and $3\hat{i} + 9\hat{j} + p\hat{k}$ is 34 cubic units then p is equal to

A. -4

B. -13

C. 13

D. 6

Answer: A



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62. If $\vec{a} \cdot \hat{i} + \vec{a} \cdot (2\hat{i} + \hat{j}) = \vec{a} \cdot (\hat{i} + \hat{j} + 3\hat{k}) = 1$ then \vec{a} is equal to

A. $\hat{i} - \hat{k}$

B. $(3\hat{i} + 3\hat{j} + \hat{k}) / 3$

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

D. $(3\hat{i} - 3\hat{j} + \hat{k}) / 3$

Answer: D



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63. If the vector $\vec{a} = 2\hat{i} + 3\hat{j} + 6\hat{k}$ and \vec{b} are collinear and $|\vec{b}| = 21$, then \vec{b} is equal to

A. $\pm(2\hat{i} + 3\hat{j} + 6\hat{k})$

B. $\pm 3(2\hat{i} + 3\hat{j} + 6\hat{k})$

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

D. $\pm 21(2\hat{i} + 3\hat{j} + 6\hat{k})$

Answer: B



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64. If \vec{a} and \vec{b} are unit vectors, then the vectors $(\vec{a} + \vec{b}) \times (\vec{a} \times \vec{b})$ is parallel to the vector.

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

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

C. $2\vec{a} - \vec{b}$

D. $2\vec{a} + \vec{b}$

Answer: A



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65. Statement I Two non-zero, non-collinear vectors are linearly independent

Statement II Any three coplanar vectors are linearly dependent

Which of the above statement is/are true?

- A. Only I
- B. Only II
- C. Both I and II
- D. Neither I nor II

Answer: C

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66. Match the columns and choose the correct answer.

Column I

- (A) $[\vec{a} \vec{b} \vec{c}]$
- (B) $(\vec{c} \times \vec{a}) \times \vec{b}$
- (C) $\vec{a} \times (\vec{b} \times \vec{c})$
- (D) $\vec{a} \cdot \vec{b}$

Column II

- 1. $|\vec{a}| |\vec{b}| \cos(\vec{a} \vec{b})$
- 2. $(\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}$
- 3. $\vec{a} \cdot \vec{b} \times \vec{c}$
- 4. $|\vec{a}| |\vec{b}|$
- 5. $(\vec{b} \cdot \vec{c})\vec{a} - (\vec{a} \cdot \vec{b})\vec{c}$

- A. $\begin{matrix} & A & B & C & D \\ a & 1 & 2 & 3 & 4 \end{matrix}$
- B. $\begin{matrix} & A & B & C & D \\ b & 3 & 5 & 5 & 1 \end{matrix}$
- C. $\begin{matrix} & A & B & C & D \\ c & 3 & 5 & 2 & 1 \end{matrix}$
- D. $\begin{matrix} & A & B & C & D \\ d & 3 & 2 & 1 & 5 \end{matrix}$

Answer: C

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67. Assertion (A): Three vectors are coplanar if one of them is expressible as a linear combination of the other two

Reason (R) Any three coplanar vectors are linearly

- A. Both A and R are true and R is the correct explanation of (A)
- B. A is true but R is not correct explanation of A
- C. A is true but R is false
- D. A is false but R is true

Answer: B



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68. The points collinear $(1,-2,-3)$ and $(2,0,0)$ among the following is

- A. $(0,4,6)$
- B. $(0,-4,-5)$
- C. $(0,-4,-6)$
- D. $(0,-4,6)$

Answer: C



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69. If $\hat{i} + 2\hat{j} + 3\hat{k}$, $3\hat{i} + 2\hat{j} + \hat{k}$ are the sides of a parallelogram, then a unit vector is parallel to one of the diagonals of the parallelogram, is

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

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

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

D. $\frac{-\hat{i} + \hat{k} + \hat{k}}{\sqrt{3}}$

Answer: A

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70. If G is the centroid of the $\triangle ABC$, then $\vec{GA} + \vec{BG} + \vec{GC}$

A. $2\vec{GB}$

B. $2\vec{GA}$

C. $\vec{0}$

D. $2\vec{BG}$

Answer: D

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71. if the vectors $\hat{i} + 3\hat{j} + 4\hat{k}$, $\lambda\hat{i} - 4\hat{j} + \hat{k}$ are orthogonal to each other.

Then λ is equal to

A. 5

B. -5

C. 8

D. -8

Answer: C



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72. The vector $\vec{c} \cdot (\vec{b} + \vec{c}) \times (\vec{a} + \vec{b} + \vec{c})$ is equal to

A. $\vec{c} \cdot \text{Vecb} \times \vec{a}$

B. 0

C. $\vec{c} \cdot \text{Veca} \times \vec{b}$

D. $\vec{a} \cdot \vec{e} \times \vec{b}$

Answer: A



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73. If $3\hat{i} + 3\hat{j} + \sqrt{3}\hat{k}$, $\hat{i} + \hat{k}$, $\sqrt{3}\hat{i} + \sqrt{3}\hat{j} + \lambda\hat{k}$ are coplanar, then λ is equal to

A. 1

B. 2

C. 3

D. 4

Answer: A



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74. If D, E and F are respectively the mid points of AB, AC and BC in $\triangle ABC$, then $\vec{BE} + \vec{AF}$ is

A. \vec{DC}

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

C. $2\vec{BF}$

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

Answer: A



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75. If \vec{a} , \vec{b} , \vec{c} are three non-coplanar vectors, then the vectors equation

