1. Determine a pair of horizontal and vertical components of the 340 kN force, as illustrated in Fig. 1.

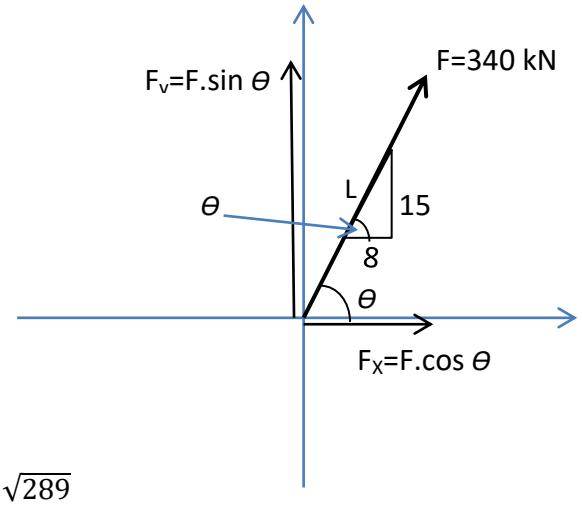


Fig. 1

L = $\sqrt{(15)^2 + (8)^2} = \sqrt{289}$

L = 17

F_X=F.cos Θ = 340 x $\frac{8}{17}$ = 160

F_y=F.sin Θ =340 x $\frac{15}{17}$ = 300

2. Resolve the 100 kN force of Fig. 2 into horizontal and vertical components for Θ = 75°

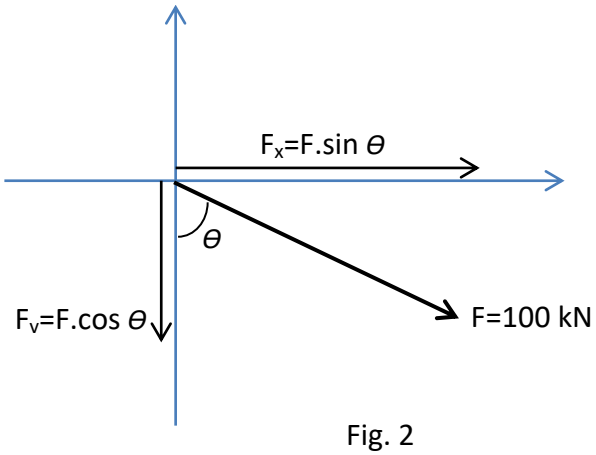


Fig. 2

F_x=F.sin Θ =100 x sin (75)

F_y = 100 x 0.966 = 96.6 kN

F_y=F.cos Θ = 100 x cos (75)

F_y= 100 x 0.2588 = 25.88 kN

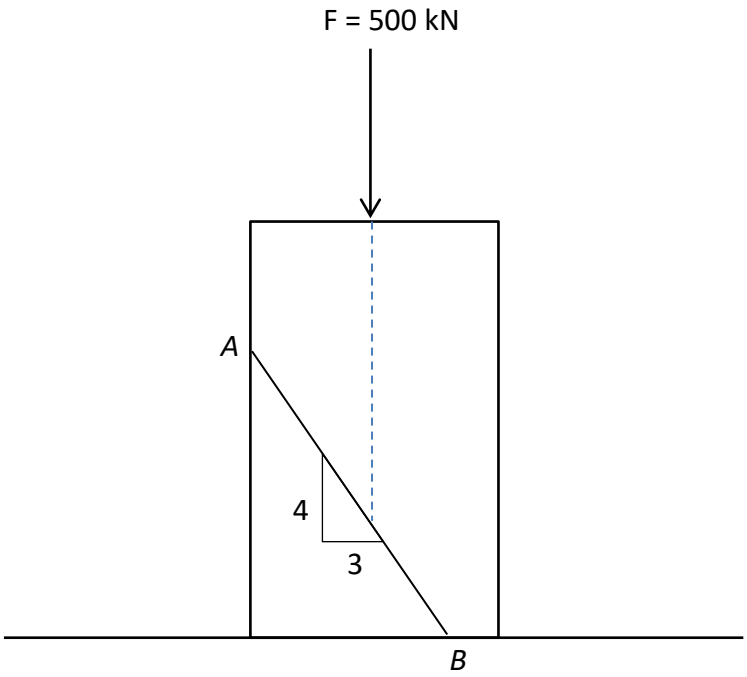


Fig. 3

3. Resolve the 500 kN force of Fig. 3 into two components: a shearing component parallel to *AB* and a normal component perpendicular to *AB*

