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India's Number 1 Education App

MATHS

BOOKS - DISHA PUBLICATION MATHS (HINGLISH)

VECTOR ALGEBRA

Jee Main 5 Years At A Glance

1. Let $\overrightarrow{u}$ be a vector coplanar with the vectors $\overrightarrow{a} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\overrightarrow{b} = \hat{j} + \hat{k}$. If $\overrightarrow{u}$ is perpendicular to its equal to $\overrightarrow{a}$ and $\overrightarrow{u} . \overrightarrow{b} = 24$, then $\left|\overrightarrow{u}\right|^2$ is equal to

A. 315

B. 256

C. 84

D. 336

Answer: D

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2. Let $\overrightarrow{a} = \hat{i} + \hat{j} + \hat{k}$, $\overrightarrow{c} = \hat{j} - \hat{k}$ and a vector $\overrightarrow{b}$ be such that $\overrightarrow{a} \times \overrightarrow{b} = \overrightarrow{c}$ and $\overrightarrow{a} . \overrightarrow{b} = 3$. Then $\left|\overrightarrow{b}\right|$ equals:

A. $\sqrt{\frac{11}{3}}$

B. $\frac{\sqrt{11}}{3}$

C. $\frac{11}{\sqrt{3}}$

D. $\frac{11}{3}$

Answer: A

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3. Let $\overrightarrow{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\overrightarrow{b} = \hat{i} + \hat{j}$. Let $\overrightarrow{c}$ be vector such that $\left|\overrightarrow{c} - \overrightarrow{a}\right| = 3$, $\left|\left(\overrightarrow{a} \times \overrightarrow{b}\right) \times \overrightarrow{c}\right| = 3$ and the angle between

$\overrightarrow{c}$ and $\overrightarrow{a} \times \overrightarrow{b}$ be 30° Then , $\overrightarrow{a} . Ve$ is equal to

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

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

C. 2

D. 5

Answer: C

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4. The area (in sq units) of the parallelogram whose diagonals are along the vectors $8\hat{i} - 6\hat{j}$ and $3\hat{i} + 4\hat{j} - 12\hat{k}$ is:

A. 26

B. 65

C. 20

D. 52

Answer: B

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5. let $\vec{a}, \vec{b}$ and $\vec{c}$ be three unit vectors such that $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{\sqrt{3}}{2}\left(\vec{b} + \vec{c}\right)$. If $\vec{b}$ is not parallel to $\vec{c}$, then the angle between $\vec{a}$ and $\vec{b}$ is:

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

B. $\frac{5\pi}{6}$

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

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

Answer: B

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6. In a triangle ABC , right angled at the vertex A , if the position vectors of A , B and C are respectively $3\hat{i} + \hat{j} - \hat{k}, \ -\hat{i} + 3\hat{j} + p\hat{k}$ and $5\hat{i} + q\hat{j} - 4\hat{k}$, then the point (p,q) lies on a line

A. making an obtuse angle with the positive direction of x-axis

B. parallel to x-axis

C. parallel to y-axis

D. making an acute angle with the positive direction of x-axis

Answer: D

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7. Let ABC be a triangle whose circumcentre is at P. If the position vectors of A, B, C and P are $\vec{a}, \vec{b}, \vec{c}$ and $\dfrac{\vec{a} + \vec{b} + \vec{c}}{4}$ respectively, then the position vector of the orthocentre of this triangle is

A. $-\left(\dfrac{\vec{a} + \vec{b} + \vec{c}}{2}\right)$

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

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

D. $\vec{0}$

Answer: C

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8. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three non-zero vectors such that no two of them are collinear and $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \frac{1}{3}\left|\vec{b}\right|\left|\vec{c}\right|\vec{a}$. If θ is the angle between vectors $\vec{b}$ and $\vec{c}$, then the value of $\sin\theta$ is:

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

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

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

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

Answer: C

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9. Let $\vec{a}$ and $\vec{b}$ be two unit vectors such that $\left|\vec{a}+\vec{b}\right|=\sqrt{3}$ if $\vec{c}=\vec{a}+2\vec{b}+3\left(\vec{a}X\vec{b}\right)$ then $2\left|\vec{c}\right|$ is equal to

A. $\sqrt{55}$

B. $\sqrt{37}$

C. $\sqrt{51}$

D. $\sqrt{43}$

Answer: A

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10. If $\left[\vec{a}\times\vec{b}\vec{b}\times\vec{c}\vec{c}\times\vec{a}\right]=\lambda\left[\vec{a}\vec{b}\vec{c}\right]^2$ then λ is equal to

A. 0

B. 1

C. 2

D. 3

Answer: B

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11. If $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 3$ and $\left|2\vec{a} - \vec{b}\right| = 5$, then $\left|2\vec{a} + \vec{b}\right|$ equals: (A) 17 (B) 7 (C) 5 (D) 1

A. 17

B. 7

C. 5

D. 1

Answer: C

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Exercise 1 Concept Builder

1. If $\overrightarrow{a} = \hat{i} + \hat{j} + \hat{k}, \hat{b}4\hat{i} + 3\hat{j} + 4\hat{k}$ and $\overrightarrow{c} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$ are linearly dependent vectors and $\left|\overrightarrow{c}\right| = \sqrt{3}$ then (A) $\alpha = 1, \beta = -1$ (B) $\alpha = 1, \beta = \pm 1$ (C) $\alpha - 1, \beta = \pm 1$ (D) $\alpha = \pm 1, \beta = 1$

A. $\alpha = 1, \beta = -1$

B. $\alpha = 1, \beta = \pm 1$

C. $\alpha = -1, \beta = \pm 1$

D. $\alpha = \pm 1, \beta = 1$

Answer: D

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2. In a triangle ABC three forces of magnitudes $3\overrightarrow{AB}, 2\overrightarrow{AC}$ and $6\overrightarrow{CB}$ are acting along the sides AB, AC and CB respectively . If the resultant meets AC at D, then the ratio DC: AD will be equal to

A. $1:1$

B. $1:2$

C. $1:3$

D. $1:4$

Answer: B

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3. If $\left|\vec{a}+\vec{b}\right|=\left|\vec{a}-\vec{b}\right|$ then the vectors $\vec{a}$ and $\vec{b}$ are adjacent sides of

