MATHS

BOOKS - RS AGGARWAL MATHS (HINGLISH)

PRODUCT OF THREE VECTORS

Solved Examples

1. Prove that $\left[\hat{i}\hat{j}\hat{k}\right] = 1,$ and $\left[\hat{i}\hat{k}\hat{j}\right] = -1.$

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2. If $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k},\ \vec{b} = -\hat{i} + 2\hat{j} + \hat{k},$ and $\vec{c} = -3\hat{i} + \hat{j} + 2\hat{k},$ find $\left[\hat{a}\hat{b}\hat{c}\right].$

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3. Find the volume of the parallelepiped whose coterminous edges are represented by the vectors

$\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}, \vec{b} = \hat{i} - \hat{j} + 2\hat{k}$ and $\vec{c} = 2\hat{i} + \hat{j} - \hat{k}.$

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4. Show that the vectors

$\hat{i} - 3\hat{j} + 4\hat{k}, 2\hat{i} - \hat{j} + 2\hat{k}$ and $4\hat{i} - 7\hat{j} + 10\hat{k}$ are coplanar.

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5. Find the value of λ so that the vectors

$\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}, \vec{b} = \hat{i} + 2\hat{j} - 3\hat{k} and \vec{c} = \hat{j} + \lambda\hat{k}$ are coplanar.

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6. Show that the four points A, B, C and D with position vectors $4\hat{i}+5\hat{j}+\hat{k},\ -\left(\hat{j}+\hat{k}\right), 3\hat{j}+9\hat{j}+4\hat{k}\ and\ 4\left(\hat{i}+\hat{j}+\hat{k}\right),$ respectively are coplanar.

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7. Find the value of λ so that the four points with position vectors $\left(-6\hat{i}+3\hat{j}+2\hat{k}\right), \left(3\hat{i}+\lambda\hat{j}+4\hat{k}\right), \left(5\hat{i}+7\hat{j}+3\hat{k}\right)$ and $\left(-13\hat{i}+17\hat{j}\right.$ are coplanar.

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8. Show that the points $A(-1,\ 4,\ -3),\ B(3,\ 2,\ -5),\ C(-3,\ 8,\ -5)and\ D(-3,\ 2,\ 1)$ are coplanar.

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Exercise 25 A

1. Prove that

(i) $\left[\hat{i}\hat{j}\hat{k}\right] = \left[\hat{j}\hat{k}\hat{i}\right] = \left[\hat{k}\hat{j}\hat{i}\right] = 1$

(ii) $\left[\hat{i}\hat{k}\hat{j}\right] = \left[\hat{k}\hat{j}\hat{i}\right] = \left[\hat{j}\hat{i}\hat{k}\right] = 1$

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2. Find $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$, when

$(i)\ \vec{a} = 2\hat{i} + \hat{j} + 3\hat{k},\ \vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j} + 2\hat{k}$

(ii) $\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k},\ \vec{b} = \hat{i} + 2\hat{j} - \hat{k}$ and $\vec{c} = 3\hat{i} - \hat{j} + 2\hat{k}$

(iii) $\vec{a} = 2\hat{i} - 3\hat{j},\ \vec{b} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = 3\hat{i} - \hat{k}$

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3. Find the volume of the parallelepiped whose coterminous edges are represented by the vectors

(i) $\vec{a} = \hat{i} + \hat{j} + \hat{k},\ \vec{b} = \hat{i} - \hat{j} + \hat{k},\ \vec{c} = \hat{i} + 2\hat{j} - \hat{k}$

(ii) $\vec{a} = -3\hat{i} + 7\hat{j} + 5\hat{k}, \vec{b} = -5\hat{i} + 7\hat{j} - 3\hat{k}, \vec{c} = 7\hat{i} - 5\hat{j} - 3\hat{k}$

(iii) $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = 2\hat{i} + \hat{j} - \hat{k}, \vec{c} = \hat{j} + \hat{k}$

(iv) $\vec{a} = 6\hat{i}, \vec{b} = 2\hat{j}, \vec{c} = 5\hat{k}$

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4. Show that the vectors $\vec{a}, \vec{b}, \vec{c}$ are coplanar, when

(i) $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = -2\hat{i} + 3\hat{j} - 4\hat{k}$ and $\vec{c} = \hat{i} - 3\hat{j} + 5\hat{k}$

(ii) $\vec{a} = \hat{i} + 3\hat{j} + \hat{k}, \vec{b} = 2\hat{i} - \hat{j} - \hat{k}$ and $\vec{c} = 7\hat{j} + 3\hat{k}$

