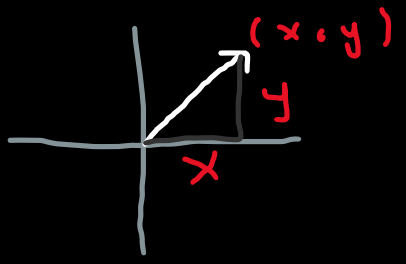
Force

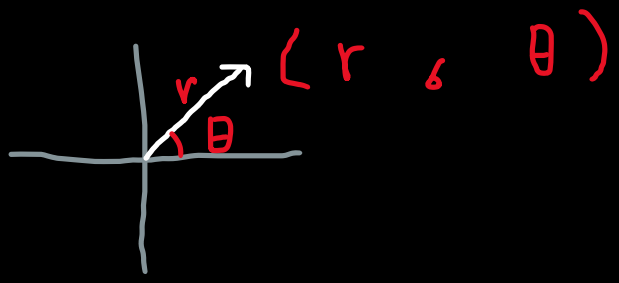
Is the effect on something by something, it is a vector quantity

The force can be in two forms

Cartesian form (x,y)



Polar form (r,Θ)



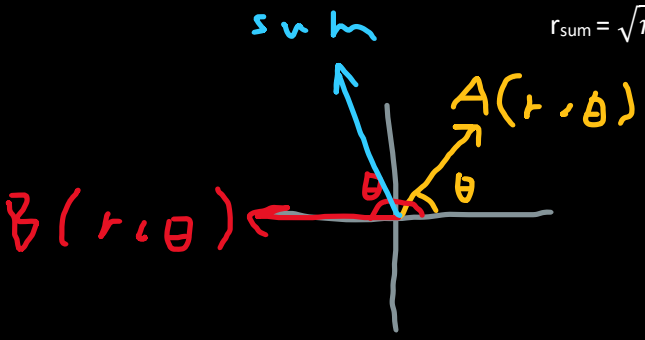
Net force | Resultant of forces

Is the sum of two or more forces acting together, to get the sum of two forces, it depends on the form

Polar form (r, Θ)

$\Theta_{sum} = tan^{-1}\left(\frac{sin(\theta_A)\times r_A + sin(\theta_B)\times r_B}{cos(\theta_A)\times r_A + cos(\theta_B)\times r_B}\right)$

$r_{sum} = \sqrt{r_A^2 + r_B^2 + 2r_A r_B\, cos(\theta_B - \theta_A)}$



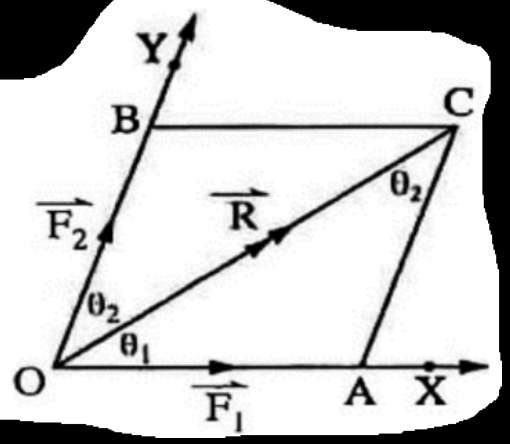
cartesian form (x , y)

sum = ($x_A + x_B$, $y_a + y_B$)

Resolution of a force

Means getting one of the added forces using the resultant force

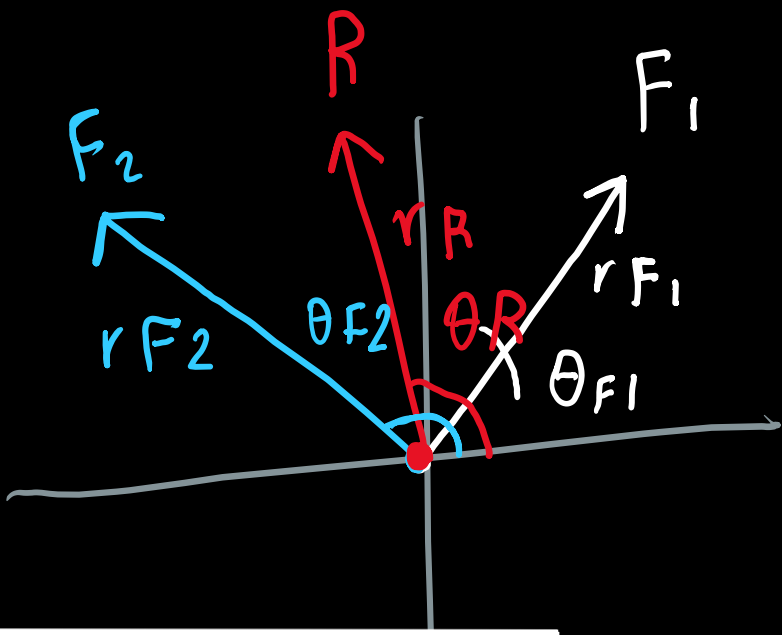
$$\frac{F_1}{\sin\theta_2} = \frac{F_2}{\sin\theta_1} = \frac{R}{\sin(\theta_1+\theta_2)}$$



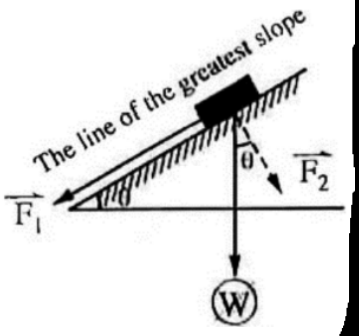
Here

- F1, F2 are the 'r's of force 1 and force 2
- R is the r / magnitude of the resultant force

- $r_{F1} = \frac{r_R\, cos(\theta_R) - r_{F2}\, cos(\theta_{F2})}{COS(\theta_{F1})}$
- $r_{F2} = \frac{r_R\, cos(\theta_R) - r_{F1}\, cos(\theta_{F1})}{COS(\theta_{F2})}$



If a body of weight (w) is placed on a smooth inclined plane with the horizontal by an angle (θ), then

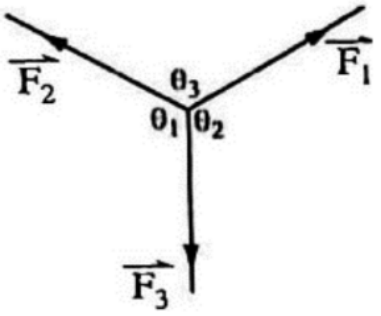


- $F_1 = w \sin\theta$ (where F_1 is the magnitude of the component in the direction of the line of the greatest slope)
- $F_2 = w \cos\theta$ (where F_2 is the magnitude of the component in the perpendicular direction on the plane)

rule

It says if three coplanar forces meeting at a point and acting on the same point are in equilibrium, then the magnitude of each force is proportional to the sine of the angle between the two other forces aka (law of sins)

$$\frac{F_1}{\sin\theta_1} = \frac{F_2}{\sin\theta_2} = \frac{F_3}{\sin\theta_3}$$



Triangle of forces

if three coplanar forces meeting at a point and acting on the same point are in equilibrium, then they can be shaped into a triangle in the same cyclic order, which means that the lengths of the sides of the triangle are proportional to the magnitudes of the corresponding forces

$$\frac{F_1}{XY} = \frac{F_2}{YZ} = \frac{F_3}{XZ}$$

Then $\triangle XYZ$ is called

"the triangle of forces"