PHYS 301  
HOMEWORK #3 
Due : 4 Feb. 2015

1. Refer to the Fourier series you derived for problem 3 on Homework #2. Use Dirichlet’s Theorem to determine expressions for $\pi$ (or $\pi^2$) by evaluating the series at $x = 0$, $\pi/2$ and $\pi$. For all the Fourier series below, find the Fourier coefficients and write out the first three non-zero terms of each trig series.

2. Find the Fourier series for $f(x) = 1 + x$ on:
   a) $0 < x < 4$
   b) $-2 < x < 2$

3. Find the Fourier series for $f(x) = x$ on:
   a) $-\pi < x < \pi$
   b) $-3 < x < 3$

4. Find the Fourier series for $f(x) = \begin{cases} -1, & -1 < x < 0 \\ 1, & 0 < x < 3 \end{cases}$

5. Use Mathematica to plot three full cycles of the Fourier series you derived for problem 4.

6. Write short Mathematica programs based on the following scenario: At the start of a ten year period ($t = 0$) you have $1000 in a bank account which draws 4% interest each year (so that your account accrues 1% interest every 3 month period). At the end of each three month cycle, you deposit $100 in your account. If you make no other deposits and no withdrawals, how much money will be in your account in 10 years? Write 3 programs to compute this value, one using a (or more) Do Loops, one using a For statement, and one using a While statement. (At the end of the three months, your initial $1000 has earned $10 in interest, and you then deposit $100, so your amount after 3 months is $1110.00; after six months you have $1221.10)