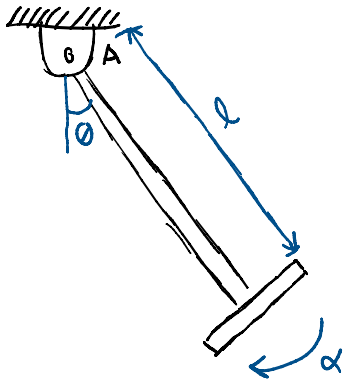20-R-KIN-DK-25   Beginner   Rotation (RBK)

Inspiration: None

A hardworking engineer is developing a playground ride for her kid. If she determines that the maximum angular acceleration of an empty ride in the instant shown should not exceed **5 rad/s^2** due to safety reasons, what should be the length of the rod in which a **1 kg** seat is attached? The seat can be modelled as a thin disk with radius **r = 0.3 m** and the rod, no matter the length, has a mass of **m = 0.6 kg**. The angle in the instant shown is **theta = 45 degrees**. Choose the most realistic value for your final answer.

$$I_A = \frac{1}{3}ml^2 + \frac{1}{4}mr^2 + md^2$$
$$= \frac{1}{3}(0.6)l^2 + \frac{1}{4}(1)(0.3)^2 + (1)\,l^2$$

-5 don't forget

$$\Sigma M_A = I_A \alpha = \left[\frac{1}{3}(0.6)l^2 + \frac{1}{4}(1)(0.3)^2 + l^2\right]\alpha = -\frac{l}{2}\sin 45\,(0.6)(9.81) - l\sin 45 (1)(9.81)$$

$$-6l^2 - 0.1125 + 9.0177327 l = 0 \qquad l = 0.0125807 \text{ or } \boxed{1.46037}$$