MATHS

BOOKS - KUMAR PRAKASHAN KENDRA MATHS (GUJRATI ENGLISH)

VECTOR ALGEBRA

Practice Work

1. Represent graphically :

(i) A displacement of 50 km., 30° West of Sout.

(ii) A displacement of 70 km., 40° West of North.

(iii) A displacement of 50 km., 45° North of East.

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2. Classify the follwing as scalar and vector quantities :

(i) 5 second (ii) $1000 \text{ cm}(3)$

(iii) 50 m/sec^2 (iv) 10 Newton

(v) 20 m/sec towards north (vi) 15 Kg.

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3. Classify the following gas scalar and vector quantities : (i) Distance (ii) Displacement (iii) Force (iv) Velocity (v) Time (vi) Speed

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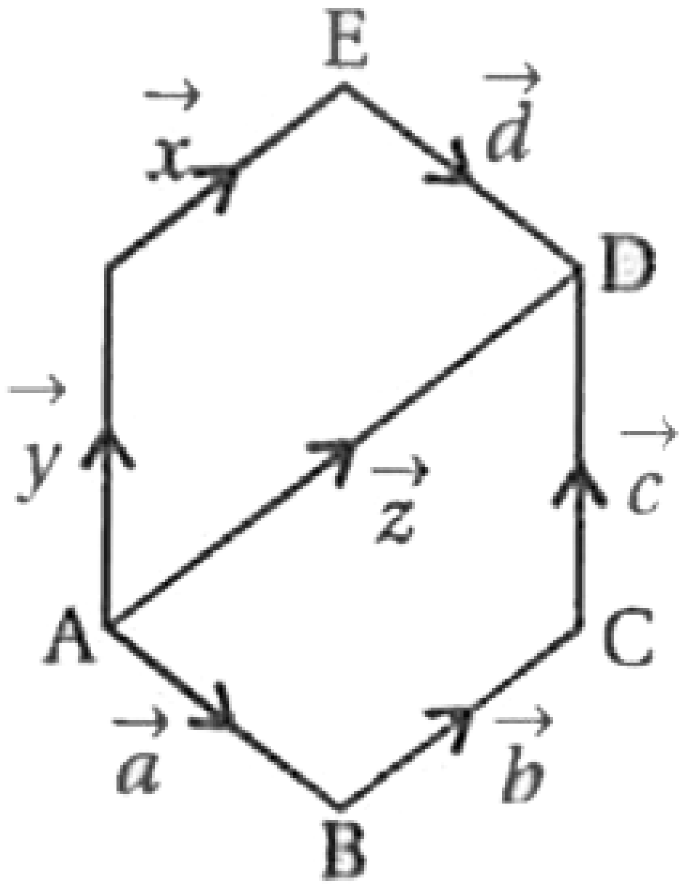
4. If figure, identify the following vectors :

(i) Collinear

(ii) Equal

(iii) Coinitial

(iv) Collinear but not equal



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5. Answer the folliwng as true of false.

(i) $\vec{a}$ and $\vec{a}$ and collinear.

(ii) Zero vector is unique.

(iii) Two collinear vectors with equal magnitude are not equal.

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6. Compute the magnitude of the following vectors :

(i) $\vec{a} = 2\hat{i} + 3\hat{j} + \sqrt{3}\hat{k}$

(ii) $\vec{b} = 3\hat{i} - 4\hat{k}$

(iii) $\vec{c} = \hat{i} + \hat{j} - 4\hat{k}$

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7. Find the unit vector in the direction of the vector $2\hat{i} - 2\hat{j} + \hat{k}$.

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8. Write the scalar and vector components of the vector with initial point (-2, 1, 0) and terminal point (1, -5, 7).

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9. Find a vector in the direction of the vector (3, -2, 2) which has magnitude $2\sqrt{17}$ units.

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10. For given vectors $\vec{a} = 3\hat{i} + 4\hat{j}$ - $5\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j}$ find the unit vectors in the direction of the vector $\vec{a} + 2\vec{b}$.

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11. The position vector of a point A is (3, 4, -5) Find,

(i) Distance of a point A from XY-plane.

(ii) Distance of a point A from X-axis.

(iii) Distance of a point A from origin.

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12. Find a unit vector in the direction of the vector (2, 3, 6).

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13. In $R^3, \vec{x} = (2, 3, 6), \vec{y} = (6, -2, 3)$ and $\vec{z} = (3, 6, -2)$, then find $2\vec{x} + \vec{y} - \vec{z}$.

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14. Find a vector in the opposite direction of a vector $-3\hat{i} + 2\sqrt{3}\hat{j} - 2\hat{k}$ which has magnitude 20 units.

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15. For given vectors, $\vec{a} = \hat{i} + 2\hat{j}$ and $\vec{b} = \hat{i} + 2\hat{k}$, find the unit vector in the direction of the vector $3\vec{a} - 2\vec{b}$.

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16. The position vector of the points A and B are respectively $\vec{a}$ and $\vec{b}$. Find the position vectors of the points which divide AB in trisection.

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17. The position vectors of the points (1, -1) and $(-2, m)$ are $\vec{a}$ and $\vec{b}$ respectively. If $\vec{a}$ and $\vec{b}$ are collinear then find the value of m.

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18. If a vector makes angles α, β and γ with OX, OY and OZ respectively, prove that $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$.

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19. Show that the direction cosines of a vector equally inclined to the axes OX,OY and OZ are $\pm\left(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$

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20. A vector $\vec{r}$ has length 21 and directi9on ratio $2, -3, 6$. Find the direction cosines and components of $\vec{r}$ given that $\vec{r}$ makes an acute angle with X- axis.

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21. If $\vec{a}$ and $\vec{b}$ are non-collinear vectors find the value of x for which vectors $\vec{\alpha} = (x - 2)\vec{a} + \vec{b}$ and $\vec{\beta} = (3 + 2x)\vec{a} - 2\vec{b}$ are collinear.

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22. Prove that the points $\hat{i} - \hat{j}, 4\hat{i} + 3\hat{j} + \hat{k}$ and $2\hat{i} - 4\hat{j} + 5\hat{k}$ are vertices of a right angled triangle.

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23. If $\overrightarrow{PQ} = 3\hat{i} + 2\hat{j} - \hat{k}$ and the co-ordinates of P is (1, -1, 2) then find the co-ordinates of Q.

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24. If A, B, C have position vectors (2, 0, 0), (0, 1, 0) and (0, 0, 2). Show that ΔABC is isosceles.

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25. $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ are adjacent side of a parallelogram then find the unit vector in the direction of the diagonal of the parallelogram.

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

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

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28. If $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{b} = 3\hat{i} - \hat{j} + 2\hat{k}$ then show that $\left(\vec{a} + \vec{b}\right)$ is a perpendicular to the vector $\vec{a} - \vec{b}$.

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

(i) $\vec{a}.\vec{b}$ (ii) $\left(\vec{a} + \vec{b}\right).\vec{c}$

(iii) $\left(\vec{a} - \vec{b}\right).\left(\vec{b} - \vec{c}\right)$

(iv) $\left(\vec{a} + 2\vec{b}\right).\vec{b}$

(v) $\left(\vec{a} - 3\vec{c}\right).\left(2\vec{a} + \vec{b}\right)$

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30. Find 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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31. For two vectors $\vec{a}$ and $\vec{b}$, $\left|\vec{a}\right| = 4$, $\left|\vec{b}\right| = 3$ and $\vec{a}.\vec{b} = 6$ find the angle between $\vec{a}$ and $\vec{b}$.

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32. $\vec{a} = \lambda\hat{i} + 3\hat{j} + 2\hat{k}, \vec{b} = \hat{i} - \hat{j} + 3\hat{k}$. If $\vec{a}$ and $\vec{b}$ are perpendicular to each other then find the value of λ.

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33. $\vec{a} = 3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\vec{b} = \hat{i} + p\hat{j} + 3\hat{k}$. If the vector $\vec{a}$ and $\vec{b}$ are parallel then find the value of P.

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34. If $\hat{i} + \hat{j} + \hat{k}, 2\hat{i} + 5\hat{j}, 3\hat{i} + 2\hat{j} - 3\hat{k}$ and $\hat{i} - 6\hat{j} - \hat{k}$ are position vectors of points A,B,C and D respectively , then find the angle between $\overrightarrow{AB}$ and $\overrightarrow{CD}$. Deduce that $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are collinear.

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35. If $\left(\vec{a} - \vec{b}\right).\left(\vec{a} + \vec{b}\right) = 27$ and $\left|\vec{a}\right| = 2\left|\vec{b}\right|$ the find $\left|\vec{a}\right|$ and $\left|\vec{b}\right|$.

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36. If a unit vector $\vec{a}$ makes angles $\frac{\pi}{3}$ with $\hat{i}$, $\frac{\pi}{4}$ with $\hat{j}$ and an acute angle θ with $\hat{k}$ then find θ and hence , the components of $\vec{a}$.

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37. A unit vector $\vec{a}$ is perpendicualr to the vectors $\hat{i} + 2\hat{j} - \hat{k}$ and $3\hat{i} - \hat{j} + \hat{k}$ then find the components of $\vec{a}$.

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38. Find the values of 'a' for which the vector $\vec{r} = \left(a^2 - 4\right)\hat{i} + 2\hat{j} - \left(a^2 - 9\right)\hat{k}$ makes acute angles with the co-ordinate axes.

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39. Find the angles which the vector $\vec{a} = \hat{i} - \hat{j} + \sqrt{2}\hat{k}$ makes with the co-ordinate axes.

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40. Dot product of a vector $\vec{a}$ with $\hat{i} + \hat{j} - 3\hat{k}, \hat{i} + 3\hat{j} - 2\hat{k}$ and $2\hat{i} + \hat{j} + 4\hat{k}$ are 0, 5 and 8 respectively. Find the vector.

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41. If $\left|\vec{a}\right| = 2, \left|\vec{b}\right| = 5$ and $\vec{a}.\vec{b} = 10$ then find $\left|\vec{a} - \vec{b}\right|$.

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42. If $\vec{a} = 5\hat{i} - \hat{j} + 7\hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \lambda\hat{k}$. If $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicualr to each other then find the value of λ.

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43. Express the vector $2\hat{i} + 3\hat{j} + \hat{k}$ as the sum of two vectors, one vector is perpendicualr to $2\hat{i} - 4\hat{j} + \hat{k}$ and the other vector is parallel to $2\hat{i} - 4\hat{j} + \hat{k}$.

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44. $A(0, -1, -2)$, $B(3, 1, 4)$ and $C(5, 7, 1)$ are vertices of ΔABD then find the measure of $\angle A$.

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45. Prove that the angle in a semicircle is right angle. (By vector method)

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46. Using vector method prove that in a right angled teriangle, the midpoint of the hypotenuse is equidistance from the vertices of the triangle.

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47. If $\vec{a} + \vec{b} + \vec{c} = 0$ and $|\vec{a}| = 6, |\vec{b}| = 5, |\vec{c}| = 7$ then find the angle between the vectors $\vec{b}$ and $\vec{c}$.

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48. The vectors of two sides of the triangle are $\vec{a} = 3\hat{i} + 6\hat{j} - 2\hat{k}$ and $\vec{b} = 4\hat{i} - \hat{j} + 3\hat{k}$ then find all the angles of the triangle.

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49. Show that the points P(-2, 3, 5), Q(1, 2, 3) and R(7, 0, -1) are collinear.

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50. $\vec{a}$ and $\vec{b}$ are any two vectors. Prove that

$$\left|\vec{a} + \vec{b}\right| \le \left|\vec{a}\right| + \left|\vec{b}\right|$$

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51. If $\left|\vec{a}+\vec{b}\right| = 60$, $\left|\vec{a}-\vec{b}\right| = 40$ and $\left|\vec{b}\right| = 46$ find $\left|\vec{a}\right|$.

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52. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors such that $\left|\vec{a}\right| = 3, \left|\vec{b}\right| = 4, \left|\vec{c}\right| = 5$and each one of them being perpendicular to the sum of the other two , find $\left|\vec{a}+\vec{b}+\vec{c}\right|$.

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53. Find the value of c for which the vectors $\vec{a} = \left(c\log_2 x\right)\hat{i} - 6\hat{j} + 3\hat{k}$ and

$\vec{b} = (\log_2 x)\hat{i} + 2\hat{j} + (2c\log_2 x)\hat{k}$ makes an obtuse angle for any $(x \in 0, \infty)$.

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54. If the angle between the unit vectors $\vec{a}$ and $\vec{b}$ is θ then prove that $\sin\frac{\theta}{2} = \frac{1}{2}\left|\hat{a} - \hat{b}\right|$.

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55. $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}, \vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$ then find the projection of $\vec{b} + \vec{c}$ on $\vec{a}$.

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56. Find a vector perpendicular to both the vectors $\hat{i} - 2\hat{j} + 3\hat{k}$ and $\hat{i} + 2\hat{j} - \hat{k}$.

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

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58. Find the area of the parallelogram whose diagonals are determined by the vectors $3\hat{i} + \hat{j} - 2\hat{k}$ and $\hat{i} - 3\hat{j} + 4\hat{k}$.

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

60. The position vectors of the points A, B, C are $\vec{a}, \vec{b}$ and $\vec{c}$ respectively. If the points A, B, C are collinear then prove that

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

61. For vectors $\vec{a}, \vec{b}$ and $\vec{c}, \vec{a}.\vec{b} = \vec{a}.\vec{c}$ and $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}, \vec{a} \neq \vec{0}$ then show that $\vec{b} = \vec{c}$.

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62. Prove that for any vector $\vec{a}$,

$\left|\vec{a} \times \hat{i}\right|^2 + \left|\vec{a} \times \hat{j}\right|^2 + \left|\vec{a} \times \hat{k}\right|^2 = 2\left|\vec{a}\right|^2$.

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63. Find the area of the parallelogram whose diagonals are determined by the vectors $3\hat{i} + \hat{j} - 2\hat{k}$ and $\hat{i} - 3\hat{j} + 4\hat{k}$.

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64. If $\left|\vec{a}\right| = 2\left|\vec{b}\right| = 5$ and $\left|\vec{a} \times \vec{b}\right| = 8$ then find $\vec{a}.\vec{b}$.

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

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66. If $\left|\vec{a}\right| = 10, \left|\vec{b}\right| = 2$ and $\vec{a}.\vec{b} = 12$ then find $\left|\vec{a} \times \vec{b}\right|$.

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67. Show that the points with position vectors $5\hat{i} + 6\hat{j} + 7\hat{k}$, $7\hat{i} - 8\hat{j} + 9\hat{k}$ and $3\hat{i} + 20\hat{j} + 5\hat{k}$ are collinear.

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68. Find the magnitude of the vector $\vec{a} = \left(3\hat{i} + 4\hat{j}\right) \times \left(\hat{i} + \hat{j} - \hat{k}\right)$.

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69. Find the area of the parallelogy whose diagonals are determined the vectors $2\hat{i} + \hat{k}$ and $\hat{i} + \hat{j} + \hat{k}$.

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70. Prove that (1, 2, 3) (2, 3, 5) and (5, 8, 13) are coplanar.

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71. If $\vec{x}, \vec{y}$ and $\vec{z}$ are non coplanar then prove that $\vec{x} + \vec{y}, \vec{y} + \vec{z}$ and $\vec{z} + \vec{x}$ are non coplanar.

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72. If the lines $ax + y + 1 = 0, x + by + 1 = 0$ and $x + y + c = 0$ are concurrent then prove that,

$$\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = .$$

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73. The volume of a parallelepiped with edges $\overrightarrow{OA} = (3, 1.4), \overrightarrow{OB} = (1, 2, 3), \overrightarrow{OC} = (2, 1, 5)$ is ....

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74. Find the value of x if the vectors $(x, x + 1, x + 2), (x + 3, x + 4, x + 5)$ and $(x + 6, x + 7, x + 8)$ are coplanar.

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75. Show that the angle between the diagonal of a cube is $\cos^{-1}\left(\frac{1}{3}\right)$.

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76. $\vec{a} = 2\hat{i} - 10\hat{j} + 2\hat{k}, \vec{b} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{c} = 2\hat{i} + \hat{j} + 3\hat{k}$ then find $\vec{a} \times \left(\vec{b} \times \vec{c}\right)$.

