Symmetries & Idealizations Homework 2

Due 10/2/15 @ 4:30 pm

QUIZ:

1. If $z_1 = 5e^{7i\pi/4}$, $z_2 = 3e^{-i\pi/2}$, and $z_3 = 9e^{(1+i\pi)/3}$, express each of the following complex numbers in rectangular form, i.e. in the form $x + iy$ where x and y are real.

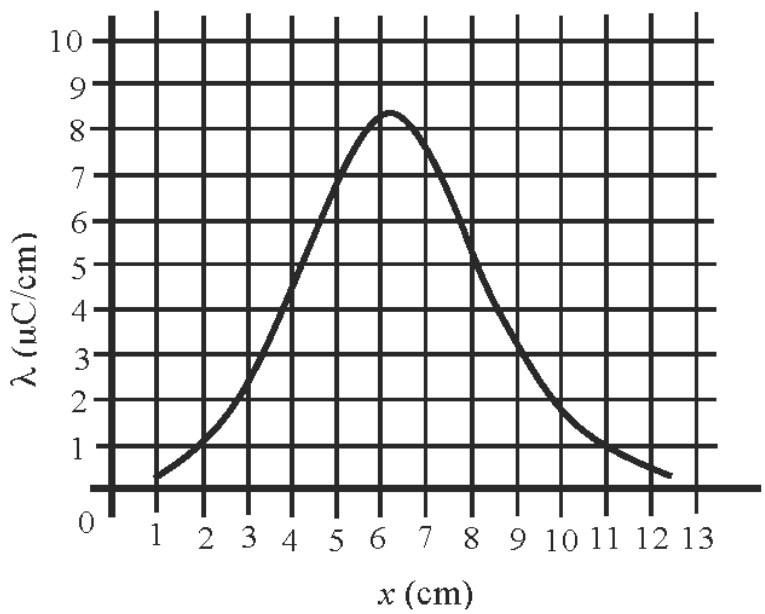
   (a) $z_1 + z_2$

   (b) $z_1 z_2$

   (c) $\frac{z_2}{z_3}$

REQUIRED:

2. The following graph represents the charge density on a thin piece of plastic (dielectric). Find the charge on the segment between centimeter 3 and centimeter 10.



3. For the data you collected from the integration machine, or you can use our data listed below, write a **short but clear** report finding the potential energy stored in the machine.

   Decide for yourself what sections you need in your report. At a minimum, include a clear statement of the problem you are trying to solve, a description of the apparatus,

a description of how you collected your data, the data itself, a clear description of how you analyzed the data, and a clear statement of what you can conclude from your analysis. Use a combination of words interlaced with other representations (equations, tables, graphs, etc.). Your intended audience is a student from next year's class who hasn't done the experiment. They should be able to replicate your experiment and analysis without difficulty. You still don't officially know what is underneath the black box, so you don't need to describe that.

Data for Integration Machine

Mass(gm)	Position (mm)
50	15.2
60	15.5
80	15.9
100	16.5
150	17.8
200	18.9
250	19.8
300	20.5
350	21.2
400	21.6
450	21.9
500	22.1
550	22.3
600	22.4
650	22.5
700	22.6
750	22.7

4. Use *Mathematica* to plot the real and imaginary parts of e^z for $z = x + iy$, x and y real.

5. (a) Charge is distributed throughout the volume of a dielectric cube with charge density $\rho = \beta z^2$, where z is the height from the bottom of the cube, and where each side of the cube has length L. What is the total charge inside the cube? Do this problem in two ways as both a single integral and as a triple integral.

   (b) Charge is distributed on the surface of a dielectric cube with charge density $\sigma = \alpha z$, where z is the height from the bottom of the cube, and where each side of the cube has length L. What is the total charge on the cube? Don't forget about the top and bottom of the cube.