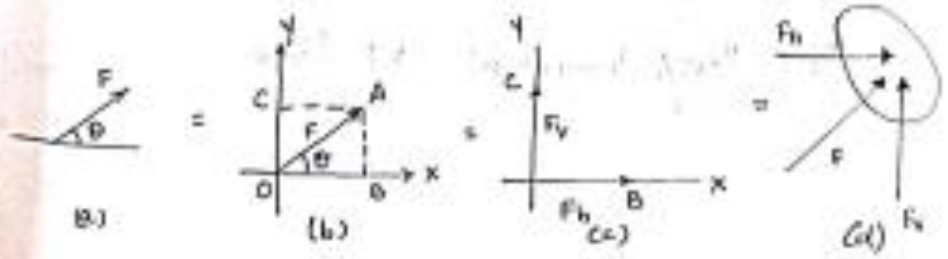
RESULTANT FORCE OF MORE THAN TWO CONCURRENT FORCES:

If two or more concurrent forces acts at a point also, we can use the theorem of parallelogram law of forces to calculate their resultant. The procedure is to repeat the application of parallelogram law till the final resultant is obtained.

* Splitting up force:



Let us resolve the forces into two components along fixed axes (ie) OX & OY.

* Magnitude of Components.

Let, F_h = Horz/. component of Force F

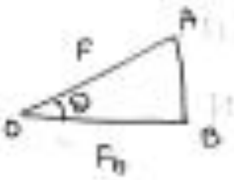
= OB or CA

F_v = Vert/. Component of Force F

= OC or BA

In Δ OAB,

$\cos\theta = \frac{OB}{OA}$



$= \frac{F_h}{F}$

$\therefore F_h = F\cos\theta$

Illly, $\sin\theta = \frac{AB}{OA}$

$= \frac{F_v}{F}$

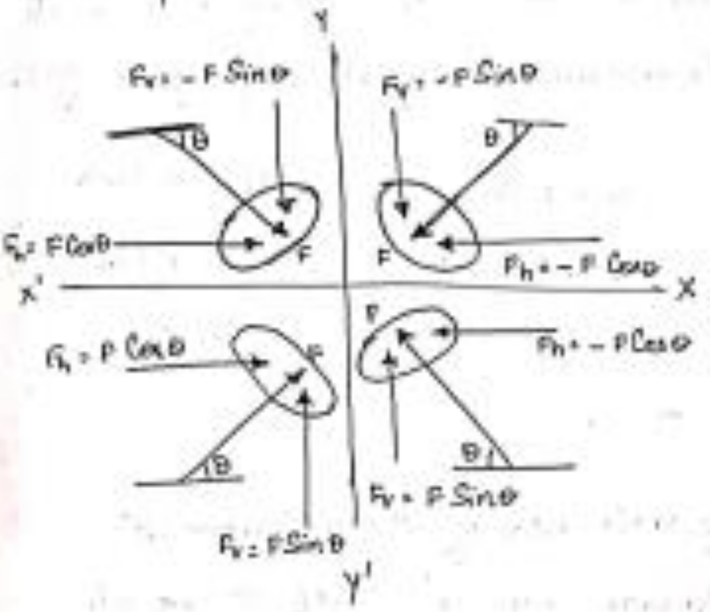
$\therefore F_v = F\sin\theta$

* Direction of Components

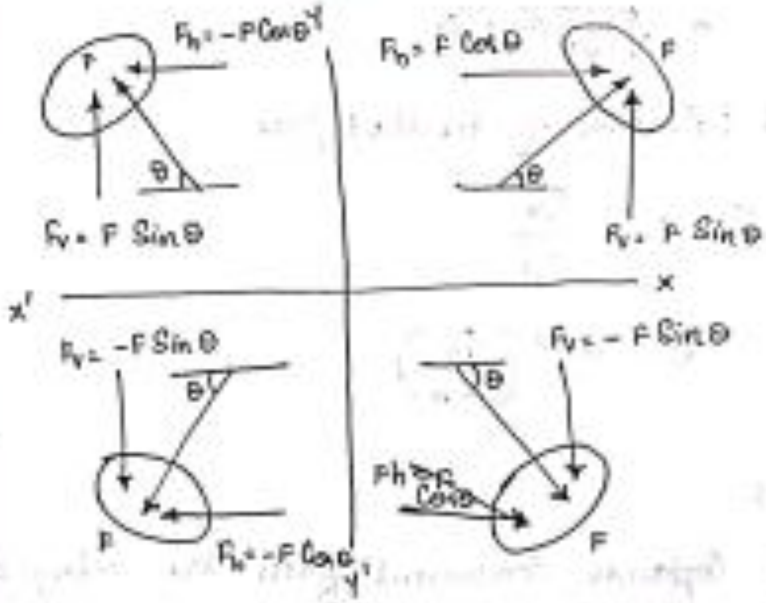
F_h = Horz/. Component = $+F\cos\theta$

$\therefore$ F_v = Vert/. Component = $+F\sin\theta$

Force Inwards;

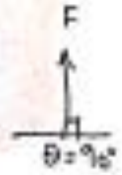


Force Outwards,



Note:

* A vertical force has no horiz. component & the vertical component is the magnitude of given force



$F_h = F \cos\theta$ $\qquad$ $F_v = F \sin\theta$

$= F \cos 90°$ $\qquad$ $= F \sin 90°$

$= 0$ $\qquad$ $= F$

* Horz. force has no vertical component & its horz. component is magnitude of given force itself

$\theta = 0°$ $\longrightarrow F$

$F_h = F \cos\theta$

$= F \cos 0$

$= F$

$F_v = F \sin\theta$

$= F \sin 0$

$= 0$

PROCEDURE:

* Find algebraic sum of Horz. Components
* Find algebraic sum of Vert. Components
* Find magnitude of resultant force

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

* Find Direction of resultant force

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

$$\alpha = \tan^{-1}\left(\frac{\Sigma V}{\Sigma H}\right)$$

PROBLEMS

1) Three Coplanar Concurrent forces are acting at a point as shown in figure. Determine the resultant in magnitude & direction.