Equilibrium of Rigid Bodies

For particles (or "particles") all the lines of action of forces GO THROUGH A POINT.

For general rigid bodies this is *not* true! Therefore, MOMENTS can result. Therefore, we also need

$$\Sigma \vec{M}_{\text{POINT}} = \vec{0}$$

for equilibrium.

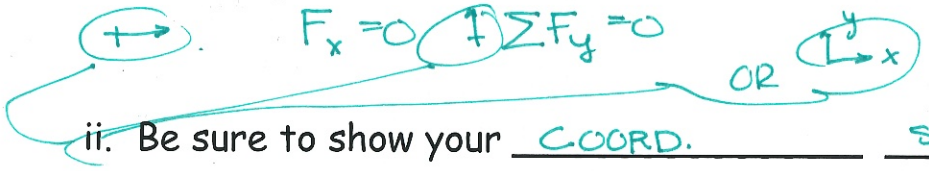
Solution plan

1) IDENTIFY SYSTEM (Draw a FBD!)

2) Apply equilibrium:

- $\Sigma \vec{F} = \vec{0}$

  i. In 2-D usually easier to do in COMPONENT form:

  ii. Be sure to show your COORD. SYS.!

- $\Sigma \vec{M}_{\text{POINT}} = \vec{0}$ IN 2-D ONLY ONE COMPONENT

  What point?

  1. ANY one you want!

  2. Look for WHERE SEVERAL LINES of ACTION of FORCES INTERSECT.

3) Solve equations!

Dos and Don'ts

- *Do* draw the FBD.
- *Don't* assume you know the value of any reaction (force or moment) when you draw them on your FBD. Leave them as unknowns, even if it seems obvious to you what the values are. (You'll be surprised how often you're intuition is wrong!)

- *Do* look at your FBD as you write the equilibrium equations. That's why you drew it!
- *Don't* write equilibrium equations first and then decide how your FBD matches your solution.

- *Do* identify your coordinate system.
- *Don't* assume it's obvious. (It's often much more convenient to use tilted axes!)

- *Do* use symbols in your solution as far as possible before plugging in numbers.
- *Don't* assume all your units work out, and so *do* write your units in each calculation.

- *Do* follow the advice above.
- *Don't* not follow the advice above.