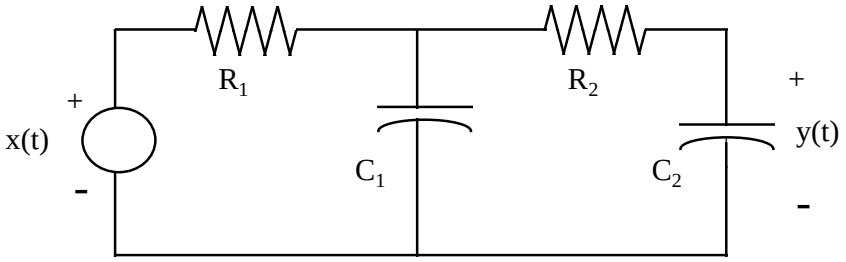
Transfer Functions:

1. Find the transfer functions of the following systems:
   a) $\dot{y} + 4y = 3x$
   b) $\ddot{y} + 4\dot{y} + 20y = 2\dot{x} - x$
   c) $\dddot{y} - 3\ddot{y} + 4\dot{y} + 8y = 4\ddot{x} - 2\dot{x} + x$

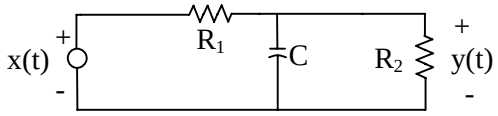
2. Find the transfer function of



Give the result for $C_1=C_2=100\mu f$, $R_1=R_2=2000\Omega$

3. Find the transfer function of the following circuit where $R_1=R_2=1000\Omega$ and $C=100\mu f$.

a)



4. For the system given below,

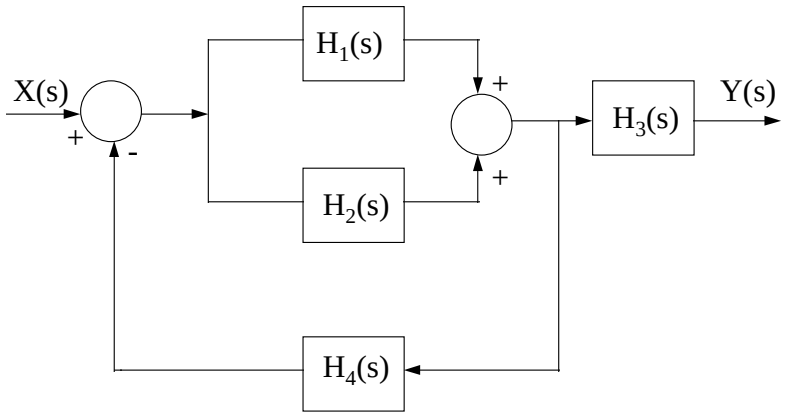
$$\ddot{y} + 8\dot{y} + 116y = 116x$$

   a) Find the transfer function.
   b) Give the poles and zeros.
   c) Give the general form of the response y(t) to a step input (do not solve explicitly).
   d) Use MATLAB to plot the step response (put your name in the title of the plot).

5. Repeat Problem 4 for the system given below. In addition, compare the types of poles of this system to those in Problem 4 and use this to explain the resulting behavior seen in the step response plots.

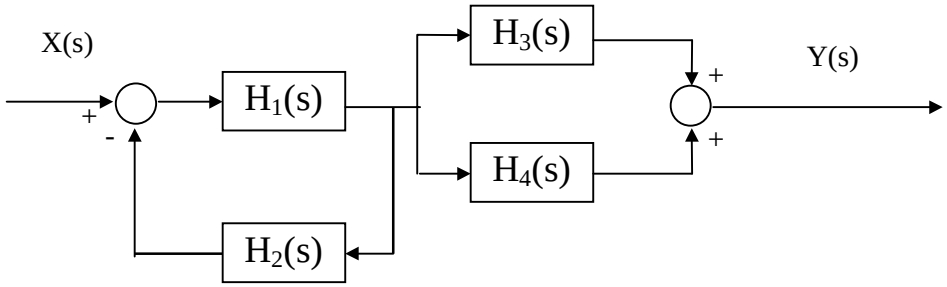
$$\ddot{y} + 8\dot{y} + 12y = 12x$$

6. Simplify the block diagram to find the transfer function



Give the transfer function H(s)=Y(s)/X(s) for $H_1(s)=2$, $H_2(s)=10/s$, $H_3(s)=\frac{0.1}{s+20}$, $H_4(s)=\frac{2}{s+4}$

7. Reduce the block diagram to one block.



8. Find the transfer function of the following circuit in terms of R_1, R_2, C, and L. Now, suppose that $R_1=R_2=2000\Omega$, C = 100μf, L = 10mH. Determine the poles of the circuit.