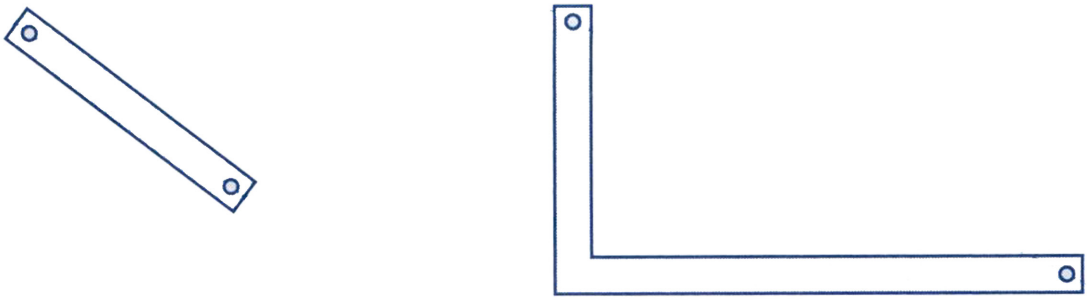
3-5
Equilibrium of Concurrent Coplanar Force Systems

Key Concept:
Equilibrium – the forces impart no translational or rotational motion

Conditions of Equilibrium:
$\sum F_x = 0$
$\sum F_y = 0$

These two equilibrium equations can be used to determine two unknown forces applied to the rigid body or unknown reactions exerted on it by its supports.

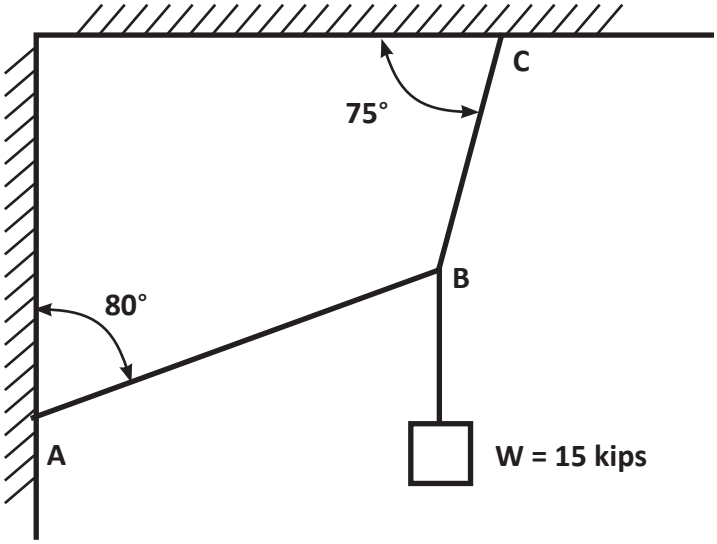
Two-Force Member (TFM)



(a) (b)

Equilibrium conditions require that the two forces be equal in magnitude, opposite in direction, and acting along the line joining the two points of application.

Example #1. Determine the tension in the cables AB and BC (a) mathematically from the force triangle and (b) by the method of rectangular components and equilibrium equations



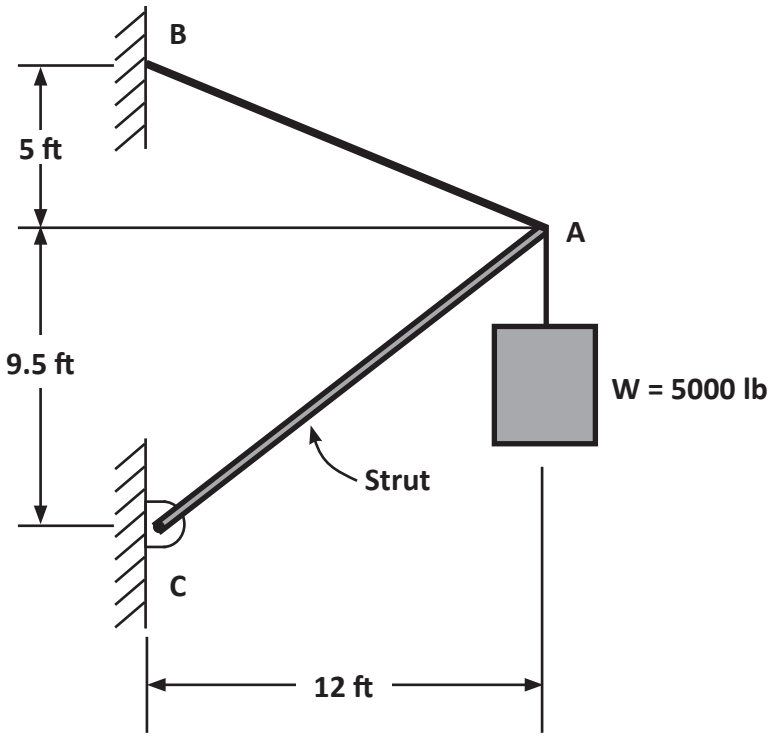
Solution.

