# MATHS

# BOOKS - MAHAVEER PUBLICATION

# VECTOR

## Question Bank

**1.** State which of the following are scalars and which are vectors?

Give reasons.

$Mass$

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**2.** State which of the following are scalars and which are vectors?

Give reasons.

$Weight$

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**3.** State which of the following are scalars and which are vectors?

Give reasons.

$Momentum$

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**4.** State which of the following are scalars and which are vectors?

Give reasons.

$Temperature$

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**5.** State which of the following are scalars and which are vectors? Give reasons.

Force

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**6.** State which of the following are scalars and which are vectors? Give reasons.

$Density$

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**7.** Represent graphically a force 40 N in a direction $60^\circ$ north of east.

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**8.** Represent graphically a force of 30 N in a direction $49^\circ$ east of north.

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**9.** When is the sum of two non zero vectors is zero ?

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**10.** The position vectors of two points A and B are $3\vec{a} + 2\vec{b}$ and $2\vec{a} - \vec{b}$ respectively. Find the vector $\overrightarrow{AB}$

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**11.** Given $\vec{a} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} - 4\hat{j} - 3\hat{k}$, find the magnitude of $\vec{a}$

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**12.** Given $\vec{a} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} - 4\hat{j} - 3\hat{k}$, find the magnitude of $\vec{b}$

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**13.** Given $\vec{a} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} - 4\hat{j} - 3\hat{k}$, find the magnitude of $\vec{a} + \vec{b}$

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**14.** Given $\vec{a} = \hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} - 4\hat{j} - 3\hat{k}$, find the magnitude of $\vec{a} - \vec{b}$

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**15.** Find the position vector of a point which divides the join of two points whose position vectors are given by $\vec{a}$ and $\vec{b}$ in the ratio 1:3 internally.

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**16.** Find the position vector of mid point of the line segment AB, if the position vectors of A and B are respectively, $\vec{x} + 3\vec{y}$ and $3\vec{x} - \vec{y}$.

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

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**18.** Find the area of the triangle having point A(1,1,1)B(1,2,3) and C(2,3,1) as its vertices.

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**19.** Find the area of the parallelogram having point A(5,-1,1), B(-1,-3,4) C(1,-6,10) and D(7,-4,7) as its vertices.

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**20.** Let, P be a point in space such that $\left|\overrightarrow{OP}\right| = \sqrt{3}$ and $\overrightarrow{OP}$ makes angles $\frac{\pi}{3}, \frac{\pi}{4}, \frac{\pi}{3}$ with positive direction of x, y and z axes respectively. Find co-ordinates of point. -

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**21.** If P(2,-1,4) is a point in the space, find the direction cosines of vector $\overrightarrow{OP}$

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**22.** Can $\left(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$ be direction cosines of a vector.

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**23.** If P(2,3,-6) and Q(3,-4,-6) are two points in the space. Find the direction cosines of $\overrightarrow{OP}$, $\overrightarrow{QO}$ and $\overrightarrow{PQ}$, where Q is the origin.

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**24.** Find the direction cosines of a vector which makes equal angles with the axes.

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**25.** If P(1,2,-3) and Q(4,3,5) are two points in space , find the direction ratio of $\overrightarrow{OP}$, $\overrightarrow{QO}$ and $\overrightarrow{PQ}$.

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**26.** Find the scalar triple product of vectors $\hat{i}+2\hat{j}+3\hat{k}, -\hat{i}-\hat{j}+\hat{k}$ and $\hat{i}+\hat{j}+\hat{k}$.

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**27.** Show that the vectors $4\hat{i}-\hat{j}+\hat{k}, 3\hat{i}-2\hat{j}-\hat{k}$ and $\hat{i}+\hat{j}+2\hat{k}$ are co-planar.

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**28.** Find lambda if the vectors $\hat{i}+\hat{j}+2\hat{k}, \lambda\hat{i}-\hat{j}+\hat{k}$ and $3\hat{i}-2\hat{j}-\hat{k}$ are co-planar.

