



PHYSICS

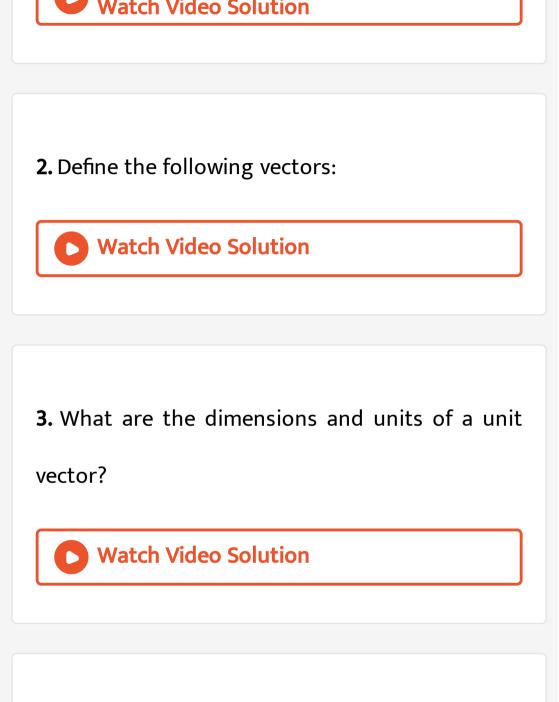
BOOKS - CHETANA PHYSICS (MARATHI ENGLISH)

MATHEMATICAL METHODS

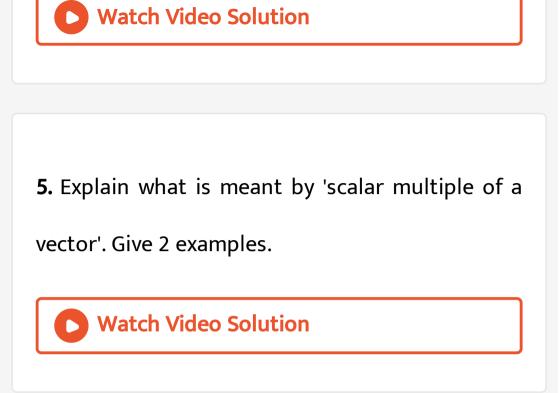


1. Define scalar and vector quantities. Give 2

examples of each



4. How can a vector be represented?

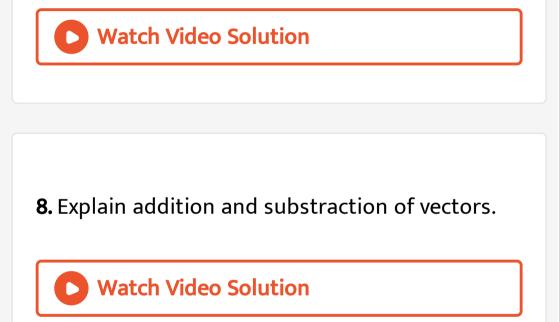


6. Distinguish between the scalars & vectors.

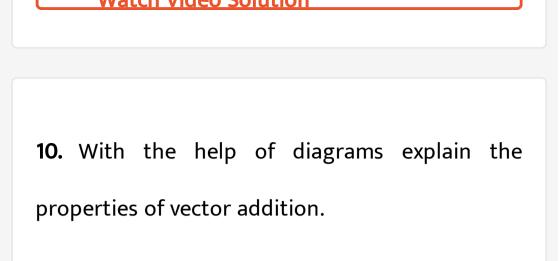


7. Is it correct to add two vectors representing

physical quantities having different dimensions?



9. State and explain the "triangle law of vector addition".

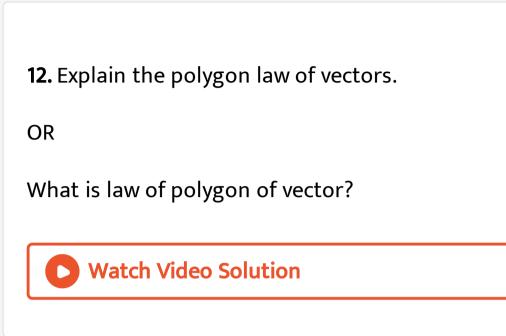




11. State the law of parallelogram of vectors.

(i) Obtain an expression for the magnitude of the resultant.

