MATHS

BOOKS - NDA PREVIOUS YEARS

VECTORS

Math

1. Let $\vec{a}, \vec{b}, \vec{c}$ be non-coplanar vectors and $\vec{p} = \frac{\vec{b} \times \vec{c}}{\left[\vec{a}\ \vec{b}\ \vec{c}\right]}, \vec{q} = \frac{\vec{c} \times \vec{a}}{\left[\vec{a}\ \vec{b}\ \vec{c}\right]}, \vec{r} = \frac{\vec{a} \times \vec{b}}{\left[\vec{a}\ \vec{b}\ \vec{c}\right]}.$

What is the value of

$\left(\vec{a} - \vec{b} - \vec{c}\right).\vec{p} + \left(\vec{b} - \vec{c} - \vec{a}\right).\vec{q} + \left(\vec{c} - \vec{a} - \vec{b}\right).\vec{r}$?

A. 0

B. -3

C. 3

D. -9

Answer: C

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2. If $\vec{a}, \vec{b}, \vec{c}$ are the position vectors of corners A, B, C or a parallelogram ABCD, then what is the position vector of the corner D?

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

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

C. $\vec{a} - \vec{b} + \vec{c}$

D. $-\vec{a} + \vec{b} + \vec{c}$

Answer: C

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3. In a ΔABC, angle B is obtuse and D, E, F are the middle points of sides BC, CA, AB respectively. Which one of the following vectors has the greatest magnitude?

A. $\overrightarrow{BC}$

B. $\overrightarrow{CA}$

C. $\overrightarrow{AB}$

D. $\overrightarrow{AD}$

Answer: B

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4. If $\vec{p} \neq \vec{0}$ and the conditions $\vec{p} . \vec{q} = \vec{p} . \vec{r}$ and $\vec{p} \times \vec{q} = \vec{p} \times \vec{r}$ hold simultaneously, then which one of the following is correct?

A. $\vec{q} \neq \vec{r}$

B. $\vec{q} = -\vec{r}$

C. $\vec{q} . \vec{r} = 0$

D. $\vec{q} = \vec{r}$

Answer: D

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5. If two unit vectors $\vec{p}$ and $\vec{q}$ make an angle $\frac{\pi}{3}$ with each other, what is the magnitude of $\vec{p} - \frac{1}{2}\vec{q}$?

A. 0

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

C. 1

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

Answer: B

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6. What are the values of x for which the two vectors $\left(x^2-1\right)\hat{i}+(x+2)\hat{j}+x^2\hat{k}$ and $2\hat{i}-x\hat{j}+3\hat{k}$ are orthogonal ?

A. No real value of x

B. $x=\frac{1}{2}$ and $x=-1$

C. $x=-\frac{1}{2}$ and $x=1$

D. $x=-1$ and $x=2$

Answer: C

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7. 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. $2\hat{i}+\hat{j}+2\hat{k}$

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

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

D. $3\hat{i} + \hat{j} - 4\hat{k}$

Answer: D

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8. A particle is acted upon by following forces:

(i) $2\hat{i} + 3\hat{j} + \hat{k}, (ii) - 5\hat{i} + 4\hat{j} - 3\hat{k}$ and $(iii) 3\hat{i} - 7\hat{k}$

In which plane does it move?

A. $x - y$ plane

B. $y - z$ plane

C. $z - x$ plane

D. any arbitrary plane

Answer: B

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9. What is the vector whose magnitude is 3, and is perpendicular to $\hat{i}+\hat{j}$ and $\hat{j}+\hat{k}$?

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

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

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

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

Answer: B

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10. If α, β, γ be angles which the vector $\vec{r}=\lambda\vec{i}+2\vec{j}-\vec{k}$ makes with the coordinate axes, then what is the value of $\sin^2\alpha+\sin^2\beta+\sin^2\gamma$?

A. 2

B. 1

C. $\lambda^2 + 1$

D. $1 - \lambda^2$

Answer: A

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11. The following question consist of two statement, one labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answer.

Assertion (A) : If $\vec{a} = 2\vec{i} + \vec{j} - 2\vec{k}, \vec{b} = \vec{i} + \vec{j} - \vec{k}$, then $\left|\vec{a}\right| \neq \left|\vec{b}\right|$

Reason (R): Two unequal vectors can never have same magnitude.

A. Both A and R are individually true, and R is the correct explanation of A.

B. Both A and R are individually true but R is not the correct explanation of A.

C. A is true but R is false.

D. A is false but R is true.

Answer: C

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12. OAB is a given triangle such that $\overrightarrow{OA} = \vec{a}, \overrightarrow{OB} = \vec{b}$. Also C is a point on $\overrightarrow{AB}$ such that $\overrightarrow{AB} = 2\overrightarrow{BC}$. What is $\overrightarrow{AC}$ equal to ?

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

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

C. $\frac{3}{2}\left(\vec{a} - \vec{b}\right)$

D. $\frac{3}{2}\left(\vec{b} - \vec{a}\right)$

Answer: A

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13. Let $ABCD$ be a p[arallelogram whose diagonals intersect at P and let O be the origin. Then prove that $\overrightarrow{O}A + \overrightarrow{O}B + \overrightarrow{O}C + \overrightarrow{O}D = 4\overrightarrow{O}P$.

A. $\overrightarrow{OP}$

B. $2\overrightarrow{OP}$

C. $3\overrightarrow{OP}$

D. $4\overrightarrow{OP}$

Answer: D

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14. If $\overrightarrow{r}_1, \overrightarrow{r}_2, \overrightarrow{r}_3$ are the position vectors off thee collinear points and scalar $pandq$ exist such that $\overrightarrow{r}_3 = p\overrightarrow{r}_1 + q\overrightarrow{r}_2$, then show that $p + q = 1$.

A. 0

B. 1

C. -1

D. 2

Answer: B

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15. Let α be the angle which the vector $\overrightarrow{V} = 2\hat{i} - \hat{j} + 2\hat{k}$ makes with the z-axis,. Then, what is the value of sin α?

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

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

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

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

Answer: C

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16. If $\vec{m}, \vec{n}, \vec{r}$ are three vectors, θ is the angle between the vectors $\vec{m}$ and $\vec{n}$, what is mnr cos θ equal to ?

A. $\left(\vec{m}.\vec{n}\right)\left(\vec{r}.\left(\vec{r}/r\right)\right)$

B. $\left(\vec{m}.\vec{n}\right)\left(\vec{r}.\vec{r}\right)$

C. $\left(\vec{m}.\vec{r}\right)\left(\vec{n}.\left(\vec{n}/n\right)\right)$

D. $\left(\vec{m}.\vec{n}\right)\vec{r}$

Answer: D

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17. If the vectors $\hat{i}-2x\hat{j}-3y\hat{k}$ and $\hat{i}+3x\hat{j}+2y\hat{k}$ are orthogonal to each other, then what is the locus of the point (x, y) ?

A. A circle

B. An ellipse

C. A parabola

D. A hyperbola

Answer: A

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18. If the components of $\vec{b}$ along and perpendicular to $\vec{a}$ are $\lambda\vec{a}$ and $\vec{b} - \lambda\vec{a}$ respectively, what is λ equal to ?

A. $\frac{\vec{a} \cdot \vec{b}}{|\vec{a}|}$

B. $\frac{\vec{a} \cdot \vec{b}}{|\vec{b}|}$

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

D. $\frac{\vec{a} \cdot \vec{b}}{|\vec{b}|^2}$

Answer: C

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19. A force $m\hat{i} - 3\hat{j} + \hat{k}$ acts on a point and so the point moves from $(20, 3m, 0) \rightarrow (0, 0, 7)$. If the work done by the force is -48 unit, what is the value of m ?

A. 5

B. 3

C. 2

D. 1

Answer: A

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20. For any two vectors $\vec{a}$ and $\vec{b}$ consider the following statement :

1. $\left|\vec{a}+\vec{b}\right|=\left|\vec{a}-\vec{b}\right| \Leftrightarrow \vec{a}, \vec{b}$ are orthogonal.
2. $\left|\vec{a}+\vec{b}\right|=\left|\vec{a}\right|+\left|\vec{b}\right| \Leftrightarrow \vec{a}, \vec{b}$ are orthogonal.
3. $\left|\vec{a}+\vec{b}\right|^2=\left|\vec{a}\right|^2+\left|\vec{b}\right|^2 \Leftrightarrow \vec{a}, \vec{b}$ are orthogonal.

Which of the above statements is/are correct?

A. 1 and 2 only

B. 1 and 3 only

C. 2 and 3 only

D. 1, 2 and 3

Answer: B

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21. Two vector $2\hat{i}+m\hat{j}-3n\hat{k}$ and $5\hat{i}+3m\hat{j}+n\hat{k}$ are such that their magnitudes are respectively $\sqrt{14}$ and $\sqrt{35}$, where m, n are integers. Which one of the following is correct?