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**29.** Find the unit vector in the direction of $2\hat{i}+3\hat{j}+\hat{k}$.\

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**30.** Let, veca = hati+2hatj $\text{and}$ vecb = 2hati+hatj. $If$|veca| = |vecb| . $Arethe \overrightarrow{\longrightarrow} rs$veca&vecb` equal?

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

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**32.** Find the scalar and dot product of vectors $\hat{i}+2\hat{j}-3\hat{k}$ and $2\hat{i}-\hat{j}+\hat{k}$.

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**33.** Show that $\frac{\hat{i}-\hat{j}}{\sqrt{2}}$ is a unit vector.

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**34.** Find the direction ratios and direction cosines of the vector $\vec{a}=\hat{i}+\hat{j}-2\hat{k}$.

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

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**36.** Find $\left|\vec{x}\right|$, if for a unit vector $\vec{a}$, $\left(\vec{x}-\vec{a}\right).\left(\vec{x}+\vec{a}\right)=12$.

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**37.** 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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**38.** If = $\vec{a}=\hat{i}-7\hat{j}+7\hat{k}$ and $\vec{b}=3\hat{i}-2\hat{j}+2\hat{k}$ find $\vec{a}\times\vec{b}$ and $\left|\vec{a}\times\vec{b}\right|$.

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**39.** Evaluate $\left(3\vec{a}-5\vec{b}\right).\left(2\vec{a}+7\vec{b}\right)$

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**40.** Find $\lambda$ and $\mu$ if $\left(2\hat{i}+6\hat{j}+27\hat{k}\right)\times\left(\hat{i}+\lambda\hat{j}+\mu\hat{k}\right)=\overrightarrow{0}$.

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**41.** Show that, $\left(\overrightarrow{a}-\overrightarrow{b}\right)\times\left(\overrightarrow{a}+\overrightarrow{b}\right)=2\left(\overrightarrow{a}\times\overrightarrow{b}\right)$.

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**42.** Find the scalar triple product vectors $\hat{i}+2\hat{j}+3\hat{k}$, $\hat{i}-\hat{j}+\hat{k}$ and $\hat{i}+\hat{j}+\hat{k}$.

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

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**44.** Show that the points A(-2, 3, 5), B(1, 2, 3) and C(7, 0, -1) are collinear

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**45.** Show that the points with position vectors $\hat{i} + 2\hat{j} + 7\hat{k}$, $2\hat{i} + 6\hat{j} + 3\hat{k}$ and $3\hat{i} + 10\hat{j} - \hat{k}$ are collinear

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**46.** 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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**47.** Show that the vectors $\frac{1}{7}\left(2\hat{i}+3\hat{j}+6\hat{k}\right), \frac{1}{7}\left(3\hat{i}-6\hat{j}+2\hat{k}\right)$ and $\frac{1}{7}\left(6\hat{i}+2\hat{j}-3\hat{k}\right)$ are mutually perpendicular.

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**48.** If $\vec{a}=5\hat{i}-\hat{j}-3\hat{k}, \vec{b}=\hat{i}+3\hat{j}-5\hat{k}$ then show that the vectors $\vec{a}+\vec{b}$ & $\vec{a}-\vec{b}$ are perpendicular

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**49.** If $\vec{a}=2\hat{i}+2\hat{j}+3\hat{k}, \vec{b}=-\hat{i}+2\hat{j}+\hat{k}$ and $\vec{c}=3\hat{i}+\hat{j}$ such that $\vec{a}+\lambda\vec{b}$ is perpendicular to $\vec{c}$ then find the value of $\lambda$.

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**50.** Find x,y,z if $\hat{i}+\hat{j}+2\hat{k}$, $-\hat{i}+z\hat{k}$ and $2\hat{i}+x\hat{j}+y\hat{k}$ are mutually orthogonal.

