YAKEEN NEET 2.0

2026

Vectors

Physics | Lecture - 6

By- Manish Raj (MR Sir)

Topics to be covered

1. # Vector Subtraction
2. Polygon law
3. Parallelogram law
   Position Vector ✓
4. Lami's thm ✓

Joint it

short Notes

Vector → ka question PdF

Assignment - 2

Vector addition

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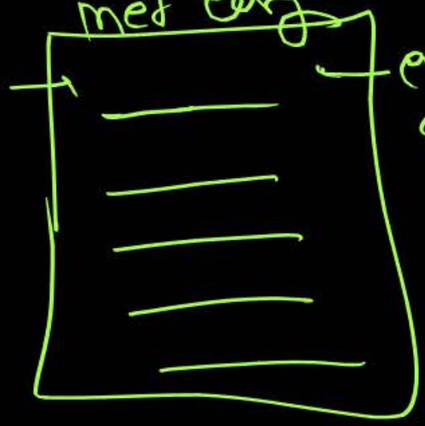

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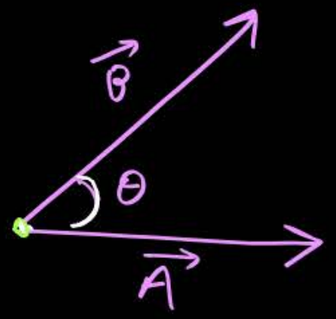
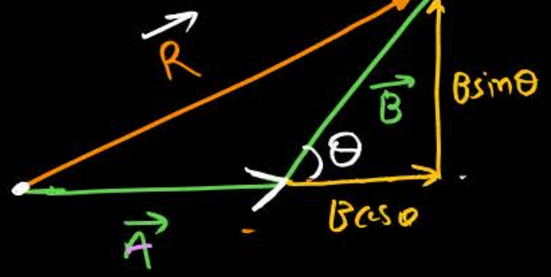
Vector addition

$\vec{R} = \vec{A} + \vec{B}$





$$R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$$

$\theta = 0^\circ$	$\theta = 90$	$\theta = 180$
$R = A + B$ (Max)	$R = \sqrt{A^2 + B^2}$	$R = A - B$ (Min)

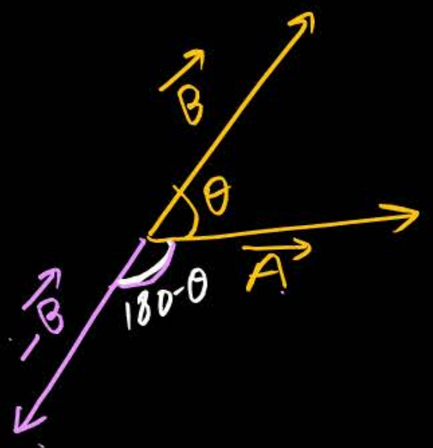
$$A - B \le R \le A + B$$

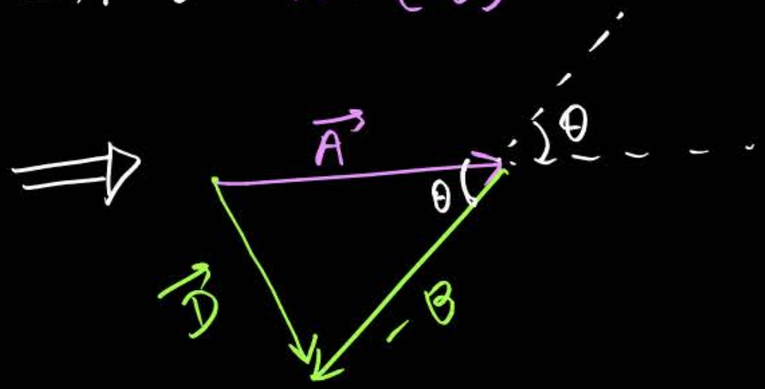
$R = 2A\cos(\theta/2)$ — Two vectors of same magnitude.

$\theta = 0$	$\theta = 60$	$\theta = 90$	$\theta = 120$	$\theta = 180$
$R = 2A$	$R = \sqrt{3}A$	$R = \sqrt{2}A$	$R = A$	$R = 0$

vector subtraction

$\vec{D} = \vec{A} - \vec{B} = \vec{A} + (-\vec{B})$





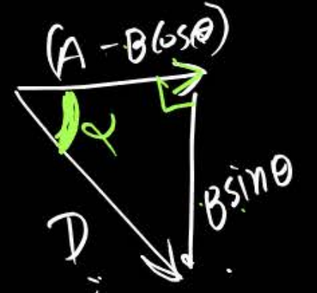
$$D = \sqrt{(A - B\cos\theta)^2 + (B\sin\theta)^2}$$

$$= \sqrt{A^2 - 2AB\cos\theta + B^2\cos^2\theta + B^2\sin^2\theta}$$

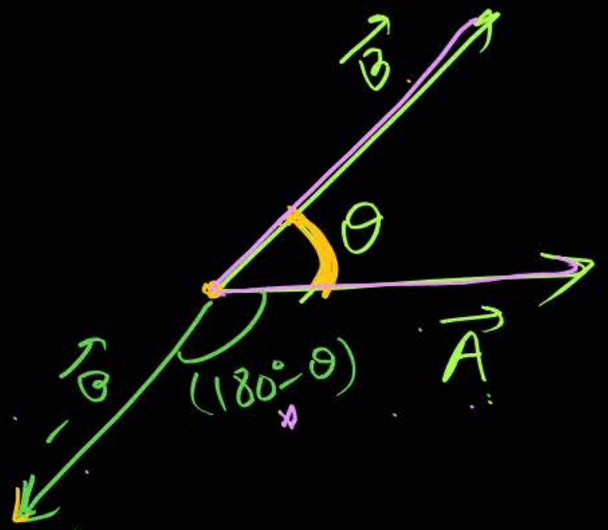
$$D = \sqrt{A^2 + B^2 - 2AB\cos\theta}$$