A. m takes 1 value, n takes 1 value

B. m takes 1 value, n takes 2 values

C. m takes 2 value, n takes 1 value

D. m takes 2 value, n takes 2 values

Answer: D

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22. Two vectors $\vec{a}$ and $\vec{b}$ are non-zero and non-collinear. What is the value of x for which the vectors $\vec{p}(x-2)\vec{a}+\vec{b}$ and $\vec{q}=(x+1)\vec{a}-\vec{b}$ are collinear?

A. 1

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

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

D. 2

Answer: B

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23. If $\vec{a}$ and $\vec{b}$ are position vectors of the points A and B respectively, then what is the position vector of a point C on AB produced such that $\overrightarrow{AC} = \overrightarrow{2AB}$?

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

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

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

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

Answer: B

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24. If $\left|\vec{a}\right| = 3, \left|\vec{b}\right| + 4$, then for what value of 1 is $\left(\vec{a} + \lambda\vec{b}\right)$ perpendicular to $\left(\vec{a} - \lambda\vec{b}\right)$?

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

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

C. $\pm\frac{9}{16}$

D. $\pm\frac{3}{5}$

Answer: A

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25. What is the magnitude of the moment of the couple consisting of the force $\vec{F} = 3\hat{i} + 2\hat{j} - \hat{k}$ acting through the point $\hat{i} - \hat{j} + \hat{k}$ and $-\vec{F}$ acting through the point $2\hat{i} - 3\hat{j} - \hat{k}$?

A. $2\sqrt{5}$

B. $3\sqrt{5}$

C. $5\sqrt{5}$

D. $7\sqrt{5}$

Answer: C

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26. Let $\vec{a} = 2\vec{j} - 3\vec{k}$, $\vec{b} = \hat{j} + 3\hat{k}$ and $\vec{c} = 3\vec{i} + 3\hat{j} + \hat{k}$. Let $\hat{n}$ be a unit vector such that $\vec{a} \cdot \hat{n} = \vec{b} \cdot \hat{n} = 0$. What is the value of $\vec{c} \cdot \hat{n}$?

A. 1

B. $\sqrt{19}$

C. 3

D. -3

Answer: D

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27. Let

$\vec{u} = \hat{i} - \hat{j}, \vec{v} = 2\hat{i} + 5\hat{j}, \vec{w} = 4\hat{i} + 3\hat{j}$ and $\vec{p} = \vec{u} + \vec{v} + \vec{w}$.

Which one of the following is correct ?

A. $-3\vec{u} + 2\vec{v} = \vec{p}$

B. $3\vec{u} - 2\vec{v} = \vec{p}$

C. $3\vec{u} + 2\vec{v} = \vec{p}$

D. $-3\vec{u} - 2\vec{v} = \vec{p}$

Answer: C

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28. If $\vec{a}$ and $\vec{b}$ are unit vectors inclined at an angle of 30° to each other, then which one of the following is correct?

A. $\left|\vec{a} + \vec{b}\right| > 1$

B. $1 > \left|\vec{a} + \vec{b}\right| < 2$

C. $\left|\vec{a}+\vec{b}\right|=2$

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

Answer: B

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29. Which one of the following is correct ? If the vector $\vec{c}$ is normal to the vectors $\vec{a}$ and $\vec{b}$, then $\vec{c}$, is :

A. parallel to both $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$

B. $\vec{a}-\vec{b}$ and parallel to $\vec{a}+\vec{b}$

C. normal to $\vec{a}+\vec{b}$ and parallel to $\vec{a}-\vec{b}$

D. normal to both $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$

Answer: D

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30. Which one of the following statements is not correct?

A. Vector product is commutative

B. Vector product is not associative

C. Vector product is distributive over addition

D. Scalar product is commutative

Answer: A

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31. If a $\hat{i}+\hat{j}+\hat{k}, \hat{i}+b\hat{j}+\hat{k}, \text{ and } \hat{i}+\hat{j}+c\hat{k}$ are coplanar vectors, then what is the value of a+b+c-abc?

A. 0

B. 1

C. 2

D. -2

Answer: C

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32. For any three non-zero vectors $\vec{a}, \vec{b}$ and $\vec{c}$ if $\left|\left(\vec{a} \times \vec{b}\right).\vec{c}\right| = \left|\vec{a}\right|\left|\vec{b}\right|\left|\vec{c}\right|$ then $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a} =$

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

B. $\vec{a}.\vec{b} = 0$ only

C. $\vec{b}.\vec{c} = 0$ only

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

Answer: D

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33. If $\vec{a} = \vec{i} + 2\hat{j} - 3\hat{k}$ and $\vec{b} = 3\hat{i} - \hat{j} + \lambda\hat{k}$ and $\left(\vec{a} + \vec{b}\right)$ is perpendicular to $\vec{a} - \vec{b}$, then what is the value of λ?

A. -2 only

B. ± 2

C. 3 only

D. ± 3

Answer: B

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34. The vectors $\overrightarrow{AB} = \vec{c}, \overrightarrow{BC} = \vec{a}, \overrightarrow{CA} = \vec{b}$, are the sides of a triangles ABC. Which of the following vectors represent (s) the median $\overrightarrow{AD}$?

1. $\frac{1}{2}\vec{a} + \vec{c}$
2. $-\frac{1}{2}\vec{b} + \frac{1}{2}\vec{c}$
3. $\frac{\vec{1}}{2}\vec{a} + \vec{b}$

Select the correct answer using the code given below

A. 1 and 2

B. $1 \text{ and } 3$

C. $1 only$

D. $2 only$

Answer: C

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35. If $\vec{a}$ is a position vector of a point (1, -3) and A is another point (-1, 5), then what are the coordinates of the point B such that $\overrightarrow{AB} = \vec{a}$?

A. (2,0)

B. (0,2)

C. (-2,0)

D. (0,-2)

Answer: B

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

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

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

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

D. $-\left(\vec{a} \times \vec{b}\right)$

Answer: B

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37. If $\rightarrow a$ is a nonzero vector of magnitude a and λ a nonzero scalar, then $\lambda \rightarrow a$ is unit vector if (A) $\lambda = 1$ (B) $\lambda = 1$ (C) $a = |\lambda|$ (D) $a = \frac{1}{|\lambda|}$

A. $\lambda = \pm 1$

B. $a = |\lambda|$

C. $a = \frac{1}{|\lambda|}$

D. $a = \frac{1}{\lambda}$only

Answer: C

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38. Let $\vec{a}$ and $\vec{b}$ be the position vectors of A and B respectively. If C is the point $3\vec{a} - 2\vec{b}$, then which one of the following is correct?

A. C is in between A and B

B. A is in between C and B

C. B is in between A and C

D. A, B, C are not collinear

Answer: B

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39. Consider the following

If $\vec{a}$ and $\vec{b}$ are the vectors forming consecutive sides of a regular hexagon ABCDEF, then

1. $\overrightarrow{CE} = \vec{b} - 2\vec{a}$ 2. $\overrightarrow{AE} = 2\vec{b} - \vec{a}$

3. $\overrightarrow{FA} = \vec{a} - \vec{b}$

Which of the above are correct?

A. 1 and 2 only

B. 2 and 3 only

C. 1 and 3 only

D. 1, 2, and 3

Answer: D

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40. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are unit vectors such that $\vec{a}$ is perpendicular to the plane of $\vec{b}$, $\vec{c}$, and the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{3}$

Then, what is $\left|\vec{a}+\vec{b}+\vec{c}\right|$?

A. 1

B. 2

C. 3

D. 4

Answer: B

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41. What is the locus of the point (x, y) for which the vectors $\left(\hat{i}-x\hat{j}-2\hat{k}\right)$ and $\left(2\hat{i}+\hat{j}+y\hat{k}\right)$ are orthogonal?

A. A circle

B. An ellipse

C. A parabola

D. A straight line

Answer: D

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42. The number of vectors of unit length perpendicular to vectors $\vec{a} = (1, 1, 0) and \vec{b} = (0, 1, 1)$ is a. one b. two c. three d. infinite

A. 1

B. 2

C. 3

D. 4

Answer: B

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43. What is the area of the rectangle of which $\vec{r} = a\hat{i} + b\hat{j}$ is a semidiagonal ?

A. $a^2 + b^2$

B. $2(a^2 + b^2)$

C. $4(a^2 + b^2)$

D. $4ab$

Answer: D

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44. If $\left(3\vec{a} - \vec{b}\right) \times \left(\vec{a} + 3\vec{b}\right) = k\vec{a} \times \vec{b}$ then what is the value of k?

A. 10

B. 5

C. 8

D. -8

Answer: A

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45. What is the value of λ if the triangle whose vertices are $\hat{i}, \hat{j}$ and $\hat{i} + \hat{j} + \lambda\hat{k}$ will be right angled?

A. 2

B. 0

C. -1

D. 1

Answer: B

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46. The scalar triple product $\left(\vec{A} \times \vec{B}\right).\vec{C}$ of three vectors $\vec{A}, \vec{B}, \vec{C}$ determines

A. Volume of a parallelopiped

B. Volume of a tetrahedron

C. Volume of an ellipsoid

D. None of the above

Answer: A

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47. If $\vec{a}\ and\ \vec{b}$ are unit vectors then write the value of $\left|\vec{a} \times \vec{b}\right|^2 + \left(\vec{a}\dot{\vec{b}}\right)^2$.

