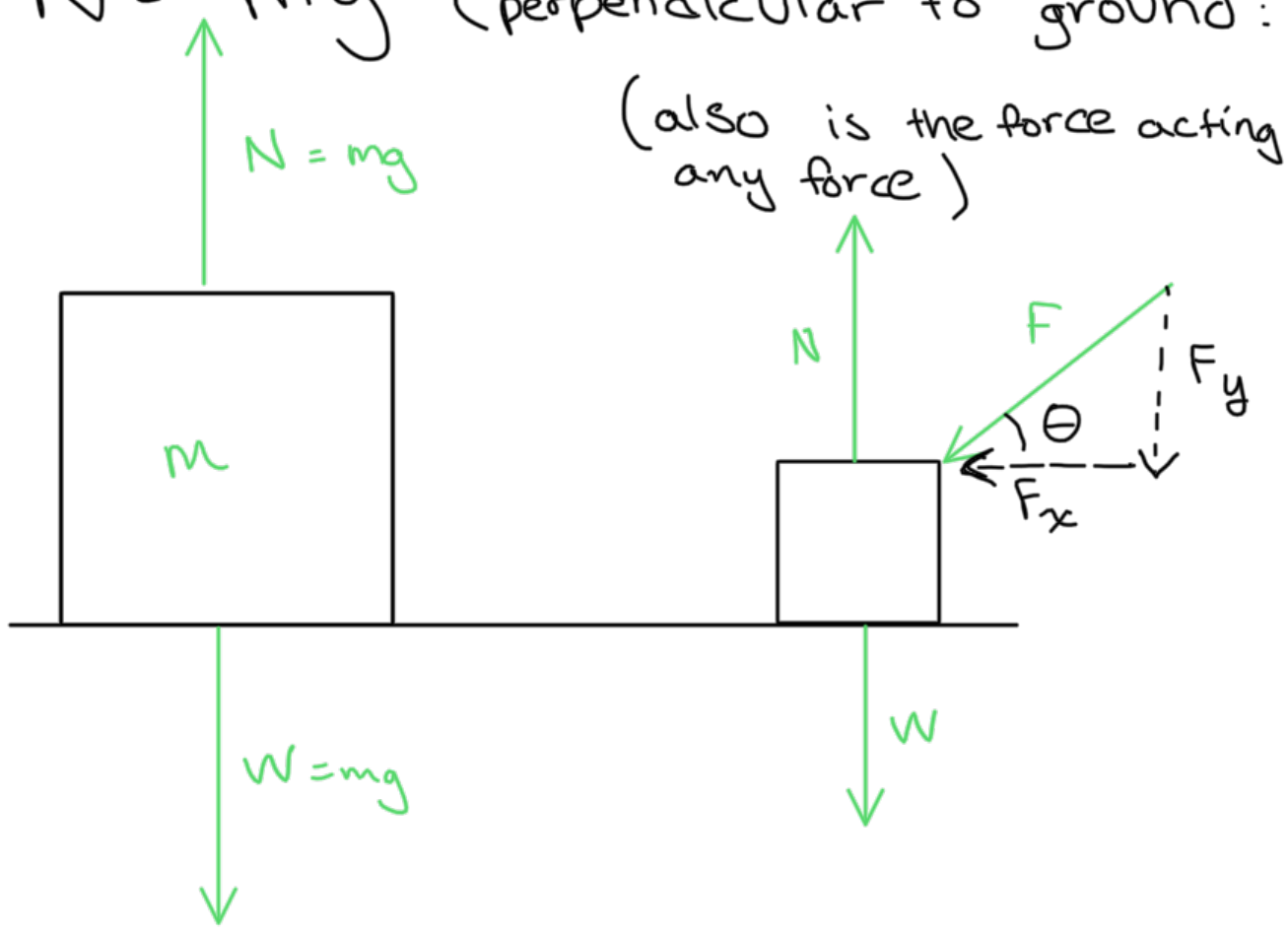
FORCES (DYNAMICS)