A. a rectangle

B. a square

C. a rhombus

D. none of these

Answer: A

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4. If the position vectors of the vertices A,B and C of a ΔABC are $7\hat{j}+10\hat{k}, -\hat{i}+6\hat{j}+6\hat{k}$ and $-4\hat{i}+9\hat{j}+6\hat{k},$ respectively, the triangle is

A. equilateral

B. isosceles

C. scalene

D. right angled and isosceles also

Answer: D

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5. If $\overrightarrow{a}=3\hat{i}-\hat{j}-4\hat{k}, \overrightarrow{b}=-2\hat{i}+4\hat{j}-3\hat{k}$ and $\overrightarrow{c}=\hat{i}+2\hat{j}-\hat{k}$ then $\left|3\overrightarrow{a}-2\overrightarrow{b}+4\overrightarrow{c}\right|$ is equal to

A. $\sqrt{298}$

B. $\sqrt{198}$

C. $\sqrt{398}$

D. $\sqrt{498}$

Answer: C

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6. The vectors $\overrightarrow{AB} = 3\hat{i} + 4\hat{k}$ and $\overrightarrow{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$ are the sides of a triangle ABC. The length of the median through A is (A) $\sqrt{72}$ (B) $\sqrt{33}$ (C) $\sqrt{2880}$ (D) $\sqrt{18}$

A. $\sqrt{13}$ units

B. $2\sqrt{5}$ units

C. 5 units

D. 10 units

Answer: C

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7. If two vertices of a triangle are i-j and j+k , then the third vertex can be

A. i+k

B. i-2j-k and -2i-j

C. i-k

D. all the above

Answer: D

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8. The figure formed by the four points $\hat{i}+\hat{j}-\hat{k}, 2\hat{i}+3\hat{j}, 5\hat{j}-2\hat{k}$ and $\hat{k}-\hat{j}$ is

A. trapezium

B. rectangle

C. parallelogram

D. none of these

Answer: D

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9. If the vector $8\hat{i} + a\hat{j}$ of magnitude 10 is the directionn of the vector $4\hat{i} - 3\hat{j}$, then the value of a is equal to (A) 6 (B) 3 (C) -3 (D) -6

A. 6

B. 3

C. -3

D. -6

Answer: D

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10. If A, B, C are vertices of a triangle whose position vectors are $\vec{a}, \vec{b}$ and $\vec{c}$ respectively and G is the centroid of ΔABC, then $\overrightarrow{GA}+\overrightarrow{GB}+\overrightarrow{GC}$, is

A. $\vec{0}$

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

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

D. $\dfrac{\vec{a}-\vec{b}-\vec{c}}{3}$

Answer: A

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11. Which of the following is an example of two different vectors with same magnitude ?

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

B. $\left(3\hat{i}+5\hat{j}+\hat{k}\right)$ and $\left(3\hat{i}+4\hat{j}+\hat{k}\right)$

C. $\left(\hat{j}+\hat{k}\right)$ and $\left(2\hat{j}+3\hat{k}\right)$

D. none of these

Answer: A

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12. $\overrightarrow{a}=3\hat{i}-5\hat{j}$ and $\overrightarrow{b}=6\hat{i}+3\hat{j}$ are two vectors and $\overrightarrow{c}$ is a vector such that $\overrightarrow{c}=\overrightarrow{a}\times\overrightarrow{b}$ then $\left|\overrightarrow{a}\right|:\left|\overrightarrow{b}\right|:\left|\overrightarrow{c}\right|$

A. $\sqrt{34}:\sqrt{45}:\sqrt{39}$

B. $\sqrt{34}:\sqrt{45}:39$

C. $34:39:45$

D. $39:35:34$

Answer: B

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13. If $\overrightarrow{p}$, $\overrightarrow{q}$ and $\overrightarrow{r}$ are perpendicular to $\overrightarrow{q}+\overrightarrow{r}$, $\overrightarrow{r}+\overrightarrow{p}$ and $\overrightarrow{p}+\overrightarrow{q}$ respectively and if $\left|\overrightarrow{p}+\overrightarrow{q}\right|=6, \left|\overrightarrow{q}+\overrightarrow{r}\right|=4\sqrt{3}$ and $\left|\overrightarrow{r}+\overrightarrow{p}\right|=4$ then $\left|\overrightarrow{p}+\overrightarrow{q}+\overrightarrow{r}\right|$ is

A. $5\sqrt{2}$

B. 10

C. 15

D. 5

Answer: A

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14. If $\overrightarrow{a}=\hat{i}+\hat{j}-\hat{k}, \overrightarrow{b}=2\hat{i}+3\hat{j}+\hat{k}$ and $\overrightarrow{c}=\hat{i}+\alpha\hat{j}$ are coplanar vector , then the value of α is :

A. $-\frac{4}{3}$

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

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

D. 2

Answer: C

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15. If $\hat{i}+\hat{j}, \hat{j}+\hat{k}, \hat{i}+\hat{k}$ are the position vectors of the vertices of a ΔABC taken in order, then $\angle A$ is equal to

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

B. $\frac{\pi}{5}$

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

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

Answer: D

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16. If $\vec{a}$ and $\vec{b}$ are non colinear vectors, then the value of α for which the vectors $\vec{u}=(\alpha-2)\vec{a}+\vec{b}$ and $\vec{v}=(2+3\alpha)\vec{a}-3\vec{b}$ are collinear is (A) $\frac{3}{2}$ (B) $\frac{2}{3}$ (C) $\frac{-3}{2}$ (D) $\frac{-2}{3}$

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

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

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

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

Answer: B

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17. If angle between $\vec{a}=\hat{i}-2\hat{j}+3\hat{k}$ and $\vec{b}=2\hat{i}+\hat{j}+\hat{k}$ is θ then the value of $\sin\theta$ is

A. $\frac{3}{2\sqrt{7}}$

B. $\frac{-2}{\sqrt{7}}$

C. $\frac{4}{3\sqrt{7}}$

D. $\frac{5}{2\sqrt{7}}$

Answer: D

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18. If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar vectors and λ is a real number then then vectors $\vec{a} + 2\vec{b} + 3\vec{c}, \lambda\vec{b} + 4\vec{c}$ and $(2\lambda - 1)\vec{c}$ are non-coplanar for

A. no value of λ

B. all except one value of λ

C. all except two values of λ

D. all values of λ

Answer: C

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19. Find the unit vector parallel to the resultant vector of $2\hat{i}+4\hat{j}-5\hat{k}$ and $\hat{i}+2\hat{j}+3\hat{k}$.

