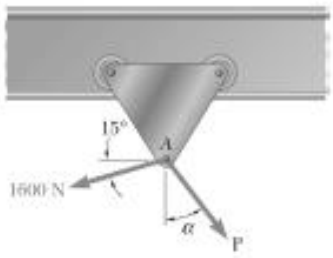
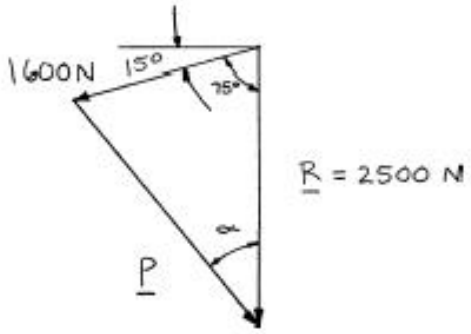


PROBLEM 2.7

A trolley that moves along a horizontal beam is acted upon by two forces as shown. Determine by trigonometry the magnitude and direction of the force **P** so that the resultant is a vertical force of 2500 N.

SOLUTION



Using the law of cosines:

$$P^2 = (1600\text{ N})^2 + (2500\text{ N})^2 - 2(1600\text{ N})(2500\text{ N})\cos 75°$$

$$P = 2596\text{ N}$$

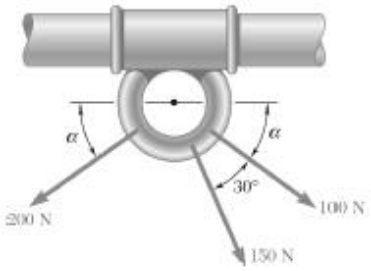
Using the law of sines:

$$\frac{\sin\alpha}{1600\text{ N}} = \frac{\sin 75°}{2596\text{ N}}$$

$$\alpha = 36.5°$$

P is directed $90° - 36.5°$ or $53.5°$ below the horizontal.

$\mathbf{P} = 2600\text{ N} \measuredangle 53.5°$ ◀



PROBLEM 2.35

Knowing that $\alpha = 35°$, determine the resultant of the three forces shown.

SOLUTION

100-N Force:

$$F_x = +(100\text{ N})\cos 35° = +81.915\text{ N}$$
$$F_y = -(100\text{ N})\sin 35° = -57.358\text{ N}$$

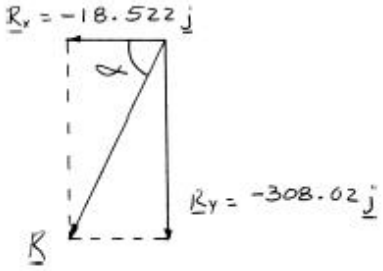
150-N Force:

$$F_x = +(150\text{ N})\cos 65° = +63.393\text{ N}$$
$$F_y = -(150\text{ N})\sin 65° = -135.946\text{ N}$$

200-N Force:

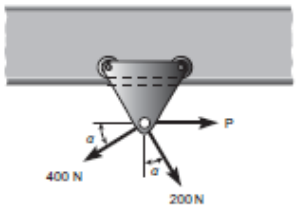
$$F_x = -(200\text{ N})\cos 35° = -163.830\text{ N}$$
$$F_y = -(200\text{ N})\sin 35° = -114.715\text{ N}$$

Force	x Comp. (N)	y Comp. (N)
100 N	+81.915	−57.358
150 N	+63.393	−135.946
200 N	−163.830	−114.715
	$R_x = -18.522$	$R_y = -308.02$



$$\mathbf{R} = R_x\mathbf{i} + R_y\mathbf{j}$$
$$= (-18.522\text{ N})\mathbf{i} + (-308.02\text{ N})\mathbf{j}$$
$$\tan\alpha = \frac{R_y}{R_x}$$
$$= \frac{308.02}{18.522}$$
$$\alpha = 86.559°$$
$$R = \frac{308.02\text{ N}}{\sin 86.559}$$

$$\mathbf{R} = 309\text{ N} \angle 86.6° \blacktriangleleft$$



PROBLEM 2.41

A hoist trolley is subjected to the three forces shown. Knowing that $\alpha = 40°$, determine (*a*) the required magnitude of the force **P** if the resultant of the three forces is to be vertical, (*b*) the corresponding magnitude of the resultant.

SOLUTION

$$R_x = \overset{+}{\rightarrow} \Sigma F_x = P + (200\text{ N})\sin 40° - (400\text{ N})\cos 40°$$

$$R_x = P - 177.860\text{ N} \qquad (1)$$

$$R_y = \overset{+}{\downarrow} \Sigma F_y = (200\text{ N})\cos 40° + (400\text{ N})\sin 40°$$

$$R_y = 410.32\text{ N} \qquad (2)$$

(*a*) For **R** to be vertical, we must have $R_x = 0$.

Set $R_x = 0$ in Eq. (1)

$$0 = P - 177.860\text{ N}$$

$$P = 177.860\text{ N} \qquad P = 177.9\text{ N} \blacktriangleleft$$

(*b*) Since **R** is to be vertical:

$$R = R_y = 410\text{ N} \qquad R = 410\text{ N} \blacktriangleleft$$