$$F = ma$$

$$W = mg \quad \text{(towards center of earth)}$$

$$N = mg \quad \text{(perpendicular to ground : up)}$$



$F_y = F \sin\theta$

$F_x \quad F \cos\theta$

$N = W + F_y$

$W = mg$

Friction

$$F_{friction} = \mu N$$

μ = friction Constant

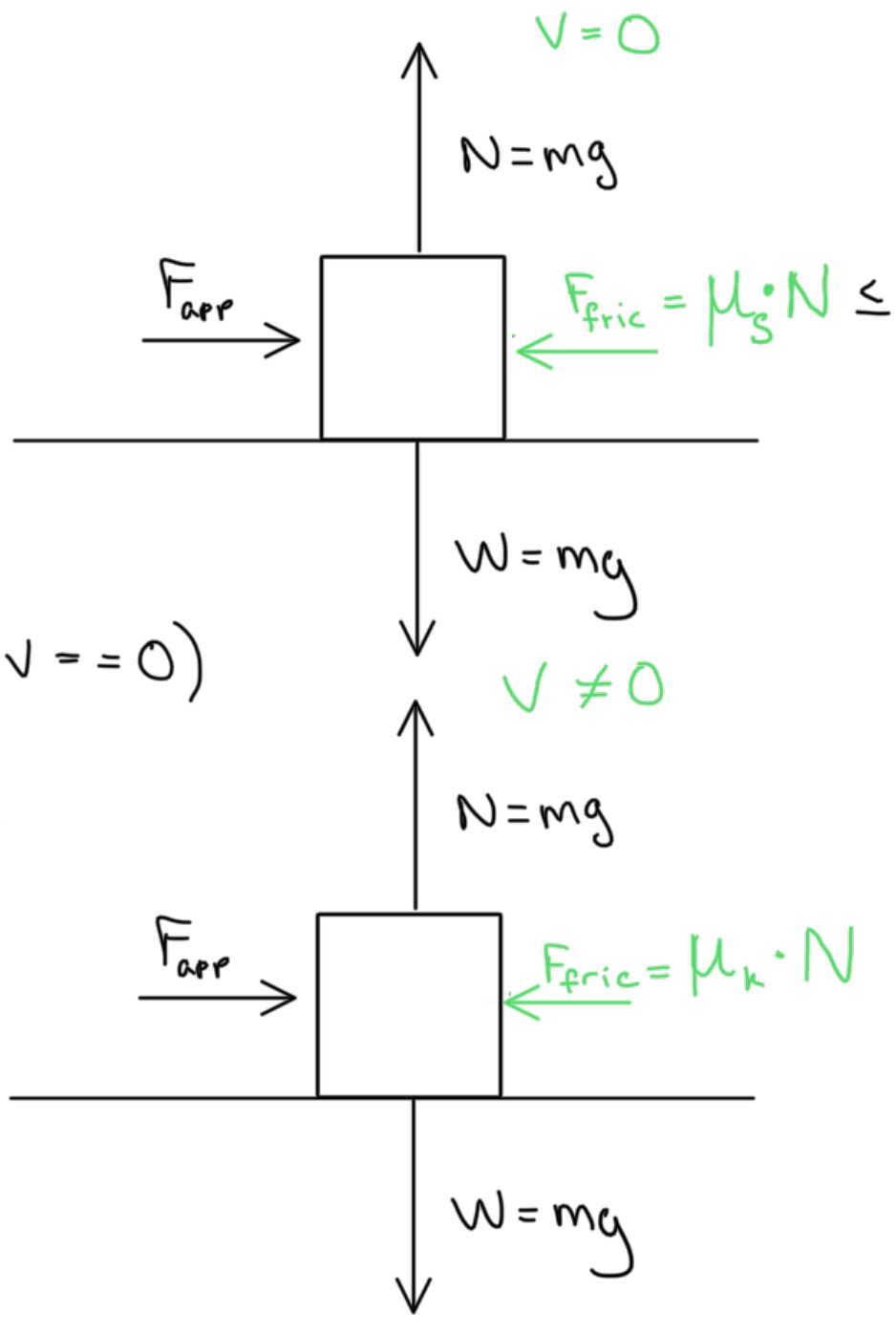
$F_{static} = \mu_s N \leq$ Applied Force

if (Applied Force $> F_{static\,max}$ && $v == 0$)