$\vec{D} = \vec{A} - \vec{B}$

Angle b/w $\vec{A}$ & $\vec{B}$



$$\tan\alpha = \frac{B\sin\theta}{A - B\cos\theta}$$ ✓



$$\vec{D} = \vec{A} - \vec{B} = \vec{A} + (-\vec{B})$$

Results of $\vec{A}$ & $-\vec{B}$

$$|\vec{D}| = \sqrt{A^2 + B^2 + 2AB\cos(180-\theta)}$$

$$D = \sqrt{A^2 + B^2 - 2AB\cos\theta}$$

$\cos(180-\theta) = -\cos\theta$

Angle b/w $\vec{A}$ & $\vec{B}$

$\vec{A} + (-\vec{B})$ or $\vec{A} - \vec{B}$ Same

$$R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$$

Results of $\vec{A}$ & $\vec{B}$

Vection addion

$$R = \sqrt{A^2+B^2+2AB\cos\theta}$$

Case-1

$\theta = 0^\circ$

$R_{max} = A+B$

Case-2

$\theta = 90^\circ$

$R = \sqrt{A^2+B^2}$

$\theta = 180$

$R = A-B$ (min)

$$A-B \leq R \leq A+B$$

$(180^\circ)_{min}$ 0° (max)

⊙ Two Vector of same magnitude.

$$R = 2A\cos(\theta/2)$$

$\theta = 0^\circ$	$\theta = 60$	$\theta = 90^\circ$	$\theta = 120$	$\theta = 180$
$R = 2A$	$R = \sqrt{3}A$	$R = \sqrt{2}A$	$R = A$	$R = 0$

Vector Subtrac

$$D = \sqrt{A^2+B^2-2AB\cos\theta}$$

Case-1

$\theta = 0^\circ$

$D = A-B$ (min)

Case-2

$\theta = 90^\circ$

$D = \sqrt{A^2+B^2}$

Case-3

$\theta = 180^\circ$

$D = A+B$ (max)

$$A-B \leq D \leq A+B$$

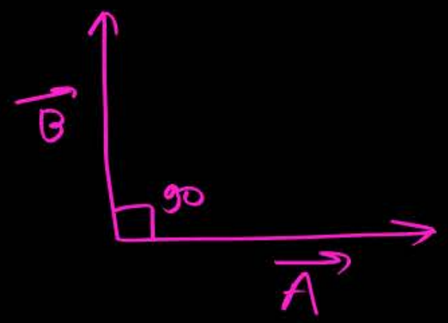
0° (min) $(\theta = 180^\circ)_{max}$

Two vector of same magnitude $|\vec{A}| = |\vec{B}| = A$

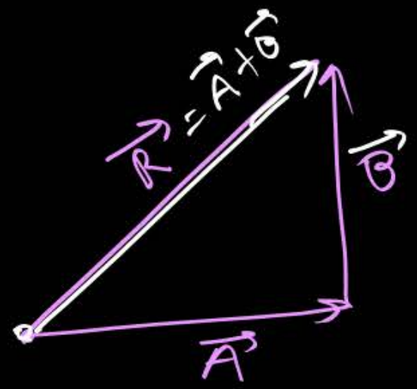
$$D = 2A\sin(\theta/2)$$

$\theta = 0^\circ$	$\theta = 60^\circ$	$\theta = 90$	$\theta = 120$	$\theta = 180$
0	$D = A$	$D = \sqrt{2}A$	$\sqrt{3}A$	$2A$

add karo

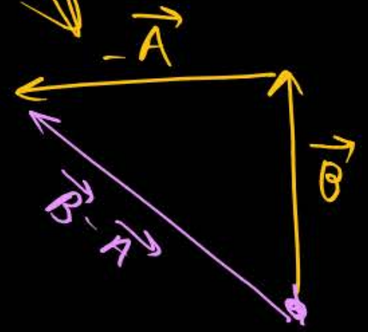


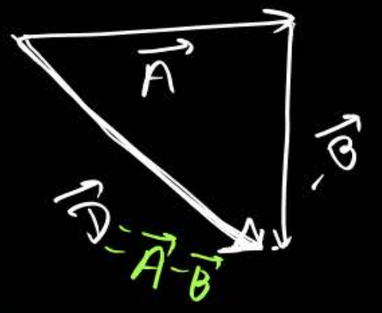
$\vec{D} = \vec{A} - \vec{B}$



$\vec{D} = \vec{B} - \vec{A}$

$= \vec{B} + (-\vec{A})$





Two vector of magnitude $|\vec{A}| = 6$ and $|\vec{B}| = 8$ find Magnitude of vector addition and vector subtraction. at Diff^{n} angle.

Soln

$(\theta = 0^\circ)_{\text{Parallel}}$

$R = 6 + 8 = 14$

$D = 8 - 6 = 2$

Soln

$\theta = 90^\circ$

$R = \sqrt{6^2 + 8^2} = \sqrt{100}$

$= 10$

$D = 10$

Soln

$\theta = 180^\circ$

$R = 2$ ✓

$D = 8 + 6 = 14$ ✓

$\Rightarrow |\vec{A}| = A$ = magnitude of $\vec{A}$

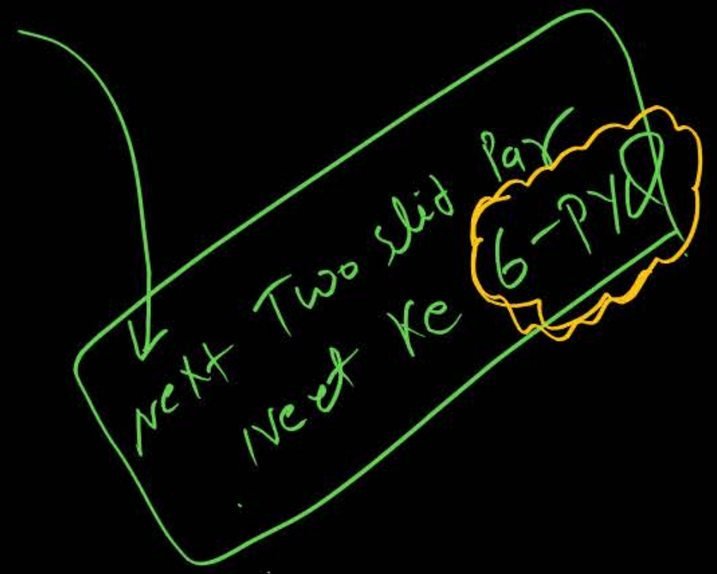
$\Rightarrow |\vec{A}+\vec{B}| = |\vec{R}|$ = magnitude of Result

$\Rightarrow |\vec{A}| + |\vec{B}| = A + B$ = sum of magnitude of $\vec{A}$ & $\vec{B}$

$\Rightarrow \vec{A} - \vec{B} = \vec{D}$

$\Rightarrow |\vec{A}-\vec{B}| = |\vec{D}|$ = magnitude of vector subtraction

$|\vec{A}| - |\vec{B}| = A - B$ = subtraction of magnitude of vector



Question

For two vector $\vec{A}$ and $\vec{B}$ vector addition $\vec{R} = \vec{A} + \vec{B}$ and vector subtraction $\vec{D} = \vec{A} - \vec{B}$ then angle between $\vec{A}$ and $\vec{B}$. for given condition.

