Will upload an updated syllabus

Next week is Native American Day (Oct 9)
No Class & Midterm Assigned
Ch 3 - Ch 5

Takehome - Probs as you did for Hwk
Due: Start of Class Oct 16
3% Decrease in final grade for each day late - down to 70% max

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Interacting Objects & Pulleys

- Forces occur in action-reaction pairs

action-reaction pair is same magnitude but opposite direction

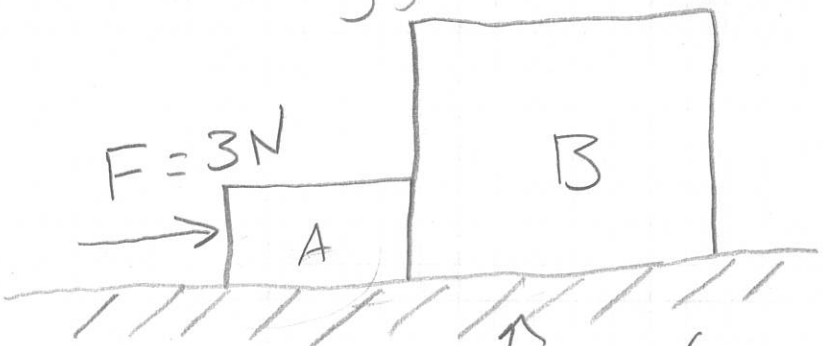
Steps: Draw each object seperately & force diagram for each