A. 0

B. 2

C. 1

D. $1/2$

Answer: C

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48. Two forces are equal to $2\overrightarrow{OA}$ and $3\overrightarrow{BO}$, their resultant being $\lambda\overrightarrow{OG}$, where G is the point on AB such that $\frac{BG}{AG} = -\frac{2}{3}$. What is the value of λ?

A. 1

B. -1

C. 2

D. None of the above

Answer: B

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49. If $\vec{a}$ and $\vec{b}$ are two unit vectors inclined at an angle 60° to each other, then which one of the following is correct?

A. $\left|\vec{a}+\vec{b}\right|<1$

B. $\left|\vec{a}+\vec{b}\right|>1$

C. $\left|\vec{a}-\vec{b}\right|<1$

D. $\left|\vec{a}-\vec{b}\right|>1$

Answer: B

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50. Let $\vec{a}=(1,\ -2,3)$ and $\vec{b}=(3,1,2)$ be two vectors and $\vec{c}$ be a vector of length l and parallel to $\left(\vec{a}+\vec{b}\right)$. What is $\vec{c}$ equal to ?

A. $\frac{1}{\sqrt{4}}(-2,\ -3,1)$

B. $\frac{1}{\sqrt{2}}(1,0,1)$

C. $\frac{1}{\sqrt{42}}(-5, -4, 1)$

D. None of these

Answer: D

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51. If $\vec{r_1} = \lambda\vec{i} + 2\hat{j} + \hat{k}, \vec{r_2} = \hat{i} + (2-\lambda)\hat{j} + 2\hat{k}$ are such that $\left|\vec{r_1}\right| > \left|\vec{r_2}\right|$, then λ satisfies which one of the following?

A. $\lambda = 0$ only

B. $\lambda = 1$

C. $\lambda < 1$

D. $\lambda < 1$

Answer: D

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52. If P, Q, R are the mid-points of the sides AB, BC and CA respectively of a triangle ABC and a, p, q are the position vectors of A,P,Q respectively, then what is position vector of R?

A. $2\vec{a} - \left(\vec{p} - \vec{q}\right)$

B. $\left(\vec{p} - \vec{q}\right) - 2\vec{a}$

C. $\vec{a} - \left(\vec{p} - \vec{q}\right)$

D. $\vec{a}/2 - \left(\vec{p} - \vec{q}\right)/2$

Answer: C

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53. What is the length of the vector (1, 1) ?

A. 0

B. 1

C. $\sqrt{2}$

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

Answer: C

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54. Which one of the following vectors of magnitude $\sqrt{51}$ makes equal angles with three vectors $\vec{a} = \frac{\hat{i} - 2\hat{j} + 2\hat{k}}{3}$, $\vec{b} = \frac{-4\hat{i} - 3\hat{k}}{5}$ and $\vec{c} = \hat{j}$?

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

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

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

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

Answer: A

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55. If $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 5$ and $\left|\vec{a} \times \vec{b}\right|$, then what is $\vec{a} . \vec{b}$ equal to ?

A. 4

B. 6

C. 8

D. 10

Answer: B

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

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

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

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

D. Both $\vec{a}$ and $\vec{b}$ are unit vectors

Answer: B

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57. If $\vec{a} = \hat{i} - 2\hat{j} + 5\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - 3\hat{k}$ then what is $\left(\vec{b} - \vec{a}\right).\left(3\vec{a} + \vec{b}\right)$ equal to ?

A. 106

B. -106

C. 53

D. -53

Answer: B

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58. Let $\vec{a}$, $\vec{b}$, $\vec{c}$ be the position vectors of points A, B, C respectively. Under which one of the following conditions are the points A, B, C

collinear?

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

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

C. $\vec{a} \times \vec{b}$ is perpendicular to $\vec{b} \times \vec{c}$

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

Answer: D

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59. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} + \hat{j} - \hat{k}$, then what is $\vec{a} \times \left(\vec{b} + \vec{c}\right) + \vec{b} \times \left(\vec{c} + \vec{a}\right) + \vec{c} \times \left(\vec{a} + \vec{b}\right)$ equal to?

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

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

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

D. $\vec{0}$

Answer: D

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60. The following item consists of two statements, one labelled the Assertion (A) and the other labelled the Reason (R). You are to examine these two statements carefully and decide if the Assertion (A) and Reason (R) are individually true and if so, whether the reason is a correct explanation of the Assertion. Select your answer using the codes given below.

Assertion (A) : The work done when the force and displacement are perpendicular to each other is zero.

Reason (R) : the dot product $\vec{A} . \vec{B}$ vanishes, if the vector $\vec{A}$ and $\vec{B}$ are perpendicular.

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A

C. A is true but R is false.

D. A is false but R is true.

Answer: B

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61. If $\hat{a}$ and $\hat{b}$ are the unit vectors along $\vec{a}$ and $\vec{b}$ respectively, then what is the projection of $\vec{b}$ on $\vec{a}$?

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

B. $\hat{a} . \hat{b}$

C. $\hat{a} . \vec{b}$

D. $\left|\vec{a} \times \vec{b}\right|$

Answer: A

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62. What are the unit vectors parallel to xy-plane and perpendicular to the vector $4\hat{i} - 3\hat{j} + \hat{k}$?

A. $\pm\left(3\hat{i} + 4\hat{j}\right)/5$

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

C. $\pm\left(3\hat{i} - 4\hat{j}\right)/5$

D. $\pm\left(4\hat{i} - 3\hat{j}\right)/5$

Answer: A

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63. What is the vector in the xy-plane through origin and perpendicular to the vector $\vec{r} = a\vec{i} + b\hat{j}$ and of the same length?

A. $-a\hat{i} - b\vec{j}$

B. $a\hat{i} - b\hat{j}$

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

D. $b\hat{i} - a\hat{j}$

Answer: D

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64. Given $\overrightarrow{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ and $\hat{b}$ is a unit vector codirectional with $\hat{a}$. If m is a scalar such that $\hat{b} = m\overrightarrow{a}$, then what is the value of m ?

A. $1/5$

B. $1/\sqrt{5}$

C. $1/29$

D. $1/\sqrt{29}$

Answer: D

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65. The magnitude of the vectors $\vec{a}$ and $\vec{b}$ are equal and the angle between them is 60°. If the vectors $\lambda\vec{a} + \vec{b}$ and $\vec{a} - \lambda\vec{b}$ are perpendicular to each other, then what is the value of λ?

A. 1

B. 2

C. 3

D. 4

Answer: A

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66. If $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 4$ and $\left|\vec{a} - \vec{b}\right| = 5$, then what is the value of $\left|\vec{a} + \vec{b}\right| = ?$

A. 3

B. 2

C. 1

D. 0

Answer: C

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67. Consider the diagonals of a quadrilateral formed by the vectors $3\hat{i} + 6\hat{j} - 2\hat{k}$ and $4\hat{i} - \hat{j} + 3\hat{k}$. The quadrilateral must be a

A. Square

B. Rhombus

C. Rectangle

D. None of these

Answer: B

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68. What is the area of the triangle with vertices $(0, 2, 2), (2, 0, -1)$ and $(3, 4, 0)$?

A. $\frac{15}{2}$ sq unit

B. 15 sq unit

C. $\frac{7}{2}$ sq unit

D. 7 sq unit

Answer: A

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69. If the angle between the vectors $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{3}$, what is the angle between $-5\vec{a}$ and $6\vec{b}$?

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

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

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

D. $\frac{3\pi}{7}$

Answer: B

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70. Consider the following statements

1. For any three vectors $\vec{a}, \vec{b}, \vec{c}$,

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

2. For any three coplanar unit vectors

$$\vec{d}, \vec{e}, \vec{f}, \left(\vec{d}\times\vec{e}\right).\vec{f}=1$$

Which of the statements given above is/are correct?

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Answer: A

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71. 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 vectors, if $\alpha = \frac{\pi}{4}$ b. $\alpha = \frac{\pi}{3}$ c. $\alpha = \frac{2\pi}{3}$ d. $\alpha = \frac{\pi}{2}$

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

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

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

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

Answer: C

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72. What is the value of λ for which the vectors $\hat{i} - \hat{j} + \hat{k}, 2\hat{i} + \hat{j} - \hat{k}$ and $\lambda\hat{i} - \hat{j} + \lambda\hat{k}$ are co-planar?

A. 1

B. 2

C. 3

D. 4

Answer: A

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73. What is the geometric interpretation of the identity $\left(\vec{a}-\vec{b}\right)\times\left(\vec{a}+\vec{b}\right)=2\left(\vec{a}\times\vec{b}\right)$?

1. If the diagonals of a given parallelogram are used as sides of a second parallelogram, then the area of the second parallelogram is twice that of the given parallelogram.

