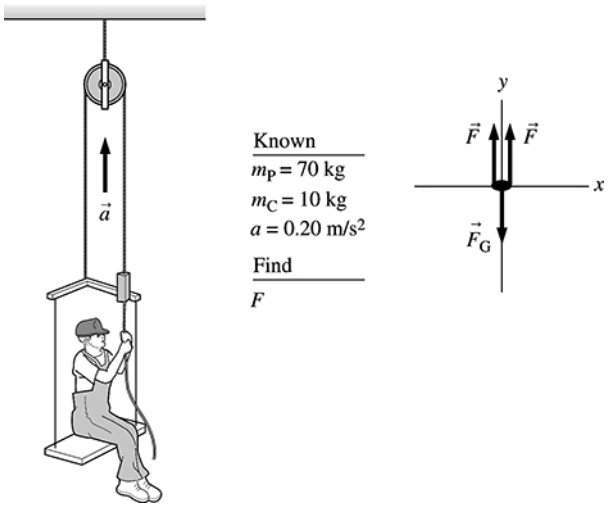
7.44. **Model:** The painter and the chair are treated as a single object and represented as a particle. We assume that the rope is massless and that the pulley is massless and frictionless.

Visualize:

Pictorial representation



Solve: If the painter pulls down on the rope with force F, Newton's third law requires the rope to pull up on the painter with force F. This is just the tension in the rope. With our model of the rope and pulley, the same tension force F also pulls up on the painter's chair. Newton's second law for $(\text{painter} + \text{chair})$ is

$$2F - F_G = (m_P + m_C)a$$

$$\Rightarrow F = \left(\tfrac{1}{2}\right)\left[(m_P + m_C)a + (m_P + m_C)g\right] = \tfrac{1}{2}(m_P + m_C)(a + g)$$

$$= \left(\tfrac{1}{2}\right)(70\text{ kg} + 10\text{ kg})\left(0.20\text{ m/s}^2 + 9.8\text{ m/s}^2\right) = 4.0 \times 10^2\text{ N}$$

Assess: A force of 400 N, which is approximately one-half the total gravitational force, is reasonable since the upward acceleration is small.