(ii) Obtain an expression for the direction of the resultant.



13. Two vectors of equal magnitude acting at a point, produce a resultant, also of the same magnitude. Find the angle between the vectors.

14. Two vectors \overrightarrow{a} and \overrightarrow{b} intersecting at a point, make an angle of 60° between them. If the magnitude of a is 8 units, and the magnitude of the resultant is 10 units, calculate the magnitude of \overrightarrow{b} . Also determine the direction of the resultant.

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15. What is meant by 'resolution of a vector'?

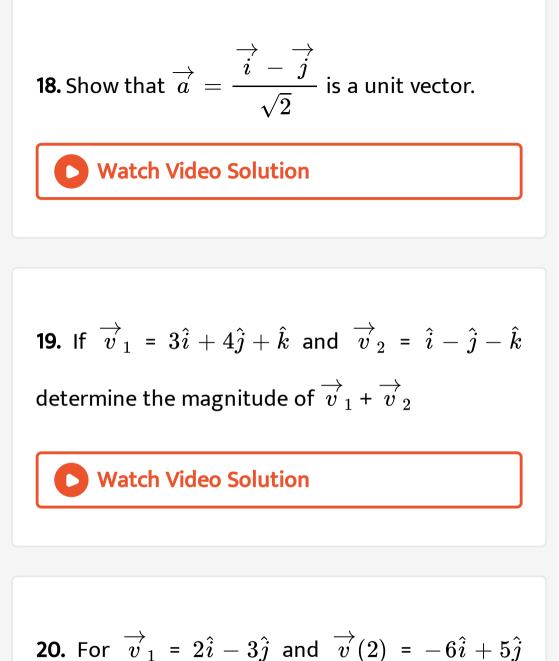
What are "rectangular components"?

16. Explain how the rectangular components of a 2-dimensional vector, convey the complete information about the vector.(i.e its magnitude and direction.)

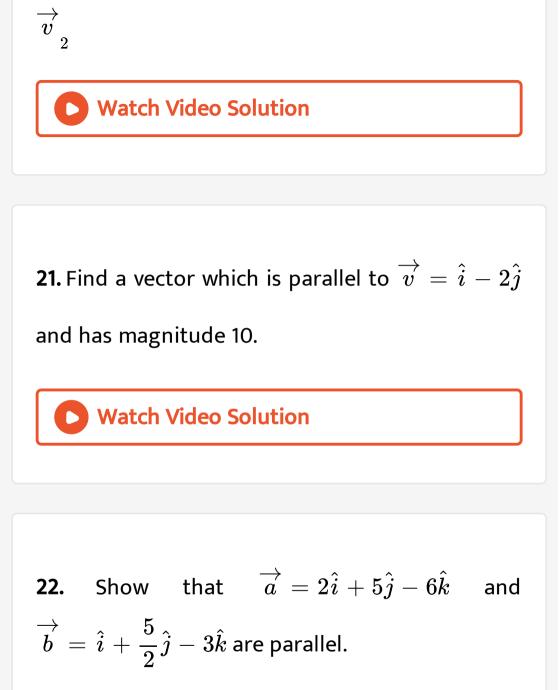
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17. How can the concept of components of a

vector be extended to a 3-dimension vector?



determine the magnitude and directon of \overrightarrow{v}_1 +



23. Define scalar product of 2 vectors. State any 2

of its properties.

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24. Derive the expression for the scalar product

of two vectors in "component form".

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25. Give 2 examples of scalar product of vectors.



26. Define vector product (or cross product) of two vectors. Also state the characteristics ofcross product.

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27. Derive the expression for the vector product

of two vectors in the "component form".

