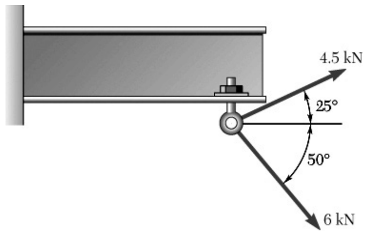
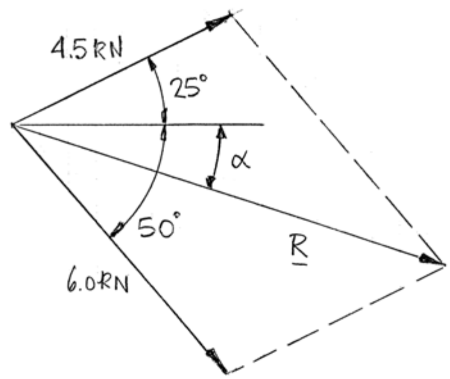
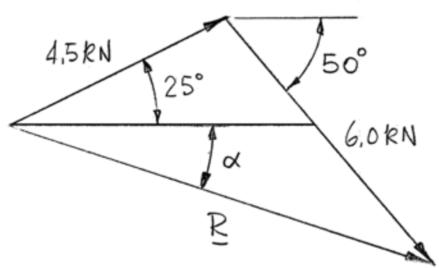
	**PROBLEM 2.1** Two forces are applied to an eye bolt fastened to a beam. Determine graphically the magnitude and direction of their resultant using (*a*) the parallelogram law, (*b*) the triangle rule.

SOLUTION

(*a*)



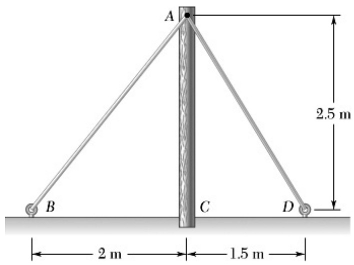
(*b*)



We measure: $R = 8.4$ kN

$\alpha = 19°$

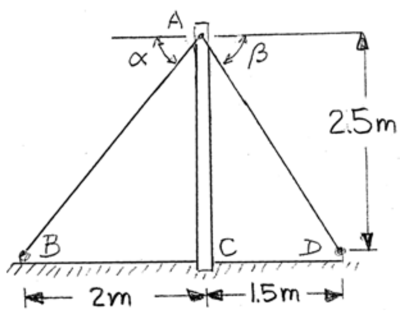
$\mathbf{R} = 8.4$ kN ◥ 19° ◀



PROBLEM 2.2

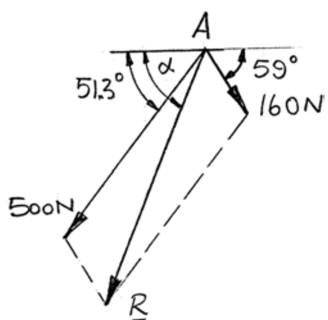
The cable stays *AB* and *AD* help support pole *AC*. Knowing that the tension is 500 N in *AB* and 160 N in *AD*, determine graphically the magnitude and direction of the resultant of the forces exerted by the stays at *A* using (*a*) the parallelogram law, (*b*) the triangle rule.

SOLUTION

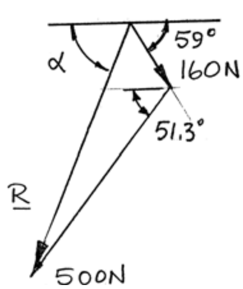


We measure: $\alpha = 51.3°, \beta = 59°$

(*a*)



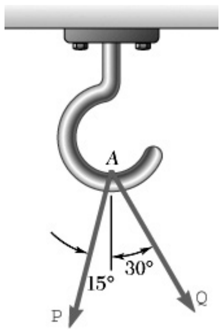
(*b*)



We measure: $R = 575$ N, $\alpha = 67°$

R = 575 N ↗ 67° ◀

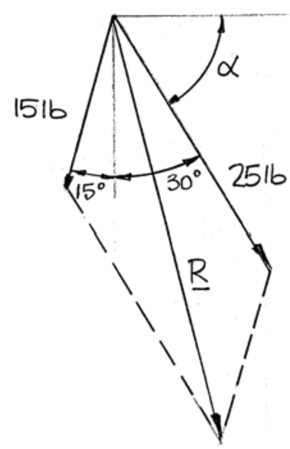
PROBLEM 2.3



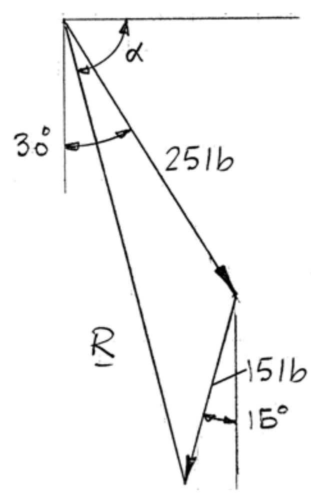
Two forces **P** and **Q** are applied as shown at point *A* of a hook support. Knowing that $P = 15$ lb and $Q = 25$ lb, determine graphically the magnitude and direction of their resultant using (*a*) the parallelogram law, (*b*) the triangle rule.