2. If the semi-diagonals of a given parallelogram are used as sides of a second parallelogram, then the area of the second parallelogram is half that of the given parallelogram.

Select the correct answer using the code given below

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Answer: C

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74. The $\vec{b}$ which is collinear with the vector $\vec{a} = (2, 1, -1)$ and satisfies the relation $\vec{a} . \vec{b} = 3$ is

A. (1, 1/2, -1/2)

B. (2/3, 1/3, -1/3)

C. (1/2, 1/4, -1/4)

D. (1,1,0)

Answer: A

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75. The vectors $\vec{a} = x\vec{i} + y\vec{j} + z\vec{k}$, $\vec{b} = \hat{k}$, $\vec{c}$ are such that they form a right handed system. What is $\vec{c}$ equal to ?

A. $\hat{j}$

B. $y\hat{j} - x\hat{k}$

C. $y\hat{i} - x\hat{j}$

D. $x\hat{i} - y\hat{j}$

Answer: C

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76. If the position vector of a point p with respect to the origin O is $\hat{i} + 3\hat{j} - 2\hat{k}$ and that of a point Q is $3\hat{i} + \hat{j} - 2\hat{k}$, then what is the position vector of the bisector of the $\angle POQ$?

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

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

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

D. None of these

Answer: B

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77. Let a, b and c be the distinct non-negative numbers. If the vectors $a\hat{i} + c\hat{k}, \hat{i} + \hat{k}, c\hat{i} + c\hat{j} + b\hat{k}$ lie on a plane, then which one of the following is correct?

A. c is thed arithmetic mean of a and b

B. c is the geometric mean of a and b

C. c is the harmonic mean of a and b

D. c is equal to zero

Answer: B

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78. If $\vec{a} = ht(i) - \hat{k}$, $\vec{b} = x\hat{i} + \hat{j} + (1-x)\hat{k}$

$\vec{c} = y\hat{i} + x\hat{j} + (1+x-y)\hat{k}.$

then $\vec{a}.\left(\vec{b} \times \vec{c}\right)$ depends on

A. x only

B. y only

C. Both x and y

D. Neither x nor y

Answer: D

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79. PQRS is a parallelogram, where $\overrightarrow{PQ} = 3\hat{i} + 2\hat{j} - m\hat{k}, \overrightarrow{PS} = \hat{i} + 3\hat{j} + \hat{k}$ and the area of the parallelogram is $\sqrt{90}$. What is the value of m?

A. 1

B. -1

C. 2

D. -2

Answer: A

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80. What is the vector equally inclined to the vectors $\hat{i} + 3\hat{j}$ and $3\hat{i} + \hat{j}$?

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

B. $2\hat{i} - \hat{j}$

C. $2\hat{i} + \hat{j}$

D. None of these

Answer: A

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81. ABCD is a quadrilateral. Forces $\overrightarrow{AB}, \overrightarrow{CB}, \overrightarrow{CD}$ and $\overrightarrow{DA}$ act along its sides. What is their resultant ?

A. $2\overrightarrow{CD}$

B. $2\overrightarrow{DA}$

C. $2\overrightarrow{BC}$

D. $2\overrightarrow{CB}$

Answer: D

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82. Find the area of the triangle whose vertices are $A(3, -1, 2), B(1, -1, -3) and C(4, -3, 1)$.

A. $\frac{\sqrt{165}}{2}$

B. $\frac{\sqrt{135}}{2}$

C. 4

D. 2

Answer: A

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83. What is the value of b such that the scalar product of the vector $\hat{i} + \hat{j} + \hat{k}$ with the unit vector parallel to the sum of the vectors $2\hat{i} + 4\hat{j} - 5\hat{k}$ and $b\hat{i} + 2\hat{j} + 3\hat{k}$ is unity ?

A. -2

B. -1

C. 0

D. 1

Answer: D

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84. Let p, q, r and s be respectively the magnitudes of the vectors $3\hat{i} - 2\hat{j}, 2\hat{i} + 2\hat{j} + \hat{k}, 4\hat{i} - \hat{j} + \hat{k}, 2\hat{i} + 2\hat{j} + 3\hat{k}$. Which one of the following is correct?

A. $r > s > q > p$

B. $s > r > p > q$

C. $r > s > p > q$

D. $s > r > q > p$

Answer: C

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85. If $x\hat{i} + y\hat{j} + z\hat{k}$ is a unit vector and $x : y : z = \sqrt{3} : 2 : 3$, then what is the value of z?

A. $\frac{3}{16}$

B. 3

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

D. 2

Answer: C

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86. Which one of the following is the unit vector perpendicular to the vectors $4\hat{i} + 2\hat{j}$ and $-3\hat{i} + 2\hat{j}$?

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

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

C. $\hat{k}$

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

Answer: C

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87. Consider the following statements in respect of the vectors $\overrightarrow{u_1}=(1,2,3), \overrightarrow{u_2}=(2,3,1), \overrightarrow{u_3}=(1,3,2)$ and $\overrightarrow{u_4}=(4,6,2)$

I. $\overrightarrow{u_1}$ is parallel to $\overrightarrow{u_4}$.

II. $\overrightarrow{u_2}$ is parallel to $\overrightarrow{u_4}$.

III. $\overrightarrow{u_2}$ is parallel to $\overrightarrow{u_3}$.

Which of the statements given above is/are correct?

A. Only I

B. Only II

C. Only III

D. Both I and III

Answer: B

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88. If the points with position vectors $10\hat{i}+3\hat{j}, 12\hat{i}-5\hat{j}$ and $a\hat{i}+11\hat{j}$ are collinear, find the value of a.

A. -8

B. 4

C. 8

D. 12

Answer: C

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89. What is the sine of angle between the vectors $\hat{i}+2\hat{j}+3\hat{k}$ and $-\hat{i}+2\hat{j}+3\hat{k}$?

A. $\sqrt{\frac{13}{7}}$

B. $\frac{\sqrt{13}}{7}$

C. $\frac{13}{\sqrt{7}}$

D. None of these

Answer: B

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90. The vector $\vec{a}$ lies in the plane of vectors $\vec{b}$ and $\vec{c}$. Which one of the following is correct ?

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

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

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

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

Answer: A

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91. What is the projection of the vector $\hat{i} - 2\hat{j} - \hat{k}$ on the vector $4\hat{i} - 4\hat{j} + 7\hat{k}$?

A. $\frac{\sqrt{5}}{2}$

B. $\frac{19}{9}$

C. $\frac{\sqrt{5}}{4}$

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

Answer: B

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92. If $\vec{a} . \vec{b} = 0$ and $\vec{a} \times \vec{b} = \vec{0}$ then which one of the following is correct ?

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

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

C. Either $\vec{a}$ or $\vec{b}$ is a null vector

D. None of the above

Answer: C

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93. If the vectors $-\hat{i}-2x\hat{j}-3y\hat{k}$ and $\hat{i}-3x\hat{j}-2y\hat{k}$ are orthogonal to each other, then what is the locus of the point (x, y) ?

A. a straight line

B. an ellipse

C. A parabola

D. a circle

Answer: D

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94. If $\vec{c}$ is a unit vector perpendicular to the vectors $\vec{a}$ and $\vec{b}$ write another unit vector perpendicular $\vec{a}$ and $\vec{b}$.

A. $\vec{a} \times \vec{a}$

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

C. $-\frac{\left(\vec{a} \times \vec{b}\right)}{\left|\vec{a} \times \vec{b}\right|}$

D. $\frac{\left(\vec{a} \times \vec{b}\right)}{\left|\vec{a} \times \vec{b}\right|}$

Answer: D

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95. For what value of m are the points with position vectors $10\hat{i} + 3\hat{j}, 12\hat{i} - 5\hat{j}$ and $m\hat{i} + 11\hat{j}$ collinear ?

A. -8

B. 4

C. 8

D. 12

Answer: C

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96. For what value of m are the vectors $2\hat{i}-3\hat{j}+4\hat{k}, \hat{i}+3\hat{j}-\hat{k}$ and $m\hat{i}-\hat{j}+2\hat{k}$ coplanar ?

A. 0

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

C. 1

D. $8/5$

Answer: D

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97. the area of triangle whose vertices are (1,2,3),(2,5-1) and (-1,1,2) is

A. $\frac{\sqrt{155}}{2}$ square units

B. $\frac{\sqrt{175}}{2}$ square units

C. $\frac{\sqrt{155}}{4}$ square units

D. $\frac{\sqrt{175}}{4}$ square units

Answer: A

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98. What is the area of the rectangle having vertices A, B, C and D with positive vectors $-\hat{i}+\frac{1}{2}\hat{j}+4\hat{k}, \hat{i}+\frac{1}{2}\hat{j}+4\hat{k}, \hat{i}-\frac{1}{2}\hat{j}+4\hat{k}$ and $-\hat{1}-\frac{1}{2}\hat{j}+4\hat{k}$?

