Week 1 Challenge Homework

Rotational Kinematics

Submission Details | Submit a digital copy (PDF, jpg, etc.) to Canvas. Include solutions to the metacognitive exercise and each question. Please use the interface to associate each page of your submission with the assignment. It makes grading much easier. Please clearly indicate which question is being solved. If data is needed to complete a problem, be sure to cite the source you've acquired your data from. Typed work will not receive credit. See the course website for further details.

Group Submissions | You may submit a group collaboration to Canvas. Add each group member to the submission. Each group member should contribute to the work. Clearly indicate which part of the submission is written by each member (color or labels are preferable).

Sensemaking | You will be asked to apply sensemaking in some problems. More information about sense-making can be found on the BoxSand Sensemaking page, which is linked on the Canvas homepage.

Metacognitive Exercise

Each week will feature a metacognitive exercise, followed by one or two challenge problems to solve. Please handwrite all of your work. The metacognitive exercise will usually ask you to reflect on your solution to the previous week's challenge problems. Because you have no previous week to "metacognate" on, this week's prompt will be a little different. Also, please note that the example solution provided is to a topic of physics we have not covered yet, so don't worry if you don't recognize some of the notation or terms used in the prompt (Friday and Monday's classes should help with this!). You should still be able to answer the questions here.

Provided to you on boxsand is an example solution to a challenge homework question. This solution is located here: https://boxsand.physics.oregonstate.edu/solutions-archive. Check the challenge homework solutions for PH202, there is a link to the example homework solution there (make sure it's PH202, not PH201!). Please note that this solutions archive contains many helpful resources for studying for this course! Explore!

(a) Please read the problem statement (but not the solution, yet!). What module (Rotational Kinematics, Statics & Dynamics, or Rotation & Conserved Quantities) do you think this homework was written for? Briefly, what physical and/or mathematical concepts / ideas / tools do you think will be needed to solve this problem?

(b) Quickly skim (do not read in depth, yet) the solution to the example challenge homework. What two things stand out to you about this solution, initially, before you have read the solution?

(c) Read the solution in depth (finally!), trying to understand each step taken in the solution. Evaluate the solution based on the rubric provided to you in the link in the solutions archive. This is the same rubric by which your challenge homework solutions will be graded.

Category	None, attempted, developing, meets, or exceeds expectations	Reasoning (briefly)
Metacognition		
Clarity of Communication		
Earnest Attempt		
Physical Representation		
Sensemaking		

(d) In two to five sentences, what ideas, concepts, or approaches will you take, either from the sample solution or your metacognitive analysis here, and apply to your solution to the rest of this week's challenge homework?

Question 1:

So far in your life, you may have assumed that as you are sitting in your chair right now, you are not accelerating. However, this picture is not quite complete! You are on the surface of the Earth, which is rotating. Which means you are in Uniform* Circular Motion about the North-South axis of the Earth!

(a) What is the linear acceleration of a person sitting in a chair on the equator?

(b) If you were sitting at the equator, would your mass times the gravitational acceleration of the Earth (mg) be greater than, less than, or equal to the normal force exerted on you by the chair you are sitting on? Explain.

(c) The latitude of Corvallis is 44.4°. If you were sitting in a chair in Corvallis, what would be your linear acceleration?

(d) A classmate of yours asks you why we have ignored this acceleration for the whole first term of physics. "Is everything we've learned a lie?" they ask. Assuming you are at the equator, use order of magnitude sensemaking arguments to assuage their fears. To do this, please answer the following prompts:

   a. Make a prediction for whether or not the approximation we made in PH201 was reasonable.

   b. Using order of magnitude sensemaking, make a comparison between your answer to part (c) and a common acceleration found in PH201. Do this by answering the following prompts:

      i. What is the order of magnitude** of the acceleration of an object in free fall on Earth?

      ii. What is the order of magnitude of your answer to question (c)?

      iii. How do these orders of magnitude compare?**

   c. Was it an appropriate approximation to assume, as we did for all of PH201, that our acceleration was zero? Explain why, or why not.

*actually, the rotational speed of the Earth is decreasing with time at a rate of about 1.7 milliseconds per century! This means, as we will discover in the conserved rotational quantities lectures, that because angular momentum must be conserved, the moon is moving slowly away from us! We can safely ignore the slowing of the Earth's rotation for this problem.

**Wikipedia has a good article on order of magnitude, here: https://en.wikipedia.org/wiki/Order_of_magnitude