8.26. **Model:** The two ropes and the two blocks (A and B) will be treated as particles.

**Visualize:**

**Physical representation**

**Solve:**

(a) The two blocks and two ropes form a combined system of total mass \( M = 2.5 \) kg. This combined system is accelerating upward at \( a = 3.0 \) m/s\(^2\) under the influence of a force \( F \) and the weight \( -Mg\mathbf{j} \). Newton’s second law applied to the combined system is

\[
(F_{\text{net}})_y = F - Mg = Ma \quad \Rightarrow \quad F = M(a + g) = 32.0 \text{ N}
\]

(b) The ropes are *not* massless. We must consider both the blocks and the ropes as systems. The force \( F \) acts only on block A because it does not contact the other objects. We can proceed to apply the \( y \)-component of Newton’s second law to each system, starting at the top. Each has an acceleration \( a = 3.0 \) m/s\(^2\). For block A:

\[
(F_{\text{net on A}})_y = F - m_A g - T_{1 \text{ on A}} = m_A a \quad \Rightarrow \quad T_{1 \text{ on A}} = F - m_A (a + g) = 19.2 \text{ N}
\]

(c) Applying Newton’s second law to rope 1:

\[
(F_{\text{net on 1}})_y = T_{A \text{ on 1}} - m_1 g - T_{B \text{ on 1}} = m_1 a
\]

\( T_{A \text{ on 1}} \) and \( T_{1 \text{ on A}} \) are an action/reaction pair. But, because the rope has mass, the two tension forces \( T_{A \text{ on 1}} \) and \( T_{B \text{ on 1}} \) are *not* the same. The tension at the lower end of rope 1, where it connects to B, is

\[
T_{B \text{ on 1}} = T_{A \text{ on 1}} - m_1 (a + g) = 16.0 \text{ N}
\]

(d) We can continue to repeat this procedure, noting from Newton’s third law that

\( T_{1 \text{ on B}} = T_{B \text{ on 1}} \) and \( T_{2 \text{ on B}} = T_{B \text{ on 2}} \)

Newton’s second law applied to block B is

\[
(F_{\text{net on B}})_y = T_{1 \text{ on B}} - m_B g - T_{2 \text{ on B}} = m_B a \quad \Rightarrow \quad T_{2 \text{ on B}} = T_{1 \text{ on B}} - m_B (a + g) = 3.2 \text{ N}
\]