A. 1/2 square unit

B. 1 square unit

C. 2 square unit

D. 4 square unit

Answer: C

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99. If $\vec{a} = (2, 1, -1), \vec{b} = (1, -1, 0), \vec{c} = (5, -1, 1)$, then what is the unit vector parallel to $\vec{a} + \vec{b} - \vec{c}$ in the opposite direction ?

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

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

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

D. None of the above

Answer: C

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100. If the magnitudes of two vectors a and b are equal then which one of the following is correct?

A. $\left(\vec{a}+\vec{b}\right)$ is parallel to $\left(\vec{a}-\vec{b}\right)$

B. $\left(\vec{a}+\vec{b}\right)\cdot\left(\vec{a}-\vec{b}\right)=1$

C. $\left(\vec{a}+\vec{b}\right)$ is perpendicular to $\left(\vec{a}-\vec{b}\right)$

D. None of the above

Answer: C

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101. Let O be the origin nad P, Q, R be the points such that $\overrightarrow{PO}+\overrightarrow{OQ}=\overrightarrow{QO}+\overrightarrow{OR}$. Then which one of the following is correct?

A. P, Q, R are the vertices of an equilateral triangle

B. P, Q, R are the vertices of an isosceles triangle

C. P, Q, R are collinear

D. None of the above

Answer: C

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102. What is the value of m if the vectors

$2\hat{i} - \hat{j} + \hat{k}, \hat{i} + 2\hat{j} - 3\hat{k}$ and $3\hat{i} + m\hat{j} + 5\hat{k}$ are coplanar?

A. -2

B. 2

C. -4

D. 4

Answer: C

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103. If $\left|\overrightarrow{c}\right| = 10, \left|\overrightarrow{b}\right| = 2$ and $\overrightarrow{a} \cdot \overrightarrow{b} = 12$, then what is the value of $\left|\overrightarrow{a} \times \overrightarrow{b}\right|$?

A. 12

B. 16

C. 20

D. 24

Answer: B

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104. If the vectors $\hat{i} - x\hat{j} - y\hat{k}$ and $\hat{i} + x\hat{j} + y\hat{k}$ are orthogonal to each other, then what is the locus of the point (x, y) ?

A. a parabola

B. an ellipse

C. a circle

D. a straight line

Answer: C

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105. EFGH is a rhombus such that the angle EFG is 60°. The magnitude of vectors $\overline{FH}$ and {m $\overline{EG}$} are equal where m is a scalar. What is the value of m?

A. 3

B. 1.5

C. $\sqrt{2}$

D. $\sqrt{3}$

Answer: D

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106. If $\vec{a} . \vec{b} = 0$ and $\vec{a} \times \vec{b} = \vec{0}$ then which one of the following is correct ?

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

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

C. $\vec{a} = \vec{0}$ or $\vec{b} = \vec{0}$

D. None of the above

Answer: C

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107. The vector $\vec{a} \times \left(\vec{b} \times \vec{a} \right)$ is coplanar with :

A. $\vec{a}$ only

B. $\vec{b}$ only

C. Both $\vec{a}$ and $\vec{b}$

D. Neither $\vec{a} n$ or $\vec{b}$

Answer: D

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108. Consider the following :

1. $4\hat{i} \times 3\hat{i} = \hat{0}$ 2. $\frac{4\hat{i}}{3\hat{i}} = \frac{4}{3}$

Which of the above is/are correct ?

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Answer: A

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109. What is the value of λ for which

$$\left(\lambda\hat{i}+\hat{j}-\hat{k}\right)\times\left(3\hat{i}-2\hat{j}+4\hat{k}\right)=\left(2\hat{i}-11\hat{j}-7\hat{k}\right)?$$

A. 2

B. -2

C. 1

D. 7

Answer: A

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110. The magnitude of the scalar p for which the vector $p\left(-3\hat{i}-2\hat{j}+13\hat{k}\right)$ is of unit length is :

A. $1/8$

B. $1/64$

C. $\sqrt{182}$

D. $\frac{1}{\sqrt{182}}$

Answer: D

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111. The vector $2\hat{j} - \hat{k}$ lies :

A. in the plane of XY

B. in the plane of YZ

C. in the plane of XZ

D. along the X-axis

Answer: B

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112. ABCD is a parallelogram . If $\overrightarrow{AB} = \vec{a}, \overrightarrow{BC} = \vec{b}$, then what $\overrightarrow{BD}$ equal to ?

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

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

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

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

Answer: D

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113. If $\vec{\beta}$ is perpendicular to both $\vec{\alpha}$ and $\vec{\lambda}$ where $\vec{\alpha} = \hat{k}$ and $\vec{\lambda} = 2\hat{i} + 3\hat{j} + 4\hat{k}$, then what is $\vec{\beta}$ equal to ?

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

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

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

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

Answer: B

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114. For any vector $\vec{\alpha}$, what is $\left(\vec{\alpha}.\hat{i}\right)\hat{i}+\left(\vec{\alpha}.\hat{j}\right)\hat{j}+\left(\vec{\alpha}.\hat{k}\right)\hat{k}$ equal to ?

A. $\vec{\alpha}$

B. $3\vec{\alpha}$

C. $-\vec{\alpha}$

D. $\vec{0}$

Answer: A

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115. If the magnitudes of $\vec{a} \times \vec{b}$ equals to $\vec{a} . \vec{b}$, then which one of the following is correct ?

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

B. The angle between $\vec{a}$ and $\vec{b}$ is 45°

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

D. $\vec{a}$ is perpendicular to $\vec{b}$

Answer: B

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116. If $\left|\vec{a}\right| = \sqrt{2}, \left|\vec{b}\right| = \sqrt{3}$ and $\left|\vec{a} + \vec{b}\right| = \sqrt{6}$, then what is $\left|\vec{a} - \vec{b}\right|$ equal to ?

A. 1

B. 2

C. 3

D. 4

Answer: B

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117. Which one of the following vectors is normal to the vector $\hat{i} + \hat{j} + \hat{k}$?

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

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

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

D. None of the above

Answer: D

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118. If θ is the angle between the vectors is $4\left(\hat{i}-\hat{k}\right)$ and $\hat{i}+\hat{j}+\hat{k}$, then what is $(\sin\theta+\cos\theta)$ equal to ?

A. 0

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

C. 1

D. 2

Answer: C

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119. If the angle between the vectors $\hat{i}-m\hat{j}$ and $\hat{j}+\hat{k}$ is $\frac{\pi}{3}$, then what is the value of m ?

A. 0

B. 2

C. -2

D. None of these

Answer: D

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120. What is the vector perpendicular to both the vectors $\hat{i} - \hat{j}$ and $\hat{i}$?

A. $\hat{i}$

B. $-\hat{j}$

C. $\hat{j}$

D. $\hat{k}$

Answer: D

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121. The position vectors of the points A and B are respectively $3\hat{i} - 5\hat{5} + 2\hat{k}$ and $\hat{i} + \hat{j} - \hat{k}$. What is the length of AB ?

A. 11

B. 9

C. 7

D. 6

Answer: C

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122. If the vectors $\hat{i} - 2x\hat{j} - 3y\hat{k}$ and $\hat{i} + 3x\hat{j} + 2y\hat{k}$ are orthogonal to each other, then what is the locus of the point (x, y) ?

A. hyperbola

B. ellipse

C. parabola

D. circle

Answer: D

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123. What is the value of P for which the vector $p\left(2\hat{i}-\hat{j}+2\hat{k}\right)$ is of 3 units length ?

A. 1

B. 2

C. 3

D. 6

Answer: A

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124. If $\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$ are three vectors such that $\vec{a} + t\vec{b}$ is perpendicular to $\vec{c}$, then what is t equal to ?

A. 8

B. 6

C. 4

D. 2

Answer: A

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125. The vertices of a triangle ABC are A (2,3,1) , B(-2, 2,0), and C(0,1,-1). What is the cosine of angle ABC ?

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

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

C. $\frac{2}{\sqrt{6}}$

D. None of these

Answer: A

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126. The vertices of a triangle ABC are A (2,3,1) , B(-2, 2,0), and C(0,1,-1).

What is the cosine of angle ABC ?

A. $6\sqrt{2}$ square unit

B. $3\sqrt{2}$

C. $10\sqrt{3}$ square unit

D. None of these

Answer: B

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127. The vertices of a triangle ABC are A (2,3,1) , B(-2, 2,0), and C(0,1,-1).

What is the magnitude of the line joining mid points of the sides AC and BC ?

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

B. 1 unit

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

D. 2 unit

Answer: C

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128. Consider the vectors $\bar{a} = \hat{i} - 2\hat{j} + \hat{k}$ and $\bar{b} = 4\hat{i} - 4\hat{j} + 7\hat{k}$.

What is the scalar projection of $\bar{a}$ on $\bar{b}$?

A. 1

B. 19/9

C. 17/9

D. 23/9

Answer: B

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129. Consider the vectors $\bar{a} = \hat{i} - 2\hat{j} + \hat{k}$ and $\bar{b} = 4\hat{i} - 4\hat{j} + 7\hat{k}$.

