Physics 201 - Lecture 14

March 1st

Irish Month

→ Assignment 4

Force is vector!

$$\underbrace{\vec{F}_{net}}_{\text{math}} = \underbrace{\vec{F}_1 + \vec{F}_2 + \vec{F}_3 \dots}_{\text{real}}$$

$$= m\boxed{\vec{a}}$$

Resolve into x, y, z components!

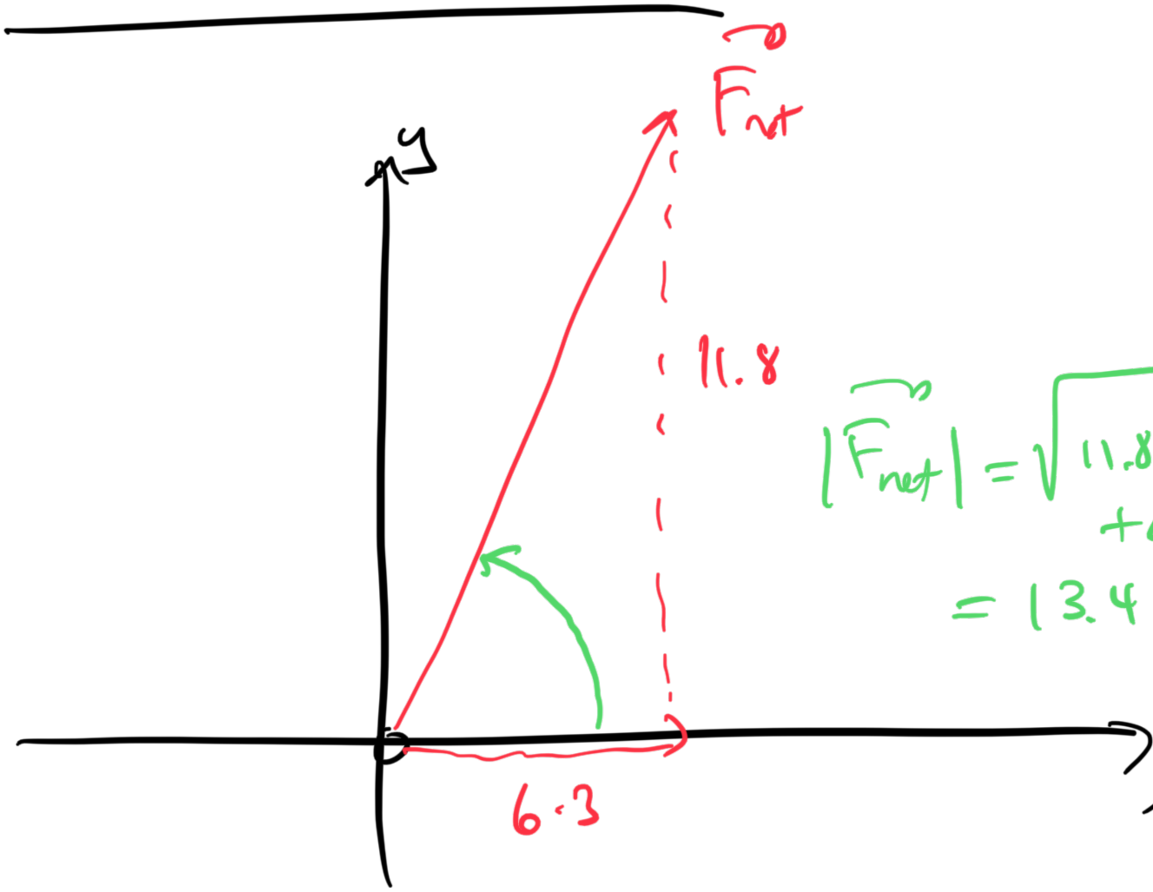
$$\vec{F} = \vec{F}_1 + \vec{F}_2$$

$$F_{net} = \ldots$$

$$= 2.1\hat{i} + 4.6\hat{j}$$

$$+ (4.2\hat{i} + 7.2\hat{j})$$

$$\boxed{\vec{F}_{net}} = 6.3\hat{i} + 11.8\hat{j}$$



$$|\vec{F}_{net}| = \sqrt{11.8^2 + 6.3^2} = 13.4\ N$$

$$\tan\theta = \frac{11.8}{6.3} \qquad \theta = 61.9^\circ$$

Δt , $\vec{F}_{\text{Applied}} \rightarrow$ " non-zero "

only " constant "

force?

