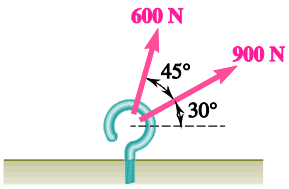
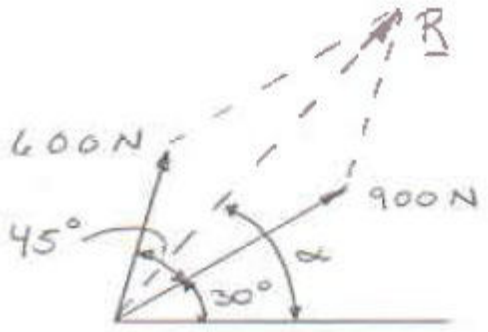


PROBLEM 2.1

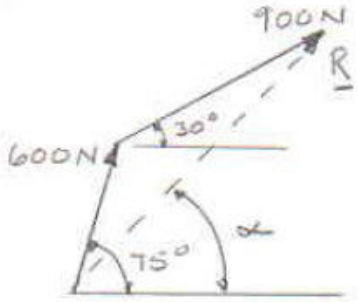
Two forces are applied as shown to a hook. Determine graphically the magnitude and direction of their resultant using (*a*) the parallelogram law, (*b*) the triangle rule.

SOLUTION

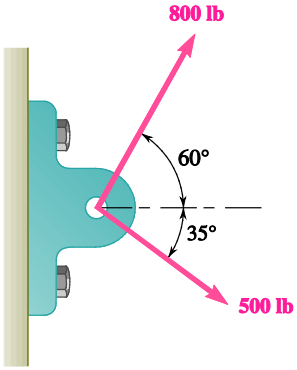
(*a*) Parallelogram law:



(*b*) Triangle rule:



We measure: $R = 1391$ kN, $\alpha = 47.8°$ $\mathbf{R} = 1391\ \text{N} \angle 47.8°$ ◀

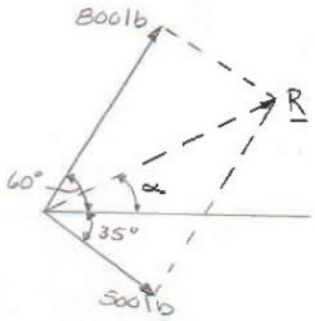


PROBLEM 2.2

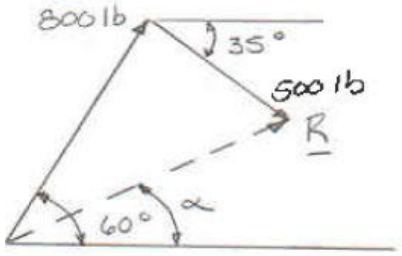
Two forces are applied as shown to a bracket support. Determine graphically the magnitude and direction of their resultant using (*a*) the parallelogram law, (*b*) the triangle rule.

SOLUTION

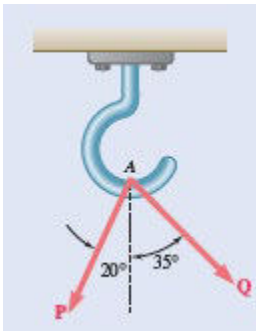
(*a*) Parallelogram law:



(*b*) Triangle rule:



We measure: $R = 906$ lb, $\alpha = 26.6°$ $R = 906$ lb $\angle 26.6°$ ◀

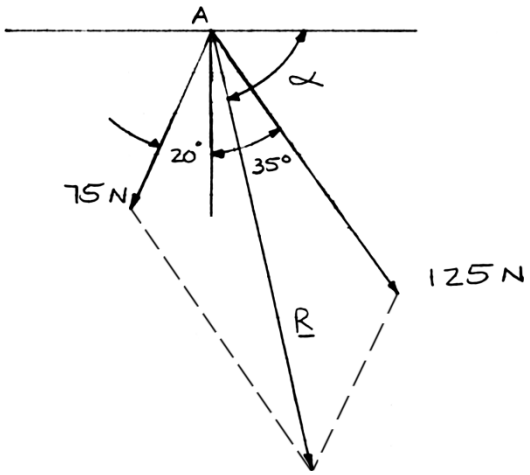


PROBLEM 2.3

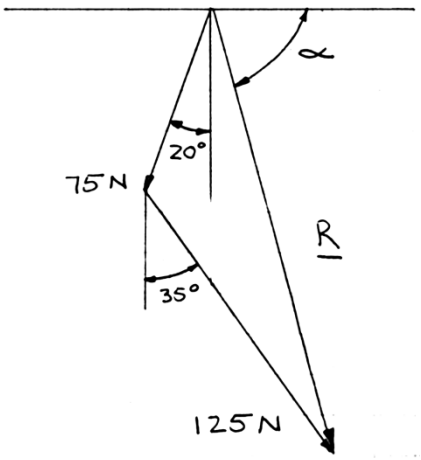
Two forces **P** and **Q** are applied as shown at Point *A* of a hook support. Knowing that $P = 75$ N and $Q = 125$ N, determine graphically the magnitude and direction of their resultant using (*a*) the parallelogram law, (*b*) the triangle rule.

