To Find the resultant of non – concurrent forces

لإيجاد محصلة القوى غير الملتقية يجب إتباع الخطوات التالية :

1. we must solve the forces in to its components

تحلل القوى إلى مركباتها

2. we must find the resultant of components parallel to x - axis

إيجاد محصلة المركبات الموازية لمحور السينات   (R_X)

3. we must find the resultant of components parallel to Y - axis
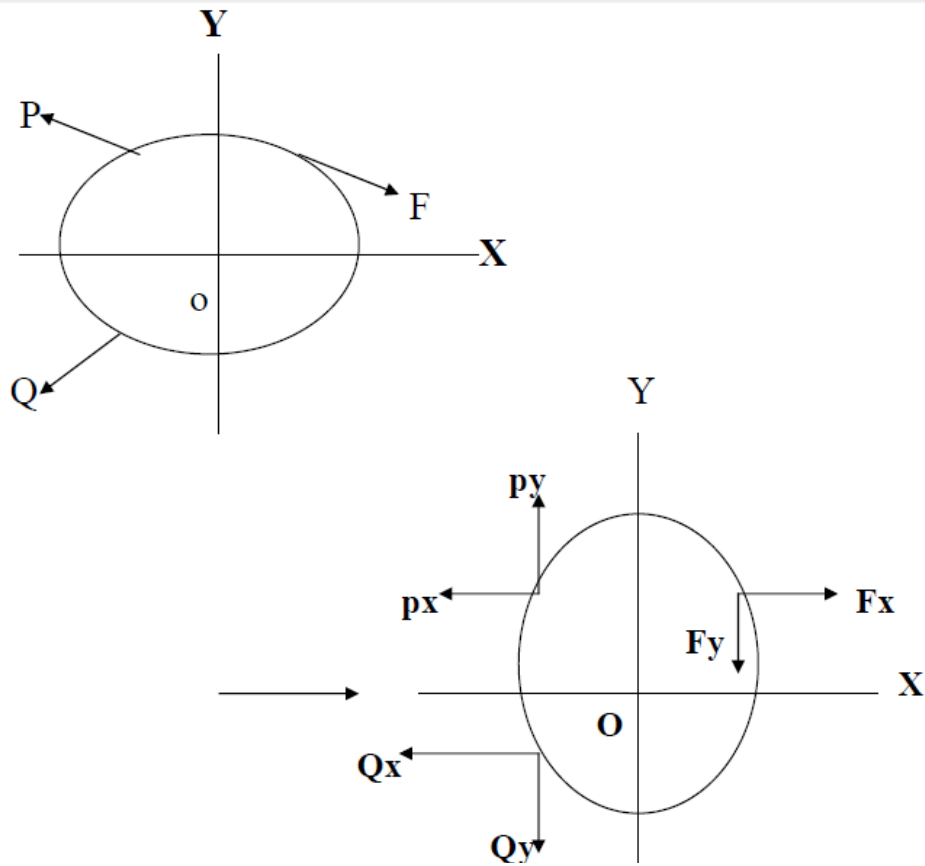
إيجاد محصلة المركبات الموازية لمحور الصادات   (RY)

4. we must find   R , θ , d

R = resultant   المحصلة

θ = Direction of resultant   اتجاه المحصلة

d = Distancec of resultant   بعد المحصلة

the following fig الشكل التالي shown there meaning   يوضح المعنى
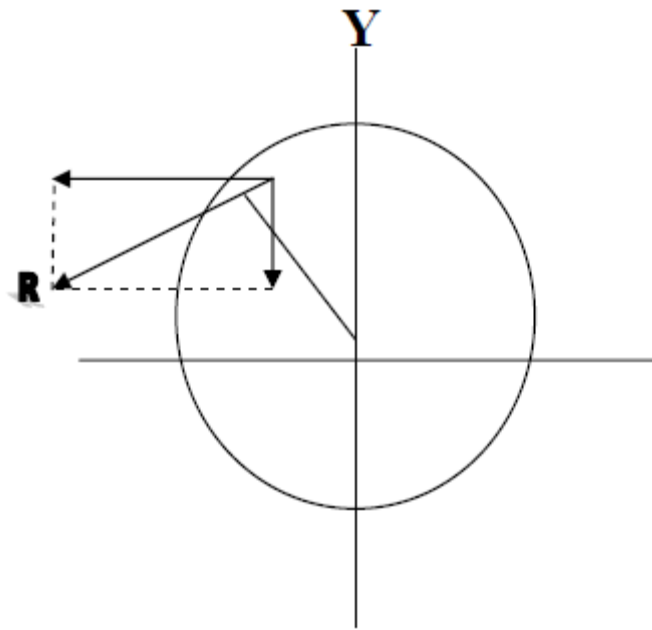
$R_x = F_x - P_x - Q_x$