A. $\dfrac{3\hat{i}+6\hat{j}+2\hat{k}}{5}$

B. $\dfrac{-3\hat{i}+6\hat{j}-2\hat{k}}{7}$

C. $\dfrac{3\hat{i}+6\hat{j}-2\hat{k}}{7}$

D. none of these

Answer: C

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20. If the middle points of sides BC, CA and AB of triangle ABC are respectively D,E ,F then position vector of centre of triangle DEF, when position vector of A, B , C are respectively $\hat{i}+\hat{j}, \hat{j}+\hat{k}, \hat{k}+\hat{i}$ is

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

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

C. $2\left(\hat{i}+\hat{j}+\hat{k}\right)$

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

Answer: D

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21. Find the length diagonal AC of a prallelogram ABCD whose two adjacent sides AB and AD are represented respectively by$2\hat{i}+4\hat{j}-5\hat{k}$ and $\hat{i}+2\hat{j}+3\hat{k}$

A. 5

B. 6

C. 7

D. 9

Answer: C

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22. If f is the centre of a circle inscribed in a triangle ABC, then $\left|\overrightarrow{BC}\right|\overrightarrow{IA} + \left|\overrightarrow{CA}\right|\overrightarrow{IB} + \left|\overrightarrow{AB}\right|\overrightarrow{IC}$ is

A. zero

B. $\dfrac{\overrightarrow{I}A + \overrightarrow{I}B + \overrightarrow{I}C}{3}$

C. $3\left(\overrightarrow{I}A + \overrightarrow{I}B + \overrightarrow{I}C\right)$

D. none of these

Answer: A

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23. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ are vectors of magnitude 3,4,5 respectively. If $\vec{a}$ is perpendicular to $\vec{b}+\vec{c}$, $\vec{b}$ is perpendicular to $\vec{c}+\vec{a}$ and $\vec{c}$ is perpendicular to $\vec{a}+\vec{b}$ then find the magnitude of $\vec{a}+\vec{b}+\vec{c}$

A. $4\sqrt{2}$

B. $3\sqrt{2}$

C. $5\sqrt{2}$

D. $3\sqrt{3}$

Answer: C

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24. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are any three coplanar unit vectors , then :

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

B. $\vec{a}.\left(\vec{b}\times\vec{c}\right)=3$

C. $\left(\vec{a}\times\vec{b}\right).\vec{c}=0$

D. $\left(\vec{c} \times \vec{a}\right).\vec{b} = 1$

Answer: C

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25. The vector $\vec{a} = \alpha\hat{i} + 2\hat{j} + \beta\hat{k}$ lies in the plane of vectors $\vec{b} = \hat{i} + \hat{j}$ and $\vec{c} = \hat{j} + \hat{k}$ and bisects the angle between $\vec{b}$ and $\vec{c}$. Then which one of the following gives possible values o α and β? (A) alpha=2, beta=1(B)alpha=1, beta=1(C)alpha=2, beta=1(D)alpha=1, beta=2`

A. $\alpha = 2, \beta = 2$

B. $\alpha = 1, \beta = 2$

C. $\alpha = 2, \beta = 1$

D. $\alpha = 1, \beta = 1$

Answer: D

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26. 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 $\widehat{n}$ is a unit vector such that $\overrightarrow{u}.\widehat{n}=0$ and $\overrightarrow{v}.\widehat{n}=0$ then find the value of $\left|\overrightarrow{w}.\widehat{n}\right|$

A. 3

B. 0

C. 1

D. 2

Answer: A

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27. If vectors $a=4\hat{i}-3\hat{j}+6\hat{k}$ and vector $b=-2\hat{i}+2\hat{j}-\hat{k}$, then (projection of vector a on vectors)/(projection of vector b on a vector) is equal to

A. $\frac{3}{7}$

B. $\frac{7}{3}$

C. 3

D. 7

Answer: B

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28. A vector of magnitude 14 lies in the xy-plane and makes an angle of 60° with x -axis . The components of the vector in the direction of x -axis and y-axis are

A. $7, 7\sqrt{3}$

B. $7\sqrt{3}, 7$

C. $14\sqrt{3}, 14/\sqrt{3}$

D. $14/\sqrt{3}, 14\sqrt{3}$

Answer: A

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29. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ find the value of $\vec{a} . \vec{b} + \vec{b} . \vec{c} + \vec{c} . \vec{a}$

A. -3

B. -2

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

D. 0

Answer: C

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30. The two variable vectors $3x\hat{i} + y\hat{j} - 3\hat{k}$ and $x\hat{i} - 4y\hat{j} + 4\hat{k}$ are orthogonal to each other, then the locus of (x, y) is

A. hyperbola

B. circle

C. straight line

D. ellipse

Answer: A

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31. Angle between the vectors $\sqrt{3}\left(\vec{a} \times \vec{b}\right)$ and $\vec{b} - \left(\vec{a} . \vec{b}\right)\vec{a}$ is

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

B. 0

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

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

Answer: A

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32. If the vector $\vec{a} = (2, \log_3 x, a)$ and $\vec{b} = (-3, a\log_3 x, \log_3 x)$ are inclined at an acute angle then

A. a = 0

B. a < 0

C. a >0

D. none of these

Answer: B and C

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33. If $\vec{a}, \vec{b}, \vec{c}$ are the 3 vectors such that $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 4, \left|\vec{c}\right| = 5, \left|\vec{a} + \vec{b} + \vec{c}\right| = 0$ then the value of $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$ is :

A. -20

B. -25

C. 25

D. 50

Answer: B

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34. The vectors $\left(2\hat{i} - m\hat{j} + 3mk\right)$ and $\left\{(1+m)\hat{i} - 2m\hat{j} + \hat{k}\right\}$ include and acute angle for

