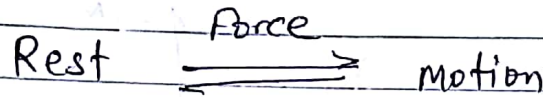


Que (1) Define force and write its characteristics.

Ans

Force :-

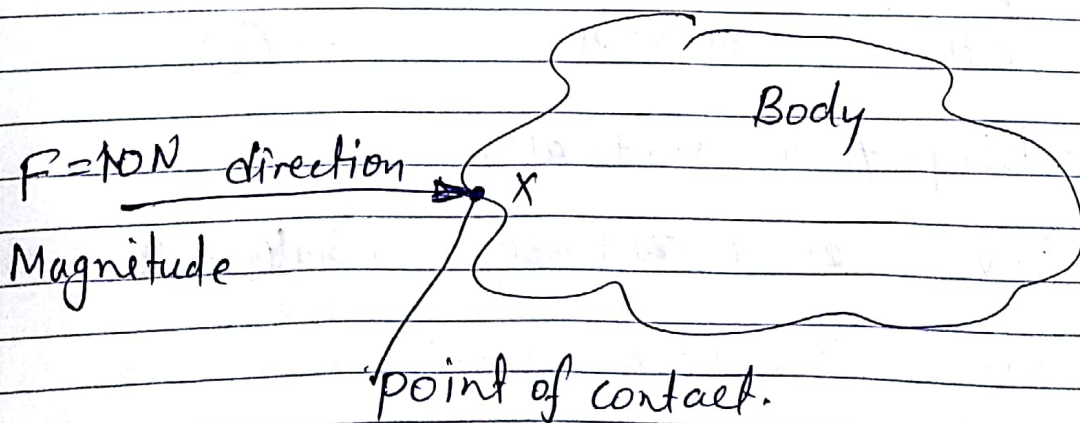
Force is define as a agent which is responsible for any body who is either rest or motion. i.e. who convert the body at rest into body in motion and vica-versa.



Characteristics of force :-

Force is a vector quantities with three characteristic

- Magnitude
- Direction
- point of Contact



Que. ② The following forces act at a point

i) 20N inclined at 30° towards north of east

ii) 25N towards north

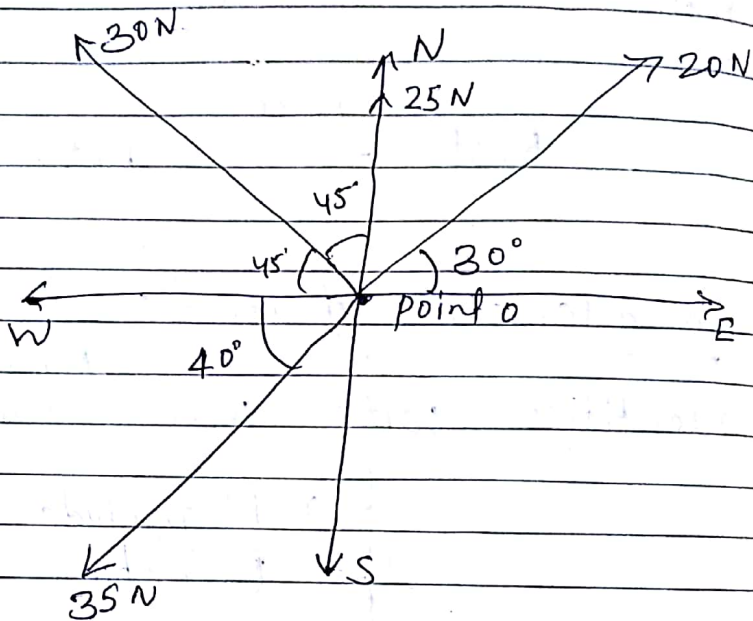
iii) 30N towards north west

iv) 35N inclined at 40° towards south of west.

Find the magnitude and direction of the resultant force.

Ans

Given



Resolving forces horizontally

$$\Sigma H = 20 \cos 30^\circ + 25 \cos 90^\circ - 30 \cos 45^\circ - 35 \cos 40^\circ$$

$$\Sigma H = -30.70 \text{ N} \quad \text{--- (1)}$$

Resolving forces vertically

$$\Sigma V = 25 + 20 \sin 30^\circ + 30 \sin 45^\circ - 35 \sin 40^\circ$$

$$\Sigma V = 33.71 \text{ N} \quad \text{--- (2)}$$

Resultant of forces at point O

$$R = \sqrt{\Sigma H^2 + \Sigma V^2}$$

$$= \sqrt{(-30.70)^2 + (33.71)^2}$$

$$= \sqrt{2078.854}$$

$$R = 45.59 \text{ N} \quad \text{Ans}$$

direction of Resultant force

$$\tan \phi = \frac{\Sigma V}{\Sigma H}$$

$$\phi = \tan^{-1} \left(\frac{33.71}{-30.70} \right)$$

$$\phi = -52.17^\circ$$

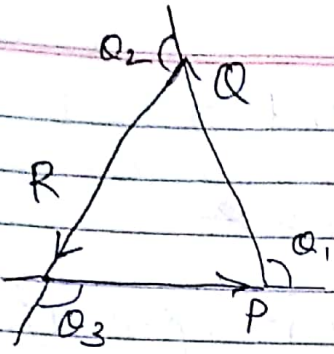
i.e. Direction of Resultant is in ~~west~~ to south side by 52.17° . north

Que. (3) State i) law of triangle of forces
ii) law of parallelogram of forces.