SOLUTION

(*a*)



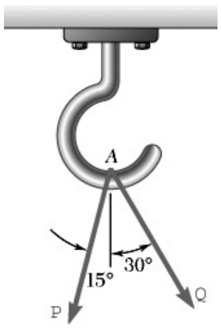
(*b*)



We measure: $R = 37$ lb, $\alpha = 76°$

$\mathbf{R} = 37$ lb ⦫ 76° ◀

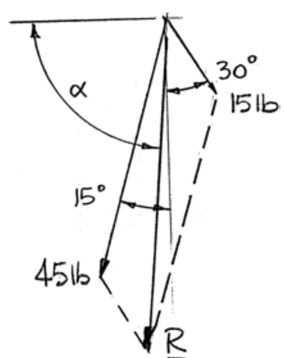
PROBLEM 2.4



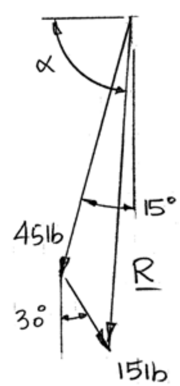
Two forces **P** and **Q** are applied as shown at point *A* of a hook support. Knowing that $P = 45$ lb and $Q = 15$ lb, determine graphically the magnitude and direction of their resultant using (*a*) the parallelogram law, (*b*) the triangle rule.

SOLUTION

(*a*)

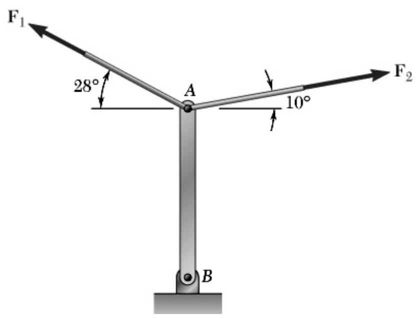


(*b*)



We measure: $R = 61.5 \text{ lb}, \alpha = 86.5°$

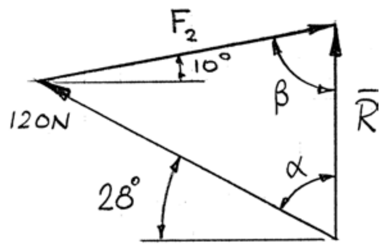
$\mathbf{R} = 61.5 \text{ lb} \nearrow 86.5°$ ◀



PROBLEM 2.5

Two control rods are attached at A to lever AB. Using trigonometry and knowing that the force in the left-hand rod is $F_1 = 120$ N, determine (*a*) the required force F_2 in the right-hand rod if the resultant **R** of the forces exerted by the rods on the lever is to be vertical, (*b*) the corresponding magnitude of **R**.

SOLUTION



Graphically, by the triangle law

We measure: $F_2 \cong 108$ N

$R \cong 77$ N

By trigonometry: Law of Sines

$$\frac{F_2}{\sin\alpha} = \frac{R}{\sin 38°} = \frac{120}{\sin\beta}$$

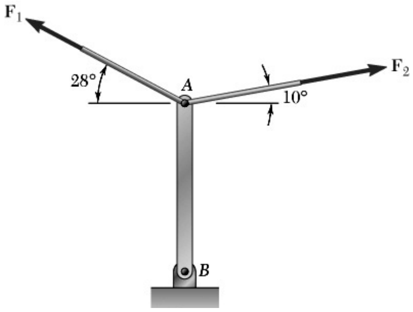
$$\alpha = 90° - 28° = 62°,\ \beta = 180° - 62° - 38° = 80°$$

Then:

$$\frac{F_2}{\sin 62°} = \frac{R}{\sin 38°} = \frac{120\text{ N}}{\sin 80°}$$

or (*a*) $F_2 = 107.6$ N ◀

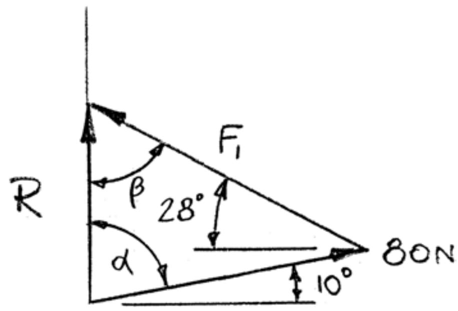
(*b*) $R = 75.0$ N ◀



PROBLEM 2.6

Two control rods are attached at *A* to lever *AB*. Using trigonometry and knowing that the force in the right-hand rod is $F_2 = 80$ N, determine (*a*) the required force F_1 in the left-hand rod if the resultant **R** of the forces exerted by the rods on the lever is to be vertical, (*b*) the corresponding magnitude of **R**.

SOLUTION



Using the Law of Sines

$$\frac{F_1}{\sin\alpha} = \frac{R}{\sin 38^\circ} = \frac{80}{\sin\beta}$$

$$\alpha = 90^\circ - 10^\circ = 80^\circ,\ \beta = 180^\circ - 80^\circ - 38^\circ = 62^\circ$$

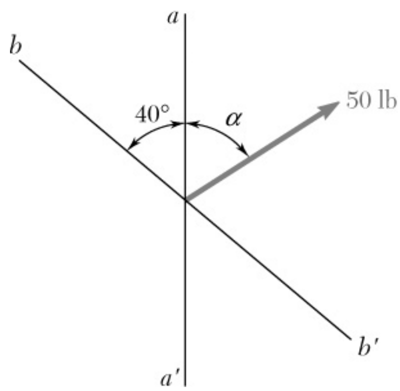
Then:

$$\frac{F_1}{\sin 80^\circ} = \frac{R}{\sin 38^\circ} = \frac{80\text{ N}}{\sin 62^\circ}$$

or (*a*) $F_1 = 89.2$ N ◀

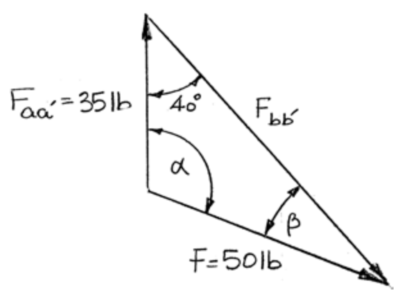
(*b*) $R = 55.8$ N ◀

PROBLEM 2.7



The 50-lb force is to be resolved into components along lines a-a' and b-b'. (*a*) Using trigonometry, determine the angle α knowing that the component along a-a' is 35 lb. (*b*) What is the corresponding value of the component along b-b'?