$$\vec{F}_{net} = \boxed{\vec{F}_{\text{Applied}}} = m\vec{a}$$

non-zero constant

non-Zero constant

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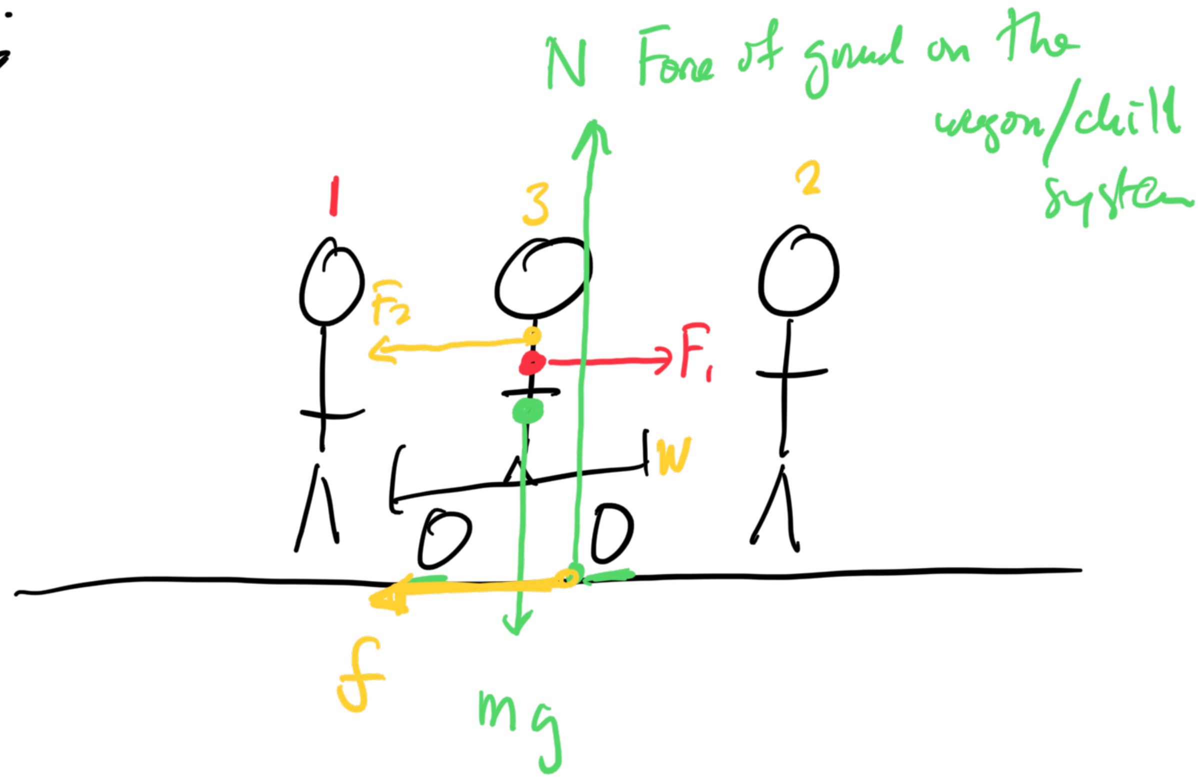
4. $m = 61 \text{ kg}$

