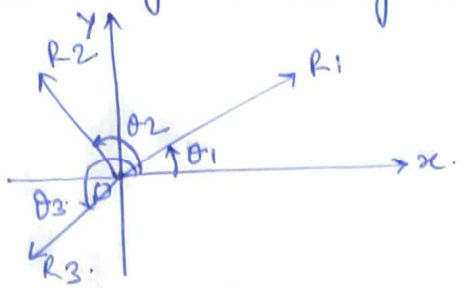
Resultant of Number of coplanar forces:-



components

Resultant of along x axis.

$$H = R_1\cos\theta_1 + R_2\cos\theta_2 + R_3\cos\theta_3.$$

Resultant components along y axis

$$V = R_1\sin\theta_1 + R_2\sin\theta_2 + R_3\sin\theta_3.$$

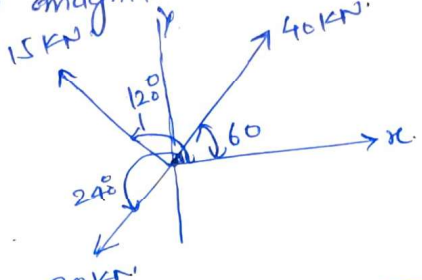
Resultant of all the forces.

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

and angle made by R with x Axis.

$$\tan\theta = \frac{V}{H}$$

(N) Three forces of magnitude 40KN, 15KN & 20KN are acting at a point O as shown in fig. The angles made by 40KN. 15KN and 20KN forces with x Axis are 60°, 120° and 240° respectively. Determine the magnitude and direction of the resultant force.



$$H = 40\times\cos 60^\circ + 15\times\cos 120^\circ + 20\times\cos 240^\circ$$

$$= 40\times\frac{1}{2} + 15\left(-\frac{1}{2}\right) + 20\times\left(-\frac{1}{2}\right)$$

$$= 20 - 7.5 - 10 = 2.5\,KN$$

$$V = 40\sin 60^\circ + 15\sin 120^\circ + 20\sin 240^\circ$$

$$= 40\times\frac{\sqrt{3}}{2} + 15\times\frac{\sqrt{3}}{2} + 20\times\left(-\frac{\sqrt{3}}{2}\right)$$

$$= 20\sqrt{3} + 7.5\sqrt{3} - 10\sqrt{3} = 30.31\,KN$$

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

$$R = \sqrt{(2.5)^2+(30.31)^2}$$

$$= 30.41\,KN$$

$$\tan\theta = \frac{V}{H}$$

$$\frac{30.31}{2.5} = 12.124$$

$$\theta = 85.28^\circ$$

System of units :-

The following system of units are mostly used :-

1. C.G.S.
2. M.K.S.
3. S.I.

Force ~~unit~~ unit in C.G.S — Dyne.

Force unit in M.K.S. — kg.force (kgf)

" " " S.I. — Newton

$1\,N$ = one kg. mass $\times$ one $\frac{\text{meter}}{s^2}$.

$= 1000\,\frac{gm.}{} \times 100\,\frac{cm.}{s^2} = 10^5\,\frac{gm\,cm}{s^2} =$ dyne.

1 Kilo N = 10

1 KN = 10^3 N.

Mega = 10^6

Giga = 10^9

Tera = 10^{12}.

~~nano~~ Milli (m) = 10^{-3}

micro (μ) = 10^{-6}

Nano (n) = 10^{-9}

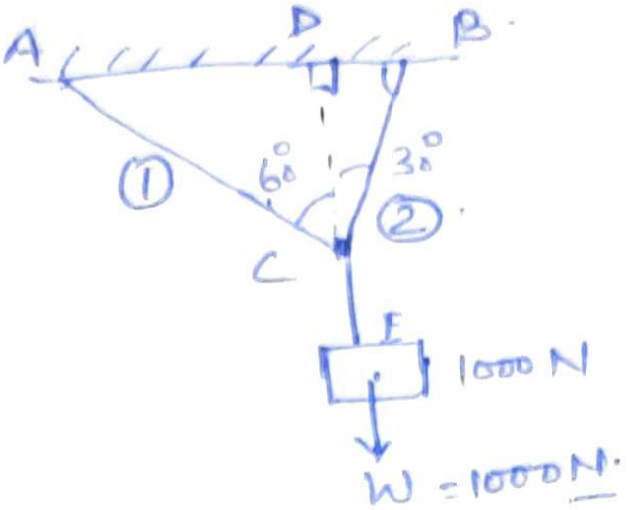
pico (p) = 10^{-12}

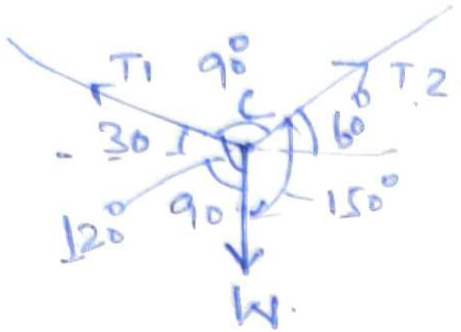
$1\,kg.(f) = 1(kg) \times \frac{9.81\,m}{s^2} = 9.81\,N.$

$\boxed{1\,kgf = 9.81\,N.}$

(10)

(N) A weight of 1000 N is supported by two chains as shown in fig. Determine the tension in each chain.





Apply Lami's Theorem - $\frac{T_1}{\sin 150^\circ} = \frac{T_2}{\sin 120^\circ} = \frac{W}{\sin 90}$

$T_1 = 1000 \times \sin 150 = 1000 \times \frac{1}{2} = 500\,N$

$T_2 = 1000 \times \sin 120 = 1000 \times .866 = 866\,N.$