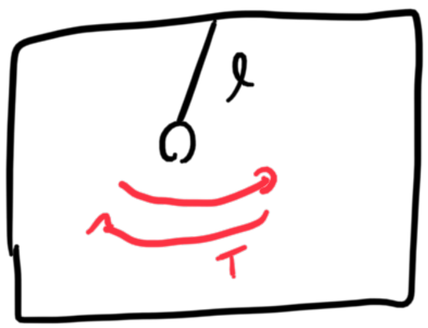
2018B#7



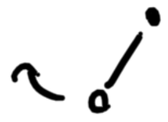
$\updownarrow \omega$

$T_g = \frac{1}{2} T$

$\omega = \sqrt{g/L}$

$\omega_g = 2\omega = \sqrt{4g/L}$ (A)

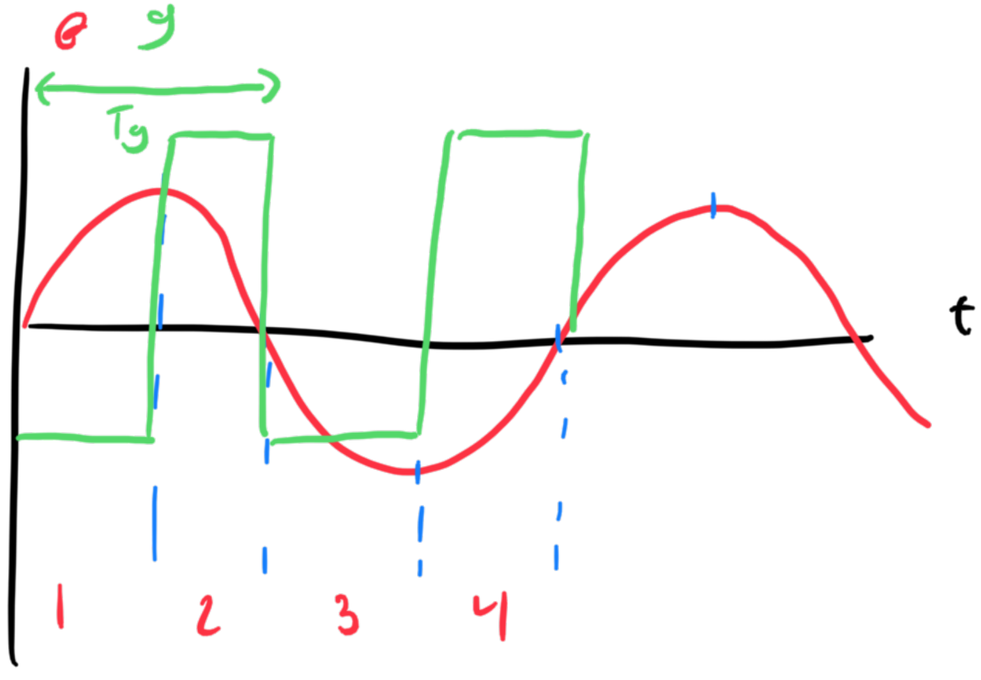
What should ω be to maximize amplitude?

