EE120, Fall 1995
Midterm #2
Professor J.M. Kahn

Problem #1
(40 pts.) Consider x(t), the periodic pulse train shown below.

Problem #1a
(15 pts.) Give an expression for X(w), the Fourier transform of x(t).

Problem #1b
(5 pts.) Plot X(w).

Problem #1c
(3 pts.) Consider y(t) = sinct. Give an expression for Y(w), its Fourier transform.

Problem #1d
(2 pts.) Plot Y(w).

Problem #1e
(10 pts.) We form the signal z(t) = x(t) * y(t). Give an explicit expression for its Fourier transform Z(w). This expression should not be stated in terms of a convolution integral.

Problem #3
(35 pts.) Consider the circuit shown, with input current i(t) and output voltage v(t).

Problem #3a
(10 pts.) Give a differential equation relating i(t) and v(t).

For the remainder of the problem, assume R = L = C = 1, so that the differential equation becomes:
(d^2v)/(dt^2) + (dv)/(dt) + v = (di)/(dt).

Problem #3b
(5 pts.) Find the transfer function H(s) that relates the input i(t) and output v(t).

Problem #3c
(5 pts.) Plot the poles and zeros of H(s) on the s-plane. Specify its region of convergence.

Problem #3d

(5 pts.) Assume that i(t) = 3, -infinity < t < infinity. Find v(t), -infinty < t < infinity.

Problem #3e

(10 pts.) Assume that v(0-) = 1, nu(0-) = -3/2 and i(t) = u(t), t >= 0. Find v(t), t >= 0. Hint: You needn't do partial fraction expansion; the transform you need is in the table.