Condition	Angle
(i) $\lvert\vec{A}+\vec{B}\rvert = \lvert\vec{R}\rvert = \lvert\vec{A}\rvert = \lvert\vec{B}\rvert$	$\theta = 120^\circ$ Ans
(ii) $\lvert\vec{A}\rvert = \lvert\vec{B}\rvert = \lvert\vec{A}-\vec{B}\rvert = \lvert\vec{D}\rvert$ (two vectr of same magn.)	60°
(iii) $A^2 + B^2 = \lvert\vec{A}-\vec{B}\rvert^2 = D^2$	$D = \sqrt{A^2+B^2}$, $\theta = 90$
(iv) $A^2 + B^2 = R^2$	$R = \sqrt{A^2+B^2}$ → $\theta = 90^\circ$ ✓

Question

Condition	Angle
(v) $\lvert\vec{A}+\vec{B}\rvert = \lvert\vec{A}-\vec{B}\rvert$	$\rightarrow$ $90°$
(vi) $\lvert\vec{A}+\vec{B}\rvert = \lvert\vec{A}\rvert + \lvert\vec{B}\rvert$	$\rightarrow$ $\theta = 0°$
(vii) $\lvert\vec{A}-\vec{B}\rvert = \lvert\vec{A}\rvert + \lvert\vec{B}\rvert$	$\rightarrow$ $180°$
(viii) $\lvert\vec{A}+\vec{B}\rvert = \lvert\vec{A}\rvert - \lvert\vec{B}\rvert$	$\rightarrow$ $180°$
(ix) $\lvert\vec{A}-\vec{B}\rvert = \lvert\vec{A}\rvert - \lvert\vec{B}\rvert$	$\rightarrow$ $0°$

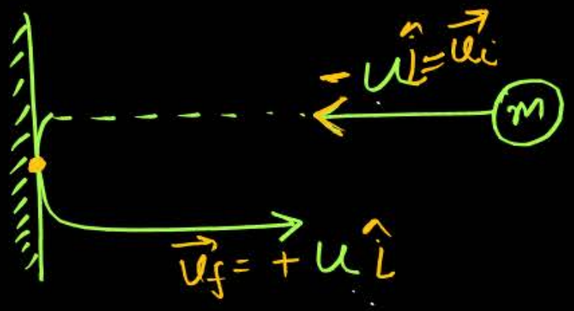
$|\vec{R}| = R = A + B$ (max)

$|\vec{D}| = A + B$

$R = A - B$ (min)

$D = A - B$ (min)

elastic collision



(Q) find change in velocity = ??

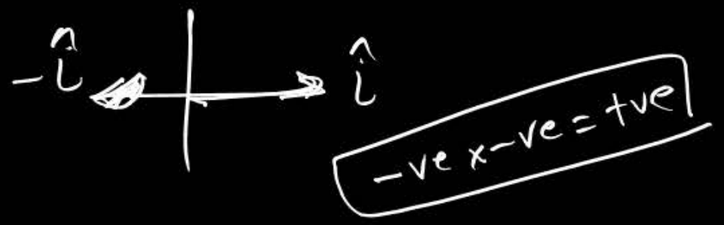
Soln

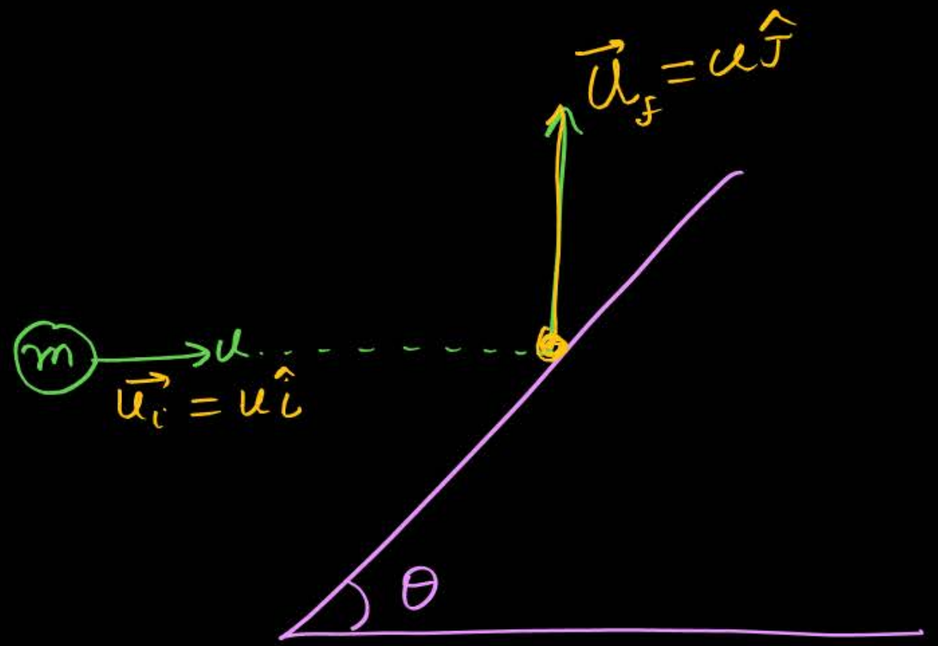
$$\vec{\Delta V} = \vec{V_f} - \vec{V_i}$$

$$= u\hat{i} - (-u\hat{i})$$

$$\vec{\Delta V} = 2u\hat{i}$$

change in velocity





(Q) Change in velocity.

