

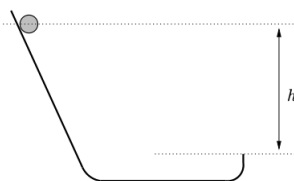
# Rotation Team Problems

Fun With Fiziks

July 14, 2022

## Practice Problems

1. Jonathan has two balls. One is a  $0.5\text{ kg}$  basketball with radius of  $0.1\text{ m}$ , which can be modeled as a hollow sphere. He also has a bowling ball with the same mass and radius, which can be modeled as a solid sphere. Which ball is easier to spin?
2. Luke and Jonathan are on a seesaw. Luke weighs  $60\text{ kg}$  and Jonathan weighs  $50\text{ kg}$ . If Luke sits  $5\text{ m}$  from the point of rotation, how far does Jonathan have to sit to balance the seesaw?
3. A rod has a moment of inertia of  $40\text{ kgm}^2$ . What torque is required to make it have an angular acceleration of  $10\text{ rad/s}^2$ ?
4. A ball of mass  $M$  and radius  $R$  has a moment of inertia of  $I = \frac{2}{5}MR^2$ . The ball rolls down the ramp. The ball is launched vertically upward off a ramp as shown in the diagram, reaching a maximum height  $y_{ball}$ . A box that does not roll with the same mass is released from the same height and reaches a maximum height of  $y_{box}$ . Does the ball or box travel higher?



5. To spin a basketball with a moment of inertia of  $10\text{ kgm}^2$  from rest, Jonathan applies a torque of  $1\text{ Nm}$  for one revolution. How fast is the basketball spinning? (Hint: think about the work-energy theorem  $W = \Delta K$ )
6. A figure skater is spinning with her arms tucked in at distance of  $0.1\text{ m}$  from their body. Then, she extends their arms out to a distance of  $0.5\text{ m}$  from her body. How many times slower does she spin?
7. Given the same ball in Problem 4, what is  $y_{ball}$  in terms of  $h$ ?