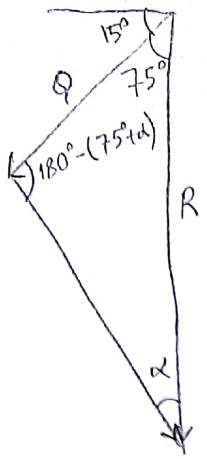
(1)



R is the resultant force acting vertically, P is the force making an angle α with vertical, and Q is the force representing 1600 N

sine rule for triangle of forces

$$\frac{P}{\sin 75^\circ} = \frac{Q}{\sin\alpha} = \frac{R}{\sin(180^\circ-(75^\circ+\alpha))}$$

Considering $\frac{Q}{\sin\alpha} = \frac{R}{\sin(180^\circ-(75^\circ+\alpha))}$ $\xrightarrow[\text{forces}]{\text{substitute}}$ $\frac{1600\,N}{\sin\alpha} = \frac{2500\,N}{\sin(180^\circ-(75^\circ+\alpha))}$

$$\Rightarrow \frac{1600}{\sin\alpha} = \frac{2500}{\sin(75^\circ+\alpha)} \Rightarrow \sin(75^\circ+\alpha) = 1.5625\sin\alpha$$

$$\Rightarrow \sin 75^\circ.\cos\alpha + \cos 75^\circ.\sin\alpha = 1.5625\sin\alpha$$

$$0.966\cos\alpha + 0.2588.\sin\alpha = 1.5625\sin\alpha$$

$$0.966\cos\alpha = 1.3037\sin\alpha$$

$$\tan\alpha = 0.740968$$

$\alpha = 36.537^\circ$ with vertical

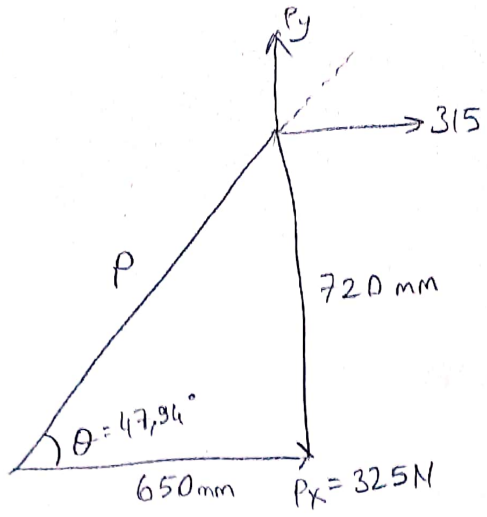
The direction of the force P is 36.537° with vertical

Considering $\frac{P}{\sin 75^\circ} = \frac{Q}{\sin\alpha}$ $\Rightarrow \frac{P}{\sin 75^\circ} = \frac{1600}{\sin 36.537^\circ}$

$$\Rightarrow P = \frac{1600\sin 75^\circ}{\sin 36.537^\circ} = 2595.95\,N$$

The magnitude of force P is 2595.95N

(2)



$$\tan\theta = \frac{720}{650}$$

$$\theta = 47.94°$$

$$\cos\theta = \frac{P_x}{P} \Rightarrow \cos 47.94° = \frac{325}{P}$$

$$P = \frac{325}{\cos 47.94°} = 485,14\ N$$

(3)

Force	Magnitude, N	x Component, N	y Component, N	z Component, N
P	600	$600\sin40°\sin25°$ $= 163$	$600\cos40°$ $= 459.63$	$600\sin40°.\cos25°$ $= 349.54$
Q	450	$450\cos55°.\cos30°$ $= 223.53$	$450\sin55°$ $= 368.62$	$-450\cos55°\sin30°$ $= -129.05$
		+ R_x	R_y	R_z
components of R →		386.53N	828.25N	220.49N

magnitude of the resultant force, R is $R = \sqrt{R_x^2 + R_y^2 + R_z^2}$

$R = \sqrt{386.53^2 + 828.25^2 + 220.49^2}$

$= 940.22N$

The direction cosine of the line of action of R with respect to x-axis

$\cos\theta_x = \frac{R_x}{R}$

$\theta_x = \cos^{-1}\left(\frac{386.53}{940.22}\right)$

$= \cos^{-1}(0.4111)$

$= 65.73°$

for y-axis

$\cos\theta_y = \frac{R_y}{R}$

$\theta_y = \cos^{-1}\left(\frac{828.25}{940.22}\right)$

$= \cos^{-1}(0.8809)$

$= 28.25°$

for z-axis

$\theta_z = \cos^{-1}\left(\frac{220.49}{940.22}\right)$

$= \cos^{-1}(0.2345)$

$= 76.44°$