SOLUTION



Using the triangle rule and the Law of Sines

(*a*)

$$\frac{\sin\beta}{35\text{ lb}} = \frac{\sin 40^\circ}{50\text{ lb}}$$

$$\sin\beta = 0.44995$$

$$\beta = 26.74^\circ$$

Then:

$$\alpha + \beta + 40^\circ = 180^\circ$$

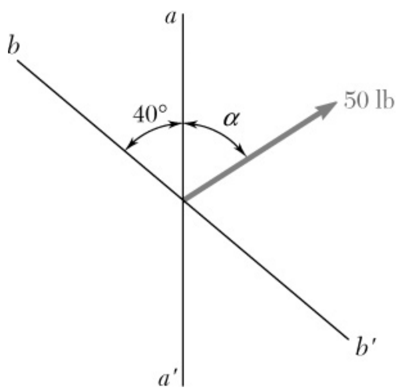
$$\alpha = 113.3^\circ \blacktriangleleft$$

(*b*) Using the Law of Sines:

$$\frac{F_{bb'}}{\sin\alpha} = \frac{50\text{ lb}}{\sin 40^\circ}$$

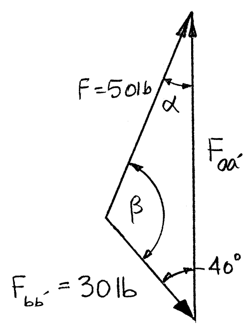
$$F_{bb'} = 71.5\text{ lb} \blacktriangleleft$$

PROBLEM 2.8



The 50-lb force is to be resolved into components along lines a-a' and b-b'. (a) Using trigonometry, determine the angle α knowing that the component along b-b' is 30 lb. (b) What is the corresponding value of the component along a-a'?

SOLUTION



Using the triangle rule and the Law of Sines

(a)

$$\frac{\sin\alpha}{30\text{ lb}} = \frac{\sin 40°}{50\text{ lb}}$$

$$\sin\alpha = 0.3857$$

$$\alpha = 22.7° \blacktriangleleft$$

(b)

$$\alpha + \beta + 40° = 180°$$

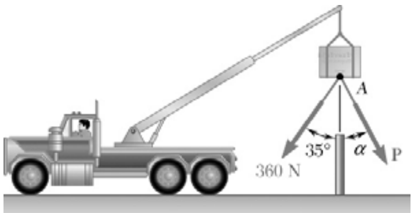
$$\beta = 117.31°$$

$$\frac{F_{aa'}}{\sin\beta} = \frac{50\text{ lb}}{\sin 40°}$$

$$F_{aa'} = 50\text{ lb}\left(\frac{\sin\beta}{\sin 40°}\right)$$

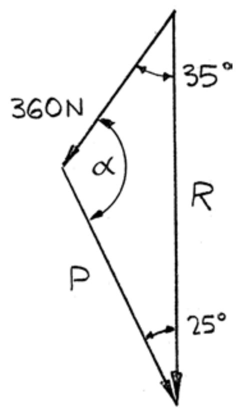
$$F_{aa'} = 69.1\text{ lb} \blacktriangleleft$$

PROBLEM 2.9



To steady a sign as it is being lowered, two cables are attached to the sign at A. Using trigonometry and knowing that $\alpha = 25°$, determine (*a*) the required magnitude of the force **P** if the resultant **R** of the two forces applied at A is to be vertical, (*b*) the corresponding magnitude of **R**.

SOLUTION



Using the triangle rule and the Law of Sines

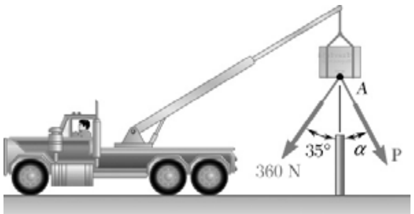
Have: $\alpha = 180° - (35° + 25°)$

$= 120°$

Then: $$\frac{P}{\sin 35°} = \frac{R}{\sin 120°} = \frac{360 \text{ N}}{\sin 25°}$$

or (*a*) $P = 489$ N ◀

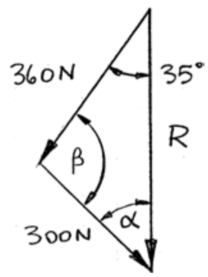
(*b*) $R = 738$ N ◀



PROBLEM 2.10

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 **P** is 300 N, determine (*a*) the required angle α if the resultant **R** of the two forces applied at *A* is to be vertical, (*b*) the corresponding magnitude of **R**.