SOLUTION

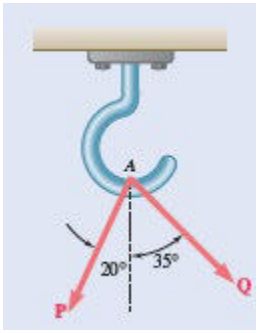
(*a*) Parallelogram law:



(*b*) Triangle rule:



We measure: $R = 179$ N, $\alpha = 75.1°$ **R** = 179 N ∠ 75.1°

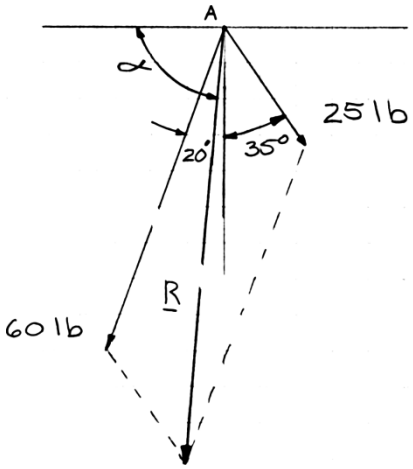


PROBLEM 2.4

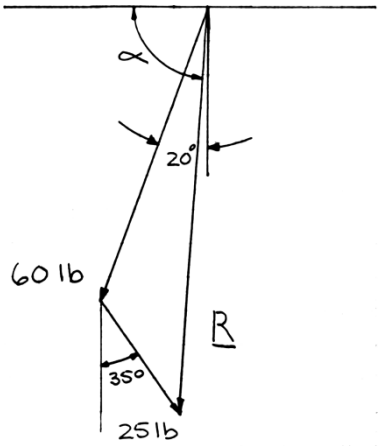
Two forces **P** and **Q** are applied as shown at Point *A* of a hook support. Knowing that $P = 60$ lb and $Q = 25$ lb, determine graphically the magnitude and direction of their resultant using (*a*) the parallelogram law, (*b*) the triangle rule.

SOLUTION

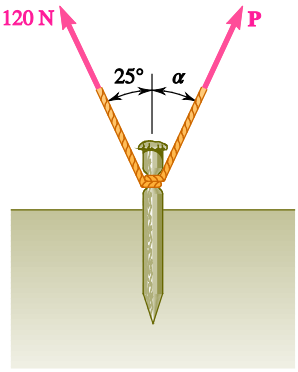
(*a*) Parallelogram law:



(*b*) Triangle rule:



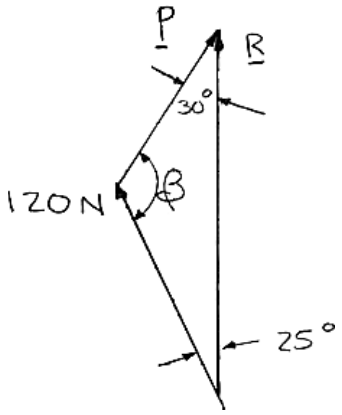
We measure: $R = 77.1$ lb, $\alpha = 85.4°$ **R** = 77.1 lb ∠ 85.4°



PROBLEM 2.5

A stake is being pulled out of the ground by means of two ropes as shown. Knowing that $\alpha = 30°$, determine by trigonometry (*a*) the magnitude of the force **P** so that the resultant force exerted on the stake is vertical, (*b*) the corresponding magnitude of the resultant.

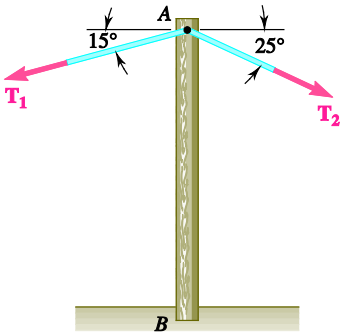
SOLUTION



Using the triangle rule and the law of sines:

(*a*)
$$\frac{120\text{ N}}{\sin 30°} = \frac{P}{\sin 25°}$$
$$P = 101.4\text{ N} \blacktriangleleft$$

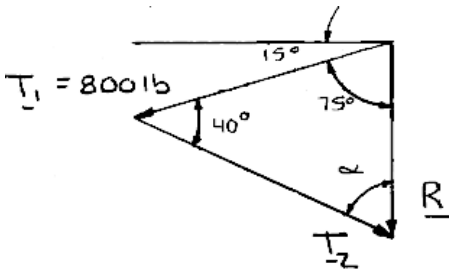
(*b*)
$$30° + \beta + 25° = 180°$$
$$\beta = 180° - 25° - 30°$$
$$= 125°$$
$$\frac{120\text{ N}}{\sin 30°} = \frac{R}{\sin 125°}$$
$$R = 196.6\text{ N} \blacktriangleleft$$



PROBLEM 2.6

A telephone cable is clamped at A to the pole AB. Knowing that the tension in the left-hand portion of the cable is $T_1 = 800$ lb, determine by trigonometry (*a*) the required tension T_2 in the right-hand portion if the resultant **R** of the forces exerted by the cable at A is to be vertical, (*b*) the corresponding magnitude of **R**.

