MATHS

BOOKS - OBJECTIVE RD SHARMA MATHS VOL I (HINGLISH)

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 $\vec{a}$ and $\vec{b}$ are unit vectors, 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 the unit vectors $\vec{a}$ and $\vec{b}$ are inclined of an angle 2θ such that $\left|\vec{a}-\vec{b}\right|<1$ and $0\leq\theta\leq\pi$ then θ 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 pyamid OPQRS locaated in the first octant $(x \geq 0, y \leq 0, z \leq 0)$ with O as origin , and OP an OR along the x-axis and y-axis respectively. The base OPQR of the pyramid is a square with OP=3 . The point S is directly above the mid-point T of the diagonal OQ such that TS=3 , Then , the angle between OQ and OS, is

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 $\left|\vec{a}-\vec{b}\right|=\sqrt{3},\text{" then "}\left|3\vec{a}+2\vec{b}\right|=$

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 $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}+\vec{c}.\vec{a}$ 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 $\left|\vec{a}. + \vec{b} + \overline{c}$, then $\cos\alpha + \cos\beta + \cos\beta$ =

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 $\left(\vec{a}.Vecb+\vec{b}.\vec{c}\right)$ 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 $OXxOY, OZ$ be three unit vectors in the direction of the sides QR , RP , PQ , respectively of a triangle PQR. If the triangle PQR varies, then the minimum value of $\cos(P+Q)+\cos(Q+R)+\cos(R+P)$ is: $-\frac{3}{2}$ (b) $\frac{5}{3}$ (c) $\frac{3}{2}$ (d) $-\frac{5}{3}$

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 $\vec{a} + \vec{b} + \vec{c} = \vec{0}, \left|\vec{a}\right| = 3, \left|\vec{b}\right| = 5$ and $\left|\vec{c}\right| = 7$, then the angle between $\vec{a}$ and $\vec{b}$ is

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

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

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

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

Answer: D

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23. If $\vec{a}. Vecb$ and $\vec{c}$ are unit vectors satisfying $\left|\vec{a}-\vec{b}\right|^2+\left|\vec{b}-\vec{c}\right|^2\left|\vec{c}-\vec{a}\right|=9, \text{ then } \left|2\vec{a}+5\vec{b}+5\vec{c}\right|$ is equal to

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 $2\hat{i}-\hat{j}+\hat{k}$, $\hat{i}+2\hat{k}$, $\hat{i}-3\hat{j}-5\hat{k}$ and $a\hat{i}-3\hat{j}+\hat{k}$ respectively are the vertices of a right angled triangle with $C=\pi/2$, 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 R^2 if the magnitude of the projection vector of the vecrtor $\alpha\hat{i}+\beta\hat{j}on\sqrt{3}\hat{i}+\hat{j}is\sqrt{3}$ 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: D

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26. The vactors $\vec{a} = 3\hat{i} - 2\hat{i} + 2\hat{k}$ 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 $\overrightarrow{e}_1 = (1, 1, 1)$ and $\overrightarrow{e}_2 = (1, 1, -1)$ and $\overrightarrow{a}$ and $\overrightarrow{b}$ are two vectors that $\overrightarrow{e}_1 = 2\overrightarrow{a} + \overrightarrow{b}$ and $\overrightarrow{e}_2 \overrightarrow{a} + 2\overrightarrow{b}$ then angle between $\overrightarrow{a}$ and $\overrightarrow{b}$ 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. The values of x for which the angle between the vectors $\overrightarrow{a} = x\hat{i} - 3\hat{j} - \hat{k}$ and $\overrightarrow{b} = 2x\hat{i} + x\hat{j} - \hat{k}$ is acute, and the angle, between the vector $\overrightarrow{b}$ and the axis of ordinates is obtuse, are

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 $\vec{a} = 2x^2\hat{i} + 4x\hat{j} = \hat{k} + \hat{k}$ and $\vec{b} = 7\hat{i} - 2\hat{j} = x\hat{k}$, is obtuse and the angle between $\vec{b}$ and the z-axis is acute and less than $\pi/6$, are

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 $\vec{a}, \vec{b}$ are two unit vectors such that $\left|\vec{a}+\vec{b}\right|=2\sqrt{3}$ and $\left|\vec{a}-\vec{b}\right|=6$ then the angle between $\vec{a}$ and $\vec{b}$, 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. For any vector $\vec{r}$,

$\left(\vec{r}\,.\,\hat{i}\right)\hat{i}+\left(\vec{r}\,.\,\hat{j}\right)\hat{j}+\left(\vec{r}\,.\,\hat{k}\right)\hat{k}$ =

A. $\vec{r}$

B. $2\vec{r}$

C. $3\vec{r}$

D. $\vec{0}$

Answer: A

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

A. 1

B. $\left|\vec{r}\right|$

C. $\vec{r}$

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

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 $3\hat{i}-\hat{i}+6\hat{k}$ 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 $\hat{i} + 2\hat{j} + 3\hat{k} \rightarrow 5\hat{i} + 4\hat{j} + \hat{k}$. Find the work done

A. 50 units

B. 20 units

C. 30 units

D. 40 units

Answer: D

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

A. 0°

B. 180°

C. 150°

D. 45°

Answer: D

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38. If $\vec{u}$ and $\vec{v}$ are unit vectors and θ is the acute angle between them, then $2u\vec{u} \times 3\vec{v}$ 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 $A_1, A_2, \ldots\ldots, A_n (n < 2)$ be the vertices of regular polygon of n sides with its centre at he origin. Let $\vec{a}_k$ be the position vector of the point $A_k, k = 1, 2, \ldots\ldots, n$

