

Name \_\_\_\_\_

Math 3150 Problems  
Haberman Chapter H3

Due Date: Problems are collected on Wednesday.

## Chapter H3: 3.2 Fourier Series, Statement of the Convergence Theorem

### Problem H3.2-1. (Sketching a Fourier Series)

For the following functions, sketch the Fourier series of  $f(x)$  (on the interval  $-L < x < L$ ), without computing Fourier coefficients. Compare  $f(x)$  to its Fourier series. Submit starred problems only.

- (a)  $f(x) = 1$
- \* (b)  $f(x) = x^2$
- (c)  $f(x) = 1 + x$
- \* (d)  $f(x) = e^x$
- (e)  $f(x) = x$  for  $x < 0$  and  $f(x) = 2x$  for  $x > 0$
- \* (f)  $f(x) = 1 + x$  for  $x > 0$  and zero otherwise
- (g)  $f(x) = x$  for  $x < L/2$  and zero otherwise

### Problem H3.2-2. (Fourier Series Coefficients)

For the following functions, sketch the Fourier series of  $f(x)$  (on the interval  $-L < x < L$ ) and determine the Fourier coefficients. Submit starred problems only.

- \* (a)  $f(x) = x$
- (b)  $f(x) = e^{-x}$
- \* (c)  $f(x) = \sin(\pi x/L)$
- (d)  $f(x) = x$  for  $x > 0$  and zero otherwise
- (e)  $f(x) = 1$  for  $|x| < L/2$  and zero otherwise
- \* (f)  $f(x) = 1$  for  $x > 0$  and zero otherwise
- (g)  $f(x) = 1$  for  $x < 0$  and  $f(x) = 2$  for  $x > 0$

### Problem H3.2-3. (Fourier Series Operation is Linear)

Show that the Fourier series operation is linear: that is, show that the Fourier series of  $c_1 f(x) + c_2 g(x)$  is the sum of  $c_1$  times the Fourier series of  $f(x)$  and  $c_2$  times the Fourier series of  $g(x)$ .

### Problem H3.2-4. (Fourier Series $F(x)$ Endpoint Values at $x = \pm L$ )

Suppose that  $f(x)$  is piecewise smooth. What value does the Fourier series of  $f(x)$  converge to at the endpoint  $x = -L$ ? at  $x = L$ ?