REVIEW - FORCES

- Free fall → in the absence of air, objects fall at the same rate ($9.8\ m/s^2$ on Earth)

Problem-Solving

1) Draw FBDs.

- "Real" with forces in actual direction
- "Broken Down" with forces in mutually orthogonal directions

2) Is there acceleration?

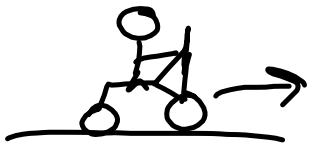
- YES $\sum \vec{F} = m\vec{a}$
- NO $\sum \vec{F} = \emptyset$
- Can do in each dimension independently

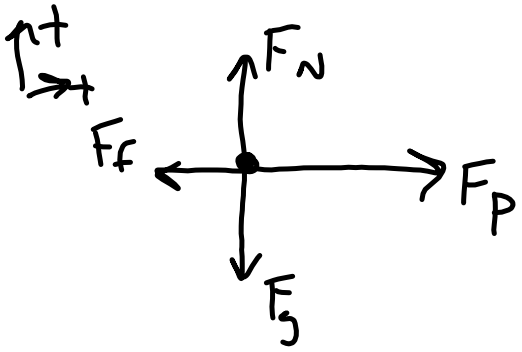
3) Use FBD to expand $\sum \vec{F}$ (net force) in each dimension

- Write each force in FBD with +/- depending on the direction

PS #6

5)





$$\sum F_x = m a_x$$

$$F_p - F_f = m a_x$$

$$a_x = \frac{F_p - F_f}{m}$$

$$= \frac{580\,N - 423.2\,N}{72\,kg}$$

$$= 2.21\,m/s^2$$

$$\sum F_y = 0$$

$$F_N - F_g = 0$$

$$F_N = F_g$$

$$= m a_g$$

$$= (72\,kg)(9.8\,m/s^2)$$

$$= 705.6\,N$$

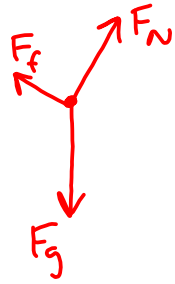
$$F_f = \mu F_N$$

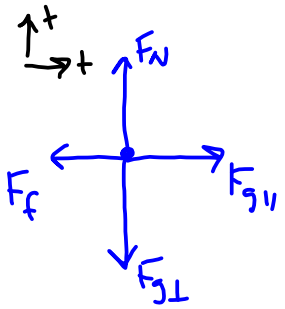
$$= (.6)(705.6\,N)$$

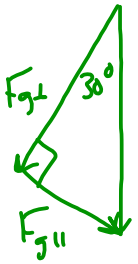
$$= 423.2\,N$$

PS #6

4)







$\cos(30^\circ) = \frac{F_{g\perp}}{F_g}$

$F_{g\perp} = F_g \cos(30^\circ)$

$= m a_g \cos(30^\circ)$

$\sin(30^\circ) = \frac{F_{g\parallel}}{F_g}$

$F_{g\parallel} = F_g \sin(30^\circ)$

$= m a_g \sin(30^\circ)$

$\sum \vec{F}_\perp = \emptyset$

$F_N - F_{g\perp} = \emptyset$

$F_N = F_{g\perp}$

$= m a_g \cos(30^\circ)$

$\sum \vec{F}_{\parallel} = m\vec{a}_{\parallel}$

$F_{g\parallel} - F_f = m a_{\parallel}$

$F_f = m a_{\parallel} - m a_g \sin(30^\circ)$

$= m\left[a_{\parallel} - a_g \sin(30^\circ)\right]$

$\mu = \frac{F_f}{F_N}$

$= \frac{m\left[a_{\parallel} - a_g \sin(30^\circ)\right]}{m a_g \cos(30^\circ)}$

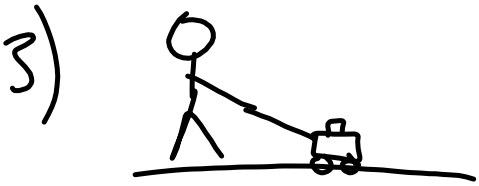
$= \frac{a_{\parallel} - a_g \sin(30^\circ)}{a_g \cos(30^\circ)}$

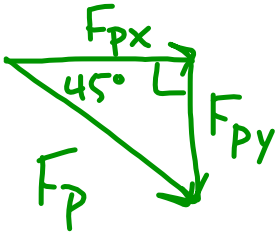
$= \frac{5.6\ m/s^2 - (9.8\ m/s^2)\sin(30^\circ)}{(9.8\ m/s^2)\cos(30^\circ)}$

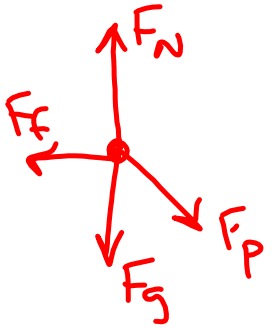
$= 0.082$

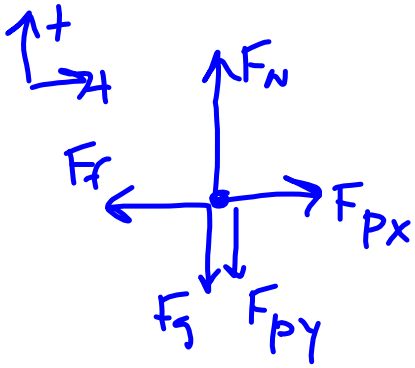
PS #7

3)









$$\sin(45^\circ) = \frac{F_{py}}{F_p}$$

$$F_{py} = F_p \sin(45^\circ) = 62.2\,N$$

$$\cos(45^\circ) = \frac{F_{px}}{F_p}$$

$$F_{px} = 62.2\,N$$

$$\Sigma F_x = \emptyset$$

$$F_{px} - F_f = \emptyset$$

$$F_f = F_p$$

$$= 62.2N$$

$$\Sigma F_y = \emptyset$$

$$F_N - F_g - F_{py} = \emptyset$$

$$F_N = F_g + F_{py}$$

$$= (14\,kg)(9.8\,m/s^2) + 62.2\,N$$

$$= 199.4\,N$$

$$\mu = \frac{F_f}{F_N}$$

$$= \frac{62.2\,N}{199.4\,N}$$

$$= 0.312$$

Problem Types:

- Horizontal