PHYS 301
HOMEWORK #8

Due : 30 March 2012

For problems 1 and 2, compute the complex Fourier coefficients for the indicated functions and write out the first the non zero terms of the complex series to $c_5$and c_{-5}. Use these coefficients to write out the corresponding Fourier sin-cos series. Compute the coefficients by hand, although you may use *Mathematica* to verify your solutions. For all problems, you may use symmetry arguments to facilitate the computation of coefficients, but you must explain explain how symmetry yields your results.

1. Consider the function :

$$f(x) = \begin{cases} 0, & -\pi < x < \pi/2 \\ 1, & \pi/2 < x < \pi \end{cases}$$

2. Consider the function :

$$f(x) = \begin{cases} -x, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$$ (intervals have been corrected; use these intervals for this Q)

For problems 3 - 5, you may use Mathematica to compute the definite integrals and also to determine the coefficients, but you must submit any Mathematica output you have with your assignment. Write out the first three non zero terms of each series and also plot 3 cycles of the Fourier series :

3. $f(x) = x, \; -1 < x < 1$

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

5. Problem 9 - 23 from Boas on p. 371

6. Mathematica Assignment :

Consider the differential equation :

$$\frac{dy}{dt} = \cos(y\,t) + 1 \text{ with } y(0) = 1$$

Write a short Mathematica program and use Euler' s Method to find a numerical solution for y (t) in this equation and plot your solution for y (t) from t = 0 to to = 10 s. You must use Euler' s method

and discretization techniques.

Submit your solution and plot as a .nb file electronically so I can compile your program and verify results. Answer the following questions about your solution either in the .nb file or with the rest of your homework. Show complete work and/or provide complete explanations for your answers :

What is the minimum value of the derivative? For what values of y and t does the function decrease? Why does the frequency oscillatory behavior of the solution increase as t increases?

Grading on Question 6: 10 pts for the program and 10 pts for the written explanations.