MATHS

BOOKS - OBJECTIVE RD SHARMA ENGLISH

SCALER AND VECTOR PRODUCTS OF TWO VECTORS

Illustration

1. if $\vec{a}$ and $\vec{b}$ are unit vectors such that $\vec{a}.\vec{b} = \cos\theta$, then the value of $\left|\vec{a} + \vec{b}\right|$, is

A. $2\sin\theta/2$

B. $2\sin\theta$

C. $2\cos\theta/2$

D. $2\cos\theta$

Answer: C

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2. If $\vec{a}, \vec{b}$ all are unit vector, then the greatest value of $\left|\vec{a}+\vec{b}\right|+\left|\vec{a}-\vec{b}\right|$ is

A. 2

B. 4

C. $2\sqrt{2}$

D. $\sqrt{2}$

Answer: C

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3. If unit vectors $\vec{a}$ and $\vec{b}$ are inclined at an angle 2θ such that $\left|\vec{a}-\vec{b}\right|<1$ and $0 \leq \theta \leq \pi$, then θ lies in the interval

A. $\left[0, \frac{\pi}{6}\right) \cup (5\pi/6, \pi]$

B. $[0, \pi]$

C. $[\pi/6, \pi/2]$

D. $[\pi/2, 5\pi/6]$

Answer: A

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4. Let $\vec{a}$ and $\vec{b}$ be two unit vectors and α be the angle between them, then $\vec{a} + \vec{b}$ is a unit vector , if α =

A. $\pi/4$

B. $\pi/3$

C. $2\pi/3$

D. $\pi/2$

Answer: C

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5. If $\left|\vec{a}-\vec{b}\right|=\left|\vec{a}\right|=\left|\vec{b}\right|=1$, then the angle between $\vec{a}$ and $\vec{b}$, is

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

B. $\frac{3\pi}{4}$

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

D. 0

Answer: A

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6. Let $\vec{a}$ and $\vec{b}$ are two vectors inclined at an angle of $60^\circ, If\left|\vec{a}\right|=\left|\vec{b}\right|=2$,the the angle between $\vec{a}$ and $\vec{a}+\vec{b}$ is

A. 30°

B. 60°

C. 45°

D. none of these

Answer: A

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7. Consider a pyramid OPQRS located in the first octant $(x \geq 0, y \geq 0, z \geq 0)$ with O as origin and OP and OR along the X-axis and the Y-axis , respectively. The base OPQRS of the pyramid is a square with OP=3. The point S is directly above the mid point T of diagonal OQ such that TS=3. Then,

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

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

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

D. $\cos^{-1}\frac{1}{3}$

Answer: C

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8. If $\vec{a}, \vec{b}$ are unit vertors such that $\vec{a} - \vec{b}$ is also a unit vector, then the angle between $\vec{a}$ and $\vec{b}$, is

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

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

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

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

Answer: B

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9. If $\vec{a}, \vec{b}$ are unit vectors such that $\left|\vec{a} + \vec{b}\right| = -1$ then $\left|2\vec{a} - 3\vec{b}\right| =$

A. 19

B. $\sqrt{19}$

C. $\sqrt{13}$

D. 4

Answer: B

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10. If $\vec{a}, \vec{b}$ are unit vectors such that $\left|\vec{a}+\vec{b}\right|=1$ and $\left|\vec{a}-\vec{b}\right|=\sqrt{3}$, then $|3\vec{a}+2\vec{b}|$=`

A. 7

B. 4

C. $\sqrt{7}$

D. $\sqrt{19}$

Answer: C

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11. If $\vec{a}$ and $\vec{b}$ are unit vectors inclined to x-axis at angle 30° and 120° then $\left|\vec{a}+\vec{b}\right|$ equals

A. $\sqrt{2/3}$

B. $\sqrt{2}$

C. $\sqrt{3}$

D. 2

Answer: B

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12. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}, \left|\vec{a}\right|=1\left|\vec{b}\right|=2, \left|\vec{c}\right|=3$, then $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$ is equal to

A. 1

B. 0

C. -7

D. 7

Answer: C

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13. Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that

$\vec{a} \perp \left(\vec{b} + \vec{c}\right), \vec{b} \perp \left(\vec{c} + \vec{a}\right)$ and $\vec{c} \perp \left(\vec{a} + \vec{b}\right)$, if $\left|\vec{a}\right| = 1, \left|\vec{b}\right.$

,

$\left|\vec{c}\right| = 3,$ then $\left|\vec{a} + \vec{b} + \vec{c}\right|$ is,

A. $\sqrt{6}$

B. 14

C. $\sqrt{14}$

D. none of these

Answer: C

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14. If two out to the three vectors , $\vec{a}$, $\vec{b}$, $\vec{c}$ are unit vectors such that $\vec{a}+\vec{b}+\vec{c}=0$ and $2\left(\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}\right)+3=0$ then the length of the third vector is