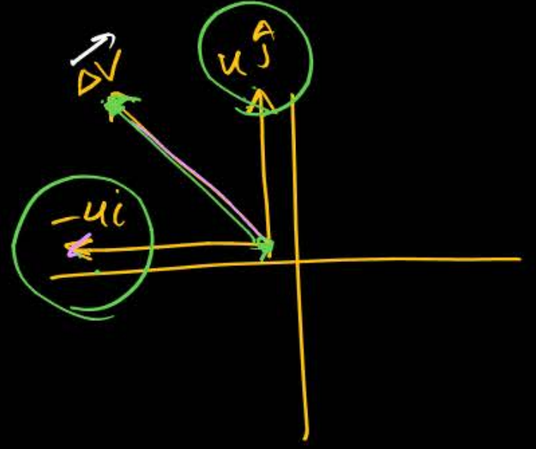
$$\vec{\Delta v} = \vec{v}_f - \vec{u}_i = u\hat{j} - u\hat{i}$$

$$= \vec{v}_f + (-\vec{u}_i)$$

$$\vec{\Delta v} = u\hat{j} - u\hat{i}$$

$$|\vec{\Delta v}| = \sqrt{u^2 + u^2} = \sqrt{2u^2}$$

$$= u\sqrt{2}$$



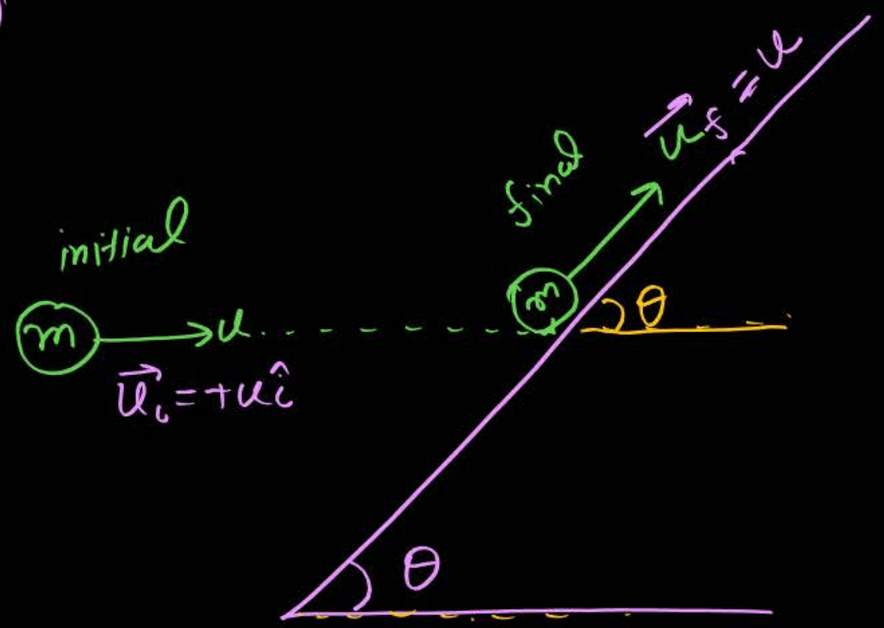
MR* Box

Vector Subtraction

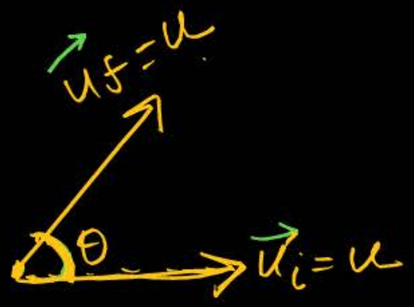
Ka matlab.

Jisko subtract kar rahe hai usko (ulta) -ve kar ke add kar do. ✓

(8)



Change in Velocity = ??



addition

$\vec{R} = \vec{u}_i + \vec{v}_f$

$|R| = 2u\cos\theta/2$

$\Delta\vec{v} = \vec{v}_f - \vec{u}_i$

$\Rightarrow$ Sub^n of Two vector of Same magnitude at an angle θ

$$|\Delta\vec{v}| = 2u\sin\theta/2$$

R

Question

If the sum of two unit vectors is a unit vector, then the magnitude of their difference is:

1. $\sqrt{3}$
2. $\sqrt{2}$
3. $\sqrt{5}$
4. $1/\sqrt{2}$

2 Vectors hai
Jinka magnitude
1 hai

$|\vec{R}| = 1$

$\{\hat{A} = 1\}$
$\{\hat{B} = 1\}$

$\{\hat{R} = 1\}$

θ (Any $\hat{A}$ & $\hat{B}$) is 120°

$\hat{A} - \hat{B} = \vec{D}$

$|\vec{D}| = 2A \sin\frac{\theta}{2}$

$= 2 \times 1 \times \sin\left(\frac{120}{2}\right)$ (60)

$= 2 \times \frac{\sqrt{3}}{2}$

$= \sqrt{3}$

Question

The vectors $\vec{A}$ and $\vec{B}$ are such that $|\vec{A}+\vec{B}| = |\vec{A}| = |\vec{B}|$, then $|\vec{A}-\vec{B}|$ may be equated to

1. $\frac{\sqrt{3}}{2}\vec{A}$
2. $\vec{A}$
3. $\sqrt{2}\,|\vec{A}|$
4. $\sqrt{3}\,|\vec{A}|$ ✓

Angle B/w $\vec{A}$ & $\vec{B}$
$\theta = 120°$ ✓

$= 2A \sin\theta/2$

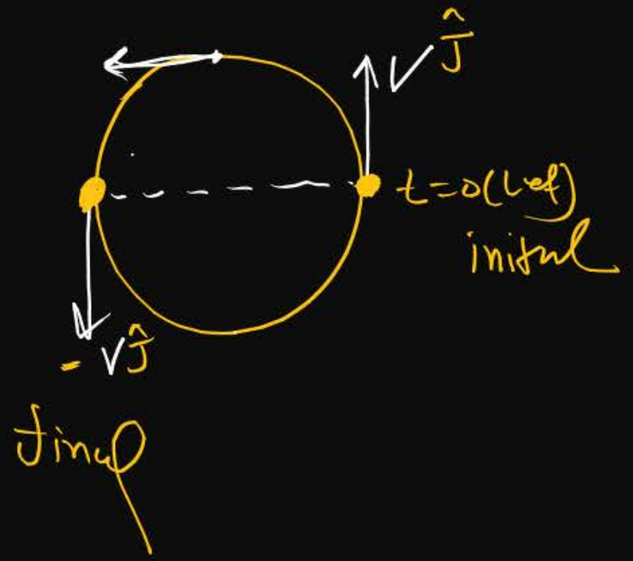
$= 2A \sin\left(\frac{120}{2}\right)$

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

$= \sqrt{3}A$

Question

Object is moving with speed V on circular path then find change in speed & velocity when it is at diametric opposite point.