SOLUTION



Using the triangle rule and the Law of Sines

(*a*) Have:

$$\frac{360\text{ N}}{\sin\alpha} = \frac{300\text{ N}}{\sin 35°}$$

$$\sin\alpha = 0.68829$$

$$\alpha = 43.5° \blacktriangleleft$$

(*b*)

$$\beta = 180 - (35° + 43.5°)$$

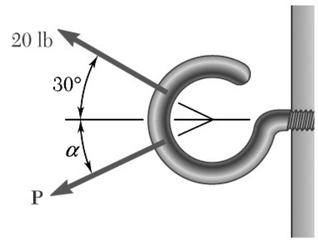
$$= 101.5°$$

Then:

$$\frac{R}{\sin 101.5°} = \frac{300\text{ N}}{\sin 35°}$$

or $R = 513\text{ N} \blacktriangleleft$

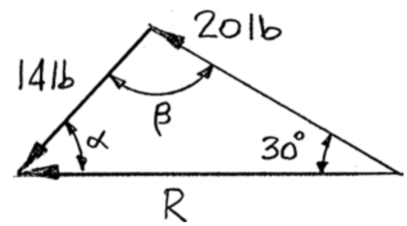
PROBLEM 2.11



Two forces are applied as shown to a hook support. Using trigonometry and knowing that the magnitude of **P** is 14 lb, determine (*a*) the required angle α if the resultant **R** of the two forces applied to the support is to be horizontal, (*b*) the corresponding magnitude of **R**.

SOLUTION

Using the triangle rule and the Law of Sines



(*a*) Have:

$$\frac{20\text{ lb}}{\sin\alpha} = \frac{14\text{ lb}}{\sin 30^\circ}$$

$$\sin\alpha = 0.71428$$

$$\alpha = 45.6^\circ \blacktriangleleft$$

(*b*)

$$\beta = 180^\circ - (30^\circ + 45.6^\circ)$$

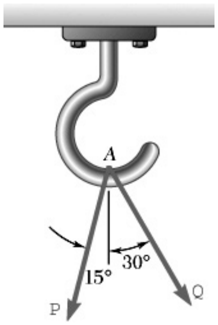
$$= 104.4^\circ$$

Then:

$$\frac{R}{\sin 104.4^\circ} = \frac{14\text{ lb}}{\sin 30^\circ}$$

$$R = 27.1\text{ lb} \blacktriangleleft$$

PROBLEM 2.12

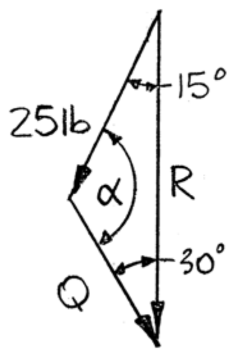


For the hook support of Problem 2.3, using trigonometry and knowing that the magnitude of **P** is 25 lb, determine (*a*) the required magnitude of the force **Q** if the resultant **R** of the two forces applied at *A* is to be vertical, (*b*) the corresponding magnitude of **R**.

Problem 2.3: Two forces **P** and **Q** are applied as shown at point *A* of a hook support. Knowing that *P* = 15 lb and *Q* = 25 lb, determine graphically the magnitude and direction of their resultant using (*a*) the parallelogram law, (*b*) the triangle rule.

SOLUTION

Using the triangle rule and the Law of Sines



(*a*) Have:

$$\frac{Q}{\sin 15°} = \frac{25\text{ lb}}{\sin 30°}$$

$Q = 12.94$ lb ◀

(*b*)

$$\beta = 180° - (15° + 30°)$$
$$= 135°$$

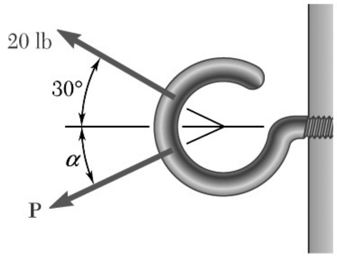
Thus:

$$\frac{R}{\sin 135°} = \frac{25\text{ lb}}{\sin 30°}$$

$$R = 25\text{ lb}\left(\frac{\sin 135°}{\sin 30°}\right) = 35.36\text{ lb}$$

$R = 35.4$ lb ◀

PROBLEM 2.13

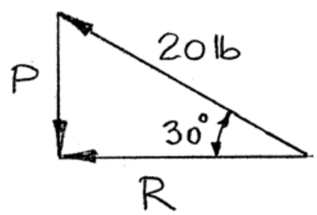


For the hook support of Problem 2.11, determine, using trigonometry, (*a*) the magnitude and direction of the smallest force **P** for which the resultant **R** of the two forces applied to the support is horizontal, (*b*) the corresponding magnitude of **R**.

Problem 2.11: Two forces are applied as shown to a hook support. Using trigonometry and knowing that the magnitude of **P** is 14 lb, determine (*a*) the required angle α if the resultant **R** of the two forces applied to the support is to be horizontal, (*b*) the corresponding magnitude of **R**.

SOLUTION

(*a*) The smallest force **P** will be perpendicular to **R**, that is, vertical



$$P = (20 \text{ lb})\sin 30°$$

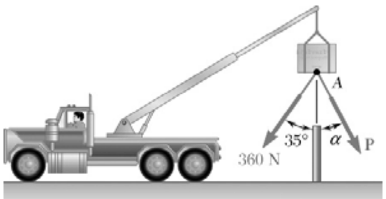
$$= 10 \text{ lb} \qquad \mathbf{P} = 10 \text{ lb} \downarrow \blacktriangleleft$$

(*b*)

$$R = (20 \text{ lb})\cos 30°$$

$$= 17.32 \text{ lb} \qquad R = 17.32 \text{ lb} \blacktriangleleft$$

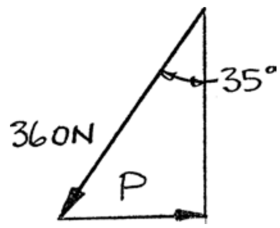
PROBLEM 2.14



As shown in Figure P2.9, two cables are attached to a sign at *A* to steady the sign as it is being lowered. Using trigonometry, determine (*a*) the magnitude and direction of the smallest force **P** for which the resultant **R** of the two forces applied at *A* is vertical, (*b*) the corresponding magnitude of **R**.