A. 3

B. 2

C. 1

D. 0

Answer: C

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15. Let $\vec{a}$, $\vec{b}$, $\vec{c}$ be three unit vectors such that $\left|\vec{a}+\vec{b}+\vec{c}\right|=1$ and $\vec{a}\perp\vec{b}$, if $\vec{c}$ makes angles $\delta\beta$ with $\vec{a}$, $\vec{b}$ respectively, then $\cos\delta+\cos\beta$ is equal to

A. 1

B. -1

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

D. 0

Answer: B

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16. Let $\vec{a}, \vec{b}, \vec{c}$ be three unit vectors such that angle between $\vec{a}$ and $\vec{b}\, is\alpha$, $\vec{b}$ and $\vec{c}$ is β and $\vec{c}$ and $\vec{a}$ is γ. if $\left|\vec{a}. + \vec{b} + \vec{c}\right.$

, then $\cos\alpha + \cos\beta + \cos\gamma$ =

A. 1

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

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

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

Answer: D

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17. Let $\vec{a}, \vec{b}, \vec{c}$ be vectors of equal magnitude such that the angle between $\vec{a}$ and $\vec{b}$ is α, $\vec{b}$ and $\vec{c}$ is β and $\vec{c}$ and $\vec{a}$ is γ .then minimum value of $\cos\alpha + \cos\beta + \cos\gamma$ is

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

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

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

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

Answer: D

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18. Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors of equal magnitude such that the angle between each pair is $\frac{\pi}{3}$. If $\left|\vec{a} + \vec{b} + \vec{c}\right| = \sqrt{6}$, then $\left|\vec{a}\right| =$

A. 2

B. -1

C. 1

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

Answer: C

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19. If $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 5$ and $\left|\vec{c}\right| = 4$ and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ then the value of $\left(\vec{a}.\vec{b} + \vec{b}.\vec{c}\right)$ is equal tio

A. 0

B. -25

C. 25

D. none of these

Answer: B

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20. Let O be the origin and$\overrightarrow{OX}, \overrightarrow{OY}, \overrightarrow{OZ}$ be three unit vector in the directions of the sides $\overrightarrow{QR}, \overrightarrow{RP}, \overrightarrow{PQ}$ respectively , of a triangle PQR.

if the triangle PQR varies , then the manimum value of $\cos(P+Q)+\cos(Q+R)+\cos(R+P)$ is

A. $-\frac{5}{3}$

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

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

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

Answer: B

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21. Angle between vectors $\vec{a}$ and $\vec{b}$ where $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vectors satisfying $\vec{a} + \vec{b} + \sqrt{3}\vec{c} = \vec{0}$ is

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

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

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

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

Answer: C

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22. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}, \left|\vec{a}\right| = 3, \left|\vec{b}\right| = 5, \left|\vec{c}\right| = 7,$ then angle between $\vec{a}$ and $\vec{b}$ is : a. $\frac{\pi}{2}$ b. $\frac{\pi}{3}$ c. $\frac{\pi}{4}$ d. $\frac{\pi}{6}$

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

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

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

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

Answer: D

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23. If $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vectors satisfying $\left|\vec{a}-\vec{b}\right|^2+\left|\vec{b}-\vec{c}\right|^2+\left|\vec{c}-\vec{a}\right|^2=9$ then find the value of $\left|2\vec{a}+5$

.

A. 0

B. 1

C. 2

D. 3

Answer: D

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24. The value of a, for which the points A, B, C with position vectors $2\hat{i}-\hat{j}+\hat{k}, \hat{i}-3\hat{j}-5\hat{k}$ and $a\hat{i}-3\hat{j}+\hat{k}$ respectively are the vertices of a right angled triangles with $C=\frac{\pi}{2}$ are

A. 2 and 1

B. -2 and -1

C. -2 and 1

D. 2 and -1

Answer: A

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25. If the magnitude of the projection vector of the vector $\alpha\hat{i}+\beta\hat{j}on\sqrt{3}\hat{i}+\hat{j}is\sqrt{3}$ and if $\alpha=2+\sqrt{3}\beta$ then possible value (s) of $|\alpha|$ is /are

A. 1,2

B. 3,4

C. 4,5

D. 3

Answer: A

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26. The vactors $\vec{a} = 3\hat{i} - 2\hat{j} + 2\hat{k}$ and $\vec{b} = -\hat{i} - 2\hat{k}$ are the adjacent sides of a parallelogram. Then , the acute angle between $\vec{a}$ and $\vec{b}$ is

