

# PHY 211 Final: Problem 3

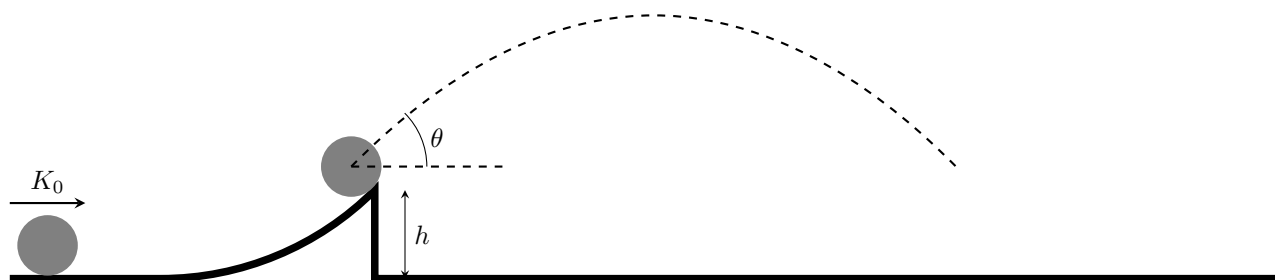
May 4, 2020

**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  $\theta = 45^\circ$  and height  $h = 15$  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  $K_0 = 1$  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 cm and a mass of 100 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?