SOLUTION

We observe that force **P** is minimum when α is 90°, that is, **P** is horizontal

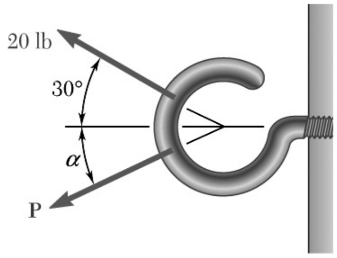


Then: (*a*) $P = (360\text{ N})\sin 35°$

or $\mathbf{P} = 206\text{ N} \longrightarrow$ ◀

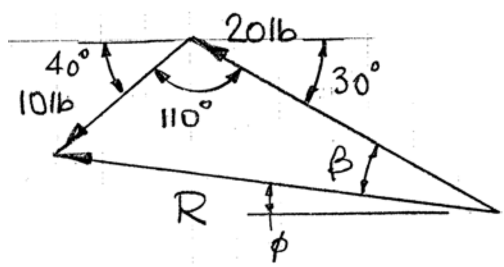
And: (*b*) $R = (360\text{ N})\cos 35°$

or $R = 295\text{ N}$ ◀

	**PROBLEM 2.15** For the hook support of Problem 2.11, determine, using trigonometry, the magnitude and direction of the resultant of the two forces applied to the support knowing that $P = 10$ lb and $\alpha = 40°$. **Problem 2.11:** Two forces are applied as shown to a hook support. Using trigonometry and knowing that the magnitude of **P** is 14 lb, determine (*a*) the required angle α if the resultant **R** of the two forces applied to the support is to be horizontal, (*b*) the corresponding magnitude of **R**.

SOLUTION

Using the force triangle and the Law of Cosines



$$R^2 = (10 \text{ lb})^2 + (20 \text{ lb})^2 - 2(10 \text{ lb})(20 \text{ lb})\cos 110°$$

$$= \left[100 + 400 - 400(-0.342)\right] \text{lb}^2$$

$$= 636.8 \text{ lb}^2$$

$$R = 25.23 \text{ lb}$$

Using now the Law of Sines

$$\frac{10 \text{ lb}}{\sin \beta} = \frac{25.23 \text{ lb}}{\sin 110°}$$

$$\sin \beta = \left(\frac{10 \text{ lb}}{25.23 \text{ lb}}\right)\sin 110°$$

$$= 0.3724$$

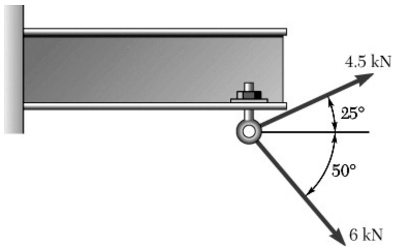
So: $\beta = 21.87°$

Angle of inclination of R, ϕ is then such that:

$$\phi + \beta = 30°$$

$$\phi = 8.13°$$

Hence: **R** $= 25.2$ lb ⦪ $8.13°$ ◀



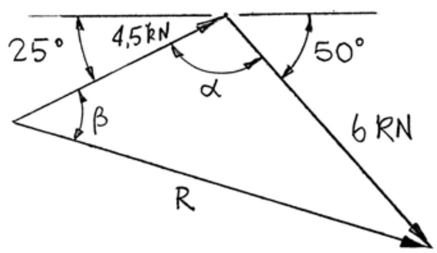
PROBLEM 2.16

Solve Problem 2.1 using trigonometry

Problem 2.1: Two forces are applied to an eye bolt fastened to a beam. Determine graphically the magnitude and direction of their resultant using (*a*) the parallelogram law, (*b*) the triangle rule.

SOLUTION

Using the force triangle, the Law of Cosines and the Law of Sines



We have:

$$\alpha = 180° - (50° + 25°)$$
$$= 105°$$

Then:

$$R^2 = (4.5 \text{ kN})^2 + (6 \text{ kN})^2 - 2(4.5 \text{ kN})(6 \text{ kN})\cos 105°$$
$$= 70.226 \text{ kN}^2$$

or

$$R = 8.3801 \text{ kN}$$

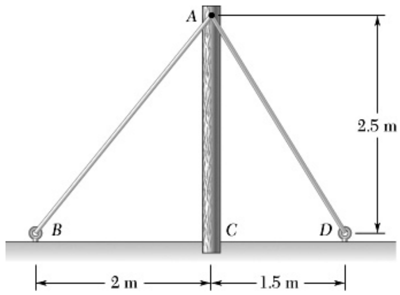
Now:

$$\frac{8.3801 \text{ kN}}{\sin 105°} = \frac{6 \text{ kN}}{\sin \beta}$$

$$\sin \beta = \left(\frac{6 \text{ kN}}{8.3801 \text{ kN}}\right)\sin 105°$$
$$= 0.6916$$
$$\beta = 43.756°$$

$$\mathbf{R} = 8.38 \text{ kN} \searrow 18.76° \blacktriangleleft$$

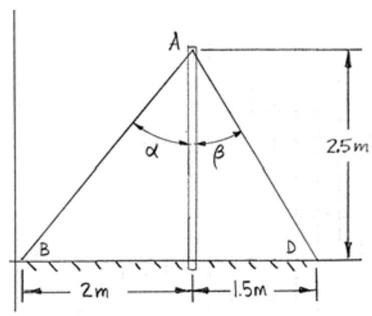
PROBLEM 2.17



Solve Problem 2.2 using trigonometry

Problem 2.2: The cable stays *AB* and *AD* help support pole *AC*. Knowing that the tension is 500 N in *AB* and 160 N in *AD*, determine graphically the magnitude and direction of the resultant of the forces exerted by the stays at *A* using (*a*) the parallelogram law, (*b*) the triangle rule.