(iii) $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}, \vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{c} = 3\hat{i} - 4\hat{j} + 7\hat{k}$

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5. Find the value of λ for which the vectors $\vec{a}, \vec{b}, \vec{c}$ are coplanar, where

(i) $\vec{a} = \left(2\hat{i} - \hat{j} + \hat{k}\right), \vec{b} = \left(\hat{i} + 2\hat{j} + 3\hat{k}\right)$ and $\vec{c} = \left(3\hat{i} + \lambda\hat{j} + 5\hat{k}\right)$

(ii) $\vec{a}\lambda\hat{i} - 10\hat{j} - 5k^2, \vec{b} = -7\hat{i} - 5\hat{j}$ and $\vec{c} = \hat{i} - -4\hat{j} - 3\hat{k}$

(iii) $\vec{a} = \hat{i} - \hat{j} + \hat{k}, \vec{b} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = \lambda\hat{i} - \hat{j} + \lambda\hat{k}$

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6. If $\vec{a} = \left(2\hat{i} - \hat{j} + \hat{k}\right)$, $\vec{b} = \left(\hat{i} - 3\hat{j} - 5\hat{k}\right)$ and $\vec{c} = \left(3\hat{i} - 4\hat{j} - \hat{k}\right)$, find $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$ and interpret the result.

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7. The volume of the parallelepiped whose edges are $\left(-12\hat{i} + \lambda\hat{k}\right)$, $\left(3\hat{j} - \hat{k}\right)$ and $\left(2\hat{i} + \hat{j} - 15\hat{k}\right)$ is 546 cubic units. Find the value of λ.

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8. Show that the vectors $\vec{a} = \left(\hat{i} + 3\hat{j} + \hat{k}\right)$, $\vec{b} = \left(2\hat{i} - \hat{j} - \hat{k}\right)$ and $\vec{c} = \left(7\hat{j} + 3\hat{k}\right)$ are parallel to the same plane. {HINT : Show that $\left[\vec{a}\ \vec{b}\ \vec{c}\right] = 0$}

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9. If the vectors $\left(a\hat{i}+a\hat{j}+c\hat{k}\right)$, $\left(\hat{i}+\hat{k}\right)$ and $\left(c\hat{i}+c\hat{j}+b\hat{k}\right)$ be coplanar, show that $c^2=ab$.

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10. Show that the four points with position vectors $4\hat{i}+8\hat{j}+12\hat{k},\ 2\hat{i}+4\,\hat{j}+6\hat{k}, 3\hat{i}+5\,\hat{j}+4\hat{k}\ and\ 5\hat{i}+8\,\hat{j}+5\hat{k}$are coplanar.

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11. Show that the four points having position vectors $6\hat{i}-7\hat{j}, 16\hat{i}-19\hat{j}-4\hat{k}, 3\hat{j}-6\hat{k}, 2\hat{i}+5\hat{j}+10\hat{k}$ are not coplanar.

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12. Find the value of λ for which the four points with position vectors $\left(\hat{i}+2\hat{j}+3\hat{k}\right)$, $\left(3\hat{i}-\hat{j}+2\hat{k}\right)$, $\left(-2\hat{i}+\lambda\hat{j}+\hat{k}\right)$ and $\left(6\hat{i}-4\hat{j}+2\hat{k}\right)$

are coplanar.

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13. Find the value of λ for which the four points with position vectors $\left(-\hat{j}+\hat{k}\right), \left(2\hat{i}-\hat{j}-\hat{k}\right), \left(\hat{i}+\lambda\hat{j}+\hat{k}\right)$ and $\left(3\hat{j}+3\hat{k}\right)$ are coplanar.

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14. Show that the point (0, -1, -1), (4 5, 1), (3, 9, 4) and (-4, 4, 4) are coplanar and find the equation of the common plane.

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15. Find λ for which the points $A(3,\ 2,\ 1),\ B(4,\ \lambda,\ 5),\ C(4,\ 2,\ -2)\ and\ D(6,\ 5,\ -1)$ are coplanar.

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Exercise 25 B

1. If $\vec{a} = x\hat{i} + 2\hat{j} - z\hat{k}$ and $\vec{b} = 3\hat{i} - y\hat{j} + \hat{k}$ are two equal vectors, then write the value of $x + y + z$.

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2. Write a unit vector in the direction of the sum of the vectors $\vec{a} = 2\hat{i} + 2\hat{j} - 5\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} - 7\hat{k}$.

