Monday's lecture relative velocity

Section 3.8

H.w Due today

FINAL Exam

Wednesday May 7

10:30 - 12:30

Practice questions on class web page

next week Bonus H.w

clickers

grp problem

Logic questions also next week

#3 H.W

b

not clear what initial angular velocity is

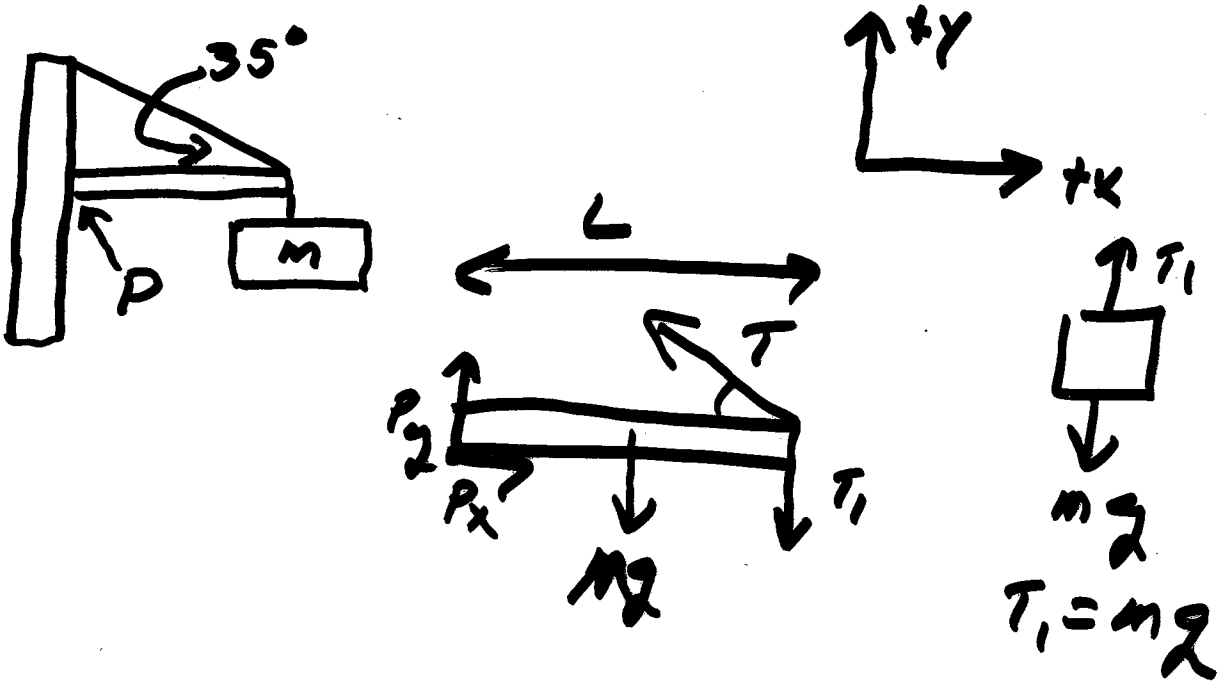
webassign assumes initial angular velocity is same as found in part 3a

Note when people step off, they exert no torque so cannot change angular velocity of merry-go-round

$(I_m + I_p)\omega_i = (I_m + I_p)\omega_f$

people carry away angular momentum so ω doesn't change

ex) A 25 kg sign hangs from a 10 kg pole what is Tension in wire and Vertical and horizontal forces on Pivot point P.



$T_1 = mg$.

$\Sigma F_x = 0$ $\quad P_x - T\cos 35^\circ = 0$ ①

$\Sigma F_y = 0$ $\quad P_y + T\sin 35^\circ - T_1 - Mg = 0$ ②

$\Sigma \tau = 0$ $\quad -Mg\left(\frac{L}{2}\right)\sin 90^\circ - T_1 L \sin 90^\circ + TL\sin 35^\circ = 0$

algebra

$$-Mg\left(\frac{L}{2}\right) - T_1 + T\sin 35^\circ = 0$$

$$T = \frac{\frac{Mg}{2} + T_1}{\sin 35^\circ} \qquad T_1 = mg$$

$$\boxed{T = 510\ N}$$

① $P_x = T\cos 35^\circ = \underline{420\,N}$

② $P_y = Mg + mg - T\sin 35^\circ = \underline{50\,N}$

Interactive Question

A heavy boy and a lightweight girl are balanced on a massless seesaw. If they both move forward so that they are one-half their original distance from the pivot point, what will happen to the seesaw?

A) The side the boy is sitting on will tilt downward.

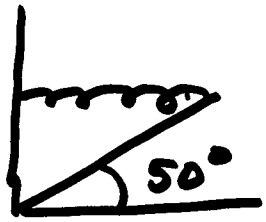
B) The side the girl is sitting on will tilt downward.

