ECE 336, spring 2024, Homework #9, **Due: April 17, 2024**

1.) Find the Laplace transform of $v(t) = e^{-2t}\sin(8t + 45°)u(t)$. Express your answer as a single rational function with a monic denominator.

2.) Find the Laplace transform of $v(t) = e^{-3t}(3t + 6)u(t)$. Express your answer as a single rational function with a monic denominator.

3.) Find the Laplace transform of $v(t) = 3tu(t) + (9 - 3t)u(t - 3)$. Express your answer as a single rational function with a monic denominator.

4.) Find the inverse Laplace transform of $V(s) = \frac{15s+31}{s^2+4s+3}$

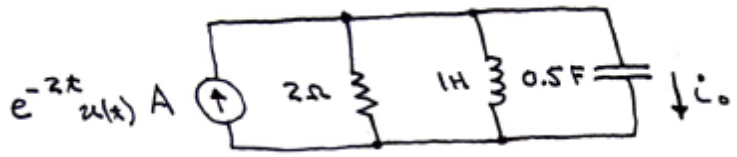
5.) Find the inverse Laplace transform of $V(s) = \frac{2s+18}{(s+8)^2}$

6.) Find the inverse Laplace transform of $V(s) = \frac{s+12}{s^2+9}$

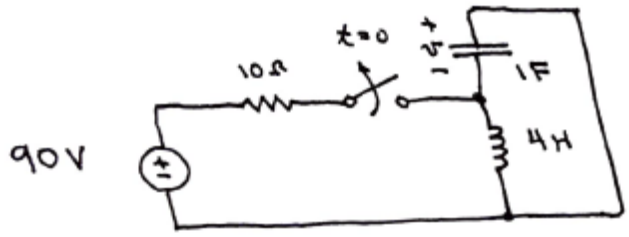
7.) Find the inverse Laplace transform of $V(s) = \frac{2s^2+31s+118}{s^3+22s^2+160s+384}$

8.) 5.) Find the initial and final values of $V(s) = \frac{6s^2+11s+25}{s^3+2s^2+5s}$ using the Laplace transform.

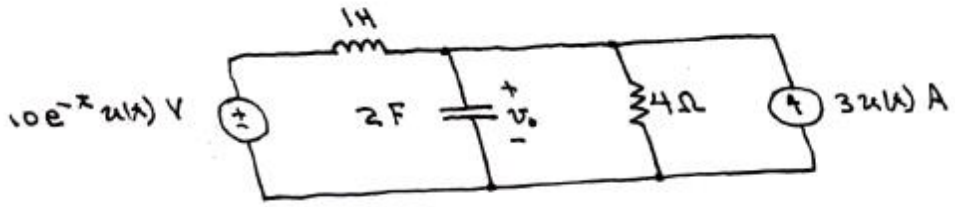
9.) Find the current $i_o(t)$ using the Laplace transform.



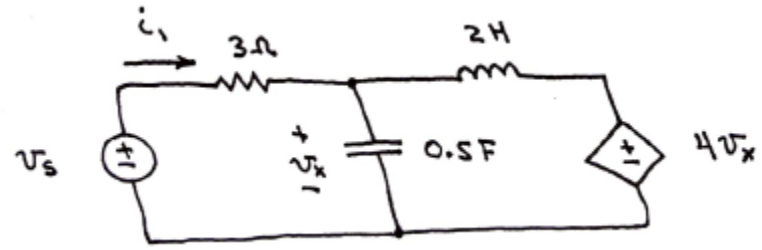
10.) Find the voltage $v(t)$ using the Laplace transform.



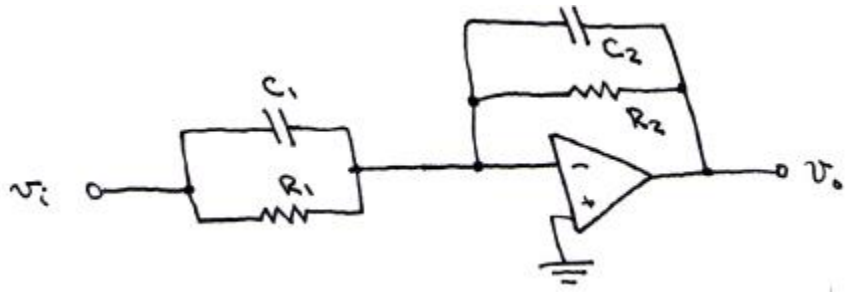
11.) Find the voltage $v_o(t)$ using the Laplace transform.



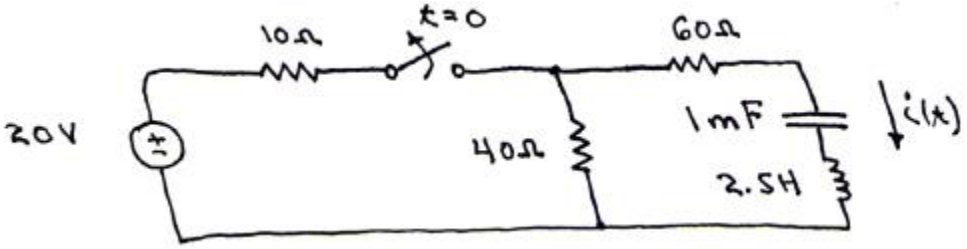
12.) Find the transfer function $H(s) \equiv \frac{I_1(s)}{V_s(s)}$ for the circuit shown below.



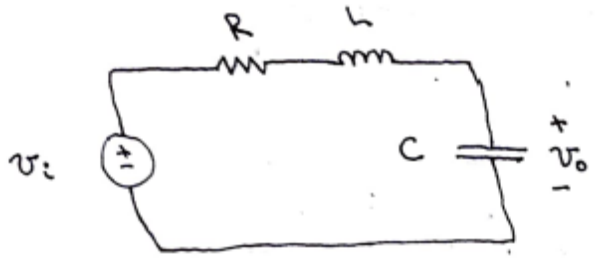
13.) Design the circuit to have the transfer function $H(s) \equiv \frac{V_o}{V_i} = \frac{s+1000}{2(s+4000)}$ for the circuit shown below. Let C_1 = 10 μF.



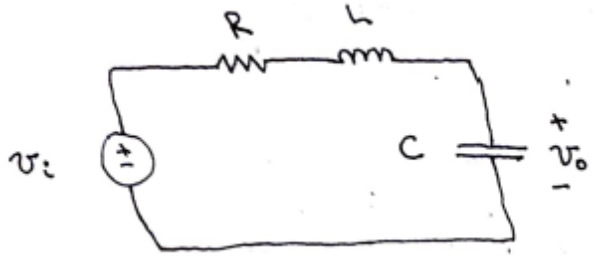
14.) Find the current $i(t)$ of the circuit below using the Laplace transform.



15.)Design the circuit below (choose *R*, *L*, and *C*) to have the transfer function $H(s) \equiv \frac{V_o}{V_i} = \frac{2}{s^2+3s+2}$.



16.) Design the circuit below (choose *R*, *L*, and *C*) to have the transfer function $H(s) \equiv \frac{V_o}{V_i} = \frac{101}{s^2+2s+101}$.



17.) Find the step-response (let $v_i(t) = u(t)$ V) for question 15 and 16 and sketch.