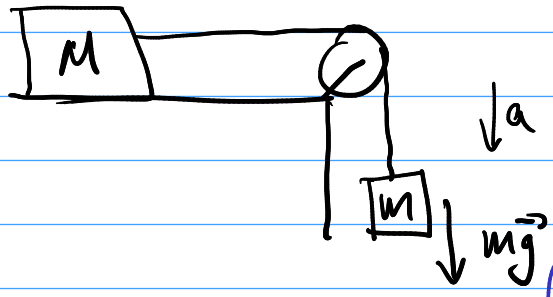
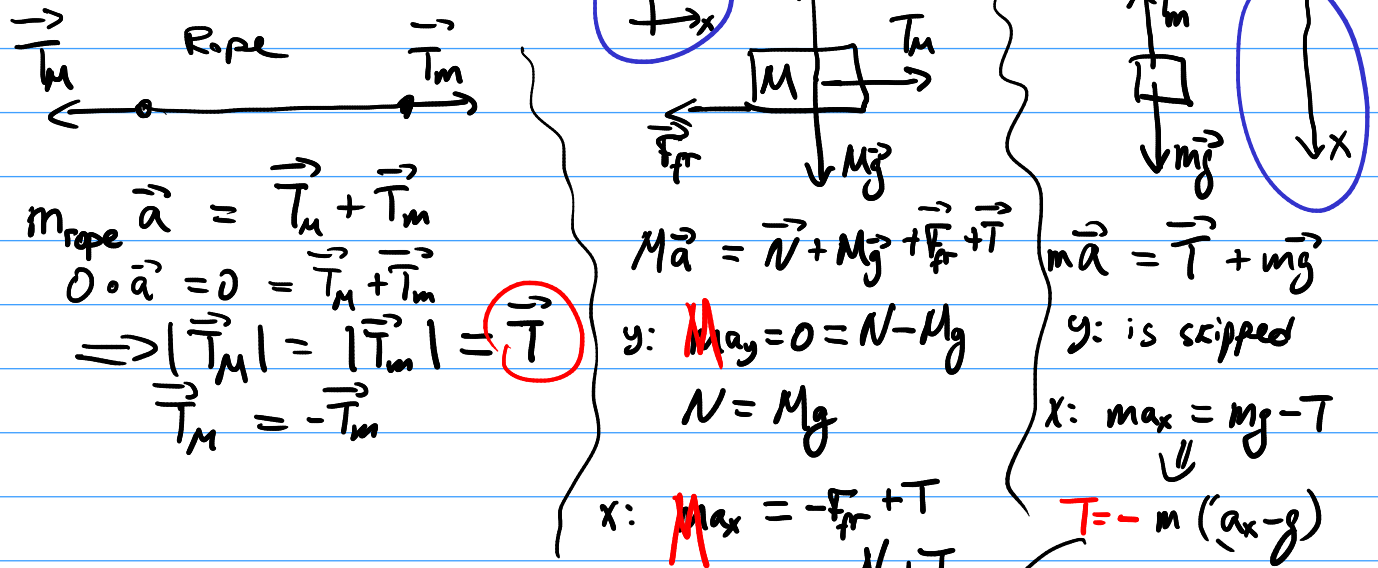
Pulley is friction less and weightless

Rope is weightless





$m_{rope}\vec{a} = \vec{T}_M + \vec{T}_m$

$0 \cdot \vec{a} = 0 = \vec{T}_M + \vec{T}_m$

$\Rightarrow |\vec{T}_M| = |\vec{T}_m| = \vec{T}$

$\vec{T}_M = -\vec{T}_m$

$M\vec{a} = \vec{N} + M\vec{g} + \vec{F}_{fr} + \vec{T}$

y: $Ma_y = 0 = N - Mg$

$N = Mg$

x: $Ma_x = -F_{fr} + T$

$= -\mu N + T$

$= -\mu Mg + T = -\mu Mg - m(a_x - g)$

$m\vec{a} = \vec{T} + m\vec{g}$

y: is skipped

x: $ma_x = mg - T$

$T = -m(a_x - g)$

$(M+m)a_x = -\mu Mg + mg$

$$a_x = \frac{mg - \mu Mg}{M+m}$$

$m = 1\,kg$

$M = 1\,T = 1000\,kg$

$\mu = 0.2$

$g = 10\,m/s^2$

$$a_x = \frac{1 \cdot 10 - 0.2 \cdot 1000 \cdot 10}{1000 + 1}$$

$$= \frac{10 - 2000}{1000 + 1} = -2\,m/s^2$$

unphysical

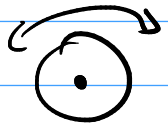
$a_x \geq 0$

$F_{fr} \leq \mu N$

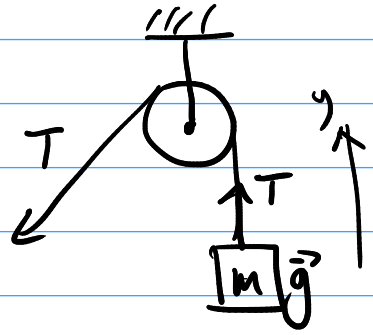
→ adjust F_{fr} accordingly

$\boxed{a_x = 0}$

Pulleys (also Blocks)



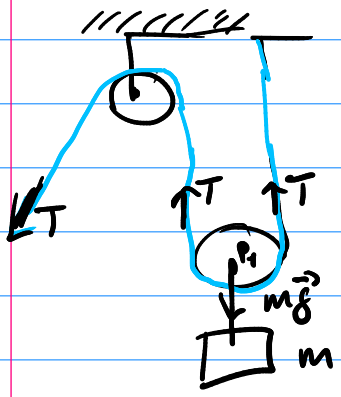
mass = 0
friction = 0



$m\vec{a} = 0 = \vec{T} + m\vec{g}$

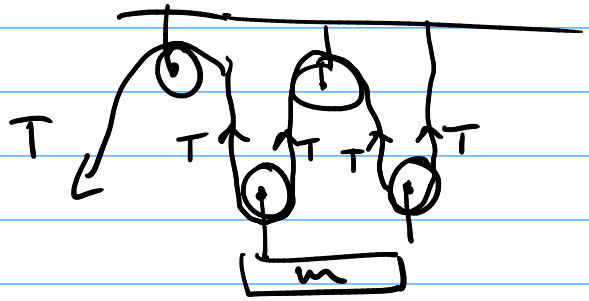
$ma_y = 0 = T - mg$

$T = mg$



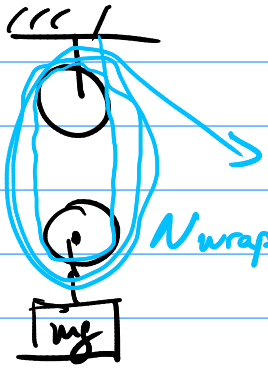
y: $2T = mg$

$T = \frac{mg}{2}$ mechanical advantage



$4T = mg$

$T = \frac{mg}{4}$



$T = \frac{mg}{2N_{wraps}}$

Drag force

$$F_d = \frac{1}{2} C \cdot \rho \cdot A \cdot v^2$$

- A: crossectional area
- ρ: density
- C: drag coef ≈ 1, shape dependent

$\rho = [\,rho\infty\,]$