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 $f(z)$ any complex analytic function of $z$. Examples of analytic functions are: $z^n$, $sinz$, $e^z$ ... 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,

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

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