Name (please print)_____

In keeping with the Honor Code, I have neither provided nor received any assistance on this test. I understand if it is later determined that I gave or received assistance, I will fail the class and will be brought before the Undergraduate Judicial Board.

Signature:_____

Problem I: [30 pts] Thévenin-Norton Equivalent Circuits

(1) Assuming you have a circuit where $\mathbb{V}_{oc} = 8\angle 7°$ V, $\mathbb{I}_{sc} = 4\angle 23°$ A, and $\omega = 10$ rad/s, draw two Norton equivalent circuits - one with the passive elements in series and one with them in parallel.
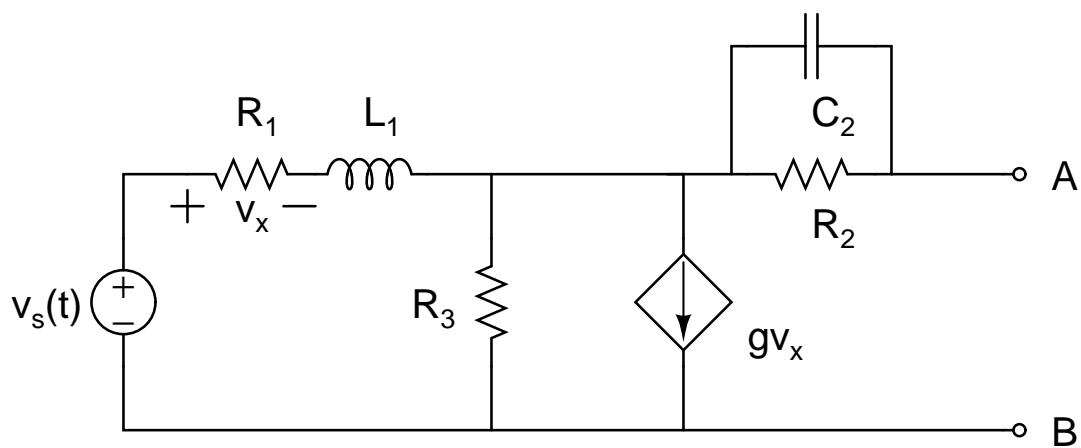
(2) Given the circuit above and the known values $v_s(t)$, C_2, L_1, R_1, R_2, R_3, and g, find $\mathbb{V}_{oc}$, $\mathbb{I}_{sc}$, and $\mathbb{Z}_{th}$ as seen across terminals A-B.

Problem II: [30 pts] Complex Power
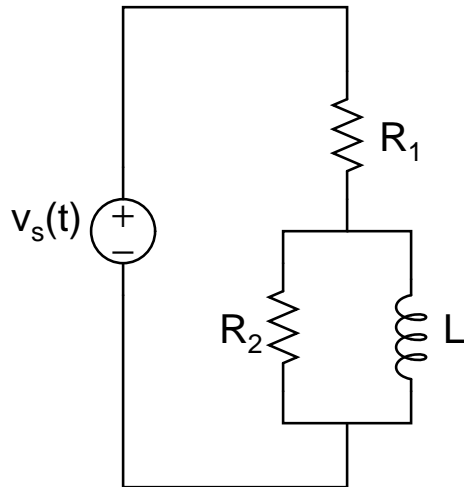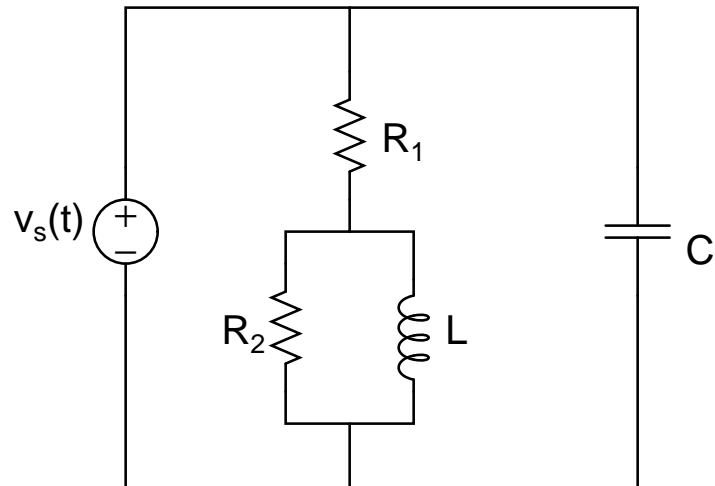