1 = 3  g ↓

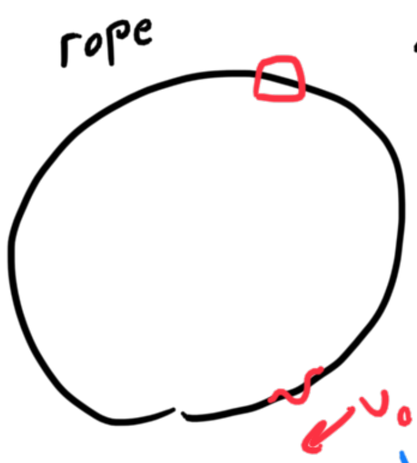
2 = 4  g ↑

3 = 1  g ↓

4 = 2  g ↑



2018 B #11



$$v = \sqrt{T/\mu}$$

T = tension

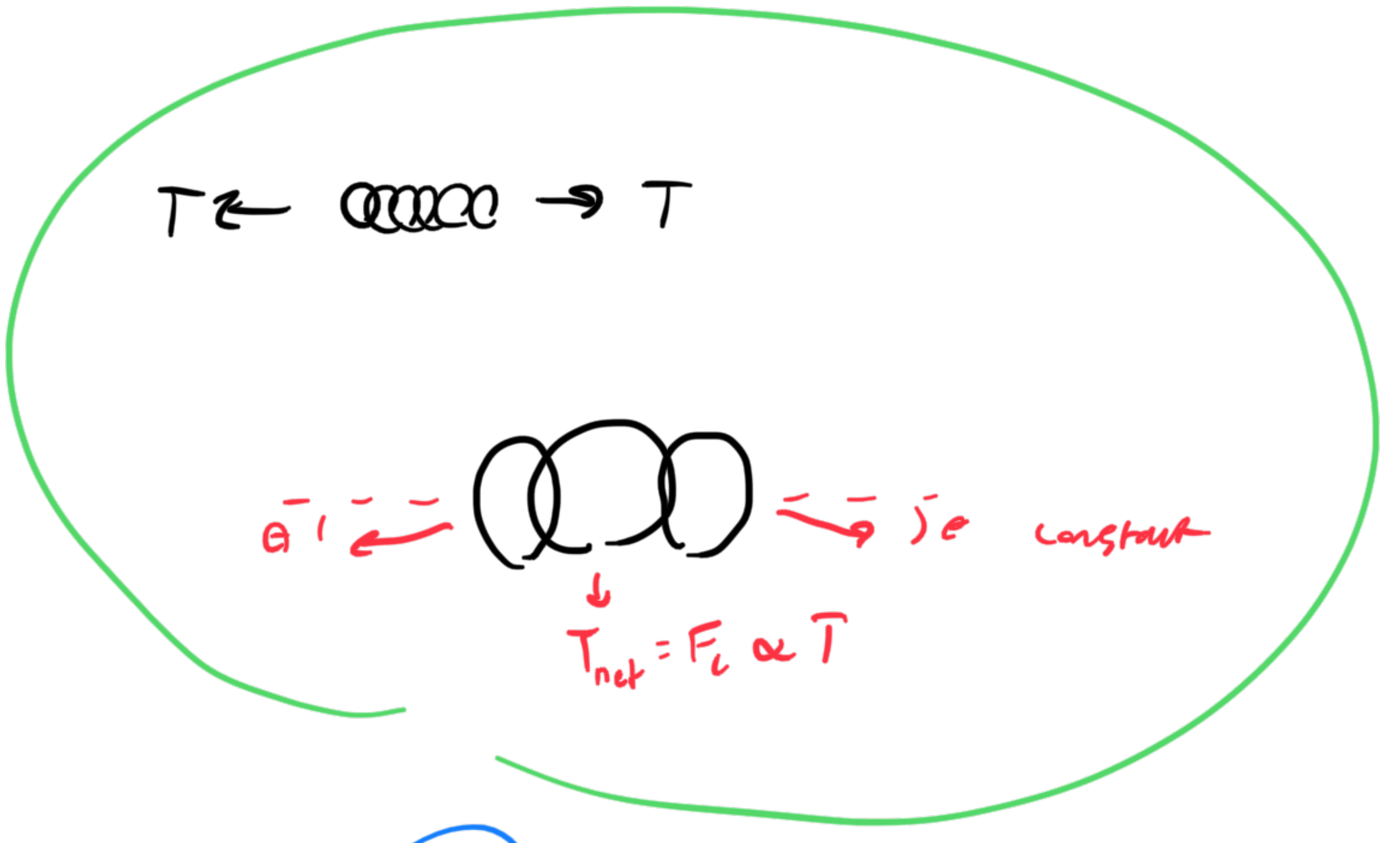
μ = mass density

HW: Could you figure this out with dimensional analysis?

T = ?

