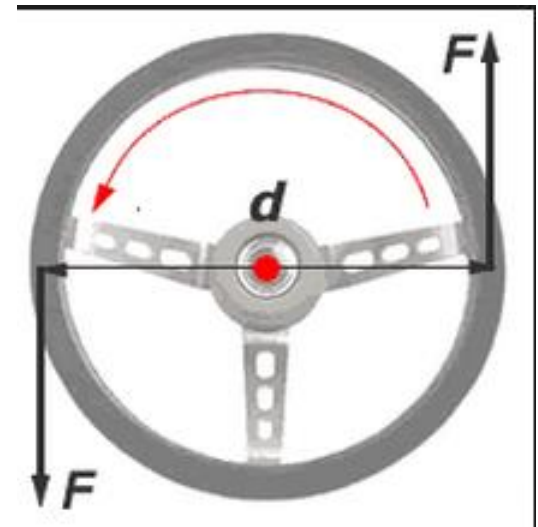
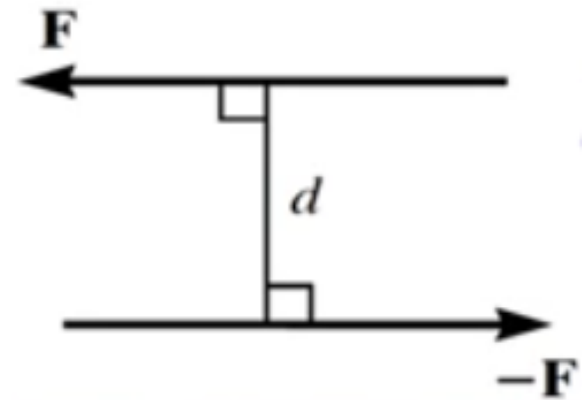
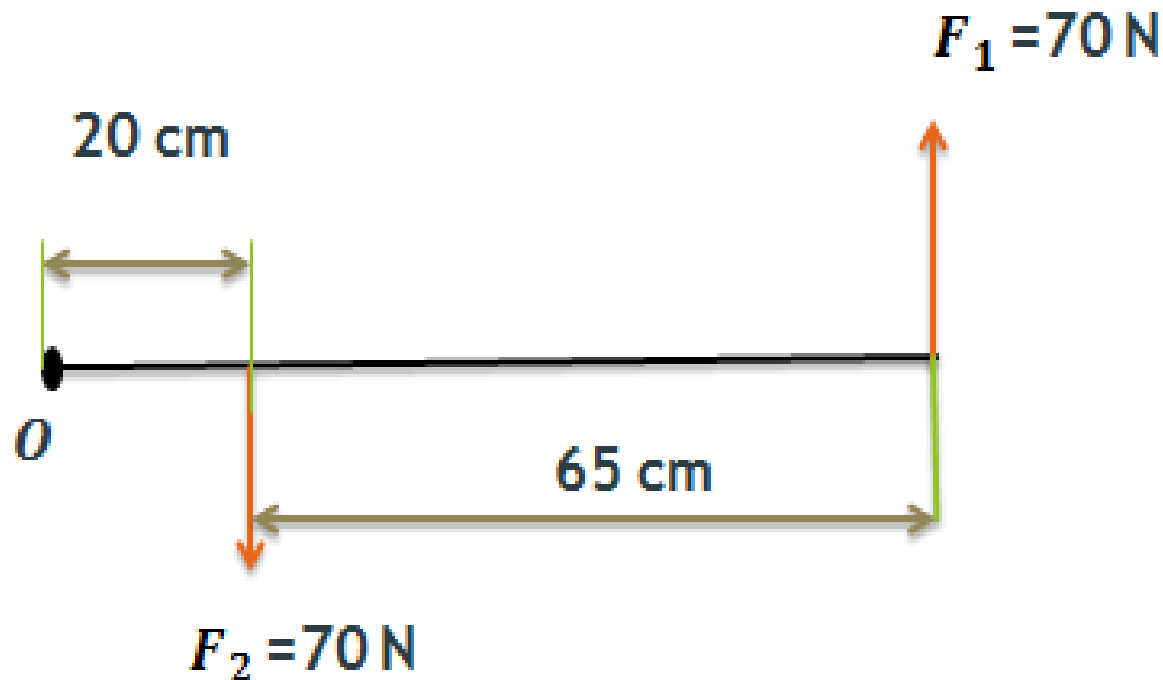


