# MATHS

## BOOKS - SAI MATHS (TELUGU ENGLISH)

## ADDITION OF VECTORS AND PRODUCT OF VECTORS

### Problems

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

A. 1

B. 5

C. 8

D. 16

**Answer: D**

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**2.** The shortest distance between the skew line $\frac{x-3}{-1}=\frac{y-4}{2}=\frac{z+2}{1}, \frac{x-1}{1}=\frac{y+7}{3}=\frac{z+2}{2}$ 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 $\Delta ABC$ are $3\hat{i}+4\hat{j}-\hat{k}, \hat{i}+3\hat{j}+\hat{k}$ and $5\left(\hat{i}+\hat{j}+\hat{k}\right)$, 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 $\bar{AD}$ dividing it internally in the ratio 3:1. The line $\bar{BP}$ 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. $\frac{4}{3}\bar{A}C$

B. $\frac{5}{3}\bar{A}C$

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

D. $\frac{6}{5}\bar{A}C$

**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 $\bar{SA} + \bar{SB} + \bar{SC} + \bar{SD} = \lambda \bar{SP}$, 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 respetively 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**

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

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

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

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

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

**Answer: B**

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

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

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

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

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

**Answer: D**

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**10.** If $\overline{a}, \overline{b}, \overline{c}$ are three vectors such that $\left|\overline{a}\right| = 1, \left|\overline{b}\right| = 2, \left|\overline{c}\right| = 3$, and $\overline{a}.\ \overline{b}. = \overline{b}.\ \overline{c} = \overline{c}.\ \overline{a} = 0$, then $\left|\left[\overline{a}\,\overline{b}\,\overline{c}\right]\right| =$

A. 0

B. 2

C. 3

D. 6

**Answer: D**

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

A. 0

B. 1

C. 2

D. 3

**Answer: B**

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**12.** The Cerrtesian equation of the plane passing through the point (3,-2,-1) and parallel to the vectors $\overline{b} = \overline{i} - 2\overline{j} + 4\overline{k}$ and $\overline{c} = 3i + 2\overline{j} - 5\overline{k}$ 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

$\overline{r} = \left(\hat{i} + 2\hat{j} + 3\hat{k}\right) + t\left(\hat{i} + 3\hat{j} + 2\hat{k}\right)$ and

$\overline{r} = \left(4\overline{i} + 5\overline{j} + 6\overline{k}\right) + t\left(2\hat{i} + 3\hat{j} + \hat{k}\right)$ 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 beween the lines $\hat{r}=\left(2\hat{i}-3\hat{j}+\hat{k}\right)+\lambda\left(\hat{i}+4\hat{j}+3\hat{k}\right)$ and $\hat{r}=\left(\hat{i}-\hat{j}+2\hat{k}\right)+\mu\left(\hat{i}+2\hat{j}\right.$

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 $r = 3i + 5j + 7k + \lambda(i + 2j + k)$ 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 $\overrightarrow{\longrightarrow} b$ are two non-zero perpendicular vectors, then a vector y satisfying equations $\vec{a} \,.\, \vec{y} = c$ (where c is scalar) and $\vec{a} \times \overrightarrow{\longrightarrow} y = b$ 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.** $\overrightarrow{\longrightarrow} a = i + j - 2h \Rightarrow \sum \{(a \times i) \times j\}^2$ 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 $p = \dfrac{b \times c}{[abc]}, q = \dfrac{c \times a}{[abc]}, r = \dfrac{a \times b}{[abc]}$.

Then, (a+b). p+(b+c).q +(c+a).r` is equal to

A. 0

B. 1

C. 2

D. 3

**Answer: D**

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

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

$l_2 : R(u) = (4j + k) + u(2i + j + 2k)$ 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 $\left(\log a^2\right)I + \left(\log b^2\right)j + \left(\log c^2\right)k$ 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 corrdinates 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 $\overrightarrow{r}$.