$R_y = p_y - F_y - Q_y$

$$R = \sqrt{R_X^2 + R_Y^2}$$

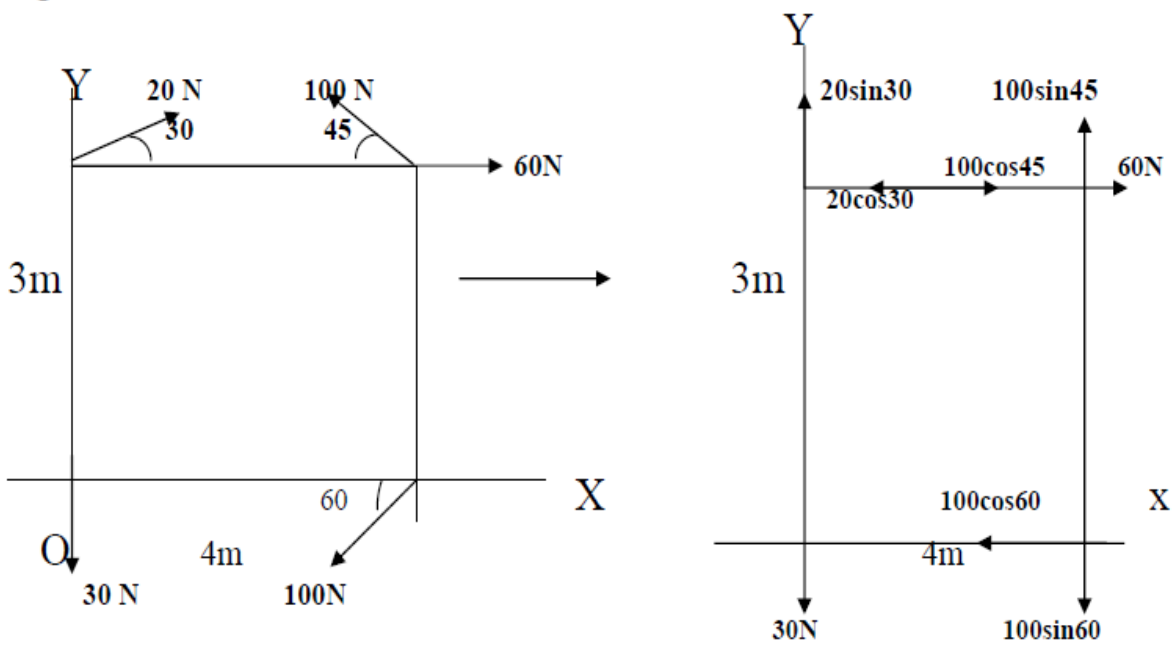$$t\,a\,n\,\theta_X = \frac{R_Y}{R_X} \qquad \theta_X = \text{ميل المحصلة عن محور السينات}$$

$$R * d = \sum M_o$$

عزم المحصلة حول (O) = مجموع عزوم القوى حول (O)

Q// The rectangular framework shown in fig . is subjected to the indicated non – concurrent system of forces . determine the magnitude and direction of the resultant , also its arm relative to origin (O) .

$$R_X = 20 \cos 30 - 100 \cos 45 - 100 \cos 60 + 60$$

$R_X = 20 * 0.866 - 100 * 0.707 - 100 * 0.5 + 60$
$R_X = 17.32 + 60 - 70.7 - 50$
$R_X = 43.38 \text{ N}$

$R_X = 43.38 \text{ N} \leftarrow$

$R_Y = 20 \sin 30 + 100 \sin 45 - 100 \sin 60 - 30$
$R_Y = 10 * 0.5 + 100 * 0.707 - 100 * 0.866 - 30$
$R_Y = -35.9 \text{ N}$