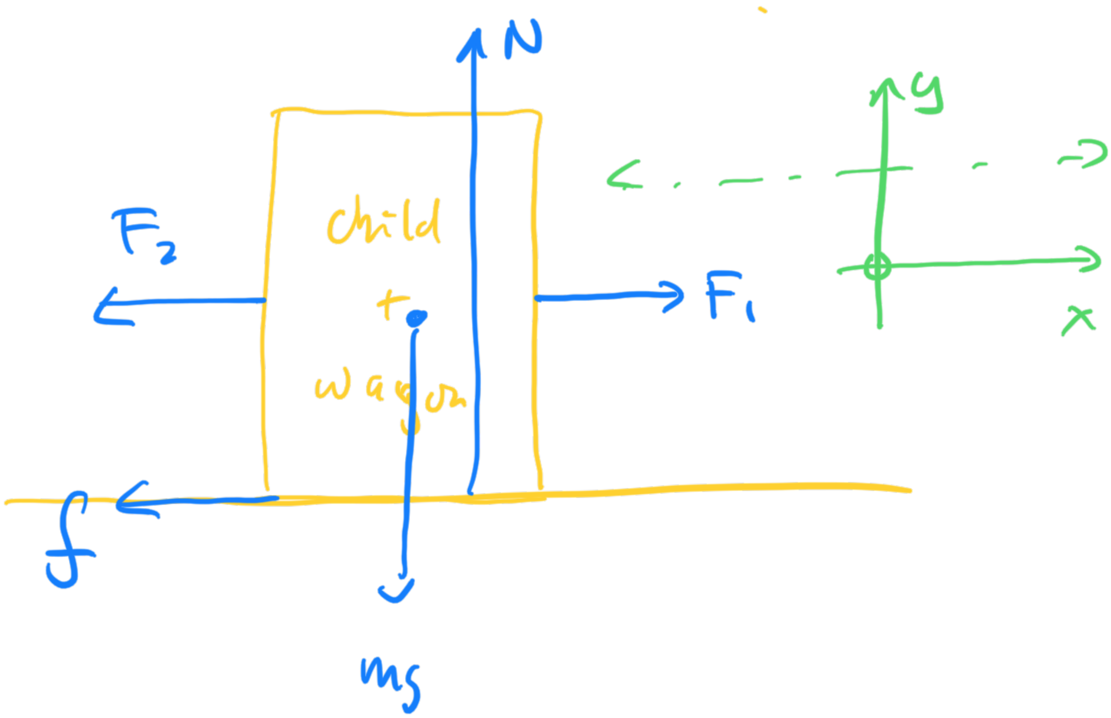
$|\vec{a}| = 1.9 \text{ m/s}^2$

$$|\vec{F}_{net}| = m\,|\vec{a}|$$

$$= (61)(1.9) = 117 \text{ N}$$

5.





Step 1: Identify all forces on the object of interest.

Step 2: Coordinate system !

$$\boxed{\begin{aligned} a_y &= 0 \\ a_x &= a \end{aligned}}$$

Step 3:

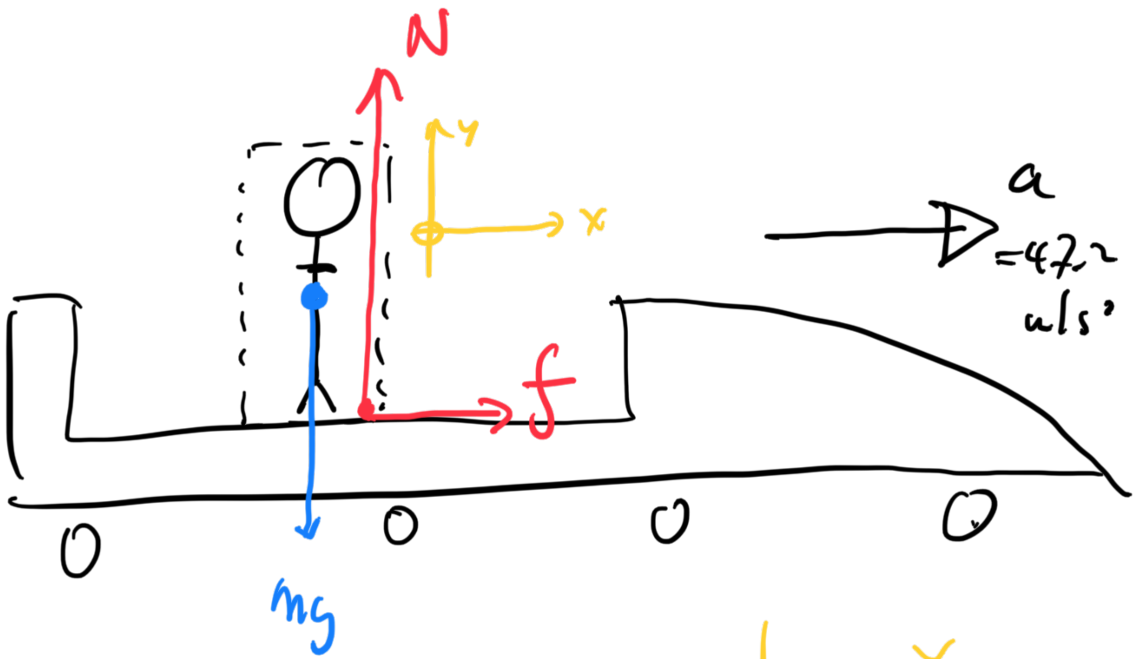
X	Y
$F_{net}^{x} = ma_x$	$F_{net}^{y} = ma_y = 0$
$\boxed{F_1 - F_2 + f = m a}$, $m = 23.0\,kg$	$\boxed{N - mg = 0}$
65 N, 91.0 N, 21.0 N	

$$a = \frac{F_1 - F_2 + f}{m}$$

$$= \frac{65 - 91 + 21}{23}$$

$$\boxed{a = -0.217\ m/s^2}$$

c) $f = 26\ N$ $\quad a = 0$



① gravity ✓

② contact forces.

X	Y
$f = ma$	$N - mg = 0$
$= (85)(4.72)$	$N = mg$
$f = 4012\ N$	$N = 833\ N$

"F_h"

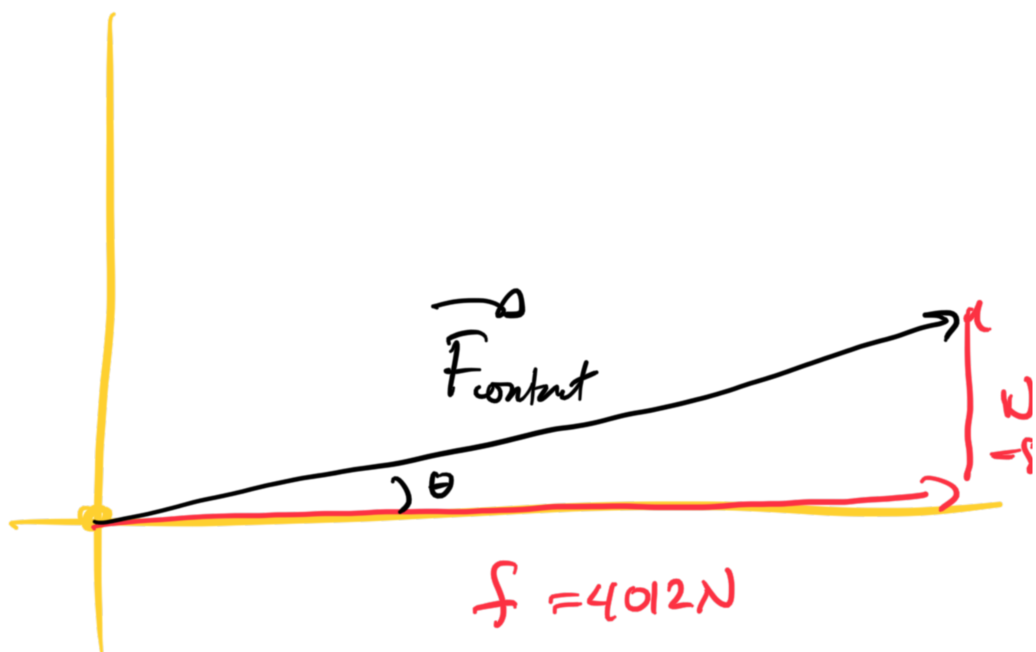
"F_v"

"weight"?