Solution:

a. Resolve the ***F*** force in two directions, shearing force ***P*** parallel to ***AB*** and a normal component ***Q*** perpendicular to ***AB*** (as shown in Fig. 3-2)
b. Complete the figure to a rectangle (as shown in Fig. 3-2)
c. assign a triangle of forces (abc)
d. assign the angles Θ and β in the triangle abc
e. apply a sin's law to determine the components ***P*** and ***Q***

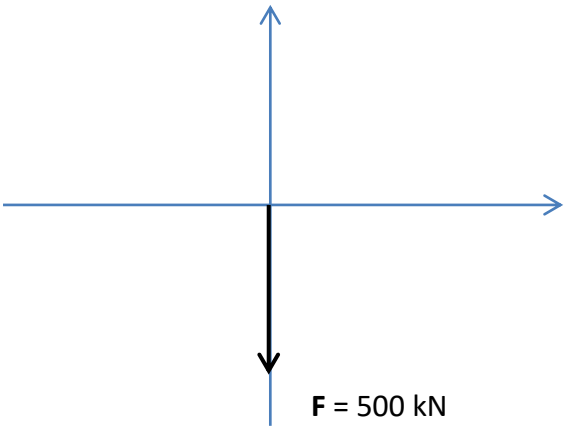


Fig. 3-1

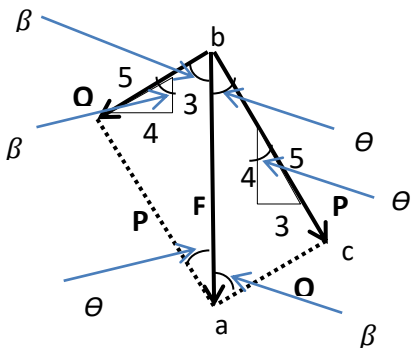


Fig. 3-2

In triangle abc

$$\frac{sin\theta}{Q} = \frac{sin\beta}{P} = \frac{\sin 90}{F}$$

$$sin\theta = \frac{3}{5} = 0.6$$

$$sin\beta = \frac{4}{5} = 0.8$$

$$\frac{sin\theta}{Q} = \frac{\sin 90}{F}$$

$$\frac{0.6}{Q} = \frac{1}{500}$$

$$Q\text{x}1 = 0.6\text{x}500$$

$$Q = 300 \text{ kN}$$

$$\frac{sin\beta}{P} = \frac{\sin 90}{F}$$

$$\frac{0.8}{P} = \frac{1}{500}$$

$$P\text{x}1 = 0.8\text{x}500$$

$$P = 400 \text{ kN}$$

4. Determine the resultant force and direction for the two forces P and Q as shown in Fig. 4

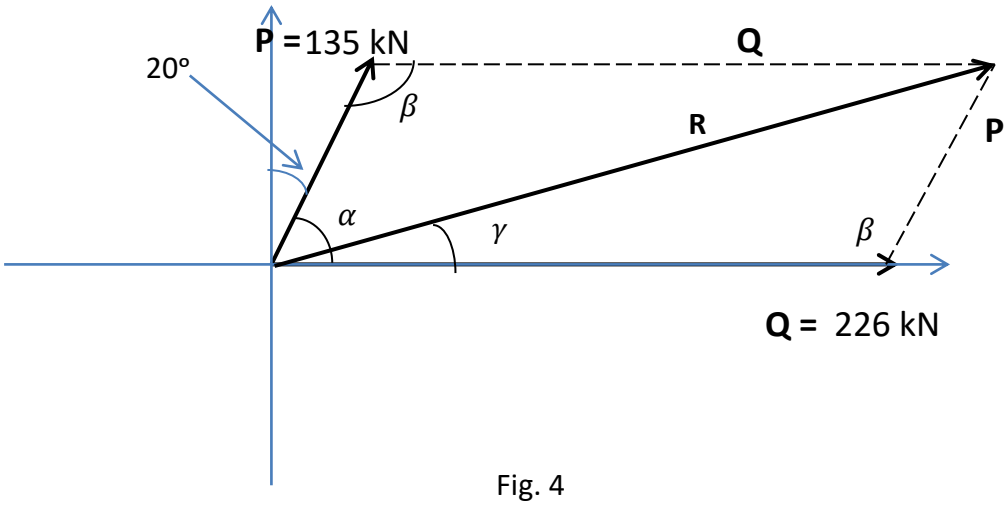


Fig. 4

Solution:

$\alpha = 90° - 20° = 70°$

$2\alpha + 2\beta = 36^{\circ}$

$\alpha + \beta = 180^{o}$

$\beta = 180 - 70 = 110^{o}$

$R^2 = Q^2 + P^2 - 2QR \cos \beta$

$R^2 = (226)^2 + (135)^2 - 2x226x135x\cos 110$

$R^2 = 51076 + 18225 - 61020 \times (-0.342)$

$R^2 = 51076 + 18225 + 20869 = 90170$

$R = \sqrt{90170} = 300.28$ kN

R= 300.28 kN

$$\frac{R}{\sin \beta} = \frac{P}{\sin \gamma}$$

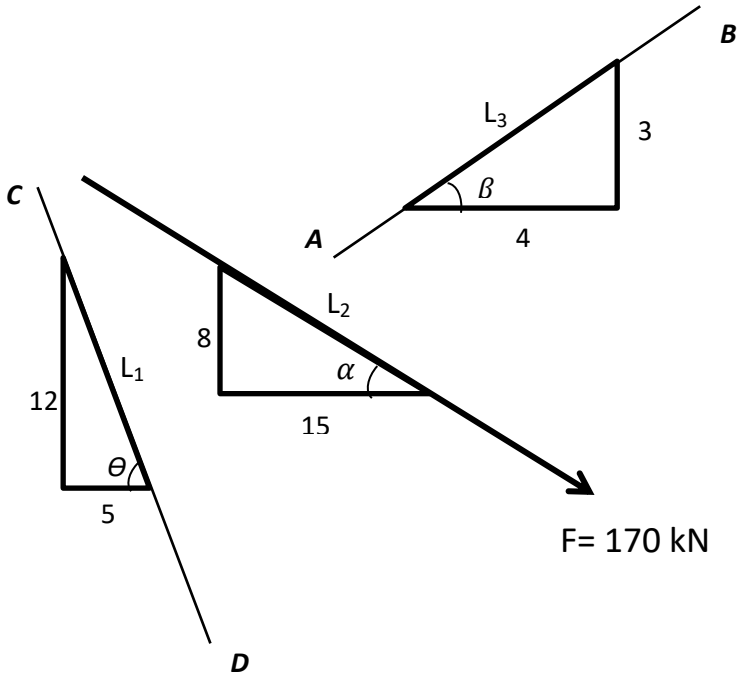
$$\frac{300.28}{0.9397} = \frac{135}{\sin \gamma}$$