$\vec{r} = (1 - p - q)\vec{a} + p\vec{b} + q\vec{c}$ represents a

A. Straight line

B. Plane

C. Plane passing through the origin

D. Sphere

Answer: B



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76. If a, b, c are three vectors such that $a = b + c$ and the angle between b and c is $\pi/2$, then (here $a = |a|, b = |b|, c = |c|$)

A. $a^2 = b^2 + c^2$

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

C. $c^2 = a^2 + b^2$

D. $2a^2 - b^2 = c^2$

Answer: A



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77. Let $\vec{a}, \vec{b}, \vec{c}$ be the position vectors of the vertices A, B, C respectively of $\triangle ABC$. The vector area of $\triangle ABC$ is

A. $\frac{1}{2} \left\{ \vec{a} \times (\vec{b} \times \vec{c}) + \vec{b} \times (\vec{c} \times \vec{a}) + \vec{c} \times (\vec{a} \times \vec{b}) \right\}$

B. $\frac{1}{2} \left\{ \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} \right\}$

C. $\frac{1}{2} \left\{ \vec{a} + \vec{b} + \vec{c} \right\}$

D. $\frac{1}{2} \left\{ (\vec{b} \cdot \vec{c}) \vec{a} + (\vec{c} \cdot \vec{a}) \vec{b} + (\vec{a} \cdot \vec{b}) \vec{c} \right\}$

Answer: B



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78. If

$$\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = \hat{i} + \hat{j}, \vec{c} = \hat{i} \text{ and } (\vec{a} \times \vec{b}) \times \vec{c} = \lambda \vec{a} + \mu \vec{b}$$

is equal to

A. 0

B. 1

C. 2

D.

Answer: A



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79. If $\vec{a} \cdot \vec{i} = \vec{a} \cdot (\vec{i} + \vec{j}) = \vec{a} \cdot (\vec{i} + \vec{j} + \vec{k})$, then \vec{a} is equal to

A. \hat{i}

B. \hat{j}

C. \hat{k}

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

Answer: A



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80. I : If three points A, B and C have position vectors $(1, x, 3)$, $(3, 4, 7)$ and $(y, -2, -5)$ respectively and if they are collinear, then $(x, y) = (2, -3)$

II : If $a = i + 4j$, $b = 2i - 3j$ and $c = 5i + 9j$ then $c = 3a + b$

A. $(2, -3)$

B. $(-2, 3)$

C. $(-2, -3)$

D. $(2, -3)$

Answer: A



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81. The orthogona projection of \vec{a} on \vec{b} is

A.
$$\frac{(\vec{a} \cdot \vec{b}) \vec{a}}{|\vec{a}|^2}$$

$$\text{B. } \frac{(\vec{a} \cdot \vec{b}) \vec{b}}{|\vec{b}|^2}$$

$$\text{C. } \frac{\vec{a}}{|\vec{a}|^2}$$

$$\text{D. } \frac{\vec{b}}{|\vec{b}|}$$

Answer: B



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82. If the position vectors of the vertices of a triangle are $2i - j + k$, $i - 3j - 5k$, $3i - 4j - 4k$ then it is

A. Equilateral

B. Isosceles

C. Right angles isosceles

D. Right angled

Answer: D

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83. If $[a \ b \ c] = 3$, then the volume (in cube units) of the parallelepiped with $2a + b$, $2b + c$ and $2c + a$ as coterminous edges is

A. 15

B. 22

C. 25

D. 27

Answer: D

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84. $\left(\vec{a} + \vec{b}\right) \cdot \left(\vec{b} + \vec{c}\right) \times \left(\vec{a} + \vec{b} + \vec{c}\right)$ is equal to

A. 0

B. $-\left[\vec{a} \ \vec{b} \ \vec{c}\right]$

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

D. $\left[\vec{a} \ \vec{b} \ \vec{c}\right]$

Answer: D



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85. If $\vec{a} = \hat{i} + 4\hat{j}$, $\vec{b} = 2\hat{i} - 3\hat{j}$, $\vec{c} = 5\hat{i} + 9\hat{j}$ then \vec{c} is equal to

A. $2\vec{a} + \vec{b}$

B. $\vec{a} + 2\vec{b}$

C. $3\vec{a} + \vec{b}$

D. $3\vec{a} + 3\vec{b}$

Answer: C



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86. ABCD is a parallelogram, with AC, BD as diagonals, then $\vec{AC} - \vec{BD}$ is equal to

A. $4\vec{AB}$

B. \vec{AB}

C. $3\vec{AB}$

D. $2\vec{AB}$

Answer: D



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87. If $\vec{a} = \hat{i} + \hat{j} + t\hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$ then the value of 't' for which $(\vec{a} + \vec{b})$ and $(\vec{a} - \vec{b})$ are perpendicular are

A. ± 2

B. $\pm 2\sqrt{3}$

C. $\pm 3\sqrt{2}$

D. ± 3

Answer: B



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88. If θ is the angle between

\vec{a} and \vec{b} and $|\vec{a} \times \vec{b}| = |\vec{a} \cdot \vec{b}|$, then θ is equal to

A. 0

B. π

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

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

Answer: D



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89. $[\hat{i} - \hat{j}\hat{j} - \hat{k}\hat{k} - \hat{i}]$ is equal to

A. 0

B. 1

C. 2

D. 3

Answer: A



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90. If the four vectors a, b, c, d are coplanar, then $(a \times b) \times (c \times d) =$

A. 0

B. 1

C. \vec{a}

D. $\text{vec}b$

Answer: A



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