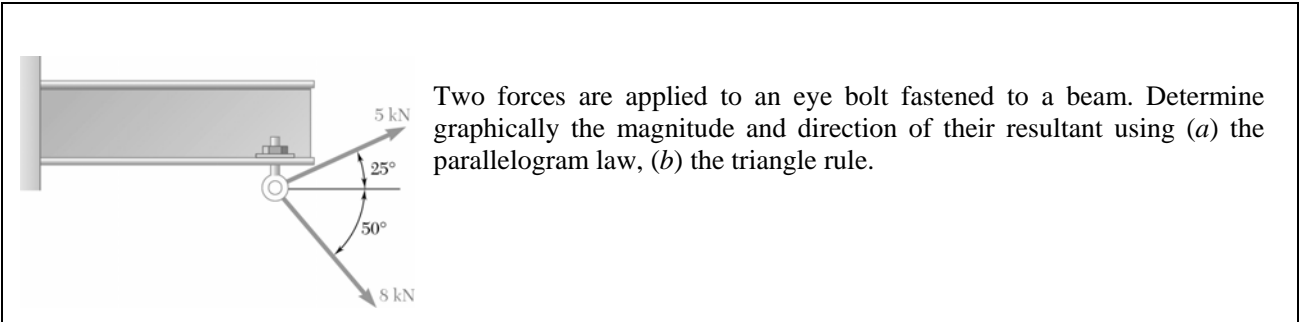
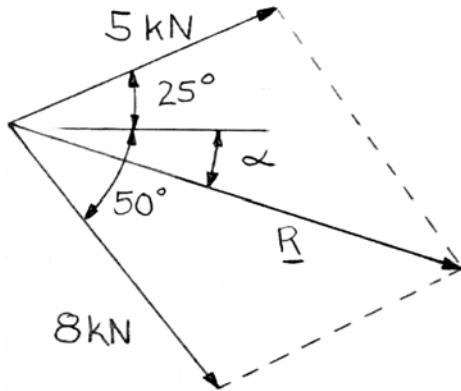


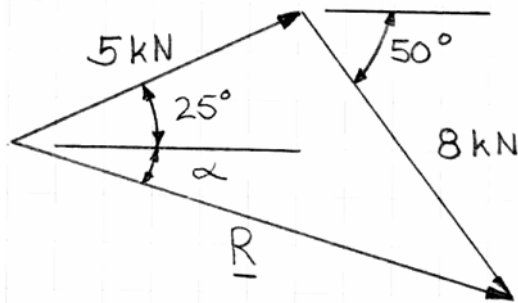
Chapter 2, Problem 3.



(a) Parallelogram law:



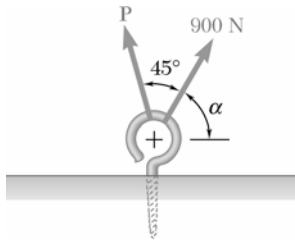
(b) Triangle rule:



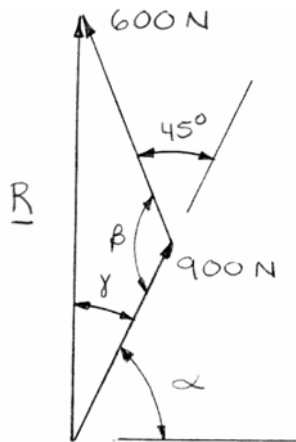
We measure:
 $R = 10.5 \text{ kN}$
 $\alpha = 22.5^\circ$

$R = 10.5 \text{ kN} \searrow 22.5^\circ \blacktriangleleft$

Chapter 2, Problem 7.



Two forces are applied as shown to a hook support. Using trigonometry and knowing that the magnitude of \mathbf{P} is 600 N, determine (a) the required angle α if the resultant \mathbf{R} of the two forces applied to the support is to be vertical, (b) the corresponding magnitude of \mathbf{R} .