$$\sin \gamma = \frac{0.9397X\ 135}{300.28}$$

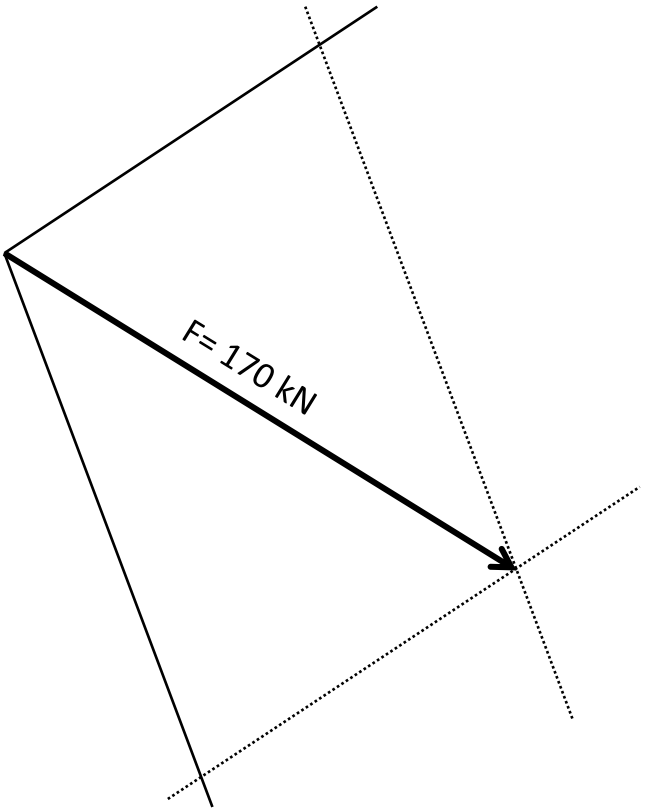
$\sin \gamma = 0.4225$

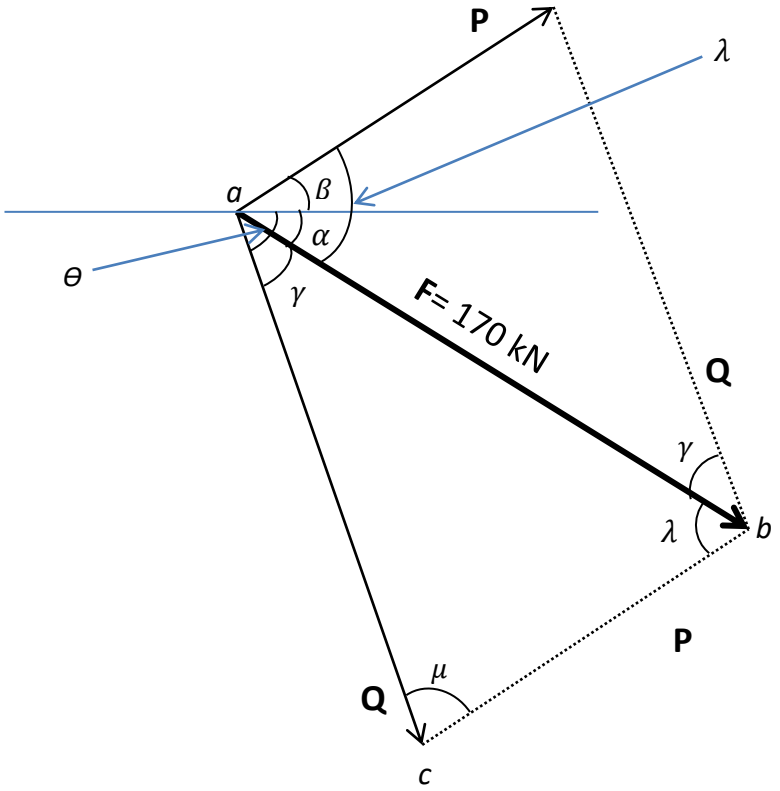
$\gamma = 25°$

Resolve the 170 kN force of Fig. 5 into two components, one along ***AB*** and the other parallel to ***CD.***



Answer





$L_1 = \sqrt{12^2 + 5^2} = \sqrt{169} = 13$

$L_2 = \sqrt{15^2 + 8^2} = \sqrt{289} = 17$

$L_3 = \sqrt{4^2 + 3}^2 = \sqrt{25} = 5$

Sin $\Theta = \frac{12}{13} = 0.923$

$\Theta = \sin^{-1}(0.923)$

$\Theta = 67.5^o$

Sin $\alpha = \frac{8}{17} = 0.470959$

$\alpha = \text{Sin}^{-1}(0.47059) = 28^o$

$Sin\ \beta = \frac{3}{5} = 0.6$

$\beta = \text{Sin}^{-1}(0.6) = 37^o$

$\lambda = \alpha + \beta = 28^o + 37^o = 65^o$

$\gamma = \Theta - \alpha = 67.5^o - 28^o = 39.5^o$

$\mu = 180^o - (\lambda + \gamma)$

$\mu = 180^o - (65^o + 39.5^o) = 75.5^o$

In the triangle abc

$\frac{Sin\ \mu}{F} = \frac{Sin\ \lambda}{Q} = \frac{Sin\ \gamma}{P}$

$\frac{Sin\ \mu}{F} = \frac{Sin\ \lambda}{Q}$

$\frac{Sin\ 75.5}{170} = \frac{Sin\ 65}{Q}$

170 x sin 65 = Q x sin 75.5

170 x 0.9063 = Q x 0.9681

Q = 159.15 kN

$\frac{Sin\ \mu}{F} = \frac{Sin\ \gamma}{P}$

$\frac{Sin\ 75.5}{170} = \frac{Sin\ 39.5}{P}$

P = $\frac{170 x Sin\ 39.5}{Sin\ 75.5} = \frac{170 x 0.6361}{0.9681} = 111.7$ kN