SOLUTION



From the geometry of the problem:

$$\alpha = \tan^{-1}\frac{2}{2.5} = 38.66°$$

$$\beta = \tan^{-1}\frac{1.5}{2.5} = 30.96°$$

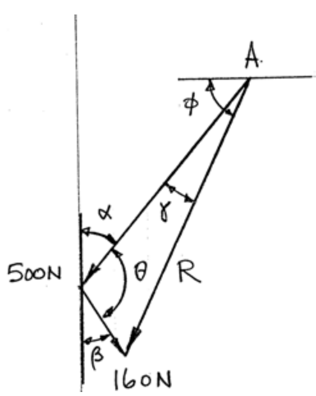
Now: $\theta = 180° - (38.66 + 30.96°) = 110.38$

And, using the Law of Cosines:

$$R^2 = (500\text{ N})^2 + (160\text{ N})^2 - 2(500\text{ N})(160\text{ N})\cos 110.38°$$

$$= 331319\text{ N}^2$$

$$R = 575.6\text{ N}$$



Using the Law of Sines:

$$\frac{160\text{ N}}{\sin\gamma} = \frac{575.6\text{ N}}{\sin 110.38°}$$

$$\sin\gamma = \left(\frac{160\text{ N}}{575.6\text{ N}}\right)\sin 110.38°$$

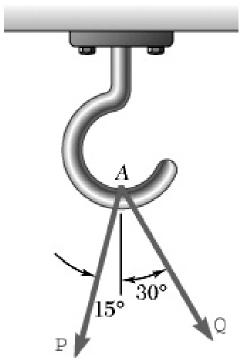
$$= 0.2606$$

$$\gamma = 15.1°$$

$$\phi = (90° - \alpha) + \gamma = 66.44°$$

$$\mathbf{R} = 576\text{ N} \nearrow 66.4° \blacktriangleleft$$

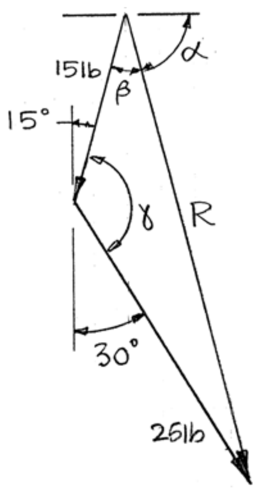
PROBLEM 2.18



Solve Problem 2.3 using trigonometry

Problem 2.3: Two forces **P** and **Q** are applied as shown at point *A* of a hook support. Knowing that $P = 15$ lb and $Q = 25$ lb, determine graphically the magnitude and direction of their resultant using (*a*) the parallelogram law, (*b*) the triangle rule.

SOLUTION



Using the force triangle and the Laws of Cosines and Sines

We have:

$$\gamma = 180° - (15° + 30°)$$

$$= 135°$$

Then:

$$R^2 = (15\text{ lb})^2 + (25\text{ lb})^2 - 2(15\text{ lb})(25\text{ lb})\cos 135°$$

$$= 1380.3\text{ lb}^2$$

or

$$R = 37.15\text{ lb}$$

and

$$\frac{25\text{ lb}}{\sin\beta} = \frac{37.15\text{ lb}}{\sin 135°}$$

$$\sin\beta = \left(\frac{25\text{ lb}}{37.15\text{ lb}}\right)\sin 135°$$

$$= 0.4758$$

$$\beta = 28.41°$$

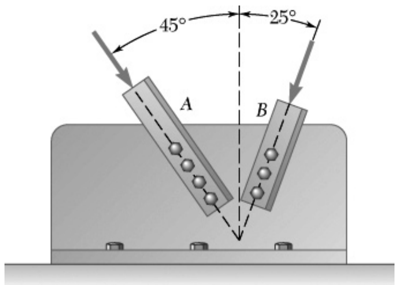
Then:

$$\alpha + \beta + 75° = 180°$$

$$\alpha = 76.59°$$

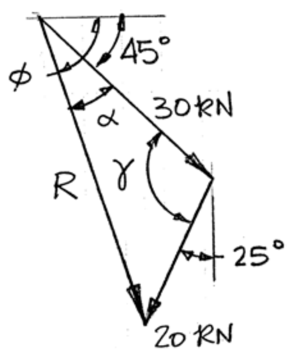
$\mathbf{R} = 37.2$ lb ⦪ 76.6° ◀

PROBLEM 2.19



Two structural members *A* and *B* are bolted to a bracket as shown. Knowing that both members are in compression and that the force is 30 kN in member *A* and 20 kN in member *B*, determine, using trigonometry, the magnitude and direction of the resultant of the forces applied to the bracket by members *A* and *B*.