What is the vector perpendicular to both the vectors ?

A. $-10\hat{i} - 3\hat{j} + 4\hat{k}$

B. $-10\hat{i} + 3\hat{j} + 4\hat{k}$

C. $10\hat{i} - 3\hat{j} + 4\hat{k}$

D. None of these

Answer: A

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130. Let a vector $\bar{r}$ make angle $60^\circ, 30^\circ$ with x and y-axes respectively.

What angle does $\bar{r}$ make with z-axis ?

A. 30°

B. 60°

C. 90°

D. 120°

Answer: C

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131. Let a vector $\bar{r}$ make angle $60^\circ, 30^\circ$ with x and y-axes respectively.

What are the direction cosines of $\bar{r}$?

A. $\left\langle \frac{1}{2}, \frac{\sqrt{3}}{2}, 0 \right\rangle$

B. $\left\langle \frac{1}{2}, \frac{\sqrt{3}}{2}, 0 \right\rangle$

C. $\left\langle \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0 \right\rangle$

D. $\left\langle -\frac{1}{2}, \frac{\sqrt{3}}{2}, 0 \right\rangle$

Answer: A

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132. Let $|\bar{a}| = 7, |\bar{b}| = 11, |\bar{a} + \bar{b}| = 10\sqrt{3}$

What is $|\bar{a} - \bar{b}|$ equal to ?

A. $2\sqrt{2}$

B. $2\sqrt{10}$

C. 5

D. 10

Answer: B

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133. Let $|\bar{a}| = 7, |\bar{b}| = 11, |\bar{a} + \bar{b}| = 10\sqrt{3}$

What is the angle between $(\bar{a} + \bar{b}$ and $(\bar{a} - \bar{b})$?

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

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

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

D. None of these

Answer: D

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134. If $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 5$ and $\left|\vec{a} \times \vec{b}\right| = 8$, then what is $\vec{a}.\ \vec{b}$ equal to ?

A. 6

B. 7

C. 8

D. 9

Answer: A

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

A. $|ve(a)|=\left|\vec{b}\right|$

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

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

D. $\vec{a}$ is unit vector.

Answer: C

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136. What is the area of the triangle OAB where O is the origin, $\overrightarrow{OA} = 3\hat{i} - \hat{j} + \hat{k}$ and $\overrightarrow{OB} = 2\hat{i} + \hat{j} - 3\hat{k}$?

A. $5\sqrt{6}$ square unit

B. $\frac{5\sqrt{6}}{2}$ square unit

C. $\sqrt{6}$ square unit

D. $\sqrt{30}$ square unit

Answer: B

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137. Which one of the following is the unit vector perpendicular to both $\vec{a} = -\hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$?

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

B. $\hat{k}$

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

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

Answer: A

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138. 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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139. For what value of λ are the vectors $\lambda\hat{i}+(1+\lambda)\hat{j}+(1+2\lambda)\hat{k}$ and $(1-\lambda)\hat{i}+\lambda\hat{j}+2\hat{k}$ perpendicular ?

A. $-1/3$

B. $1/3$

C. $2/3$

D. 1

Answer: A

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140. Vector $\vec{a}, \vec{b}$ and $\vec{c}$ are such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ and $|a|=3, \left|\vec{b}\right|=5$ and $\left|\vec{c}\right|=7$. Find the angle between $\vec{a}$ and $\vec{b}$.

A. $\pi/6$

B. $\pi/4$

C. $\pi/3$

D. $\pi / 2$

Answer: C

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141. $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ such that $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 5$ and $\left|\vec{c}\right| = 7.$ What is $\vec{a} . \vec{b} + \vec{b} . \vec{c} + \vec{c} . \vec{a}$ equal to ?

A. -83

B. $-83 / 2$

C. 75

D. $-75 / 2$

Answer: B

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142. $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ such that $\left|\vec{a}\right|=3, \left|\vec{b}\right|=5$ and $\left|\vec{c}\right|=7.$

What is cosine of the angle between $\vec{b}$ and $\vec{c}$?

A. $11/12$

B. $13/14$

C. $-11/12$

D. $-13/14$

Answer: D

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143. $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ such that $\left|\vec{a}\right|=3, \left|\vec{b}\right|=5$ and $\left|\vec{c}\right|=7.$

What is $\left|\vec{a}+\vec{b}\right|$ equal to ?

A. 7

B. 8

C. 10

D. 11

Answer: A

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144. The adjacent sides AB and AC of a triangle ABC are represented by the vectors $-2\hat{i}+3\hat{j}+2\hat{k}$ and $-4\hat{i}+5\hat{j}+2\hat{k}$ respectively. The area of the triangle ABC is

A. 6 square units

B. 5 square units

C. 4 square units

D. 3 square units

Answer: D

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145. A force $\vec{F} = 3\hat{i} + 4\hat{j} - 3\hat{k}$ is applied at the point P, whose position vector is $\vec{r} = \widehat{2i} - 2\hat{j} - 3\hat{k}$. What is the magnitude of the moment of the force about the origin ?

A. 23 units

B. 19 units

C. 18 units

D. 21 units

Answer: A

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146. Given that the vectors α and β are non-collinear. The values of x and y for which $\vec{u} - \vec{v} = \vec{w}$ holds true if $\vec{u} = 2x\alpha + y\beta$, $\vec{v} = 2y\alpha + 3x\beta$ and $\vec{w} = 2\alpha - 5\beta$ are

A. $x = 2, y = 1$

B. $x = 1, y = 2$

C. $x = -2, y = 1$

D. $x = -2, y = -1$

Answer: A

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147. If $\left|\vec{a}\right| = 7, \left|\vec{b}\right| = 11$ and $\left|\vec{a} + \vec{b}\right| = 10\sqrt{3}$, then $\left|\vec{a} - \vec{b}\right|$ is equal to

A. 40

B. 10

C. $4\sqrt{10}$

D. $2\sqrt{10}$

Answer: D

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148. Let α, β, λ be distinct real numbers. The points with position vectros $\alpha\hat{i} + \beta\hat{j} + \lambda\hat{k}, \beta\hat{i} + \lambda\hat{j} + \alpha\hat{k}$ and $\lambda\hat{i} + \alpha\hat{j} + \beta\hat{k}$

A. are collinear

B. form an equilateral triangle

C. form a scalene triangle

D. form a right-angled triangle

Answer: B

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149. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, then which of the following is/are correct?

1. $\vec{a}, \vec{b}, \vec{c}$ are coplanar.

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

Select the correct answer using the code given below.

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Answer: C

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150. 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 perpendicular to $\vec{b}$

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

Answer: C

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151. The area of the square, one of whose diagonals is $3\hat{i} + 4\hat{j}$ is

A. 12 square unit

B. 12.5 square unit

C. 25 square unit

D. 156.25 square unit

Answer: B

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152. $ABCD$ is parallelogram and P is the point of intersection of its diagonals. If O is the origin of reference, show that $\overrightarrow{O}A + \overrightarrow{O}B + \overrightarrow{O}C + \overrightarrow{O}D = 4\overrightarrow{O}P$.

A. $4\overrightarrow{OP}$

B. $2\overrightarrow{OP}$

C. $\overrightarrow{OP}$

D. Null vector

Answer: A

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153. If $\overrightarrow{b}$ and $\overrightarrow{c}$ are the position vectors of the points B and C respectively, then the position vector of the point D such that $\overrightarrow{BD} = 4\overrightarrow{BC}$ is

A. $4\left(\overrightarrow{c} - \overrightarrow{b}\right)$

B. $-4\left(\overrightarrow{c} - \overrightarrow{b}\right)$

C. $4\overrightarrow{c} - 3\overrightarrow{b}$

D. $4\overrightarrow{c} + 3\overrightarrow{b}$

Answer: C

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154. If the position vector $\vec{a}$ at the point (5,n) is such that $|\vec{a}| = 13$ find the value of n.

A. ± 8

B. ± 12

C. 8 only

D. 12 only

Answer: B

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155. If $\left|\vec{a}\right| = 2$ and $\left|\vec{b}\right| = 3$, then $\left|\vec{a} \times \vec{b}\right|^2 + \left|\vec{a} . \vec{b}\right|^2$ is equal to

A. 72

B. 64

C. 48

D. 36

Answer: D

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156. Consider the following inequalities in respect of vectors $\vec{a}$ and $\vec{b}$:

1. $\left|\vec{a}+\vec{b}\right| £ \left|\vec{a}\right|+\left|\vec{b}\right|$
2. $\left|\vec{a}-\vec{b}\right| 3 \left|\vec{a}\right|-\left|\vec{b}\right|$

Which of the above is/are correct ?