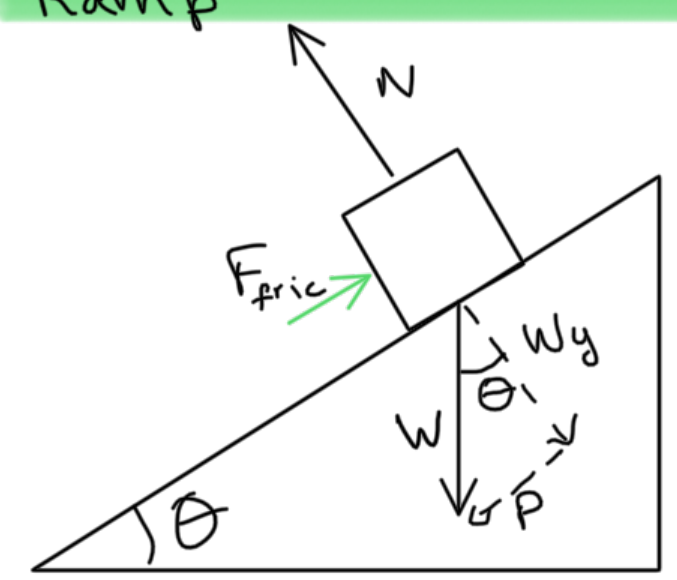
{

$F_{friction} = F_{friction\,kinetic} = \mu_k N$

}



Ramp



$$P = W \cdot \sin\theta$$

$$N = W_y = W\cos\theta$$

$$F_{fric} = \mu N$$

$$F_{net} = P + F_{fric}$$

$$a = \frac{(P + F_{fric})}{m}$$

Circular Motion

$$F_c = a_c \cdot m$$

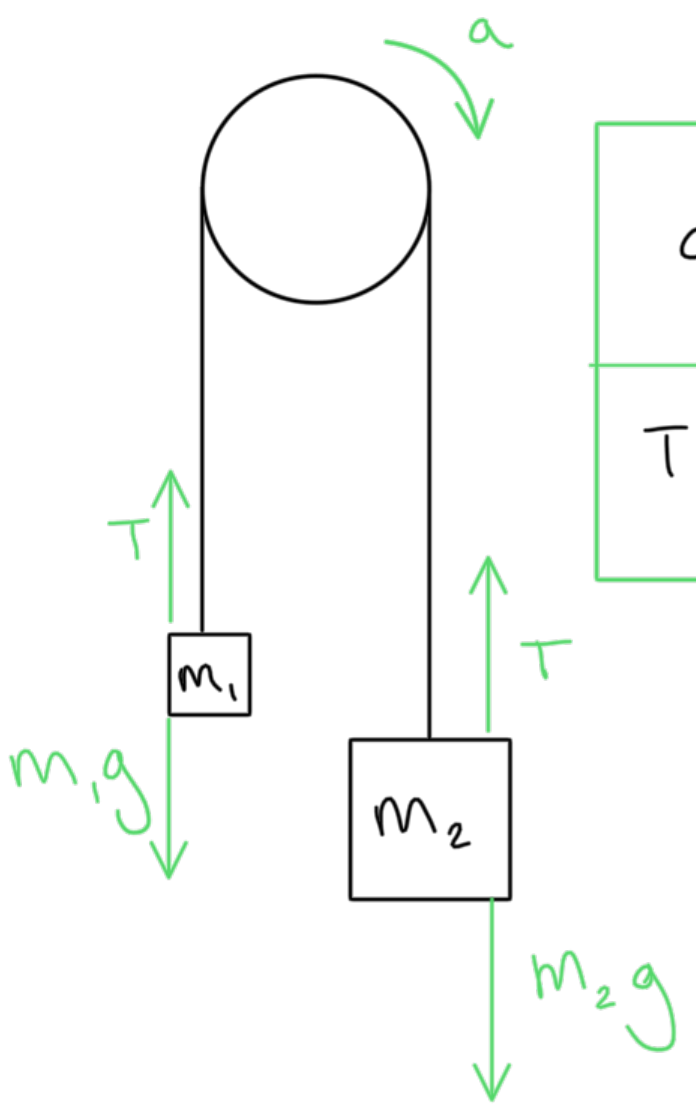
