

## Homework 5 - Due Wed. Apr. 3rd

### Introduction to Harmonic Analysis and its Applications

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## Homework Policies

As in homework 1.

Exercises marked by (\*) are not mandatory, but give you extra credit that will accumulate throughout the course and may affect your final grade.

**Study.** Sections 1,2.1,3.0 (we did not cover 3.1,3.2,3.3 in class),4 in Chapter 5.

**Review before midterm.** Review the theory and the main results, making sure you understand the meaning of the main theorems, how they connect to each other, and what the main technical ideas in their proofs. At this point in the class it is useful to go over the material covered so far and connect the ideas we have seen in a coherent picture, e.g. relationships between Fourier analysis and PDE's and kernels, Fourier analysis on the circle vs. Fourier analysis on the real line, regularity vs. decay of Fourier transform, fundamental operations such as convolution, Dirchlet and Fejér kernels, etc.... Go over the past homework, or better try them again, or even better try other exercises/problems from the book. The exercises below are related several problems we discussed for the Fourier transform on the circle, and provide another way of preparing for the midterm.

### Exercises

*Exercise 1* (25pts). Exercise 2, from chapter 5, on page 161, in Stein and Shakarchi's book on Fourier transforms of indicator functions and "tent" functions.

*Exercise 2* (25pts). Exercise 3 part (a), from chapter 5, on page 162, in Stein and Shakarchi's book on showing that decay of the Fourier transform implies Hölder regularity.

*Exercise 3* (25pts). Exercise 7 from chapter 5, on page 163, in Stein and Shakarchi's book on showing moderate decrease for the convolution of functions of moderate decrease.

*Exercise 4* (25pts). Exercise 9 from chapter 5, on page 163, in Stein and Shakarchi's book on the Fejér kernel on the real line.