SOLUTION



Using the force triangle and the Laws of Cosines and Sines

We have: $\gamma = 180° - (45° + 25°) = 110°$

Then: $R^2 = (30\text{ kN})^2 + (20\text{ kN})^2 - 2(30\text{ kN})(20\text{ kN})\cos 110°$

$$= 1710.4\text{ kN}^2$$

$$R = 41.357\text{ kN}$$

and

$$\frac{20\text{ kN}}{\sin\alpha} = \frac{41.357\text{ kN}}{\sin 110°}$$

$$\sin\alpha = \left(\frac{20\text{ kN}}{41.357\text{ kN}}\right)\sin 110°$$

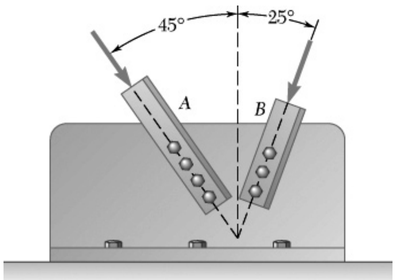
$$= 0.4544$$

$$\alpha = 27.028°$$

Hence: $\phi = \alpha + 45° = 72.028°$

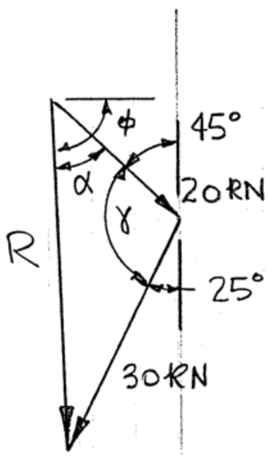
$\mathbf{R} = 41.4\text{ kN}$ ⦪ $72.0°$ ◀

PROBLEM 2.20



Two structural members *A* and *B* are bolted to a bracket as shown. Knowing that both members are in compression and that the force is 20 kN in member *A* and 30 kN in member *B*, determine, using trigonometry, the magnitude and direction of the resultant of the forces applied to the bracket by members *A* and *B*.

SOLUTION



Using the force triangle and the Laws of Cosines and Sines

We have: $\gamma = 180° - (45° + 25°) = 110°$

Then: $R^2 = (30\text{ kN})^2 + (20\text{ kN})^2 - 2(30\text{ kN})(20\text{ kN})\cos 110°$

$$= 1710.4\text{ kN}^2$$

$$R = 41.357\text{ kN}$$

and

$$\frac{30\text{ kN}}{\sin\alpha} = \frac{41.357\text{ kN}}{\sin 110°}$$

$$\sin\alpha = \left(\frac{30\text{ kN}}{41.357\text{ kN}}\right)\sin 110°$$

$$= 0.6816$$

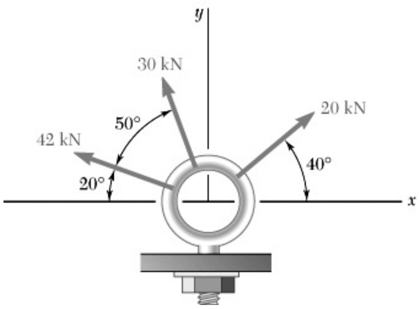
$$\alpha = 42.97°$$

Finally: $\phi = \alpha + 45° = 87.97°$

R $= 41.4$ kN ⦨ $88.0°$ ◀

PROBLEM 2.21

Determine the x and y components of each of the forces shown.



SOLUTION

20 kN Force:

$$F_x = +(20\text{ kN})\cos 40°, \qquad F_x = 15.32\text{ kN} \blacktriangleleft$$

$$F_y = +(20\text{ kN})\sin 40°, \qquad F_y = 12.86\text{ kN} \blacktriangleleft$$

30 kN Force:

$$F_x = -(30\text{ kN})\cos 70°, \qquad F_x = -10.26\text{ kN} \blacktriangleleft$$

$$F_y = +(30\text{ kN})\sin 70°, \qquad F_y = 28.2\text{ kN} \blacktriangleleft$$

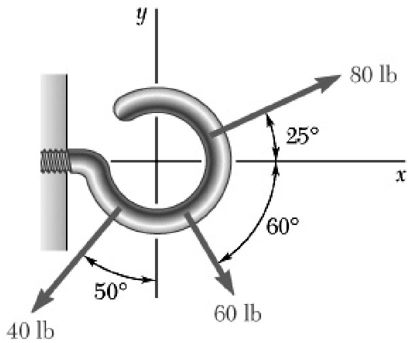
42 kN Force:

$$F_x = -(42\text{ kN})\cos 20°, \qquad F_x = -39.5\text{ kN} \blacktriangleleft$$

$$F_y = +(42\text{ kN})\sin 20°, \qquad F_y = 14.36\text{ kN} \blacktriangleleft$$

PROBLEM 2.22

Determine the x and y components of each of the forces shown.