Draw seperate free body diagrams
Write Newtons 2nd law for Each object

Objects in Contact have same acceleration

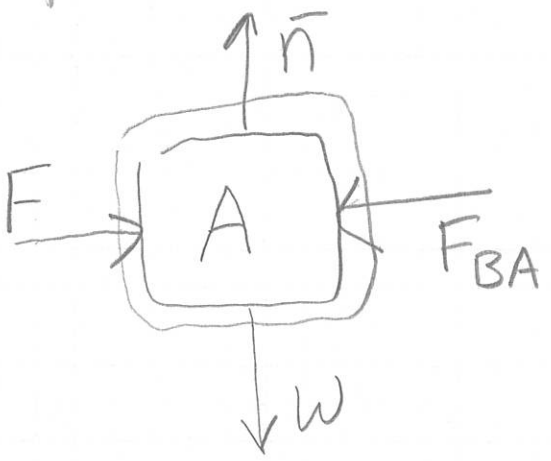
	A	B
mass kg	5	10

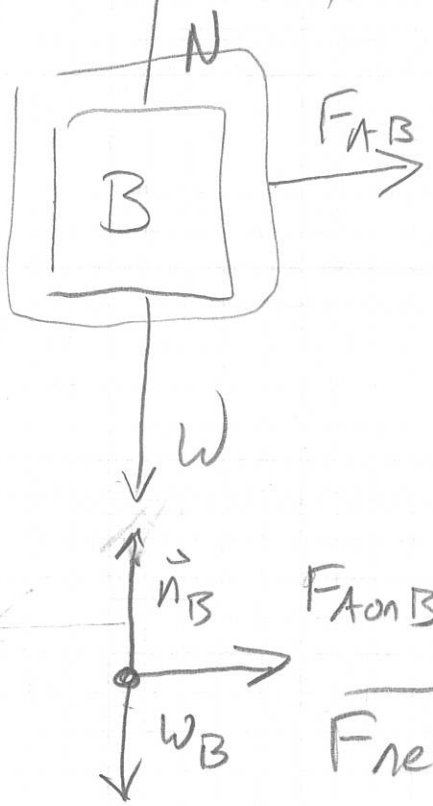
Interacting forces Example

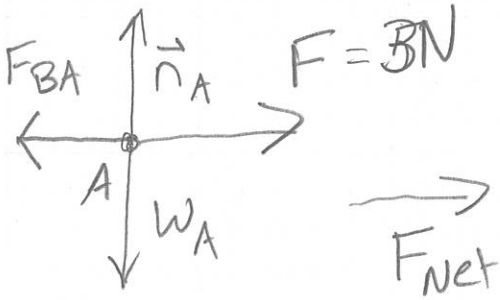


Find Force of A on B

Frictionless surface







$\Sigma F_{yA} = n_A - W_A = \emptyset$

$\Sigma F_{yB} = n_B - W_B = \emptyset$

$\Sigma F_{xA} = 3N - F_{BA} = F_{net}$

$3N - F_{BA} = m_A a$

$\Sigma F_{xB} = F_{AB} = F_{net}$

$F_{AB} = m_B a = F_{net}$

By Newtons 3rd

$F_{AB} = F_{BA}$

Interacting forces Example Cont

$3N - F_{BA} = m_A a$ $\quad F_{AB} = F_{BA} = m_B a$

↖ - substitute $\frac{F_{BA}}{m_B} = a$

$$3N - F_{BA} = m_A \left[\frac{F_{BA}}{m_B} \right]$$

$$3N - F_{BA} = \frac{m_A}{m_B} F_{BA}$$

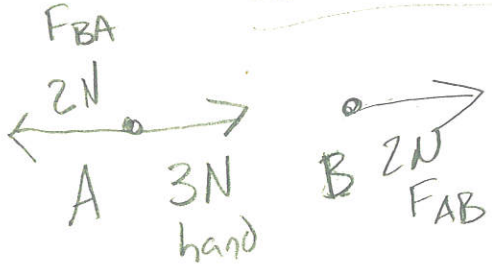
put in knowns

$$3N - F_{BA} = \frac{5\,kg}{10\,kg} F_{BA}$$

$$3N = 0.5 F_{BA} + F_{BA}$$

$$\frac{3N}{1.5} = \frac{1.5 F_{BA}}{1.5}$$

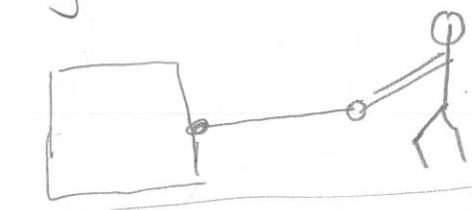
$$2N = F_{BA}$$



This means:
F_{Hand} accelerates both blocks (15kg) but F_{AB} accelerates only Block B (10kg)

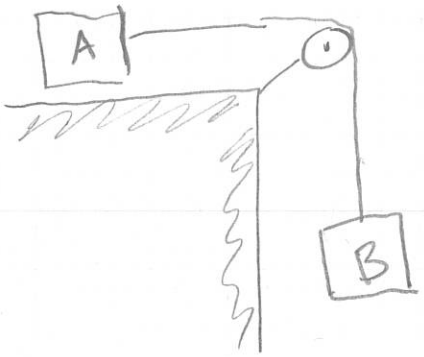
Ropes & Pulleys

Magic trick for ropes: assume a massless rope that transmits a tension force undiminished



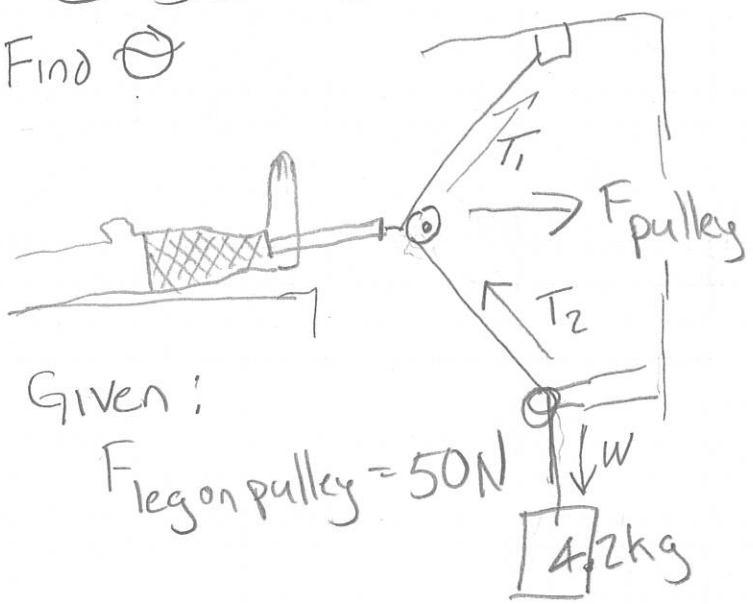
Magic trick for pulleys:

Assume a frictionless pulley so tension is equal at both ends



Pulley Example - Placing a leg in traction

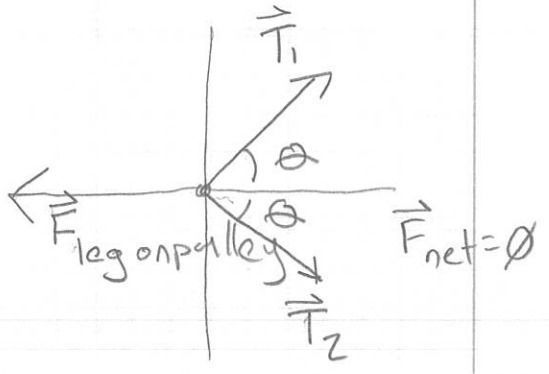
Find Θ



Given:

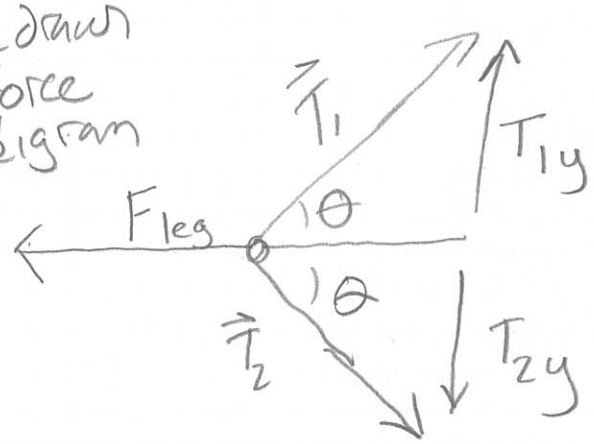
$F_{leg\ on\ pulley} = 50N$

Nothing is moving
nothing accelerating
Static Equilibrium
$F_{net} = \emptyset$



$$T = W = m\vec{g} = 4.2 \times 9.8$$
$$= 41.2N$$

Redraw Force diagram



$$\Sigma \vec{F}_y : \emptyset = T_1 \sin\theta - T_2 \sin\theta = \emptyset$$

$$\Sigma F_x = \emptyset = T_{1x} + T_{2x} - F_{leg} = m a_x^{\emptyset}$$

$$T_{1x} + T_{2x} = F_{leg} = 50\,N$$

$$T_{1x} = T_{2x}$$

$$T_x + T_x = 50\,N$$

$$2T\cos\emptyset = 50\,N$$

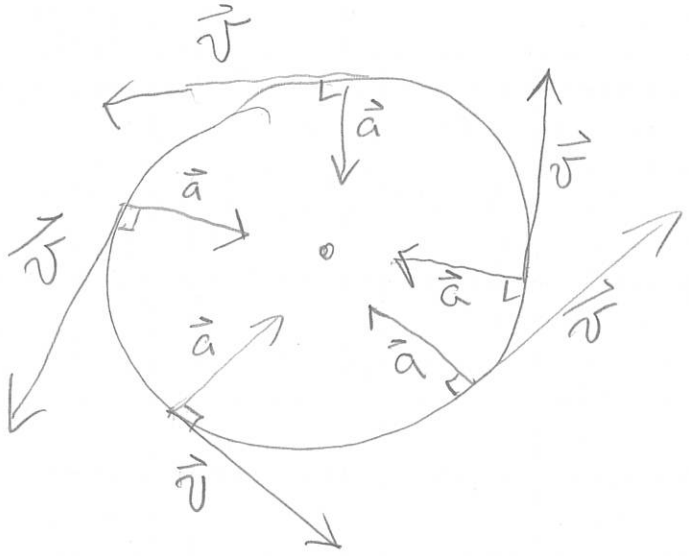
$$\cos\emptyset = \frac{50\,N}{2T} = \frac{50\,N}{2 \cdot 41.2\,N}$$

$$\cos\emptyset = \left(\frac{50}{82.4}\right)$$

$$\emptyset = \cos^{-1}(0.607)$$

$$\underline{\emptyset = 53^\circ}$$

Ch6 probs: 1, 3, 15, 17, 27, 31, 41
Hwk



$$\vec{a} = \frac{v^2}{r} \left[\frac{m^2/s^2}{m}\right]$$

Centripital acceleration is periodic

Period, T is amount of time for one revolution [sec] happens again & again

frequency, $f = \frac{1}{T}$ how many revolutions per unit time

[1 rev = 2π radians] $v = \frac{2\pi r}{T} \left[\frac{m}{s}\right]$

$$v = \frac{2\pi r}{T} \cdot \frac{T}{1/f} = 2\pi r f \left[\frac{m}{s}\right]$$

2018-10-01, Phys214, Wk6

Useful Equations

$$a = \frac{v^2}{r} = \frac{(2\pi f r)^2}{r} = (2\pi f)^2 r \quad \left[\frac{m}{s^2}\right]$$ 7/10

$$a = \frac{v^2}{r} = \left(\frac{2\pi r}{T}\right)^2 = \left(\frac{2\pi}{T}\right)^2 r \quad \left[\frac{m}{s^2}\right]$$

3600 rpm
25cm blade diameter = [0.125m radius]

Time for 1 rev?
Velocity of tooth?
acceleration of tooth?