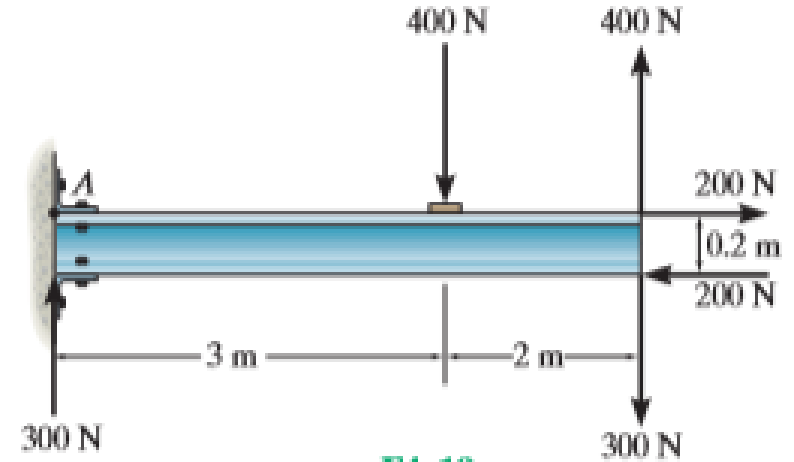
Moment of a Couple

A couple is defined as two parallel forces that have the same magnitude, but opposite directions, and are separated by a perpendicular distance (d).

$$M = F \times d$$

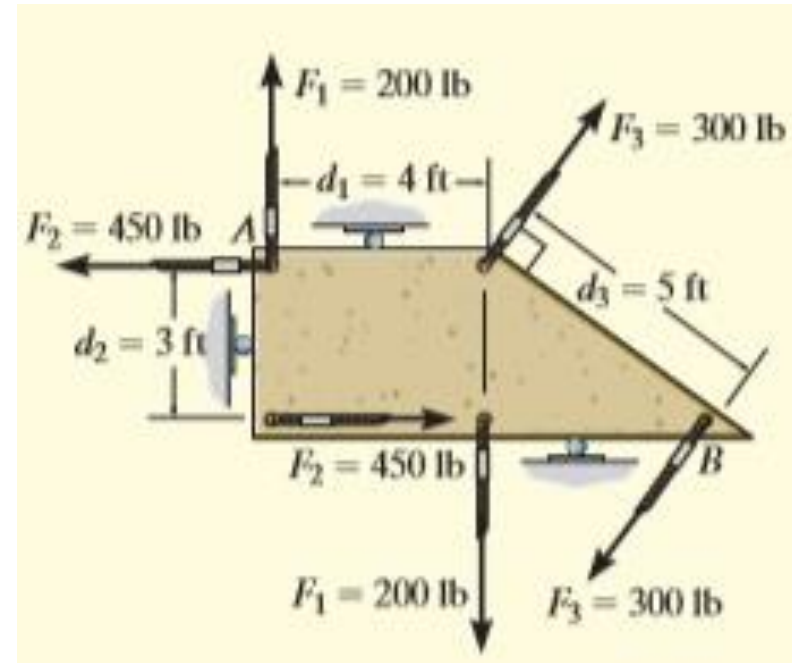


EXAMPLE : Determine the resultant couple moment acting on the beam.



Example

Determine the resultant couple moment of the three couples acting on the plate in Fig.