Speed → How fast

Velocity → How fast / where

Change in speed = final speed − initial speed ✓

$= V - V = 0$

Change in velocity $= \vec{V}_f - \vec{V}_i = -V\hat{J} - V\hat{J}$

$= -2V\hat{J}$

Question

Initial velocity of object is 10 m/s east after some time its velocity becomes 10 m/s North then find change in velocity is?

Soln

$$\vec{u}_i = 10\hat{i}$$

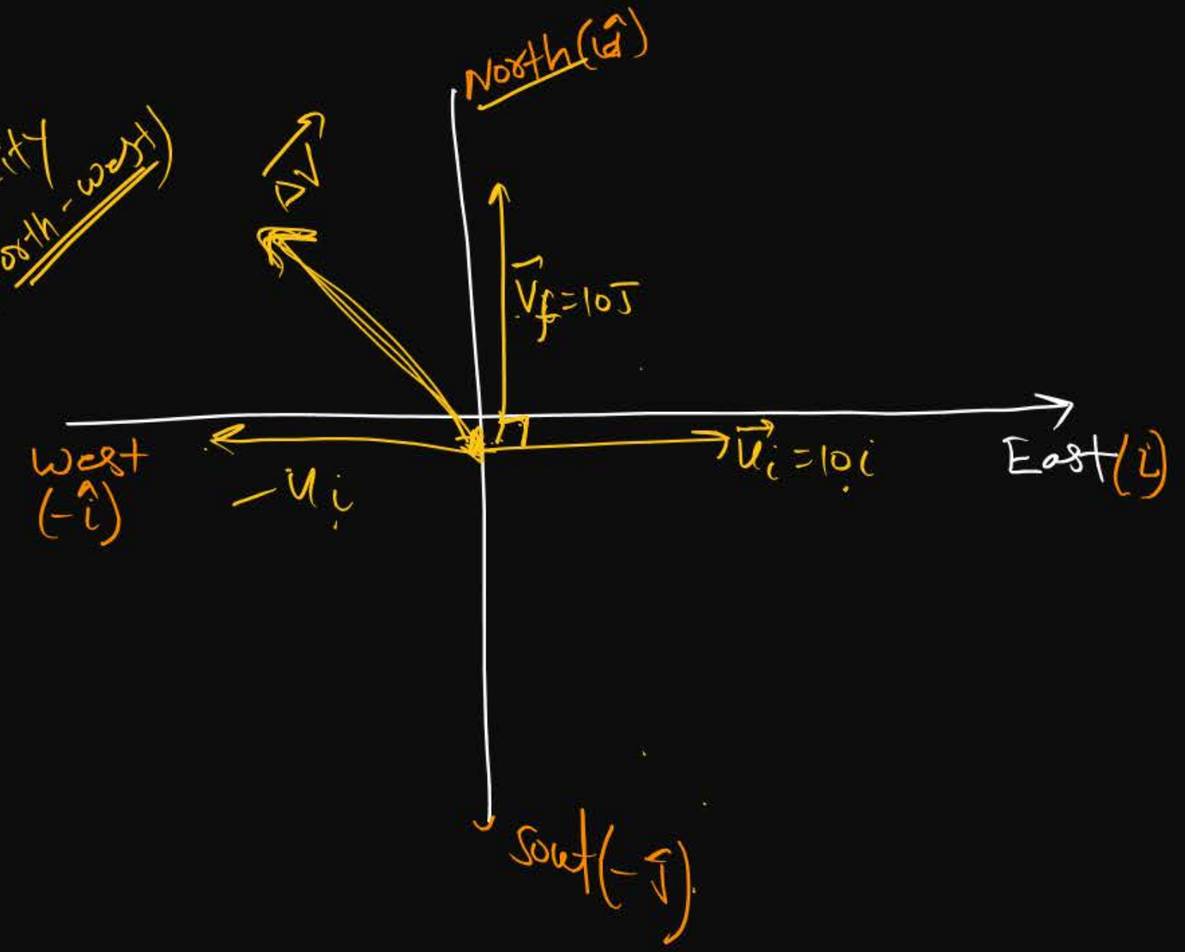
$$V_f = 10\hat{j}$$

$$\vec{\Delta V} = \vec{V}_f - \vec{V}_i$$

$$= 10\hat{j} - 10\hat{i}$$

$$|\vec{\Delta V}| = \sqrt{10^2 + (-10)^2} = \sqrt{200} = 10\sqrt{2} \quad (\text{North west})$$

Change in velocity in (North - west)



Question

Majnu Majedar is moving with 6 m/s in east and Ramlal is moving with 6 m/s at 30° east of North, then find relative velocity of Ramlal w.r.t. MM.