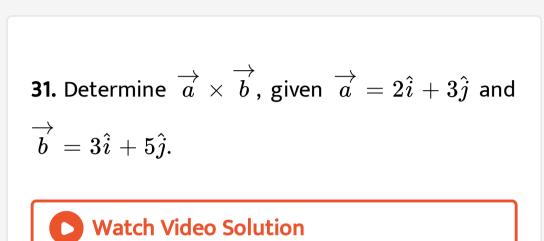
28. Give 2 examples of vector product of two vectors.



29. Explain the physical significance of the magnitude of the cross product.

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30. Distinguish between dot product and cross product.



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32. Show that vectors
$$\overrightarrow{a} = 2\hat{i} + 3\hat{j} + 6\hat{k}$$
, $\overrightarrow{b} = 3\hat{i} - 6\hat{j} + 2\hat{k}$ and $\overrightarrow{c} = 6\hat{i} + 2\hat{j} - 3\hat{k}$ are

mutually perpenducalar.

33. Determine the vector product of \overrightarrow{v}_1 = 2hati +

3hatj-hatk and oversetrarrvunderset(2)

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

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34. Given
$$\overrightarrow{v}_1$$
=5hati + 2hatj and oversetrarrvunderset(2) = $a\hat{i} - 6\hat{j}$

perpenducalar to each other, determine the value

of 'a'.



35. Find, \overrightarrow{P} . \overrightarrow{Q} where $\overrightarrow{P} = 2\hat{i} + 2\hat{j} + \hat{k}$ and $\overrightarrow{Q} = \hat{i} - \hat{j} + 2\hat{k}$

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36. Show that the vectors $\overrightarrow{A} = 4\hat{i} + 2\hat{j} - 4\hat{k}$ and $\overrightarrow{B} = \hat{i} + 4\hat{j} + 3\widehat{K}$ are perpenducular to each other.

37. Find a if $\overrightarrow{A} = 3\hat{i} - 2\hat{j} + 4\hat{k}$ and $\overrightarrow{B} = a\hat{i} + 2\hat{j} - \hat{k}$ are perpendicular to one another.



38. Find unit vectors perpendicular to the plane of the vectors. $\overrightarrow{A}=\hat{i}-2\hat{j}+\hat{k}$ and $\overrightarrow{B}=2i-k$

39. Find the cosine of the angle between the given vectors: $\overrightarrow{P}=3\hat{i}+12\hat{j}-4\hat{k}$ and $\overrightarrow{Q}=2\hat{i}+2\hat{j}+\hat{k}$

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40. Find the angle between the vectors
$$ec{A}=2\hat{i}+3\hat{j}+2\hat{k}$$
 and $ec{B}=\hat{i}-\hat{j}+3\hat{k}$

41. If $\overrightarrow{P} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\overrightarrow{Q} = 3\hat{i} + \hat{j} + 2\hat{k}$. Find the angle between \overrightarrow{P} and \overrightarrow{Q}

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42. A particle has a displacement represented by $\vec{r} = (\hat{i} + 2\hat{j} + \hat{k})$ m when under the action of two forces $\vec{F}_1 = (2hati - 3hatj + 2hatk)Nq$ and oversetrarrFunderset(2) $= (\hat{i} + \hat{j} + 3\hat{k})$ N. Find the work done.



43. Find $\overrightarrow{A} \times \overrightarrow{B}$, where $\overrightarrow{A} = 2\hat{i} - 5\hat{j} + 3\hat{k}$ and $\overrightarrow{B} = 3\hat{i} + 4\hat{j} - 9\hat{k}$

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44. If
$$\overrightarrow{A} = 2\hat{i} + \hat{j} - \hat{k}$$
 and $\overrightarrow{B} = \hat{i} + \hat{j} - \hat{k}$, determine the unit vector parallel to $\overrightarrow{A} \times \overrightarrow{B}$.

45. A force
$$\overrightarrow{F}=\left(4\hat{i}+2\hat{j}-\hat{k}
ight)$$
 N acts on a body at a distance of $\overrightarrow{r}=\left(-\hat{i}-3\hat{j}+\hat{k}
ight)$ m

from the origin of an inertial reference frame.