Forces Equilibrium on Particle

Conditions for Particle Equilibrium

A particle is said to be in equilibrium if it remains at rest originally, or has a constant velocity when originally in motion.

$$\sum F_x = 0 \dots\dots\dots 1$$

Which means :-

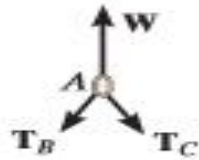
$$\sum F_y = 0 \dots\dots\dots 2$$

$$\sum F_M = 0 \dots\dots\dots 3$$

The Free Body Diagram

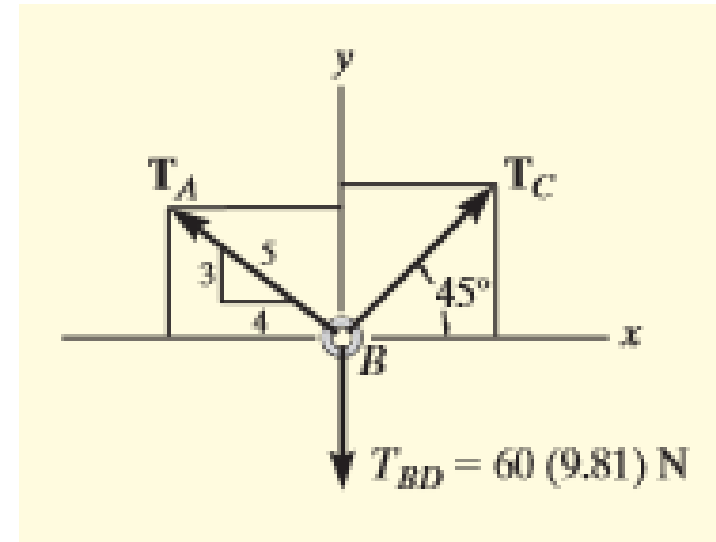
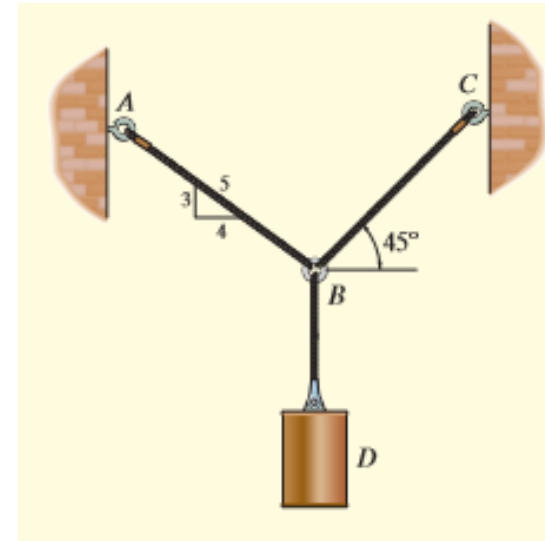
To apply the equation of equilibrium, we must account for all the known and unknown forces which act on the particle. The best way to do this is to think of the particle as isolated and “free” from its surroundings.

- 1- Draw outlined shape of particle.
- 2- Show all forces.
- 3- Identify forces and direction

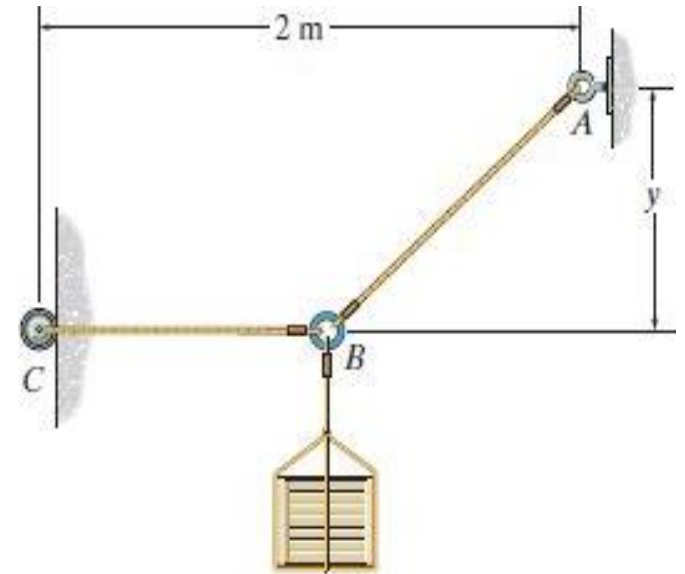


Example: Determine necessary tension in cables BA and BC to support the 60-kg cylinder in figure.