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Answer: C

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157. If the magnitude of difference of two unit vectors is $\sqrt{3}$, then the magnitude of sum of the two vectors is

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

B. 1 unit

C. 2 unit

D. 3 unit

Answer: B

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158. If the vectors $\alpha\hat{i}+\alpha\hat{j}+\lambda\hat{k}, \hat{i}+\hat{k}$ and $\lambda\hat{i}+\lambda\hat{j}+\beta\hat{k}$ lie on a plane, where α, β and λ are distinct non-negative numbers, then λ is

A. Arithmetic mean of α and β

B. Geometric mean of α and β

C. Harmonic mean of α and β

D. None of the above

Answer: B

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159. The vectors $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$ are such that $\vec{a} \times \vec{b} = \vec{c} \times d$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$. Which of the following is/are correct?

1. $\left(\vec{a} - \vec{d}\right) \times \left(\vec{b} - \vec{c}\right) = \vec{0}$
2. $\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) = \vec{0}$

Select the correct answer using the code given below :

A. 1 only

B. 2only

C. Both 1 and 2

D. Neither 1 nor 2

Answer: C

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160. Let $\hat{a}$, $\hat{b}$ be two unit vectors and θ be the angle between them.

What is $\cos\left(\frac{\theta}{2}\right)$ equal to ?

A. $\frac{\left|\hat{a}-\hat{b}\right|}{2}$

B. $\frac{\left|\hat{a}+\hat{b}\right|}{2}$

C. $\frac{\left|\hat{i}-\hat{b}\right|}{4}$

D. $\frac{\left|\hat{a}+\hat{b}\right|}{4}$

Answer: B

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161. Let $\hat{a}$, $\hat{b}$ be two unit vectors and θ be the angle between them.

What is $\sin\left(\frac{\theta}{2}\right)$ equal to ?

A. $\frac{\left|\hat{a}-\hat{b}\right|}{2}$

B. $\frac{\left|\hat{a}+\hat{b}\right|}{2}$

C. $\frac{\left|\hat{i}-\hat{b}\right|}{4}$

D. $\frac{\left|\hat{a}+\hat{b}\right|}{4}$

Answer: A

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162. What is a vector of unit length orthogonal to both the vectors

$\hat{i}+\hat{j}+\hat{k}$ and $2\hat{i}+3\hat{j}-\hat{k}$?

A. $\frac{-4\hat{i}+3\hat{j}-\hat{k}}{\sqrt{26}}$

B. $\frac{-4\hat{i}+3\hat{j}+\hat{k}}{\sqrt{26}}$

C. $\frac{-3\hat{i}+2\hat{j}-\hat{k}}{\sqrt{14}}$

D. $\frac{-3\hat{i}+2\hat{j}+\hat{k}}{\sqrt{14}}$

Answer: B

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163. If $\vec{a}, \vec{b}, \vec{c}$ are the position vectors of the vertices of an equilateral triangle whose orthocenter is at the origin, then

A. $\vec{a}+\vec{a}+\vec{c}=\vec{0}$

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

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

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

Answer: A

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164. What is the area of the parallelogram having diagonals $3\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}-3\hat{j}+4\hat{k}$?

A. $5\sqrt{5}$ square units

B. $4\sqrt{5}$ square units

C. $5\sqrt{3}$ square units

D. $15\sqrt{2}$ square units

Answer: C

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165. Let $\vec{a}=\hat{i}+\hat{j}$, $\vec{b}=3\hat{i}+4\hat{k}$ and $\vec{b}=\vec{c}+\vec{d}$, where $\vec{c}$ is parallel to $\vec{a}$ and $\vec{d}$ is perpendicular to $\vec{a}$.

What is $\vec{c}$ equal to ?

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

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

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

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

Answer: A

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166. Let $\vec{a}=\hat{i}+\hat{j}$, $\vec{b}=3\hat{i}+4\hat{k}$ and $\vec{b}=\vec{c}+\vec{d}$, where $\vec{c}$ is parallel to $\vec{a}$ and $\vec{d}$ is perpendicular to $\vec{a}$.

If $\vec{d}=x\hat{i}+y\hat{j}+z\hat{k}$, then which of the following equations is/are correct ?

1. y-x=4

2. 2z-3=0

Select the correct answer using the code given below:

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Answer: D

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167. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors such that $\vec{a} + \vec{b} + \vec{c} = 0$ and $\left|\vec{a}\right| = 10, \left|\vec{b}\right| = 6$ and $\left|\vec{c}\right| = 14.$

What is $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$. equal to ?

A. -332

B. -166

C. 0

D. 166

Answer: B

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168. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors such that $\vec{a} + \vec{b} + \vec{c} = 0$ and $|\vec{a}| = 10, |\vec{b}| = 6$ and $|\vec{c}| = 14.$

What is the angle between $\vec{a}$ and $\vec{b}$?

A. 30°

B. 45°

C. 60°

D. 75°

Answer: C

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169. If in a right-angled triangle ABC, hypotenuse AC=p, then what is $\overrightarrow{AB}.\overrightarrow{AC} + \overrightarrow{BC}.\overrightarrow{BA} + \overrightarrow{CA}.\overrightarrow{CB}$ equal to ?

A. P, Q, R are the vertices of an equilateral triangle

B. p^2

C. $2p^2$

D. $\frac{p^2}{2}$

Answer: B

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170. Find the moment of $\vec{F}$ about point (2, -1, 3), where force $\vec{F} = 3\hat{i} + 2\hat{j} - 4\hat{k}$ is acting on point (1, -1, 2).

A. $\hat{i} + 4\hat{j} + 4\hat{k}$

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

C. $2\hat{i} - 7\hat{j} - 2\hat{k}$

D. $2\hat{i} + 4\hat{j} - \hat{k}$

Answer: C

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171. If $\vec{a} = \hat{i} - \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + 3\hat{j} + 2\hat{k}$ and $\vec{c} = \hat{i} - m\hat{j} + n\hat{k}$ are three coplanar vectors and $\left|\vec{c}\right| = \sqrt{6}$, then which one of the following is correct?

A. m=2 and n=± 1

B. $m = \pm 2$ and n=-1

C. $m = 2$ and $n = -1$

D. $m = \pm 2$ and $n = 1$

Answer: D

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172. Let $ABCD$ be a p[arallelogram whose diagonals intersect at P and let O be the origin. Then prove that $\vec{O}A + \vec{O}B + \vec{O}C + \vec{O}D = 4\vec{O}P$.

A. $2\overrightarrow{OP}$

B. $4\overrightarrow{OP}$

C. $6\overrightarrow{OP}$

D. $8\overrightarrow{OP}$

Answer: B

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173. ABCD is a quadrilateral whose diagonals are AC and BD. Which one of the following is correct?

A. $\overrightarrow{BA} + \overrightarrow{CD} = \overrightarrow{AC} + \overrightarrow{DB}$

B. $\overrightarrow{BA} + \overrightarrow{CD} = \overrightarrow{BD} + \overrightarrow{CA}$

C. $\overrightarrow{BA} + \overrightarrow{CD} = \overrightarrow{AC} + \overrightarrow{BD}$

D. $\overrightarrow{BA} + \overrightarrow{CD} = \overrightarrow{BC} + \overrightarrow{AD}$

Answer: B

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174. If $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{b} \times \vec{c} = \vec{a}$, then which one of the following is correct?

A. $\vec{a}, \vec{b}, \vec{c}$ are orthogonal in pairs and $\left|\vec{a}\right| = \left|\vec{c}\right|$ and $\left|\vec{b}\right| = 1$

B. $\vec{a}, \vec{b}, \vec{c}$ are non-orthogonal to each other

C. $\vec{a}, \vec{b}, \vec{c}$ are orthogonal in pairs but $\left|\vec{a}\right| \neq \left|\vec{c}\right|$

D. $\vec{a}, \vec{b}, \vec{c}$ are orthogonal is pairs but $\left|\vec{b}\right| \neq 1$

Answer: A

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175. If $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{b} = 3\hat{i} + 2\hat{j} - \lambda\hat{k}$ are perpendicular, then what is the value of λ ?

A. 2

B. 3

C. 4

D. 5

Answer: B

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176. If α, β and λ are the angles which the vector $\overrightarrow{OP}$ (O being the origin) makes with positive direction of the coordinate axes, then which of the following are correct?

1. $\cos^2\alpha + \cos^2\beta = \sin^2\lambda$

2. $\sin^2\alpha + \sin^2\beta = \cos^2\lambda$

3. $\sin^2\alpha + \sin^2\beta + \sin^2\lambda = 2$

Select the correct answer using the code given below.

A. 1 and 2 only

B. 2 and 3 only

C. 1 and 3 only

D. 1,2 and 3

Answer: C

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177. Let $\vec{\alpha} = \hat{i} + 2\hat{j} - \hat{k}, \vec{\beta} = 2\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{\lambda} = 2\hat{i} + \hat{j} + 6\hat{k}$ be three vectors. If $\vec{\alpha}$ and $\vec{\beta}$ are both perpendicular to the vector $\vec{\delta}$ and $\vec{\delta} . \vec{\lambda} = 10$, then what is the magnitude of $\vec{\delta}$?