Given the circuit above and the known values:

$$v_s(t) = 5\cos(377t + 8°) \text{ V}$$
$$L = 650 \text{ mH}$$
$$R_1 = 300 \text{ } \Omega$$
$$R_2 = 700 \text{ } \Omega$$

(1) Find the equivalent impedance $\mathbb{Z}$ as seen by the voltage source

(2) Find the complex power delivered by the voltage source, $\mathbb{S}_{del}$

(3) Find the power factor; be sure to indicate if it is **lagging** or leading (hint hint)

Assume you add a 5 μF capacitor in parallel with the voltage source as shown above.

(a) Find the equivalent impedance $\mathbb{Z}$ as seen by the voltage source

(b) Find the complex power delivered by the voltage source, $\$_{\text{del}}$

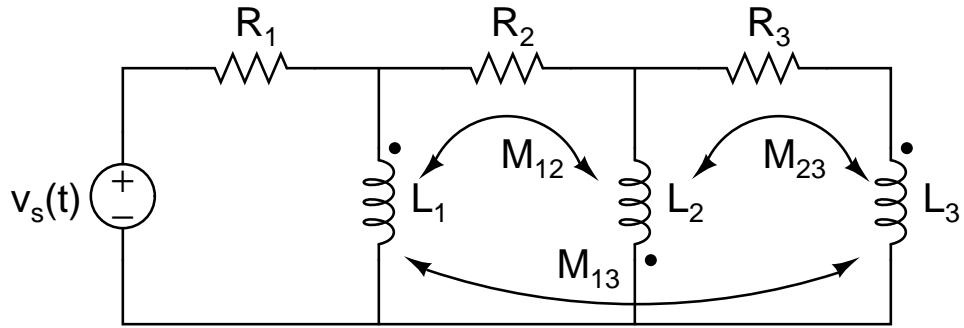(c) Find the power factor; be sure to indicate if it is lagging or leading

Problem III: [20 pts] Transformers
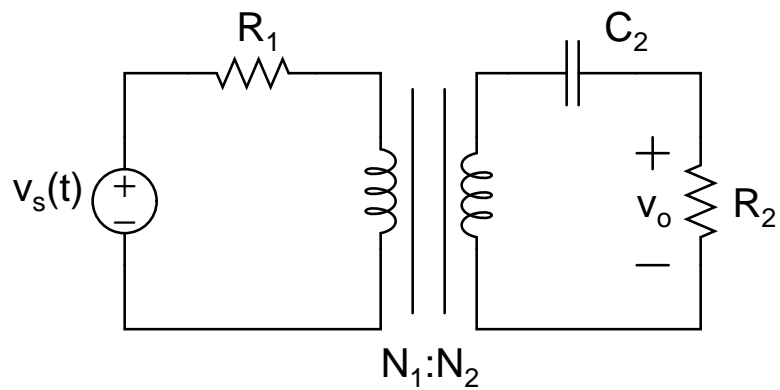
Given the circuit above and known values $v_s(t)$, C_2, R_1, R_2, N_1, and N_2, find the network function:

$$\mathbb{H}(j\omega) = \frac{\mathbb{V}_o}{\mathbb{V}_s}$$

Problem IV: [20 pts] Mutual Inductance

R_1 R_2 R_3

$v_s(t)$ M_{12} L_1 L_2 M_{23} L_3

M_{13}

Given the circuit above and known values $v_s(t)$, L_1, L_2, L_3, M_{12}, M_{13}, M_{23}, R_1, R_2, R_3, write the three mesh current equations in the frequency domain *or* in the time domain.