$\boxed{mg} \equiv$ Weight

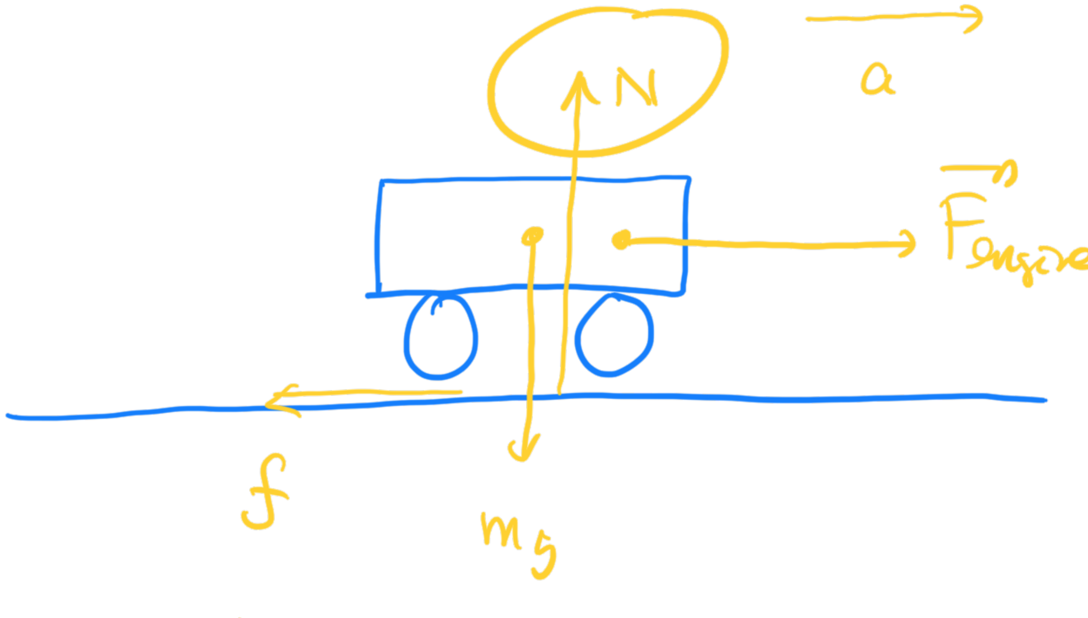
$$\frac{|F_n|}{|W|} = \frac{4012\ N}{(85)(9.8)} = 4.82$$