SOLUTION

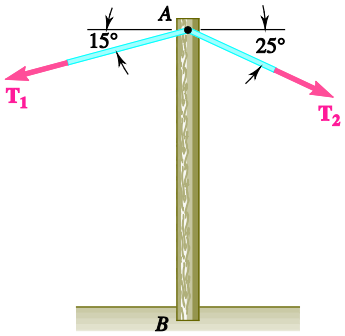


Using the triangle rule and the law of sines:

(*a*)
$$75^\circ + 40^\circ + \alpha = 180^\circ$$
$$\alpha = 180^\circ - 75^\circ - 40^\circ$$
$$= 65^\circ$$

$$\frac{800 \text{ lb}}{\sin 65^\circ} = \frac{T_2}{\sin 75^\circ} \qquad T_2 = 853 \text{ lb} \blacktriangleleft$$

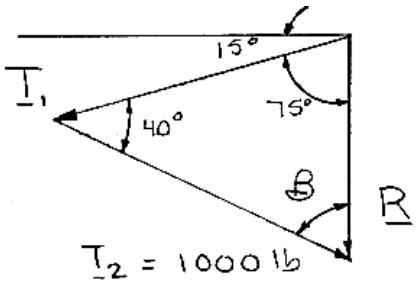
(*b*)
$$\frac{800 \text{ lb}}{\sin 65^\circ} = \frac{R}{\sin 40^\circ} \qquad R = 567 \text{ lb} \blacktriangleleft$$



PROBLEM 2.7

A telephone cable is clamped at A to the pole AB. Knowing that the tension in the right-hand portion of the cable is $T_2 = 1000$ lb, determine by trigonometry (a) the required tension T_1 in the left-hand portion if the resultant **R** of the forces exerted by the cable at A is to be vertical, (b) the corresponding magnitude of **R**.

SOLUTION

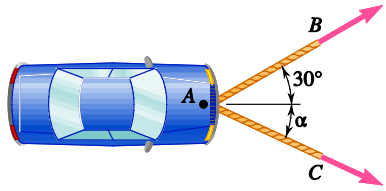


Using the triangle rule and the law of sines:

(a)
$$75° + 40° + \beta = 180°$$
$$\beta = 180° - 75° - 40°$$
$$= 65°$$
$$\frac{1000 \text{ lb}}{\sin 75°} = \frac{T_1}{\sin 65°} \qquad T_1 = 938 \text{ lb} \blacktriangleleft$$

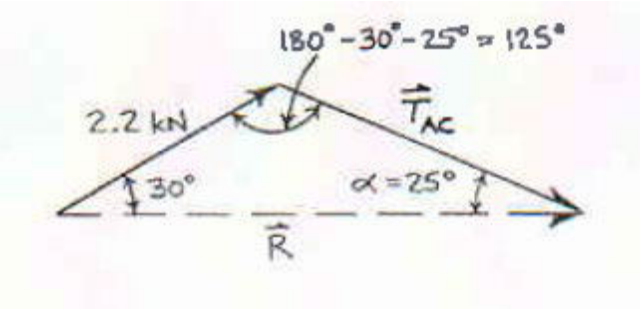
(b)
$$\frac{1000 \text{ lb}}{\sin 75°} = \frac{R}{\sin 40°} \qquad R = 665 \text{ lb} \blacktriangleleft$$

PROBLEM 2.8



A disabled automobile is pulled by means of two ropes as shown. The tension in rope AB is 2.2 kN, and the angle α is 25°. Knowing that the resultant of the two forces applied at A is directed along the axis of the automobile, determine by trigonometry (*a*) the tension in rope AC, (*b*) the magnitude of the resultant of the two forces applied at A.

SOLUTION



Using the law of sines:

$$\frac{T_{AC}}{\sin 30^\circ} = \frac{R}{\sin 125^\circ} = \frac{2.2 \text{ kN}}{\sin 25^\circ}$$

$$T_{AC} = 2.603 \text{ kN}$$
$$R = 4.264 \text{ kN}$$

(*a*) $T_{AC} = 2.60$ kN ◀

(*b*) $R = 4.26$ kN ◀