Using the triangle rule and the Law of Cosines,

Have: $\beta = 180^\circ - 45^\circ$

$$\beta = 135^\circ$$

Then:

$$R^2 = (900)^2 + (600)^2 - 2(900)(600)\cos 135^\circ$$

$$\text{or } R = 1390.57 \text{ N}$$

Using the Law of Sines,

$$\frac{600}{\sin \gamma} = \frac{1390.57}{\sin 135^\circ}$$

$$\text{or } \gamma = 17.7642^\circ$$

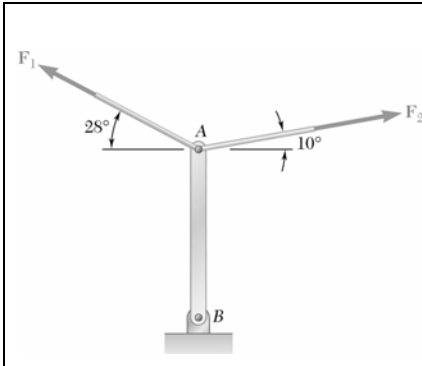
$$\text{and } \alpha = 90^\circ - 17.7642^\circ$$

$$\alpha = 72.236^\circ$$

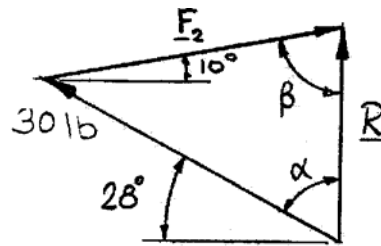
(a) $\alpha = 72.2^\circ \blacktriangleleft$

(b) $R = 1.391 \text{ kN} \blacktriangleleft$

Chapter 2, Problem 8.



Two control rods are attached at A to lever AB. Using trigonometry and knowing that the force in the left-hand rod is $F_1 = 30$ lb, determine (a) the required force F_2 in the right-hand rod if the resultant \mathbf{R} of the forces exerted by the rods on the lever is to be vertical, (b) the corresponding magnitude of \mathbf{R} .



By trigonometry: Law of Sines

$$\frac{F_2}{\sin \alpha} = \frac{R}{\sin 38^\circ} = \frac{30}{\sin \beta}$$

$$\alpha = 90^\circ - 28^\circ = 62^\circ, \beta = 180^\circ - 62^\circ - 38^\circ = 80^\circ$$

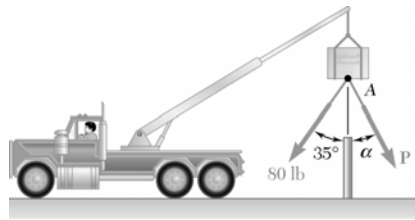
Then:

$$\frac{F_2}{\sin 62^\circ} = \frac{R}{\sin 38^\circ} = \frac{30 \text{ lb}}{\sin 80^\circ}$$

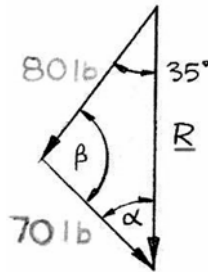
or (a) $F_2 = 26.9 \text{ lb} \blacktriangleleft$

(b) $R = 18.75 \text{ lb} \blacktriangleleft$

Chapter 2, Problem 12.



To steady a sign as it is being lowered, two cables are attached to the sign at A. Using trigonometry and knowing that the magnitude of \mathbf{P} is 70 lb, determine (a) the required angle α if the resultant \mathbf{R} of the two forces applied at A is to be vertical, (b) the corresponding magnitude of \mathbf{R} .



Using the triangle rule and the Law of Sines

(a) Have:
$$\frac{80 \text{ lb}}{\sin \alpha} = \frac{70 \text{ lb}}{\sin 35^\circ}$$

