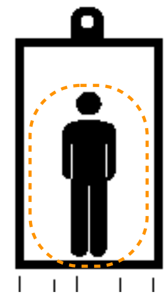
Solving Dynamics Problems (3rd reference): Newton's Second Law

"Once is happenstance. Twice is coincidence. Three times begins to seem like a message to be ignored at one's peril".
– The Orphan's of Raspay

Setup State: Sketch a Free-Body Diagram

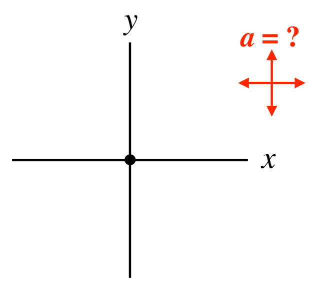


1. Isolate the object being analyzed.
   Identify ALL forces that act ON the object; NOT the forces it exerts on its surroundings.

2. Draw a *convenient* coordinate system.

3. Represent the object as a dot at the origin (particle model).

4. Draw vectors representing each of the identified forces. (Tail of force vector on the object. Illustrate angles.)



[new]

5. Illustrate the direction of the acceleration near the FBD (not on the center dot).

Analysis Stage: Apply Newton's Laws (i.e. "Read" the free-body diagrams).
Similar to Newton's 1st Law problems:

	example:
• Write applicable Newton's Law statement *independently* for each direction (axis). i.e: Newton's 2nd Law ($\Sigma \boldsymbol{F} = m\boldsymbol{a}$)	$\sum \vec{F}_y = m\vec{a}_y$
• Write the explicit sum of the vectors or vector components along that direction. Note: there must be a term for every arrow in the FBD.	$\vec{F}_{1y} + \vec{F}_{2y} + \ldots + \vec{F}_{Ny} = m\vec{a}_y$
• Use +/– signs to represent the direction of the force vectors **<u>and</u>** the acceleration vector. Note: the terms are now magnitudes (no arrow hats); the direction is represented by the +/– signs.	$F_{1y} - F_{2y} + \ldots - F_{Ny} = +ma_y$
• Write the vector components in terms of the original vectors and functions of the angles (sin or cos), when applicable. If the angle is not known, you may leave it as a component.	$F_1 \cos\theta_1 - F_2 \sin\theta_2 + \ldots = +ma_y$
• Identify and solve for the desired quantity.	

Suggestion: Do not carry out algebraic steps until the direction is represented with +/– signs.