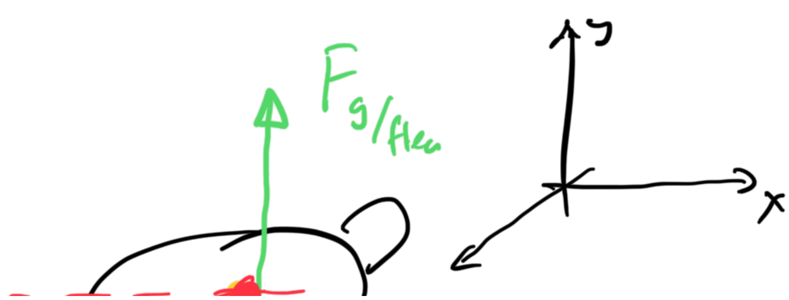
"g-force" $\quad 4.82\,g$

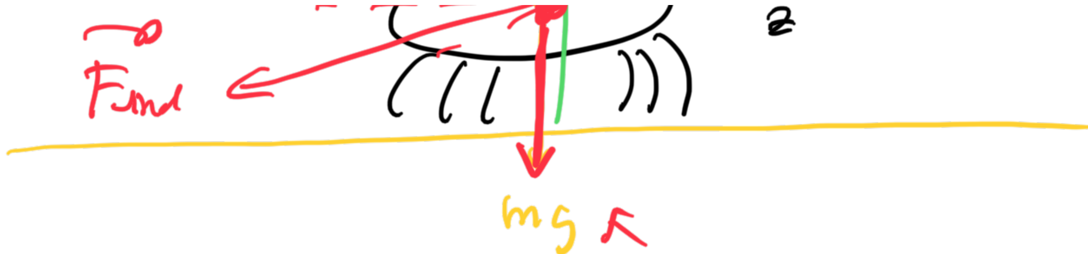


$$\tan\theta = \frac{833\ N}{4012\ N} \qquad \theta = 11.7^\circ$$

$$\sqrt{833^2 + 4012^2} = 4097.6$$







$$\boxed{\vec{F}_{flea/grnd} = -F\hat{j}}$$

$$\vec{F}_{grnd/flea} = \boxed{+F\hat{j}}$$

Newton's 3rd Law

$$\boxed{\vec{F}_{grnd/flea}} = +1.98\times10^{-5}\,\hat{j}$$

$$\vec{F}_{wind} = -6.82\times10^{-5}\,\hat{i} + 5.82\times10^{-5}\,\hat{k}$$

$$\vec{mg} = -\underbrace{(6.00\times10^{-7})}_{m}\underbrace{(9.8)}_{g}(\hat{j})$$

$$\vec{F}_{net} = \vec{F}_{g/f} + \vec{F}_w + \vec{mg}$$

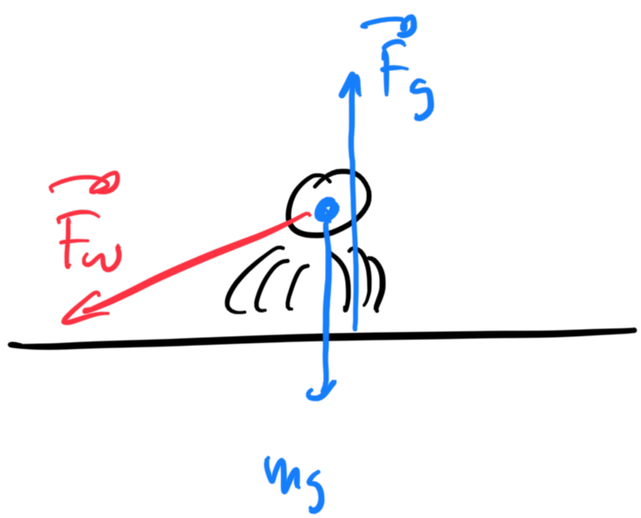
$$= 1.98\times10^{-5}\,\hat{j} + (-6.82\times10^{-5})\,\hat{i}$$

$+ 5.82 \times 10^{\ldots} \hat{k}$

$$- 5.88 \times 10^{-6} \hat{j}$$

$$\vec{F}_{net} = \underset{6.\times10^{-7}}{\underline{1.392 \times 10^{-5}}} \hat{j} - \underset{6.\times10^{-7}}{\underline{6.82 \times 10^{-5}}} \hat{i} + \underset{6\times10^{-7}}{\underline{5.82 \times 10^{-5}}} \hat{k}$$

$$\vec{a} = \frac{\vec{F}_{net}}{m} = 23.2 \hat{j} - 11.4 \hat{i} + 97 \hat{k}$$



$\vec{F} = \vec{F} + \vec{F} + \vec{F}$

$$F_{NET} = F_w + F_{gnd} + F_g$$

$$= \vec{F}_w + \vec{F}_{grnd} + m\vec{g}$$

$$= 1.98\times10^{-5}\,\hat{j} \qquad - 5.88\times10^{-6}$$

given.

$$-6.82\times10^{-5}\,\hat{i} + 5.82\times10^{-5}\,\hat{k}$$

$$\frac{\vec{F}_{net}}{m} = \frac{1.392\times10^{-5}}{6.00\times10^{-7}}\,\hat{j} - \frac{6.82\times10^{-5}}{6.00\times10^{-7}}\,\hat{i} + \frac{5.82\times10^{-5}}{6.00\times10^{-7}}\,\hat{k}$$

$$\vec{F}_{net} = m\vec{a} \qquad \vec{a} = \boxed{\frac{\vec{F}_{net}}{m}}$$