# PHY 211 Final: Problem 3

May 4, 2020

## This is only one of the exam problems. You must read the full instructions before starting the exam.

**Instructions:** Solve this problem and submit it to Blackboard before 11:59 PM Syracuse time (Eastern Daylight Time) on Tuesday, May 5. You will submit all three written problems as separate submissions to help us grade more efficiently. There is also a multiple choice set.

## Problem 3

You can roll differently shaped objects up a curved ramp, which launches them into the air at an angle $\theta = 45°$ and height $h = 15\,\text{cm}$. No matter which shape you pick, you always start it out so that it is rolling without slipping with a fixed amount of *total* kinetic energy $K_0 = 1\,\text{J}$ (translational and rotational) before it starts up the ramp.
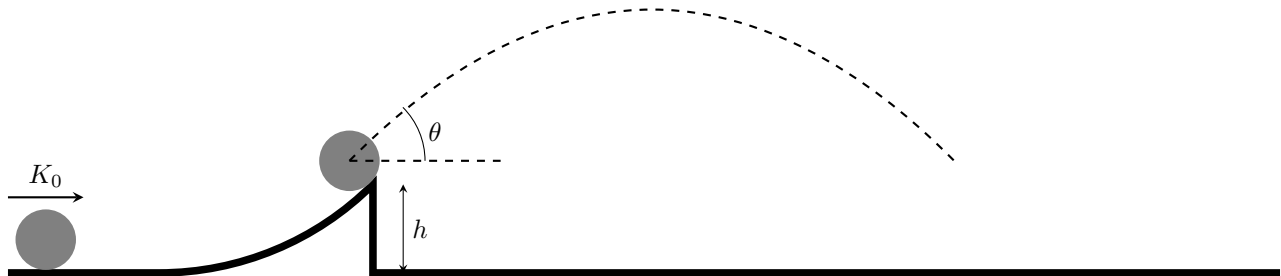
**(a)** (10 points). You have the following rolling shapes: a solid spherical ball, a hollow spherical ball, a solid cylinder, and a hollow cylinder. Each has a radius of $5\,\text{cm}$ and a mass of $100\,\text{g}$. Which one of these will land the farthest from the ramp? Explain your answer. *Note: you may want to start writing some formulas, but you shouldn't need to calculate the actual distance for each shape separately to answer this question.*

**(b)** (15 points). How far from the end of the ramp will the farthest one land?