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**51.** Find a vector and unit vector perpendicular to each of the vector $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ Where $\vec{a}=3\hat{i}+2\hat{j}+2\hat{k}\&\vec{b}=\hat{i}+2\hat{j}-2\hat{k}.$

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**52.** Find a vector of magnitude 11 in the direction opposite to that of $\overrightarrow{PQ}$, where P and Q are the points (1,3,2) and (-1,0,8), respectively.

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**53.** If the points (-1,-1,2) ,(2,m,5) and (3,11,6) are co-linear then find the value of m.

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**54.** Calculate the work done if a sled is pulled forward 50m along a frictionless surface by a force of 250N at an angle of $60^\circ$ to the horizontal.

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**55.** It takes 12000J of work to pull a sled 200m with a 120N force. Determine the angle of the rope with the horizontal.

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**56.** Calculate the work done by a force F = $-5\hat{i}+\hat{j}+7\hat{k}N$ when its point of application moves from point $\left(-2\hat{i}-6\hat{j}+\hat{k}\right)m$ to the point $\left(\hat{i}-\hat{j}+10\hat{k}\right)m$.

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**57.** A bolt is tightened using a 20N force, applied at an angle of $30^\circ$ to the end of a wrench that is 30 cm long. Calculate the magnitude of the moment or torque about its point of rotation.

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**58.** A bicycle pedal, 20 cm in length, has a 50N force applied to it at an angle of $45^\circ$. Determine the magnitude of the moment or torque.

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**59.** Which of the following is a vector quantity ?

A. Mass

B. Force

C. Time

D. Temperature

**Answer:**

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**60.** You are given a displacement vector of 5 cm due east. Show by a diagram the corresponding negative vector.

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**61.** Represent graphically a force 60N is a direction $60^\circ$ west of north.

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**62.** Represent graphically a force 100N is a direction $45^\circ$ west of north.

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**63.** The quantity which has only magnitude is called

A. A scalar quantity

B. A vector quantity

C. A chemical quantity

D. A magnitude quantity

**Answer:**

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**64.** Force is a vector quantity. True or false ?

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**65.** What is the magnitude of a unit vector?

A. It has no magnitude

B. Zero vector

C. Constant but not zero

D. Unity

**Answer:**

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**66.** Which have the following has zero magnitude?

A. Fixed vector

B. Zero vector

C. Modulus of a vector

D. Unit vector

**Answer:**

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**67.** Adding of two vectors to get a single vector is termed as

A. Final vector

B. Resultant vector

C. Dominant vector

D. Recessive vector

**Answer:**

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**68.** A vector which can be displaced parallel to itself and applied at any point, is known as?

A. Free vector

B. Null vector

C. Position vector

D. Unit vector

**Answer:**

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**69.** Which of the following lists of physical quantities consists only of Vector?

A. Time, temperature, velocity

B. Force, volume, momentum

C. Velocity, acceleration, mass

D. Force, accelration, velocity

**Answer:**

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**70.** If two vectors 2A and 3B which are in same direction are added together then their resultant is given by ?

A. 2A+3B

B. 3A+2B

C. 2A-3B

D. None of above

**Answer:**

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**71.** If two non-zero vectors are perpendicular to each other then their Scalar product is equal to ?

A. 0

B. 1

C. 2

D. 3

**Answer:**

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**72.** Two forces are acting together on an object. The magnitude of their resultant is minimum when the angle between the forces is

A. $0^\circ$

B. $60^\circ$

C. $120^\circ$

D. $180^\circ$

**Answer:**

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**73.** If the resultant of two forces each of magnitude F is 2F, then the angle between them will be?

A. $0^\circ$

B. $60^\circ$

C. $120^\circ$

D. $180^\circ$

**Answer:**

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**74.** The Scalar product of two vectors is $2\sqrt{3}$ and the magnitude of their vector product is 2. The angle between them is

A. $30^\circ$

B. $60^\circ$

C. $45^\circ$

D. $0^\circ$

**Answer:**

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**75.** Which of the following vectors is/are perpendicular to the vector $4\hat{i} + 3\hat{j}$?

