

Problem 18.1: The signal  $x(t) = e^{-a|t|}$  has a Fourier transform  $X(j\omega) = \frac{2a}{a^2 + \omega^2}$ , where  $a > 0$  is a real constant.

- (a) Use properties of Fourier transforms to quickly find the Fourier transform of  $g(t) = 3e^{-2|t-1|}$ . State which properties you use at the time you use them.
- (b) Make two separate plots of the magnitude and the phase of your answer from part (a). Use a straightedge and label all axes and important features. Show the origin for context.

Problem 18.2: The RC filter in Figure 1 has impulse response  $h(t) = \frac{1}{2}e^{-t/2}u(t)$ . Use properties of Fourier transforms to find the output of the filter when the input is  $x(t) = e^{-t/3}u(t)$ . State which property you use at the time you use it.

Problem 18.3: The signal  $x(t) = e^{-t}u(t)$  has Fourier transform  $X(j\omega) = \frac{1}{1+j\omega}$ . Use this fact along with properties of Fourier transforms to quickly find the Fourier transform of the following signals. State which properties you use at the time you use them.

- (a)  $x_a(t) = x(1-t) + x(-1-t)$
- (b)  $x_b(t) = x(3t-6)$
- (c)  $x_c(t) = \frac{d^2}{dt^2}x(t-1)$

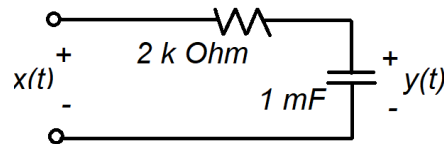


Figure 1

Optional, but testable, problems: From the textbook, Problems 4.10. 4.24.