Self-Directed Project 4 – Laplace's Equation in Cylindrical Coordinates

Due 27 October, 2009, 5 pm

Worth: 15 pts toward final grade

Write Laplace's equation in cylindrical coordinates.

1. A cylindrical capacitor consists of two concentric (infinite) cylinders. The inner cylinder has a radius of 3.00 cm. and is grounded. The outer cylinder has a radius of 3.02 cm and is held at a potential of 12.0 V. Find the potential at r=3.01 cm.

2. Use separation of variables to obtain the general 3D solution. Write up and submit this solution.

3. Use separation of variables to obtain the 2D solution for the case in which the potential is independent of z. Write up and submit this solution for the cylindrical harmonics (more properly called the polar harmonics). Make sure your solution is complete. (Hint: what about an infinite straight wire?)

4. Do problems 3.24 and 3.25 from Griffiths.