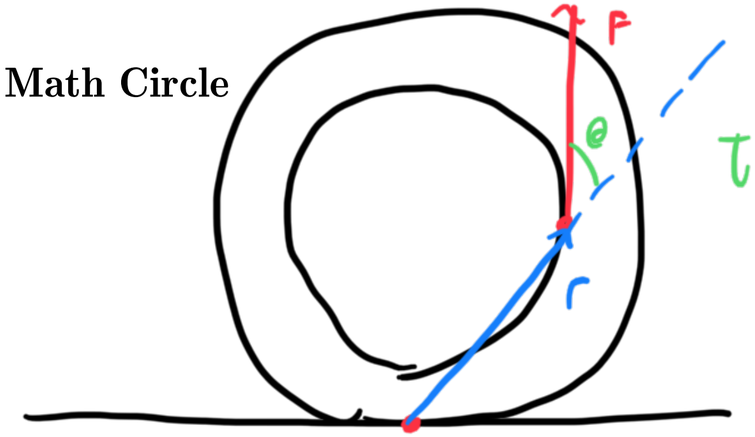
$F_c = mv^2/R = m\omega^2 R$

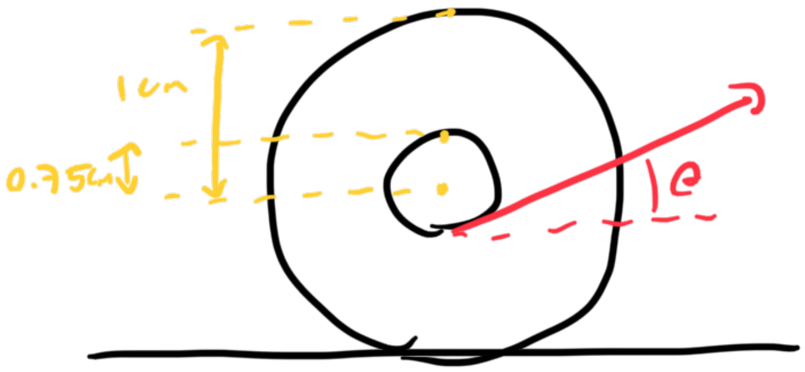
What applies this force?

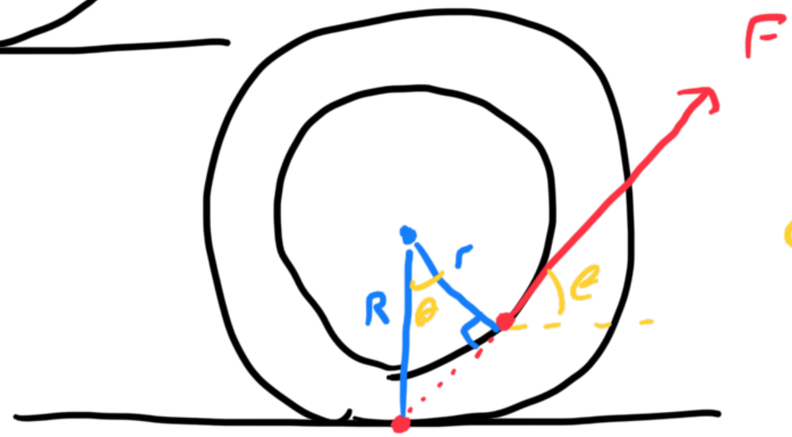


$v \propto \sqrt{T} \propto \sqrt{F_c} \propto \sqrt{\omega^2} = \omega \Rightarrow$ (C)

2018 B #14







$\theta = \arccos\left(\frac{r}{R}\right)$

$= 41.4°$

(B)

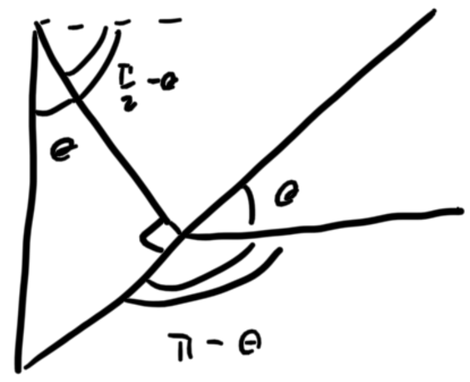
θ so the spool slips

but doesn't rotate!

