

MATH464, Sec. 0101: Transform Methods
Department of Mathematics, UMCP
Homework 5

Fall 2022

Posted: Wednesday, 10/05/22

Due: Thursday, 10/13/22 IN CLASS

Answer all questions. Make sure that you explain all your steps and justify your answers. Each problem is worth 10 points (equally distributed among its parts). **Total number of points: 80**

By using known rules, compute the Fourier transforms $F(s)$ for all real s of the following functions $f : \mathbb{R} \rightarrow \mathbb{R}$ (Problems 30-37).

Note: The use of Matlab, or any other software, is strictly NOT permitted.

30.

$$f(x) = \begin{cases} 4 - 2 \sin(\pi x) & \text{if } 0 < x < 15, \\ 0 & \text{if } x < 0 \text{ or } x > 15. \end{cases}$$

Note: Use the Box function, $\Pi(x)$.

31. $f(x) = \cos(2\pi b x) e^{-a|x|}$ for some $a > 0$ and $b > 0$. **Note:** You may use Problem 27 (HW4).

32.

$$f(x) = \frac{\sin(2\pi b x)}{x^2 + a^2},$$

for some $a > 0$, $b > 0$. **Note:** You may invoke Problem 28 (HW4).

33.

$$f(x) = e^{-|ax+b|},$$

for some $a, b \in \mathbb{R}$, with $a \neq 0$. **Hint:** You may invoke Problem 27 (HW4).

34.

$$f(x) = e^{-a(x-b)^2},$$

for some $a > 0$ and $b \in \mathbb{R}$.

35.

$$f(x) = \int_{-\infty}^{\infty} e^{2\pi i s x - s^8 + s^3} ds.$$

36.

$$f(x) = \frac{2}{x^2 - 4x + 5}.$$

Note: You may invoke Problem 28.

37.

$$f(x) = \frac{2x - 4}{x^2 - 4x + 5}.$$

Note: You may invoke Problem 36.