

SP352 HW #5

“The Laplace Equation—Solution & Applications” handout:

WUP = warmup problems on pages 65 to 66

SL = regular problems on pages 66 to 98

due Thursday 28 February by 0900:

- (a) WUP #1—Assume that the two constants c and k are positive.
- (b) WUP #2—The problem is asking you to verify the Laplace equation for 4 different functions.
- (c) SL #1—To be clear, the corner values starting at the top right and proceeding clockwise are 0, 0, 0.5, and 0.5. Each of you needs to do your own work in Excel. Three plots are requested, plus the spreadsheet values after the final iteration. For the surface plot, do a “3-D Surface” plot. Note that the instructions are a little different for Excel 2010: Go to File > Options > Formulas: then set Workbook Calculation to “Manual” with “Recalculate workbook before saving” unchecked, click “Enable iterative calculation” and set Maximum Iterations first to “1” then later increase it to as high as “10,000”. After clicking OK, hit F9 repeatedly to update the spreadsheet and watch the values start to change. Format the interior cells as “Number” with 3 decimal places.
- (d) SL #2—Making the array 300 wide is of course a crude approximation to infinite width. You may find it easier to do a 301×21 grid in Excel, rather than 21×300 . In that case, index the top edge as 0 to 20 with values of 1 (except 0.5 at the corners) and the left edge as 0 to 300. Fix the value of b at 20. You should make two surface plots: one of the iteration results and the other of values computed using Griffiths’ formula; if you have done things right, the two should look identical!
- (e) SL #12

Footnote: I have written up a step-by-step derivation of the Griffiths’ formula used in problem (d) at <http://usna.edu/Users/physics/mungan/Scholarship/GriffithsFormula.pdf>.