Find the torque acting on the body.



46. Find the area of the triangle formed by $\overrightarrow{A}=3\hat{i}-4\hat{j}+2\hat{k}$ m and $\overrightarrow{B}=\hat{i}+\hat{j}-2\hat{k}$ as

adjacent sides.



47. Find the area of the parallelogram with adjacent sides formed by \overrightarrow{P} and \overrightarrow{Q}



48. If $\left|\overline{A} + \overline{B}\right| = \left|\overline{A} - \overline{B}\right|$ then what can be the angle between \overline{A} and \overline{B} ?

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49. Using the rule for different for quotient of two functions, prove that $\frac{d}{dx}\left(\frac{\sin x}{\cos x}\right) = \sec^2 x.$

The angle made by $2\hat{i}+3\hat{j}$ with Z axis is

A.
$$30^{\circ}$$

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

C. $\tan^{-1}\left(\frac{3}{2}\right)$

D. 90°



The magnitude of (hati + hatj +hatk)` is

A. 1

B. 3

C. $\sqrt{3}$

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

Answer:

vector $2 \hat{i} + 3 \hat{j} - 7 \hat{k}$ and $\hat{i} + m \hat{j} - 2 \hat{k}$ are perpendicular vectors. The value of m is

$$\mathsf{A.}-\frac{1}{3}$$

1

B. -3

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

D. $-\frac{16}{3}$



If
$$\left(\overrightarrow{a} + \overrightarrow{b}\right)$$
 is maximum, the angle between \overrightarrow{a}
and \overrightarrow{b} must be

A. $45^{\,\circ}$

 B.0°

C. 90°

D. 180°



If the vector $\overrightarrow{a}\hat{i} + 0.8\hat{j} + 0.06\hat{k}$ is said to be unit vector, the value of a is.

A. 1

B. -1.4

C. 0

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

Answer:

When 2 vectors \overrightarrow{a} and \overrightarrow{b} are added, the magnitude of the resultant is always

A. greater than (a+b)

B. less than (a+b)

C. never greater than (a+b)

D. equal to (a+b)

Answer:

If a vector has magnitude5, its components have magnitude

A. 2 and 3

B. 2.5 and 3.5

C. 1 and 4

D. 3 and 4



Two forces of magnitude 7N and 5N act on a particle. The minimum magnitude of the resultant is

A. 1 N

B. 2 N

C. 6 N

D. 5 N

Answer:

A force $\stackrel{
ightarrow}{F}=\left(2\hat{i}-10\hat{j}+12\hat{k}
ight)$ N acts as a particle which moves along the positive Z axis. If it covers a distance of 10 m, the work done is A. 40 I B. 100 J C. 120 J $D_{.} - 100J$



The force acting on a body of mass m, produces acceleration a,given by the equation F= ma. If $\overrightarrow{F} = \left(8\hat{i} + 6\hat{j} - 10\hat{k}\right)$ N and acceleration is 1 m/s^2 , the mass of the body is

A. 4 kg

B. 20 kg

C. 200 kg

D. $10\sqrt{2}$ kg



The value of
$$\left(\overrightarrow{A}+\overrightarrow{B}
ight) imes \left(\overrightarrow{A}-\overrightarrow{B}
ight)$$
 is

A. 0

B. $A^2 - B^2$ C. $\overrightarrow{B} \times \overrightarrow{A}$ D. $2\left(\overrightarrow{B} \times \overrightarrow{A}\right)$

Answer:

The angle between $\left(\hat{i} + \hat{j}
ight)$ and $\left(\hat{j} + \hat{k}
ight)$ is

A. 0°

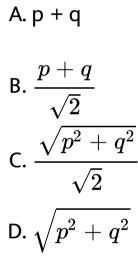
B. 90°

C. 30°

D. 60°



The resultant of two vectors \overrightarrow{p} and \overrightarrow{q} make 45° angle with both the magnitude of the resultant