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

B. $8\hat{i}$

C. $7\hat{j}$

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

**Answer:**

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**76.** Represent graphically a displacement of 30km, $60^\circ$ east of north.

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**77.** Classify the following measures as scalars and vectors. 20 kg.

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**78.** Classify the following measures as scalars and vectors.5 meter north-west

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**79.** Classify the following measures as scalars and vectors. $60^\circ$

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**80.** Classify the following measures as scalars and vectors. 10 watt

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**81.** Classify the following measures as scalars and vectors. $10^{-5} coluomb$

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**82.** Classify the following measures as scalars and vectors. $30\frac{m}{s^2}$

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**83.** Classify the following as scalar and vector quantities. Time period

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**84.** Classify the following as scalar and vector quantities. Distance

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**85.** Classify the following as scalar and vector quantities. Force

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**86.** Classify the following as scalar and vector quantities. Velocity

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**87.** Classify the following as scalar and vector quantities. Work done

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**88.** Answer the following as true or false.

Two collinear vectors are always equal in magnitude.

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**89.** Answer the following as true or false.

Two vectors having same magnitude are always collinear.

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**90.** Answer the following as true or false.

Two collinear vectors having the same magnitude are equal.

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**91.** Compute the magnitude of the following vectors:

$\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{b} = 3\hat{i} + \hat{j} - 4\hat{k}, \vec{c} = -\frac{1}{\sqrt{3}}\hat{i} - \frac{1}{\sqrt{3}}\hat{j} + \frac{1}{\sqrt{3}}\hat{k}.$

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**92.** Write two different vectors having same magnitude.

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**93.** Write two different vectors having same direction.

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**94.** Find the values of x,y and z so that the vectors $3\hat{i}+\hat{j}+4\hat{k}$ and $x\hat{i}+y\hat{j}+z\hat{k}$ are equal,

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**95.** Find the scalar and vector components of the vector with initial point (3, 5) and terminal point (-2,3).

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**96.** Find the sum of the vectors $\vec{a}=-2\hat{i}+\hat{j}-4\hat{k}$ and $\vec{b}=3\hat{i}-\hat{j}+5\hat{k}$.

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

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**98.** Find the unit vector in the direction of vector PQ, where P and Q are the points (1, 2, 3)and (4, 5, 6) respectively.

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

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**100.** 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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**101.** 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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**102.** Find the direction cosines of the vector $\hat{i} + 2\hat{j} + 3\hat{k}$.

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

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**104.** 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 Internally

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**105.** 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 externally

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**106.** Find the position vector of the mid point of the vector joining the points P(2,4, -1) and Q(4, 2, 5).

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**107.** 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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**108.** If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$, show that $\left(\vec{a} - \vec{d}\right)$ is parallel to $\left(\vec{b} - \vec{c}\right)$.

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**109.** Find the area of the parallelogram whose adjacent sides are represented by the vectors $\hat{i} + 2\hat{j} + 3\hat{k}$ and $3\hat{i} - 2\hat{j} + \hat{k}$.

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**110.** Find the area of the $\triangle ABC$ where co ordinates of A,B,C are (3, -1, 2),(1, -1, -3) and (4, -3, 1) respectively.

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**111.** If $\vec{A} = \hat{i} + 2\hat{j} + 3\hat{k}$ and $\vec{B} = \hat{i} + 4\hat{j} - 2\hat{k}$ then find $\left(\vec{A} + \vec{B}\right) \times \left(\vec{A} - \vec{B}\right)$.

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**112.** Find a unit vector perpendicular to each of the vectors $2\hat{i} - 3\hat{j} + \hat{k}$ and $3\hat{i} - 4\hat{j} - \hat{k}$.

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