Solution:



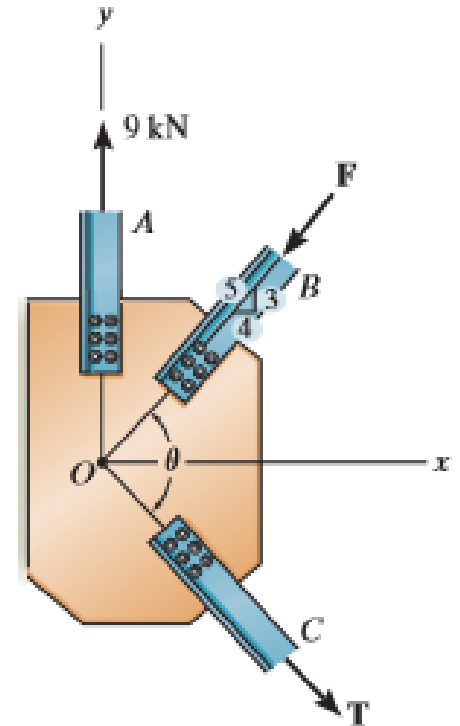
Example: Determine the force in each cord for equilibrium of the 200-kg crate. Cord BC remains horizontal due to the roller at C , and AB has a length of 1.5 m, $y = 0.75$ m?



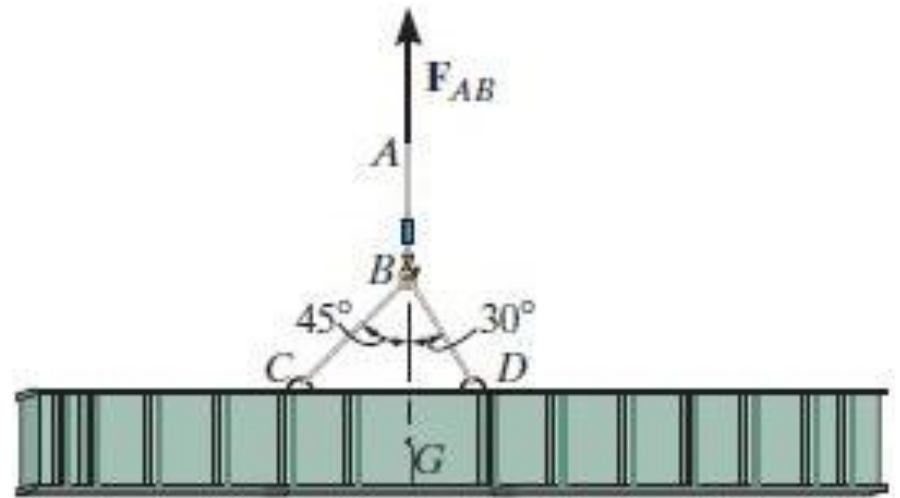
Example: The gusset plate is subjected to the forces of three members. Determine the tension force in member C and its angle for equilibrium. The forces are concurrent at point O. Take $F = 8\text{ kN}$

Solution:

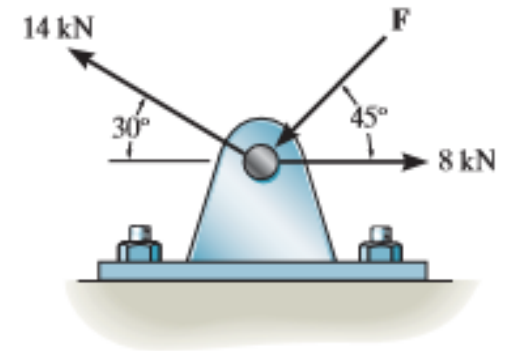
.



Example: If cables BD and BC can withstand a maximum tensile force of 20 kN, determine the maximum mass of the girder that can be suspended from cable AB so that neither cable will fail. The center of mass of the girder is located at point G?



H.W: Determine the magnitude of force F so that the resultant force of the three forces is as small as possible. What is the magnitude of this smallest resultant force?



H.W: If the 1.5-m -long cord AB can withstand a maximum force of 3500 N , determine the force in cord BC and the distance y so that the 200-kg crate can be supported?