$I \times \left(\overrightarrow{r} \times i\right) + j \times \left(\overrightarrow{r} \times j\right) + \times \left(\overrightarrow{r} + \times k\right)$ 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 $\lambda$ 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 $\bar{a} + \bar{b} + \bar{c} = \bar{0}$, then the angle between $\bar{a}$ and $\bar{b}$ 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. $\left(\overline{a}+2\overline{b}-\overline{c}\right)\left(\overline{a}-\overline{b}\right)\times\left(\overline{a}-\overline{b}-\overline{c}\right)$ is equal to

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

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

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

D. $\overline{0}$

**Answer: C**

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**40.** If $\bar{u} = \bar{a} - \bar{b}, \bar{v} = \bar{a} + \bar{b}, \left|\bar{a}\right| = \left|\bar{b}\right| = 2, \text{ then } \left|\bar{u} \times \bar{v}\right|$ is equal to

A. $2\sqrt{16 - \left(\bar{a}. \bar{b}\right)^2}$

B. $\sqrt{16 - \left(\bar{a}. \bar{b}\right)^2}$

C. $2\sqrt{4 - \left(\bar{a}. \bar{b}\right)^2}$

D. $\sqrt{4 - \left(\bar{a}. \bar{b}\right)^2}$

**Answer: A**

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**41.** If the angle $\theta$ between the vectors $\vec{a} = 2x^2\hat{i} + 4x\hat{j} + \hat{k}$ and $\bar{b} = 7\hat{i} - 2\hat{j} + x\hat{k}$ 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 parallelopiped 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 $\overrightarrow{AB} + 2\overrightarrow{AD} + \overrightarrow{BC} - 2\overrightarrow{DC} = k\overrightarrow{PQ}$ then k is equal to

A. $-6$

B. $-4$

C. 6

D. 4

**Answer: A**

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

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

A. $-7 < \lambda < 1$

B. $\lambda > 1$

C. $1 < \lambda < 7$

D. $-5 < \lambda < 1$

**Answer: A**

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**47.** The volume of the tetrahedron having the edes $\hat{i} + 2\hat{j} - \hat{k}, \hat{i} + \hat{j} + \hat{k}, \hat{i} - \hat{j} + \lambda\hat{k}$ as coterminous, is $\dfrac{2}{3}$ cubic unit. Then $\lambda$ 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 a and b. If R is a point on $\overrightarrow{PQ}$ such that $\overrightarrow{P}R = 5\overrightarrow{P}Q$, then the position vector of R is

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

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

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

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

**Answer: A**

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**49.** If the points with position vectors $60\hat{i} + 3j, 40\hat{i} - 8\hat{j}$ 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 $\overrightarrow{a} = \hat{i} + \hat{k}, \hat{k}, \overline{b} = \hat{i} - \hat{j} + \hat{k}, \overline{c} = \hat{i} + \hat{j} - \hat{k}$ and $\overline{d} = \hat{i} - \hat{j} - \hat{k}$,

then match the following columns

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

A.
$$\begin{matrix} & A & B & C & D \\ a & 3 & 1 & 2 & 6 \end{matrix}$$

B.
$$\begin{matrix} & A & B & C & D \\ b & 3 & 1 & 6 & 5 \end{matrix}$$

C. 

| | $A$ | $B$ | $C$ | $D$ |
|---|---|---|---|---|
| $c$ | 1 | 3 | 2 | 6 |

D. 

| | $A$ | $B$ | $C$ | $D$ |
|---|---|---|---|---|
| $d$ | 1 | 3 | 6 | 4 |

**Answer: B**

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

$\left|\vec{a} \times \hat{i}\right|^2 + \left|\vec{a} \times \hat{j}\right|^2 + \left|\vec{a} \times \hat{k}\right|^2 = 2\left|\vec{a}\right|^2$ 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 $\vec{a} = \bar{i} - \bar{j} - \bar{k}$ and $\vec{b} = \lambda\hat{i} - 3\hat{j} + \hat{k}$ and the orthogonal projection of $\vec{b}$ on $\vec{a}\, is \frac{4}{3}\left(\hat{i} - \hat{j} - \hat{k}\right)$, then $\lambda$ 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. $2/3$

C. $1/6$

D. $1/3$

**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 $\lambda$ is equal to

A. $-1$

B. $1/2$

C. $-3/2$

D. 2

**Answer: C**

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**61.** If the volume of parallelopiped 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 $\vec{a}\,.\,\hat{i} + \vec{a}\,.\left(2\hat{i} + \hat{j}\right) = \vec{a}\,.\left(\hat{i} + \hat{j} + 3\hat{k}\right) = 1$ then $\vec{a}$ is equal to