A. $\sqrt{3}$ units

B. $2\sqrt{3}$ units

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

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

Answer: B

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178. If $\hat{a}$ and $\hat{b}$ are two unit vectors, then the vector $\left(\hat{a}+\hat{b}\right)\times\left(\hat{a}\times\hat{b}\right)$ is parallel to

A. $\left(\hat{a}-\hat{b}\right)$

B. $\left(\hat{a}+\hat{b}\right)$

C. $\left(2\hat{a}-\hat{b}\right)$

D. $\left(2\hat{a}+\hat{b}\right)$

Answer: A

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179. A force $\vec{F}=\hat{i}+3\hat{j}+2\hat{k}$ acts on a particle to displace it from the point A $\left(\hat{i}+2\hat{j}-3\hat{k}\right)$ to the point $B\left(3\hat{i}-\hat{j}+5\hat{k}\right)$. The work done by the force will be

A. 5 units

B. 7 units

C. 9 units

D. 10 units

Answer: C

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180. 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. $4\left|\vec{a}\right|^2$

Answer: B

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181. If the vectors $a\hat{i}+\hat{j}+\hat{k}, \hat{i}+b\hat{j}+\hat{k}$ and $\hat{i}+\hat{j}+c\hat{k}(a,b,c,\neq 1)$ are coplanar, then the value of $\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}$ is equal to

A. 0

B. 1

C. a+b+c

D. abc

Answer: B

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182. If $\left|\vec{a}\right|=2, \left|\vec{b}\right|=7 \, and \, \vec{a}\times\vec{b}=3\hat{i}+2\hat{j}+6\hat{k}$, find the angle between $\vec{a} \, and \, \vec{b}$.

A. 30°

B. 45°

C. 60°

D. 90°

Answer: A

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183. Let p and q be the position vectors of P and Q respectively with respect to O and $|p| = p$, $|q| = q$. The points R and S divide PQ internally and externally in the ratio 2 : 3 respectively. If $\overrightarrow{OR}$ and $\overrightarrow{OS}$ are perpendicular, then (A) $9p^2 = 4q^2$ (B) $4p^2 = 9q^2$ (C) $9p = 4q$ (D) $4p = 9q$

A. $9p^2 = 4q^2$

B. $4p^2 = 9p^2$

C. $9p = 4q$

D. $4p = 9q$

Answer: A

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184. What is the moment about the point $\hat{i} + 2\hat{j} - \hat{k}$ of a force represented by $3\hat{i} + \hat{k}$ acting through the point $2\hat{i} - \hat{j} + 3\hat{k}$?

A. $-3\hat{i} + 11\hat{j} + 9\hat{k}$

B. $3\hat{i} + 2\hat{j} + 9\hat{k}$

C. $3\hat{i} + 4\hat{j} + 9\hat{k}$

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

Answer: A

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185. If $\vec{a} + 2\vec{b} + 3\vec{c} = \vec{0}$ and $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} = \lambda\left(\vec{b} \times \vec{c}\right)$, then what is the value of λ ?

A. 2

B. 3

C. 4

D. 6

Answer: D

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186. If the vectors $\vec{k}$ and $\vec{A}$ are parallel to each other, what is $k\vec{k} \times \vec{A}$ equal to ?

A. $k^2\vec{A}$

B. $\vec{0}$

C. $-k^2\vec{A}$

D. $\vec{A}$

Answer: B

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187. Let $\left|\vec{a}\right| = 0, \left|\vec{b}\right| = 0$

$\left(\vec{a} + \vec{b}\right).\left(\vec{a} + \vec{b}\right) = \left|\vec{a}\right|^2 + \left|\vec{b}\right|^2$ holds if and only if

A. $\vec{a}$ and $\vec{b}$ are perpendicular

B. $\vec{a}$ and $\vec{b}$ are parallel

C. $\vec{a}$ and $\vec{b}$ are inclined at an angle of 45°

D. $\vec{a}$ and $\vec{b}$ are anti-parallel

Answer: A

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188. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, then what is $\vec{r}.\left(\hat{i} + \hat{j} + \hat{k}\right)$ equal to?

A. x

B. x+y

C. $-(x+y+z)$

D. $(x+y+z)$

Answer: D

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189. A unit vector perpendicular to each of the vectors $2\hat{i}-\hat{j}+\hat{k}$ and $3\hat{i}-4\hat{j}-\hat{k}$ is

A. $\frac{1}{\sqrt{3}}\hat{i}+\frac{1}{\sqrt{3}}\hat{j}-\frac{1}{\sqrt{3}}\hat{k}$

B. $\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{2}\hat{j}+\frac{1}{2}\hat{k}$

C. $\frac{1}{\sqrt{3}}\hat{i}-\frac{1}{\sqrt{3}}\hat{j}-\frac{1}{\sqrt{3}}\hat{k}$

D. $\frac{1}{\sqrt{3}}\hat{i}+\frac{1}{\sqrt{3}}\hat{j}+\frac{1}{\sqrt{3}}\hat{k}$

Answer: A

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190. If $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 4$ and $\left|\vec{a} - \vec{b}\right| = 5$, then what is the value of $\left|\vec{a} + \vec{b}\right| = ?$

A. 8

B. 6

C. $5\sqrt{2}$

D. 5

Answer: D

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191. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three mutually perpendicular vectors each of unit magnitud. If $\vec{A} = \vec{a} + \vec{b} + \vec{c}, \vec{B} = \vec{a} - \vec{b} + \vec{c}$ and $\vec{C} = \vec{a} - \vec{b} - \vec{c}$, then which one of the following is correct?

A. $\left|\vec{A}\right| > \left|\vec{B}\right| > \left|\vec{C}\right|$

B. $\left|\overrightarrow{A}\right| = \left|\overrightarrow{B}\right| \neq \left|\overrightarrow{C}\right|$

C. $\left|\overrightarrow{A}\right| = \left|\overrightarrow{B}\right| = \left|\overrightarrow{C}\right|$

D. $\left|\overrightarrow{A}\right| \neq \left|\overrightarrow{B}\right| \neq \left|\overrightarrow{C}\right|$

Answer: C

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192. What is $\left(\overrightarrow{a} - \overrightarrow{b}\right) \times \left(\overrightarrow{a} + \overrightarrow{b}\right)$ equal to?

A. $\overrightarrow{0}$

B. $\overrightarrow{a} \times \overrightarrow{b}$

C. $2\left(\overrightarrow{a} \times \overrightarrow{b}\right)$

D. $\left|\overrightarrow{a}\right|^2 - \left|\overrightarrow{b}\right|^2$

Answer: C

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193. A spacecraft at $\hat{i} + 2\hat{j} + 3\hat{k}$ is subjected to a force $\lambda\hat{k}$ by firing a rocket. The spacecraft is subjected to a moment of magnitude

A. λ

B. $\sqrt{3}\lambda$

C. $\sqrt{5}\lambda$

D. None of these

Answer: C

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194. In a triangle ABC, if taken in order, consider the following statements:

1. $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = \overrightarrow{0}$

2. $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{CA} = \overrightarrow{0}$

3. $\overrightarrow{AB} - \overrightarrow{BC} + \overrightarrow{CA} = \overrightarrow{0}$

4. $\overrightarrow{BA} - \overrightarrow{BC} + \overrightarrow{CA} = \overrightarrow{0}$

How many of the above statements are correct?

A. One

B. Two

C. Three

D. Four

Answer: A

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195. If $\overrightarrow{a} = \hat{i} - 2\hat{j} + 5\hat{k}$ and $\overrightarrow{b} = 2\hat{i} + \hat{j} - 3\hat{k}$ then what is $\left(\overrightarrow{b} - \overrightarrow{a}\right).\left(3\overrightarrow{a} + \overrightarrow{b}\right)$ equal to ?

A. 106

B. -106

C. 53

D. -53

Answer: B

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196. If the position vectors of points A and B are $3\hat{i} - 2\hat{j} + \hat{k}$ and $2\hat{i} + 4\hat{j} - 3\hat{k}$ respectively, then what is the length of $\overrightarrow{AB}$?

A. $\sqrt{14}$

B. $\sqrt{29}$

C. $\sqrt{43}$

D. $\sqrt{53}$

Answer: D

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197. If in a right-angled triangle ABC, hypotenuse AC=p, then what is $\overrightarrow{AB}.\overrightarrow{AC}+\overrightarrow{BC}.\overrightarrow{BA}+\overrightarrow{CA}.\overrightarrow{CB}$ equal to ?

A. p^2

B. $2p^2$

C. $\frac{p^2}{2}$

D. p

Answer: A

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198. The sine of the angle between vectors $\overrightarrow{a}=2\hat{i}-6\hat{j}-3\hat{k}$ and $\overrightarrow{b}=4\hat{i}+3\hat{j}-\hat{k}$

A. $\frac{1}{\sqrt{26}}$

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

C. $\frac{5}{26}$

D. $\frac{1}{26}$

Answer: B

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199. What is the value of λ for which the vectors $3\hat{i}+4\hat{j}-\hat{k}$ and $-2\hat{i}+\lambda\hat{j}+10\hat{k}$ are perpendicular?

A. 1

B. 2

C. 3

D. 4

Answer: D

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