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3. For what value λ are the vectors $\vec{a} = 2\hat{i} + \lambda\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 3\hat{k}$ perpendicular to each other?

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4. Find the value of $'p'$ for which the vectors $3\hat{i}+2\hat{j}+9\hat{k}\ and\ \hat{i}-2p\hat{j}+3\hat{j}+3\hat{k}$ are parallel.

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5. Find λ, when the projection of $\vec{a}=\lambda\hat{i}+\hat{j}+4\hat{k}\ on\ \vec{b}=2\hat{i}+6\hat{j}+3\hat{k}\ is\ 4$ units.

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6. If $\vec{a}$ and $\vec{b}$ are perpendicular vectors such that $\left|\vec{a}+\vec{b}\right|=13$ and $\left|\vec{a}\right|=5$, find the value of $\left|\vec{b}\right|$.

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7. Find $\left|\vec{x}\right|$, if for a unit vector $\vec{a}$, $\left(\vec{x}-\vec{a}\right)\vec{x}\cdot\vec{a}=15.$

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8. Find the sum of the vectors $\vec{a} = \left(\hat{i} - 3\hat{k}\right), \vec{b} = \left(2\hat{j} - \hat{k}\right)$ and $\vec{c} = \left(2\hat{i} - 3\hat{j} + 2\hat{k}\right)$.

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9. Find the sum of the following vectors $\vec{a} = \hat{i} - 2\hat{j}, \vec{b} = 2\hat{i} - 3\hat{j}, \vec{c} = 2\hat{i} + 3\hat{k}$.

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10. Writhe the projection of the vector $7\hat{i} + \hat{j} - 4\hat{k}$ on the vector $2\hat{i} + 6\hat{j} + 3\hat{k}$.

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11. Find $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$, when

$(i)\ \vec{a} = 2\hat{i} + \hat{j} + 3\hat{k},\ \vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j} + 2\hat{k}$

(ii) $\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k},\ \vec{b} = \hat{i} + 2\hat{j} - \hat{k}$ and $\vec{c} = 3\hat{i} - \hat{j} + 2\hat{k}$

(iii) $\vec{a} = 2\hat{i} - 3\hat{j},\ \vec{b} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = 3\hat{i} - \hat{k}$

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12. Find $\left[\vec{a}\ \vec{b}\ \vec{c}\right]$, when

$(i)\ \vec{a} = 2\hat{i} + \hat{j} + 3\hat{k},\ \vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j} + 2\hat{k}$

(ii) $\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k},\ \vec{b} = \hat{i} + 2\hat{j} - \hat{k}$ and $\vec{c} = 3\hat{i} - \hat{j} + 2\hat{k}$

(iii) $\vec{a} = 2\hat{i} - 3\hat{j},\ \vec{b} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = 3\hat{i} - \hat{k}$

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13. Find a vector in the direction of vector $2\hat{i} - 3\hat{j} + 6\hat{k}$ which has magnitude 21 units.

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14. If $\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$ then $\vec{a} + t\vec{b}$ is perpendicular to $\vec{c}$ if t =

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15. Write a vector of magnitude 15 units in the direction of vecor $\left(\hat{i} - 2\hat{j} + 2\hat{k}\right)$.

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16. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 4\hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{c} = \hat{i} - 2\hat{j} + \hat{k}$, find a vector of magnitude 6 units which is parallel to the vector $2\vec{a} - \vec{b} + 3\vec{\cdot}$

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17. Write the projection of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$

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18. Writhe the angle between two vectors $\vec{a}\ and\ \vec{b}\backslash$ with magnitudes $\sqrt{3}\ and\ 2$ repsectively having $\vec{a}\dot{\vec{b}} = \sqrt{6}$.

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19. Find $\left|\vec{a} \times \vec{b}\right|$, if $\vec{a} = \hat{i} - 7\hat{j} + 7\hat{k} and\ \vec{b} = 3\hat{i} - 2\hat{j} + 2\hat{k}$.

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20. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes 1 and 2 respectively and $\left|\vec{a} \times \vec{b}\right| = \sqrt{3}$.

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21. Given that $\rightarrow a \cdot \rightarrow b = 0$ and $\rightarrow a \times \rightarrow b = \rightarrow 0$. What can you conclude about the vectors $\rightarrow a$ and $\rightarrow b$.