$$\sin \alpha = 0.65552$$

$$\alpha = 40.959^\circ$$

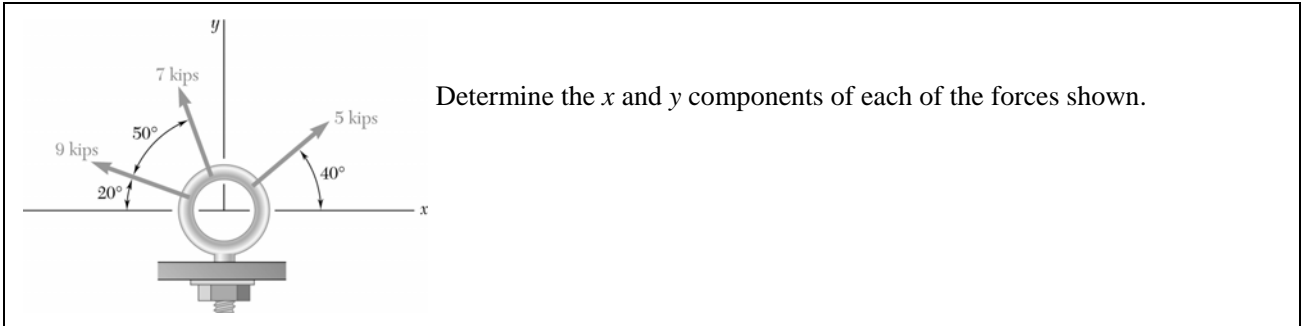
or $\alpha = 41.0^\circ \blacktriangleleft$

(b)
$$\begin{aligned} \beta &= 180 - (35^\circ + 40.959^\circ) \\ &= 104.041^\circ \end{aligned}$$

Then:
$$\frac{R}{\sin 104.041^\circ} = \frac{70 \text{ lb}}{\sin 35^\circ}$$

or $R = 118.4 \text{ lb} \blacktriangleleft$

Chapter 2, Problem 22.



5 kips: $F_x = (5 \text{ kips})\cos 40^\circ$ or $F_x = 3.83 \text{ kips} \blacktriangleleft$

$F_y = (5 \text{ kips})\sin 40^\circ$ or $F_y = 3.21 \text{ kips} \blacktriangleleft$

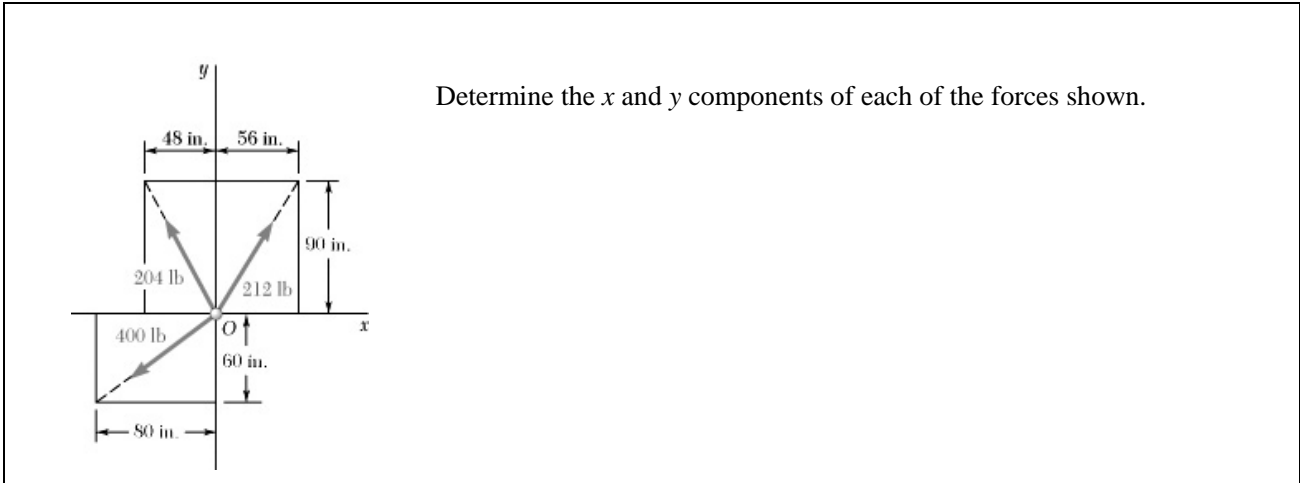
7 kips: $F_x = -(7 \text{ kips})\cos 70^\circ$ or $F_x = -2.39 \text{ kips} \blacktriangleleft$

