Newton's Second Law Guide

① **Free Body Diagram**

- For each mass in the problem, draw the free body diagram.
- Use subscripts to distinguish similar kinds of forces (e.g. w_1 and w_2 if there are two different weights.)

② **Choose Coordinates**

- Base your coordinates on the acceleration!! Your algebra will always be easier if you don't have components of acceleration.
- If $a = 0$, choose the coordinates that gives fewest sines & cosines.
- This really is a binary choice:

$$\begin{matrix} \Sigma F_x \\ \Sigma F_y \end{matrix} = \left\{ \begin{matrix} 0 \\ ma \end{matrix} \right. \quad \underline{\text{OR}} \quad \begin{matrix} \Sigma F_{\parallel} \\ \Sigma F_{\perp} \end{matrix} = \left\{ \begin{matrix} 0 \\ ma \end{matrix} \right.$$

- This will give you two equations, one for each component

  (e.g. $\Sigma F_{\parallel} = ma$ & $\Sigma F_{\perp} = 0$ or $\Sigma F_x = 0$ & $\Sigma F_y = 0$)

③ **Apply N2L**

- Figure out the left half of your two equations from your free body diagram.
- For each coordinate, add up all the arrows* in the positive direction and subtract all the arrows* in negative direction

  * - or components of arrows
- Personally, I will always set the positive

direction to be the direction of the acceleration because I make fewer mistakes that way. But its up to you. Just be clear.

④ Do some algebra

At this point, you will have two equations and hopefully two unknowns. So do the algebra!

This can get blobby, so be patient and don't freak out. :)

TLDR:

1. FBD - for each mass
2. Coordinates - base it on acceleration
3. N2L - add and subtract the arrows in the FBD
4. Algebra - Do it