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22. Write the value of p for which $\vec{a} = 3\hat{i} + 2\hat{j} + 9\hat{k}\ and\ \vec{b} = \hat{i} + p\hat{j} + 3\hat{k}$ are parallel vectors.

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23. Write the value of $\hat{i}.\left(\hat{j} \times \hat{k}\right) + \hat{j}.\left(\hat{i} \times \hat{k}\right) + \hat{k}.\left(\hat{i} \times \hat{j}\right)$.

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24. Find the volume of the parallelepiped whose edges are represented by the vectors $\vec{a} = \left(2\hat{i} - 3\hat{j} + 4\hat{k}\right), \vec{b} = \left(\hat{i} + 2\hat{j} - \hat{k}\right)$ and $\vec{c} = \left(3\hat{i} - \hat{j} + 2\hat{k}\right)$.

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25. Show that the vectors $\vec{a} = -2\hat{i} - 2\hat{j} + 4\hat{k}, \vec{b} = -2\hat{i} + 4\hat{j} - 2\hat{k}\ and\ \vec{c} = 4\hat{i} - 2\hat{j} - 2\hat{k}$ are coplanar.

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26. If $\vec{a} = \left(2\hat{i} + 6\hat{j} + 27\hat{k}\right)$ and $\vec{b} = \left(\hat{i} + \lambda(j) + \mu\hat{k}\right)$ are such that $\vec{a} \times \vec{b} = \vec{0}$ then find the values of λ and μ.

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27. If $\left|\vec{a} \times \vec{b}\right| = \left|\vec{a}.\vec{b}\right|$, then find angle between $\vec{a}$ and $\vec{b}$

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28. When does $\left|\vec{a}+\vec{b}\right| = \left|\vec{a}\right| + \left|\vec{b}\right|$ hold?

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29. Find the direction cosines of a vector which is equally inclined to the x-axis, y-axis and z-axis.

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30. If $P \equiv (1, 5, 4)$ and $Q \equiv (4, 1, -2)$ find the direction ratios of $\overrightarrow{PQ}$

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31. Find the direction cosines of the vector $\hat{i} + 2\hat{j} + 3\hat{k}$.

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32. If $\hat{a}$ and $\hat{b}$ are unit vectors such that $\left(\hat{a}+\hat{b}\right)$ is a unit vector, what is the angle between $\hat{a}$ and $\hat{b}$?

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Objective Questions

1. Find a unit vector in the direction of $\vec{a} = 2\hat{i} - 3\hat{j} + 6\hat{k}$

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

B. $\left(\frac{2}{5}\hat{i} - \frac{3}{5}\hat{j} + \frac{6}{5}\hat{k}\right)$

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

D. none of these

Answer: C

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2. Write the direction cosines of the vector $-2\hat{i}+\hat{j}-5\hat{k}$

A. $-2, 1, -5$

B. $\frac{1}{3}, \frac{-1}{6}, \frac{-5}{6}$

C. $\frac{2}{\sqrt{30}}, \frac{1}{\sqrt{30}}, \frac{5}{\sqrt{30}}$

D. $\frac{-2}{\sqrt{30}}, \frac{1}{\sqrt{30}}, \frac{-5}{\sqrt{30}}$

Answer: D

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3. If $A(1, 2, -3)$ and $B(-1, -2, 1)$ are the two given points in space then find (i) the direction ratios of $\overrightarrow{AB}$ and (ii) the direction cosines of $\overrightarrow{AB}$. Express $\overrightarrow{AB}$ in terms of $\hat{i}$, $\hat{j}$ and $\hat{k}$.

A. $-2, -4, 4$

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

C. $\frac{-1}{3}, \frac{-2}{3}, \frac{2}{3}$

D. none of these

Answer: C

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4. If a vector makes angle α, β, γ with OX, OY and OZ respectively, then write the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$

A. 1

B. 2

C. 0

D. 3

Answer: B

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5. The vector $(\cos\alpha\cos\beta)\hat{i}+(\cos\alpha s\in\beta)\hat{j}+(s\in\alpha)\hat{k}$ is a a. null vector b. unit vector c. constant vector d. none of these

A. null vector

B. unit vector

C. a constant vector

D. none of these

Answer: B

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6. What is the angle which the vector $\left(\hat{i}+\hat{j}+\sqrt{2}\hat{k}\right)$ makes with the z-axis ?