Answer:

is

The angle between \overrightarrow{a} and the resultant of $\left(2\overrightarrow{a}+\overrightarrow{b}\right)$ and $\left(2\overrightarrow{a}-\overrightarrow{b}\right)$ is

A. 0°

B. 90°

$$\mathsf{C}.\tan^{-1}\!\left(\frac{1}{2}\right)$$

D. 45°



 \overrightarrow{p} and \overrightarrow{q} are two vectors. Then $\overrightarrow{P}.\left(\overrightarrow{p} imes\overrightarrow{q}
ight)$ is

A. pq

 $\mathsf{B.}\,p^2q$

C. zero

D. 2pq

Answer:

If
$$y = x^2 + 2x$$
, then $rac{dy}{dx}$ at x= 4 is

A. 4

B. 6

C. 8

D. 10



The displacement s of a particle is expressed by the relation $s = (6t^2 - 3t + 6)$ metres and t is in seconds. The velocity of the particle at t = 2 seconds is ... m/s.

A. 9

B. 81

C. 4.5

D. 21





The value of the integral
$$\displaystyle{\int_2^3 x^2 dx}$$
 is

A. 5

B. 19

C.
$$\frac{19}{3}$$

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



68. Chose the correct option $\int_0^{\pi/2} \sin heta d heta$ is equal to A. 0 B. -1 C. 1 $\mathsf{D}.\,\frac{1}{2}$



$$\int_0^{\pi/2} \overrightarrow{a} . \overrightarrow{b}$$
 d theta` is equal to

B.-ab

C. 0

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



The resultant of 2 forces 10N and 15N acting along + x and - x axes respectively is

A. 25N along + x axis

B. 25N along - x axis

C. 5N along + x axis

D. 5N along - x axis



For 2 vectors to be equal, they should have

A. Same magnitude

B. Same direction

C. Same magnitude and direction

D. Same magnitude but opposite direction

Answer:

The magnitude of scalar product of two unit vectors perpendicular to each other is

A. Zero

B. 1

C. -1

D. 2



The magnitude of vector product of two unit vectors making an angle of 60° with each other is

A. 1

B. 2

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

D. frac(sqrt3)(2)`

Answer:

If \overrightarrow{a} , \overrightarrow{b} , and \overrightarrow{C} are 3 vectors, then which of the

following is not correct?

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

$$\mathsf{C}.\overrightarrow{A}\times\overrightarrow{B}=\overrightarrow{B}\times\overrightarrow{A}$$

D.

$$\overrightarrow{A} imes \left(\overrightarrow{B} + \overrightarrow{C}
ight) = \left(\overrightarrow{A} imes \overrightarrow{B}
ight) + \left(\overrightarrow{A} imes \overrightarrow{C}
ight)$$

Answer:

75. The magnitude of the sum of 2 vectors is_____

A. Always equal to sum of magnitude of 2 vectorsB. Never equal to the sum of magnitude of 2 vectors

C. May be equal to the sum of magnitude of 2 vectors

D. Always less than sum of magnitude of 2 vectors

A. A. Always equal to sum of magnitude of 2

vectors

B. B. Never equal to the sum of magnitude of

2 vectors

C. C. May be equal to the sum of magnitude of

2 vectors

D. D. Always less than sum of magnitude of 2

vectors



76. State True/False:

The magnitude of the sum of 2 vectors is always

equal to the sum of magnitude of 2 vector.



77. State True/False:

The magnitude of the sum of 2 vectors is never

equal to the sum of magnitude of 2 vector.

78. State True/False:

The magnitude of the sum of 2 vectors is may be

equal to the sum of magnitude of 2 vector.



If \overrightarrow{a} and \overrightarrow{b} are 2 vectors of same magnitude

than
$$\left(\overrightarrow{a} + \overrightarrow{b}
ight)$$
 is

(a) at an angle $45^{\,\circ}$ with both vectors.