A. $\pi/4$

B. $\pi/3$

C. $3\pi/4$

D. $2\pi/3$

Answer: A

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27. If $e_1 = \hat{i} + \hat{j} + \hat{k}$ and $e_2 = \hat{i} + \hat{j} - \hat{k}$ and $\vec{a}$ and $\vec{b}$ are two vectors such that $e_1 = 2\vec{a} + \vec{b}$ and $\vec{e}_2 = \vec{a} + 2\vec{b}$, then angle between $\vec{a}$ and $\vec{b}$ is:

A. $\cos^{-1}\left(\frac{7}{9}\right)$

B. $\cos^{-1}\left(\frac{7}{11}\right)$

C. $\cos^{-1}\left(-\frac{7}{11}\right)$

D. $\cos^{-1}\left(\frac{6\sqrt{2}}{11}\right)$

Answer: C

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28. Find the least positive integral value of x for which the angle betweenn vectors $a = x\hat{i} - 3\hat{j} - \hat{k}$ and $b = 2x\hat{i} + x\hat{j} - \hat{k}$ is acute.

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

B. $-2, 3$

C. all $x < 0$

D. $x > 0$

Answer: C

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29. The value of x for which the angle between $\vec{a} = 2x^2\hat{i} + 4x\hat{j} + \hat{k}$ and $\vec{b} = 7\hat{i} - 2\hat{j} + \hat{k}$ is obtuse and the angle between $\vec{b}$ and the z-axis is acute and less then $\pi/6$

A. $a < x < 1/2$

B. $1/2 < x < 15$

C. $x > 1/2 \text{ or } x < 0$

D. none of these

Answer: D

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30. If $\overrightarrow{a}, \overrightarrow{b}$ are two unit vectors such that $\left|\overrightarrow{a} + \overrightarrow{b}\right| = 2\sqrt{3}$ and $\left|\overrightarrow{a} - \overrightarrow{b}\right| = 6$ then the angle between $\overrightarrow{a}$ and $\overrightarrow{b}$, is

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

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

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

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

Answer: B

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31. If $\overrightarrow{a}$ is any non-zero vector, then $\left(\overrightarrow{a} . \hat{i}\right)\hat{i} + \left(\overrightarrow{a} . \hat{j}\right)\hat{j} + \left(\overrightarrow{a} . \overrightarrow{k}\right)\hat{k}$ is equal to ....

A. $\overrightarrow{r}$

B. $2\vec{r}$

C. $3\vec{r}$

D. $\vec{0}$

Answer: A

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32. For any vector $\vec{r}$, $(\vec{r}.\hat{i})^2 + (\vec{r}.\hat{j})^2 + (\vec{r}.\hat{k})^2$ is equal to

A. 1

B. $|\vec{r}|$

C. $\vec{r}$

D. $|\vec{r}|^2$

Answer: D

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33. A vector of magnitude 4 which is equally inclined to the vectors $\hat{i}+\hat{j}, \hat{j}+\hat{k}$ and $\hat{k}+\hat{i}$, is

A. $\frac{4}{\sqrt{3}}\left(\hat{i}-\hat{j}-\hat{k}\right)$

B. $\frac{4}{\sqrt{3}}\left(\hat{i}+\hat{j}-\hat{k}\right)$

C. $\frac{4}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$

D. $\frac{4}{\sqrt{3}}\left(\hat{i}+\hat{j}-\hat{k}\right)$

Answer: C

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34. Forces of magnitudes 5 and 3 units acting in the directions $6\hat{i}+2\hat{j}+3\hat{k}$ and $3\hat{i}-2\hat{i}+6\hat{k}$ respectively act on a particle which is displaced from the point (2,2,-1) to (4,3,1) . The work done by the forces, is

A. 148 unit

B. $\frac{148}{7}$ unit

C. 296 units

D. none of these

Answer: B

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35. A groove is in the form of a broken line ABC and the position vectors fo the three points are respectively $2\hat{i}-3\hat{j}+2\hat{k}, 3\hat{i}-\hat{k}, \hat{i}+\hat{j}+\hat{k}$, A force of magnitude $24\sqrt{3}$ acts on a particle of unit mass kept at the point A and moves it angle the groove to the point C. If the line of action of the force is parallel to the vector $\hat{i}+2\hat{j}+\hat{k}$ all along, the number of units of work done by the force is

