Problem # 1

At $t = -2$ ms, a sinusoidal voltage is known to be zero and going positive. The voltage is next zero at $t = 8$ ms. It is also known that the voltage is 80.9 V at $t = 0$.

a) What is the frequency of v in hertz?

b) What is the expression for v?

Problem #2

Use the concept of the phasor to combine the following sinusoidal functions into a single trigonometric expression:

a) $y = 50\cos(500t + 60°) + 100\cos(500t - 30°)$,

b) $y = 200\cos(377t + 50°) - 100\sin(377t + 150°)$

c) $y = 80\cos(100t + 30°) - 100\sin(100t - 135°) + 50\cos(100t - 90°)$, and

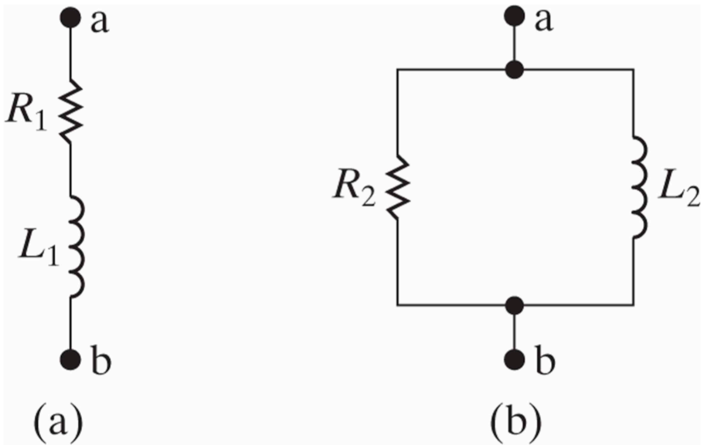
d) $y = 250\cos\omega t + 250\cos(\omega t + 120°) + 250\cos(\omega t - 120°)$.

Problem #3

a) Show that, at a given frequency ω, the circuits in the Figure (a) and (b) will have the same impedance between the terminals a, b if

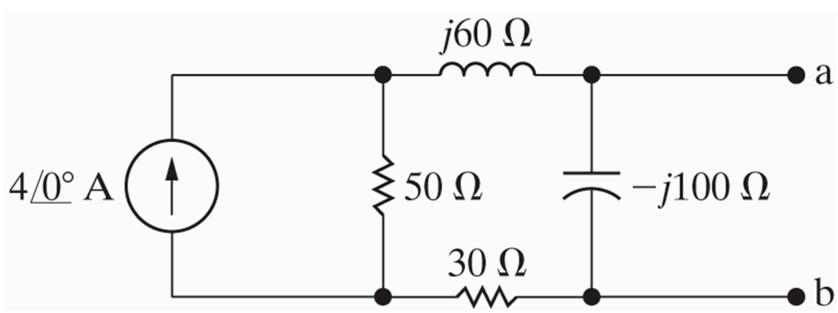
$$R_1 = \frac{\omega^2 L_2^2 R_2}{R_2^2 + \omega^2 L_2^2}, \qquad L_1 = \frac{R_2^2 L_2}{R_2^2 + \omega^2 L_2^2}.$$

b) Find the values of resistance and inductance that when connected in series will have the same impedance at 4 krad/s as that of a 5 kΩ resistor connected in parallel with a 1.25 H inductor.



Problem #4

Use source transformations to find the Norton equivalent circuit with respect to the terminals a, b for the circuit.

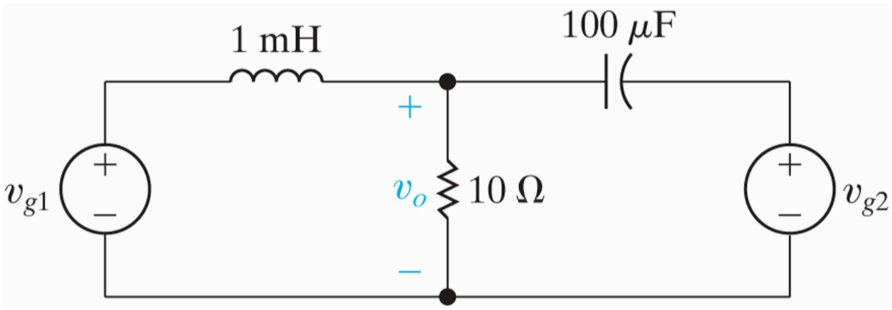


Problem #5

Use the node-voltage method to find the steady-state expression for $v_o(t)$ in the circuit if

$$v_{g1} = 20\cos(2000t - 36.87°)\ \text{V},$$

$$v_{g2} = 50\sin(2000t - 16.26°)\ \text{V}.$$



Problem #6

Use the mesh-current method to find the steady-state expression for $i_o(t)$ in the circuit if

$v_a = 60 \cos 40{,}000t$ V,

$v_b = 90 \sin (40{,}000t + 180°)$ V.