Physics 211 Final Exam, Question 1

Instructions for this exam:

This exam is in *four separate parts*. **This is not the whole exam; this is part 1 of 4.** It contains the instructions, an academic integrity affirmation, and some short answer questions.

The first three parts are PDF's like this one, similar to Exam 3. You will submit them using Blackboard like you submit your homework and the problems for Exam 3. In general, if there is anything interfering with your ability to submit your responses on time, please notify us as soon as possible.

The last part is seventeen multiple choice questions that you will complete using Blackboard online. In an emergency, if you are unable to use Blackboard, please contact one of the professors for an alternative format.

You may either:

- Write on this document electronically, using a stylus and tablet
- Print this document out and write on it, and submit scans or photographs of it
- Write the answers on your own paper, and submit scans or photographs of it

If you submit scans or photographs, please ensure that you are submitting JPEG or PDF files.
"Live Photos" (from newer iOS devices) and .HEIC files are more difficult for us to work with.

You may:

- Consult any materials on the course website, video library, any of your notes, or the OpenStax textbook for reference
- Contact teaching staff to ask for clarification on any portion of the exam. (We will try to provide quick responses to emails and monitor the Virtual Physics Clinic, WeChat, and Discord.)
- Make use of Google Calculator or similar tools to do arithmetic

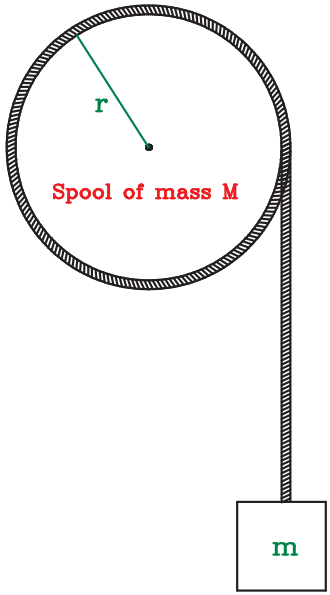
You may not:

- Provide assistance to anyone else in our class on this exam
- Consult online references other than the OpenStax textbook (for example, Chegg and Coursehero) regarding the material on the exam after the exam period begins

Regardless of format, please copy the following text in your submission and sign your name to it:

"I affirm that my answers represent my own work and understanding,
and that I have not given or received unauthorized help on this exam."

A rope is wrapped around a uniform solid cylindrical spool of radius r and mass M. The other end of the rope is attached to a bucket of mass m and released. Since the rope does not stretch, as the bucket falls, the spool must rotate to unwind more rope; it does this without friction.



a) Draw free body diagrams, or extended free body diagrams if appropriate, for both objects. Indicate your choice of translational and rotational coordinate systems. *(4 points)*

b) Write equations that relate the forces on the bucket to its translational acceleration and the forces on the spool to its angular acceleration. *(6 points)*

c) Find the acceleration of the falling bucket in terms of m, M, and g. *(10 points)*

d) If the spool were replaced with a hollow cylinder of the same mass, would the acceleration increase, decrease, or stay the same? Why? *(5 points)*