HW 13 Advanced Computational Physics

November 22, 2005 Due November 29

1. Evaluate
$$\oint_C \frac{dz}{(z-i)(z-3)}$$
where C is the square of side 4 centered on the origin with sides parallel to the real and imaginary axes.

2. Evaluate
$$f(k) = \int_{-\infty}^{\infty} \frac{e^{ikx}}{(x+3i)^2}\, dx$$
for real k.

3. Consider $f(x) = e^{-|x|}$.

   (a) Compute the Fourier Transform
   $$F(k) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} dx\, f(x) e^{-ikx}.$$

   (b) Using $F(k)$ from (a), compute the inverse Fourier Transform
   $$f(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} dk\, F(k) e^{ikx}$$
   and make sure you get the original function $f(x)$.

4. Repeat the preceding problem using $f(x) = 1/(x^2+4)^2$.

5. Repeat the preceding problem using
$$f(x) = \begin{cases} xe^{-x}, & x > 0 \\ 0, & x < 0. \end{cases}$$