1) [10 points] The floor is frictionless, but there is friction between the two masses. A 100 N force is applied to the 10 kg mass. Assume for the moment that the 10 kg mass does not slip on the 40 kg mass. What must be the magnitude of the friction force acting between the masses? (Hint: Both masses will move forward with the same acceleration.)

\[ F - f_s = m_A a \\
\frac{f_s}{m_B} = a = \frac{F}{m_B} \]

\[ F = f_s + \frac{m_A}{m_B} f_s \]

\[ f_s = \frac{F}{1 + \frac{m_A}{m_B}} = \frac{100}{1 + 0.25} = 80 \text{ N} \]

2) [10 points] Two wires are tied to the 1.0 kg sphere shown in the Figure. The sphere revolves in a horizontal circle at constant speed. For what speed is the tension the same in both wires?

\[ T_1 \sin \alpha + T_2 \sin \beta = mg \]

\[ T_1 \cos \alpha + T_2 \cos \beta = \frac{m v^2}{r} \quad \text{(Fnet)} \]

If \( T_1 = T_2 \)

\[ \left\{ \begin{array}{l}
T_1 \frac{1}{2} + T_2 \frac{1}{2} = mg \\
T_1 \frac{1}{2} + T_2 \frac{1}{2} = m \frac{v^2}{r} 
\end{array} \right. \]

\[ r = 1 \text{ m}, \quad \sin 60^\circ \]

\[ mg = m \frac{v^2}{r} \quad v = \sqrt{gr} = \sqrt{9.8 \times \frac{13}{2}} = 3.91 \text{ m/s} \]