A. all values of m

B. $m < -2 \text{ or } m > -1/2$

C. m = -1/2

D. $m \in \left[-2, -\frac{1}{2}\right]$

Answer: B

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35. Let $\vec{a}, \vec{b}, \vec{c}$ be three unit vectors such that $|\vec{a}+\vec{b}+\vec{c}| = 1$ 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. $\frac{3}{2}$

B. 1

C. -1

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

Answer: C

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36. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three vectors of which every pair is non colinear. If the vector $\vec{a}+\vec{b}$ and $\vec{b}+\vec{c}$ are collinear with the vector $\vec{c}$ and $\vec{a}$ respectively then which one of the following is correct? (A) $\vec{a}+\vec{b}+\vec{c}$ is a nul vector(B)veca+vecb+vecc$isaunit\overrightarrow{r}(C)$

veca+vecb+vecc$isa \xrightarrow{} rofmagnitude2units(D)$veca+vecb+vecc` isd a vector of magnitude 3 units

A. a unit vector

B. the unit vector

C. equally inclined to $\vec{a}, \vec{b}, \vec{c}$

D. none of these

Answer: B

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37. The two vectors $(x^2-1)\hat{i}+(x+2)\hat{j}+x^2\hat{k}$ and $2\hat{i}-x\hat{j}+3\hat{k}$ are orthogonal

A. for no real value of x

B. for x = -1

C. for x = 1/2

D. for x = -1/2 and x = 1

Answer: D

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38. 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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39. For any vector $\vec{a}$ the value of $\left(\vec{a}\times\hat{i}\right)^2+\left(\vec{a}\times\hat{j}\right)^2+\left(\vec{a}\times\hat{k}\right)^2$ is equal to (A) $4\vec{a}^2$ (B) $2\vec{a}^2$ (C) $\vec{a}^2$ (D) $3\vec{a}^2$

A. $3\vec{a}^2$

B. $\vec{a}^2$

C. $2\vec{a}^2$

D. $4\vec{a}^2$

Answer: C

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40. If $\left(\vec{a}\times\vec{b}\right)\times\vec{c}=\vec{a}\times\left(\vec{b}\times\vec{c}\right)$, where $\vec{a}$, $\vec{b}$ and $\vec{c}$ are any three vectors such that $\vec{a}.\vec{b}\neq 0,\ \vec{b}.\vec{c}\neq 0$, then $\vec{a}$ and $\vec{c}$ are:

A. inclined at an angle of $\frac{\pi}{3}$ between them

B. inclined at an angled of $\frac{\pi}{6}$ between them

C. perpendicular

D. parallel

Answer: D

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41. $\vec{a} = 3\hat{i} - 5\hat{j}$ and $\vec{b} = 6\hat{i} + 3\hat{j}$ are two vectors and $\vec{c}$ is a vector such that $\vec{c} = \vec{a} \times \vec{b}$ then $|\vec{a}| : |\vec{b}| : |\vec{c}|$

A. $\sqrt{34} : \sqrt{45} : \sqrt{39}$

B. $\sqrt{34} : \sqrt{45} : 39$

C. $34 : 39 : 45$

D. $39 : 35 : 34$

Answer: B

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42. Vectors $\overrightarrow{a}$ and $\overrightarrow{b}$ are inclined at an angle $\theta = 120^\circ$. If $\left|\overrightarrow{a}\right| = \left|\overrightarrow{b}\right| = 2$, then $\left[\left(\overrightarrow{a} + 3\overrightarrow{b}\right) \times \left(3\overrightarrow{a} + \overrightarrow{b}\right)\right]^2$ is equal to

A. 190

B. 275

C. 300

D. 768

Answer: D

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43. For any vector $\overrightarrow{p}$, the value of

$\frac{3}{2}\left\{\left|\overrightarrow{p} \times \hat{i}\right|^2 + \left|\overrightarrow{p} \times \hat{j}\right|^2 + \left|\overrightarrow{p} \times \hat{k}\right|^2\right\}$ is

A. $\overrightarrow{p}^2$

B. $2\overrightarrow{p}^2$

C. $3\vec{p}^2$

D. $4\vec{p}^2$

Answer: C

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44. If $\left(\vec{a} \times \vec{b}\right)^2 + \left(\vec{a} . \vec{b}\right)^2$ = 676 and $\left|\vec{b}\right| = 2$, then $\left|\vec{a}\right|$ is equal to

A. 13

B. 26

C. 39

D. none of these

Answer: A

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45. What is the interior acute angle of the parallelogram whose sides are represented by the vectors $\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}+\hat{k}$ and $\frac{1}{\sqrt{2}}\hat{i}-\frac{1}{\sqrt{2}}\hat{j}+\hat{k}$?

A. 60°

B. 45°

C. 30°

D. 15°

Answer: A

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46. Area of rectangle having vertices A, B , C and D with position vector $\left(-\hat{i}+\frac{1}{2}\hat{j}+4\hat{k}\right)$, $\left(\hat{i}+\frac{1}{2}\hat{j}+4\hat{k}\right)$, $\left(\hat{i}-\frac{1}{2}\hat{j}+4\hat{k}\right)$ and $\left(-\hat{i}-\frac{1}{2}\hat{j}+4\hat{k}\right)$ is

A. 1/2 sq. units

B. 1sq. Units

C. 2sq. Units

D. 4sq. Units

Answer: C

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47. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be non-zero vectors such that no two are collinear and

$$\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \frac{1}{3}\left|\vec{b}\right|\left|\vec{c}\right|\vec{a}$$

If θ is the acute angle between the vectors $\vec{b}$ and $\vec{c}$ then $\sin\theta$ equals

A. $\dfrac{2\sqrt{2}}{3}$

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

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

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

Answer: A

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48. Let $\vec{a}, \vec{b}, \vec{c}$ such that $|\vec{a}| = 1, |\vec{b}| = 1$ and $|\vec{c}| = 2$ and if $\vec{a} \times (\vec{a} \times \vec{c}) + \vec{b} = 0$ then find acute angle between $\vec{a}$ and $\vec{c}$

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

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

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

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

Answer: A

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49. $|(a \times b).\, c| = |a||b||c|$, if

