PAL Problem Set 14 for Phys 5A
(Moment of Inertia and Newton's Second Law for Rotation)

Always explain your answers and show your work.

Problem 1 - The figure shows a simple model of a seesaw. These consist of a plank/rod of mass $m_r = 10 \, kg$ and length $2x$ allowed to pivot freely about its center (or central axis), as shown in the diagram. Two children are modelled as small spheres of masses $m_1 = 30 \, kg$ and $m_2 = 50 \, kg$ as shown.

    A. Where is the center of mass of the assembly?

    B. What is the moment of inertia of the seesaw through the axis that goes through the middle of the plank?

Problem 2 - A solid cylinder with a radius of 4.1 cm has the same mass as a solid sphere of radius R. If the cylinder and sphere have the same moment of inertia about their centers, what is the sphere's radius? *Hint: the moment of inertia of a cylinder about the center is* $I = \frac{1}{2}MR^2$, *and the moment of inertia of a solid sphere is* $I = \frac{2}{5}MR^2$

Problem 3 - A string is wrapped around a uniform solid cylinder of radius r, as shown in The figure shows a cylinder of mass m and radius r that can rotate about its horizontal axis. A string is wrapped around the cylinder. A block of mass m is hanging from the free end of the string. The cylinder can rotate freely about its axis. The loose end of the string is attached to a block. The block and cylinder each have mass m.

Find the magnitude α of the angular acceleration of the cylinder as the block descends.