Fourier Analysis

Assignment 6

20181029

Name : _____

Student ID : _____

1. Roughly plot the convolution result of the given functions.

$$f(x) = \begin{cases} 1, & \text{if } -0.5 \le x \le 0.5 \\ 0, & \text{otherwise} \end{cases}$$

$$g(x) = \begin{cases} 1, & \text{if } -0.25 \le x \le 0.25 \\ 0, & \text{otherwise} \end{cases}$$

2. According to the attached Table of Fourier Transforms, write the given $\hat{h}$ as a product of two known Fourier transforms $\hat{f}$ and $\hat{g}$. Identify the functions f and g and express h as a convolution.
   $\hat{h}(\omega) = \frac{e^{-\omega^2}}{1+\omega^2}$
3. Let $f(x) = xe^{-\frac{1}{2}x^2}$ and $g(x) = e^{-x^2}$
   (a) What are the Fourier transforms of f and g?
   (b) What is the Fourier transform of $f * g$?
   Hint : Theorem 4, Section 7.2 of the textbook.

Reading Materials : Section 7.2, 7.8 of the textbook.