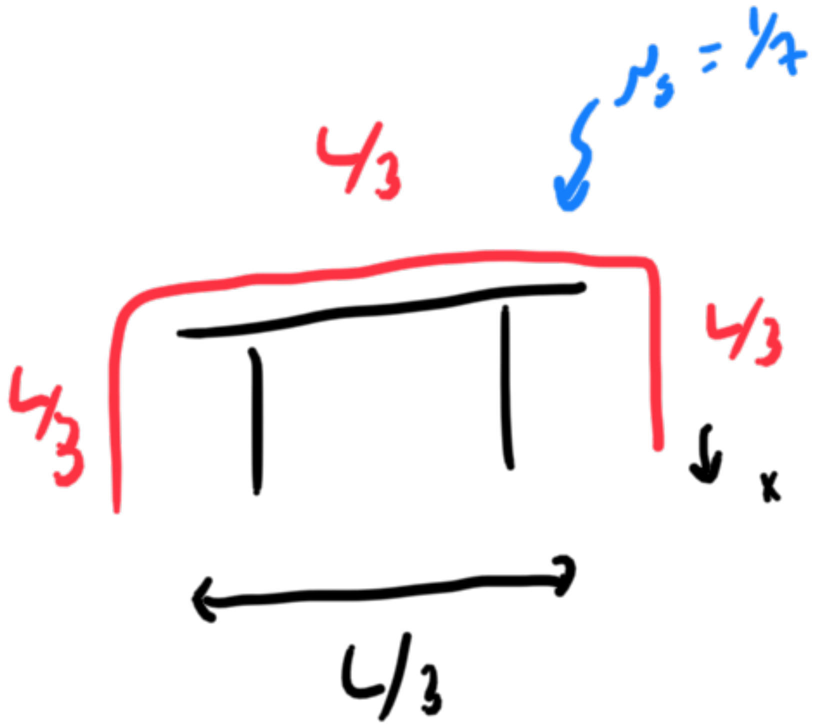
$$\alpha = 0 \Rightarrow \tau_{net} = 0$$

$$\vec{\tau} = \vec{r} \times \vec{F} = rF\sin\Theta$$

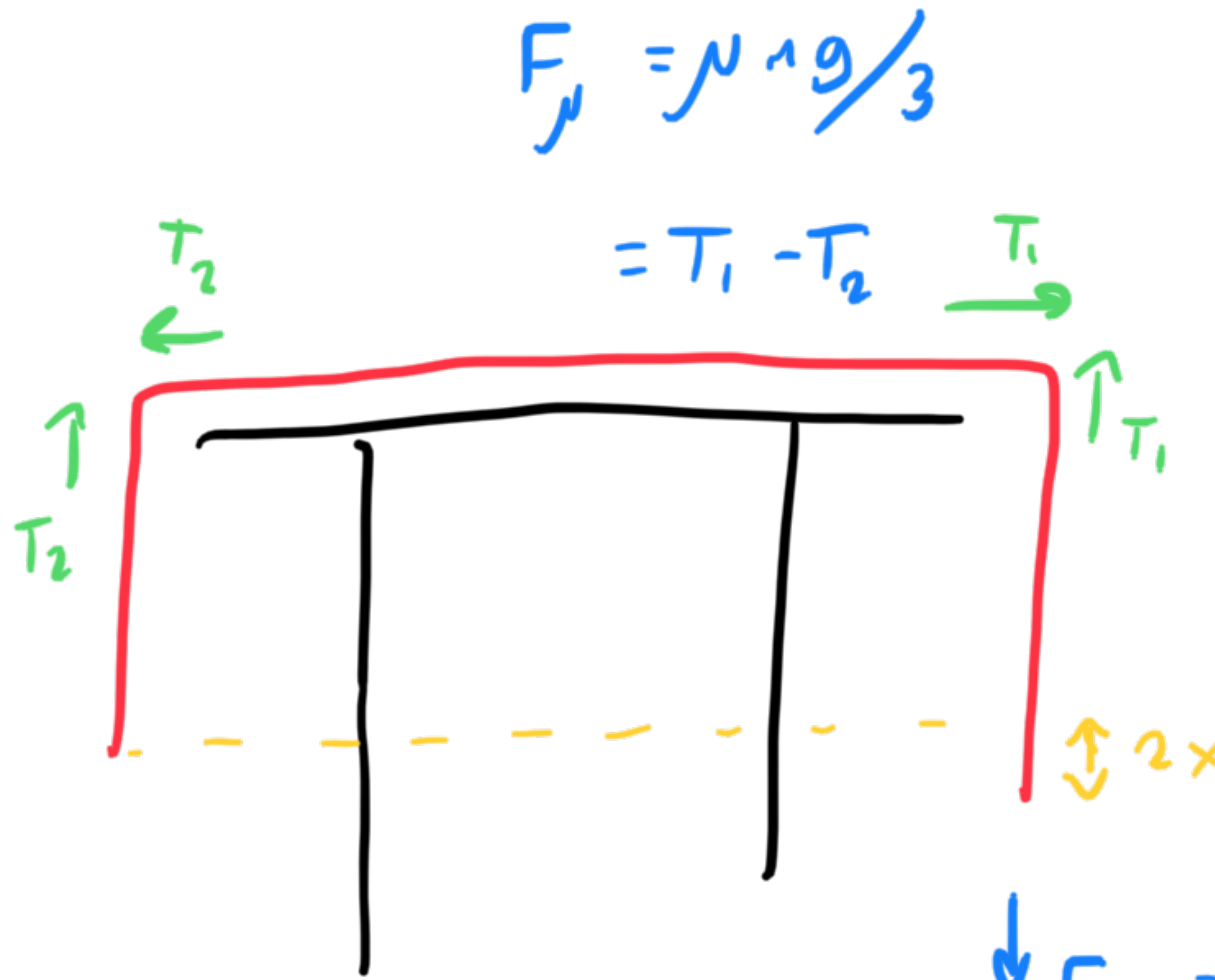
(θ = angle btwn F & r)