A. a.b = b.c = 0

B. b.c = c.a = 0

C. c.a = a.b = 0

D. a.b = b.c = c.a = 0

Answer: D

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50. If $\vec{a} = \hat{i} + \hat{j}, \vec{b} = 2\hat{j} - \hat{k}$ and $\vec{r} \times \vec{a} = \vec{b} \times \vec{a}, \vec{r} \times \vec{b} = \vec{a} \times \vec{b}$, then what is the value of $\frac{\vec{r}}{\left|\vec{r}\right|}$

A. $\frac{\left(\hat{i} + 3\hat{j} - \hat{k}\right)}{\sqrt{11}}$

B. $\frac{\left(\hat{i} - 3\hat{j} + \hat{k}\right)}{\sqrt{11}}$

C. $\frac{\left(\hat{i} + 3\hat{j} + \hat{k}\right)}{\sqrt{11}}$

D. $\frac{\left(\hat{i} - 3\hat{j} - \hat{k}\right)}{\sqrt{11}}$

Answer: A

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51. Let $\vec{a}=\hat{i}-\hat{k}, \vec{b}=x\hat{i}+\hat{j}+(1-x)\hat{k}$ and $\vec{c}=y\hat{i}+x\hat{j}+(1+x-y)\hat{k}$, then $\left[\vec{a}\,\vec{b}\,\vec{c}\right]$ depends on

A. only y

B. only x

C. both x and y

D. neither x nor y

Answer: D

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52. If $\vec{a}, \vec{b}, \vec{c}$ are three non coplanar vectors , then the value of $\dfrac{\vec{a}.\left(\vec{b}\times\vec{c}\right)}{\left(\vec{c}\times\vec{a}\right).\vec{b}}+\dfrac{\vec{b}.\left(\vec{a}\times\vec{c}\right)}{\vec{c}.\left(\vec{a}\times\vec{b}\right)}$ is

A. 0

B. 2

C. 1

D. none of these

Answer: A

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53. Let $\overrightarrow{A} = 2\hat{i} + \hat{k}$, $\overrightarrow{B} = \hat{i} + \hat{j} + \hat{k}$ and $\overrightarrow{C} = 4\hat{i} - 3\hat{j} + 7\hat{k}$. Determine a vector $\overrightarrow{R}$ satisfying $\overrightarrow{R} \times \overrightarrow{B} = \overrightarrow{C} \times \overrightarrow{B}$ and $\overrightarrow{R} . \overrightarrow{A} = 0$

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

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

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

D. none of these

Answer: B

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54. A particle is acted upon by constant forces $4\hat{i}+\hat{j}-3\hat{k}$ and $3\hat{i}+\hat{j}-\hat{k}$ which displace it from a point $\hat{i}+2\hat{j}+3\hat{k}$ to the point $5\hat{i}+4\hat{j}+\hat{k}$. The work done in standard units by the forces is given by:

A. 50 units

B. 20 units

C. 30 units

D. 40 units

Answer: D

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55. Force $\hat{i}+2\hat{j}-3\hat{k}, 2\hat{i}+3\hat{j}+4\hat{k}$ and $-\hat{i}-\hat{j}+\hat{k}$ are acting at the point P(0,1,2) . The moment of these forces about the point A(1,-2,0) is

A. $2\hat{i} - 6\hat{j} + 10\hat{k}$

B. $-2\hat{i} + 6\hat{j} - 10\hat{k}$

C. $2\hat{i} + 6\hat{j} - 10\hat{k}$

D. none of these

Answer: B

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56. The resultant moment of three forces $\hat{i} + 2\hat{j} - 3\hat{k}$, $2\hat{i} + 3\hat{j} + 4\hat{k}$ and $-\hat{i} - \hat{j} + \hat{k}$ acting on particle at a point P (0,1,2) about the point A (1,-2,0) is

A. $6\sqrt{2}$

B. $\sqrt{140}$

C. $\sqrt{21}$

D. none

Answer: B

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57. If $\left(\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right)\right). \left(\vec{a} \times \vec{d}\right) = 0$, then which of the following is alaways true ?

A. $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ are necessarily coplanar

B. either $\vec{a}$ or $\vec{d}$ must lie in the plane of $\vec{b}$ and $\vec{c}$

C. either $\vec{b}$ or $\vec{c}$ must lie in the pane of $\vec{a}$ and $\vec{d}$

D. either $\vec{a}$ or $\vec{b}$ must lie in the plane of $\vec{c}$ and $\vec{d}$

Answer: C

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58. A force $\vec{F} = \left(\hat{i} - 8\hat{j} - 7\hat{k}\right)$ is resolved along the mutually perpendicular directions , one of which is in the direction of

$\overrightarrow{a} = 2\hat{i} + 2\hat{j} + \hat{k}$. Then the component of $\overrightarrow{F}$ in the direction of $\overrightarrow{a}$ is

A. $-14\hat{i} - 14\hat{j} - 7\hat{k}$

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

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

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

Answer: B

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59. Find the moment about the point $\hat{i} + 2\hat{j} + 3\hat{k}$ of a force represented by $\hat{i} + \hat{j} + \hat{k}$ acting through the point $2\hat{i} + 3\hat{j} + \hat{k}$.

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

B. $3\hat{i} + \hat{j}$

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

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

Answer: D

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60. Two forces whose magnitudes are 2N and 3N act on a particle in the direction of the vectros $2\hat{i} + 4\hat{j} + 4\hat{k}$ and $4\hat{i} - 4\hat{j}j + 2\hat{k}$ respectively. If the particle is displaced from the origin O to the point (1,2,2). Find the work done.

A. 6gm - cm

B. 4gm - cm

C. 5gm - cm

D. none of these

Answer: A

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Exercise 2 Concept Applicator

1. The points D, E, F divide BC, CA and AB of the triangle ABC in the ratio $1:4, 3:2$ and $3:7$ respectively and the point divides AB in the ratio $1:3$, then $\left(\overline{AD}+\overline{BE}+\overline{CF}\right):\overline{CK}$ is equal to

A. $1:1$

B. $2:5$

C. $5:2$

D. none of these

Answer: B

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2. OABCDE is a regular hexagon of side 2 units in the XY-plane in the first quadrant. O being the origin and OA taken along the x-axis. A point P is taken on a line parallel to the z-axis through the centre of the hexagon at a distance of 3 unit from O in the positive Z direction. Then find vector AP.