SOLUTION

40 lb Force:

$$F_x = -(40 \text{ lb})\sin 50°, \qquad F_x = -30.6 \text{ lb} \blacktriangleleft$$

$$F_y = -(40 \text{ lb})\cos 50°, \qquad F_y = -25.7 \text{ lb} \blacktriangleleft$$

60 lb Force:

$$F_x = +(60 \text{ lb})\cos 60°, \qquad F_x = 30.0 \text{ lb} \blacktriangleleft$$

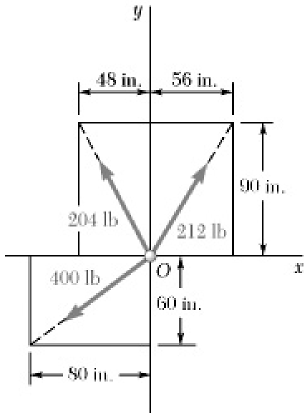
$$F_y = -(60 \text{ lb})\sin 60°, \qquad F_y = -52.0 \text{ lb} \blacktriangleleft$$

80 lb Force:

$$F_x = +(80 \text{ lb})\cos 25°, \qquad F_x = 72.5 \text{ lb} \blacktriangleleft$$

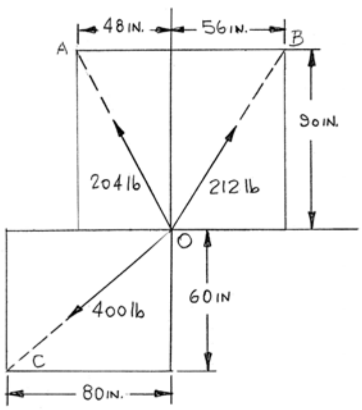
$$F_y = +(80 \text{ lb})\sin 25°, \qquad F_y = 33.8 \text{ lb} \blacktriangleleft$$

PROBLEM 2.23



Determine the x and y components of each of the forces shown.

SOLUTION



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:

$$F_x = -(102 \text{ lb})\frac{48}{102}, \qquad F_x = -48.0 \text{ lb} \blacktriangleleft$$

$$F_y = +(102 \text{ lb})\frac{90}{102}, \qquad F_y = 90.0 \text{ lb} \blacktriangleleft$$

212 lb Force:

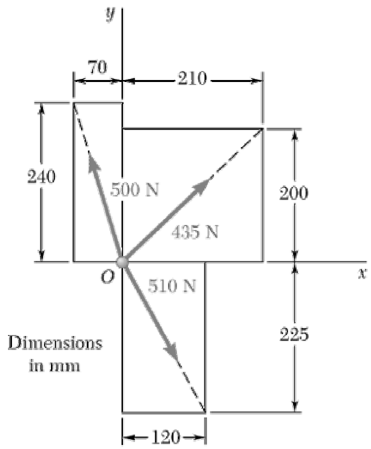
$$F_x = +(212 \text{ lb})\frac{56}{106}, \qquad F_x = 112.0 \text{ lb} \blacktriangleleft$$

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

400 lb Force:

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

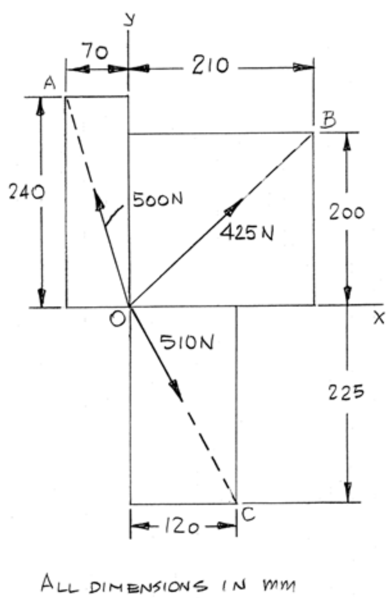
$$F_y = -(400 \text{ lb})\frac{60}{100}, \qquad F_y = -240 \text{ lb} \blacktriangleleft$$



PROBLEM 2.24

Determine the *x* and *y* components of each of the forces shown.

SOLUTION



We compute the following distances:

$$OA = \sqrt{(70)^2 + (240)^2} = 250 \text{ mm}$$

$$OB = \sqrt{(210)^2 + (200)^2} = 290 \text{ mm}$$

$$OC = \sqrt{(120)^2 + (225)^2} = 255 \text{ mm}$$

500 N Force:

$$F_x = -500 \text{ N}\left(\frac{70}{250}\right) \qquad F_x = -140.0 \text{ N} \blacktriangleleft$$

$$F_y = +500 \text{ N}\left(\frac{240}{250}\right) \qquad F_y = 480 \text{ N} \blacktriangleleft$$

435 N Force:

$$F_x = +435 \text{ N}\left(\frac{210}{290}\right) \qquad F_x = 315 \text{ N} \blacktriangleleft$$

$$F_y = +435 \text{ N}\left(\frac{200}{290}\right) \qquad F_y = 300 \text{ N} \blacktriangleleft$$

510 N Force:

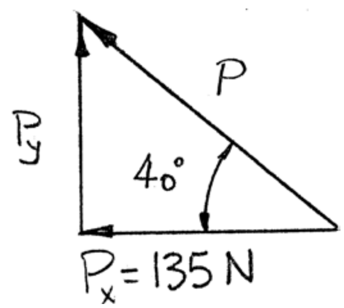
$$F_x = +510 \text{ N}\left(\frac{120}{255}\right) \qquad F_x = 240 \text{ N} \blacktriangleleft$$

$$F_y = -510 \text{ N}\left(\frac{225}{255}\right) \qquad F_y = -450 \text{ N} \blacktriangleleft$$

PROBLEM 2.25

While emptying a wheelbarrow, a gardener exerts on each handle *AB* a force **P** directed along line *CD*. Knowing that **P** must have a 135-N horizontal component, determine (*a*) the magnitude of the force **P**, (*b*) its vertical component.

SOLUTION



(*a*)

$$P = \frac{P_x}{\cos 40°}$$

$$= \frac{135 \text{ N}}{\cos 40°}$$

or $P = 176.2$ N ◀

(*b*)

$$P_y = P_x \tan 40° = P \sin 40°$$

$$= (135 \text{ N}) \tan 40°$$

or $P_y = 113.3$ N ◀