2018B #20



maximum x so the string doesn't fall off the table?



$F_g = 2x\rho g$

$F_\mu = \mu g \frac{L}{3} \rho$

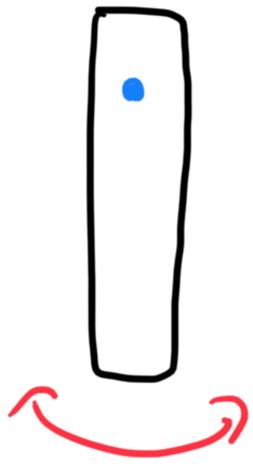
$F_g = F_\mu \Rightarrow 2x = \frac{\mu L}{3}$

maximum

$x = L/42$

2018B #21

$T = ?$



Parallel axis thm:

$$I = I_c + Mx^2$$

$$I = \frac{1}{12}ML^2 + Mx^2$$

Minimize $\frac{I}{mx}$.

$$T = 2\pi\sqrt{\frac{I}{mgx}}$$

HW: derive or read derivation

$$T = 2\pi\sqrt{\frac{\text{"mass"}}{\text{"restoring force"}}}$$

$$\left(\frac{I}{mx} = x + \frac{1}{12}\frac{L^2}{x}\right)$$

OHW: read about AM-GM

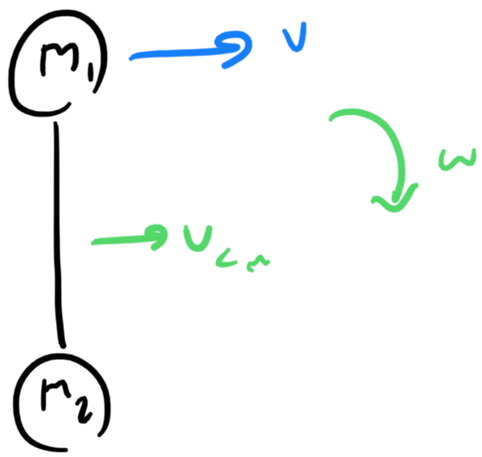
$\left(y = \frac{x}{c} \qquad c = \frac{L}{2\sqrt{3}}\right)$

$$= c\left(y + \frac{1}{y}\right)$$

$\Rightarrow$ min when $y = 1$, $\boxed{x = cy = \frac{L}{2\sqrt{3}}}$

(B)

2018B #23



$$v_{cm} = \frac{m_1 v}{m_1 + m_2}$$

$$r_1 = \frac{m_2 L}{m_1 + m_2} \qquad r_2 = \frac{m_1 L}{m_1 + m_2}$$

$$v = v_{cm} + r_1 \omega = \frac{m_1 v}{m_1 + m_2} + \frac{m_2 L \omega}{m_1 + m_2}$$

next time m_2 is at rest?

$$\Rightarrow \quad \omega = v/L$$

$$v_{2_0} = v_{cm} - r_2 \omega$$

$$\epsilon = T = 2\pi/\omega = \frac{2\pi L}{v} \qquad (A)$$