PHYS 301
HOMEWORK #2

Due : 24 Jan. 2014

1. Review problem 4 from the first homework assignment. Compute the value of

$$(dx)^2 + (dy)^2$$

in terms of ρ and ϕ. What is the geometric meaning of this result?

2. Use the following formulae for sin/cos addition :

$$\sin(a \pm b) = \sin a \cos b \pm \cos a \sin b$$
$$\cos(a \pm b) = \cos a \cos b \mp \sin a \sin b$$

to show that

$$\int_{-\pi}^{\pi} \cos(m\,x) \cos(n\,x)\, dx = 0 \text{ for } m \neq n \text{ (and m, n are integers)}$$

and

$$\int_{-\pi}^{\pi} \sin(m\,x) \sin(n\,x)\, dx = 0 \text{ for } m \neq n \text{ (m, n integers)}$$

In problems 3 - 6, find the Fourier coefficients for the indicated functions, and write out explicitly the first three non - zero terms of each series (i.e., sin and/or cos series). You must show explicitly how you compute all integrals, although you may use symmetry arguments when appropriate to determine the values of integrals.

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

4. $f(x) = \text{Abs}[x], \quad -\pi < x < \pi$

5. $f(x) = \begin{cases} 0, & -\pi < x < 0 \\ \cos x, & 0 < x < \pi \end{cases}$

6. $f(x) = 1 - x, \quad -\pi < x < \pi$

7. Using the Fourier coefficients you compute for problem 6, use Mathematica to plot the first 10 non zero terms of the Fourier series on the interval $(-3\pi, 3\pi)$. Please submit your Mathematica output with your homework assignment.