ENEE 380: Homework #2

Due: Tuesday Sept. 22, 2009

Jackson: Problems 1.7, 1.15, 1.21, 1.22

Also,

2.A Two dimensional solutions of Laplace's equations in Cartesian coordinates are easy to come by. Let $z = x + iy$ be a complex number, and $f(z)$ <u>any</u> complex analytic function of z. Examples of analytic functions are: z^n, $\sin z$, e^z ... The complex function f will have a real part $f_R(x,y)$ and an imaginary part $f_I(x,y)$ each of which depend on x and y. Both f_R and f_I can be regarded as the real functions of x and y as well as the real and imaginary parts of the complex function $f = f_R + i f_I$.

Show that f_R and f_I are both solutions of Laplace's Equation. Along the way you must first show the following (Cauchy-Riemann) equations,

$$\frac{\partial f_R}{\partial x} = -\frac{\partial f_I}{\partial y}, \qquad \frac{\partial f_R}{\partial y} = \frac{\partial f_I}{\partial x}.$$

Take $f(z)$ to be arcsin(z). Make contour plots of the potential corresponding to the real part of f. What problem is this the potential for?