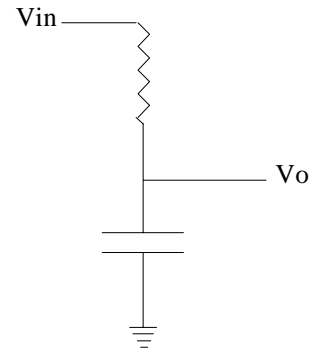


PHGN511 Homework #8
 Due Friday, Oct. 29, 2004 at the beginning of class
 More Fourier Transforms

1. Butkov 7.6a
2. Butkov 7.11 (just the Fourier transform solution, not the Laplace transform. Note this is a problem where you can find or guess the answer pretty easily, so you should know if your solution is correct.)
3. Butkov 7.12 (again, just do the Fourier transform.)

4. Let's consider the simple low pass filter below. For a fixed frequency input of voltage $V_{in} = V e^{i \omega t}$, the output will be $V_o = \frac{V_{in}}{R + \frac{1}{i \omega C}} \frac{1}{1 + i \omega RC} = \frac{V_{in}}{1 + i \omega RC}$. What we really mean

in writing this is that the input voltage is the real part of V_{in} and the output voltage is the real part of V_o . Now, let's assume the system is linear, so we can sum (integrate) the response from a range of frequencies. Let's also assume V_{in} is a square pulse beginning at time -1/2 second and ending at time 1/2 second and of magnitude 1 volt, and that the RC time constant of our filter is 0.1sec.



a) Obtain the Fourier transform of V_{in} (note the definition here is somewhat different than we have used both in terms of the prefactor, and the sign in the exponent), and make a numerical plot of V_{in} from -1sec to 1sec by integrating the transform. Note, if you use Mathematica, you can't sum all frequencies, and you will end up with some Gibbs phenomena type features. Do the best you can in a reasonable period of time.

b) Now obtain an expression for V_o . Again, make a plot of the output from -1sec to 1sec. Qualitatively explain the difference between the plots in a) and b).