PHYS 259 L04: Assignment 3
Marking feedback (general to class)

For class on January 27, 2017

(1)

To get a full mark you needed a full explanation. This can be found in the solutions. Broken down, key points that needed to be addresed were:

- Washer → series of concentric rings with different radii
- Superposition of **electric field contributions** from infite number of rings **of inifinitesmal thickness** (i.e., dr)
- Field at P is integration of **infinitesimal** electric field contributions between inner and outer radii

(2)

- Follows directly from taking dE/dq for the E_{ring} provided. Answer in solutions.

(3)

- The relevant surface area element, dA, can be found in a several ways.
- Because we want to integrate rings in the *radial* direction, the relevant dA is the area between a ring with radius r and one with radius $r + dr$.
- This can be thought of:
  1. As a circle of circumfrence $2\pi r$ and thickness dr : $dA = circumfrence \times thickness = 2\pi r dr$
  2. Via the derivative of a circle with radius r and area A:
     $dA/dr = d(\pi r^2)/dr$
     $dA = 2\pi r dr$
  3. As finding the area between a circle of radius r and radius (r+dr) manually:
     $dA = \pi(r + dr)^2 - \pi r^2$
     $= \pi(r^2 + 2rdr + dr^2 - r^2)$
     $= \pi(2rdr + dr^2)$
     $= 2\pi r dr$ (since $dr \to 0$, dr^2 is negligable and we ignore it)
- Note: dA is an *infinitesimal* area element. It is *not* the total area between the inner and outer rings.
- Correct answer was only 1/2. You have to show work that demonstrated you were using one of these methods. If you chose to do method (3) and used, e.g., r_2 and r_1, that was fine, but you had to show a substitution from $r_2 \to r_1 + dr$ for it to be correct.
- In addition, careful with r and R. R and 2R were inner and outer radii with fixed value (constants) so they should not be your variables. r is the variable.

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(4)

- Answer should follow the steps in the solutions.
- Many people lost marks for the intemediary step ($dq = \sigma dA$). This step was key.
- Many tried to start with $\sigma = Q/A_{total}$ where Q was total charge and A_{total}. These are all constants. However, q and A are variables. I can choose any section of the washer, find it's area, A and multipy by σ to get the charge of that particular area. Pay attention to what in your problem is a variable and what is a constant.

(5)

- Answer in solutions.
- You needed to show all your work - i.e., write the expression for dE from question (2), with the next step showing that you subbed dq with the soltuion from (4). Those who immediately made the substitution BUT wrote explicitly the substitution they were making, were still given full marks.
- It should have been an expression for dE, not just the integral.
- Careful with your variables (e.g. the integral of E is NOT the same as the integral of dE. E = integral of dE).
- NOTE: Those who had incorrect dA or $d\sigma$ but plugged into dE correctly got full marks for question 6 (if all the steps were carried out right). You should **not** do all your work and at the end pretend it equals one of the multiple choice questions.