

3450:439/539:001 **Homework 9** Spring 2008

Recommended due date: Thursday, March 27, 2008

THIS HOMEWORK IS NOT FOR COURSE CREDIT. However, you need to do problems to learn the material. Also, about 1/3 of your exam will consist of recommended homework problems.

1. Consider the function f that has period $2L$ and $f(x) = 1 - x$ for $0 \leq x < 2L$.
 - (a) Graph the function to which its Fourier series converges. Include three periods.
 - (b) Find the **complex form** of the Fourier series expansion of $f(x)$.
2. Show that $\mathcal{F}\{f'(x)\} = i\omega\hat{f}(\omega)$ using the definition of the Fourier transform and integration by parts.
3. Using the definition of the Fourier transform, find the Fourier transform of $f(x) = e^{-|x|}$. Graph the amplitude spectrum.
4. Consider the unit step function

$$f(x) = \begin{cases} 0, & -\infty < x < 0 \\ 1, & 0 \leq x < \infty \end{cases}.$$

- (a) Using the definition of the Fourier transform, find the Fourier transform of $f(x)$ if possible. If it is not possible, state why not.
 - (b) Using the definition of the Laplace transform, find the Laplace transform of $f(x)$ if possible. If it is not possible, state why not.
5. Using linearity of the Laplace transform and a table of Laplace transforms, find the Laplace transform of $-3 \cos(2t) + 5 \sin(4t)$.
 6. Using linearity of the inverse Laplace transform and a table of inverse Laplace transforms, find the inverse Laplace transform of $\frac{2}{s^4} \left(\frac{1}{s} - \frac{3}{s^2} + \frac{4}{s^6} \right)$.