Fourier Analysis

Assignment 3

20181015

Name : _____

Student ID : _____

1. Use (5) in Section 2.5 to compute E_N for $N = 1, 2, 3$.
   $f(x) = \begin{cases} 1, & \text{if } 0 < x < 1 \\ -1, & \text{if } -1 < x < 0 \end{cases}$
   Fourier Series : $\frac{4}{\pi} \sum_{k=0}^{\infty} \frac{1}{(2k+1)} \sin(2k+1)\pi x$
   Hint : (5) $E_N = \frac{1}{2p} \int_{-p}^{p} f(x)^2 dx - a_0^2 - \frac{1}{2} \sum_{n=1}^{N} (a_n^2 + b_n^2)$
2. Use Parseval's identity and the Fourier series expansion
   $\frac{x}{2} = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n} \sin nx, \quad -\pi < x < \pi$
   to obtain
   $\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$
3. Find the complex form of the Fourier series of the given 2π-periodic function
   $f(x) = \cosh ax$ if $-\pi < x < \pi$ ($a \neq 0, \pm i, \pm 2i, \pm 3i, \ldots$)
   Hint : Example 1 in Section 2.6 of the textbook.

Reading Materials : Section 2.4, 2.5, 2.6 of the textbook.