Homework 2

Math 4306 - Partial Differential Equations

Dr. Mewomo

Do all the problems. Type each one up using latex and submit on or before the due date.

1. Given the function $f(x) = x^2$.

   (a) Find the Fourier series of f over $(-\pi, \pi)$.

   (b) Using (a), show that $\frac{\pi^2}{12} = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^2}$.

   (c) Using (a) and Parseval's identity, show that $\frac{\pi^4}{90} = \sum_{n=1}^{\infty} \frac{1}{n^4}$.

2. Given the function

$$f(x) = \begin{cases} 0, & \text{if } -\pi < x \leq 0 \\ \sin x, & \text{if } 0 < x \leq \pi \end{cases}$$

   (a) Find the Fourier series of $f(x)$ over $(-\pi, \pi)$.

   (b) Using (a) and Parseval's identity, show that

$$\frac{\pi^2}{16} - \frac{1}{2} = \sum_{k=even} \frac{1}{(k^2-1)^2}.$$

3. David L. Powers Sixth Edition - Section 1.9 Exercise 1 (a), (b)

4. David L. Powers Sixth Edition - Section 1.9 Exercise 2

5. David L. Powers Sixth Edition - Section 1.9 Exercise 5 (c)