PHYS 301

HOMEWORK #4

Due : 7 Feb. 2014

Do all integrals by hand and show your work or justify results using symmetry arguments. For questions 1 - 5, determine the Fourier coefficients for the indicated series and write out explicitly the first three non zerms of each series. Use trig series (not exponentials).

1. $f(x) = \cos(\pi x) \quad -1/2 < x < 1/2$

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

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

4. $f(x) = \begin{cases} 1 + 2x, & -2 < x < 0 \\ 1 - 2x, & 0 < x < 2 \end{cases}$

5. $f(x) = e^{-2x}, \quad -2 < x < 2$

For each of the series you obtain in questions 1 - 5, use Mathematica to verify that your series are accurate by plotting the (at least) 50 non zero terms of each expansion over three full cycles of the function. Submit your output with your homework. You must use a closed form expression to represent the terms of the Fourier series (in other words, you may not write out each term explicitly. For example :

```
Plot[(8 / π^3) Sum[Sin[n π x] / n^3, {n, 1, 50}], {x, -3, 3}]
```

is the acceptable code for plotting the answer to question 15 c in the text (p. 363). Do not try to write this as :

```
Plot[(8 / π^3) (Sin[π x] + Sin[2 π x] / 8 + Sin[3 π x] / 27 + ...), {x, -3 π, 3 π}]
```