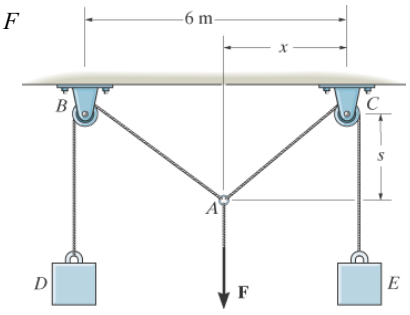
NAME:

Quiz 02: Chapter 03

Blocks D and E have masses $m_D = 4\text{kg}$ and $m_E = 6\text{kg}$. If $x = 2\text{m}$, determine the sag s and force F for equilibrium.



Block D: $T_D - m_D g = 0 \Rightarrow T_D = m_D g = (4\text{kg})(9.8\text{m/s}^2) = 39.2\text{N}$

Block E: $T_E - m_E g = 0 \Rightarrow T_E = m_E g = (6\text{kg})(9.8\text{m/s}^2) = 58.8\text{N}$

Ring A: $\sum F_x = T_E\cos\theta_E - T_D\cos\theta_D = 0$

$\sum F_y = T_E\sin\theta_E + T_D\sin\theta_D - F = 0$

$$\cos\theta_D = \frac{6-x}{\sqrt{(6-x)^2+s^2}} = \frac{4}{\sqrt{16+s^2}} \qquad \sin\theta_D = \frac{s}{\sqrt{(6-x)^2+s^2}} = \frac{s}{\sqrt{16+s^2}}$$

$$\cos\theta_E = \frac{x}{\sqrt{x^2+s^2}} = \frac{2}{\sqrt{4+s^2}} \qquad \sin\theta_E = \frac{s}{\sqrt{x^2+s^2}} = \frac{s}{\sqrt{4+s^2}}$$

$$T_D\cos\theta_D = T_E\cos\theta_E \Rightarrow (39.2\text{N})\left[\frac{4}{\sqrt{16+s^2}}\right] = (58.8\text{N})\left[\frac{2}{\sqrt{4+s^2}}\right]$$

$$2(39.2)\sqrt{4+s^2} = (58.8)\sqrt{16+s^2}$$

$$(6147)(4+s^2) = (3457)(16+s^2)$$

$$(6147-3457)s^2 = (3457)(16) - (6147)(4)$$

$$s = 3.38\text{m}$$

$$\sin\theta_D = \frac{s}{\sqrt{16+s^2}} = \frac{3.38}{\sqrt{16+(3.38)^2}} = 0.645$$

$$\sin\theta_E = \frac{s}{\sqrt{4+s^2}} \quad \frac{3.38}{\sqrt{4+(3.38)^2}} = 0.861$$

$$F = T_D\sin\theta_D + T_E\sin\theta_E = (39.2\text{N})(0.645) + (58.8\text{N})(0.861) = 75.9\text{N}$$