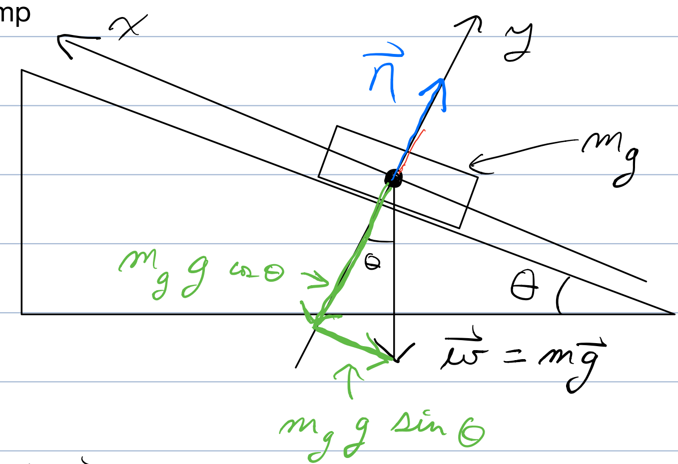
Cart going down a ramp



Apply $\sum \vec{F}_g = m_g \vec{a}_g$ to the glider.

x - components

$$\sum F_x = m_g a_{gx}$$

$$-m_g g \sin\theta = m_g a_{gx}$$

or $\boxed{a_{gx} = -g \sin\theta}$

y - components

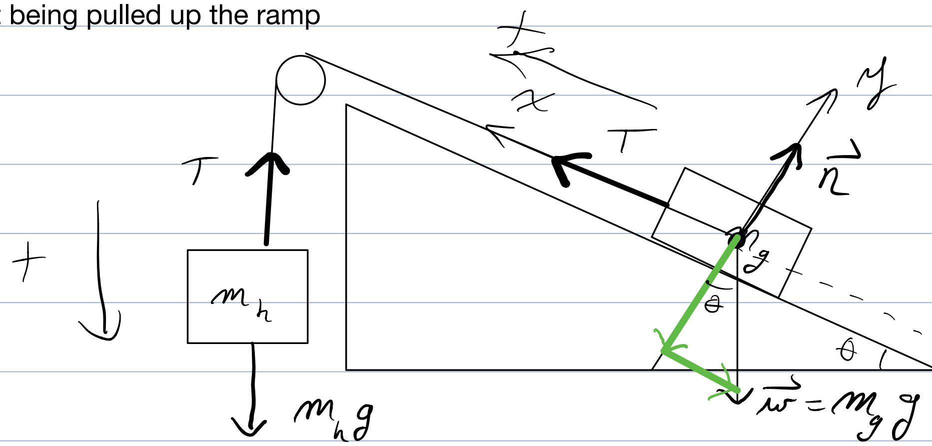
$$\sum F_y = m_g a_{gy} = 0$$

← Doesn't lift off the ramp

$$n - m_g g \cos\theta = 0$$

$$\boxed{n = m_g g \cos\theta.}$$

Cart being pulled up the ramp



Free body diagram for hanging mass:

$$\Sigma F = m_h a_h$$

$$m_h g - T = m_h a_h$$

Free body diagram for glider

x - components: $\Sigma F_x = m_g a_{gx}$

$$T - m_g g \sin\theta = m_g a_{gx}$$

Notes:

1) Tensions are the same
2) $a_h = a_{gx} = a$ Both are positive

∴ Solve first for T and plug it into the second

$$m_h g - T = m_h a$$

$m_h (g - a) = T$. Plug into glider:

$$T - m_g g \sin\theta = m_g a$$

$$m_h (g - a) - m_g g \sin\theta = m_g a$$

$$m_h g - m_g g \sin\theta = (m_g + m_h) a$$

Solving for acceleration a:

$$a = \frac{m_h g - m_g g \sin\theta}{m_g + m_h}$$

Lab this week: Test this for $\theta = 0$.