A. $144\sqrt{2}$

B. $144\sqrt{3}$

C. $72\sqrt{2}$

D. $72\sqrt{3}$

Answer: C

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36. A paticle acted on by constant forces $4\hat{i}+\hat{j}-3\hat{k}$ and $3\hat{i}+\hat{j}-\hat{k}$ is displaced from the point $\hat{i}+2\hat{j}+3\hat{k}\to 5\hat{i}+4\hat{j}+\hat{k}$. Find the work done

A. 50 units

B. 20 units

C. 30 units

D. 40 units

Answer: D

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37. If $\vec{a}\cdot\vec{b}=\left|\vec{a}\times\vec{b}\right|$, then this angle between $\vec{a}$ and $\vec{b}$ is,

A. 0°

B. 180°

C. 150°

D. 45°

Answer: D

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38. If $\overrightarrow{u}$ and $\overrightarrow{v}$ are unit vectors and θ is the acute angle between them, then $2\overrightarrow{u} \times 3\overrightarrow{v}$ is a unit vector for

A. no value of θ

B. exactly on value of θ

C. exactly two values of θ

D. more than two values of θ

Answer: B

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39. Let $A_1, A_2, \ldots .., A_n (n < 2)$ be the vertices of regular polygon of n sides with its centre at he origin. Let $\overrightarrow{a}_k$ be the position vector of the point $A_k, k = 1, 2, \ldots .., n$

if $\left|\sum_{k=1}^{n-1} \left(\overrightarrow{a}_k \times \overrightarrow{a}_k + 1\right)\right| = \left|\sum_{k=1}^{n-1} \left(\overrightarrow{a} k. \overrightarrow{a} k + 1\right)\right|$ then the minimum value of n is

A. 1

B. 2

C. 8

D. 9

Answer: C

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40. Let O be the origin and$\overrightarrow{OX}, \overrightarrow{OY}, \overrightarrow{OZ}$ be three unit vector in the directions of the sides $\overrightarrow{QR}, \overrightarrow{RP}, \overrightarrow{PQ}$ respectively , of a triangle PQR.

$\left|\overrightarrow{OX} \times \overrightarrow{OY}\right| =$

A. sin (P +Q)

B. sin 2R

C. sin (P +R)

D. sin (Q +R)

Answer: A

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41. If the angle between the vectors $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{3}$ and the area of the triangle with adjacemnt sides parallel to $\vec{a}$ and $\vec{b}$ is 3 , then a.b is

A. $\sqrt{3}$

B. 2sqrt3`

C. 4sqrt3`

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

Answer: B

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42. If $\overrightarrow{a} = 2\hat{i} - 3\hat{j} - 1\hat{k} \text{ and } \overrightarrow{b} = \hat{i} + 4\hat{j} - 2\hat{k} \text{ then } \overrightarrow{a} \times \overrightarrow{b}$ is

A. $10\hat{i} + 2\hat{j} + 11\hat{k}$

B. $10\hat{i} + 3\hat{j} + 11\hat{k}$

C. $10\hat{i} - 3\hat{j} + 11\hat{k}$

D. $10\hat{i} - 3\hat{j} - 10\hat{k}$

Answer: B

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43. For any vector $\vec{a}$

$\left|\vec{a}\times\hat{i}\right|^2+\left|\vec{a}\times\hat{j}\right|^2+\left|\vec{a}\times\hat{k}\right|^2$ is equal to

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

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

C. $3\left|\vec{a}\right|^2$

D. $2\left|\vec{a}\right|$

Answer: B

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44. Prove that

$\left(\vec{a}.\hat{i}\right)\left(\vec{a}\times\hat{i}\right)+\left(\vec{a}.\hat{j}\right)\left(\vec{a}\times\hat{j}\right)+\left(\vec{a}.\hat{k}\right)\left(\vec{a}\times\hat{k}\right)=\vec{0}$

A. $3\vec{a}$

B. $\vec{a}$

C. $\vec{0}$

D. $2\vec{a}$

Answer: C

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45. The number of unit vectors perpendicular to the plane of vectors $\vec{a} = 2\hat{i} - 6\hat{j} - 3\hat{k}$ and $\vec{b} = 4\hat{i} + 3\hat{j} - \hat{k}$ is/are

A. $\frac{1}{\sqrt{26}}\left(4\hat{i} = 3\hat{j} - \hat{k}\right)$

B. $\frac{1}{7}\left(2\hat{i} - 6\hat{j} - 3\hat{k}\right)$

C. $\frac{1}{7}\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$

D. $\frac{1}{7}\left(2\hat{i} - 3\hat{j} - 6\hat{k}\right)$

Answer: C

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46. The number of vectors of unit length perpendicular to the vectors $\widehat{a} = \hat{i} + \hat{j}$ and $\overrightarrow{b} = \hat{j} + \hat{k}$ is

