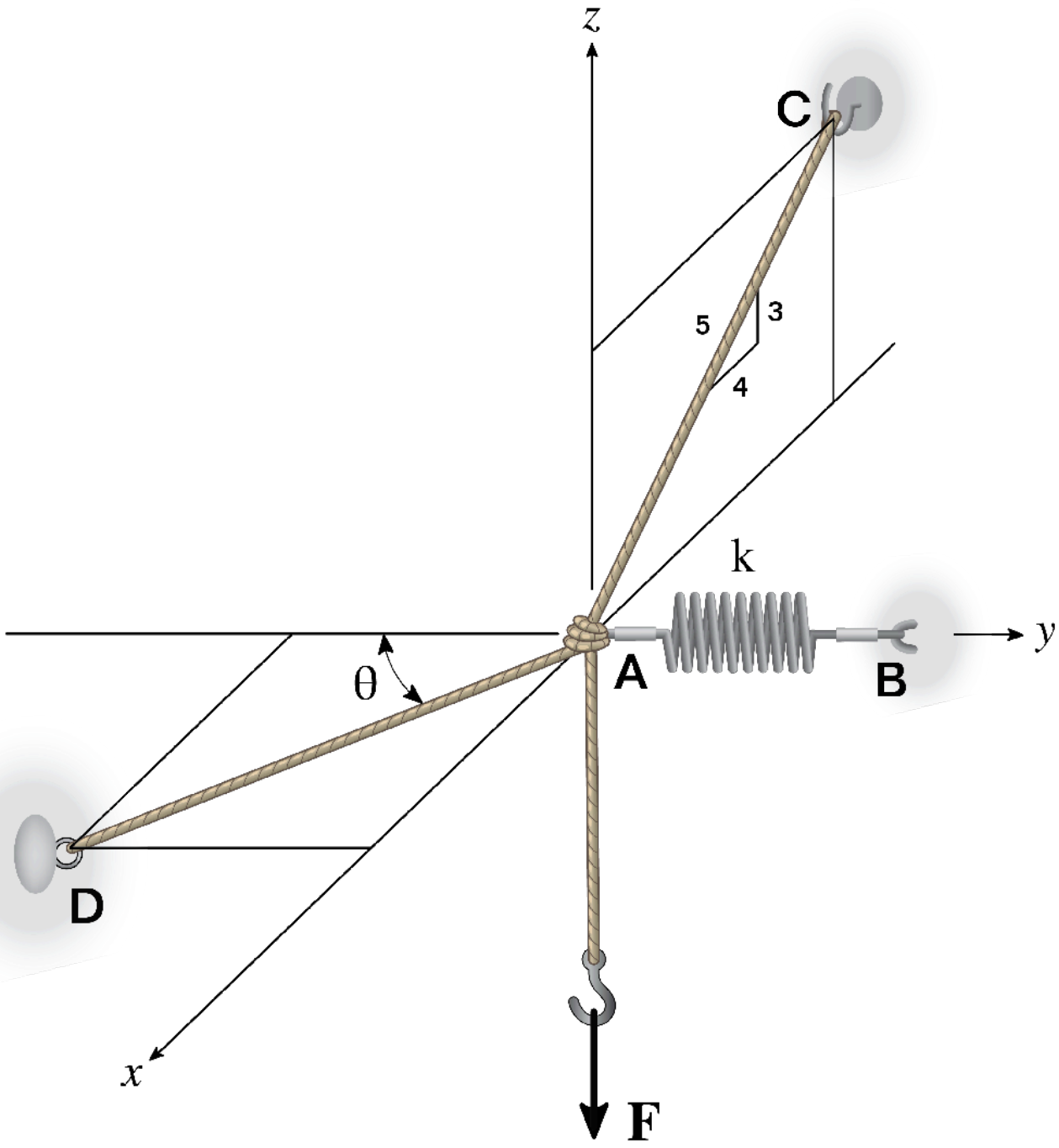
21-S-3.4-



RP-06

Three cables and a spring are connected by a knot at A. If one cable is pulled by a hook with a force F and the spring has an unstretched length of x_0, find the tension in the other two cables as well as the equilibrium length of the spring.

Find the magnitudes of the forces applied by the two other cables and the spring.

$$\Sigma F_z = 0 : \frac{3}{5} F_{AC} - F = 0$$

$$\Rightarrow F_{AC} = F \cdot \frac{5}{3}$$

$$\Sigma F_x = 0 : F_{AD} \sin\theta - \frac{4}{5} F_{AC} = 0$$

$$\Rightarrow F_{AD} = \frac{4}{3} \cdot \frac{F}{\sin\theta}$$

$$\Sigma F_y = 0 : F_{AB} - F_{AD} \cos\theta = 0 \rightarrow F_{AB} = F_{AD} \cos\theta$$

$$\Rightarrow F_{AB} = \frac{4}{3} \cdot \frac{F}{\tan\theta}$$

Find the equilibrium length of the spring x_E.

$$F_{AB} = k\Delta x = k \cdot (x_E - x_0)$$

$$\Rightarrow x_E = x_0 + \frac{F_{AB}}{k}$$