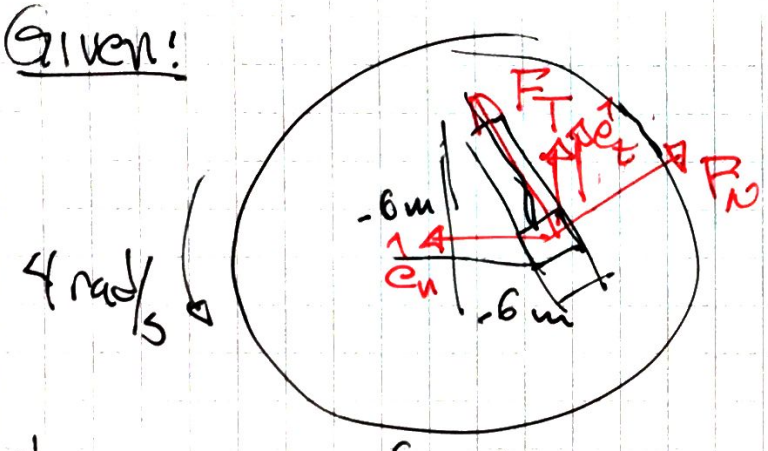
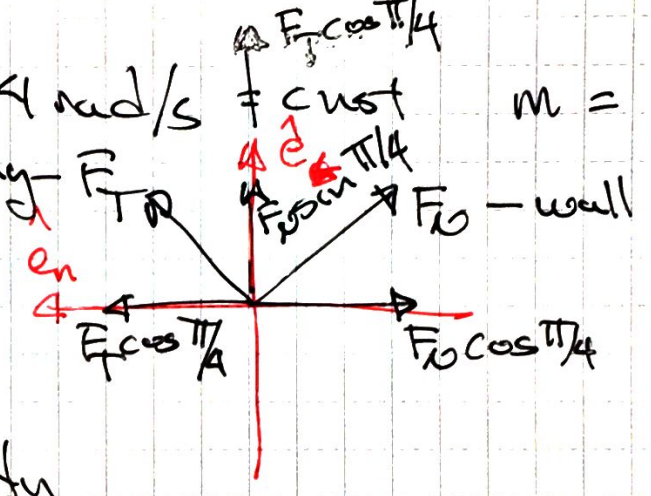
Given:



$\omega = 4$ rad/s ≠ const $m = .5$ kg



Assump no friction, no gravity

Req'd Forces on slider (n/t)

Strategy: FBD in n/t coord, set equal to a in n/t

Estimate: a $\omega = 4$ rad/s $\Rightarrow$ $r\omega = v = .6\text{m}(4) = 2.4$ m/s

the inward $a = \frac{v^2}{\rho} = \frac{6.2 \text{ m}^2/\text{s}^2}{.6 \text{ m}} \simeq 10$ m/s^2

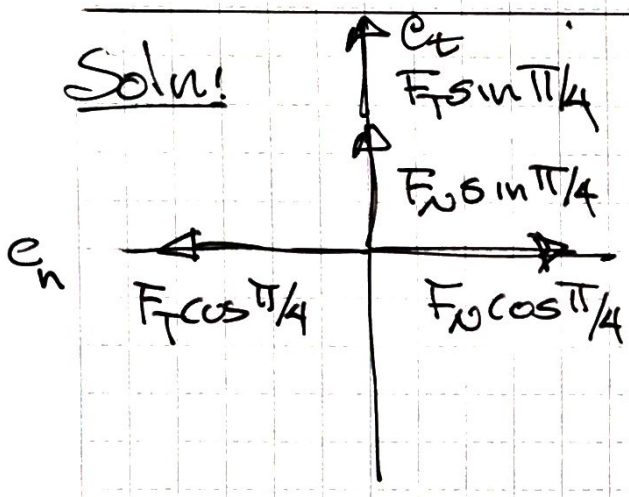
$a_t = 0$ because ω = const

system @ 45° $\Rightarrow$ $a_n = \frac{\sqrt{2}}{2} F = 7$ m/s^2 each way

$F = ma \simeq .5\text{kg}(7 \text{m/s}^2) = 3.5 - 4$ N in both

~~normal and tangential~~ string & wall forces

Soln!



$\hat{e}_t \quad F_{net} = (F_T + F_N)\sin\pi/4 = m a_t$

$e_n \quad F_{net} = (F_T - F_N)\cos\pi/4 = m a_n$

$a_n = \frac{v^2}{\rho}\hat{e}_n = \rho\omega^2 \hat{e}_n$

$a_t = \frac{dv_t}{dt}\hat{e}_t = 0\,\hat{e}_t \quad (\omega = \text{const})$

Start w/ easy one $a_t = 0 \Rightarrow (F_T + F_N)\sin\pi/4 = m\overbrace{a_t}^{0} = 0$

$\Rightarrow (F_T + F_N) = 0 \Rightarrow F_T = -F_N$ ← assumed wrong direction

now the normal direction

$(F_T - F_N)\cos\pi/4 = m\rho\omega^2 = 2F_T\cos\pi/4 \quad \rho = .6\,m,\ \omega = 4\,rad/s,\ m = \frac{1}{2}\,kg$

$\Rightarrow F_T = \frac{m\rho\omega^2}{2\cos\pi/4} = \frac{\frac{1}{2}.6\,m(4\,m/s)^2}{2\,\frac{\sqrt{2}}{2}} = \boxed{3.39\,N}$

Discussion: I originally got 7N for the forces but as I tried to figure out what I could have done better in the estimate I realized I had forgotten the mass in my last calculation. Fixed the missing mass and now everything feels good

1 SQUARE =