A. 1

B. 2

C. 4

D. infinite

Answer: B

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47. A unit vector making an obtuse angle with x-axis and perpendicular to the plane containing the points $\hat{i} + 2\hat{j} + 3\hat{k}, 2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\hat{i} + 5\hat{j} + 7\hat{k}$ also makes an obtuse angle with

A. y-axis

B. z-axis

C. y and z axes

D. x and y axes

Answer: B

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48. Let $\overrightarrow{u}=\hat{i}+\hat{j}, \overrightarrow{v}=\hat{i}-\hat{j}$ and $\overrightarrow{w}=\hat{i}+2\hat{j}+3\hat{k}$ If $\widehat{n}$ isa unit vector such that $\overrightarrow{u}.\widehat{n}=0$ and $\overrightarrow{v}.\widehat{n}=0,$ then $\left|\overrightarrow{w}.\widehat{n}\right|$ is equal to

A. 3

B. 0

C. 1

D. 2

Answer: A

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49. If $\overrightarrow{a} = \hat{i} + \hat{j} - \hat{k}, \overrightarrow{b} = -\hat{i} + 2\hat{j} + 2\hat{k}$ and $\overrightarrow{c} = -\hat{i} + 2\hat{j} - \hat{k}$, then a unit vector normal to the vectors $\overrightarrow{a} + \overrightarrow{b}$ and $\overrightarrow{b} - \overrightarrow{c}$, is

A. $\hat{i}$

B. $\hat{j}$

C. $\hat{k}$

D. none of these

Answer: A

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50. A unit vector perpendicular to both $\hat{i} + \hat{j}$ and $\hat{j} + \hat{k}$ is

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

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

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

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

Answer: C

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51. Let $\vec{a}=2\hat{i}+\hat{j}-2\hat{k}$ and $\vec{b}=\hat{i}+\hat{j}$. Let $\vec{c}$ be vector such that $\left|\vec{c}-\vec{a}\right|=3, \left|\left(\vec{a}\times\vec{b}\right)\times\vec{c}\right|=3$ and the angle between $\vec{c}$ and $\vec{a}\times\vec{b}$ be 30° Then , $\vec{a}.Ve$ is equal to

A. $\frac{25}{8}$

B. 2

C. 5

D. $\frac{1}{8}$

Answer: B

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52. Let $\vec{a}, \vec{b}, \vec{c}$ be the position vectors of three vertices A,B,C of a triangle respectively. Then the area fo the triangle is

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

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

C. $\frac{1}{2}\left|\vec{b} \times \vec{c}\right|$

D. $\frac{1}{2}\left|\vec{c} \times \vec{a}\right|$

Answer: A

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53. If $\overrightarrow{AB} = \vec{b}$ and $\overrightarrow{AC} = \vec{c}$ then the length of the perpendicular from A to the line BC is

A. $\frac{\left|\vec{b} \times \vec{c}\right|}{\left|\vec{b} + \vec{c}\right|}$

B. $\frac{\left|\vec{b} \times \vec{c}\right|}{\left|\vec{b} - \vec{c}\right|}$

C. $\dfrac{\left|\vec{b}\times\vec{c}\right|}{2\left|\vec{b}-\vec{c}\right|}$

D. $\dfrac{\left|\vec{b}\times\vec{c}\right|}{2\left|\vec{b}+\vec{c}\right|}$

Answer: B

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54. The perpendicular distance of the point $\vec{c}$ from the joining $\vec{a}$ and $\vec{b}$ is

A. $\dfrac{\left|\vec{b}\times\vec{c}+\vec{c}\times\vec{a}+\vec{a}\times\vec{b}\right|}{\left|\vec{b}-\vec{a}\right|}$

B. $\dfrac{\left|\vec{a}\times\vec{b}+\vec{b}\times\vec{c}+\vec{c}\times\vec{a}\right|}{\left|\vec{b}-\vec{a}\right|}$

C. $\dfrac{\left|\vec{a}\times\vec{b}+\vec{b}\times\vec{c}+\vec{c}\times\vec{a}\right|}{\left|\vec{a}-\vec{a}\right|}$

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

Answer: A

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55. If the diagonals of a parallelogram are represented by the vectors $3\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}+3\hat{j}-4\hat{k}$, then its area in square units , is

A. $5\sqrt{3}$

B. $6\sqrt{3}$

C. $\sqrt{42}$

D. $2\sqrt{42}$

Answer: C

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56. if $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ then

A. $\vec{a}.\vec{b} = \vec{b}.\vec{c} = \vec{c}.\vec{a}$

B. $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$

C. $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{a} \times \vec{c}$

D. $\vec{b} \times \vec{a} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$

Answer: B

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57. Let a, b, c be unit vectors such that a+b+c=0. Which one of the following is correct?

