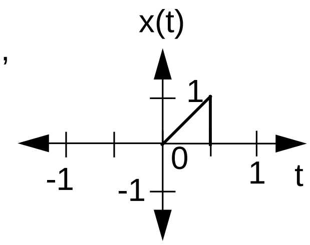
Name:

Problem	Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
TOTAL	100	

What grade do you think you deserve in this course? ______________

Explain (base your argument on our discussion of minimal competency at the beginning of the semester — don't just say you worked hard):

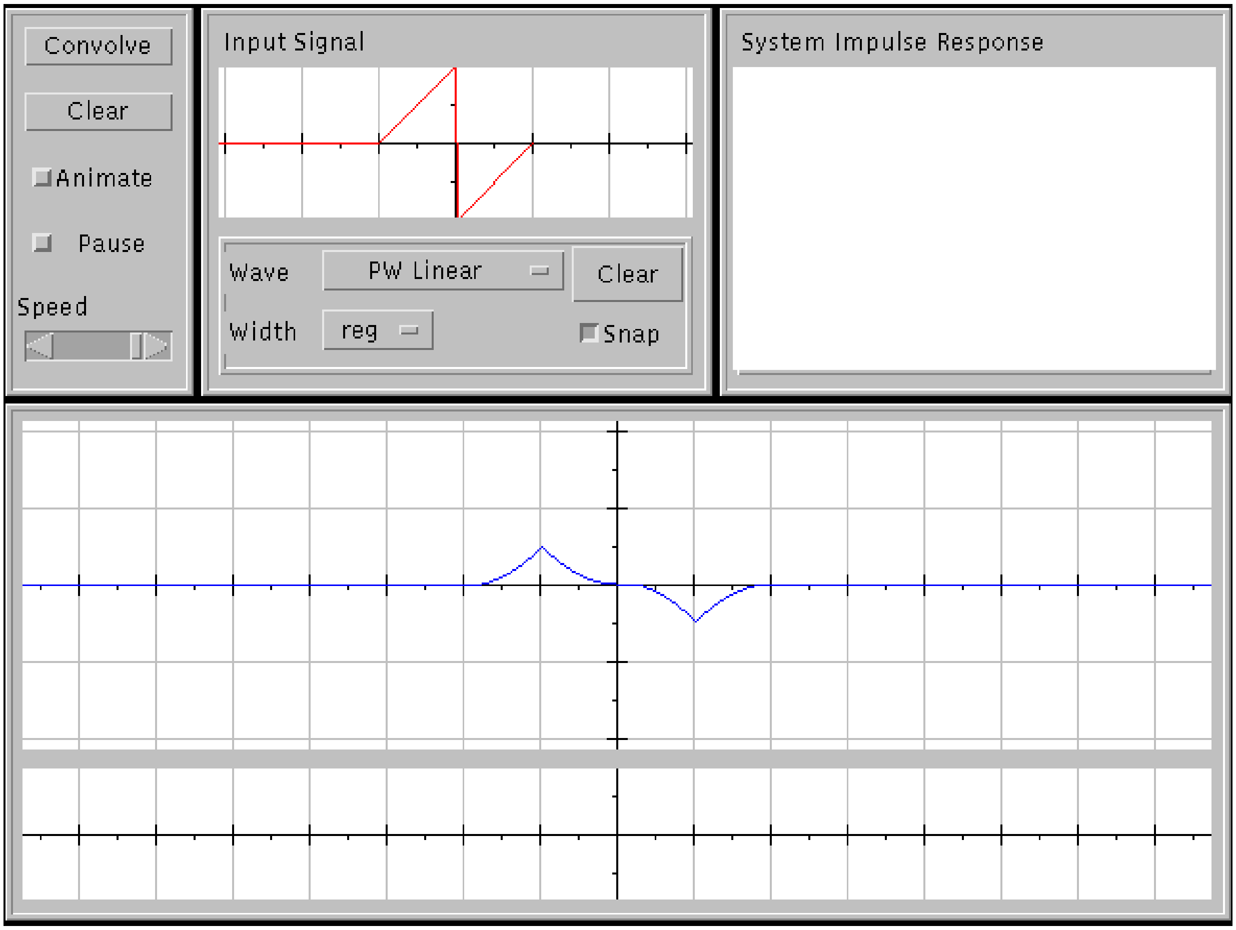
Problem No. 1: For the signal shown: (a) find the Fourier transform, (b) find the Laplace transform, (c) set $s = j\omega$ in the Laplace transform, and (d) discuss any similarities or differences in the results of parts (a) and (c).