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

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

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

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

Answer: A

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7. If $\vec{a}$ and $\vec{b}$ are vectors such that $\left|\vec{a}\right| = \sqrt{3}, \left|\vec{b}\right| = 2$ and $\vec{a}.\vec{b} = \sqrt{6}$ then the angle between $\vec{a}$ and $\vec{b}$ is

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

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

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

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

Answer: C

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8. If $\vec{a}$ and $\vec{B}$ are two vectors such that $\left|\vec{a}\right| = \left|\vec{b}\right| = \sqrt{2}$ and $\vec{a}.\vec{b} = -1$, find the angle between $\vec{a}$ and $\vec{b}$.

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

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

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

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

Answer: D

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9. Find the angle between the vectors $\hat{i} - 2\hat{j} + 3\hat{k} and 3\hat{i} - 2\hat{j} + \hat{k}$.

A. $\cos^{-1}.\frac{5}{7}$

B. $\cos^{-1}.\frac{3}{5}$

C. $\cos^{-1}.\frac{3}{\sqrt{14}}$

D. none of these

Answer: A

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10. If $\vec{a} = \left(\hat{i} + 2\hat{j} - 3\hat{k}\right)$ and $\vec{b} = \left(3\hat{i} - \hat{j} + 2\hat{k}\right)$ then the angle between $\left(\vec{a} + \vec{b}\right)$ and $\left(\vec{a} - \vec{b}\right)$ is

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

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

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

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

Answer: C

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11. If $\vec{a} = \left(\hat{i} + 2\hat{j} - 3\hat{k}\right)$ and $\vec{b} = \left(3\hat{i} - \hat{j} + 2\hat{k}\right)$ then calculate the angle between $\left(2\vec{a} + \vec{b}\right)$ and $\left(\vec{a} + 2\vec{b}\right)$.

A. $\cos^{-1}\left(\frac{21}{50}\right)$

B. $\cos^{-1}\left(\frac{31}{50}\right)$

C. $\cos^{-1}\left(\frac{11}{30}\right)$

D. none of these

Answer: B

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12. If $\vec{a} = \left(2\hat{i} + 4\hat{j} - k^2\right)$ and $\vec{b} = \left(3\hat{i} - 2\hat{j} + \lambda\hat{k}\right)$ be such that $\vec{a} \perp \vec{b}$ then $\lambda = ?$

A. 2

B. -2

C. 3

D. -3

Answer: B

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13. What is the projection of $\vec{a} = \left(2\hat{i} - \hat{j} + \hat{k}\right)$ on $\vec{b} = \left(\hat{i} - 2\hat{j} + \hat{k}\right)$?

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

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

C. $\frac{5}{\sqrt{6}}$

D. none of these

Answer: C

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14. If $\left|\vec{a} + \vec{b}\right| = \left|\vec{a} - \vec{b}\right|$, then

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

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

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

D. none of these

Answer: C

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15. If $\vec{a}$ and $\vec{b}$ are mutually perpendicular unit vectors then $\left(3\vec{a} + 2\vec{b}\right).\left(5\vec{a} - 6\vec{b}\right) = ?$

A. 3

B. 5

C. 6

D. 12

Answer: A

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16. If the vectors $\overrightarrow{a} = 3\hat{i} + \hat{j} - 2\hat{k}$ and $\overrightarrow{b} = \hat{i} + \lambda\hat{j} - 3\hat{k}$ are perpendicular to each other then $\lambda = ?$

A. -3

B. -6

C. -9

D. -1

Answer: C

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17. If θ is the angle between two unit vectors $\widehat{a}$ and $\hat{b}$ then $\frac{1}{2}\left|\widehat{a} - \hat{b}\right| = ?$

A. $\cos. \frac{\theta}{2}$

B. $\sin. \frac{\theta}{2}$

C. $\tan. \frac{\theta}{2}$

D. none of these

Answer: B

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18. If $\vec{a} = \left(\hat{i} - \hat{j} + 2\hat{k}\right)$ and $\vec{b} = \left(2\hat{i} + 3\hat{j} - 4\hat{k}\right)$ then $\left|\vec{a} \times \vec{b}\right| = ?$

A. $\sqrt{174}$

B. $\sqrt{84}$

C. $\sqrt{93}$

D. none of these

Answer: C

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19. If $\vec{a} = \left(\hat{i} - 2\hat{j} + 3\hat{k}\right)$ and $\vec{b} = \left(\hat{i} - 3\hat{k}\right)$ then $\left|\vec{b} \times 2\vec{a}\right| = ?$

