Review/finish/simplify
in discuss the solution

What happens to:
cord itself

being pulled apart!

\[ \overrightarrow{F_{T1}} = \overrightarrow{F_{T2}} = \overrightarrow{F_T}, \]
if: the cord doesn't stretch, has no mass, and the pulley spins completely freely (has no mass).

\[ F_T = m_1 g \sin \Theta = m_1 a_{1x} \]
\[ F_{N1} = m_1 g \cos \Theta = m_1 a_{1y} = 0 \]

\[ F_{T1} = \mu \times F_{N1} \]

\[ F_T - m_2 g = m_2 a_{2y} \]
(working in "y"")

\[ a_{1x} = -a_{2y} : a_{1x} = a_s, a_{2y} = -a_s \]
\[ F_{tr} = \mu_k F_{n} \]

\( F_T - F_{th} - m_1 g \sin \theta = m_1 a_s \quad F_T - m_2 g = m_2 (-a_s) \)

\( F_{n1} = m_1 g \cos \theta \)

\[ F_T - \mu_k (m_1 g \cos \theta) - m_1 g \sin \theta = m_1 a_s \]

\( F_T - m_2 g = -m_2 a_s \)

\[ F_T = m_2 g - m_2 a_s \]

\[ m_2 g - m_2 a_s - \mu_k (m_1 g \cos \theta) - m_1 g \sin \theta = m_1 a_s \]

\[ a_s = g \frac{m_2 - m_1 (\sin \theta + \mu \cos \theta)}{m_1 + m_2} \]

Special cases:
- \( \theta = 0^\circ \), \( \theta = 90^\circ \)
- \( m_1 = 0 \), \( m_2 = 0 \)
- All lead to simple(r) clear examples!

How about this special case? \( m_1 = m_2 = m \).

\( a_s = g \frac{m_2 - m_1 (\sin \theta + \mu \cos \theta)}{2m} \)

\[ a_s = g \frac{1 - \mu (\sin \theta + \mu \cos \theta)}{2} \]

duh - not super useful.
motivation: is the force throughout the object the same, or does it get reduced? Do we need the whole thing to be of equal strength, or can we make it stronger?

Interaction: modeled by: pair of equal forces, acting out on each object, in opposite directions. Formally:
\[ \vec{F}_{12} = -\vec{F}_{21} \]

the Third Newton's Law

\[ q_{1x} = q_{2x} = 0 \]

\[ F_0 - F_{21} = m_1 a_{1x} \]

\[ F_{N1} - m_1 g = m_1 a_{1y} = 0 \]

\[ F_0 - F_{21} = m_1 a_s \]
\[ F_{12} = m_2 a_s \]

\[ a_s = \frac{F_0}{m_1 + m_2} \]
\[ F_{12} = F_0 \cdot \frac{m_2}{m_1 + m_2} \]

\[ \text{so the force gets reduced!} \]

\[ \text{See clearer} \]
page: Added for (a little) clarification.

we got the system:

\[ F_0 - F_{21} = m_1 a_s \Rightarrow F_{12} = m_2 a_s \]

It solves algebraically to:

\[ a_s = \frac{F_0}{m_1 + m_2} \quad \text{(this we knew - they move as one)} \]

\[ F_{12} = F_0 \cdot \frac{m_2}{m_1 + m_2} \quad \text{was our objective!} \]

\[ \text{the force gets reduced} \]

\[ \text{inside the material!} \]

As the force at this point, down our material (at that surface), is only a fraction of what pushes outside: the remaining mass divided by the total mass, of \( F_0 \).

So, the further we go, the less force is felt.