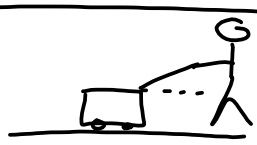
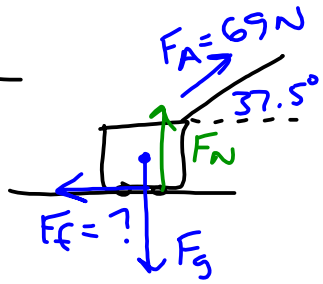
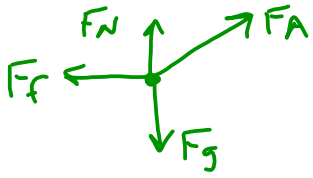
Forces PS #7

Ex)

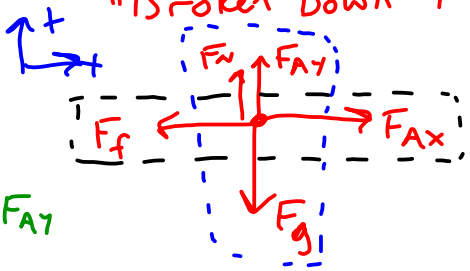


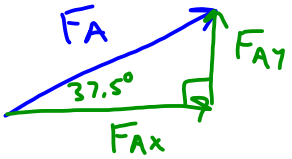


"Real" FBD



"Broken Down" FBD





$\cos(37.5°) = \frac{F_{Ax}}{F_A}$ $\sin(37.5°) = \frac{F_{Ay}}{F_A}$

$F_{Ax} = F_A \cos(37.5°)$ $F_{Ay} = F_A \sin(37.5°)$

$= 54.7\ N$ $= 42\ N$

$$\Sigma F_y = \emptyset$$

$$-F_g + F_N + F_{Ay} = \emptyset$$

$$F_N = F_g - F_{Ay}$$

$$= (15\ kg)(9.8\ m/s^2) - 42\ N$$

$$= 105\ N$$

$$\Sigma F_x = m a_x$$

$$F_{Ax} - F_f = m a_x$$

$$a = \frac{F_{Ax} - F_f}{m}$$

$$= \frac{54.7\ N - 26.3\ N}{15\ kg}$$

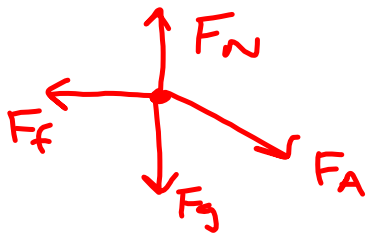
$$= 1.89\ m/s^2$$

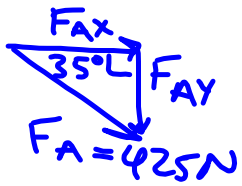
$F_f = \mu F_N$

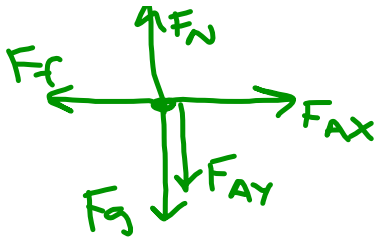
$= (0.25)(105\ N)$

$= 26.3\ N$

2)







$$\sum \bar{F}_y = \emptyset$$

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

$$F_N = F_g + F_{AY}$$
$$= 325N + 224N$$
$$= 569N$$

$$F_{AX} = F_A \cos(35°)$$
$$= 348\,N$$

$$F_{AY} = F_A \sin(35°)$$
$$= 244\,N$$

$$\sum \bar{F}_x = m\bar{a}_x$$

$$F_{AX} - F_f = ma_x$$

$$a_x = \frac{F_{AX} - F_f}{m}$$
$$= \frac{348N - 199N}{33.2kg}$$
$$= 4.49\ m/s^2$$

$$F_f = \mu F_N$$
$$= (0.35)(569N)$$
$$= 199\,N$$

Problem-Solving Ideas

1) Is there a force at an angle?

Yes → break into x- and y-components

2) Draw FBD with all forces

"Real" FBD → forces in actual directions

"Broken Down" FBD → forces only in x- and y-directions

3) Is there acceleration in the x-direction?

YES → $\sum \bar{F}_x = m\bar{a}_x$

NO → $\sum \bar{F}_x = \emptyset$

] solve for variables

4) Is there acceleration in the y-direction?

YES → $\sum \bar{F}_y = m\bar{a}_y$

NO → $\sum \bar{F}_y = \emptyset$

] solve for variables

List of Variables

F → force (N)

m → mass (kg)

a → acceleration (m/s^2)

F_g → force due to gravity (N)

a_g → acceleration due to gravity (m/s^2)
($9,8\ m/s^2$ on Earth)

μ → coefficient of friction (no units)