Physics 3344 **Professor Scalise**

Fall 2006 **Assignment #10**

Due: 9 November 2006

1. Verify that the orthonormal basis $\{\hat{n}_1, \hat{n}_2, \hat{n}_3\}$ given in lecture is complete by showing that $\sum_{n=1}^{3} \hat{n}_{ni}\hat{n}_{nj} = \delta_{ij}$

2. Find the first four non-zero Fourier coefficients for the continuous triangle wave. How does the n'th term depend on n? Plot your Fourier approximation to the function. Mathematica is useful here.

3. Find the first four non-zero Fourier coefficients for the discontinuous square wave. How does the n'th term depend on n? Plot your Fourier approximation to the function. Mathematica is useful here.

4. Consider the first full period of the sine function:$\sin(x)$, $0 < x < 2\pi$.

   (a) Expand this in a Fourier **cosine** series and list the first four non-zero Fourier coefficients. This is not a trick question - the answer is not zero or "it's impossible".

   (b) Plot the original function and your four-term approximation using a computer for the range $0 < x < 2\pi$.

   (c) Plot the original function and your four-term approximation using a computer for the range $-2\pi < x < 0$. Comment.

   (d) Expand $\sin(x)$, $0 < x < 2\pi$, in a Fourier sine series.