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

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

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

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

Answer: C

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3. The vectors $\bar{a}(x)=\cos x\bar{i}+\sin x\bar{j}, \bar{b}(x)=x\bar{i}+\sin x\bar{j}$ are collinear for :

A. unique value of x , $0<x<\frac{\pi}{6}$

B. unique value of $\frac{\pi}{6}<x<\frac{\pi}{3}$

C. no value of x

D. infinitely many values of x , 0 lt x lt pi/2`

Answer: B

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4. The position vectors of the point A, B, C and D are $3\hat{i} - 2\hat{j} - \hat{k}, 2\hat{i} + 3\hat{j} - 4\hat{k}, \ -\hat{i} + \hat{j} + 2\hat{k}$ and $4\hat{i} + 5\hat{j} + \lambda\hat{k}$, respectively. If the points A, B, C and D lie on a plane, find the value of λ.

A. $-\dfrac{146}{17}$

B. $-\dfrac{137}{17}$

C. $-\dfrac{154}{17}$

D. $-\dfrac{162}{17}$

Answer: A

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5. Let $x^2 + 3y^2 = 3$ be the equation of an ellipse in the $x - y$ plane. $A and B$ are two points whose position vectors are $-\sqrt{3}\hat{i} and - \sqrt{3}\hat{i} + 2\hat{k}$. Then the position vector of a point P on the ellipse such that $\angle APB = \pi/4$ is a. $\pm\hat{j}$ b. $\pm(\hat{i} + \hat{j})$ c. $\pm\hat{i}$ d. none of these

A. $\pm\hat{j}$

B. $\pm(\hat{i} + \hat{j})$

C. $\pm\hat{i}$

D. none of these

Answer: A

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

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

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

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

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

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

Answer: B

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7. If $\vec{x}$ and $\vec{y}$ are two non-collinear vectors and ABC is a triangle with side lengths a,b and c satisfying (20a-15b) $\vec{x}$ + (15b-12c) $\vec{y}$ + (12c-20a) $\vec{x} \times \vec{y}$ is:

A. an acute angled triangle

B. an obtuse -angled triangle

C. a right - angled triangle

D. an isosceles triangle

Answer: C

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8. If $\overrightarrow{u}, \overrightarrow{v}, \overrightarrow{w}$ are noncoplanar vectors and p, q are real numbers, then the equality $\left[3\overrightarrow{u}, p\overrightarrow{v}, p\overrightarrow{w}\right] - \left[p\overrightarrow{v}, \overrightarrow{w}, q\overrightarrow{u}\right] - \left[2\overrightarrow{w}, q\overrightarrow{v}, q\overrightarrow{u}\right] = 0$ holds for (1) exactly one value of (p, q) (2) exactly two values of (p, q) (3) more than two but not all values of (p, q) (4) all values of (p, q)

A. exactly two values of (p,q)

B. more than two but not all values of (p,q)

C. all values of (p,q)

D. exactly on e value of (p,q)

Answer: D

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9. Lelt two non collinear unit vectors $\widehat{a}$ and $\hat{b}$ form and acute angle. A point P moves so that at any time t the position vector $\overrightarrow{OP}$ (where O is the origin) is given by $\widehat{a}\cos t + \hat{b}\sin t$. When P is farthest from origin O, let M be the length of $\overrightarrow{OP}$ and $\widehat{u}$ be the unit vector along $\overrightarrow{OP}$ Then (A)

$\widehat{u} = \dfrac{\widehat{a} + \hat{b}}{\left|\widehat{a} + \hat{b}\right|}$ and $M = \left(1 + \widehat{a}.\,\hat{b}\right)^{\frac{1}{2}}$ (B)

$\widehat{u} = \dfrac{\widehat{a} - \hat{b}}{\left|\widehat{a} - \hat{b}\right|}$ and $M = \left(1 + \widehat{a}.\,\hat{b}\right)^{\frac{1}{2}}$ (C)

$\widehat{u} = \dfrac{\widehat{a} + \hat{b}}{\left|\widehat{a} + \hat{b}\right|}$ and $M = \left(1 + 2\widehat{a}.\,\hat{b}\right)^{\frac{1}{2}}$ (D)

$\widehat{u} = \dfrac{\widehat{a} - \hat{b}}{\left|\widehat{a} - \hat{b}\right|}$ and $M = \left(1 + 2\widehat{a}.\,\hat{b}\right)^{\frac{1}{2}}$

A. $\widehat{u} = \dfrac{\widehat{a} + \hat{b}}{\left|\widehat{a} + \hat{b}\right|}$ and $M = \left(1 + \widehat{a}.\,\hat{b}\right)^{1/2}$

B. $\widehat{u} = \dfrac{\widehat{a} - \hat{b}}{\left|\widehat{a} - \hat{b}\right|}$ and $M = \left(1 + \widehat{a}.\,\hat{b}\right)^{1/2}$

C. $\widehat{u} = \dfrac{\widehat{a} + \hat{b}}{\left|\widehat{a} + \hat{b}\right|}$ and $M = \left(1 + \widehat{a}.\,\hat{b}\right)^{1/2}$

D. $\widehat{u} = \dfrac{\widehat{a} + \hat{b}}{\left|\widehat{a} + \hat{b}\right|}$ and $M = \left(1 + 2\widehat{a}.\,\hat{b}\right)^{1/2}$

Answer: A

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10. A non-zero vecto $\overrightarrow{a}$ is such tha its projections along vectors $\frac{\hat{i}+\hat{j}}{\sqrt{2}}, \frac{-\hat{i}+\hat{j}}{\sqrt{2}}$ and $\hat{k}$ are equal , then unit vector along $\overrightarrow{a}$ us

A. $\frac{\sqrt{2}\hat{j}-\hat{k}}{\sqrt{3}}$

B. $\frac{\hat{j}-\sqrt{2}\hat{k}}{\sqrt{3}}$

C. $\frac{\sqrt{2}}{\sqrt{3}}\hat{j}+\frac{\hat{k}}{\sqrt{3}}$

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

Answer: C

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11. $\overrightarrow{a}, \overrightarrow{b}, \overrightarrow{c}$ are three vectors with magnitude $\left|\overrightarrow{a}\right|=4, \left|\overrightarrow{b}\right|=4, \left|\overrightarrow{c}\right|=2$ and such that $\overrightarrow{a}$ is perpendicular to $\left(\overrightarrow{b}+\overrightarrow{c}\right)$, $\overrightarrow{b}$ is perpendicular to $\left(\overrightarrow{c}+\overrightarrow{a}\right)$ and $\overrightarrow{c}$ is perpendicualr to $\left(\overrightarrow{a}+\overrightarrow{b}\right)$. It follows that $\left|\overrightarrow{a}+\overrightarrow{b}+\overrightarrow{c}\right|$ is equal to :