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

$\vec{c} = \hat{i} + 2\hat{j} - \hat{k}$ then find that

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

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78. Find a unit vector perpendicualr to the plane which passes through the point $P(1, -1, 2), Q(2, 0, -1)$ and $R(0, 2, 1)$.

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79. Find a vector of magnitude $\sqrt{51}$ and makes equal angle with the vectors

$\vec{a} = \frac{1}{3}\left(\hat{i} - 2\hat{j} + 2\hat{k}\right), \vec{b} = \frac{1}{5}\left(-4\hat{i} - 3\hat{k}\right)$ and $\vec{c} = \hat{j}$.

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80. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be unit vectors such that $\vec{a}.\vec{b} = \vec{a}.\vec{c} = 0$ and the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{6}$. Prove that $\vec{a} = \pm 2\left(\vec{b} \times \vec{c}\right)$.

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81. Let $\overrightarrow{OA} = \vec{a}, \overrightarrow{OB} = 10\vec{a} + 2\vec{b}$ and $\overrightarrow{OC} = \vec{b}$ where O is origin. Let P denotes the area of the quadrilateral OABC and q denote the area of the parallelogram with OA and OC as adjacent side. Prove that P = 6q.

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82. If A, B, C and D by any four points in space, prove that

$\left|\overrightarrow{AB} \times \overrightarrow{CD} + \overrightarrow{BC} \times \overrightarrow{AD} + \overrightarrow{CA} \times \overrightarrow{BD}\right| = 4$ (Area of triangle ABC)

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83. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{c} = \hat{j} - \hat{k}$ are given vectors, then find a vector $\vec{b}$ satisfying the equations $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{a}.\vec{b} = 3$.

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84. Using vector, Prove that for ΔABC,

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}.$$

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85. If $A(3, 2, -4), B(4, 3, -4), C(3, 3, 3)$ and $D(4, 2, -3)$ are given then find the projection of $\overrightarrow{AD}$ on $\overrightarrow{AB} \times \overrightarrow{AC}$.

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86. The sum of two unit vectors is a unit vector then the magnitude of their difference is $\sqrt{3}$. Prove this.

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87. For anyy two vectors $\vec{a}$ and $\vec{b}$, show that

$$\left(1+|\vec{a}|^2\right)\left(1+\left|\vec{b}\right|^2\right)=$$

$$\left|\left(1-\vec{a}.\vec{b}\right)\right|^2+\left|\vec{a}+\vec{b}+\left(\vec{a}\times\vec{b}\right)\right|^2$$

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88. P(2, -1, 4) and Q (4, 3, 2) are given points. Find the prove which divides the line joining P and Q in the ratio 2 : 3. (i) Internally (ii) Externally (Using vector method).

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89. If $\vec{a}$ and $\vec{b}$ are the vectors determined by two adjacent sides of a regular hexagonn ABCDEF. What are the vectors determined by the other sides taken in order ?

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Exercise 10 1

1. Represent graphically a displacement of 40 km , 30° east of north.

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2. Classify the following measures as scalars and vectors .

(i) 10 kg

(ii) 2 meters north

(iii)40°

(iv) 40 watt

(v) 10^{19} coulomb

(vi) $20m/s^2$

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3. Classify the following as scalar and vector quantities.

(i) time period

(ii) distance

(iii) force

(iv) velocity

(v) work done

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4. In figure identify the following vectors :

(i) Coinitial

(ii) Equal

(iii) Collinear but not equal

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5. Answer the followings true or false.

(i) $\vec{a}$ and $-\vec{a}$ are collinear.

(ii) Two collinear vectors are always equal in magnitude.

(iii) Two vectors having same magnitude are collinear.

(iv) Two collinear vectors having the same magnitude are equal.

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Exercise 10 2

1. Compute the magnitude of the following vectors :

$$\vec{a} = \hat{i} + \hat{j} + k, \vec{b} = 2\hat{i} - 7\hat{j} - 3\hat{k}, \vec{c} = \frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} - \frac{1}{\sqrt{3}}\hat{k}$$

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2. Compute the magnitude of the following vectors :

$$\vec{a} = \hat{i} + \hat{j} + k, \vec{b} = 2\hat{i} - 7\hat{j} - 3\hat{k}, \vec{c} = \frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} - \frac{1}{\sqrt{3}}\hat{k}$$

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3. Compute the magnitude of the following vectors :

$$\vec{a} = \hat{i} + \hat{j} + k, \vec{b} = 2\hat{i} - 7\hat{j} - 3\hat{k}, \vec{c} = \frac{1}{\sqrt{3}}\hat{i} + \frac{1}{\sqrt{3}}\hat{j} - \frac{1}{\sqrt{3}}\hat{k}$$

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4. Write two different vectors having same magnitude.

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5. Write two different vectors having same direction.

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6. Find the values of x and y so that the vectors $2\hat{i} + 3\hat{j}$ and $x\hat{i} + y\hat{j}$ are equal.

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7. Find the scalar and vector components of the vector with initial point (2,1) and terminal point (-5,7).

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8. Find the sum of the vectors $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}, \vec{b} = -2\hat{i} + 4\hat{j} + 5\hat{k}$ and $\vec{c} = \hat{i} - 6\hat{j} - -7\hat{k}$.

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

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10. Find the unit vector in the direction of vector $\overrightarrow{PQ}$, where P and Q are the points (1,2,3) and (4,5,6), respectively.

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11. For given vectors $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = -\hat{i} + \hat{j} - \hat{k}$, find the unit vector in the direction of the vector $\vec{a} + \vec{b}$.

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12. Find a vector in the direction of vector $5\hat{i} - \hat{j} + 2\hat{k}$ which has magnitude 8 units.

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13. Show that the vectors $2\hat{i} - 3\hat{j} + 4\hat{k}$ and $-4\hat{i} + 6\hat{j} - 8\hat{k}$ are collinear.

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

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15. Find the direction cosines of the vector joining the points A(1,2,-3) and B(-1,-2,1), directed from A to B.

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16. Show that the vector $\hat{i} + \hat{j} + \hat{k}$ is equally inclined to the axes OX, OY and OZ.

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17. Find the position vector of a point R which divides the line joining two points P and Q whose position vectors are $\hat{i} + 2\hat{j} - \hat{k}$ and $-\hat{i} + \hat{j} + \hat{k}$ respectively, in the ratio 2 : 1.

(i) internally (ii) externally

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18. Find the position vector of the mid point of the vector joining the points P(2,3,4) and Q(4,1,-2).

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19. Show that the points A, B and C with position vectors, $\vec{a} = 3\hat{i} - 4\hat{j} - 4\hat{k}$, $\vec{b} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{c} = \hat{i} - 3\hat{j} - 5\hat{k}$, respectively form the vertices of a right angled triangle.

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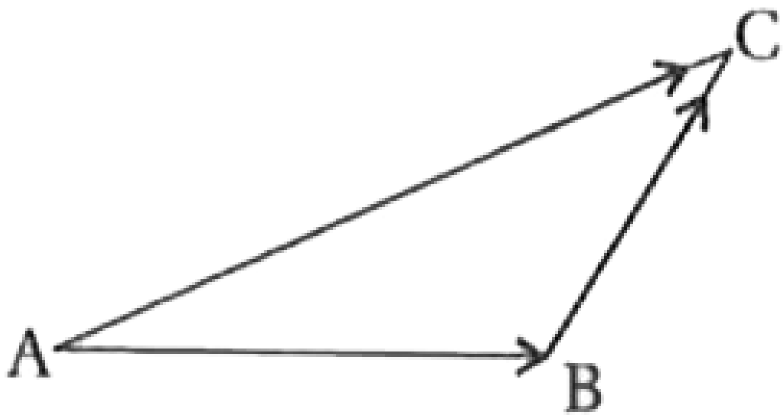
20. If triangle ABC (Fig 10.18), which of the following is not true :

(A) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = \vec{0}$

(B) $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{AC} = \vec{0}$

(C) $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{CA} = \vec{0}$

(D) $\overrightarrow{AB} - \overrightarrow{CB} + \overrightarrow{CA} = \vec{0}$



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21. If $\vec{a}$ and $\vec{b}$, are two collinear vectors, then which of the following are incorrect :

(A) $\vec{b} = \lambda\vec{a}$, for some scalar λ

(B) $\vec{a} = \pm\vec{b}$

(C) the respective components of $\vec{a}$ and $\vec{b}$ are not proportional

(D) both the vectors $\vec{a}$ and $\vec{b}$ have same direction, but different magnitudes.

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Exercise 10 3

1. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes $\sqrt{3}$ and 2, respectively having $\vec{a} \cdot \vec{b} = \sqrt{6}$.

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

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3. Find the projection of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$.

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4. Find the projection of the vector $\hat{i} + 3\hat{j} + 7\hat{k}$ on the vector $7\hat{i} - \hat{j} + 8\hat{k}$.

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5. Show that each of the given three vectors is a unit vector. $\frac{1}{7}\left(2\hat{i}+3\hat{j}+6\hat{k}\right), \frac{1}{7}\left(3\hat{i}-6\hat{j}+2\hat{k}\right), \frac{1}{7}\left(6\hat{i}+2\hat{j}-3\hat{k}\right)$

Also , show that they are mutually perpendicular to each other.

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6. Find $|\vec{a}|$ and $|\vec{b}|$, if $\left(\vec{a}+\vec{b}\right).\left(\vec{a}-\vec{b}\right)=8$ and $|\vec{a}|=8|\vec{b}|$.

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7. Evaluate the product $\left(3\vec{a}-5\vec{b}\right)\cdot\left(2\vec{a}+7\vec{b}\right)$.

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8. Find the magnitude of two vectors $\vec{a}$ and $\vec{b}$, having the same magnitude and such that the angle between them is $60°$ and their scalar product is $\frac{1}{2}$.

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9. Find $|\vec{x}|$, iif for a unit vector $\vec{a}$, $(\vec{x} - \vec{a}).(\vec{x} + \vec{a}) = 12$.

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10. 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 such that $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$, then find the value of λ.

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11. Show that $|\vec{a}|\vec{b} + |\vec{b}|\vec{a}$ is perpendicualr to $|\vec{a}|\vec{b} - |\vec{b}|\vec{a}$, for any to nonzero vectors $\vec{a}$ and $\vec{b}$.

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12. If $\vec{a}.\vec{a} = 0$ and $\vec{a}.\vec{b} = 0$ then what can be concluded about the vector $\vec{b}$?

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

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14. If either vector $\vec{a} = \vec{0}$ or $\vec{b} = \vec{0}$, , then $\vec{a} \cdot \vec{b} = 0$. But the converes need not be true . Justify your answer with an example.

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15. If either vector A,B,C of a triangle ABC are (1,2,3), (-1,0,0),(0,1,2), respectively , then find $\angle ABC$. [$\angle ABC$ is the angle between the vectors $\overrightarrow{BA}$ and $\overrightarrow{BC}$].

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16. Show that the points A(1, 2, 7), B(2, 6, 3) and C(3, 10, -1) are collinear.

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17. Show that the points $A\left(2\hat{i} - \hat{j} + \hat{k}\right), B\left(\hat{i} - 3\hat{j} - 5\hat{k}\right), C\left(3\hat{i} - 4j - 4\hat{k}\right)$ are vertices of a right angled triangle.

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18. If $\vec{a}$ is a nonzero vector of mangitude 'a' and λ a nonzero scalar , then $\lambda\vec{a}$ is unit vector if

A. $\lambda = 1$

B. $\lambda = -1$

C. $a = |\lambda|$

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

Answer: D

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Exercise 10 4

1. 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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2. Find a unit perpendicular to each of the vector $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$, where $\vec{a} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$.

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3. If a unit vector $\vec{a}$ makes angles $\frac{\pi}{3}$ with $\hat{i}$, $\frac{\pi}{4}$ with $\hat{j}$ and an acute angle θ with $\hat{k}$ then find θ and hence , the components of $\vec{a}$.

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4. Show that, $\left(\vec{a} - \vec{b}\right) \times \left(\vec{a} + \vec{b}\right) = 2\left(\vec{a} \times \vec{b}\right)$.

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5. Find λ and μ if

$\left(2\hat{i} + 6\hat{j} + 27\hat{k}\right) \times \left(\hat{i} + \lambda\hat{j} + \mu\hat{k}\right) = \vec{0}$.

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6. Given that $\vec{a}.\vec{b} = 0$ and $\vec{a} \times \vec{b} = 0$. What can you conclude about the vectors $\vec{a}$ and $\vec{b}$?

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7. Let the vectors $\vec{a}, \vec{b}\vec{c}$ be given as $a_1\hat{i} + a_2\hat{j} + a_3\hat{k}, b_1\hat{i} + b_2\hat{j} + b_3\hat{k}c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$. Then show that $\vec{a} \times \left(\vec{b} + \vec{c}\right) = \vec{a} \times \vec{b} + \vec{a} \times \vec{c}$

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8. If either $\vec{a} = \vec{0}$ or $\vec{b} = \vec{0}$, then $\vec{a} \times \vec{b} = \vec{0}$. Is the converse true ? Justify your answer with an example.

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9. Find the area of the triangle with vertices A(1, 1, 2), B(2, 3, 5) and C(1, 5, 5).

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10. Find the area of the parallelogram whose adjacent sides are determined by the vectors $\vec{a} = \hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$.

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11. Let the vectors $\vec{a}$ and $\vec{b}$ be such that $|\vec{a}| = 3$ and $|\vec{b}| = \frac{\sqrt{2}}{3}$, then $\vec{a} \times \vec{b}$ is a unit vector, if the angle between $\vec{a}$ and $\vec{b}$ is.......

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

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

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

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

Answer: B

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12. Area of a rectangle having vertices A, B, C and D with position 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 $-\hat{i}-\frac{1}{2}\hat{j}+4\hat{k}$, respectively is ....

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

B. 1

C. 2

D. 4

Answer: C

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Exercise 10 5

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

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2. Show that the vectors, $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = -2\hat{i} + 3\hat{j} - 4\hat{k}$ and $\vec{c} = \hat{i} - 3\hat{j} + 5\hat{k}$ are coplanar.

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3. Find λ if the vectors $\hat{i} - \hat{j} + \hat{k}, 3\hat{i} - \hat{j} + 2\hat{k}$ and $\hat{i} + \lambda\hat{j} - 3\hat{k}$ are coplannar.

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4. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = \hat{i}$ and $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$. Then If $c_1 = 1$ and $c_2 = 2$ find c_3 which makes $\vec{a}, \vec{b}$ and $\vec{c}$ coplanar.

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5. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = \hat{i}$ and $\vec{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$. Then If $c_2 = -1$ and $c_3 = 1$. Show that no value of c_1 can make $\vec{a}$, $\vec{b}$ and $\vec{c}$ coplanar.

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6. Show that the four points as 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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7. Find x such that the four points A(3, 2, 1), B(4, x, 5), C(4, 2, -2) and D(6, 5, -1) are coplanar.

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8. Show that the vectors $\vec{a}, \vec{b}$ and $\vec{c}$ coplanar if $\vec{a} + \vec{b}, \vec{b} + \vec{c}$ and $\vec{c} + \vec{a}$ are coplanar.

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Miscellaneous Exercise 10

1. Write down a unit vector in XY-plane, making an angle of 30° with the positive direction of x-axis.

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2. Find the scalar components and magnitude of the vector joining the points $P(x_1, y_1, z_1)$ and $Q(x_2, y_2, z_2)$.

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

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4. If $\vec{a} = \vec{b} + \vec{c}$, then is it true that $|\vec{a}| = |\vec{b}| + |\vec{c}|$?

Justify your answer .

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5. Find the value of x for which $x\left(\hat{i} + \hat{j} + \hat{k}\right)$ is a unit vector.

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6. Find a vector of magnitude 5 units and parallel to the resultant of the vectors $\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + \hat{k}$.

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7. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = 2\hat{j} - \hat{j} + 3\hat{k}$ and $\vec{c} = \hat{i} - 2\hat{j} + \hat{k}$, find a unit vector parallel to the vector $2\vec{a} - \vec{b} + 3\vec{c}$.

