

# Assignment 6: The Fourier Transform

D. Zack Garza

October 31, 2019

## Contents

1	Problem 1	1
2	Problem 2	2
3	Problem 3	2
4	Problem 4	2
5	Problem 5	2
6	Problem 6	2

## 1 Problem 1

Assuming the hint, we have

$$\lim_{|\xi| \rightarrow \infty} \hat{f}(\xi) = \lim_{\xi' \rightarrow 0} \frac{1}{2} \int_{\mathbb{R}^n} (f(x) - f(x - \xi')) \exp(-2\pi i x \cdot \xi) \, dx$$

But as an immediate consequence, this yields

$$\begin{aligned} |\hat{f}(\xi)| &= \left| \int_{\mathbb{R}^n} (f(x) - f(x - \xi')) \exp(-2\pi i x \cdot \xi) \, dx \right| \\ &\leq \int_{\mathbb{R}^n} |f(x) - f(x - \xi')| |\exp(-2\pi i x \cdot \xi)| \, dx \\ &\leq \int_{\mathbb{R}^n} |f(x) - f(x - \xi')| \, dx \end{aligned}$$

**2 Problem 2**

**3 Problem 3**

**4 Problem 4**

**5 Problem 5**

**6 Problem 6**