$$= \frac{mv^2}{r}$$

$$= m r \omega^2$$

$$v = \frac{2\pi r}{T}$$

Common Test Problems

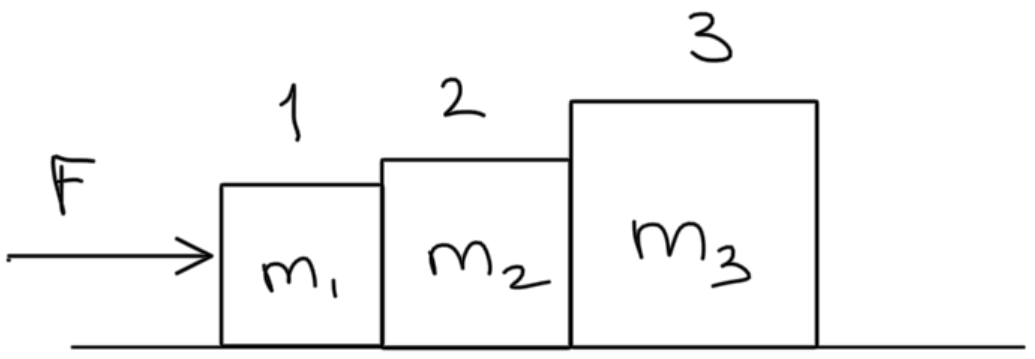
Pulley



$$a = \frac{F_{net}}{m_t} = \frac{m_2 g - m_1 g}{m_2 + m_1}$$

$$T = m_2 g - m_2 a = m_1 g + m_1 a$$

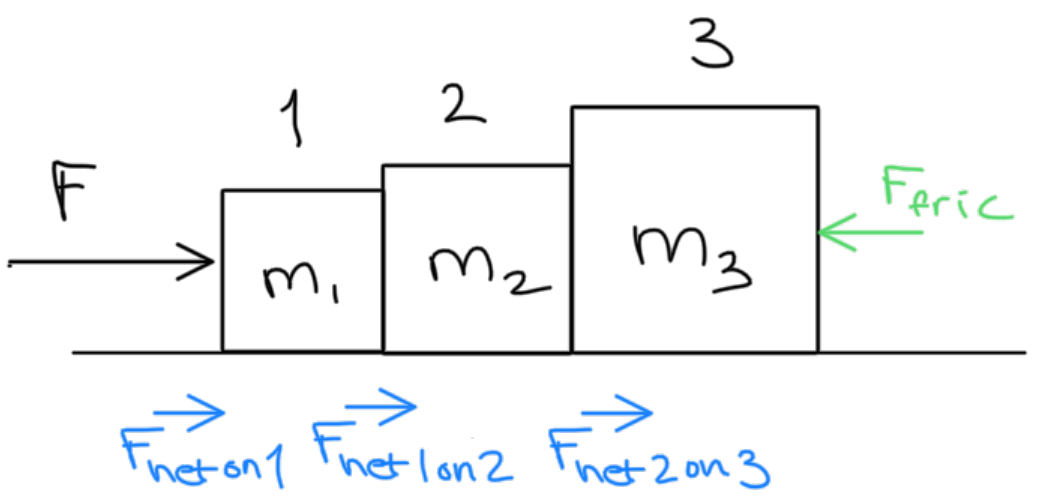
Frictionless Blocks