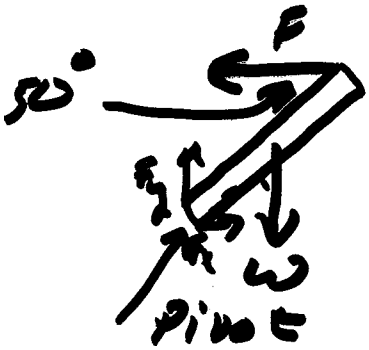
C) Nothing, the seesaw will still be balanced.

D) It is impossible to say without knowing the masses and the distances.

ex) A 10.1 kg uniform board is wedged in a corner and held by a spring at a 50° angle with respect to the horizontal. How much does spring stretch?

(k = 176 N/m)



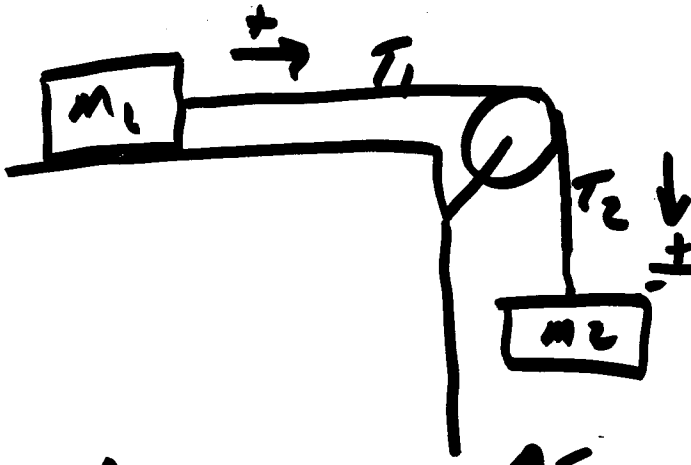


$$\Sigma\tau = 0 \qquad +FL\sin 50^\circ - mg\left(\frac{L}{2}\right)\sin 40^\circ = 0$$

$F = kx$

$$kx\sin 50^\circ = \frac{mg}{2}\sin 40^\circ$$

$$\boxed{x = .236\ m}$$

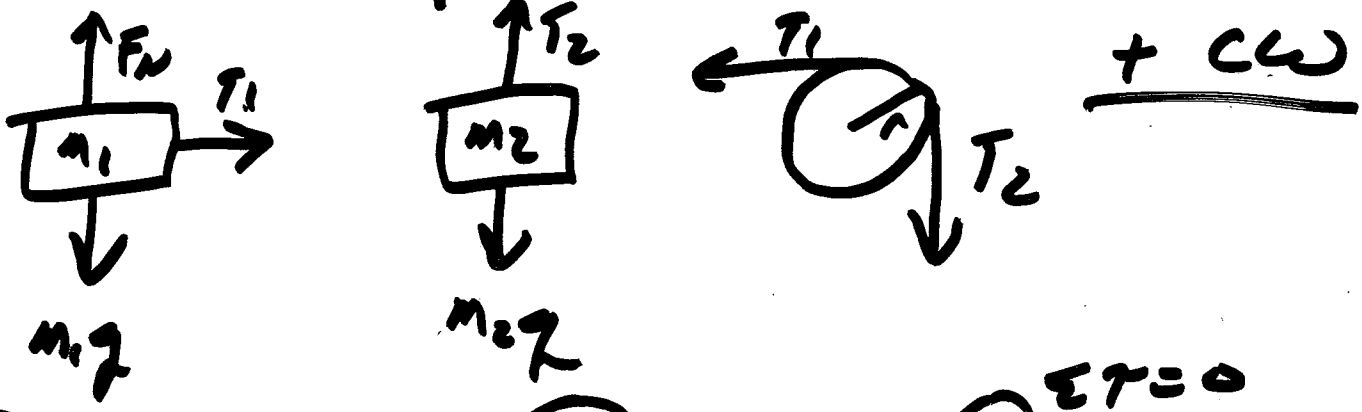


Pulley has moment of inertia I

+ table frictionless

Find acceleration

+ CW



① $T_1 = m_1 a$

$F_N = m_1 g$

② $m_2 g - T_2 = m_2 a$

③ $\Sigma \tau = 0$

$+r T_2 - r T_1 = I\alpha$

$+a = \alpha r +$ $\alpha = \frac{a}{r}$

$r T_2 - r T_1 = I \frac{a}{r}$

$T_2 - T_1 = I \frac{a}{r^2}$

$(m_2 g - m_2 a) - (m_1 a) = I \frac{a}{r^2}$

$I \frac{a}{r^2} + m_2 a + m_1 a = m_2 g$

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

$$a = \frac{m_2 g}{\frac{I}{r^2} + m_2 + m_1}$$