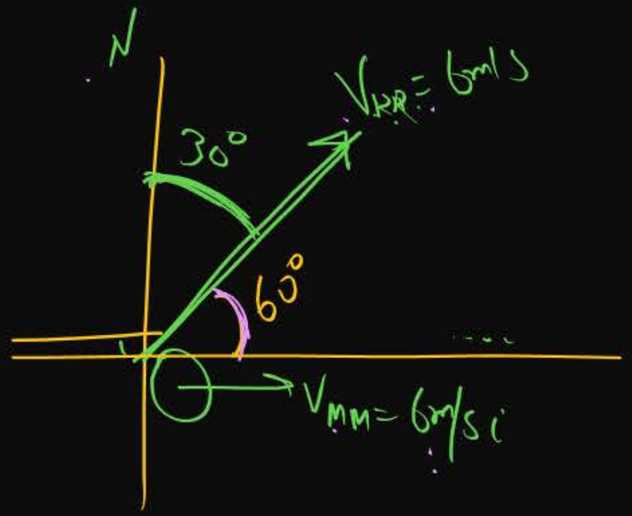
$\vec{v}_{R.L \text{ w.r.t. MM}} = \vec{v}_{R.L} - \vec{V}_{MM}$ (given)

$= \vec{v}_{R.L} + (-\vec{V}_{MM})$

= Vector subtract of Two vectors of Same magnitude (6) at angle 60

$\vec{v}_{MM} = 6\ m/s\ \hat{i}$

$V_{R.L} = 6\ m/s$ at 30° east of North



(*) $|\Delta\vec{V}| = 2V \sin\frac{\theta}{2}$

$= 2 \times 6 \times \sin\frac{60}{2}$

$= 2 \times 6 \times \frac{1}{2} = 6$

Question

Initial velocity of Ramlal is 5 m/s in north after some time it is moving 5 m/s in east then find

(i) Change in velocity

(ii) Magnitude of change in velocity

(iii) Change in magnitude of velocity

Zero

$\vec{u_i} = 5\hat{j}$ North

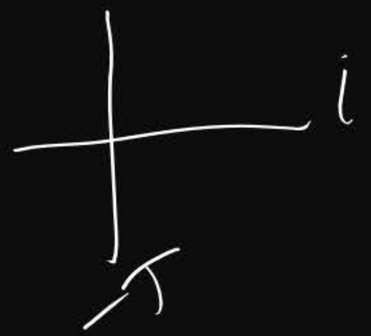
$\vec{v_f} = 5\hat{i}$ east ✓

$|\vec{v_f}| = 5$

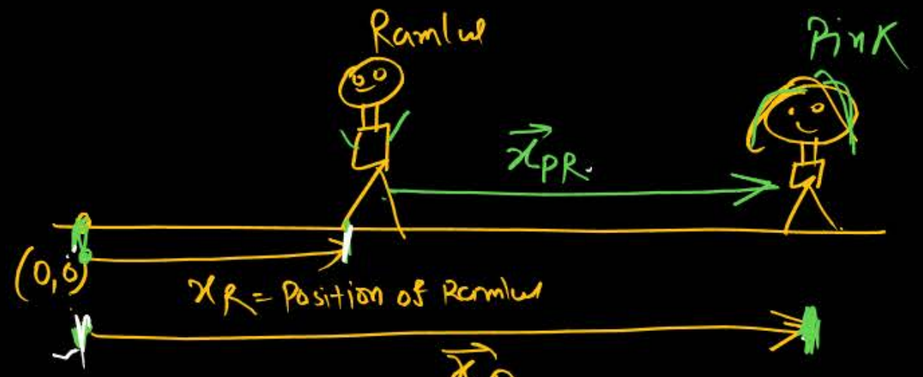
Sol^n (i) $\Delta\vec{v} = \vec{v_f} - \vec{v_i}$

$= 5\hat{i} - 5\hat{j}$

(ii) $|\Delta\vec{v}| = 5\sqrt{2}$ (south-east)



Position and displacement vector :-



$$\vec{x}_{PR} = \vec{x}_P - \vec{x}_R$$

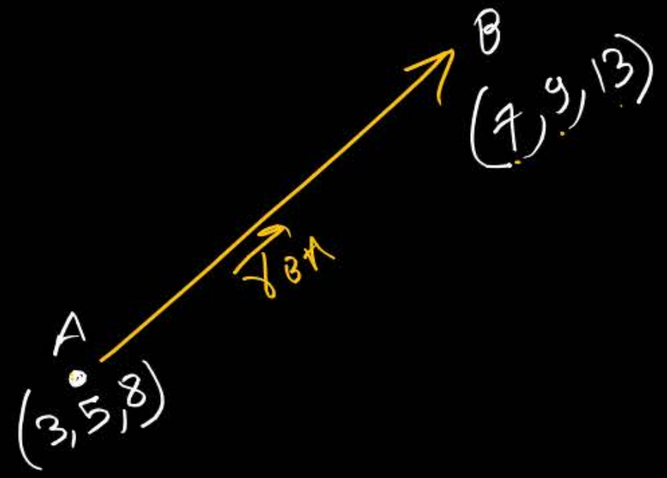
Position of Pinki w.r.t Ramlal

$$\vec{x}_{RP} = \vec{x}_R - \vec{x}_P$$

$$\vec{r}_{AB} = \vec{r}_A - \vec{r}_B$$

↑ observer

$$\vec{V}_{AB} = \vec{V}_A - \vec{V}_B$$



⑧ Find Position of B w.r.t A

$$\vec{r}_{BA} = \vec{r}_B - \vec{r}_A$$

$$= (7\hat{i} + 9\hat{j} + 13\hat{k}) - (3\hat{i} + 5\hat{j} + 8\hat{k}) = 4\hat{i} + 4\hat{j} + 5\hat{k}$$

$$\vec{r}_{BA} = 4\hat{i} + 4\hat{j} + 5\hat{k}$$

Question

Find position vector of A(1, 2, 1) w.r.t. point B(–1, 2, 0)?

