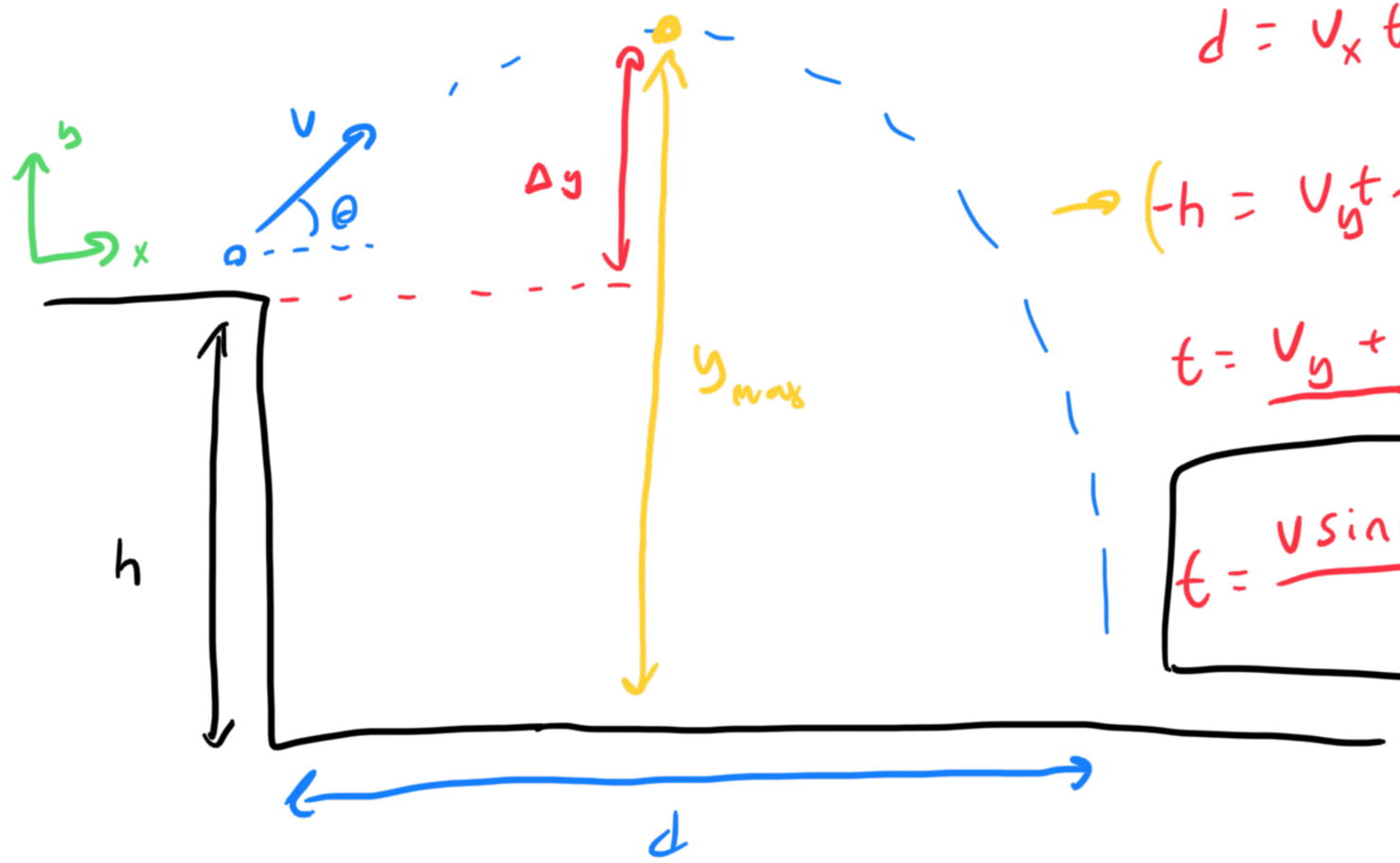
# Pre-F=ma




$a_x = 0 \Rightarrow v = \frac{\Delta x}{\Delta t}$

$d = v_x t = v\cos\theta\, t$

$-h = v_y t - \frac{1}{2} g t^2$

$y_f = y_i + v_y t + \frac{1}{2} a_y t^2$

$-h = 0 + v\sin\theta\, t - \frac{1}{2} g t^2$

$t = \frac{v_y + \sqrt{v_y^2 + 2gh}}{g}$

$$t = \frac{v\sin\theta + \sqrt{v^2\sin^2\theta + 2gh}}{g}$$

$$d = v\cos\theta\left[\frac{v\sin\theta + \sqrt{v^2\sin^2\theta + 2gh}}{g}\right]$$

1. $d = ?$

2. $y_{max} = ?$

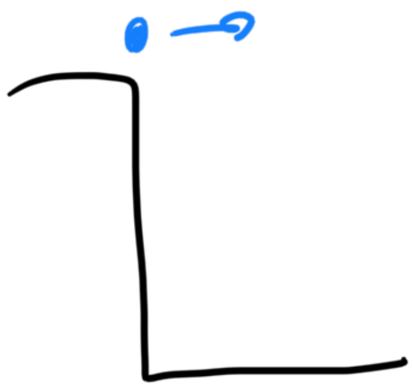
$v_f^2 = v_i^2 + 2a\Delta y$

$0 = v^2\sin^2\theta - 2g\Delta y$

$$y_{max} = \frac{v^2\sin^2\theta}{2g} + h$$

$$t = \frac{v\sin\theta + \sqrt{v^2\sin^2\theta + 2gh}}{g} \qquad d = v\cos\theta\left[\frac{v\sin\theta + \sqrt{v^2\sin^2\theta + 2gh}}{g}\right] \qquad y_{max} = \frac{v^2\sin^2\theta}{2g} + h$$