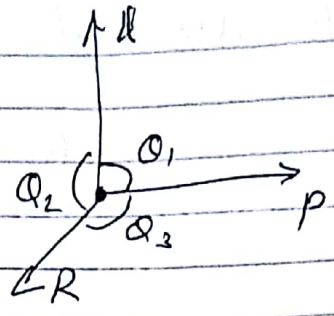
Ans

1) Law of triangle of forces:-

Its states that if ~~many~~ three forces ~~are~~ acting on a point one represented in magnitude & direction by three side of a triangle then the forces are said to be in equilibrium.



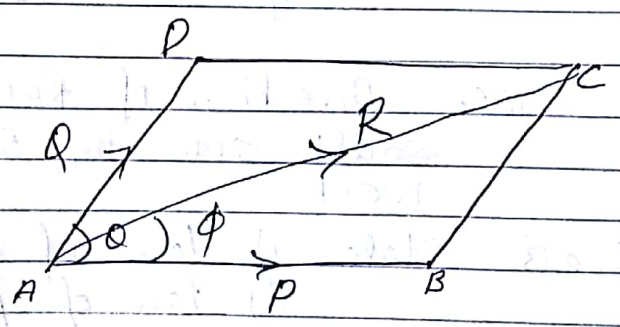
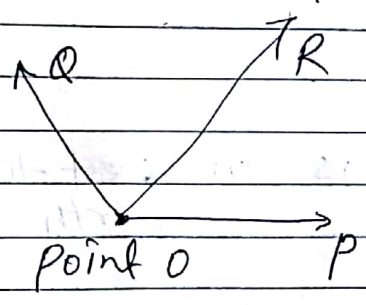
forces are in equilibrium



three forces acting on a point

ii) law of parallelogram of forces :-

Its states that if two forces are acting on a point are represented in magnitude & direction by two adjacent side of a parallelogram than their resultant is equal in magnitude & direction to the resultant passes through the point.



Resultant force

$$R = \sqrt{P^2 + Q^2 + 2PQ \cos \theta}$$

direction of resultant

$$\tan \phi = \frac{Q \sin \theta}{P + Q \cos \theta}$$

Que. (A) The length of a horizontal jib and Tie member of a jib crane are 3m and $2\sqrt{3}$ m respectively. If it carries a load of 400kN. Find the forces in jib and the tie member

Ans

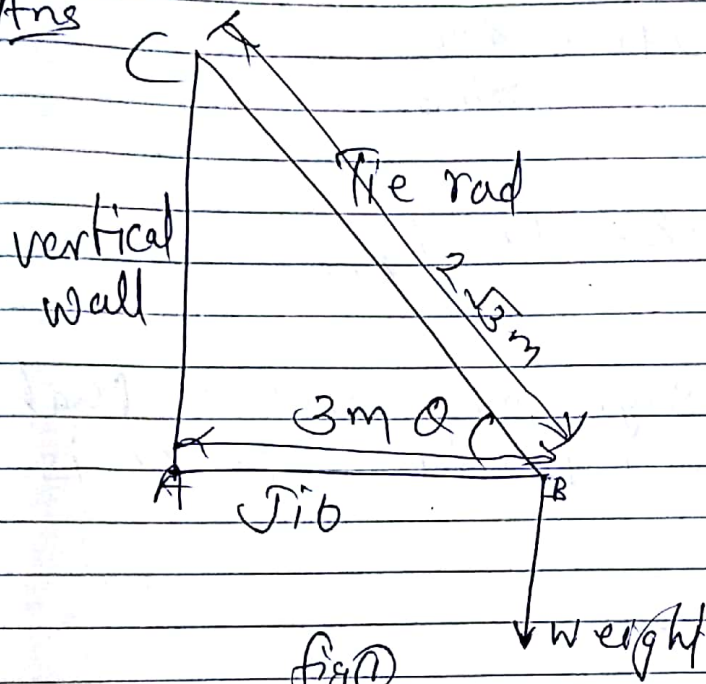


fig (1)

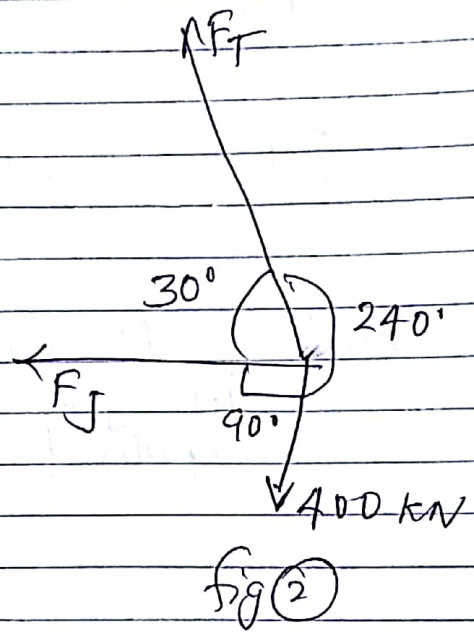


fig (2)

पाइथोगोरस प्रमेय लगाने पर (ΔABC)

$$\theta = \cos^{-1} \left(\frac{AB}{AC} \right)$$

$$= \cos^{-1} \left(\frac{3}{2\sqrt{3}} \right)$$

$$\theta = 30^\circ$$

Applying Lammis theorem in fig (2)

$$\frac{F_T}{\sin 90} = \frac{F_J}{\sin 240} = \frac{400}{\sin 30}$$

where F_T = force in tie member

F_J = force in jib

$$F_T = \frac{\sin 90 \times 400}{\sin 30}$$

$$F_T = 800 \text{ kN} \quad \text{Ans}$$

$$F_j = \frac{\sin 120 \times 400}{\sin 30}$$

$$F_j = -692.82 \text{ kN} \quad \text{Ans}$$

Note Here (-) sign represented that in jib compressive force is applied.