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

A. 1

B. 2

C. 8

D. 9

Answer: D

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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 $\overrightarrow{OR}, \overrightarrow{RP}, \overrightarrow{PQ}$ respectively, of a triangle PQR, Then , $\left|\overrightarrow{OX} \times \overrightarrow{OY}\right|$ =

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 is

A. $\sqrt{3}$

B. 2sqrt3`

C. 4sqrt3`

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

Answer: B

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42. If $\overrightarrow{a} = 2\hat{i} - 3\hat{k}$ and $\overrightarrow{b} = \hat{i} + 4\hat{j} - 2\hat{k}$ 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. $\left(\vec{a}\,.\,\hat{i}\right)\left(\vec{a}\times\hat{i}\right)+\left(\vec{a}\,.\,\hat{j}\right)+\left(\vec{a}\,.\,\hat{k}\right)\left(\vec{a}\times\hat{k}\right)$ is equal to

A. $3\vec{a}$

B. $\vec{a}$

C. $\vec{0}$

D. $2\vec{a}$

Answer: C

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45. A unit vector perpendicular to the plane of $\overrightarrow{a} = 2\hat{i} - 6\hat{j} - 3\hat{k}$ and $\overrightarrow{b} = 4\hat{i} + 3\hat{j} - \hat{k}$ is

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 $\hat{a} = \hat{i} + \hat{j}$ 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 $\overrightarrow{u} = \hat{i} + \hat{j}, \overrightarrow{v} = \hat{i} - \hat{j} a \text{ and } \hat{i} - \hat{j} \text{ and } \overrightarrow{w} = \hat{i} + 2\hat{j} + 3\hat{k}$ If $\widehat{n}$ isa unit vector such that $\overrightarrow{u} . \widehat{n} = 0 \text{ and } \overrightarrow{n} . \widehat{n} = 0, \quad \text{then } \left|\overrightarrow{w} . \widehat{n}\right|$ 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. If $\vec{a}, \vec{b}, \vec{c}$ are the position vectors of the vertices. A,B,C of a triangle ABC. Then the area of triangle ABC 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. $\sqrt{42}$

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 $\vec{a}, \vec{b}, \vec{c}$ be unit vetors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, 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 $\triangle PQR$ be a triangle. Let $\overrightarrow{a} = \overrightarrow{QR}, \overrightarrow{b} = \overrightarrow{RP}$ and $\overrightarrow{c} = \overrightarrow{PQ}$. if $\left|\overrightarrow{a}\right| = 12, \left|\overrightarrow{b}\right| = 4\sqrt{3}$ and $\overrightarrow{b}, \overrightarrow{c}$

, then which of the following is (are) true ?

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

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

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

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

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 $\overrightarrow{a}.\overrightarrow{a} = x\hat{i} + y\hat{j} + z\hat{k}$ and $\overrightarrow{b} = \hat{j}$ are such that $\overrightarrow{a}$, $\overrightarrow{b}$, and $\overrightarrow{b}$ from a right handed system , then $\overrightarrow{c}$ id

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. If the area of parallelogram whose diagonals coincide with the following pair of vectors is $5\sqrt{3}$,then 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 $\vec{a}, \vec{b}, \vec{c}$ be unit vectors such that $\vec{a}.\vec{b} = 0 = \vec{a}.\vec{c}$. If the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{6}$, then $\vec{a}$ equals

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 $\overrightarrow{u} = u_1\hat{i} + u_2\hat{j}$ be a unit vector in xy plane and $\overrightarrow{w} = \frac{1}{\sqrt{6}}\left(\hat{i} + \hat{j} + 2\hat{k}\right)$. Given that there exists a vector $\overrightarrow{c}$ " in " R_3 " such that $\left|\overrightarrow{u} \times \overrightarrow{v}\right| = 1$ and $\overrightarrow{w}.\left(\overrightarrow{u} \times \overrightarrow{v}\right) = 1$, 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 $\overrightarrow{u} = u_1\hat{i} + u_3\hat{k}$ be a unit vector in xz-plane and $\overrightarrow{q} = \frac{1}{\sqrt{6}}\left(\hat{i} + \hat{j} + 2\hat{k}\right)$. If there exists a vector $\overrightarrow{v}$ in such that $\left|\overrightarrow{u} \times \overrightarrow{u}\right| = 1$ and $\overrightarrow{w}.\left(\overrightarrow{u} \times \overrightarrow{c}\right)$ .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 for 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 $3\hat{i} + 2\hat{k}$ 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 the forces $5\hat{i} + \hat{j}$ 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 $\vec{a} = (c\log_2 x)\hat{k}$ make an obtuse angle for any $x \ne (0, \infty)$ 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 doubled in magnitude, then it becomes $4\hat{i}+(4x-2)\hat{j}+2\hat{k}$. Then values of x are (A) $-\frac{2}{3}$ (B) $\frac{1}{3}$ (C) $\frac{2}{3}$ (D) 2

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

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. 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 $p^{\text{th}}, q^{\text{th}}$ and r^{th} terms of G.P then the angle between the vector

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

, 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

$\vec{u} = a^{-1}\hat{i} + b^{-1}\hat{j} + c^{-1}\hat{k}$ and $\vec{v} = (q-r)\hat{i} + (q-r)\hat{i} + (r-p)\hat{j} + (p$

A. are parallel

B. are othogonal

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

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