Lesson 1:

THE FORCES

The effect of the force depends on three factors :

1) the magnitude of the force

2) the direction of force

3) the point of action

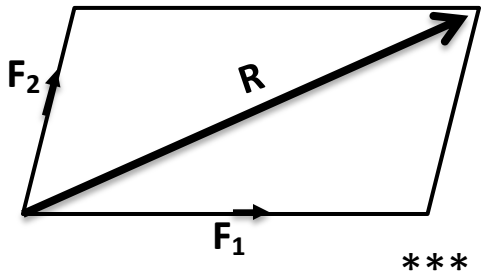
Remarks : units of magnitude of the force (kg . wt) and (dyne)

1 kg. wt = 9.8 newten = 1000 gm . wt ,

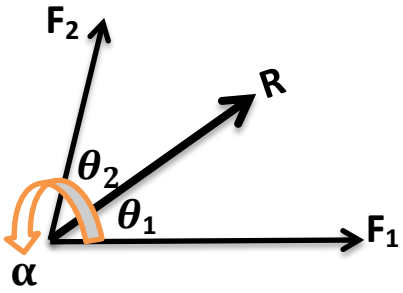
1 gm . wt = 980 dyne , 1 newten = 10^5 dyne

The resultant of two forces

Graphical — the rule of parallelogram of force



analytical



*** *Analytical* ***

$$R = \sqrt{F_1^2 + F_2^2 + 2F_1F_2 \cos\alpha}$$

$$\tan\theta_1 = \frac{F_2 \sin\alpha}{F_1 + F_2\cos\alpha} \quad , \tan\theta_2 = \frac{F_1 \sin\alpha}{F_2 + F_1\cos\alpha}$$

If $R \perp F1$, $\tan\theta_1 = \tan 90 = \frac{1}{0} = \frac{F_2 \sin\alpha}{F_1 + F_2\cos\alpha}$

$$\therefore \quad F_1 + F_2\cos\alpha = 0$$

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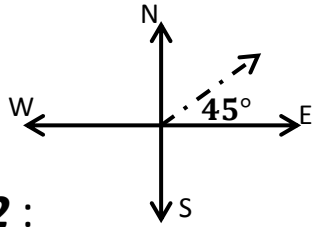
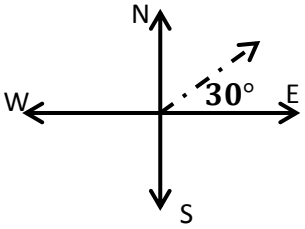
SPECIAL CASES:-

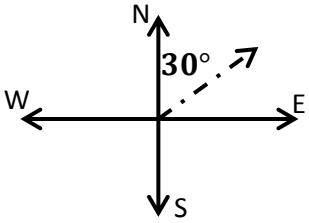
Relation F_1 , F_2		
Same line and same direction	R = $F_1 + F_2$	$\alpha = 0$
Same line and opposite direction	R= $\lvert F_1 - F_2 \rvert$	$\alpha = 180°$
$F_1 \perp F_2$	$R = \sqrt{F_1^2 + F_2^2}$	$\tan\theta = \frac{F_2}{F_1}$
$F_1 = F_2$	$R = 2F \cos\frac{\alpha}{2}$	$\theta = \frac{\alpha}{2}$

- (W N E S)

Make direction north of east , 30 north of east ,30 east of north

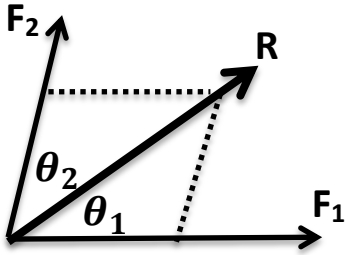






Lesson 2 :

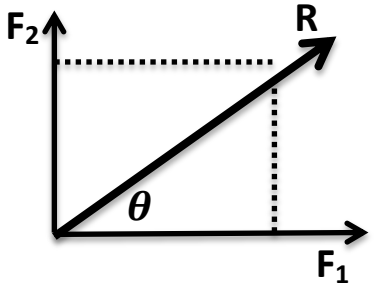
1) Resolution of force into two components :



$$\frac{f_1}{\sin\theta_2} = \frac{f_2}{\sin\theta_1} = \frac{R}{\sin(\theta_1+\theta_2)}$$

$$\therefore F_1 = \frac{R\ \sin\theta_2}{\sin(\theta_1+\theta_2)} \quad , F_2 = \frac{R\ \sin\theta_1}{\sin(\theta_1+\theta_2)}$$

2) Resolution of force into two perpendicular directions:



$$\frac{f_1}{\sin(90-\theta)} = \frac{f_2}{\sin\theta} = \frac{R}{\sin 90}$$

$F_1 = R\cos\theta$, $F_2 = R\sin\theta$

Cos ⟶ near , sin ⟶ far

- If i and j are two direction OX and OY
  then $\overrightarrow{F_1} = (R\ cos\ \theta)i$, $\overrightarrow{F_2} = (R\ \sin\theta)\ j$
  R = $\overrightarrow{F1}$ + $\overrightarrow{F2}$ = $(R\ cos\ \theta)i + (R\ \sin\theta)\ j$
- If $\overrightarrow{F}$ = (f , θ) , $then\ \overrightarrow{F} = f\cos\theta\ \overrightarrow{i} + f\ \sin\theta\ \overrightarrow{j}$