$\theta = 0$



$$t_{\theta=0} = \frac{\sqrt{2gh}}{g} = \sqrt{\frac{2h}{g}} = t_{freefall} \qquad y_{max} = h$$

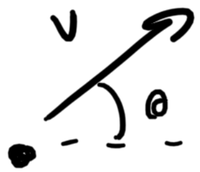
$$d_{\theta=0} = v\sqrt{\frac{2h}{g}}$$

$\theta = 90^\circ = \pi/2$

$$d_{\theta=0} = 0$$

$$t = \frac{v + \sqrt{v^2 + 2gh}}{g}$$

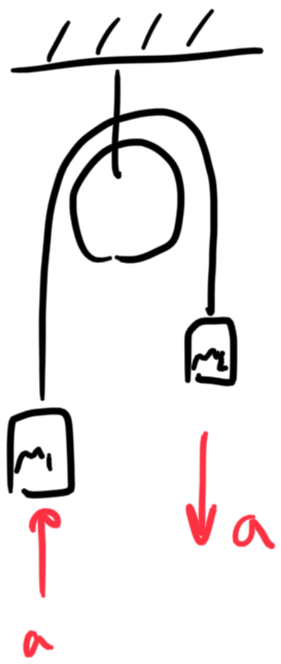
$$y_{max} = \boxed{\frac{v^2}{2g}} + h$$


$$d_{max} = v^2 \sin^2(2\theta)/g$$

$\theta = 0$ $\quad$ $\theta = 90$

$d_{max} = 0$ $\quad$ $d_{max} = 0$



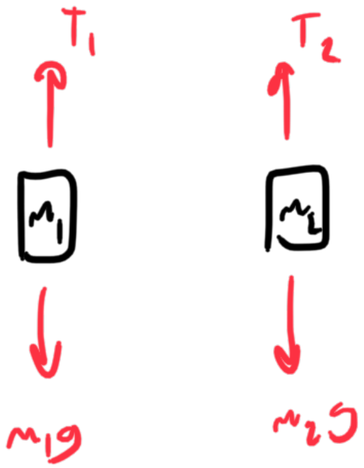

$m_2 \geq m_1$

$l_{rope} = cst.$

$\Delta y_1 + \Delta y_2 = 0 \Rightarrow a_1 + a_2 = 0$

$a_1 = -a_2$

$v_1 = -v_2$




$|T_1| = |T_2|$

$\frac{T}{m_1} - g = g - \frac{T}{m_2} = a$

$T\left(\frac{1}{m_1} + \frac{1}{m_2}\right) = 2g$

$a = \frac{2g\left(\frac{1}{m_1} + \frac{1}{m_2}\right)^{-1}}{m_1} - g$

$= \frac{2g}{m_1\left(\frac{1}{m_1} + \frac{1}{m_2}\right)} - g$

$= \frac{2g}{1 + \frac{m_1}{m_2}} - g$

$= g\left(\frac{2}{1 + \frac{m_1}{m_2}} - 1\right)$

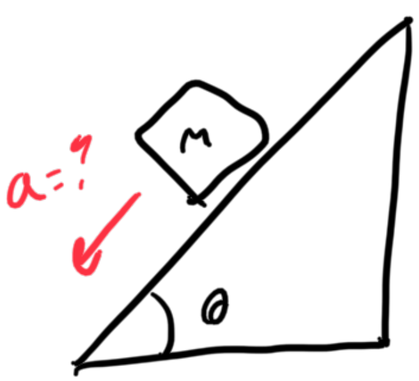
$$a = g\left(\frac{2}{1+m_1/m_2} - 1\right)$$

$m_1 = 0 \Rightarrow a = g$ (freefall)

$m_1 = m_2 \Rightarrow a = 0$

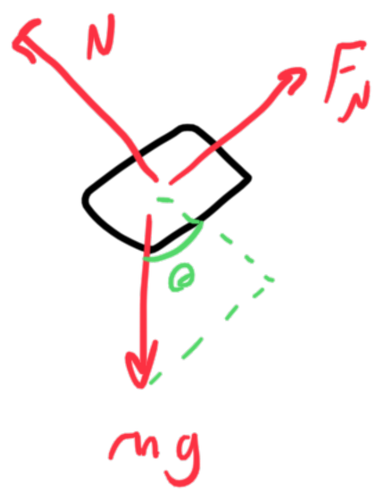
$g = 0 \Rightarrow a = 0$ regardless of $m_1, m_2$

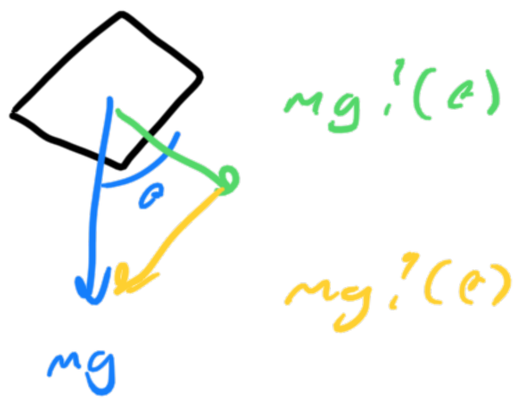
$\mu \neq 0$ $\mu = \mu_s = \mu_k$










$\theta = 90$

$N = 0 \Rightarrow a = g$

$\theta = 0$

No horizontal forces

$a = 0$

$N = mg\cos\theta$

$ma = mg\sin\theta - \mu N$

$= g\sin\theta - \mu g\cos\theta$

$\theta = 0 \Rightarrow$ mg, 0

$\theta = 90^\circ \Rightarrow$ 0, mg