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8. Show that the points A(1,-2,-8),B(5,0,-2)andC(11,3,7) are collinear , and find the ratio in which B divides AC.

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9. Find the position vector of a point R which divides the line joining two points P and Q whose position vectors are $\left(2\vec{a} + \vec{b}\right)$ and $\left(\vec{a} - 3\vec{b}\right)$ externally in the ratio $1:2$ Also , show that P is the mid point of the line segment RQ.

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10. The two adjacent sides of a parallelogram are $2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\hat{i} - 2\hat{j} - 3\hat{k}$. Find the unit vector parallel to its diagonal. Also, find its area.

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11. Show that the direction cosines of a vector equally inclined to the axes OX, OY and OZ are $\pm\left(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$.

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12. Let $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}, \vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$, and $\vec{c}.\vec{d} = 15$.

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13. The scalar product of the vector $\hat{i} + \hat{j} + \hat{k}$ with a unit vector along the sum of vectors $2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\lambda\hat{i} + 2\hat{j} + 3\hat{k}$ is equal to one. Find the value of λ.

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14. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular vectors of equal magnitudes, show that the vector $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to $\vec{a}, \vec{b}$ and $\vec{c}$.

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15. prove that $\left(\vec{a}+\vec{b}\right).\left(\vec{a}+\vec{b}\right)=\left|\vec{a}\right|^2+\left|\vec{b}\right|^2$, if and only if $\vec{a}, \vec{b}$ are perpendicular, given $\vec{a}\neq\vec{0}, \vec{b}\neq\vec{0}$.

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16. If θ is angle between two vectors $\vec{a}$ and $\vec{b}$ then $\vec{a}.\vec{b}\geq 0$ only when ....

A. $0<\theta<\dfrac{\pi}{2}$

B. $0\leq\theta\leq\dfrac{\pi}{2}$

C. $0<\theta<\pi$

D. $0\leq\theta\leq\pi$

Answer: B

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17. Let $\vec{a}$ and $\vec{b}$ be two unit vectors and θ is the angle between them. Then $\vec{a} + \vec{b}$ is a unit vector if ....

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

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

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

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

Answer: D

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18. The value of $\hat{i}.\left(\hat{j}\times\hat{k}\right)+\hat{j}.\left(\hat{i}\times\hat{k}\right)+\hat{k}.\left(\hat{i}\times\hat{j}\right)$ is ....

A. 0

B. - 1

C. 1

D. 3

Answer: C

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19. If θ is the angle between any two vectors $\vec{a}$ and $\vec{b}$, then $\left|\vec{a} \cdot \vec{b}\right| = \left|\vec{a} \times \vec{b}\right|$ when θ is equal to

A. 0

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

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

D. π

Answer: B

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Textbook Illustrations For Practive Work

1. Represent graphically a displacement of 40 km, 30° west of south.

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2. Classify the following measures as scalars and vectors.

(i) 5 seconds

(ii) $1000cm^3$

(iii) 10 Newton

(iv) 30km/hr

(v) $10g/cm^3$

(vi) 20m/s towards north

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3. In Fig 10.5 ., which of the vectors are :

(i) Collinear

(ii) Equal

(iii) Coinitial

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4. Find the values of x,y and z so that the vectors $\vec{a} = x\hat{i} + 2\hat{j} + z\hat{k}$ and $\vec{b} = 2\hat{i} + y\hat{j} + \hat{k}$ are equal .

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5. Let $\vec{a} = \hat{i} + 2\hat{j}$ and $\vec{b} = 2\hat{i} + \hat{j}$. Is $|\vec{a}| = |\vec{b}|$? Are the vectors $\vec{a}$ and $\vec{b}$ equal?

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6. Find a vector in the direction of vector $\vec{a} = \hat{i} - 2\hat{j}$ that has magnitude 7 units.

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7. Find a vector in the direction of vector $\vec{a} = \hat{i} - 2\hat{j}$ that has magnitude 7 units.

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8. Find the unit vector in the direction of the sum of vectors , $\vec{a} = 2\hat{i} + 2\hat{j} - 5\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} + 3\hat{k}$.

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9. Write the direction ratio's of the vector $\vec{a} = \hat{i} + \hat{j} - 2\hat{k}$ and hence calculate its direction cosines.

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10. Find the vector joining the points P(2,3,0) and Q(-1,-2,-4) directed from P to Q.

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11. Consider two points P and Q with position vectors $\overrightarrow{OP} = 3\hat{a} - 2\vec{b}$ and $\overrightarrow{OQ} = \vec{a} + \vec{b}$. Find the position vector of a point R which divides the line joining P and Q in the ratio 2 : 1, (i) internally, and (ii) externally.

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12. Show that the points $A\left(2\hat{i} - \hat{j} + \hat{k}\right), B\left(\hat{i} - 3\hat{j} - 5\hat{k}\right), C\left(3\hat{i} - 4j - 4\hat{k}\right)$ are vertices of a right angled triangle.

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13. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ with magnitudes 1 and 2 respectively and when $\vec{a} \cdot \vec{b} = 1.$

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14. Find angle θ between the vectors $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}.$

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15. If $\vec{a} = 5\hat{i} - \hat{j} - 3\hat{k}$ and $\vec{b} = \hat{i} + 3\hat{j} - 5\hat{k}$, then show that the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicualr.

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16. Find the projection of the vector $\vec{a} = 2\hat{i} + 3\hat{j} + 2k$ on the vector $\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$.

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17. Find $\left|\vec{a} - \vec{b}\right|$, if two vectors $\vec{a}$ and $\vec{b}$ are such that $\left|\vec{a}\right| = 2$, $\left|\vec{b}\right| = 3$ and $\vec{a}.\vec{b} = 4$.

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18. If $\vec{a}$ is a unit vector and $(\vec{x} - \vec{a}).(\vec{x} + \vec{a}) = 8$ then find $|\vec{x}|$.

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19. For any two vectors $\vec{a}$ and $\vec{b}$, we always have $|\vec{a} \cdot \vec{b}| \leq |\vec{a}||\vec{b}|$(Cauchy- Schwartz inequality).

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20. For any two vectors $\vec{a}$ and $\vec{b}$, we always have $|\vec{a} + \vec{b}| \leq |\vec{a}| + |\vec{b}|$ (triangle inequality).

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21. Show that the points $A\left(-2\hat{i}+3\hat{j}+5\hat{k}\right), B\left(\hat{i}+2\hat{j}+3\hat{k}\right)$ and $C\left(7\hat{i}-\hat{k}\right)$ are collinear.

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22. Find $\left|\vec{a}\times\vec{b}\right|$, if $\vec{a}=2\hat{i}+\hat{j}+3\hat{k}$ and $\vec{b}=3\hat{i}+5\hat{j}-2\hat{k}$

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23. Find a unit vector perpendicualr to each of the vectors $\left(\vec{a}+\vec{b}\right)$ and $\left(\vec{a}-\vec{b}\right)$, where

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

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24. Find the area of atriangle having the points A(1,1,1), B (1,2,3) and C(2,3,1) as its vertices.

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

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26. If $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}, \vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j} + 2\hat{k}$ then find $\vec{a}.\left(\vec{b} \times \vec{c}\right)$.

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27. Show that the vectors $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = -2\hat{i} + 3\hat{j} - 4\hat{k}$ and $\vec{c} = \hat{i} - \hat{j} + 5\hat{k}$ are coplannar.

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28. If the vectors $\vec{a} = \hat{i} + 3\hat{j} + \hat{k}, \vec{b} = 2\hat{i} - \hat{j} - \hat{k}$ and $\vec{c} = \lambda\hat{i} + 7\hat{j} + 3\hat{k}$ are coplannar then find λ.

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29. If $4\hat{i}+5\hat{j}+\hat{k}$, $-\left(\hat{j}+\hat{k}\right)$, $3\hat{i}+9\hat{j}+4\hat{k}$ and $4\left(-\hat{i}+\hat{j}+\hat{k}\right)$ are position vectors of the points A, B, C and D then prove that A, B, C, D are coplannar.

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30. Prove that $\left[\vec{a}+\vec{b}, \vec{b}+\vec{c}, \vec{c}+\vec{a}\right]=2\left[\vec{a}, \vec{b}, \vec{c}\right]$.

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31. Prove that $\left[\vec{a}, \vec{b}, \vec{c}+\vec{d}\right]=\left[\vec{a}, \vec{b}, \vec{c}\right]+\left[\vec{a}, \vec{b}, \vec{d}\right]$.

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32. Write all the unit vectors in XY-plane.

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33. If $\hat{i} + \hat{j} + \hat{k}, 2\hat{i} + 5\hat{j}, 3\hat{i} + 2\hat{j} - 3\hat{k}$ and $\hat{i} - 6\hat{j} - \hat{k}$ are the position vectors of points A, B, C and D respectively, then find the angle between $\overrightarrow{AB}$ and $\overrightarrow{CD}$. Deduce that $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are collinear.

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34. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors such that $|\vec{a}| = 3, |\vec{b}| = 4, |\vec{c}| = 5$ and each one the them being perpendicular to the sum of the other two, find $|\vec{a} + \vec{b} + \vec{c}|$.

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35. Three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ satisfy the condition $\vec{a} + \vec{b} + \vec{c} = \vec{0}$. Evaluate the quantity $\mu = \vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$, if $|\vec{a}| = 1, |\vec{b}| = 4$ and $|\vec{c}| = 2$.

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36. If with reference to the right handed system of mutually perpendicular unit vectors $\hat{i}, \hat{j}$ and $\hat{k}$, $\vec{\alpha} = 3\hat{i} - \hat{j}$, $\vec{\beta} = 2\hat{i} + \hat{j} - 3\hat{k}$, then express $\vec{\beta}$ in the form $\vec{\beta} = \vec{\beta}_1 + \vec{\beta}_2$, where $\vec{\beta}_1$ is parallel to $\vec{\alpha}$ and $\vec{\beta}_2$ is perpendicular to $\vec{\alpha}$.

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Solutions Of Ncert Exemplar Problems Short Answer Type Questions

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

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2. If $\bar{a} = \hat{i} + \hat{j} + 2\hat{k}$ and $\bar{b} = 2\hat{i} + \hat{j} - 2\hat{k}$, find the unit vector in the direction of

(i) $6\bar{b}$ (ii) $2\bar{a} - \bar{b}$

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3. Find a unit vector in the direction of $\overrightarrow{PQ}$, where P and Q have coordinates (5, 0, 8) and (3, 3, 2), respectively.

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4. If A and B are the positon vectors of $\bar{a}$ and $\bar{b}$ respectively, then find the positon vector of a point C in $\overrightarrow{BA}$ produced such that $\overrightarrow{BC} = 1.5\overrightarrow{BA}$.

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5. Using vectors, find the value of k, such that the points $(k, -10, 3), (1, -1, 3)$ and (3, 5, 3) are collinear.

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6. A vector $\bar{r}$ is inclined at equal angles to the three axes. If the magnitude of $\vec{r}$ is $2\sqrt{3}$ units, then find the

value of $\vec{r}$.

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7. If a vector $\vec{r}$ has magnitude 14 and direction ratios 2, 3, -6. Then find the direction cosines and components of $\vec{r}$, given that $\bar{r}$ makes an acute angle with X - axis.

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8. Find a vector of magnitude 6, which is perpendicualr to both the vectors $2\bar{i}$ - $\bar{j} + 2\bar{k}$ and $4\bar{i}$ - $\bar{j} + 3\bar{k}$.

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9. Find the angle between the vectors $2\hat{i} - \hat{j} + \hat{k}$ and $3\hat{i} + 4\hat{j} - \hat{k}$.

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10. If $\bar{a} + \bar{b} + \bar{c} = 0$, then show that $\bar{a} \times \bar{b} = \bar{b} \times \bar{c} = \bar{c} \times \bar{a}$.

Interpret the result geometrically.

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11. Find the sine of the angle between the vectors $\bar{a} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\bar{b} = 2\hat{i} - 2\hat{j} + 4\hat{k}$.

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12. If A, B, C and D are the points with position vectors $\hat{i} + \hat{j} - \hat{k}, 2\hat{i} - \hat{j} + 3\hat{k}, 2\hat{i} - 3\hat{k}$ and $3\hat{i} - 2\hat{j} + \hat{k}$ respectively, then find the projection of $\overrightarrow{AB}$ along $\overrightarrow{CD}$.

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13. Using vectors, find the area of the ΔABC with vertices $A(1, 2, 3)$, $B(2, -1, 4)$ and $C(4, 5, -1)$.

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14. Using vectors, prove that the parallelogram on the same base and between the same parallels are equal in area.

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15. Prove that in any ΔABC, $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$ where a, b and c are the magnitudes of the sides opposite to the vertices A, B and C respectively.

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16. Show that area of the parallelogram whose diagonals are given by $\vec{a}$ and $\vec{b}$ is $\frac{1}{2}.\left|\bar{a} \times \bar{b}\right|$. Also, find the area of the parallelogram, whose diagonals are $2\bar{i} - \bar{j} + \bar{k}$ and $\bar{i} + 3\bar{j} - \bar{k}$.

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17. If $\bar{a} = \bar{i} + \bar{j} + \bar{k}$ and $\bar{b} = \bar{j} - \bar{k}$, then find a vector $\vec{c}$ such that $\bar{a} \times \bar{c} = \bar{b}$ and $\bar{a}.\bar{c} = 3$.

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Solutions Of Ncert Exemplar Problems Objective Type Questions

1. The vector in the direction of the vector $\vec{a} = \bar{i} - 2\bar{j} + 2\bar{k}$ that has magnitude 9 is ....

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

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

C. $3\left(\bar{i} - 2\bar{j} + 2\bar{k}\right)$

D. $9\left(\bar{i} - 2\bar{j} + 2\bar{k}\right)$

Answer: C

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2. The position vector of the point which divides the join of points $2\bar{a} - 3\bar{b}$ and $\bar{a} + \bar{b}$ in the ratio 3 : 1, is ....

A. $\dfrac{3\bar{a} - 2\bar{b}}{4}$

B. $\dfrac{7\bar{a} - 8\bar{b}}{4}$

C. $\dfrac{3\bar{a}}{4}$

D. $\dfrac{5\bar{a}}{4}$

Answer: D

Watch Video Solution

3. The vector having initial and terminal points as (2, 5, 0) and (-3, 7, 4) respectively is ....

A. $-\bar{i} + 12\bar{j} + 4\bar{k}$

B. $5\bar{i} + 2\bar{j} - 4\bar{k}$

C. $-5\bar{i} + 2\bar{j} + 4\bar{k}$

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

Answer: C

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4. The angle between two vectors a and b with magnitudes $\sqrt{3}$ and 4, respectively and $\bar{a}.\bar{b} = 2\sqrt{3}$ is ....

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

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

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

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

Answer: B

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5. Find the value of λ such that the vectors $\bar{a} = 2\bar{i} + \lambda\bar{j} + \bar{k}$ and $\bar{b} = \bar{i} + 2\bar{j} + 3\bar{k}$ are orthogonal ....

A. 0

B. 1

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

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

Answer: D

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6. The value of λ for which the vectors $3\bar{i} - 6\bar{j} + \bar{k}$ and $2\bar{i} - 4\bar{j} + \lambda\bar{k}$ are parallel is .....

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

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

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

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

Answer: A

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7. The vectors from origin to the points A and B are $\bar{a} = 2\bar{i} - 3\bar{j} + 2\bar{k}$ and $\bar{b} = 2\bar{i} + 3\bar{j} + \bar{k}$ respectively, then the area of ΔOAB is equal to ....

A. 340

B. $2\sqrt{5}$

C. $\sqrt{229}$

D. $\frac{1}{2}\left(\sqrt{229}\right)$

Answer: D

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8. $\bar{a} = 2\bar{i} - 3\bar{j} + 2\bar{k}$ and $\bar{b} = 2\bar{i} + 3\bar{j} + \bar{k}$ are the sides of triangle OAB. Then its area is ...... seq. unit.

A. 340

B. $2\sqrt{5}$

C. $\sqrt{229}$

D. $\frac{1}{2}\left(\sqrt{229}\right)$

Answer: D

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9. For any vector $\bar{a}$, the value of $(\bar{a} \times i)^2 + (\bar{a} \times j)^2 + (\bar{a} \times \bar{k})^2$ is ....

