Roll# Student 1:   Roll# Evaluator 1:

Roll# Student 2:   Roll# Evaluator 2:

Problem 1

Consider the function $f(t) = e^{-2|t|}$ for $-\infty < t < \infty$, and its graph is drawn in the following figure.
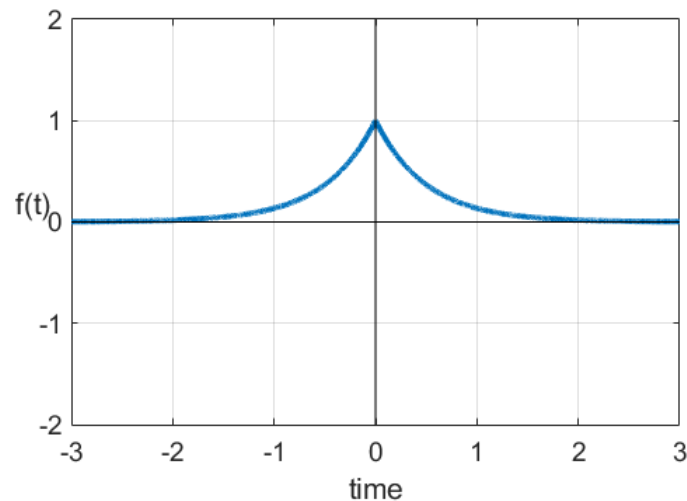

Figure 1

(a) Based on function's properties, predict whether its Fourier transform is real, pure imaginary or complex. [2 Minutes]

(b) Based on function's properties, predict whether its amplitude and phase spectra are even or odd. [2 Minutes]

(c) Evaluate its Fourier transform $F(\omega)$. [10 Minutes]

(d) Sketch the amplitude and phase spectrum of $F(\omega)$. [You may use Desmos or Wolfram Alpha]. [10 Minutes]

(e) Using the properties of Fourier transform and your answer to (c), find the Fourier transforms of the functions $f_1(t)$, $f_2(t)$, $f_3(t)$, $f_4(t)$ and $f_5(t)$ that are graphed on the next page. for each figure, $f(t)$ is drawn on the left for reference. You are only given the following information. [30 Minutes]

- $f_3(t) = e^{-|t|}$
- $f_4(t) = f_3'(t)$
- $f_5(t) = \dfrac{4}{t^2 + 4}$

(f) Plot the amplitude and phase spectra of each of the functions in (e). [20 Minutes]