Test 3

Parts of Test 3 are going to look similar to Test 2, but some parts will be different. Plus I wanted to get everything written up clearly so that we can make sure there is no confusion! Or at least that is the idea behind this document. As this is a test, I'm expecting you to work independently on your problems and solutions. You are free to consult any other resource (including the internet), just not other people. With that said, here is what I would like from you for Test 3.

Part I: This portion will look very similar to Test 2. On the last page are a summary of all the learning objectives from this section. You need to choose TWO (and you can't choose whatever objective you assign to Part II below here), and write a short question that would test that objective. Things to keep in mind:

- It should be a test question! That is, one that you could complete in 10 minutes or less from start to finish.
- It should satisfy the learning objective.
- It can take inspiration from other problems, but should be your own original problem. No just changing the numbers from some other problem. Creating a problem is part of showing me you understand a concept. Make sure that is clear.

As before, you should prepare 1 pdf that is just the questions and then another pdf that is your **worked out** solutions to the two questions. The scoring rubric will look mostly like Test 2, where I will give points for:

- 0-4 points for how well our solutions match.
- 0-2 points for if it was clear what I was supposed to be doing in a problem.
- 0-1 points for if the problem met the objective.
- 0-1 points for if I could complete the problem in under 10 minutes.

And then I'll give you 1 extra credit point again if you give both problems a connecting theme!

Part II: This will look similar to a video homework submission, except that I am giving you the problem instead of you creating it yourself. The rest should look like a normal video homework assignment. In a sub 5 minute video, record yourself solving and explaining your work as you go. As per usual, you can always write out or prepare your solution beforehand and then just walk me through it, but make sure it is clear to me both what you are doing and why you are doing it! In addition to your normal explanation, please clearly identify which of the learning objectives the question is based on, and you can not choose that same objective for one of your Part I questions. This portion will be scored according to:

- 1 point for correctly identifying the applicable learning objective.
- 4 points for the solution to both parts being accurate and numerically correct.
- 4 points for the explanation for both parts being correct and showing strong understanding.
- 1 point for the video being well made, with audio clear and easy to understand and everything rotated properly and legible.

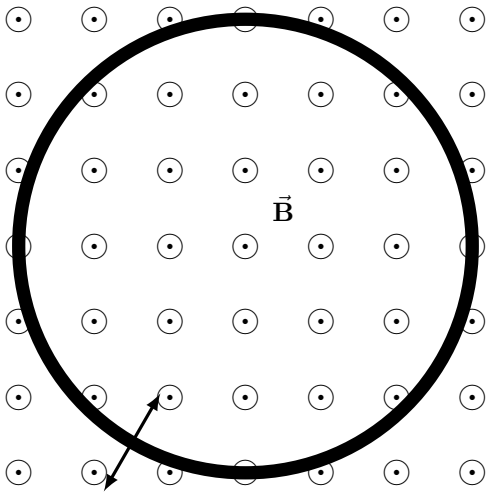
While the test would normally be happening on Friday (and we still won't have class on Friday), given my backlog of grading at the moment, there is no way I'll be able to start scoring them until next week. So I'm allowing you the weekend to submit everything as well. So by Sunday night at midnight, I should have received an email from you with:

1. 1 attached pdf of your 2 created test questions
2. 1 attached pdf of worked out solutions to your 2 created test questions
3. 1 linked video of you solving out the question provided on the next page

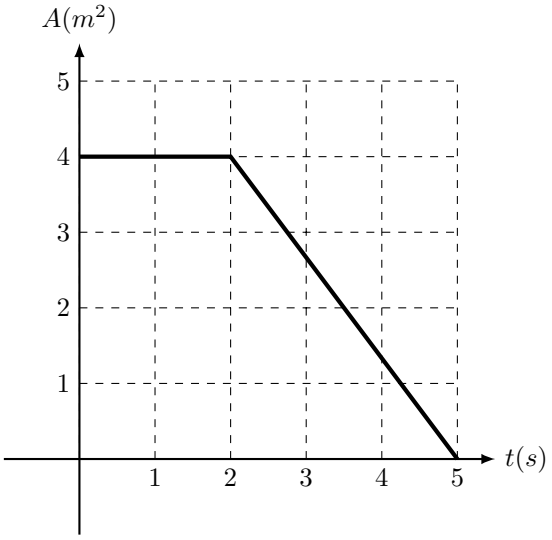
Please make the subject line: Test 3 Submission, so I can be sure to not lose it amidst the flood of emails I get these days. If you have any question about what I am expecting or if I made any game-breaking typos anywhere, please do not hesitate to ask! Either via email or Campuswire! Good luck!

Part II Question: Answer this in video homework fashion.

1. Voldemort needs to induce a current in a single, variable-area loop in order to power his latest spell. The area of the loop changes with time according to the plot to the below right. The geometry and orientation of the situation is shown to the below left. If the loop is placed in a constant 15 T magnetic field, what is the potential difference around the loop **and** in what direction is any induced current flowing at:
   (a) $t = 1\,\text{s}$
   (b) $t = 4\,\text{s}$



Variable size loop



Below is a summary of the objectives pulled from each homework in this section.

- **HW16:**
  - I understand how to calculate magnetic forces due to moving charges or currents.
- **HW17:**
  - I understand how the Hall effect voltage is related to electric properties of materials.
- **HW18:**
  - I can calculate motional emfs and determine how they interact with their surroundings.
- **HW19:**
  - I can compute field fluxes through various surfaces.
  - I understand how the total flux through a surface relates to the charge enclosed.
- **HW19b:**
  - I can use Gauss's Law to reason about the relationship between source charges and electric fields.
- **HW20:**
  - I can use Faraday's law to calculate the emf associated with the curly electric field.
- **HW21:**
  - I can utilize Maxwell's version of Ampere's Law to correctly determine the effects of changing electric fields.
- **HW22:**
  - I can use properties of electromagnetic radiation to determine aspects about the magnetic or electric fields.
  - I can use the Poynting vector to relate radiation to energy transfer.
- **HW23:**
  - I understand how oscillating charges create sinusoidal radiation.
  - I understand the basics of how radiation interacts with matter.
- **V8:**
  - I can use Ampere's Law to to determine an unknown current or magnetic field given information about the other and the system geometry.