(a) mathematically from the force triangle

(b) by the method of rectangular components and equilibrium equations

Example #2
Determine the tension in the cable AB and the axial force in the strut AC (a) mathematically from the force triangle and (b) by equilibrium equations.

Solution.
(a) mathematically from the force triangle



(b) by equilibrium equations

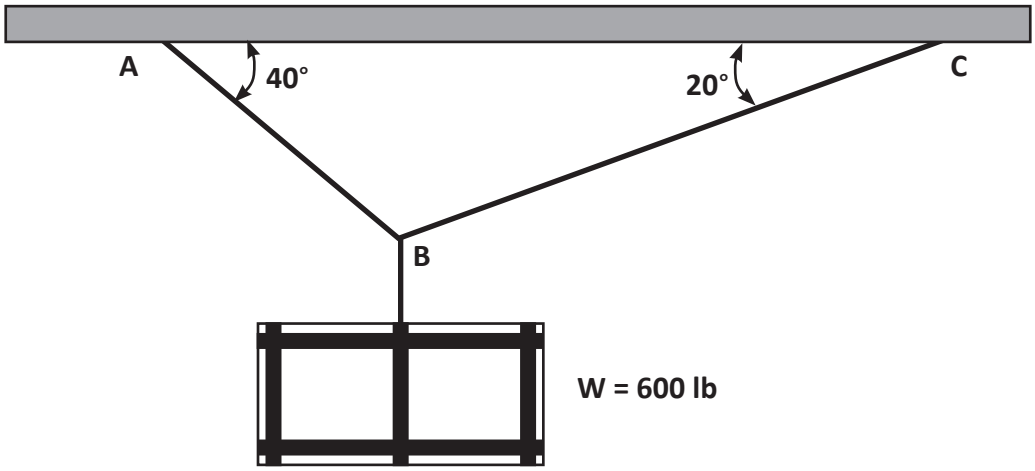
Example #3

A crate weighing 600 lb is suspended by two cables.

(a) Draw a free body diagram of point

(b) Construct a force triangle that satisfies the conditions of equilibrium of point B

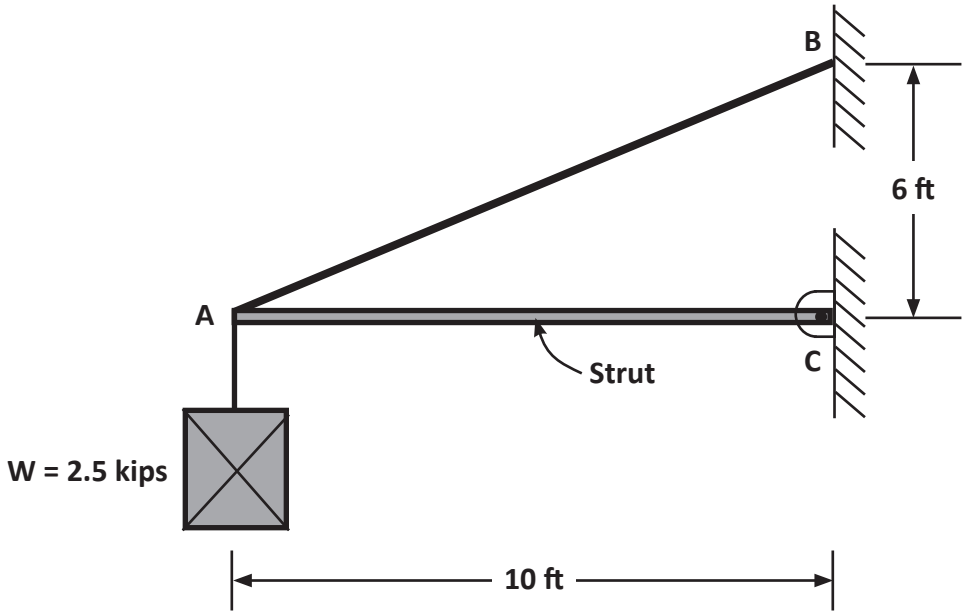
(c) Use the force triangle to determine the tension in cables AB and BC



Solution.

Example #4

Determine the tension in the cable and the tension or compression in the strut (a) mathematically from the force triangle and (b) by equilibrium equations.



Solution.

(a) mathematically from the force triangle

(b) by equilibrium equations

Example #5

Determine the push force P required to hold the 10-kg homogeneous cylinder stationary on the 10° incline shown in Fig. P3-11. Neglect the weight of the handle.

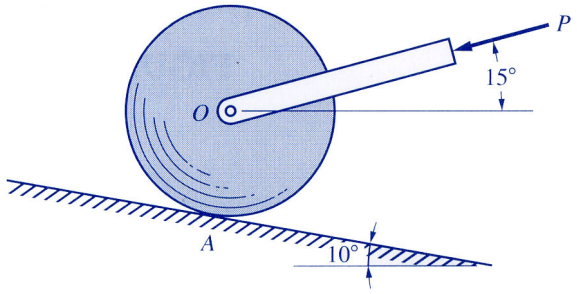


FIGURE P3–11

Solution.