80. State True/False:

If \overrightarrow{a} and \overrightarrow{b} are 3 vectors of same magnitude than $\left(\overrightarrow{a} + \overrightarrow{b}\right)$ is

(b) at an angle of $45^{\,\circ}\,$ with any vector

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81. State True/False:

If \overrightarrow{a} and \overrightarrow{b} are 4 vectors of same magnitude than $\left(\overrightarrow{a} + \overrightarrow{b}\right)$ is

c. in a plain containing the 2 vectors

82. If
$$\hat{i}$$
 and \hat{j} are unit vectors , then $\left(\hat{i}+\hat{j}
ight)$

may be a unit vector



83. If \hat{i} and \hat{j} are unit vectors , then $\left(\hat{i}+\hat{j}
ight)$

is a unit vector



84. If
$$\hat{i}$$
 and \hat{j} are unit vectors , then $\left(\hat{i}+\hat{j}
ight)$

is not a unit vector



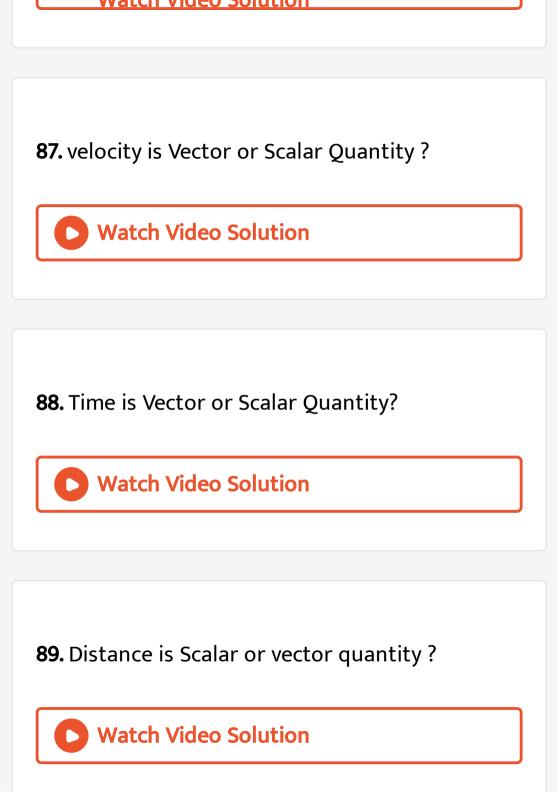
85. If
$$\hat{i}$$
 and \hat{j} are unit vectors , then $\left(\hat{i}+\hat{j}
ight)$

is a vector of magnitude2

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86. Pressure is Vector or Scalar Quantity?





90. What is meant by 'resolution of a vector'?



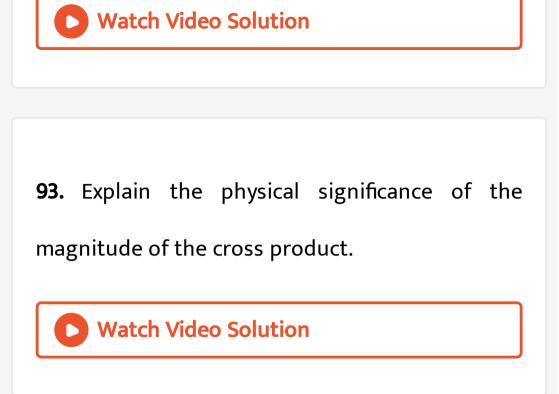
91. State the triangle law of vectors. State any 2

of its properties.

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92. Define scalar product of 2 vectors. State any 2

of its properties.



94. Explain addition and substraction of vectors.



95. Two forces of magnitude 10N and 15N act at a point making angle of 60° between them. Find the magnitude of the resultant and the angle made by it with the 10N force.



96. Determine the area of the parallelogram formed by the 2 vectors . $\hat{i}+3\hat{j}-4\hat{k}$ and $3\hat{i}-2\hat{j}-\hat{k}$

97. State the law of parallelogram of vectors.Obtain an expression for the magnitude of the resultant.



98. A dimensionally correct equation need not be actually correct, but a dimensionally incorrect equation is necessarily wrong. Justify.