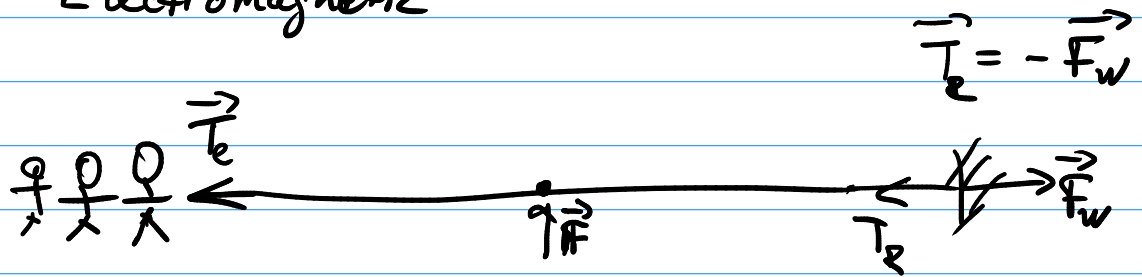
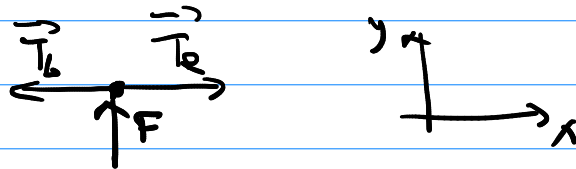


2nd $\Sigma \vec{F} = m\vec{a}$ | 3rd $\vec{F}_{AB} = -\vec{F}_{BA}$

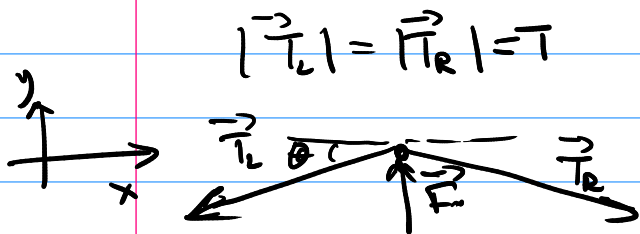
- 1 Strong nuclear force proton \leftrightarrow neutron
- 2 Weak force β -decay, radioactivity
- 3 Gravitational
- 4 Electromagnetic



Free body diagram



$$\Sigma \vec{F} = m\vec{a} = \vec{T}_L + \vec{T}_R + \vec{F} = 0$$



$$|\vec{T}_L| = |\vec{T}_R| = T$$

$$x: T_{Lx} + T_{Rx} + F_x = 0$$

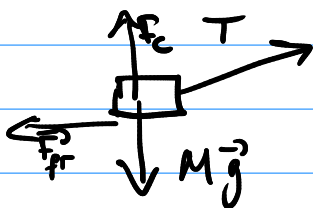
$$y: T_{Ly} + T_{Ry} + F_y = 0 = \cancel{0} + \cancel{0} + F$$

$$x: -T \cos \theta + T \cos \theta + 0 = 0$$

$$y: -T \sin \theta - T \sin \theta + F = 0$$

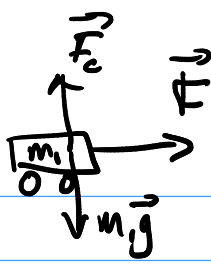
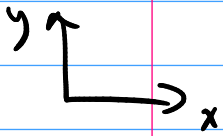
$$T = \frac{F}{2 \sin \theta}$$

Students - rope system



$$\Sigma \vec{F} = 0$$

$$x: -F_f + T_x = M a_x = 0$$



no friction!

$$\vec{F}_c + \vec{F} + m_1 \vec{g} = m_1 \vec{a}$$

$$y: F_c + \underset{0}{F}_y - m_1 g = m_1 a_y = 0$$

$$F_c = m_1 g$$

$$x: \underset{0}{F}_{cx} + F_x + m_1 g_x = m_1 a_x$$

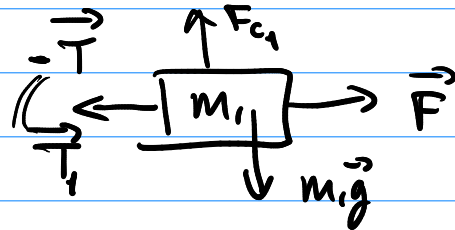
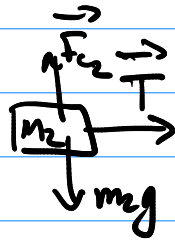
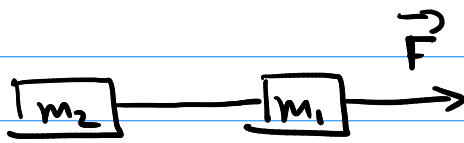
$$+ F + 0 = m_1 a$$

$$a_x = a$$

$$\vec{a} = a_x \hat{x} = \frac{F}{m_1} \hat{x}$$

$\vec{a} - ?$

$$\vec{T} = \vec{F} ?$$



$$\vec{a}_1 = \vec{a}_2 = \vec{a}$$

y: boring

$$x: T_x + \cancel{F_x} = m_2 a_{2x}$$

$$T = m_2 a$$

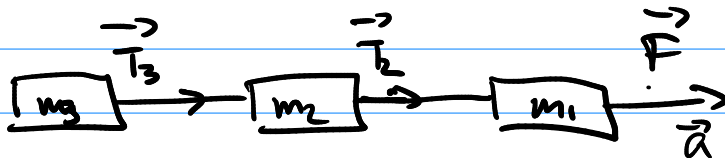
$$x: T_x + F_x = m_1 a_x = m_1 a$$

$$-T_x + F = m_1 a$$

$$-m_2 a + F = m_1 a$$

$$T = \frac{F \cdot m_2}{m_1 + m_2}$$

$$a = \frac{F}{m_1 + m_2}$$

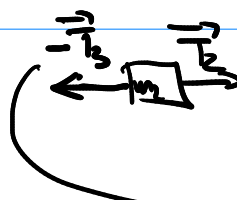


$$\vec{a} = a_x \hat{x}$$

$$T_2 = T_3 !$$

$$x: (m_1 + m_2 + m_3) a = F$$

$$a = \frac{F}{m_1 + m_2 + m_3} ; T_3 = m_3 a$$



$$-m_3 a + T_2 = m_2 a$$

$$T_2 = \frac{m_2 + m_3}{m_1 + m_2 + m_3} F$$