**Fall 2009 - Math 463 Section 0201**
**Complex Variables for Scientists and Engineers**
Homework #11 - Not due

1. Determine the zeros and their order for the given function
   (a) $f(z) = \sin^2 z$
   (b) $f(z) = ze^z - z$
2. Determine the order of the poles for the given function
   (a) $f(z) = \tan z$
   (b) $f(z) = \dfrac{\sin z}{z^2 - z}$
   (c) $f(z) = \dfrac{e^z}{(e^z - 1)^2}$
3. Find the residue at each pole of the given function
   (a) $f(z) = \dfrac{e^z}{e^z - 1}$
   (b) $f(z) = \dfrac{z + 1}{\sin z}$
4. Evaluate the Cauchy principal value of the given improper integral
   (a) $\displaystyle\int_{-\infty}^{\infty} \frac{1}{(x^2 + 4)^2} dx$
   (b) $\displaystyle\int_{-\infty}^{\infty} \frac{x^2 + 1}{x^4 + 1} dx$
5. Evaluate the Cauchy principal value of the given improper integral
   (a) $\displaystyle\int_{-\infty}^{\infty} \frac{\cos x}{x^2 + 1} dx$
   (b) $\displaystyle\int_{-\infty}^{\infty} \frac{\cos(3x)}{(x^2 + 1)^2} dx$
6. Use an indented path to show that

$$\text{P.V.} \int_0^{\infty} \frac{1 - \cos x}{x^2}\, dx = \frac{\pi}{2}$$