Physics 7311 Professor Scalise
Homework Assignment #9 Fall 2022

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23. A thin flat conducting circular disk of radius R is located in the xy-plane with its center at the origin and is maintained at potential V with the convention that $V = 0$ infinitely far away. I will tell you that the charge density on the disk is proportional to $(R^2 - s^2)^{-\frac{1}{2}}$ in cylindrical polar coordinates rather than have you derive it.

    (a) What is the volume charge density scalar field $\rho(\vec{r})$ everywhere, in cylindrical coordinates? (This will require Dirac delta functions and there should be no arbitrary constants.)

    (b) Find the potential on the z-axis.

    (c) Find the capacitance of the disk and compare this to the capacitance of a sphere of radius R. See also page 19 of Jackson 3rd ed. for Henry Cavendish's measurements.

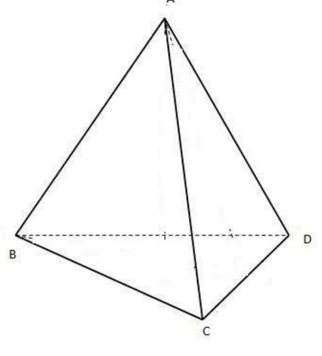
24. The northern hemisphere with radius R is coated with uniform monopole density σ.

    (a) Find the potential on the z-axis and graph it.

    (b) Find the electric field, magnitude and direction, just under the north pole ($z = \lim_{\epsilon->0} R - \epsilon$).

    (c) Find the electric field, magnitude and direction, just over the north pole ($z = \lim_{\epsilon->0} R + \epsilon$).

Bonus:(5 points) Due when the homework is due.



If each vertex of a tetrahedron is connected by a resistor R (6 in total), what is the equivalent resistance from one vertex to another?

If each vertex of a cube is connected by a resistor R (12 in total), what is the equivalent resistance from one vertex to an adjacent vertex (connected by a cube edge)?