A. $|\bar{a}|^2$

B. $3|\bar{a}|^2$

C. $4|\bar{a}|^2$

D. $2|\bar{a}|^2$

Answer: D

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10. If $|\bar{a}| = 10$, $|\bar{b}| = 2$ and $\bar{a}.\bar{b} = 12$ then the value of $|\bar{a} \times \bar{b}|$ is ....

A. 5

B. 10

C. 14

D. 16

Answer: D

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11. The vectors $\lambda\bar{i} + \bar{j} + 2\bar{k}, \bar{i} + \lambda\bar{j} - \bar{k}$ and $2\bar{i} - \bar{j} + \lambda\bar{k}$ are coplanar, if ....

A. $\lambda = -2$

B. $\lambda = 0$

C. $\lambda = 1$

D. $\lambda = -1$

Answer: A

Watch Video Solution

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

A. 1

B. 3

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

D. None of these

Answer: C

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13. The projection vector of $\bar{a}$ on $\bar{b}$ is ....

A. $\left(\frac{\bar{a}.\bar{b}}{\left|\bar{b}\right|^2}\right).\bar{b}$

B. $\frac{\bar{a}.\bar{b}}{\left|\bar{b}\right|}$

C. $\frac{\bar{a}.\bar{b}}{\left|\bar{a}\right|}$

D. $\left(\frac{\bar{a}.\bar{b}}{\left|\bar{a}\right|^2}\right).\bar{b}$

Answer: A

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14. If $\bar{a}$, $\bar{b}$ and $\bar{c}$ are three vectors such that $\bar{a}+\bar{b}+\bar{c}=\bar{0}$ and $\left|\bar{a}\right|=2$, $\left|\bar{b}\right|=3$ and $\left|\bar{c}\right|=5$, then the value of $\bar{a}.\bar{b}+\bar{b}.\bar{c}+\bar{c}.\bar{a}$ is ....

A. 0

B. 1

C. - 19

D. 38

Answer: C

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15. If $|\bar{a}| = 4$ and $-3 \leq \lambda \leq 2$, then the range of $|\lambda . \bar{a}|$ is ....

A. [0, 8]

B. [- 12, 8]

C. [0, 12]

D. [8, 12]

Answer: C

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16. The number of vectors of unit length perpendicular to the vectors $\bar{a} = 2\bar{i} + \bar{j} + 2\bar{k}$ and $\bar{b} = \bar{j} + \bar{k}$ is ....

A. Only one

B. Only two

C. Only three

D. infinite

Answer: B

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17. The vector $\left(\bar{a}+\bar{b}\right)$ bisects the angle between the non-collinear vectors $\bar{a}$ and $\bar{b}$, if ....

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18. If $\bar{r}.\bar{a}=0, \bar{r}.\bar{b}=0$ and $\bar{r}.\bar{c}=0$ for some non-zero vector $\bar{r}$, then the value of $\bar{a}.\left(\bar{b}\times\bar{c}\right)$ is ....

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19. The vectors $\bar{a} = 3\bar{i} - 2\bar{j} + 2\bar{k}$ and $\bar{b} = -\bar{i} - 2\bar{k}$ are the adjacent sides of a parallelogram. The angle between its diagonals is ....

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20. The values of k, for which $|k.\bar{a}| < |\bar{a}|$ and $k.\bar{a} + \frac{1}{2}\bar{a}$ is parallel to $\bar{a}$ holds true are ....

where $k \in [-1, 1] - \left\{-\frac{1}{2}\right\}$ i.e. $k \in [-1, 1]k \neq -\frac{1}{2}$

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21. The value of the expression $\left|\bar{a} \times \bar{b}\right|^2 + \left(\bar{a}.\bar{b}\right)^2$ is ....

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22. If $\left|\bar{a} \times \bar{b}\right|^2 + \left|\bar{a}.\bar{b}\right|^2 = 144$ and $\left|\bar{a}\right| = 4$, then $\left|\bar{b}\right|$ is equal to ....

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23. If $\bar{a}$ is any non-zero vector, then

$\left(\bar{a}.\bar{i}\right).\bar{i} + \left(\bar{a}.\bar{j}\right).\bar{j} + \left(\bar{a}.\bar{k}\right).\bar{k}$ is equal to ....

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Solutions Of Ncert Exemplar Problems True False

1. If $|\bar{a}| = |\bar{b}|$, then necessarily it implies $\bar{a} = \pm \bar{b}$.

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2. Position vector of a point $\vec{P}$ is a vector whose initial point is origin.

Watch Video Solution

3. If $\left|\bar{a} + \bar{b}\right| = \left|\bar{a} - \bar{b}\right|$, then the vectors $\bar{a}$ and $\bar{b}$ are orthogonal.

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4. The formula $\left|\bar{a} + \bar{b}\right|^2 = \left|\bar{a}\right|^2 + \left|\bar{b}\right|^2 + 2\bar{a} \times \bar{b}$ is valid for non-zero vectors $\bar{a}$ and $\bar{b}$.

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5. If $\bar{a}$ and $\bar{b}$ are adjacent sides of a rhombus, then $\bar{a}.\bar{b} = 0$.

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Solutions Of Ncert Exemplar Problems Multiple Choice Questions Mcqs

1. The unit vector in the direction of $\bar{x} = (-2, 1, -2)$ is

....

A. $\left(\frac{2}{3}, -\frac{1}{3}, \frac{2}{3}\right)$

B. $\left(-\frac{2}{3}, \frac{1}{3}, -\frac{2}{3}\right)$

C. $\left(-\frac{2}{9}, \frac{1}{9}, -\frac{2}{9}\right)$

D. $\left(\frac{2}{9}, -\frac{1}{9}, \frac{2}{9}\right)$

Answer: B

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2. Out of the following,........is not a unit vector.

A. $(\cos\alpha, \sin\alpha)$

B. $(-\cos\alpha, -\sin\alpha)$

C. $(-\cos 2\alpha, \sin 2\alpha)$

D. $(\cos 2\alpha, \sin\alpha)$

Answer: D

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3. $\bar{x} = (2, 3)$ and $\bar{y} = (5, -2)$ are .... Vectors.

A. collinear

B. non collinear

C. co direction

D. opposite direction

Answer: B

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4. The vectors $(3, 6, -9)$ and ....have same direction ratio.

A. (1, 2, 3)

B. $(\pi, 2\pi, 3\pi)$

C. $(-1, -2, 3)$

D. (1, 2, 0)

Answer: C

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5. The number of unit vectors which are collinear with non zero vector $\bar{a}$ is ....

A. Exactly one

B. Exactly two

C. Exactly three

D. Any positive integer

Answer: B

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6. The direction cosines of $\bar{r} = (6, -2, 3)$ are ....

A. 6, -2, 3

B. $\frac{6}{\sqrt{7}}, \frac{-2}{\sqrt{7}}, \frac{3}{\sqrt{7}}$

C. $\frac{-6}{7}, \frac{2}{7}, \frac{-3}{7}$

D. $\frac{6}{7}, \frac{-2}{7}, \frac{3}{7}$

Answer: D

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7. For the vectors $A(-1, -2, 3)$ and $B(1, 2, -1)$ the direction cosines of $\overrightarrow{AB}$ are ....

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

B. 2, 4, -4

C. $\frac{2}{\sqrt{6}}, \frac{4}{\sqrt{6}}, \frac{-4}{\sqrt{6}}$

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

Answer: A

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8. If α, β and γ are direction cosines of the vector $\vec{x}$ then $1 + \cos 2\alpha + \cos 2\beta + \cos 2\lambda =$ ....

A. 0

B. 1

C. -1

D. 2

Answer: A

9. If the vector $\vec{b}$ is collinear to the vector $\bar{a}$ and $\bar{a} = \left(2\sqrt{2}, -1, 4\right)$ and $\left|\vec{b}\right| = 10$ then ....

A. $a \pm b = 0$

B. $a \pm 2b = 0$

C. $2a \pm b = 0$

D. None of these

Answer: C

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10. ABCDEF is a regular hexagone. $AB + AC + AD + AE + AF = \lambda AD$ then λ = ...

A. 0

B. 1

C. 2

D. 3

Answer: D

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11. If the vectors $10\hat{i} + 3\hat{j}, 12\hat{i} - 15\hat{j}$ and $a\hat{i} + 11\hat{j}$ are collinear a = ...

A. -8

B. 4

C. 2

D. $-\dfrac{82}{9}$

Answer: D

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12. The direction of vector $\vec{b}$ is North-East and that $\vec{c}$ is North-West $\left|\vec{b}\right| = \left|\vec{c}\right| = 4$. If $\vec{a} = \vec{c} - \vec{b}$ then the magnitude and direction of the vectors $\vec{a}$ are ....

A. $4\sqrt{2}$ towards north

B. $4\sqrt{2}$ towards west

C. 4 towards west

D. 4 towards south

Answer: B

Watch Video Solution

13. If $\bar{x} = (-1, 4, -2), \bar{y} = (-4, 16, -8)$ then $|\bar{x} + \bar{y}| \ldots\ldots\ldots\ldots |\bar{x}| + |\bar{y}|$

A. $=$

B. $>$

C. $\geq$

D. $\leq$

Answer: A

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14. The unit vector in the direction of the sum of the vectors $(1, 1, 1), (2, -1, -1)$ and (0, 2, 6) ....

A. $-\frac{1}{7}(3, 2, 6)$

B. $\frac{1}{49}(3, 2, 6)$

C. $\frac{1}{7}(3, -2, 6)$

D. $\frac{1}{7}(3, 2, 6)$

Answer: D

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15. The vector $2\hat{i} + 2\hat{j} - \hat{k}$ makes ....measure of angles with the axes.

A. $\cos^{-1}\frac{2}{3}, \cos^{-1}\frac{2}{3}, \pi - \cos^{-1}\frac{1}{3}$

B. $\cos^{-1}\frac{2}{3}, \cos^{-1}\frac{2}{3}, \cos^{-1}\frac{1}{3}$

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

D. $\cos^{-1}\frac{2}{3}, \pi - \cos^{-1}\frac{2}{3}, \cos^{-1}\frac{1}{3}$

Answer: A

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16. The unit vector in the direction $6\hat{i} - 2\hat{j} + 3\hat{k}$ is ....

A. $\frac{6}{7}\hat{i} + \frac{2}{7}\hat{j} + \frac{3}{7}\hat{k}$

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

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

D. $\frac{6}{7}\hat{i} + \frac{2}{7}\hat{j} - \frac{3}{7}\hat{k}$

Answer: B

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17. The unit vector parallel to the vecotr $\bar{a} - \bar{b}$ is ....

where $\bar{a} = (1, 2, -3)$ and $\bar{b} = (-2, -4, -9)$

A. $\pm(1, 2, 2)$

B. $\pm(3, 6, 6)$

C. $\pm\left(\frac{1}{3}, \frac{2}{3}, \frac{2}{3}\right)$

D. $\pm\left(\frac{2}{3}, \frac{2}{3}, \frac{1}{3}\right)$

Answer: C

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18. If $\bar{a} = (1, 1, 1), \bar{b} = (4, -2, 3)$ and $\bar{c} = (1, -2, 1)$ then the vector of magnitude 6 in the direction of $2\bar{a} - \bar{b} + 3\bar{c}$ is ....

A. $\left(\frac{1}{3}, \frac{-2}{3}, \frac{2}{3}\right)$

B. (2, -4, 4)

C. $(-2, 4, -4)$

D. $\left(\frac{-1}{3}, \frac{2}{3}, \frac{-2}{3}\right)$

Answer: B

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19. The unit vector in the opposite direction of $\bar{x} + \bar{y} - 2\bar{z}$ is .... where $\bar{x} = (1, 1, 0), \bar{y} = (0, 1, 1)$ and $\bar{z} = (1, 0, 1)$.

A. $\left(\frac{1}{\sqrt{6}}, \frac{-2}{\sqrt{6}}, \frac{1}{\sqrt{6}}\right)$

B. $\left(\frac{1}{6}, \frac{-2}{6}, \frac{1}{6}\right)$

C. $\left(\frac{-1}{\sqrt{6}}, \frac{2}{\sqrt{6}}, \frac{-1}{\sqrt{6}}\right)$

D. $\left(\frac{-1}{6}, \frac{2}{6}, \frac{-1}{6}\right)$

Answer: A

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20. The vector with magnitude $17\sqrt{2}$ and in the opposite direction of $(0, 1, -1)$ is ....

A. $17\sqrt{2}(0, 1, -1)$

B. $(0, 17, -17)$

C. $(17, 17, 0)$

D. $(0, -17, 17)$

Answer: D

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21. Out of the following .... Is the unit vector in the direction of $\left(3\hat{i}+4\hat{j}-5\hat{k}\right)+2\left(2\hat{i}+\hat{j}\right)$.

A. $\frac{7}{\sqrt{110}}\hat{i}+\frac{6}{\sqrt{110}}\hat{j}-\frac{5}{\sqrt{110}}\hat{k}$

B. $-\frac{7}{\sqrt{110}}\hat{i}-\frac{6}{\sqrt{110}}\hat{j}-\frac{5}{\sqrt{110}}\hat{k}$

C. $\frac{7}{\sqrt{110}}\hat{i}-\frac{6}{\sqrt{110}}\hat{j}-\frac{5}{\sqrt{110}}\hat{k}$

D. $\frac{5}{\sqrt{110}}\hat{i}+\frac{6}{\sqrt{110}}\hat{j}-\frac{5}{\sqrt{110}}\hat{k}$

Answer: A

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22. The position vector of the point P is (4, 5, -3). The distance of the point P from the plane XY, YZ and XZ is P_1, P_2 and P_3 respectively then $\sum^{3} i=1P_i$ = ...

A. 6

B. 12

C. $2\sqrt{25}$

D. $5\sqrt{2}$

Answer: B

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23. The position vector of a point A is (4, 2, -3). If the distance of the point A from XY- plane is p_1 and from Y - axis is p_2 then $p_1 + p_2 =$ ....

A. 2

B. 3

C. 8

D. 7

Answer: C

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24. $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = \hat{i} - \hat{j} + \hat{k}$

and $\vec{c} = \hat{i} + 2\hat{j} - \hat{k}$ then the value of

$$\begin{vmatrix} \vec{a}.\vec{b} & \vec{a}.\vec{b} & \vec{a}.\vec{c} \\ \vec{b}.\vec{a} & \vec{b}.\vec{a} & \vec{b}.\vec{c} \\ \vec{c}.\vec{a} & \vec{c}.\vec{b} & \vec{c}.\vec{c} \end{vmatrix}$$ is ....

A. 2

B. 4

C. 16

D. 64

Answer: C

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25. A(1, 1, 2), B(4, 3, 1) and C(2, 3, 5) are vertices of a triangle ABC. The vector along the bisector $\angle A$ is ....

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

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

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

D. None of these

Answer: C

Watch Video Solution

26. The position vectors of two points A and B are respectively $6\vec{a} + 2\vec{b}$ and $\vec{a}$ - $3\bar{b}$. If the point C divides AB internally in the ratio 3 : 2 then the position vector of C is ....

A. $3\vec{a}$ - $\vec{b}$

B. $3\vec{a} + \vec{b}$

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

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

Answer: A

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27. The position vectors of the vertices of triangle are $3\hat{i}+4\hat{j}+5\hat{k}$, $\hat{i}+7\hat{k}$ and $5\hat{i}+5\hat{j}$. The distance between ortho centre and circum centre is ....

A. $=0$

B. $\sqrt{306}$

C. $2\sqrt{306}$

D. $\frac{3}{2}\sqrt{306}$

Answer: B

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28. The angle between the unit vectors $\vec{a}$ and $\vec{b}$ is 2θ. Where $\theta \in [0, \pi]$. If $\left|\vec{a} - \vec{b}\right| < 1$ then $\theta \in$ .... interval.

A. $\left[0, \frac{\pi}{6}\right]$

B. $\left[\frac{\pi}{6}, \frac{\pi}{2}\right]$

C. $\left[\frac{5\pi}{6}, \pi\right]$

D. $\left[\frac{\pi}{2}, \frac{5\pi}{6}\right]$

Answer: A

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29. $\square ABCD$ is a parallelogram. $\left(A_1\right)$ and B_1 are midpoints of the sides $\overline{BC}$ and $\overline{AD}$ respectively. If $\overrightarrow{AA_1} + \overrightarrow{AB_1} = \lambda \overrightarrow{AC}$ then λ = ...