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

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

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

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

**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 $\left|\vec{b}\right| = 21,$ then $\vec{b}$ is equal to

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

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

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

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

**Answer: B**

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**64.** If $\vec{a}$ and $\vec{b}$ are unit vectors, then the vectors $\left(\vec{a} + \vec{b}\right) \times \left(\vec{a} \times \left(\vec{b}\right)\right)$ 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 | | Column II |
|---|---|---|---|
| (A) | $[\vec{a}\ \vec{b}\ \vec{c}]$ | 1. | $\lvert\vec{a}\rvert\lvert\vec{b}\rvert\cos(\vec{a}\ \vec{b})$ |
| (B) | $(\vec{c}\times\vec{a})\times\vec{b}$ | 2. | $(\vec{a}.\vec{c})\vec{b}-(\vec{a}.\vec{b})\vec{c}$ |
| (C) | $\vec{a}\times(\vec{b}\times\vec{c})$ | 3. | $\vec{a}.\vec{b}\times\vec{c}$ |
| (D) | $\vec{a}.\vec{b}$ | 4. | $\lvert\vec{a}\rvert\lvert\vec{b}\rvert$ |
| | | 5. | $(\vec{b}.\vec{c})\vec{a}-(\vec{a}.\vec{b})\vec{c}$ |

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 prallel to one of the diagonals of the parallelogram, is

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

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

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

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

**Answer: A**

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**70.** If G is the centroid of the $\triangle ABC, \quad \text{then} \quad \bar{G}A+\bar{B}G+\bar{G}C$

A. $2\bar{G}B$

B. $2\bar{G}A$

C. $\vec{0}$

D. $2\bar{B}G$

**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 othogonal to each other.

Then $\lambda$ is equal to

A. 5

B. $-5$

C. 8

D. $-8$

**Answer: C**

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**72.** The vector $\overrightarrow{c}.\left(\overrightarrow{b}+\overrightarrow{c}\right)\times\left(\overrightarrow{a}+\overrightarrow{b}+\overrightarrow{c}\right)$ is equal to

A. $\overrightarrow{c}.Vecb\times\overrightarrow{a}$

B. 0

C. $\overrightarrow{c}.Veca\times\overrightarrow{b}$

D. $\overrightarrow{a} . Ve \times \overrightarrow{b}$

**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 $\lambda$ 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 $\triangle ABC, \quad \text{then} \quad \bar{B}E + \bar{A}F$ is

A. $\bar{D}C$

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

C. $2\bar{B}F$

D. $\frac{3}{2}\bar{B}F$

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

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

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

**Answer: B**

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**78.** If $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \bar{b} = \vec{i} + \vec{j}, \vec{c} = \vec{i}$ and $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \lambda \vec{a} + \mu \vec{b}$ is equal to

A. 0

B. 1

C. 2

D.

**Answer: A**

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**79.** If $\vec{a}\,.\,\vec{i}=\vec{a}\,.\left(\vec{i}+\vec{j}\right)=\vec{a}\,.\left(\vec{i}+\vec{j}+\vec{k}\right)$, 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 $\overline{a} on \overline{b}$ is

A. $\dfrac{\left(\vec{a}\,.\,\vec{b}\right)\vec{a}}{\left|\vec{a}\right|^{2}}$

B. $\frac{\left(\vec{a}\,.\,\vec{b}\right)\vec{b}}{\left|\vec{b}\right|^2}$

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

D. $\frac{\vec{b}}{\left|\vec{b}\right|}$

**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 parallelopiped with 2a + b, 2b + c and 2c + a as coteminous edges is

A. 15

B. 22

C. 25

D. 27

**Answer: D**

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**84.** $\left(\vec{a}+\vec{b}\right).\left(\vec{b}+\vec{c}\right)\times\left(\vec{a}+\vec{b}+\vec{c}\right)$ 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 $\vec{a} = \hat{i} + 4\hat{j},\ \vec{b} = 2\hat{i} - 3\hat{j},\ \vec{c} = 5\hat{i} + 9\hat{j}\ \text{ then }\ \vec{c}$ is equal to

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

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

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

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

**Answer: C**

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

A. $4\bar{A}B$

B. $\bar{A}B$

C. $3\bar{A}B$

D. $2\bar{A}B$

**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 $\left(\vec{a} + \vec{b}\right)$ and $\left(\vec{a} - \vec{b}\right)$ are perpendicular are

A. $\pm 2$

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

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

D. $\pm 3$

**Answer: B**

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**88.** If $\theta$ is the angled between $\vec{a}$ and $\vec{b}$ and $\left|\vec{a} \times \vec{b}\right| = \left|\vec{a} . \vec{b}\right|$, then $\theta$ is equal to

A. 0

B. $\pi$

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

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

**Answer: D**

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89. $\left[\hat{i}-\hat{j}\hat{j}-\hat{k}\hat{k}-\hat{i}\right]$ 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. vecb`

**Answer: A**

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