A. $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a} = \vec{0}$

B. $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a} \neq \vec{0}$

C. $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{a} \times \vec{c} = \vec{0}$

D. $\vec{a} \times \vec{b}, \vec{b} \times \vec{c}, \vec{c} \times \vec{a}$ are mutually perpendicular vectors.

Answer: B

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58. Let PQR be a triangle . Let $\vec{a} = \overline{QR}, \vec{b} = \overline{RP}$ and $\vec{c} = \overline{PQ}$. if $|\vec{a}| = 12, |\vec{b}| = 4\sqrt{3}$ and $\vec{b} . \vec{c}$

then which of the following is (are) true ?

A. $\frac{1}{2}|\vec{c}|^2 - |\vec{a}| = 12$

B. $\frac{1}{2}|\vec{c}|^2 + |\vec{a}| = 30$

C. $|\vec{a} \times \vec{b} + \vec{c} \times \vec{a}| = 48\sqrt{3}$

D. $\vec{a} . \vec{b} = -72$

Answer: A::C::D

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59. Let $\overrightarrow{a}$ be a unit vector perpendicular to unit vectors $\overrightarrow{b}$ and $\overrightarrow{c}$ and if the angle between $\overrightarrow{b}$ and $\overrightarrow{c}$ is α, then $\overrightarrow{b} \times \overrightarrow{c}$ is

A. $\pm(\cos\alpha)\overrightarrow{a}$

B. $\pm(\cos ec\alpha)\overrightarrow{a}$

C. $\pm(\sin\alpha)\overrightarrow{a}$

D. none of these

Answer: C

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60. If the vectors $\overrightarrow{c}$, $\overrightarrow{a} = x\hat{i} + y\hat{j} + z\hat{k}$ and $\overrightarrow{b} = \hat{j}$ are such that $\overrightarrow{a}$, $\overrightarrow{c}$ and $\overrightarrow{b}$ form a right handed system then $\overrightarrow{c}$ is

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

B. $\overrightarrow{0}$

C. $y\hat{j}$

D. $-z\widehat{+}x\hat{k}$

Answer: A

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61. The area of parallelogram whose diagonals coincide with the following pair of vectors is $5\sqrt{3}$. The vectors are

A. $3\hat{i}+2\hat{i}-\hat{k}, 3\hat{i}-\hat{j}+4\hat{k}$

B. $\frac{3}{2}\hat{i}+\frac{1}{2}\hat{j}-\hat{k}, 2\hat{i}-6\hat{j}+8\hat{k}$

C. $3\hat{i}+\hat{j}-2\hat{k}, \hat{i}+3\hat{j}+4\hat{k}$

D. none of these

Answer: B

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62. Let $\vec{a} - 2\hat{i} + \hat{j} + \hat{k}, \vec{b} = \hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 2\hat{i} - 3\hat{j} + 4\hat{k}$. A vector $\vec{r}$ is

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

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

C. $3\hat{i} + 2\hat{j} + 4\hat{k}$

D. $\hat{i} - 5\hat{j} + 3\hat{k}$

Answer: D

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63. vectors $\vec{a}$ and $\vec{b}$ are inclined at an angle $\theta = 60^\circ$. If $\left|\vec{a}\right| = 1, \left|\vec{b}\right| = 2,$ then $\left[\left(\vec{a} + 3\vec{b}\right) \times \left(3\vec{a} - \vec{b}\right)\right]^2$ is equal to

A. 225

B. 275

C. 325

D. 300

Answer: D

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64. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be unit vectors such that $\vec{a}.\vec{b} = 0 = \vec{a}.\vec{c}$. It the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{6}$ then find $\vec{a}$.

A. $\pm 2\left(\vec{b} \times \vec{c}\right)$

B. $2\left(\vec{b} \times \vec{c}\right)$

C. $\pm \frac{1}{2}\left(\vec{b} \times \vec{c}\right)$

D. $-\frac{1}{2}\left(\vec{b} \times \vec{c}\right)$

Answer: A

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65. Let $\vec{u} = u_1\hat{i} + u_2\hat{j}$ be a unit vector in xy plane and $\vec{w} = \frac{1}{\sqrt{6}}\left(\hat{i} + \hat{j} + 2\hat{k}\right)$. Given that there exists a vector $\vec{v}$ " in " R_3 " such that $\left|\vec{u} \times \vec{v}\right| = 1$ and $\vec{w}.\left(\vec{u} \times \vec{v}\right) = 1$, then