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

B. 1

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

D. 2

Answer: C

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30. In ΔABC, $\overrightarrow{AB} = 3\hat{i} + 4\hat{k}$ and $\overrightarrow{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$. Length of the median drawn from A is ....

A. $\sqrt{18}$

B. $\sqrt{72}$

C. $\sqrt{33}$

D. $\sqrt{45}$

Answer: C

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31. If $\bar{x} = (a, 4, 2a)$ and $\bar{y} = (2a, -1, a)$ are perpendicualr to each other then a = ...

A. 2

B. 1

C. 4

D. Any real number

Answer: B

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32. If $\bar{x} = (3, 1, 0), \bar{y} = (2, 2, 3), \bar{z} = (-1, 2, 1)$.

If $\bar{x} \perp \left(\bar{y} + k\bar{z}\right)$ then k = ...

A. 8

B. 4

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

D. $\frac{1}{4}$

Answer: A

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33. If $\bar{x} = (1, 2, 4), \bar{y} = (-1, -2, k), k \neq -4$ then $\left|\bar{x}.\bar{y}\right| \ldots\ldots\ldots \left|\bar{x}\right|\left|\bar{y}\right|$

A. $<$

B. $>$

C. $=$

D. $\geq$

Answer: A

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34. If $\bar{a} = (-3, 1, 0)$ and $\bar{b} = (1, -1, -1)$ then $\text{Comp}_{\bar{a}}\bar{b}$

....

A. $\frac{4}{\sqrt{10}}$

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

C. $\frac{-4}{\sqrt{10}}$

D. $-\frac{\sqrt{3}}{4}$

Answer: C

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35. The projection of $(1, 2, -1)$ on $\hat{i}$ is ....

A. $\frac{1}{\sqrt{6}}$

B. $-\frac{1}{\sqrt{6}}$

C. 1

D. -1

Answer: C

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36. $A(3, -1), B(2, 3)$ and $C(5, 1)$ are given then $m\angle A =$

....

A. $\cos^{-1}\frac{3}{\sqrt{34}}$

B. $\pi - \cos^{-1}\frac{3}{\sqrt{34}}$

C. $\sin^{-1}\frac{5}{\sqrt{34}}$

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

Answer: A

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37. $\bar{x}$ and $\bar{y}$ are unit vectors and $\left(\bar{x}\hat{,}\bar{y}\right) = \theta$. If θ = ... then $\bar{x} + \bar{y}$ will becomes unit vector.

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

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

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

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

Answer: D

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38. If $\left|\bar{x} + \bar{y}\right| = \left|\bar{x} - \bar{y}\right|$, then

A. $\bar{x}$ is parallel to $\bar{y}$

B. $\bar{x} \perp \bar{y}$

C. $\left|\bar{x}\right| = \left|\bar{y}\right|$

D. $\bar{x} = \bar{y}$

Answer: B

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39. $\bar{x}, \bar{y}, \bar{z}$ are zero vectors. If .... then $\bar{x}.\bar{y} = \bar{x}.\bar{z}.\ (\bar{x}, \bar{y} \neq 0)$.

A. $\bar{x}$ is perpendicular to $\bar{y}$.

B. $\bar{x}$ is perpendicular to $\bar{z}$.

C. $\bar{x}$ is perpendicular to $\bar{y} + \bar{z}$.

D. $\bar{x}$ is perpendicular to $\bar{y} = \bar{z}$.

Answer: D

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40. $\bar{x}, \bar{y}, \bar{z}$ are non zero vectors. If $\left(\bar{x} \hat{,} \bar{y}\right) = \frac{\pi}{2}$ and $\bar{z} = \bar{x} + \bar{y}$, then ....

A. $|\bar{x}|^2 + |\bar{y}|^2 + |\bar{z}|^2 = 3$

B. $|\bar{x}|^2 + |\bar{y}|^2 + |\bar{z}|^2 = 1$

C. $|\bar{x}|^2 - |\bar{y}|^2 = |\bar{z}|^2$

D. $|\bar{x}|^2 + |\bar{y}|^2 = |\bar{z}|^2$

Answer: D

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41. If $\bar{x}.\bar{y} = \bar{x}.\bar{z} \neq 0$ and $\bar{x} \times \bar{y} = \bar{x} \times \bar{z} \neq \bar{0}$ and $\bar{x} \neq \bar{0}$ then

....

A. $\bar{x}$ is parallel to $\bar{y}$ and $\bar{z}$

B. $\bar{x}$ is perpendicular to $\bar{y}$ and $\bar{z}$

C. $\bar{y} \neq \bar{z}$

D. $\bar{y} \neq \bar{z}$

Answer: C

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42. If $\bar{a} = (3, 1, -2)$ and $\bar{b} = (1, 3, -2)$ then $\left(\bar{a} \ \hat{} \ \bar{b}\right) =$

....

A. $\cos^{-1}\dfrac{2\sqrt{6}}{7}$

B. $\pi - \cos^{-1}\dfrac{5}{7}$

C. $\sin^{-1}\dfrac{2\sqrt{6}}{7}$

D. $\tan^{-1}\dfrac{5}{2\sqrt{6}}$

Answer: C

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43. If $\bar{x} = (1, 1, -1), \bar{y} = (-1, 2, 2)$ and $\bar{z} = (-1, 2, -1)$ then the unit victor perpendicular to both $\bar{x} + \bar{y}$ and $\bar{y} - \bar{z}$ is ....

A. $\pm(4, 0, 0)$

B. $\pm(0, 0, 9)$

C. $\pm(1, 0, 0)$

D. $\pm(0, 0, 1)$

Answer: C

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44. If $\left(3\hat{i}+4\hat{j}+9\hat{k}\right)$ and $\left(a\hat{i}-3\hat{j}+1\hat{k}\right)$ are perpendicualr to each other then a = ...

A. 1

B. -1

C. 7

D. -7

Answer: A

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45. If $|\bar{a}| = 2, |\bar{b}| = 4, |\bar{c}| = 1$ and $\bar{a} + \bar{b} = -\bar{c}$ then $\bar{a}.\bar{b} + \bar{b}.\bar{c} + \bar{c}.\bar{a} =$ ....

A. -9.5

B. -10.5

C. 10.5

D. 7.5

Answer: B

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46. If $|\bar{x}| = |\bar{y}| = 2$ and $(\bar{x} \ \hat{} \ \bar{y}) = \theta$ then $|\bar{x} - \bar{y}\cos\theta| =$

....

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

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

C. $\sqrt{2}\sin\theta$

D. $2\sin\theta$

Answer: D

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47. The projection of the vector $(-4, -2, 4)$ on $(2, 1, 1)$ is ....

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

B. $(-2, -1, -1)$

C. $(1, -1, -2)$

D. $(-1, 1, 2)$

Answer: B

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48. The magnitude of the projection of vector (4, 1, 3) and (1, -2, 3) is ....

A. $\frac{15}{\sqrt{14}}$

B. $\frac{15}{14}$

C. $\frac{11}{14}$

D. $\frac{11}{\sqrt{14}}$

Answer: D

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49. The unit vector perpendicular to $(3, -4)$ in R^2 is

....

A. $\left(\frac{3}{5}, -\frac{4}{5}\right)$

B. $\left(-\frac{4}{5}, -\frac{3}{5}\right)$

C. $\left(\frac{4}{5}, -\frac{3}{5}\right)$

D. $\left(\frac{3}{5}, \frac{4}{5}\right)$

Answer: B

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50. The unit vector perpendicualr to $(3, 4)$is ....

A. $\left(\frac{4}{5}, \frac{3}{5}\right)$

B. $\left(-\frac{4}{5}, \frac{3}{5}\right)$

C. $\left(-\frac{3}{5}, \frac{4}{5}\right)$

D. $\left(\frac{3}{5}, \frac{4}{5}\right)$

Answer: B

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51. If $|\bar{x}| = |\bar{y}| = 1$ and $\bar{x} \perp \bar{y}$, then $|\bar{x} - \bar{y}|$ =..............

A. $\sqrt{2}$

B. $\sqrt{3}$

C. 1

D. 0

Answer: A

Watch Video Solution

52. $\bar{a} = (-3, 1, 0), \bar{b} = (1, -1, -1)$ then $\left|\text{Comp}_{\bar{b}}\bar{a}\right|$ =

....

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

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

C. $-\frac{4}{\sqrt{10}}$

D. $\dfrac{4}{\sqrt{10}}$

Answer: B

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53. If $\bar{a} + \bar{b} + \bar{c} = \bar{0}$ and $|\bar{a}| = 3, |\bar{b}| = 5, |\bar{c}| = 7$ and $\left(\bar{a} \overset{\wedge}{,} \bar{b}\right)\alpha$ then $\alpha =$ ....

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

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

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

D. $\dfrac{5\pi}{6}$

Answer: A

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54. A(1, -2, 4), B(5, -1, 7), C(3, 6, -2) and D(4, 5, -1) are given vectors. Then the projection of $\overrightarrow{AB}$ on $\overrightarrow{CD}$ is ....

A. (1, -1, 1)

B. $\frac{3}{13}(4, 1, 3)$

C. $\left(2\sqrt{3}, -2\sqrt{3}, 2\sqrt{3}\right)$

D. (2, -2, 2)

Answer: C

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55. In a right angled triangle ABC, hypotenuse $AB = P$ then $\overline{AB}.\overline{AC} + \overline{BC}.\overline{BA} + \overline{CA}.\overline{CB}$ = ...

A. $2P^2$

B. $\frac{P^2}{2}$

C. P^2

D. None of these

Answer: C

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56. $\square ABCDEF$ is a regular hexagone with each side a.

$$\bar{AB}.\,\bar{AF} + \frac{1}{2}\bar{BC}^2 = \text{..........}$$

A. a

B. a^2

C. $2a^2$

D. 0

Answer: D

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57. For vectors $\bar{a}, \bar{b}, \bar{c}$, $|\bar{a} - \bar{c}| = |\bar{b} - \bar{c}|$ then the value

$$(\bar{b} - \bar{a}).\left(\bar{c} - \frac{\bar{a} + \bar{b}}{2}\right) = \text{..........}$$

A. 0

B. -1

C. 1

D. 2

Answer: A

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58. A unit vector is coplanner with $\bar{i} + \bar{j} + 2\bar{k}$ and $\bar{i} + 2\bar{j} + \bar{k}$ and it is perpendicular to the vector $\bar{i} + \bar{j} + \bar{k}$.

Then the vector ....

A. $\frac{\bar{i} - \bar{j}}{\sqrt{2}}$

B. $\pm\left(\frac{\bar{j} - \bar{k}}{\sqrt{2}}\right)$

C. $\frac{\bar{k} - \bar{i}}{\sqrt{2}}$

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

Answer: B

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59. The angle between the unit vectors $\bar{a}$ and $\bar{b}$ is θ. If $\bar{a} - \sqrt{2}\bar{b}$ is a unit vector then θ = ...

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

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

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

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

Answer: B

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60. For unit vectors $\bar{a}$ and $\bar{b}$, if $\bar{a} + 2\bar{b}$ and $5\bar{a} - 4\bar{b}$ are perpendicular to each other then the angle between $\bar{a}$

and $\bar{b}$ is ....

A. $45°$

B. $60°$

C. $\cos^{-1}\left(\frac{1}{3}\right)$

D. $\cos^{-1}\frac{2}{7}$

Answer: B

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61. $\bar{a} = 2\bar{i} - 3\bar{j} + 6\bar{k}$ and $\bar{b} = -2\bar{i} + 2\bar{j} - \bar{k}$ then $\frac{\text{Proj}_{\bar{b}}\bar{a}}{\text{Proj}_{\bar{a}}\bar{b}} =$

....

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

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

C. 3

D. 7

Answer: B

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62. $\bar{b} = 3\hat{j} + 4\hat{k}, \bar{a} = \hat{i} + \hat{j}$. If $\bar{b}_1$ and $\bar{b}_2$ are component of $\bar{b}$ and $\bar{b}_1 = \frac{3}{2}\hat{i} + \frac{3}{2}\hat{j}$, $\bar{b}_2$ is perpendicualr to $\bar{a}$ then $\bar{b}_2$ = ...

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

B. $-\frac{3}{2}\hat{i} + \frac{3}{2}\hat{j} + 4\hat{k}$

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

D. None of these

Answer: B

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63. The unit vector $\bar{a}$ and $\bar{b}$ are perpendicualr to each other. The unit vector $\bar{c}$ makes an angle θ with $\bar{a}$ and $\bar{b}$. If $\bar{c} = \alpha\bar{a} + \beta\bar{b} + \gamma\left(\bar{a} \times \bar{b}\right)$ then ....

A. $\alpha = 2\beta$

B. $\gamma^2 = 1 + 2\alpha^2$

C. $\gamma^2 = \cos 2\theta$

D. $\beta^2 = \dfrac{1 + \cos 2\theta}{2}$

Answer: D

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64. Vector $\bar{a} = 6\hat{i} - 3\hat{j}$, $\bar{b} = 2\hat{i} - 6\hat{j}$ and $\bar{c} = -2\hat{i} + 21\hat{j}$ are such that $\bar{\alpha} = \bar{a} + \bar{b} + \bar{c}$. The vector $\bar{\alpha}$ is represented as .... A component of $\bar{a}$ and $\bar{b}$.

A. $3\bar{a} - 2\bar{b}$

B. $2\bar{a} - 3\bar{b}$

C. $3\bar{b} - 2\bar{a}$

D. None of these

Answer: B

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65. $\bar{a}, \bar{b}$ and $\bar{c}$ are unit vectors. The value of $\left|\bar{a} - \bar{b}\right|^2 + \left|\bar{b} - \bar{c}\right|^2 + \left|\bar{c} - \bar{a}\right|^2$ is not expected ....

A. 4

B. 9

C. 8

D. 6

Answer: B

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66. If $\bar{a}, \bar{b}$ and $\bar{c}$ are perpendicualr to $\bar{b}+\bar{c}, \bar{c}+\bar{a}$ and $\bar{a}+\bar{b}$ respectively and $\left|\bar{a}+\bar{b}\right|=6, \left|\bar{b}+\bar{c}\right|=8$ and $\left|\bar{c}+\bar{a}\right|=10$ then $\left|\bar{a}+\bar{b}+\bar{c}\right|$ =..................

A. $5\sqrt{2}$

B. 50

C. $10\sqrt{2}$

D. 10

Answer: D

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67. $\bar{a}$ and $\bar{b}$ are unit vectors. $\left|\bar{a}+\bar{b}\right| = \sqrt{3}$ then the value of $\left(3\bar{a} - 4\bar{b}\right).\left(2\bar{a}+5\bar{b}\right)$ = ...

A. -21

B. 21

C. $\frac{21}{2}$

D. $-\frac{21}{2}$

Answer: D

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68. ΔABC is an equilateral triangle. Its side is l. Any point P lies on the circum centre of ΔABC. Then

$$\left|\overline{PA}\right|^2 + \left|\overline{PB}\right|^2 + \left|\overline{PC}\right|^2 = \text{..............}$$

A. $2l^2$

B. $2\sqrt{3}l^2$

C. l^2

D. $3l^2$

Answer: A

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69. $\vec{a} = 2\hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} - \hat{k}$ are the adjacent sides of a parallelogram. The angle between their diagonals is ....

A. $\cos^{-1}\left(\frac{1}{3}\right)$

B. $\cos^{-1}\left(\frac{1}{2}\right)$

C. $\cos^{-1}\left(\frac{4}{9}\right)$

D. $\cos^{-1}\left(\frac{5}{9}\right)$

Answer: A

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70. The position vectors of four points A, B, C and D in the plane are $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$. If $(\vec{a} - \vec{d}).(\vec{b} - \vec{c}) = (\vec{b} - \vec{d}).(\vec{c} - \vec{a}) = 0$ then D is a ....is ΔABC.

