Problem 1 (Work on this problem after the Lecture/Recitation on Convolution)

Find $y(t) = x(t) * h(t)$ for each paired $x(t)$ and $h(t)$ in the figure below.

**Problem 2.**

Determine $i_o(t)$ in the circuit shown below.
Problem 3.

Find $v_x(s)$ in the circuit shown below.

Problem 4.

When the input to a system is a unit step function, the response is $10 \cos 2t$. Obtain the transfer function of the system.

Problem 5.

Obtain the transfer function $H(s) = V_o/V_s$ for the circuit shown below.

Problem 6.

For the circuit shown below, find:

(a) $I_1/V_s$
(b) $I_2/V_x$
Problem 7.

A parallel RL circuit has $R = 4 \, \Omega$ and $L = 1 \, \text{H}$. The input to the circuit is $i_d(t) = 2e^{-t}u(t) \, \text{A}$. Find the inductor current $i_L(t)$ for all $t > 0$ and assume that $i_L(0) = -2 \, \text{A}$.

Problem 8.

A circuit has a transfer function

$$H(s) = \frac{s + 4}{(s + 1)(s + 2)^2}$$

Find the impulse response.

Problem 9.

Show that the parallel $RLC$ circuit shown below is stable.

Problem 10.

It is desired to realize the transfer function

$$\frac{v_2(s)}{v_1(s)} = \frac{2s}{s^2 + 2s + 6}$$

using the circuit shown below. Choose $R = 1 \, \text{k\Omega}$ and find $L$ and $C$. 
Problem 11.

Design an op amp circuit shown below, that will realize the following transfer function,

\[
\frac{V_o(s)}{V_i(s)} = -\frac{s + 1000}{2(s + 4000)}
\]

Choose \( C_1 = 10 \, \mu\text{F} \), determine \( R_1 \), \( R_2 \), and \( C_2 \).