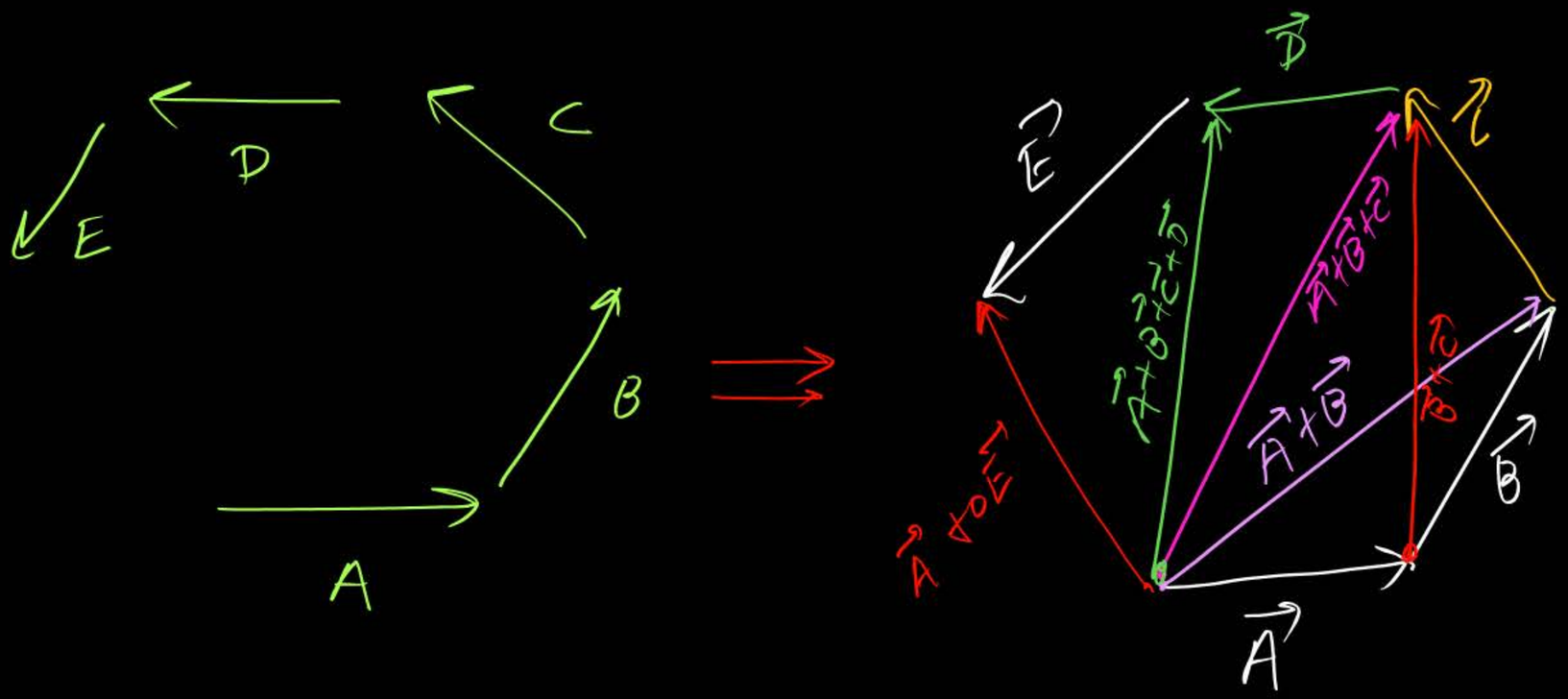
$$\vec{r}_{AB} = \vec{r}_A - \vec{r}_B$$

$$= (i + 2j + k) - (-i + 2j + 0k)$$

$$= i + 2j + k + i - 2j$$

$$\vec{r}_{AB} = 2i + k$$

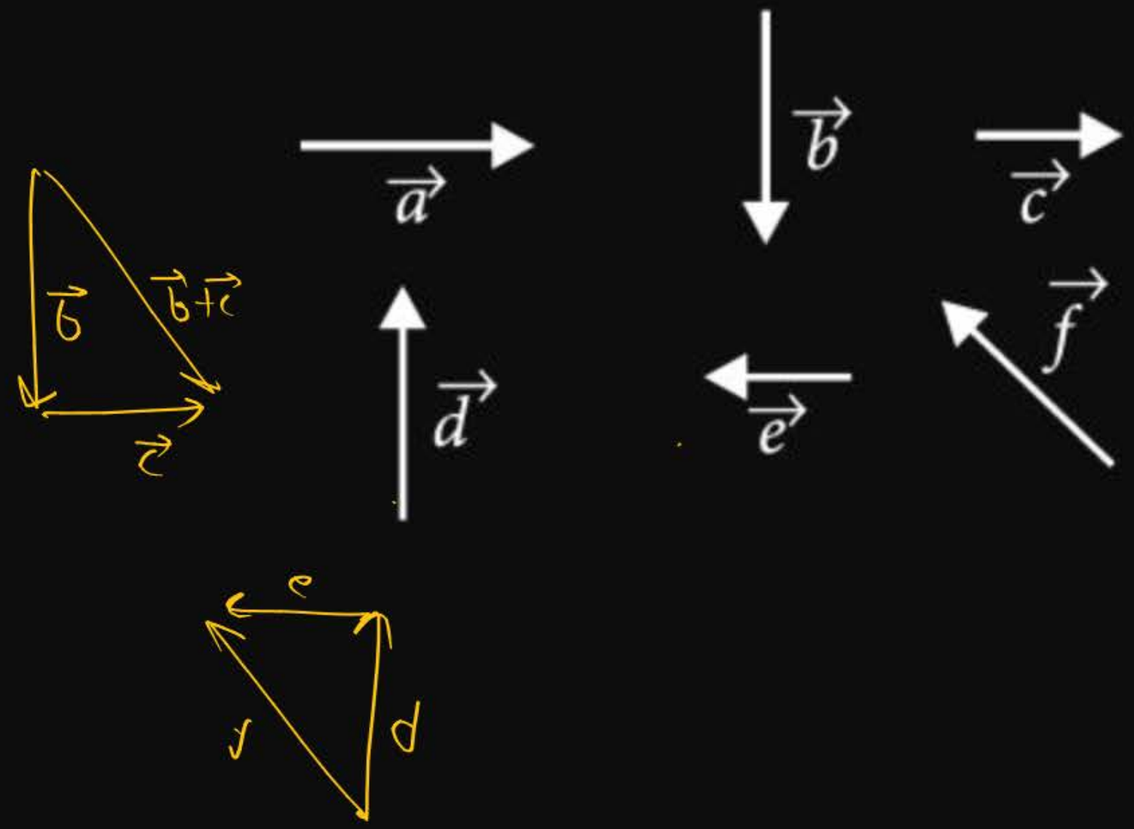
Polygon law of vector addition ⟶ Same as Triangle of addition but for More than Two vector.



