Physics 50 **Assignment #13** **Spring 2010**

The topic this week is **Complex Variables.**

Readings: Riley, Hobson, and Bence - Chapter 24
Boccio - 17_ComplexVariables

Problems:

EP-11 Some Elementary Functions - Write answers in form a+bi

(a) $(-1)^{1/3}$ (b) $\sqrt{2-i}$ (c) $(-1-i)^{-1/2}$

EP-12 Find the Taylor series expansion for $f(z) = \ell n(1+z)$

EP-13 Use known Taylor series expansions about the origin to determine

$$f(z) = \frac{\sin z}{1-z}$$

EP-14 For each function, find all the Taylor series and Laurent series expansions about the point z = a and state the region of convergence

$(a)\quad \frac{1}{z} \quad , \quad a=1$

$(b)\quad \frac{1}{z^2+1} \quad , \quad a=i$

$(c)\quad \frac{1}{(z+1)(z-2)} \quad , \quad a=2$

EP-15 Find the residue of each function at each pole.

$(a)\quad \frac{1}{z^2}\sin 2z \qquad (b)\frac{\cos z}{z^2+2z+1}$

EP-16 Evaluate each integral around the circle $|z|=2$.

$(a)\quad \oint \frac{\sin z}{z^3}dz \qquad (b)\quad \oint \frac{\sin z}{z^3-z^2}dz \qquad (c)\quad \oint \frac{z^2+1}{z(z+1)^3}dz$

EP-17 Determine the value of each real integral.

$(a)\quad \int_0^{2\pi} \frac{d\theta}{(2+\cos\theta)^2} \qquad (b)\quad \int_0^{2\pi} \frac{\sin 2\theta d\theta}{5+4\cos\theta}$

EP-18 Evaluate each integral.

$$(a)\quad \int_{-\infty}^{\infty} \frac{1+x}{1+x^3}dx \qquad (b)\quad \int_{-\infty}^{\infty} \frac{\cos x}{(1+x^2)^2}dx \qquad (c)\quad \int_{0}^{\infty} \frac{\cos x}{1+x^4}dx$$

EP-19 Find the value of

$$\int_{-\infty}^{\infty} \frac{1}{x^4-1}dx$$

using a closed path where you have a large semicircle in the upper half-plane and you integrate around(small semicircles in upper half-plane) the two poles on the real axis.