A. $|u_1| = |u_2|$

B. $|u_2| = 2|u_2|$

C. $2|u_1| = |u_2|$

D. $|u_1| - 3|u_2|$

Answer: A

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66. Let $\vec{u} = u_1\hat{i} + u_3\hat{k}$ be a unit vector in xz-plane and $\vec{q} = \frac{1}{\sqrt{6}}\left(\hat{i} + \hat{j} + 2\hat{k}\right)$. If there exists a vector $\vec{c}$ in such that $\left|\vec{u} \times \vec{c}\right| = 1$ and $\vec{q}.\left(\vec{u} \times \vec{c}\right) = 1$.Then

A. $|u_1| = |u_3|$

B. $|u_1| = 2|u_3|$

C. $|u_1| = 2|u_3|$

D. $2|u_1| = |u_3|$

Answer: B

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67. Let $\vec{u} = u_1\hat{i} + u_2\hat{j} + u_3\hat{k}$ be a unit vector in R^3 and $\vec{w} = \frac{1}{\sqrt{6}}\left(\hat{i} + \hat{j} + 2\hat{k}\right)$, Given that there exists a vector $\vec{v}$ in R^3 such that $\left|\vec{u} \times \vec{v}\right| = 1$ and $\vec{w} \, . \left(\vec{u} \times \vec{v}\right) = 1$ which of the following statements is correct ?

A. There is exactly one choice for such $\vec{v}$

B. There are exactly two for such $\vec{v}$

C. There are exactly four such $\vec{v}$

D. There are infinitely many choices for such $\vec{v}$

Answer: D

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68. IF the force represented by $3\hat{j} + 2\hat{k}$ is acting through the point $5\hat{i} + 4\hat{j} - 3\hat{k}$, then its moment about th point (1,3,1) is

A. $14\hat{i} - 8\hat{j} + 12\hat{k}$

B. $-14\hat{i} + 8\hat{j} - 12\hat{k}$

C. $-6\hat{i} - \hat{j} + 9\hat{k}$

D. $6\hat{i} + \hat{j} - 9\hat{k}$

Answer: A

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69. The moment of the couple formed by forces $5\hat{i} + \hat{k}$ and $-5\hat{i} - \hat{k}$ acting at the points (9,-1,2) and (3,-2,1) respectively is,

A. $-\hat{i}+\hat{j}+5\hat{k}$

B. $\hat{i}-11\hat{j}-5\hat{k}$

C. $-\hat{i}=11\hat{j}+5\hat{k}$

D. $\hat{i}-\hat{j}-5\hat{k}$

Answer: D

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70. A force of 39 kg. wt is acting at a point p (-4,2,5) in the direaction $12\hat{i}-4\hat{j}-3\hat{k}$. The moment of this force about a line through the origin having the direction of $2\hat{i}-2\hat{j}+\hat{k}$ is

A. 76 units

B. - 76 units

C. $42\hat{i}+144\hat{j}-24\hat{k}$

D. none of these

Answer: B

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71. The moment about a line through the origin having the direction of $112\hat{i} - 4\hat{j} - 3\hat{k}$ is

A. $\frac{760}{13}$

B. $\frac{-760}{13}$

C. $\frac{76}{13}$

D. $\frac{760}{3}$

Answer: B

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72. The moment of the couple consisting of the force through the point $2\hat{i} - 3\hat{j} - \hat{k}$ is

A. 5

B. $5\sqrt{5}$

C. $\sqrt{5}$

D. 25

Answer: B

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Section I Solved Mcqs

1. The length of the longer diagonal of the parallelogram constructed on $5\vec{a}+2\vec{b}$ and $\vec{a}-3\vec{b}$, if it is given that $|\vec{a}|=2\sqrt{2}, |\vec{b}|=3$ and $\vec{a}.Vecb=\frac{\pi}{4}$ is

A. 15

B. $\sqrt{3}$

C. $\sqrt{593}$

D. $\sqrt{369}$

Answer: C

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2. If the vectors $\vec{a} = (c\log_2 x)\hat{i} - 6\hat{j} + 3\hat{k}$ and $\vec{b} = (\log_2 x)\hat{i} + 2\hat{j} + (2c\log_2 x)\hat{k}$ make an obtuse angle for any $x = (0, \infty)$ then c belongs to

A. $(-\infty, 0)$

B. $(-\infty, -4/3)$

C. $(-4/3, 0)$

D. $(-4/3, \infty)$

Answer: C

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3. Let $\vec{a}$, $\vec{b}$, $\vec{c}$ represent respectively $\overrightarrow{BC}, \overrightarrow{CA}$ and $\overrightarrow{AB}$ where ABC is a triangle , Then ,