A. $10\sqrt{3}$

B. $5\sqrt{17}$

C. $4\sqrt{19}$

D. $2\sqrt{23}$

Answer: C

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

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

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

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

Answer: A

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21. If $\left|\overrightarrow{a}\right| = \sqrt{26}, \left|\overrightarrow{b}\right| = 7$ and $\left|\overrightarrow{a} \times \overrightarrow{b}\right| = 35,$ then $\overrightarrow{a} \cdot \overrightarrow{b} =$

A. 5

B. 7

C. 13

D. 12

Answer: B

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22. Find the area of a parallelogram whose adjacent sides are given by the vectors $\rightarrow a = 3\hat{i} + \hat{j} + 4\hat{k}$and $\rightarrow b = \hat{i} - \hat{j} + \hat{k}.$

A. $\sqrt{42}$ sq units

B. 6 sq units

C. $\sqrt{35}$sq units

D. none of these

Answer: A

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23. Find the area a parallelogram whose diagonals are $\vec{a} = 3\hat{i} + \hat{j} - 2\hat{k} and \vec{b} = \hat{i} - 3\hat{j} + 4\hat{k}.$

A. $7\sqrt{3}$ sq units

B. $5\sqrt{3}$ sq units

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

D. none of these

Answer: B

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24. Two adjacent sides of a triangle are represented by the vectors $\vec{a} = 3\hat{i} + 4\hat{j}$ and $\vec{b} = -5\hat{i} + 7\hat{j}$. The area of the triangle is

A. 41 sq units

B. 37 sq units

C. $\frac{41}{2}$ sq units

D. none of these

Answer: C

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25. The unit vector normal to the plane containing $\vec{a} = \left(\hat{i} - \hat{j} - \hat{k}\right)$ and $\vec{b} = \left(\hat{i} + \hat{j} + \hat{k}\right)$ is

A. $\left(\hat{j} - \hat{k}\right)$

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

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

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

Answer: C

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

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

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

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

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

Answer: D

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27. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are three mutually perpendicular unit vectors, then prove that $\left|\vec{a}+\vec{b}+\vec{c}\right| = \sqrt{3}$

A. 1

B. $\sqrt{2}$

C. $\sqrt{3}$

D. 2

Answer: C

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28. Prove that

(i) $\left[\hat{i}\hat{j}\hat{k}\right] = \left[\hat{j}\hat{k}\hat{i}\right] = \left[\hat{k}\hat{j}\hat{i}\right] = 1$

(ii) $\left[\hat{i}\hat{k}\hat{j}\right] = \left[\hat{k}\hat{j}\hat{i}\right] = \left[\hat{j}\hat{i}\hat{k}\right] = 1$

A. 0

B. 1

C. 2

D. 3

Answer: B

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29. Find the volume of the parallelepiped whose coterminous edges are represented by the vector: $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}, \ \vec{b} = \hat{i} + 2\hat{j} - \hat{k}, \ \vec{c} = 3\hat{i} - \hat{j} + 2\hat{k}$.

A. 21 cubic units

B. 14 cubic units

C. 7 cubic units

D. none of these

Answer: C

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30. If the volume of a parallelepied having $\vec{a} = \left(5\hat{i} - 4\hat{j} + \hat{k}\right)$, $\vec{b} = \left(4\hat{i} + 3\hat{j} + \lambda\hat{k}\right)$ and $\vec{c} = \left(\hat{i} - 2\hat{j} + 7\hat{k}\right)$ as coterminous edges, is 216 cubic units then the value of λ is

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

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

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

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

Answer: A

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31. It is given that the vectors $\vec{a} = \left(2\hat{i} - 2\hat{k}\right)$, $\vec{b} = \hat{i} + (\lambda + 1)\hat{j}$ and $\vec{c} = \left(4\hat{j} + 2\hat{k}\right)$ are coplanar. Then, the value of λ is

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

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

C. 2

D. 1

Answer: D

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32. Which of the following is meaningless?

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

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

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

D. none of these

Answer: B

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33. Prove that $\vec{A} \cdot \left(\vec{A} \times \vec{B}\right) = 0$

A. 0

B. 1

C. $a^2 b$

D. meaningless

Answer: A

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34. For any three vectors $\vec{a}, \vec{b}, \vec{c}, \left(\vec{a} - \vec{b}\right) \cdot \left(\vec{b} - \vec{c}\right) \times \left(\vec{c} - \vec{a}\right)$ is equal to

A. $2\left[\vec{a}\,\vec{b}\,\vec{c}\right]$

B. 1

C. 0

D. none of these

Answer: C

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