A. In centre

B. circum centre

C. ortho centre

D. centriod

Answer: C

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71. If $\vec{\alpha} = \frac{1}{a}\hat{i} + \frac{4}{b}\hat{j} + b\hat{k}$ and $\vec{\beta} = b\hat{i} + a\hat{j} + \frac{1}{b}\hat{k}$ then the maximum value $\frac{10}{5 + \vec{\alpha}.\vec{\beta}}$ is ....

A. 1

B. 5

C. 2

D. 3

Answer: A

Watch Video Solution

72. The unit vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are not coplanar. If $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{1}{\sqrt{2}}(b + c)$ then the angle between $\vec{a}$ and $\vec{b}$ is ....

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

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

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

D. π

Answer: A

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73. If $\vec{x}+\vec{y}+\vec{z}=0$ and $\left|\vec{x}\right|=\left|\vec{y}\right|=\left|\vec{z}\right|=2$ If the angle between $\vec{y}$ and $\vec{z}$ and θ. Then $\operatorname{cos}ec^2\theta+\cot^2\theta$= ....

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

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

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

D. 1

Answer: B

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74. $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - \hat{k}$, $\vec{c} = \hat{i} + \hat{j} - 2\hat{k}$. The vector $\vec{r}$ is coplanner with vector $\vec{b}$ and $\vec{c}$. If the magnitude of the projection $\vec{r}$ on $\vec{a}$ is $\sqrt{\frac{2}{3}}$ then $\vec{r}$ = ...

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

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

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

D. $2\hat{i} + \hat{j} + 5\hat{k}$

Answer: B

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75. $\vec{a} = \hat{i} + \hat{j} + \sqrt{2}\hat{k}, \vec{b} = b_1\hat{i} + b_2\hat{j} + \sqrt{2}\hat{k}$ and $\vec{c} = 5\hat{i} + \hat{j} + \sqrt{2}k$ are three vectors. The projection of the vector $\vec{b}$ on $\vec{a}$ is $|\vec{a}|$. If $\vec{a} + \vec{b}$ is perpendicular to $\vec{c}$ then $|\vec{b}|$= ....

A. $\sqrt{32}$

B. $\sqrt{22}$

C. 4

D. 6

Answer: D

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76. $\vec{a} = 2\hat{i} + \lambda_1\hat{j} + 3\hat{k}$, $\vec{b} = 4\hat{i} + (3 - \lambda_2)\hat{j} + 6\hat{k}$ and $\vec{c} = 3\hat{i} + 6\hat{j} + (\lambda_3 - 1)\hat{k}$ are three vectors. Vector $\vec{b} = 2\vec{a}$ and $\vec{a}$ is perpendicular to $\vec{b}$ then the possible value of $(\lambda_1, \lambda_2, \lambda_3)$ is ....

A. $\left(\frac{1}{2}, 4, -2\right)$

B. $\left(-\frac{1}{2}, 4, 0\right)$

C. $(1, 3, 1)$

D. (1, 5, 1)

Answer: B

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77. $\square ABCD$ is a parallelogram $\overrightarrow{AB} = \bar{q}, \overrightarrow{AD} = \bar{p}, \angle BAC$ is on acute angle. From the point B, the perpendicular is drawn on side $\overrightarrow{AD}$. The vector along with it is $\vec{r}$. Then $\vec{r}$ = ...

A. $\vec{r} = 3\bar{q} - \dfrac{3(\bar{p}.\bar{q})}{(\bar{p}.\bar{p})}\bar{p}$

B. $\vec{r} = -\bar{q} + \dfrac{(\bar{p}.\bar{q})}{(\bar{p}.\bar{p})}\bar{p}$

C. $\vec{r} = \bar{q} - \dfrac{(\bar{p}.\bar{q})}{(\bar{p}.\bar{p})}\bar{p}$

D. $\vec{r} = -3\bar{q} + \dfrac{3(\bar{p}.\bar{q})}{(\bar{p}.\bar{p})}\bar{p}$

Answer: B

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78. The position vectors of A, B and C are $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$ and $x\hat{i} - 3\hat{j} + \hat{k}$ respectively in ΔABC. If $\angle C = \frac{\pi}{2}$ then the value of x is ....

A. -2 and -1

B. -2 and 1

C. 2 and -1

D. 2 and 1

Answer: D

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79. A particle is acted upon constant forces $\vec{F}_1 = 4\hat{i} + \hat{j} - 3\hat{k}$ and $\vec{F}_2 = 3\hat{i} + \hat{j} - \hat{k}$ which displace it from a point $A = \hat{i} + 2\hat{j} + 3\hat{k}$ to the point $B = 5\hat{i} + 4\hat{j} + \hat{k}$. The work done in standard units by the forces is given by ....

A. 40

B. 30

C. 25

D. 15

Answer: A

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80. Let $\vec{u}$, $\vec{v}$ and $\vec{w}$ be such that $|\vec{u}| = 1$, $|\vec{v}| = 2$, $|\vec{w}| = 3$. If the projection $\vec{v}$ along $\vec{u}$ is equal to that of $\vec{w}$ along $\vec{u}$ and $\vec{v}, \vec{w}$ are perpendicular to each orher, then $|\vec{u} - \vec{v} + \vec{w}|$ equals ....

A. 2

B. $\sqrt{7}$

C. $\sqrt{14}$

D. 14

Answer: C

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81. The centroid of ΔABC is G. The angle between $\overrightarrow{GB}$ and $\overrightarrow{GC}$ is obtuse angle then ....

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

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

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

D. None of these

Answer: A

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82. The area of the parallelogram whose diagonals are $\hat{j} + \hat{k}$ and $\hat{i} + \hat{k}$ is ....

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

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

C. 3

D. $\sqrt{3}$

Answer: A

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83. The area of the parallelogram whose adjacent side is $\hat{i}+\hat{k}$ and $\hat{i}+\hat{j}$ is ....

A. 3

B. $\sqrt{3}$

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

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

Answer: B

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84. If $\bar{x}$ and $\bar{y}$ are non zero, non collinear vector then the number of unit vectors which are perpendicular to both $\bar{x}$ and $\bar{y}$ is ....

A. 2

B. 4

C. Do not get

D. Infinite

Answer: A

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85. If $\left|\bar{x}.\,\bar{y}\right| = \cos\alpha$, then $\left|\bar{x} \times \bar{y}\right|$ = ...

A. $\pm\sin\alpha$

B. $\sin\alpha$

C. $-\sin\alpha$

D. $\sin^2\alpha$

Answer: B

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86. If $\bar{a} = (2, 0, 1)$ and $\bar{b} = (1, 1, 1)$ then $\sin\left(\bar{a} \hat{,} \bar{b}\right) = \ldots\ldots\ldots\ldots\ldots$

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

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

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

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

Answer: C

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87. The unit vector perpendicular to both the vectors (3, -1, 0) and (-2, 1, 3) is ....

A. $\pm(-3, -9, 1)$

B. $\pm(-3, 9, -1)$

C. $\pm\frac{1}{\sqrt{91}}(-3, -9, 1)$

D. $\pm\frac{1}{\sqrt{91}}(-3, 9, -1)$

Answer: C

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88. The area of the parallelogram with diagonals $\hat{i}+\hat{j}$ and $\hat{j}+\hat{k}$ is ....

A. $\sqrt{3}$

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

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

D. 0

Answer: C

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89. The angle between the vectors $(2, -1, 1)$ and $(1, -1, 2)$ is ....

A. $\cos^{-1}\left(\frac{1}{6}\right)$

B. $\sin^{-1}\left(\frac{5}{6}\right)$

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

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

Answer: D

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90. If $|\bar{x}| = 7.\ |\bar{y}| = \sqrt{2}, \bar{x} \times \bar{y} = (6, 2, 3)$ then $|\bar{x}.\bar{y}|^2 =$

....

A. 98

B. 7

C. 147

D. 49

Answer: D

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91. The unit vector perpendicualr to both the vectors

$\hat{i} + 2\hat{j} - 2\hat{k}$ and $-\hat{i} + 2\hat{j} + 2\hat{k}$ is ....

A. $\frac{1}{\sqrt{5}}\left(2\hat{i} - \hat{k}\right)$

B. $\frac{1}{\sqrt{5}}\left(- 2\hat{i} + \hat{k}\right)$

C. $\frac{1}{\sqrt{5}}\left(2\hat{i} + \hat{j} + \hat{k}\right)$

D. $\frac{1}{\sqrt{5}}\left(2\hat{i} + \hat{k}\right)$

Answer: D

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92. A(-1, 2, 3), B(1, 1, 1) and C(2, -1, 3) are three points in the plane. The unit vector perpendicular to the plane ABC is ....

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

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

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

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

Answer: A

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93. If $\left|\bar{a}.\,\bar{b}\right| = 3$ and $\left|\bar{a} \times \bar{b}\right| = 4$ then the angle between $\bar{a}$ and $\bar{b}$ is ....

A. $\cos^{-1}\frac{3}{4}$

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

C. $\cos^{-1}\frac{4}{5}$

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

Answer: B

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94. $\bar{r} \times \bar{a} = \bar{b} \times \bar{a}, \bar{r} \times \bar{b} = \bar{a} \times \bar{b}, \bar{a} \neq \bar{0}, \bar{b} \neq \bar{0}\bar{a} \neq \lambda\bar{b}.$ If $\bar{a}.\bar{b} = 0$ then $\bar{r}$ = ...

A. $\bar{a}$ - $\bar{b}$

B. $\bar{a} + \bar{b}$

C. $\bar{a} \times \bar{b} + \bar{a}$

D. $\bar{a} \times \bar{b} + \bar{b}$

Answer: B

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95. $\left(\bar{a} \times \bar{b}\right)^2$ = ...

A. $\begin{vmatrix} \bar{a}.\bar{b} & \bar{a}.\bar{a} \\ \bar{b}.\bar{b} & \bar{b}.\bar{a} \end{vmatrix}$

B. $\begin{vmatrix} \bar{a}.\bar{a} & \bar{a}.\bar{b} \\ \bar{b}.\bar{a} & \bar{b}.\bar{b} \end{vmatrix}$

C. $\begin{vmatrix} \bar{a} & \bar{b} \\ \bar{b} & \bar{a} \end{vmatrix}$

D. None of these

Answer: B

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96. $|\bar{a}| = 2, |\bar{b}| = 3$ and $\bar{a}$ and $\bar{b}$ are perpendicular to each other. The area of the triangle with vertices $\bar{0}, \bar{a} + \bar{b}$ and $\bar{a}$ - $\bar{b}$ is ....

A. 5

B. 1

C. 6

D. 8

Answer: C

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97. $\bar{a} = \hat{i} + \hat{j} + \hat{k}, \bar{b} = \hat{i} + 3\hat{j} + 5\hat{k}$ and $\bar{c} = 7\hat{i} + 9\hat{j} + 11\hat{k}$ are vectors. The area of the parallelogram whose diagonals are $\bar{a} + \bar{b}$ and $\bar{b} + \bar{c}$ is ....

A. $4\sqrt{6}$

B. $\frac{1}{2}\sqrt{21}$

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

D. $\sqrt{6}$

Answer: A

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98. In ΔABC, the bisector of $\angle A$ is $\overline{AD}$.

$\overline{AD} = \alpha\overline{AB} + \beta\overline{AC}$, where ....

A. $\alpha = \frac{\left|\overline{AB}\right|}{\left|\overline{AB} + \overline{AC}\right|}, \beta = \frac{\left|\overline{AC}\right|}{\left|\overline{AB} + \overline{AC}\right|}$

B. $\alpha = \frac{\left|\overline{AC}\right|}{\left|\overline{AB}\right| + \left|\overline{AC}\right|}, \beta = \frac{\left|\overline{AB}\right|}{\left|\overline{AB}\right| + \left|\overline{AC}\right|}$

C. $\alpha = \frac{\left|\overline{AB}\right|}{\left|\overline{AC}\right|}, \beta = \frac{\left|\overline{AC}\right|}{\left|\overline{AB}\right|}$

D. None of these

Answer: B

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99. The vector $\bar{a} = (x, y, z)$ makes an obtuse angle with y- axis. $\bar{b} = (y, -2z, 3x)$ and $\bar{c} = (2z, 3x, -y)$. The vector $\bar{a}$ makes equal angle with $\bar{b}$ and $\bar{c}$. $\bar{a}$ is perpendicular to $\bar{d} = (1, -1, 2)$. If $|\bar{a}| = 2\sqrt{3}$ then $\bar{a}$ = ...

A. (1, 2, 3)

B. (2, -2, -2)

C. (-1, 2, 4)

D. None of these

Answer: B

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100. The vectors $\bar{a}$ and $\bar{b}$ are unit vectors perpendicular to each other. The unit vector $\bar{c}$ makes an angle θ with $\bar{a}$ and $\bar{b}$. If $\bar{c} = x\bar{a} + y\bar{b} + z\left(\bar{a} \times \bar{b}\right)$ then ....

A. $x = \cos\theta, y = \sin\theta, z = \cos 2\theta$

B. $x = \sin\theta, y = \cos\theta, z = -\cos 2\theta$

C. $x = y = \cos\theta, z^2 = \cos 2\theta$

D. $x = y = \cos\theta, z = -\cos 2\theta$

Answer: D

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101. $\bar{a}, \bar{b}$ and $\bar{c}$ are unit vectors. $\bar{a}.\bar{b} = 0 = \bar{a}.\bar{c}$ and the angle between $\bar{b}$ and $\bar{c}$ is $\frac{\pi}{3}$. Then $\left|\bar{a} \times \bar{b} - \bar{a} \times \bar{c}\right| =$ ....

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

B. 1

C. 2

D. 0

Answer: B

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102. The modulus of the vectors $\bar{a}$ and $\bar{b}$ are 2 and 3 respectively. If $\left|2\left(\bar{a} \times \bar{b}\right)\right| + \left|3\left(\bar{a}.\bar{b}\right)\right| = k$ then the maximum value of k = ...

A. $\sqrt{13}$

B. $2\sqrt{13}$

C. $6\sqrt{13}$

D. $10\sqrt{13}$

Answer: C

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103. For a vector $\bar{a}$, $\bar{a} \times \vec{r} = \bar{j}$ then $\bar{a}.\bar{r}$ = ...

A. -1

B. 0

C. 1

D. None of these

Answer: D

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104. If $\bar{\mu} = \bar{a} - \bar{b}, \bar{v} = \bar{a} + \bar{b}, \left|\bar{a}\right| = \left|\bar{b}\right| = 2$ then $\left|\bar{\mu} \times \bar{v}\right| = \ldots\ldots\ldots.$

A. $2\sqrt{16 - \left(\bar{a}.\bar{b}\right)^2}$

B. $2\sqrt{4\left(\bar{a}.\bar{b}\right)^2}$

C. $\sqrt{16 - \left(\bar{a}.\bar{b}\right)^2}$

D. $\sqrt{4 - \left(\bar{a}.\bar{b}\right)^2}$

Answer: A

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105. In a parallelogram ABCD, $\overrightarrow{AB} = \hat{i} + \hat{j} + \hat{k}$ and diagonal $\overrightarrow{AC} = \hat{i} - \hat{j} + \hat{k}$ then $\angle BAC$ = ...

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

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

C. $\sin^{-1}\left(\frac{\sqrt{8}}{3}\right)$

D. $\cos^{-1}\left(\frac{\sqrt{8}}{3}\right)$

Answer: C

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106. The points $A(\vec{a}), B(\vec{b})$ and $C(\vec{c})$ are collinear then ....

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

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

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

D. None of these

Answer: B

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107. For any vectors $\vec{a}, \vec{b}$ and $\vec{c}$. Out of the following, which statement is true ?

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

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

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

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

Answer: D

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108. $\bar{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\bar{b} = \hat{i} + \hat{j}$. The vector $\bar{c}$ is such that $\bar{a} \cdot \bar{c} = |\bar{c}|$, $|\bar{c} - \bar{a}| = 2\sqrt{2}$ and the angle between $\bar{a} \times \bar{b}$ and $\bar{c}$ is 30° then $\left|\left(\bar{a} \times \bar{b}\right) \times \bar{c}\right|$ = ...