A. 9

B. 6

C. 5

D. 4

Answer: B

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12. If the two adjacent sides of two rectangles are represented by vectors $\vec{p}=5\vec{a}-3\vec{b};\vec{q}=-\vec{a}-2\vec{b}\,and\,\vec{r}=-4\vec{a}-\vec{b};\vec{s}=-\vec{a}+\vec{b}$ respectively, then the angel between the vector $\vec{x}=\frac{1}{3}\left(\vec{p}+\vec{r}+\vec{s}\right)and\,\vec{y}=\frac{1}{5}\left(\vec{r}+\vec{s}\right)$ is $\cos^{-1}\left(\frac{19}{5\sqrt{43}}\right)$ b. $\cos^{-1}\left(\frac{19}{5\sqrt{43}}\right)$ c. $\pi\cos^{-1}\left(\frac{19}{5\sqrt{43}}\right)$ d. cannot be evaluate

A. $\cos^{-1}\left(\frac{19}{5\sqrt{43}}\right)$

B. $\cos^{-1}\left(\frac{19}{5\sqrt{43}}\right)$

C. $\pi \cos^{-1}\left(\frac{19}{5\sqrt{43}}\right)$

D. cannot be evaluated

Answer: B

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13. OA, OB, OC are the sides of a rectangular parallelopiped whose diagonals are OO', AA' , BB' and CC' . D is the centre of the rectangle AC'O'B' and D' is the centre of the rectangle O'A'CB' . If the sides OA, OB , OC are in the ratio 1:2:3 , the angle $\angle DOD'$ is equal to

A. $\frac{\cos^{-1}(24)}{\sqrt{697}}$

B. $\frac{\cos^{-1}(22)}{\sqrt{619}}$

C. $\frac{\sin^{-1}(24)}{\sqrt{697}}$

D. $\frac{\sin^{-1}(22)}{\sqrt{619}}$

Answer: A

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14. If the positive numbers a, b and c are the pth, qth and rth terms of GP, then the vectors loga. $\hat{i} + lob.\ \hat{j} + \log c.\ \hat{k}$ and $(q-r)\hat{i} + (r-p)\hat{j} + (p-q)\hat{k}$ are

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

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

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

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

Answer: D

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15. A vector $\overrightarrow{a} = (x, y, z)$ makes an obtuse angle with F-axis, and make equal angles with $\overrightarrow{b} = (y, -2z, 3x)$ and $\overrightarrow{c} = (2z, 3x, -y)$ and $\overrightarrow{a}$ is perpendicular to $\overrightarrow{d} = (1, -1, 2)$ if $\left|\overrightarrow{a}\right| = 2\sqrt{3}$ then vector $\overrightarrow{a}$ is:

A. (-2,2,2)

B. $(1, 1, \sqrt{10})$

C. (2,-2,-2)

D. none of these

Answer: C

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16. Let $\overrightarrow{O}B = \hat{i} + 2\hat{j} + 2\hat{k}$ and$\overrightarrow{O}A = 4\hat{i} + 2\hat{j} + 2\hat{k}$. The distance of the point B from the straight line passing through A and parallel to the vector $2\hat{i} + 3\hat{j} + 6\hat{k}$ is

A. $\frac{7\sqrt{5}}{9}$

B. $\frac{5\sqrt{7}}{9}$

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

D. $\frac{9\sqrt{5}}{7}$

Answer: D

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17. If a_1, a_2 and a_3 are three numbers satisfying $a_1^2 + a_2^2 + a_3^2 = 1$, then the maximum value of $(4a_1 - 3a_2)^2 + (5a_2 - 4a_3)^2 + (3a_3 - 5a_1)^2$ is k, then $\left[\frac{k}{14}\right]$ is equal to (where [.] denotes the greatest integer function)

A. 1

B. 2

C. 3

D. 4

Answer: C

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18. Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be non coplanar unit vectors equally inclined to one another at an acute angle θ. Then $\left|\left[\vec{a}\,\vec{b}\,\vec{c}\right]\right|$ in terms of θ is equal to

A. $(1+\cos\theta)\sqrt{\cos 2\theta}$

B. $(1+\cos\theta)\sqrt{1-2\cos 2\theta}$

C. $(1-\cos\theta)\sqrt{1+2\cos\theta}$

D. none of these

Answer: C

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19. Let $\vec{a}$, $\vec{b}$, $\vec{c}$ be three non coplanar vectors , and let $\vec{p}$, $\vec{q}$ and $\vec{r}$ be the vectors defined by the relation

$$\vec{p}=\frac{\vec{b}\times\vec{c}}{\left[\vec{a}\,\vec{b}\,\vec{c}\right]},\ \vec{q}=\frac{\vec{c}\times\vec{a}}{\left[\vec{a}\,\vec{b}\,\vec{c}\right]}\ \text{and}\ \vec{r}=\frac{\vec{a}\times\vec{b}}{\left[\vec{a}\,\vec{b}\,\vec{c}\right]}$$

Then the value of the expension

$\left(\vec{a}+\vec{b}\right).\vec{p}+\left(\vec{b}+\vec{c}\right).q+\left(\vec{c}+\vec{a}\right).\vec{r}$ is equal to

A. 0

B. 1

C. 2

D. 3

Answer: D

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20. Let $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$. If $\vec{c}$ is a vector such that $\vec{a} \cdot \vec{c} = |\vec{c}|, |\vec{c} - \vec{a}| = 2\sqrt{2}$ and the angle between $\vec{a} \times \vec{b}$ and $\vec{c}$ is 30° then $\left|\left(\vec{a} \times \vec{b}\right) \times \vec{c}\right|$ is equal to :