$$F_{1\text{ on }2} = \frac{m_2 + m_3}{m_T} \cdot F$$

$$F_{2\text{ on }3} = \frac{m_3}{m_T} \cdot F$$

Friction Blocks



$$F_{fric} = \mu \cdot N$$

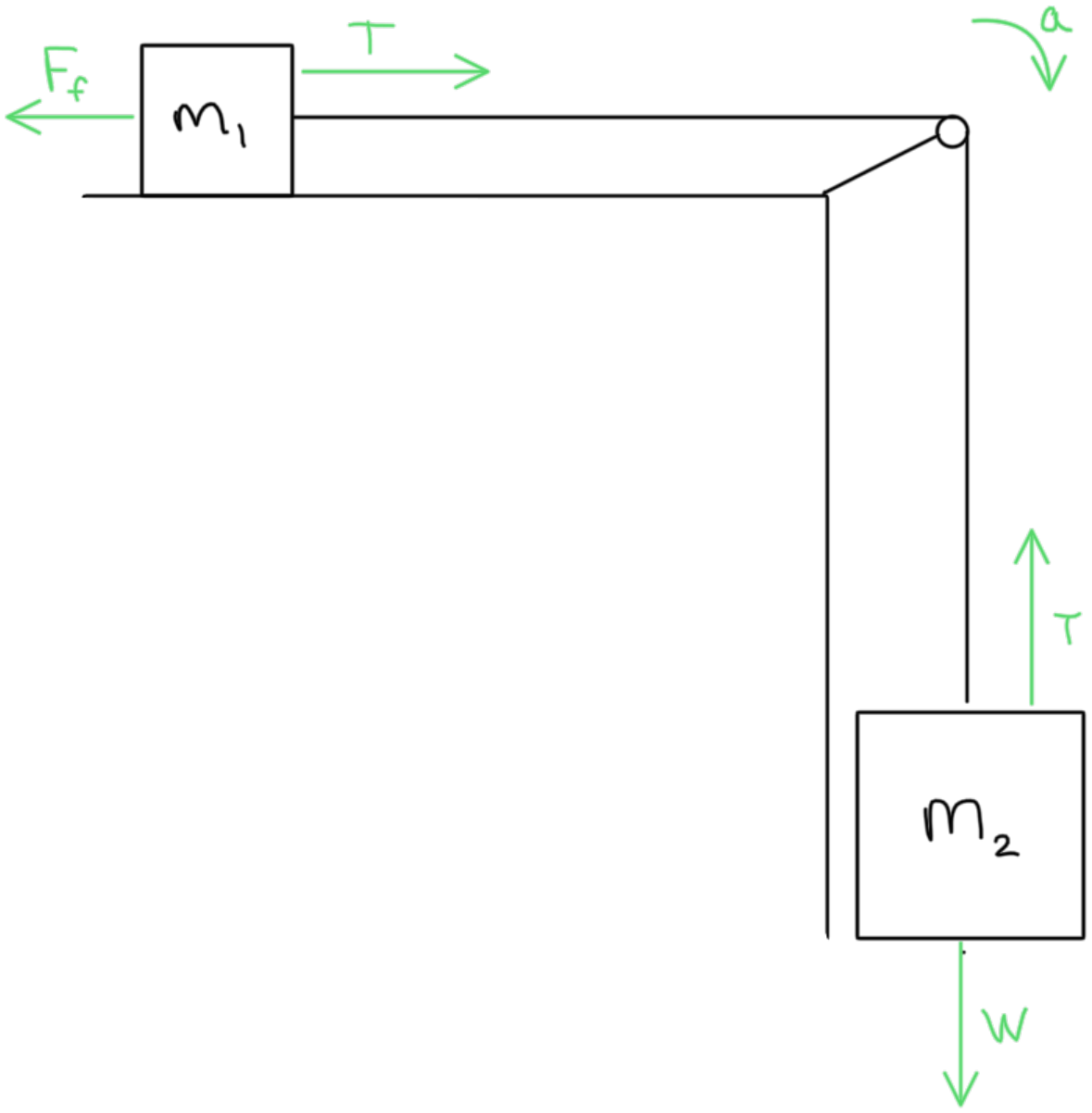
$$a_{net} = \frac{F - F_{fk}}{m_T}$$

$$a_{fric} = \frac{F_{fk}}{m_T}$$

$$F_{net\,1on2} = F - F_{net\,on1} - F_{fk_1}$$

$$F_{net\,2on3} = F - F_{net\,1on2} - F_{fk_2}$$