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

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

C. 2

D. 3

Answer: B

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109. In a quadrilateral ABCD, $\overrightarrow{AB} = \vec{b}, \overrightarrow{AD} = \vec{d}$ and $\overrightarrow{AC} = m\vec{b} + p\vec{d}(m + p \geq 1)$. The area of the quadrilateral ABCD is ....

A. $\frac{1}{2}(p + m)\left|\vec{b} \times \vec{d}\right|$

B. $\left|\vec{b} \times \vec{d}\right|$

C. $2\left|\vec{b} \times \vec{d}\right|$

D. Nothing can be said

Answer: A

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110. If $\vec{a} = 2\hat{i} + \hat{j} + x\hat{k}$ and $\vec{b} = \hat{i} + \hat{j} - \hat{k}$ then the minimum area of a parallelogram formed by the vectors $\vec{a}$ and $\vec{b}$ is ....

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

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

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

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

Answer: B

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111. If $\vec{a}.\hat{i} = 4$ then $\left(\vec{a} \times \hat{j}\right).\left(2\hat{j} - 3\hat{k}\right) =$ ....

A. -12

B. 2

C. 0

D. 12

Answer: A

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112. $\vec{a}, \vec{b}$ and $\vec{c}$ are unit vectors $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \frac{\vec{b}}{2}$. The vector $\vec{a}$ makes the angle ...., ... with $\vec{b}$ and $\vec{c}$

respectively.

A. $40^\circ, 80^\circ$

B. $45^\circ, 45^\circ$

C. $30^\circ, 60^\circ$

D. $90^\circ, 60^\circ$

Answer: D

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113. If $\vec{u} = \hat{i} \times \left(\vec{a} \times \hat{i}\right) + \hat{j} \times \left(\vec{a} \times \hat{j}\right) + \hat{k} \times \left(\vec{a} \times \hat{k}\right)$ then $\vec{u}$ = ...

A. 0

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

C. $2\vec{a}$

D. $\vec{a}$

Answer: C

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114. For the vectors $\vec{x}$ and $\vec{y}$, $\vec{x} + \vec{y} = \vec{a}$, $\vec{x} \times \vec{y} = \vec{b}$ and $\vec{x}.\vec{a} = 1$ then $\vec{x}$ = ..., $\vec{y}$ = ...

A. $\vec{a}$, $\vec{a}$ - $\vec{x}$

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

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

D. None of these

Answer: D

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115. Vector $\vec{a} = \hat{i} - \hat{j}, \vec{b} = \hat{i} + \hat{j} + \hat{k}$. The vector $\vec{c}$ is such that $\vec{a} \times \vec{c} + \vec{b} = 0$ and $\vec{a}. \vec{c} = 4$ then $\left|\vec{c}\right|^2$ = ...

A. 8

B. $\frac{19}{2}$

C. 9

D. $\frac{17}{2}$

Answer: B

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116. The vectors $\vec{a}$ and $\vec{b}$ are not perpendicular. The vectors $\vec{c}$ and $\vec{d}$ are such that $\vec{b}\times\vec{c}=\vec{b}\times\vec{d}$ and $\vec{a}.\vec{d}=0$ then $\vec{d}$ = ...

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

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

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

D. $\vec{b} - \left(\frac{\vec{b} \cdot \vec{c}}{\vec{a} \cdot \vec{b}}\right)\vec{c}$

Answer: C

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117. $\vec{a} = \hat{j} - \hat{k}$ and $\vec{c} = \hat{i} - \hat{j} - \hat{k}$. The vector $\vec{b}$ is such that $\vec{a} \times \vec{b} + \vec{c} = 0$ and $\vec{a} \cdot \vec{b} = 3$ then $\vec{b}$ = ...

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

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

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

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

Answer: A

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118. For any vector $\vec{a}$, $\left(\vec{a} \times \vec{i}\right)^2 + \left(\vec{a} \times \hat{j}\right)^2 + \left(\vec{a} \times \vec{k}\right)^2 =$

....

A. $4a^2$

B. $2a^2$

C. a^2

D. $3a^2$

Answer: B

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119. $\vec{a}, \vec{b}$ and $\vec{c}$ are three vector $\vec{a} \neq 0$ and $|\vec{a}| = |\vec{c}| = 1, |\vec{b}| = 4, |\vec{b} \times \vec{c}| = \sqrt{15}$. If $\vec{b} - 2\vec{c} = \lambda\vec{a}$ then the value of λ is ....

A. -4

B. -2

C. 1

D. 3

Answer: A

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120. For any vecotr $\vec{a}$, The value of $\hat{i} \times (\vec{a} \times \hat{i}) + j \times (\vec{a} \times \vec{j}) + \hat{k} \times (\vec{a} \times \hat{k})$ is ....

A. $2\vec{a}$

B. $-2\vec{a}$

C. $\vec{a}$

D. $-\vec{a}$

Answer: A

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121. If $(a_1, 1, 1), (1, a_2, 1)$ and $(1, 1, a_3)$ are coplaner (where $a_i \geq 1, i = 1, 2, 3)$ then $\sum_{i=1}^{3} \frac{1}{1 - a_i}$ = ...

A. 0

B. - 1

C. 1

D. $3 - \sum_{i=1}^{3} a_i$

Answer: C

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122. If $\bar{x} = (1, -1, 0), \bar{y} = (0, 1, 3)$ and $\bar{z} = (2, 1, 1)$ then

$\bar{x} \times (\bar{y} \times \bar{z})$ = ...

A. $(2, 4, 2)$

B. $(2, 2, 4)$

C. $(4, 4, 2)$

D. $(-2, 2, 4)$

Answer: B

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123. If $\left[\vec{a}\times\vec{b}, \vec{b}\times\vec{c}, \vec{c}\times\vec{a}\right] = \lambda\left[\vec{a}, \vec{b}, \vec{c}\right]^2$ then λ = ...

A. 0

B. 1

C. 2

D. 3

Answer: B

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124. The volume of a parallelepiped with edges $\overrightarrow{OA} = (3, 1.4), \overrightarrow{OB} = (1, 2, 3), \overrightarrow{OC} = (2, 1, 5)$ is ....

A. 10

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

C. -10

D. 1

Answer: A

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125. Let $\vec{a}, \vec{b}$ and $\vec{c}$ are three unit vectors such that $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{\sqrt{3}}{2}(\vec{b} + \vec{c})$. If the vectors $\vec{b}$ and $\vec{c}$ are not parallel then the angle between $\vec{a}$ and $\vec{b}$ is ....

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

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

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

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

Answer: D

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126. If $|\bar{a}| = 1$ and $\bar{a} \times \bar{b} = (1, 2, 3)$ then $\bar{a} \times \left[\bar{a} \times \left(\bar{a} \times \bar{b}\right)\right] =$ ....

A. (1, 2, 3)

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

C. $(0, 0, 0)$

D. (1, 0, 0)

Answer: B

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127. If $\bar{x} \times \left(\bar{y} \times \bar{z}\right) = \left(\bar{x} \times \bar{y}\right) \times \bar{z}$ then $\bar{y} \times \left(\bar{z} \times \bar{x}\right) =$ ....

A. $\bar{z} \times (\bar{x} \times \bar{y})$

B. $\bar{x} \times (\bar{y} \times \bar{z})$

C. $\bar{0}$

D. $\bar{x} \times (\bar{z} \times \bar{y})$

Answer: C

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128. Let $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$. Let the vector $\vec{c}$ is such that $|\vec{c} - \vec{a}| = 3$, $|(\vec{a} \times \vec{b}) \times \vec{c}| = 3$. The angle between $\vec{c}$ and $\vec{a} \times \vec{b}$ is 30°. Then $\vec{a}.\vec{c}$ = ...

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

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

C. 2

D. 5

Answer: C

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129. If the unit $\bar{a}, \bar{b}$ and $\bar{c}$ are coplanar then ....

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

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

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

D. $(\bar{c} \times \bar{a}).\bar{b} = 1$

Answer: C

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130. If $\bar{a}, \bar{b}$ and $\bar{c}$ are not coplanar then

$(\bar{a} + \bar{b} + \bar{c}) \cdot [(\bar{a} + \bar{b}) \times (\bar{a} + \bar{c})] =$ ....

A. $[\bar{a} \quad \bar{b} \quad \bar{c}]$

B. $2[\bar{a} \quad \bar{b} \quad \bar{c}]$

C. $-[\bar{a} \quad \bar{b} \quad \bar{c}]$

D. $-2[\bar{a} \quad \bar{b} \quad \bar{c}]$

Answer: B

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131. If the vectors $3\hat{i} - 2\hat{j} - \hat{k}$, $2\hat{i} - 3\hat{j} - 4\hat{k}$, $-\hat{i} + \hat{j} + 2\hat{k}$ and $4\hat{i} + 5\hat{j} + \lambda\hat{k}$ are in the same plane then λ = ...

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

B. $\frac{146}{17}$

C. $\frac{-17}{146}$

D. $\frac{17}{147}$

Answer: A

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132. If the unit vectors $\bar{a}, \bar{b}$ and $\bar{c}$ are coplanar then

$\left[2\bar{a} - \bar{b}, 2\bar{b} - \bar{c}, 2\bar{c} - \bar{a}\right]$ = ...

A. 0

B. 1

C. $-\sqrt{3}$

D. $\sqrt{3}$

Answer: A

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133. $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}, \vec{b} = \hat{i} + 2\hat{j} - \hat{k}, \vec{c} = \hat{i} + \hat{j} - 2\hat{k}$. The vector $\vec{r}$ is coplanner with vector $\vec{b}$ and $\vec{c}$. If the magnitude of the projection $\vec{r}$ on $\vec{a}$ is $\sqrt{\frac{2}{3}}$ then $\vec{r}$ = ...

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

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

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

D. $2\hat{i} + \hat{j} + 5\hat{k}$

Answer: B

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134. $\bar{a}, \bar{b}$ and $\bar{c}$ are non zero vectors.

$\left|\left(\bar{a} \times \bar{b}\right) \cdot \bar{c}\right| = |\bar{a}|\left|\bar{b}\right||\bar{c}|$ then ....

A. $\bar{a} \cdot \bar{b} = 0, \bar{b} \cdot \bar{c} = 0$

B. $\bar{b} \cdot \bar{c} = 0, \bar{c} \cdot \bar{a} = 0$

C. $\bar{c} \cdot \bar{a} = 0, \bar{a} \cdot \bar{b} = 0$

D. $\bar{a} \cdot \bar{b} = \bar{b} \cdot \bar{c} = \bar{c} \cdot \bar{a} = 0$

Answer: D

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135. $\bar{d} = \lambda\left(\bar{a} \times \bar{b}\right) + \mu\left(\bar{b} \times \bar{c}\right) + v\left(\bar{c} \times \bar{a}\right)$ and $\left[\bar{a}\bar{b}\bar{c}\right] = \frac{1}{8}$

then $\lambda + \mu + v$ = ...

A. $\bar{d} \cdot \left(\bar{a} + \bar{b} + \bar{c}\right)$

B. $2\bar{d}.\left(\bar{a} + \bar{b} + \bar{c}\right)$

C. $4\bar{d}.\left(\bar{a} + \bar{b} + \bar{c}\right)$

D. $8\bar{d} \cdot \left(\bar{a} + \bar{b} + \bar{c}\right)$

Answer: D

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136. The volume of the tetrahedron whose vertices $\hat{i} - 6\hat{j} + 10\hat{k}$, $-\hat{i} - 3\hat{j} + 7\hat{k}$, $5\hat{i} - \hat{j} + \lambda\hat{k}$ and $7\hat{i} - 4\hat{j} + 7\hat{k}$ is 11 $(\text{unit})^3$ then λ = ...

A. -3

B. 3

C. 7

D. -1

Answer: C

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137. $\bar{a}, \bar{b}$ and $\bar{c}$ are three non zero, non planar vectors. $\bar{p} = \bar{a} + \bar{b} - 2\bar{c}, \bar{q} = 3\bar{a} - 2\bar{b} + \bar{c}$ and $\bar{r} = \bar{a} - 4\bar{b} + 2\bar{c}$. The volume of the parallelepiped formed by the vectors $\bar{a}, \bar{b}$ and $\bar{c}$ is V_1 and the volume of the parallelepiped formed by the vectors $\bar{p}, \bar{q}$ and $\bar{r}$ is V_2 then $V_2 : V_1$ = ...

A. $3:1$

B. $7:1$

C. $11:1$

D. $15:1$

Answer: D

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138. $\bar{a} = (1, 2, -3), \bar{b} = (2, 1, -1)$. The vector $\bar{\mu}$ is such that $\bar{a} \times \bar{\mu} = \bar{a} \times \bar{b}$ and $\bar{a}.\bar{\mu} = 0$ then $\left|\bar{\mu}\right|$ = ...

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

B. 10

C. $\sqrt{10}$

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

Answer: D

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139.

$\bar{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}, \bar{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}, \bar{c} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$

are three non zero vectors. The unit vector $\bar{c}$ is perpendicular to $\bar{a}$ and $\bar{b}$. The angle between $\bar{a}$ and $\bar{b}$ is

$\frac{\pi}{6}$ then, $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ = ...

A. 0

B. 1

C. $\frac{1}{4}|\bar{a}|^2|\bar{b}|^2$

D. $\frac{3}{4}|\bar{a}|^2|\bar{b}|^2$

Answer: C

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140. The adjacent sides of the parallelogram are $\bar{a} = 3\bar{\alpha} - \bar{\beta}, \bar{b} = \bar{\alpha} + 3\bar{\beta}, |\bar{\alpha}| = |\bar{\beta}| = 2$. The angle $\bar{\alpha}$ and $\bar{\beta}$ is $\frac{\pi}{3}$. The length of any one of the diagonal of a parallelogram is ....

A. $4\sqrt{7}$

B. $4\sqrt{5}$

C. $3\sqrt{7}$

D. $3\sqrt{5}$

Answer: A

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141. $\bar{\alpha} = 2\hat{i} + 3\hat{j} - \hat{k}, \bar{\beta} = -\hat{i} + 2\hat{j} - 4\hat{k}$ and $\bar{\gamma} = \hat{i} + \hat{j} + \hat{k}$ then $\left(\bar{\alpha} \times \bar{\beta}\right) \cdot \left(\bar{\alpha} \times \bar{\gamma}\right) =$ ....

A. 60

B. 64

C. 74

D. -74

Answer: D

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142. If $\bar{\mu} = \hat{i} \times \left(\bar{a} \times \hat{i}\right) + \hat{j} \times \left(\bar{a} \times \hat{j}\right)) + \hat{k} \times \left(\bar{a} \times \hat{k}\right)$ then

$\bar{\mu}$ = ...

A. 0

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

C. $2\bar{a}$

D. $\bar{a}$

Answer: C

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143. $\bar{a}, \bar{b}$ and $\bar{c}$ are three unit vectors. $\bar{a} \perp \bar{b}$ and $\bar{a} \mid \mid \bar{c}$ then $\bar{a} \times \left(\bar{b} \times \bar{c}\right)$ = ...

A. $\bar{a}$

B. $\bar{b}$

C. $\bar{c}$

D. 0

Answer: B

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144. $\bar{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\bar{b} = \hat{i} + \hat{j}$. The vector $\bar{c}$ is such that $\bar{a} \cdot \bar{c} = |\bar{c}|, |\bar{c} - \bar{a}| = 2\sqrt{2}$ and the angle between $\bar{a} \times \bar{b}$ and $\bar{c}$ is 30° then $\left|\left(\bar{a} \times \bar{b}\right) \times \bar{c}\right|$ = ...

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

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

C. 2

D. 3

Answer: B

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145. The vectors $\bar{a}$ and $\bar{b}$ are perpendicular then $\bar{a} \times \left\{\bar{a} \times \left\{\bar{a} \times \left(\bar{a} \times \bar{b}\right)\right\}\right\} = \ldots\ldots\ldots\ldots$

A. $|\bar{a}|^2\bar{b}$

B. $|\bar{a}|^3\bar{b}$

C. $|\bar{a}|^4\bar{b}$

D. None of these

Answer: C

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146. If $\bar{a}, \bar{b}, \bar{c}$ and $\bar{d}$ are coplanar vectors then $\left(\bar{a} \times \bar{b}\right) \times \left(\bar{c} \times \bar{d}\right) =$ ....

