Do the following problems from the text

**P.4-4, P.4-6, P.4-7**

Run the MATLAB program:

```matlab
x=-4.05:.1:4.05;
 y=-4.05:.1:4.05;
[xx,yy] = meshgrid(x,y);
cz = xx + i*yy;
cpot = asin(cz);
pot = real(cpot);
contour(xx,yy,pot,10)
```

Describe a physical placement of electrodes that would produce a potential of the form shown. Modify the above program using the 'quiver' and 'gradient' commands to plot the electric field vector lines.

**Also**

Two dimensional solutions of Laplace's equations in Cartesian coordinates are easy to come by. Let \( z = x + jy \) be a complex number, and \( f(z) \) any complex analytic function of \( z \). Examples of analytic functions are: \( z^n, \sin z, e^z \) ... basically, almost anything you can imagine. 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 \( f = f_R + j f_I \).

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,

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

This follows from

\[
\frac{\partial f}{\partial x} = f'(z), \quad \frac{\partial f}{\partial y} = j f'(z).
\]

Then it is easy to show
\[
\frac{\partial^2 f_R}{\partial x^2} + \frac{\partial^2 f_R}{\partial y^2} = \frac{\partial^2 f_I}{\partial x^2} + \frac{\partial^2 f_I}{\partial y^2} = 0 .
\]

Figure out which function \( f \) was used in the MATLAB program listed above. Play with other functions and try to figure out what placement of electrodes is needed to realize the potentials.