$$3600 \frac{\text{revs}}{\text{min}} \left| \frac{\text{min}}{60\text{sec}} \right| = 60 \frac{\text{revs}}{\text{sec}}$$

$$= 60 \text{ sec}^{-1}$$

Time for 1 rev?
Find period: $T = \frac{1}{f} = \frac{1}{60} \left[\frac{1}{\text{sec}^{-1}}\right]$

$$T = 0.017 \text{ sec}$$

Velocity of tooth:

$$v = 2\pi f r = 2\pi (60 \text{ sec}^{-1})(0.125 \text{ m})$$

$$v = 47 \text{ m/s}$$

find acceleration

$a = (2\pi f)^2 r$ or $\frac{v^2}{r}$

see book

$$\frac{(47\ m/s)^2}{0.1.25\ m}$$

$1.8 \times 10^4\ m/s^2$

how many gravities?

$$\frac{1.8 \times 10^4\ m/s^2}{9.8\ m/s^2}$$

$0.18 \times 10^4\ g$

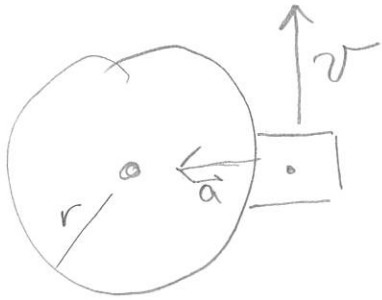
$1.8 \times 10^3\ g$

1800 g

Find period of carnival ride

$r = 5\ m$

$a_{max} = 20\ m/s^2$ (about 2g)



find: period, T at a_{max}

v_{riders}

$$a = \left(\frac{2\pi}{T}\right)^2 r \Rightarrow \frac{(2\pi)^2}{T^2} r = a$$

$$T^2 = \frac{2\pi^2}{a} r$$

$$2\pi\sqrt{\frac{5\ m}{20\ m/s^2}} = T = 2\pi\sqrt{\frac{r}{a}}$$

$$2\pi\left[(0.25\ sec^2)\right]^{\frac{1}{2}} = 2\pi(0.5)\ sec$$

$$T = \pi\ sec$$

$$T = 3.1\ sec$$

for v: $ar = v^2$ or book for check

$$20(5) = v^2$$

$$100 = v^2$$

$$[10\ m/s = v]$$

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

$$v = \frac{2\pi 5}{3.1}$$

Person running around a track

$m = 75\,kg$

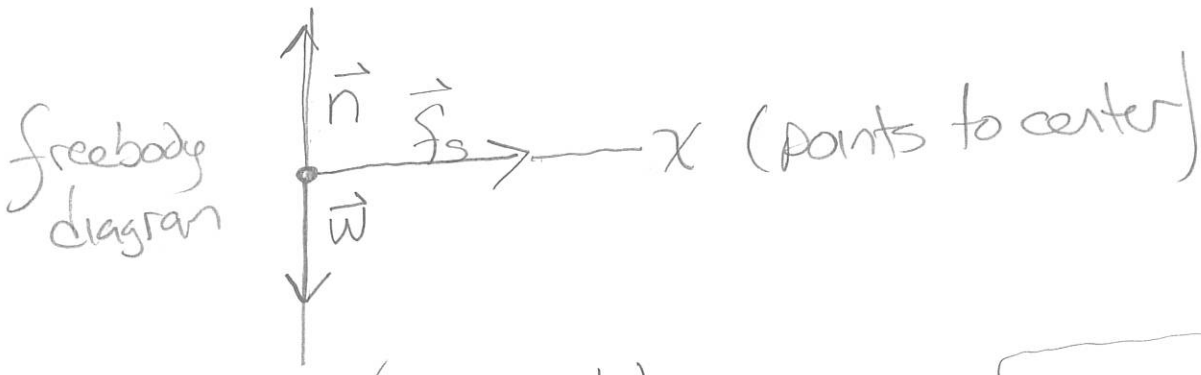
$r = 2.5\,m$

$f_s = 600\,N$

Assess:

find v

think of a shoe



Newtons 2nd

$$\Sigma F_y = \cancel{0} = n - w$$

$$\Sigma F_x = f_s = m\vec{a} = m\frac{v^2}{r}$$

$$600\,N = 75\,kg\,\frac{v^2}{2.5\,m}$$

$$600\,N = 30\,v^2\,\frac{kg}{m}$$

$$20\,\frac{m^2}{sec^2} = \frac{600\,\cancel{kg}\,m/s^2}{30\,\cancel{kg}/m} = v^2$$

$$4.5\,m/s = v$$