Symmetries & Idealizations Homework 5

Due 10/14/15 @ 4:30 pm

QUIZ:

1. Be able to give the first four nonzero terms of the power series for $\sin z$, $\cos z$, e^z, $\ln(1+z)$, and $(1+z)^p$.

PRACTICE:

2. Using integration, find the surface area of a cone.

REQUIRED:

3. A helix with 17 turns has height H and radius R. Charge is distributed on the helix so that the charge density increases like the square of the distance up the helix. At the bottom of the helix the linear charge density is $0\,\frac{\text{C}}{\text{m}}$. At the top of the helix, the linear charge density is $13\,\frac{\text{C}}{\text{m}}$. What is the total charge on the helix?

4. A conical surface (an empty ice-cream cone) carries a uniform charge density σ. The height of the cone is a, as is the radius of the top. Find the potential at point P (in the center of the opening of the cone), letting the potential at infinity be zero.

5. For the data you collected from the derivatives machine, write a **short but clear** report finding the derivative
$$\frac{dx}{dF}$$
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 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.

   We have been spending a lot of class time on representations, so think carefully about what data you need to include and how you will best represent it and briefly justify your choices in your report.