Pulley 2

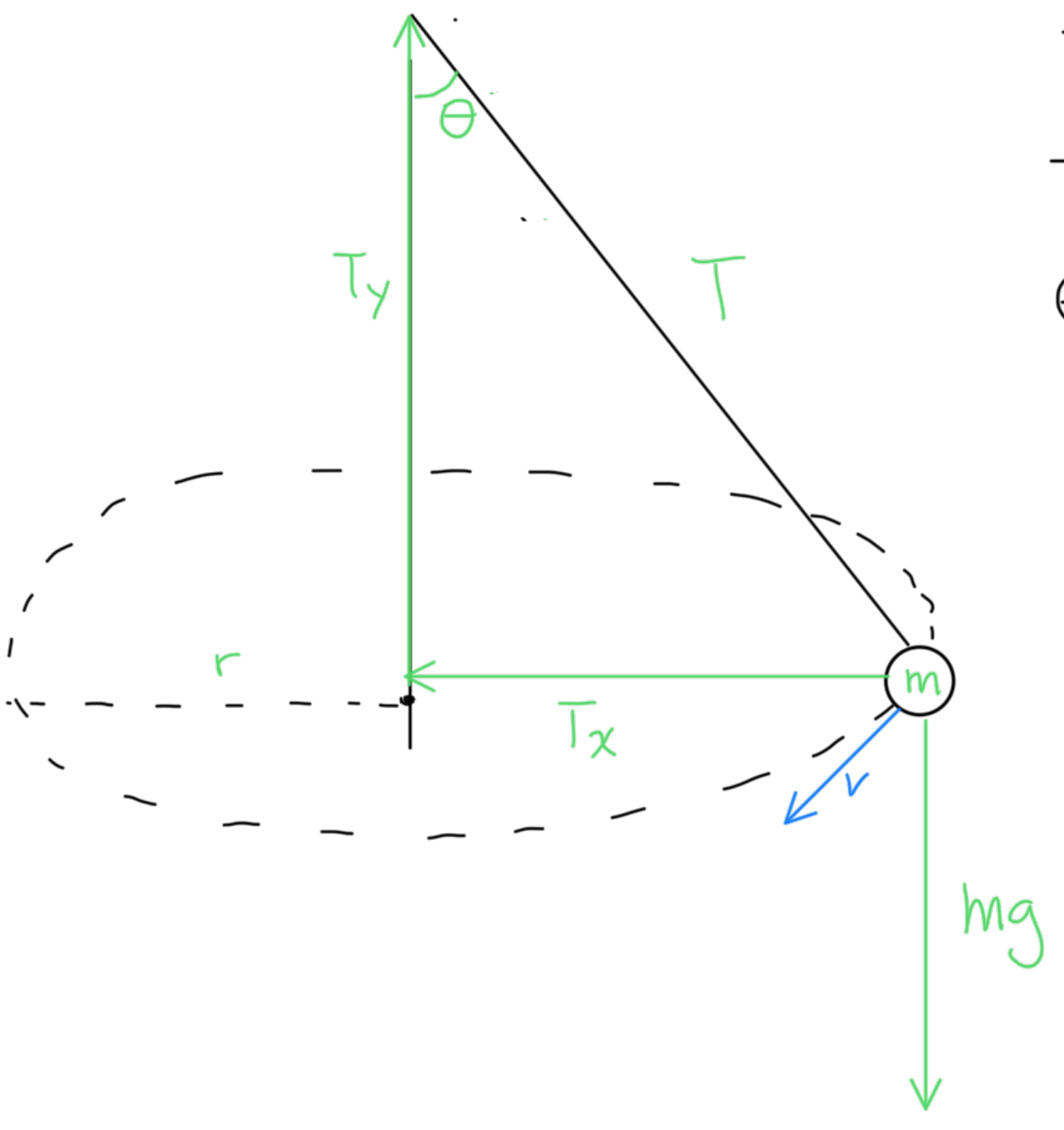


$$a = \frac{F_{net}}{m} = \frac{m_2 g - F_f}{m_1 + m_2}$$

$$F_{netx} = T - F_f$$

$$T = m_1 a + F_f = m_2 a + m_2 g$$

Tetherball



$$T_x = F_c = \frac{mv^2}{r} = mr\omega$$

$$T_y = mg$$

$$\Theta = \tan^{-1}\left(\frac{T_x}{T_y}\right)$$

$$T = \sqrt{T_x^2 + T_y^2}$$