A. $2/3$

B. $3/2$

C. 2

D. 3

Answer: B

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21. Let $\vec{r}, \vec{a}, \vec{b}$ and $\vec{c}$ be four non zero vectors such that $\vec{r}.\vec{a}=0, \left|\vec{r}\times\vec{b}\right|=\left|\vec{r}\right|\left|\vec{b}\right|$ and $\left|\vec{r}\times\vec{c}\right|=\left|\vec{r}\right|\left|\vec{c}\right|$. Then [abc] is equal to

A. |a||b||c|

B. ` - |a||b||c|

C. 0

D. none of these

Answer: C

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22. Let $\vec{r} = \left(\vec{a} \times \vec{b}\right)\sin x + \left(\vec{b} + \vec{c}\right)\cos y + 2\left(\vec{c} \times \vec{a}\right)$ where $\vec{a}, \vec{b}, \vec{c}$ are three non coplanar vectors . If $\vec{r}$ is perpendicular to $\vec{a} + \vec{b} + \vec{c}$, the minimum value of $x^2 + y^2$ is

A. π^2

B. $\frac{\pi^2}{4}$

C. $\frac{5\pi^2}{4}$

D. none of these

Answer: C

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23. A girl walks 4 km towards west, then she walks 3 km in a direction $30o$ east of north and stops. Determine the girls displacement from her initial point of departure.

A. $-\frac{3}{2}\hat{i} + \frac{3\sqrt{3}}{2}\hat{j}$

B. $-\frac{5}{2}\hat{i}+\frac{3}{2}\hat{j}$

C. $-\frac{5}{2}\hat{i}+\frac{3\sqrt{3}}{2}\hat{j}$

D. none of these

Answer: C

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24. If $\vec{a}+\vec{b}+\vec{c}=0,$ prove that $\left(\vec{a}\times\vec{b}\right)=\left(\vec{b}\times\vec{c}\right)=\left(\vec{c}\times\vec{a}\right)$

A. a vector perpendicualr to the plane of $\vec{a}, \vec{b}, \vec{c}$ and vec c `

B. a scalar quantity

C. $\vec{0}$

D. none of these

Answer: C

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25. If $\left|\vec{a}+\vec{b}\right|=\left|\vec{a}-\vec{b}\right|$, then which one of the following is correct ?

A. $\vec{a}=\lambda\vec{b}$ for some scalar λ

B. $\vec{a}$ is parallel to $\vec{b}$

C. $\vec{a}$ is perpendicualr to $\vec{b}$

D. $\vec{a}=\vec{b}=\vec{0}$

Answer: C

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26. The resultant of forces $\vec{P}$ and $\vec{Q}$ is $\vec{R}$. If $\vec{Q}$ is doubled the $\vec{R}$ is doubled . If the direction of $\vec{Q}$ is reversed , then $\vec{R}$ is again doubled , then $P^2 : Q^2 : R^2$ is

A. $2:3:1$

B. $3:1:1$

C. $2:3:2$

D. $1:2:3$

Answer: C

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27. If $\overrightarrow{b}$ is a vector whose initial point divides thejoin of $5\hat{i} and 5\hat{j}$ in the ratio $k:1$ and whose terminal point is the origin and $\left|\overrightarrow{b}\right| \leq \sqrt{37}, thenk$ lies in the interval a. $[-6, -1/6]$ b. $(-\infty, -6] \cup [-1/6, \infty)$ c. $[0, 6]$ d. none of these

A. $\left[-6, -\frac{1}{6}\right]$

B. $(-\infty, -6) \cup \left[-\frac{1}{6}, \infty\right]$

C. [0,6]

D. $\left[-\frac{1}{6}, 6\right]$

Answer: A

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28. A body travels a distance s in t seconds. It starts from rest and ends at rest . In the first part of the journey , it moves with constant acceleration f and in the second part with constant retardation r. the value of t is given by

A. $\sqrt{8s\left(\frac{1}{f}+\frac{1}{r}\right)}$

B. $2s\left(\frac{1}{f}+\frac{1}{r}\right)$

C. $\frac{2s}{\frac{1}{f}+\frac{1}{r}}$

D. $\sqrt{2s(f+r)}$

Answer: A

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29. Two particles start simultaneously from the same point and move along two straight lines. One with uniform velocity v and other with a uniform acceleration a. if α is the angle between the lines of motion of two particles then the least value of relative velocity will be at time given by

A. $\frac{u \cos \alpha}{f}$

B. $\frac{u \sin \alpha}{f}$

C. $\frac{f \cos \alpha}{u}$

D. $u \sin \alpha$

Answer: A

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30. $\overrightarrow{p}, \overrightarrow{q}, and \overrightarrow{r}$ are three mutually perpendicular vectors of the same magnitude. If vector $\overrightarrow{x}$ satisfies the equation $\overrightarrow{p} \times \left(\left(\overrightarrow{x} - \overrightarrow{q}\right) \times \overrightarrow{p}\right) + \overrightarrow{q} \times \left(\left(\overrightarrow{x} - \overrightarrow{r}\right) \times \overrightarrow{q}\right) + \overrightarrow{r} \times \left(\left(\overrightarrow{x} - \overrightarrow{p}\right) \times$ is given by $\frac{1}{2}\left(\overrightarrow{p} + \overrightarrow{q} - 2\overrightarrow{r}\right)$ b. $\frac{1}{2}\left(\overrightarrow{p} + \overrightarrow{q} + \overrightarrow{r}\right)$ c. $\frac{1}{3}\left(\overrightarrow{p} + \overrightarrow{q} + \overrightarrow{r}\right)$ d. $\frac{1}{3}\left(2\overrightarrow{p} + \overrightarrow{q} - \overrightarrow{r}\right)$

A. $\frac{1}{2}\left(\overrightarrow{p}+\overrightarrow{q}-\overrightarrow{2}r\right)$

B. $\frac{1}{2}\left(\overrightarrow{p}+\overrightarrow{q}+\overrightarrow{r}\right)$

C. $\frac{1}{3}\left(\overrightarrow{p}+\overrightarrow{q}+\overrightarrow{r}\right)$

D. $\frac{1}{3}\left(2\overrightarrow{p}+\overrightarrow{q}-\overrightarrow{r}\right)$

Answer: B

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