Question

Six vectors, $\vec{a}$ through $\vec{f}$ have the magnitudes and directions indicates in the figure. Which of the following statements is true? **(2010)**

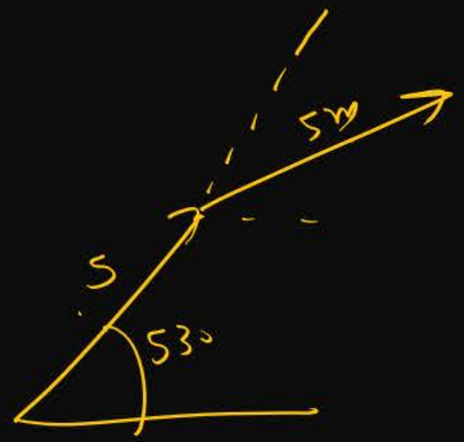
1. $\vec{b}+\vec{c}=\vec{f}$
2. $\vec{d}+\vec{c}=\vec{f}$
3. $\vec{d}+\vec{e}=\vec{f}$
4. $\vec{b}+\vec{e}=\vec{f}$

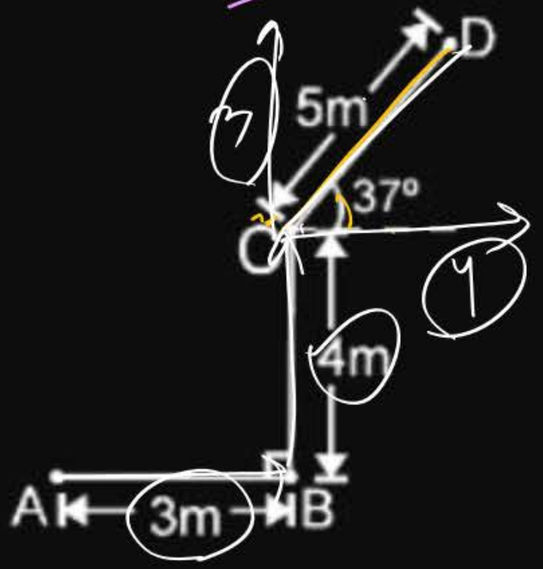


Question

A particle moves along a path ABCD as shown in the figure. Then the magnitude of net displacement of the particle from position A to D is:

1. 10 m
2. $5\sqrt{2}$ m
3. 9 m
4. $7\sqrt{2}$ m





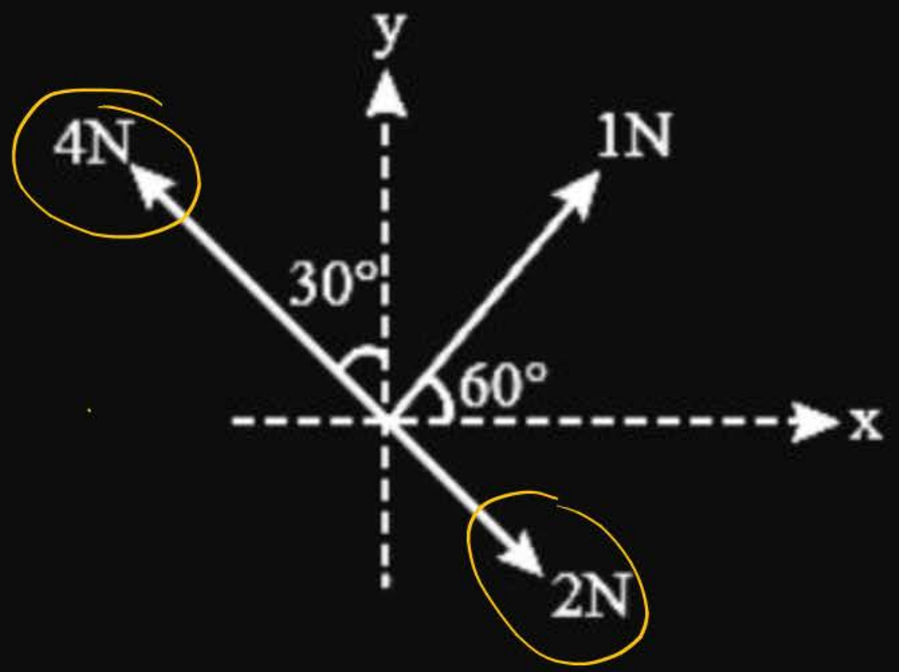
Question H/W

Two object moving with velocity $V_1 = 20\sqrt{2}$ South-West and $V_2 = 40$ m/s North then $\vec{V}_1 + \vec{V}_2 = ?$

Question

H/W
Component ke sath

Three force acting on the body as shown in figure. To have resultant force only along y-axis, magnitude of minimum additional force needed is?



1. $\sqrt{3}$ N
2. $\frac{\sqrt{3}}{2}$ N
3. 1.5 N
4. $\frac{1}{2}$ N

Question

If a student moves as given below:

(i) 50m in East

(ii) 20m in North

(iii) $40\sqrt{2}$m in S-E direction. Find net Displacement?

Question H/W

If $\vec{A} = 2\hat{\imath} + 3\hat{\jmath} + 4\hat{k}$ and $\vec{B} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ find:

(i) $\vec{A} + \vec{B}$

(ii) $\vec{B} - \vec{A}$

(iii) $\vec{B} - \frac{\vec{A}}{2}$

(iv) $2\vec{A} + \vec{B}$

(v) $\vec{A} - 2\vec{B}$

Question

H/W

If $\vec{A} = 2\hat{\imath} - 4\hat{\jmath} + 3\hat{k}$ and $\vec{B} = 4\hat{\imath} - 8\hat{\jmath} + 6\hat{k}$ find angle between $\vec{A}$ and $\vec{B}$.

1. Zero
2. $90°$
3. $60°$
4. Can't find

Question

H/W

If $\vec{A} + \vec{B} + \vec{C} = 0$ and $\vec{A} = 2\hat{\imath} + \hat{\jmath} - \hat{k}$ and $\vec{B} = \hat{\imath} + 2\hat{\jmath} + \hat{k}$, then find $\vec{C}$?

Question

H/W

Force of magnitude 20 N acting along vector $\vec{A} = 2\hat{\imath} + 3\hat{\jmath} - \sqrt{3}\hat{k}$, then find force in vector force and acceleration of object if mass 5 kg.

THANK YOU