1 Concept Summary For:

1.1 Title: Equilibrium of a Rigid Body

1.2 Key allowable formula(s):

Translational equilibrium: $\sum F_x = 0; \sum F_y = 0$
Torque of a force: $\vec{\tau_A} = F \cdot l_\perp$
Rotational equilibrium: $\vec{\tau_A} = 0$

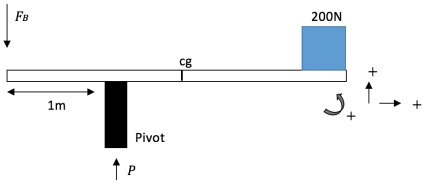
1.3 Definition of each new symbol and its units:

$\vec{\tau_A}$: Torque, turning effect of force in "Nm" A: Point chosen for axis of rotation
$l_\perp$: Moment axis, shortest distance from A to line of vector of G in "m"

1.4 Additional important information:(sign conventions, special characteristics, reference zero values, when concept does not work, special cases, etc)

1. $\vec{\tau}$ is a vector, either clockwise(cw) or counter clockwise (ccw) for direction (usually ccw is positive).
2. $\vec{\tau}$ of a force acting on A is 0
3. If rigid body is in equilibrium, you can close A anywhere. Best to choose at point of most unknown forces- makes $\sum \tau = 0$ which is easier to solve.
4. For finding τ of weight of rigid body, use centre gravity(cg). If the body is uniform then cg is at geometric centre.

1.5 Simple examples or explanations:



A 4m plank, uniform, of 100N has a 200N object at one end:
I can find $\vec{F_B}$ by $\sum \tau_A = 0$(A at point):
$F_B(1m) + P(0) - 100N(1m) - 200N(3m) = 0$
$\rightarrow F(B) = 700N$
I can find $\vec{P}$ by $\sum \vec{F_y} = 0 : \vec{P} - 700N - 100N - 200N = 0$
$\rightarrow \vec{P} = 1000N$

1.6 Relevant knowns and unknowns: (words or phrases from word problems that signal theses)

• Rigid bodies signified by objects such as "ladder", "beam", "plank", etc. watch for parallel force component (require $\sum \tau_A$=0)

• "About to tip" means force of 'other' support or beam is 0

• "About to slip" means $F_S = \mu_s F_N$ if not about to slip do not use this equation