$R_Y = 35.9 \text{N} \downarrow$

$$R = \sqrt{R_X{}^2 + R_Y{}^2} \qquad = \sqrt{(43.38)^2 + (35.9)^2}$$

$R = 56.3 \text{ N}$

$$\tan \theta = \frac{R_Y}{R_X} = \frac{35.9}{43.38} = 0.827$$

$\theta = 39.6$

$R * d = \sum M_o$

$R*d = (30*0) + (20\cos30 *3) + (20\sin30*0)$
$\quad - (100\sin45*4) - (100\cos45*3) + (60*3)$
$\quad + (100\sin60*4) + (100\cos60*0)$
$R*d = 0 + 20* 0.866 * 3 + 20*0.5 *0$
$\quad + 100 * 0.707 * 4 + 100 * 0.707 * 3 + 180 + 100*0.866*4 + 100*0.5*0$
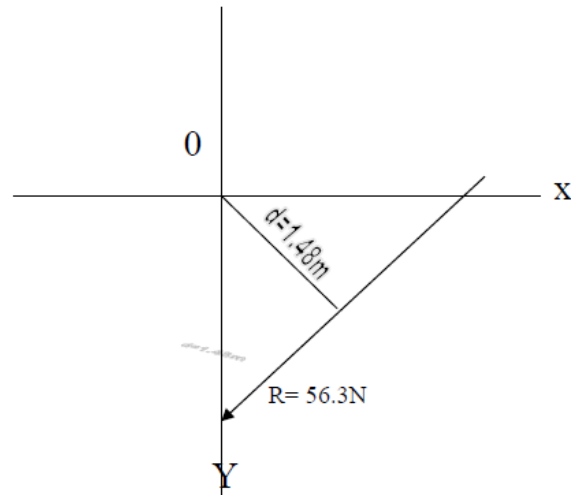
+ 100 * 0.866 * 4 + 100 * 0.5 * 0

R * d = 0 + 51.96 + 0 − 212.1 − 282.8 + 180 + 346.4 + 0
R * d = 83.46   N.m

$$d = \frac{93.46}{56.3} = 1.48N$$

d = 1.48 m

0

X

d=1.48m

R= 56.3N

Y

Q// Determine completely the resultant of force acting on step pulley shown in Fig .

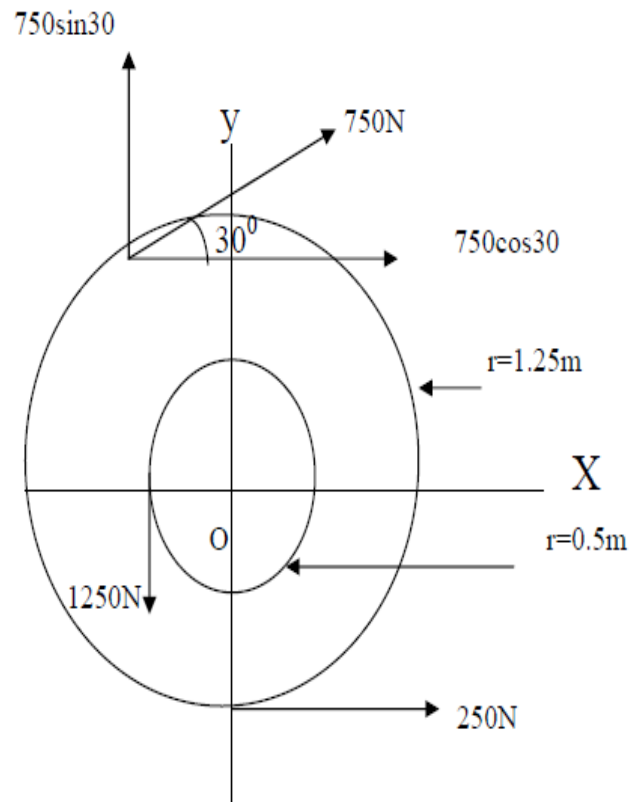R_x = 750 cos30 + 250
R_X = 750 * 0.866 + 250
R_X = 899.5N

R_X = 899.5 N ⟶

R_Y = 750 sin 30 - 1250
R_Y = 750 * 0.5 −
R_Y = - 875 N

R_Y = 875 N ↓

750sin30

y

750N

30°

750cos30

r=1.25m

X

O

r=0.5m

1250N

250N

$$R = \sqrt{R_X{}^2 + R_y{}^2} = \sqrt{(899.5)^2 + (875)^2}$$

R = 1255 N

$$\tan \theta = \frac{R_y}{R_X} = \frac{875}{899.5} = 0.972$$

$\theta = 44°$

$$R*d = \sum M_O$$

R * d = 750 * 1.25 – 1250 * 0.5 – 250 * 1.25
R * d = 0

d = 0

أي أن (R) تمر في النقطة (O) .