A. $\left|\bar{a} \times \bar{c}\right|^2$

B. $\left(\bar{a} \times \bar{a}\right)^2$

C. $\left|\bar{b} \times \bar{c}\right|^2$

D. 0

Answer: D

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147. $\bar{a} \times \left[\bar{a} \times \left(\bar{a} \times \bar{b}\right)\right] =$ ....

A. $(\bar{a} \times \bar{a}) \cdot (\bar{b} \times \bar{a})$

B. $\bar{a} \cdot (\bar{b} \times \bar{a})$ - $\bar{b} \cdot (\bar{a} \times \bar{b})$

C. $[\bar{a} \cdot (\bar{a} \times \bar{b})]\bar{a}$

D. $(\bar{a} \cdot \bar{a})(\bar{b} \times \bar{a})$

Answer: D

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148. For three vectors $\bar{a}, \bar{b}$ and $\bar{c}$, $\bar{a} \times (\bar{b} \times \bar{c}) = (\bar{a} \times \bar{b}) \times \bar{c}$ then

A. $\bar{b} \times (\bar{a} \times \bar{c}) = 0$

B. $\bar{a}(\bar{b} \times \bar{c}) = 0$

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

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

Answer: A

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149. If $\bar{a} = \hat{i} + \hat{j} + \hat{k}, \bar{b} = \hat{i} + \hat{j}, \bar{c} = \hat{i}$ and $\left(\bar{a} \times \bar{b}\right) \times \bar{c} = \lambda\bar{a} + \mu\bar{b}$ then $\lambda + \mu$ = ...

A. 0

B. 1

C. 2

D. 3

Answer: A

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150. $\left[\bar{a} \times \bar{b} \quad \bar{a} \times \bar{c} \quad \bar{d}\right]$ = ...

A. $\left(\bar{a} \cdot \bar{d}\right)\left[\bar{a}\bar{b}\bar{c}\right]$

B. $\left(\bar{a} \cdot \bar{c}\right)\left[\bar{a}\bar{b}\bar{c}\right]$

C. $\left(\bar{a} \cdot \bar{b}\right)\left[\bar{a}\bar{b}\bar{c}\right]$

D. None of these

Answer: A

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151. If $\left(\bar{a} \times \bar{b}\right) \times \left(\bar{b} \times \bar{c}\right) = \bar{b}$, where $\bar{a}, \bar{b}, \bar{c}$ are non zero vectors, then ....

A. $\bar{a}, \bar{b}, \bar{c}$ are coplanar vectors.

B. $\bar{a}, \bar{b}, \bar{c}$ may be coplanar vectors.

C. $\bar{a}, \bar{b}, \bar{c}$ are not coplanar vectors.

D. can not say anything.

Answer: C

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152. If $\bar{a}, \bar{c}$ and $\bar{d}$ are not coplanar vectors and $\bar{d}.\left(\bar{a} \times \left(\bar{b} \times \left(\bar{c} \times \bar{d}\right)\right)\right) = K\left[\bar{a}, \bar{c}, \bar{d}\right]$ then K = ...

A. $\bar{b} \cdot \bar{d}$

B. $\bar{a} \cdot \bar{d}$

C. $\bar{b} \cdot \bar{a}$

D. $\bar{a} \cdot \bar{c}$

Answer: A

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153. If $4\bar{a}+5\bar{b}+9\bar{c}=0$ then $\left(\bar{a}\times\bar{b}\right)\times\left[\left(\bar{b}\times\bar{c}\right)\times\left(\bar{c}\times\bar{a}\right)\right]=$ ....

A. Perpendicular vector to the plane $\bar{a}$, $\bar{b}$ and $\bar{c}$

B. Scalar quantity

C. $\bar{0}$

D. None of these

Answer: C

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154. $\vec{a}, \vec{b}$ and $\vec{c}$ are non zero vectors. $\left(\vec{a} \times \vec{b}\right) \times \vec{c} = \frac{1}{3}\left|\vec{b}\right|\left|\vec{c}\right|\vec{a}$. If the acute angle between the vectors $\vec{b}$ and $\vec{c}$ is θ then $\sin\theta$ = ...

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

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

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

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

Answer: D

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155. If $\vec{a}$ is a unit vector and $\vec{b} = (2, 1, -1)$ and $\vec{c} = (1, 0, 3)$. Then the maximum value of $\left[\vec{a}\,\vec{b}\,\vec{c}\right]$ is..............

A. -1

B. $\sqrt{59}$

C. $\sqrt{6} + \sqrt{10} + 1$

D. $\sqrt{60}$

Answer: B

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156. The volume of the parallelepiped with edges $-12\hat{i}+\alpha\hat{k}$, $3\hat{j}-\hat{k}$ and $2\hat{i}+\hat{j}-15\hat{k}$ is 546 then α = ...

A. 3

B. 2

C. -3

D. -2

Answer: C

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157. $\bar{a} \times \left[\bar{a} \times \left(\bar{a} \times \bar{b}\right)\right]$ = ...

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

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

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

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

Answer: D

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158. $\vec{a} \perp \vec{b}$ and $\vec{c}$, $\left|\vec{a}\right| = 2$, $\left|\vec{b}\right| = 3$, $\left|\vec{c}\right| = 4$. The angle between $\vec{b}$ and $\vec{c}$ is $\frac{2\pi}{3}$ then $\left|\left[\vec{a}\vec{b}\vec{c}\right]\right|$= ....

A. $4\sqrt{3}$

B. $6\sqrt{3}$

C. $12\sqrt{3}$

D. $18\sqrt{3}$

Answer: C

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159. $\left(\vec{a}\times\vec{b}\right)\times\vec{c}=\vec{a}\times\left(\vec{b}\times\vec{c}\right)$. If $\vec{a}\cdot\vec{c}$ ....

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

B. are perpendicular vectors

C. are parallel vectors

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

Answer: C

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160. $\vec{u}$, $\vec{v}$ and $\vec{w}$ are not co-planar vectors and p and q are real numbers. If $\left[3\vec{u}, p\vec{v}, p\vec{w}\right]$ - $\left[p\vec{v}, \vec{w}, q\vec{u}\right]$ - $\left[2\vec{w}, q\vec{v}, q\vec{u}\right] = 0$ then ....

A. (p, q) has only two values.

B. (p, q) has more than two values. But not all the values.

C. (p . q) has all the values.

D. $(p. q)$ has only one value.

Answer: B

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161. Let $\vec{X}, \vec{Y}$ and $\vec{Z}$ be three vectors such that $\left|\vec{X}\right| = \left|\vec{Y}\right| = \left|\vec{Z}\right| = \sqrt{2}$. The angle between $\vec{X}, \vec{Y}$ and $\vec{Z}$ with each other $60°$. $\vec{X} \times \left(\vec{Y} \times \vec{Z}\right) = \vec{a}, \vec{Y} \times \left(\vec{Z} \times \vec{X}\right) = \vec{b}$ and $\vec{X} \times \vec{Y} = \vec{C}$

Vector $\vec{X}$ = ...

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

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

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

D. None of these

Answer:

Watch Video Solution

162. Let $\vec{X}, \vec{Y}$ and $\vec{Z}$ be three vectors such that $\left|\vec{X}\right|=\left|\vec{Y}\right|=\left|\vec{Z}\right|=\sqrt{2}$. The angle between $\vec{X}, \vec{Y}$ and $\vec{Z}$ with each other 60°. $\vec{X}\times\left(\vec{Y}\times\vec{Z}\right)=\vec{a}, \vec{Y}\times\left(\vec{Z}\times\vec{X}\right)=\vec{b}$ and $\vec{X}\times\vec{Y}=\vec{C}$

Vector $\vec{Y}$ = ...

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

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

C. $4\left\{\left(\vec{a}+\vec{b}\right)+\left(\vec{a}+\vec{b}\right)\times\vec{c}\right\}$

D. None of these

Answer:

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163. Let $\vec{X}, \vec{Y}$ and $\vec{Z}$ be three vectors such that $\left|\vec{X}\right| = \left|\vec{Y}\right| = \left|\vec{Z}\right| = \sqrt{2}$. The angle between $\vec{X}, \vec{Y}$ and $\vec{Z}$ with each other 60°. $\vec{X}\times\left(\vec{Y}\times\vec{Z}\right)=\vec{a}, \vec{Y}\times\left(\vec{Z}\times\vec{X}\right)=\vec{b}$ and $\vec{X}\times\vec{Y}=\vec{C}$

Vector $\vec{Z}$ = ...

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

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

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

D. None of these

Answer:

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164. Measure of the angle between the vector $\vec{a}=\hat{i}-\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}+\hat{j}+\hat{k}$ is ....

A. $\sin^{-1}\frac{2\sqrt{2}}{3}$

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

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

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

Answer: A

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

A. -2

B. -8

C. 8

D. 2

Answer: B

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166. Find the area of a parallelogram whose adjacent sides are given by the vectors $\vec{a} = 3\hat{i} + 5\hat{j} - 2\hat{k}$ and $\vec{b} = 2\hat{i} + \hat{j} + 3\hat{k}$.

A. $\frac{1}{2}\sqrt{507}$

B. $\sqrt{387}$

C. $\sqrt{507}$

D. 25

Answer: C

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167. Let $\left|\vec{x}\right| = \left|\vec{y}\right| = \left|\vec{x} + \vec{y}\right| = 1$ and if measure of the angle between $\vec{x}$ and $\vec{y}$ is α, then $\cos\alpha$ = ...

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

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

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

D. 1

Answer: A

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168.

$$\hat{i} \cdot \left(\hat{k} \times \hat{j}\right) + \hat{j} \cdot \left(\hat{i} \times \hat{k}\right) + \hat{k} \cdot \left(\hat{j} \times \hat{i}\right) + \hat{i} \cdot \left(\hat{i} \times \hat{j}\right) + \hat{j} \cdot \left(\hat{j} \times \hat{k}\right)$$

= ....

A. -1

B. 1

C. 3

D. -3

Answer: D

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169. For three vectors $\vec{a}, \vec{b}$ and $\vec{c}, \vec{a}+\vec{b}+\vec{c}=\vec{0}\left|\vec{a}\right|=3, \left|\vec{b}\right|=4, \left|\vec{c}\right|=5$, then evaluate $2\left(\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}\right)$.

A. 100

B. 50

C. -25

D. -50

Answer: D

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170. A vector $\vec{a} = \alpha\hat{i} + 2\hat{j} + \beta\hat{k}(\alpha, \beta \in R)$ lies in the plane of the vectors, $\vec{b} = \hat{i} + \hat{j}$ and $\vec{c} = \hat{i} - \hat{j} + 4\hat{k}$. If $\vec{a}$ bisects the angle between $\vec{b}$ and $\vec{c}$, then

A. $\vec{a} \cdot \hat{i} + 2 = 0$

B. $\vec{a} \cdot \hat{k} + 2 = 0$

C. $\vec{a} \cdot \hat{i} + 1 = 0$

D. None of these

Answer: D

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

$\vec{a}, + \vec{b} + \vec{c} = \vec{0}.$

If $\lambda = \vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$ and

$\vec{d} = \vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}$ then the ordered pair $\left(\lambda, \vec{d}\right)$

is equal to :

A. $\left(\frac{3}{2}, 3\vec{a} \times \vec{c}\right)$

B. $\left(-\frac{3}{2}, 3\vec{c} \times \vec{b}\right)$

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

D. $\left(\frac{3}{2}, 3\vec{b} \times \vec{c}\right)$

Answer: C

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Practice Paper 10 Section A

1. $\hat{i}\cdot\left(\hat{j}\times\hat{k}\right)+\hat{j}\cdot\left(\hat{i}\times\hat{k}\right)+\hat{k}\cdot\left(\hat{i}\times\hat{j}\right)$ =...............

A. 0

B. 1

C. 2

D. 3

Answer:

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2. Let A(1, 2, -3) and B(-1, -2, 1) are two vectors. Direction cosines of the vector joining the vector in the direction A to is ....

A. $\left(-\frac{1}{3}, -\frac{2}{3}, \frac{2}{3}\right)$

B. $\left(\frac{1}{3}, -\frac{2}{3}, -\frac{2}{3}\right)$

C. $\left(-\frac{1}{3}, -\frac{2}{3}, -\frac{2}{3}\right)$

D. $\left(\frac{1}{3}, \frac{2}{3}, \frac{2}{3}\right)$

Answer: A

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3. $\bar{x}$ and $\bar{y}$ are unit vectors and the angle between them is θ. If θ = ... Then $\bar{x} + \bar{y}$ is a unit vector.

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

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

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

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

Answer:

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4. If $|\bar{a}| = 2, |\bar{b}| = 4, |\bar{c}| = 1$ and $\bar{a} + \bar{b} = -\bar{c}$ then $\bar{a}.\bar{b} + \bar{b}.\bar{c} + \bar{c}.\bar{a} =$ ....

A. -9.5

B. -10.5

C. 10.5

D. 7.5

Answer:

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5. The magnitude of the projection of $\hat{i} + 3\hat{j} + 7\hat{k}$ on $7\hat{i} - \hat{j} + 8\hat{k}$ is ....

A. $\frac{60}{\sqrt{114}}$

B. $\frac{60}{\sqrt{104}}$

C. $\frac{60}{\sqrt{141}}$

D. $\frac{60}{\sqrt{144}}$

Answer: A

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6. $\vec{a} \perp \vec{b}$ and $\vec{c}$, $\left|\vec{a}\right| = 2$, $\left|\vec{b}\right| = 3$, $\left|\vec{c}\right| = 4$. The angle between $\vec{b}$ and $\vec{c}$ is $\frac{2\pi}{3}$ then $\left|\left[\vec{a}\,\vec{b}\,\vec{c}\right]\right|$= ....

A. $4\sqrt{3}$

B. $6\sqrt{3}$`

C. $12\sqrt{3}$

D. $18\sqrt{3}$

Answer:

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Practice Paper 10 Section B

1. If a unit vector $\vec{a}$ makes an angle $\frac{\pi}{3}$ with $\hat{i}$, $\frac{\pi}{4}$ sith $\hat{j}$ and an acute angle θ with $\hat{k}$, then find the component of $\vec{a}$.

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2. $|\vec{a}| = 3,\ |\vec{b} = \frac{\sqrt{2}}{3}$. If $\vec{a} \times \vec{b}$ is a unit vector then find the angle between $\vec{a}$ and $\vec{b}$.

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3. If the vectors $\hat{i} - \hat{j} + \hat{k}, 3\hat{i} + \hat{j} + 2\hat{k}$ and $\hat{i} + \lambda\hat{j} - 3\hat{k}$ are coplanar then find the value of λ.

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4. A vector has magnitude 5 units. It is parallel to the resultant vectors of $\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + \hat{k}$. Find this vector.

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Practice Paper 10 Section C

1. The adjacent sides of a parallelogram are $2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\hat{i} - 2\hat{j} - 3\hat{k}$. Find the unit vector parallel to its diagonal. Also find the area of the parallelogram.

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2. Consider two points P and Q with position vectors $2\vec{a} + \vec{b}$ and $\vec{a}$ - $3\vec{b}$ respectively. Find the position vector of a point R which divide the line segment joining P and Q in the ratio. 1 : 2 externally. Prove that P is a midpoint of line segment RQ.

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3. For the vectors $\vec{a}, \vec{b}$ and $\vec{c}, \left|\vec{a}\right| = 3, \left|\vec{b}\right| = 4$ and $\left|\vec{c}\right| = 5$. Each vector is the perpendicular to the sum of remaining two vectors. Find $\left|\vec{a} + \vec{b} + \vec{c}\right|$.

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4. Prove that $\left[\vec{a}+\vec{b}, \vec{b}+\vec{c}, \vec{c}+\vec{a}\right]=2\left[\vec{a}, \vec{b}, \vec{c}\right]$.

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Practice Paper 10 Section D

1. Express the vector $2\hat{i}+3\hat{j}+\hat{k}$ as the sum of two vectors, one vector is perpendicualr to $2\hat{i}-4\hat{j}+\hat{k}$ and the other vector is parallel to $2\hat{i}-4\hat{j}+\hat{k}$.

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2. If (a, 1, 1), (1, b, 1) and (1, 1, c) are coplanar then prove that $\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}=1.$

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