A. $\vec{a} + \vec{b} = \vec{c}$

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

C. $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$

D. $\left[\vec{a}\vec{b}\vec{c}\right] = \left[\vec{b}\vec{c}\vec{a}\right] = \left[\vec{c}\vec{a}\vec{b}\right] \neq 0$

Answer: C

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4. The vector $\hat{i} + x\hat{j} + 3\hat{k}$ is rotated through an angle θ and is doubled in magnitude. It now becomes $4\hat{i} + (4x - 2)\hat{j} + 2\hat{k}$. The values of x are

A. $-2/3, 2$

B. 1/3,2

C. 2/3,-2

D. 2,-1/3

Answer: A

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5. If $\vec{a}, \vec{b}$ are unit vectors such that the vector $\vec{a} + 3\vec{b}$ is peependicular to $7\vec{a} - \vec{b}$ and $\vec{a} - 4\vec{b}$ is prependicular to $7\vec{a} - 2\vec{b}$ then the angle between $\vec{a}$ and $\vec{b}$ is

A. $\pi/6$

B. $\pi/4$

C. $\pi/3$

D. $\pi/2$

Answer: C

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6. if G is the centroid of $\triangle ABC$ such that $\overrightarrow{GB}$ and $\overrightarrow{GC}$ are inclined at on obtuse angle, then

A. $5a^2 > b^2 + c^2$

B. $5c^2 > a^2 + b^2$

C. $5b^2 > a^2 + c^2$

D. none of these

Answer:

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7. A vector of magnitude 4 which is equally inclined to the vectors $\hat{i} + \hat{j}, \hat{j} + \hat{k}$ and $\hat{k} + \hat{i}$, is

A. $\dfrac{4}{\sqrt{3}}\left(\hat{i} - \hat{j} - \hat{k}\right)$

B. $\dfrac{4}{\sqrt{3}}\left(\hat{i} + \hat{j} - \hat{k}\right)$

C. $\dfrac{4}{\sqrt{3}}\left(\hat{i} + \hat{j} + \hat{k}\right)$

D. none of these

Answer: C

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8. Unit vectors equally inclined to the vectors $\hat{i}, \frac{1}{3}\left(-2\hat{i}+\hat{j}+2\hat{k}\right) = \pm\frac{4}{\sqrt{3}}\left(4\hat{j}+3\hat{k}\right)$ are

A. $\pm\frac{1}{\sqrt{51}}\left(\hat{i}-5\hat{j}+5\hat{k}\right)$

B. $\pm\frac{1}{\sqrt{51}}\left(\hat{i}-5\hat{j}-5\hat{k}\right)$

C. $\pm\frac{1}{\sqrt{t}}51\left(\hat{i}+5\hat{j}+5\hat{k}\right)$

D. none of these

Answer: A

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9. If a,b,c are the p^{th}, q^{th} and r^{th} terms of G.P then the angle between the vector

$\overrightarrow{u} = (\log a)\hat{i} + (\log b)\hat{j} + (\log c)\hat{k}$ and $\overrightarrow{v} - (q-r)\hat{i} + (r-p)\hat{i} + (r-p$

, is

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

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

C. π

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

Answer: D

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10. If a, b,c are the pth, qth, and rth terms of a HP, then the vectors

$\overrightarrow{u} = \frac{\hat{i}}{a} + \frac{\hat{j}}{b} + \frac{\hat{k}}{c}$ and $\overrightarrow{v} = (q-r)\hat{i} + (r-p)\hat{j} + (p-q)\hat{k}$

A. are parallel

B. are othogonal

C. satisfy $\vec{u} \cdot \vec{v} = 1$

D. satisfy $\left|\vec{u} \times \vec{v}\right| = \hat{i} + \hat{j} + \hat{k}$

Answer: B

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11. Let a,b,c denote the lengths of the sides of a triangle such that

$(a-b)\vec{u} + (b-c)\vec{v} + (c-a)\left(\vec{u} \times \vec{v}\right) = \vec{0}$

For any two non-collinear vectors $\vec{u}$ and $\vec{u}$,then the triangle is

A. right angled

B. equilateral

C. isoscels

D. obtuse angled

Answer: B

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12. The vectors $\overrightarrow{a}, \overrightarrow{b}$ and $\overrightarrow{u} \times \overrightarrow{u}$ are of the same length and taken pairwise they form equal angles. If $\overrightarrow{a} = \hat{i} + \hat{j}$ and $\overrightarrow{b} = \hat{j} + \hat{k}$ then $\overrightarrow{c}$ is equal to

A. $\hat{i} + \hat{k}, \frac{1}{3}\left(-\hat{i} + 4\hat{j} - \hat{k}\right)$

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

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

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

Answer: A

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