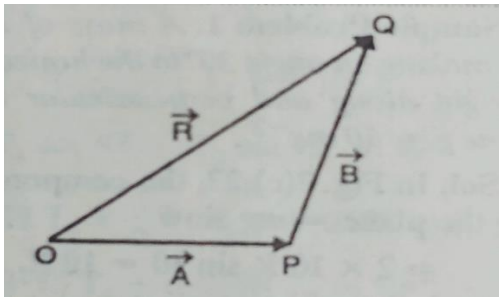
Resolution of vector –

It is the process of splitting a single vector into two or more vectors in different directions which together produce the same effect as is produced by the single vector alone .



Let a vector $\overrightarrow{R}$ be represented by $\overrightarrow{OQ}$.

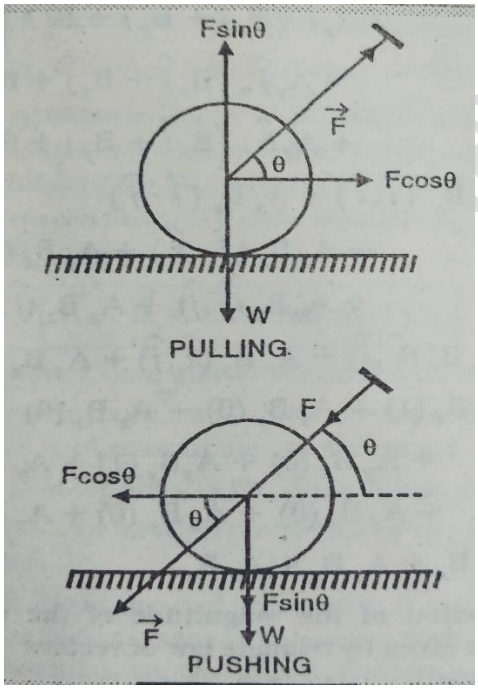
Let $\overrightarrow{A}$ and $\vec{B}$ be represented by $\overrightarrow{OP}$ and $\overrightarrow{PQ}$,

so that $\overrightarrow{OQ}$ = $\overrightarrow{OP}$ + $\overrightarrow{PQ}$ or ,$\vec{R}$= $\vec{A}$ +$\vec{B}$,

Then $\vec{A}$ and $\vec{B}$ are the component vector of $\vec{R}$.

Application of resolution of vector –

(1) It is easier to pull a lawn roller than push it - Suppose a lawn roller of weight W , let it be pulled or pushed by force F at an angle Θ as shown in figure .



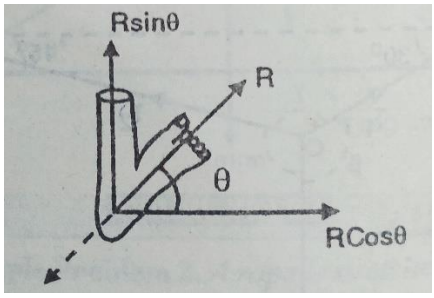
In case of pulling – As shown in figure (upper) , when we apply the force F at angle Θ with the horizontal , in that case Fcos Θ acts horizontally and Fsin Θ vertically upward , then we can see Fcos Θ try to move the roller horizontally . But friction force opposes the motion of the body . Here friction force f μ R = μ(mg - F sinΘ)] .

In case of pushing – As shown in figure (lower) when we are applying a force F then it has two components F cos Θ along horizontal and FsinΘ along the vertically downward direction .

Then F cosΘ will try to move the roller but frictional force [f= μR = μ(mg +F sinΘ)] opposes the motion of the roller .

Then clearly we can see opposing force i.e. force of friction in case of pushing is more so we need to do more work in case of pushing then pulling and hence we can say it is easier to pull than push a lawn roller .

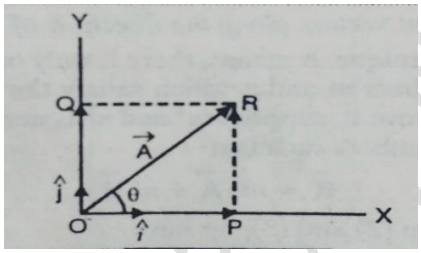
(2) Walking of a man is the another example of resolution of vector –



When a man walk on the ground then it pushes the ground at an angle 'Θ' then ground reaction 'R' is same but in opposite direction as shown in above figure . Then we can resolve in two components RcosΘ in horizontal direction and RsinΘ in vertically upward direction . Here RsinΘ balance the weight of the man and RcosΘ helps to walk in forward direction .

Rectangular components of a vector in a plane –

If we split a vector in two component vectors at right angles to each other then the component vectors are called rectangular components of a vector .



Suppose a vector $\vec{A}$ is represented by $\overrightarrow{OR}$, has to be resolved in two rectangular components along X-axis which is $\overrightarrow{OP}$, and along Y-axis which is $\overrightarrow{OQ}$. OR makes angle 'Θ' with the horizontal as shown in figure . so using trigonometry we can write $\overrightarrow{OP}$ =$\overrightarrow{OR}$ cosΘ= $\vec{A}$ cosΘ , and $\overrightarrow{OQ}$ = $\overrightarrow{OR}$ sinΘ = $\vec{A}$ sinΘ ;

Then from triangle law of vector addition OR=OP+OQ

So, $\vec{A} = \vec{A}\cos\Theta\,\hat{\imath} + \vec{A}\sin\Theta\,\hat{\jmath}$ .....required result .

If we want to find the magnitude of the given equation A = $[(A\cos\Theta)^2 + (A\sin\Theta)^2]^{1/2}$.

And to get the direction tanΘ= PR/OP=OQ/OP= AsinΘ/A cosΘ .