$F_y = (7 \text{ kips})\sin 70^\circ$ or $F_y = 6.58 \text{ kips} \blacktriangleleft$

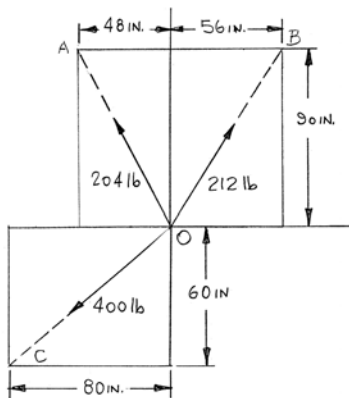
9 kips: $F_x = -(9 \text{ kips})\cos 20^\circ$ or $F_x = -8.46 \text{ kips} \blacktriangleleft$

$F_y = (9 \text{ kips})\sin 20^\circ$ or $F_y = 3.08 \text{ kips} \blacktriangleleft$

Chapter 2, Problem 24.



We compute the following distances:



$$OA = \sqrt{(48)^2 + (90)^2} = 102 \text{ in.}$$

$$OB = \sqrt{(56)^2 + (90)^2} = 106 \text{ in.}$$

$$OC = \sqrt{(80)^2 + (60)^2} = 100 \text{ in.}$$

Then:

204 lb Force:

$$F_x = -(204 \text{ lb}) \frac{48}{102}, \quad F_x = -96.0 \text{ lb} \blacktriangleleft$$

$$F_y = +(204 \text{ lb}) \frac{90}{102}, \quad F_y = 180.0 \text{ lb} \blacktriangleleft$$

212 lb Force:

$$F_x = +(212 \text{ lb}) \frac{56}{106}, \quad F_x = 112.0 \text{ lb} \blacktriangleleft$$

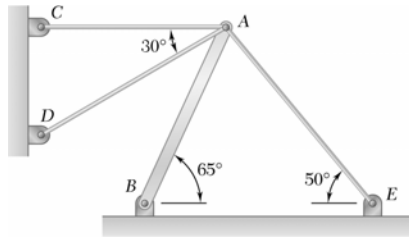
$$F_y = +(212 \text{ lb}) \frac{90}{106}, \quad F_y = 180.0 \text{ lb} \blacktriangleleft$$

400 lb Force:

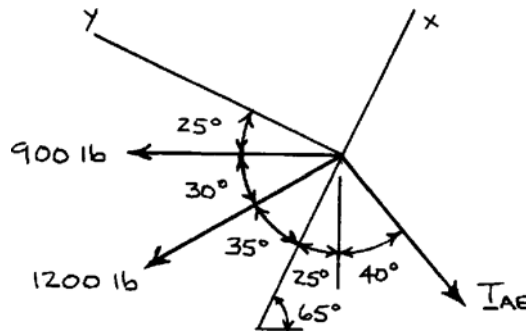
$$F_x = -(400 \text{ lb}) \frac{80}{100}, \quad F_x = -320 \text{ lb} \blacktriangleleft$$

$$F_y = -(400 \text{ lb}) \frac{60}{100}, \quad F_y = -240 \text{ lb} \blacktriangleleft$$

Chapter 2, Problem 42.



Boom AB is held in the position shown by three cables. Knowing that the tensions in cables AC and AD are 900 lb and 1200 lb, respectively, determine (a) the tension in cable AE if the resultant of the tensions exerted at point A of the boom must be directed along AB , (b) the corresponding magnitude of the resultant.



(a) Require $R_y = \Sigma F_y = 0$:

$$(900 \text{ lb})\cos 25^\circ + (1200 \text{ lb})\sin 35^\circ - T_{AE} \sin 65^\circ = 0$$

$$\text{or } T_{AE} = 1659.45 \text{ lb}$$

$$T_{AE} = 1659 \text{ lb} \blacktriangleleft$$

(b) $R = \Sigma F_x$

$$R = -(900 \text{ lb})\sin 25^\circ - (1200 \text{ lb})\cos 35^\circ - (1659.45 \text{ lb})\cos 65^\circ$$

$$R = 2060 \text{ lb} \blacktriangleleft$$