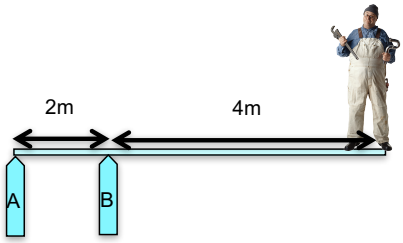
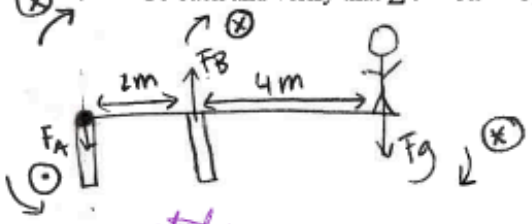
Big Exam #4:

My friend (mass 90 kg) stands at the end of a very light rigid board secured to two pylons as shown at right.



- Please draw and label your own free body diagram, don't just use the diagram I provide.
- Find the force magnitude *and* direction that each pylon applies to the board.
- Go back and verify that $\sum \vec{\tau} = I\vec{\alpha} = 0$, and $\sum \vec{F} = m\vec{a} = 0$.

• Go back and verify that $\sum \vec{\tau} = I\vec{\alpha} = 0$, and $\sum \vec{F} = m\vec{a} = 0$.



$F_g = mg$

$F_g = (90\ kg)(10\ m/s^2) = 900\ N$

$F_B > F_A > F_g$

I would use a rotatational dynamics lens and a linear dynamics lens b/c torque causes angular acceleration = 0, similar to how force causes linear acceleration = 0

$\sum \vec{F} = m\vec{a} \rightarrow -F_A + F_B - F_g = m\vec{a}^{\,0}$

$\sum \vec{\tau} = I\vec{\alpha} \quad \tau_B + \tau_g = I\vec{\alpha}^{\,0}$

$r_B F_B + r_P mg = 0$

$(2m)F_B + (6m)(900\ N) = 0$

$2F_B = 5400\ N$

$F_B = 2700\ N$

A

It is reasonable that F_B is the largest force b/c it must oppose both F_A and F_g.

$-F_A + F_B - F_g = 0$

$-F_A + 2700\ N - 900\ N = 0$

$-F_A = -1800\ N$

$F_A = 1800\ N$

$\sum \vec{F} = -1800\ N + 2700\ N - 900\ N = 0$

$\sum \vec{\tau} = -\tau_A + \tau_B + \tau_g = -(2m)(1800N) + (4m)(900N) = 0$ ✓

$\sum \vec{\tau} = -\tau_A + \tau_B + \tau_g = -(6m)(1800N) + (4m)(2700N) = 0$ ✓

*already solved using τ_A as the pivot point