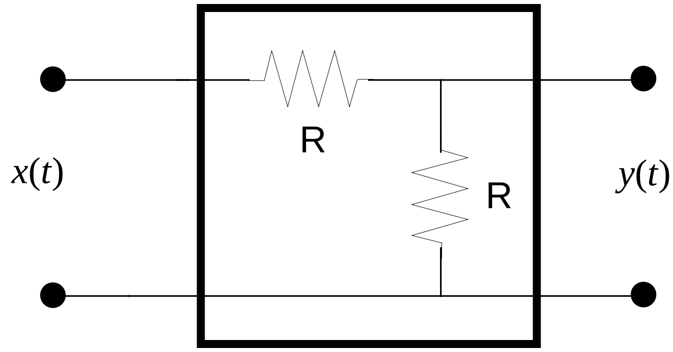
Fourier	Laplace

Explanation:

Problem No. 2: Using principles of convolution, determine the impulse response.



Problem No. 3: Derive an expression for the power and root mean square value of the signal $x(t) = A\sin(2\pi ft + \theta)$. Relate this to the following circuit:

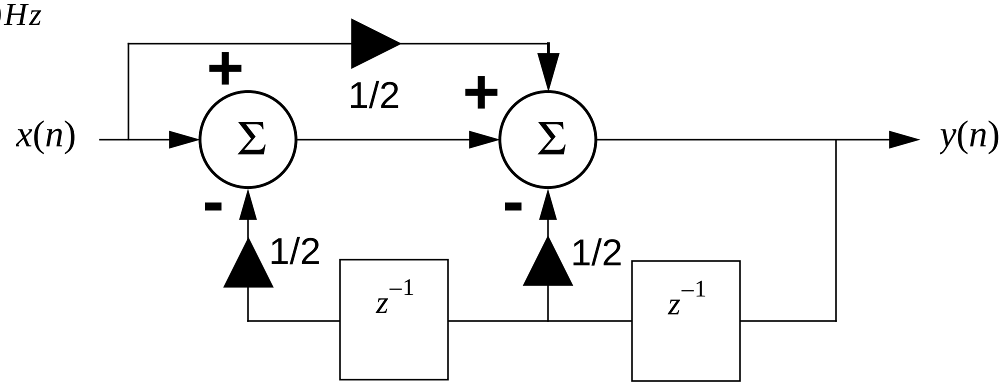


Problem No. 4: Given $H(s) = \frac{1 + 0.5s}{s^2 + 2s + 1}$, find $h(t)$.

Problem No. 5: Given the difference equation $y(n) = a_1 y(n-1) + a_2 y(n-2) + x(n)$, for what values of a_1 and a_2 is the system stable?

Problem No. 6: For a four-point discrete Fourier Transform (DFT), it is suggested you use the window function $w(n) = \{0.5, 1, 1, -0.5\}$. Demonstrate whether this is better than using a simple rectangular window.

Problem No. 7: Find and plot the frequency response of the system shown below. Assume $f_s = 10Hz$



Problem No. 8: Using the Fast Fourier Transform (FFT), design a system that can detect one of two signals: $x_1(t) = A\sin(2\pi(1011)t)$ or $x_2(t) = A\sin(2\pi(1027)t)$. Try to minimize the computational and memory resources.

Problem No. 9: Our local supermarket, Foodmax, hires you to design a digital scale to weigh produce items as they pass over the bar code scanner at a cash register. Starting from the output of the analog weight scale, design a system based on digital signal processing that accurately determines the weight of an item, and communicates this to the cash register. (Hint: think about what the signal from the analog scale looks like as items are placed on the scale.)

Problem No. 10: Next, let's focus on the analog scale described in problem 9. Is this a linear, time-invariant system? Explain. Is this a dynamic system? Explain.