EE281 - Phasors & Impedances

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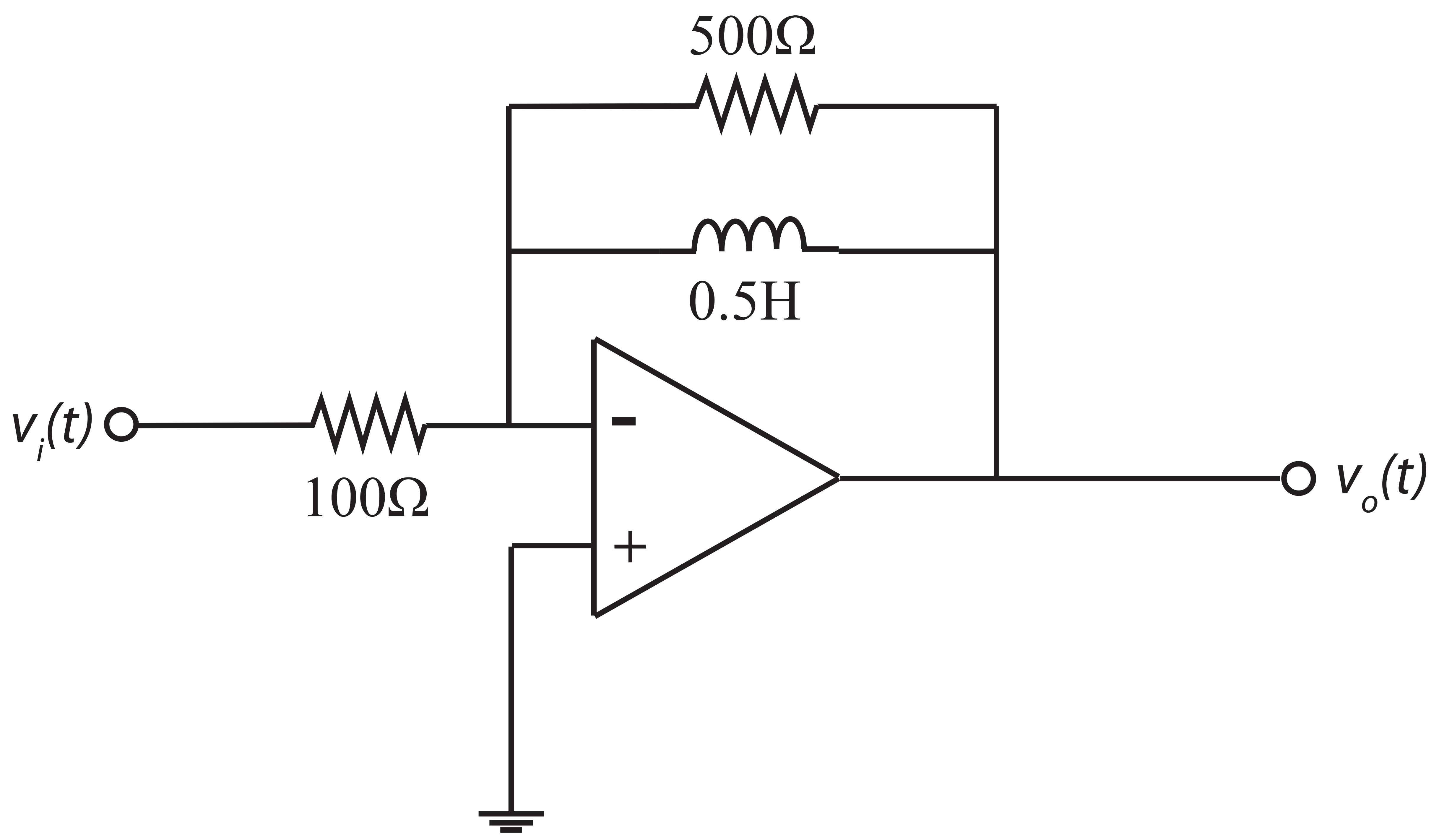
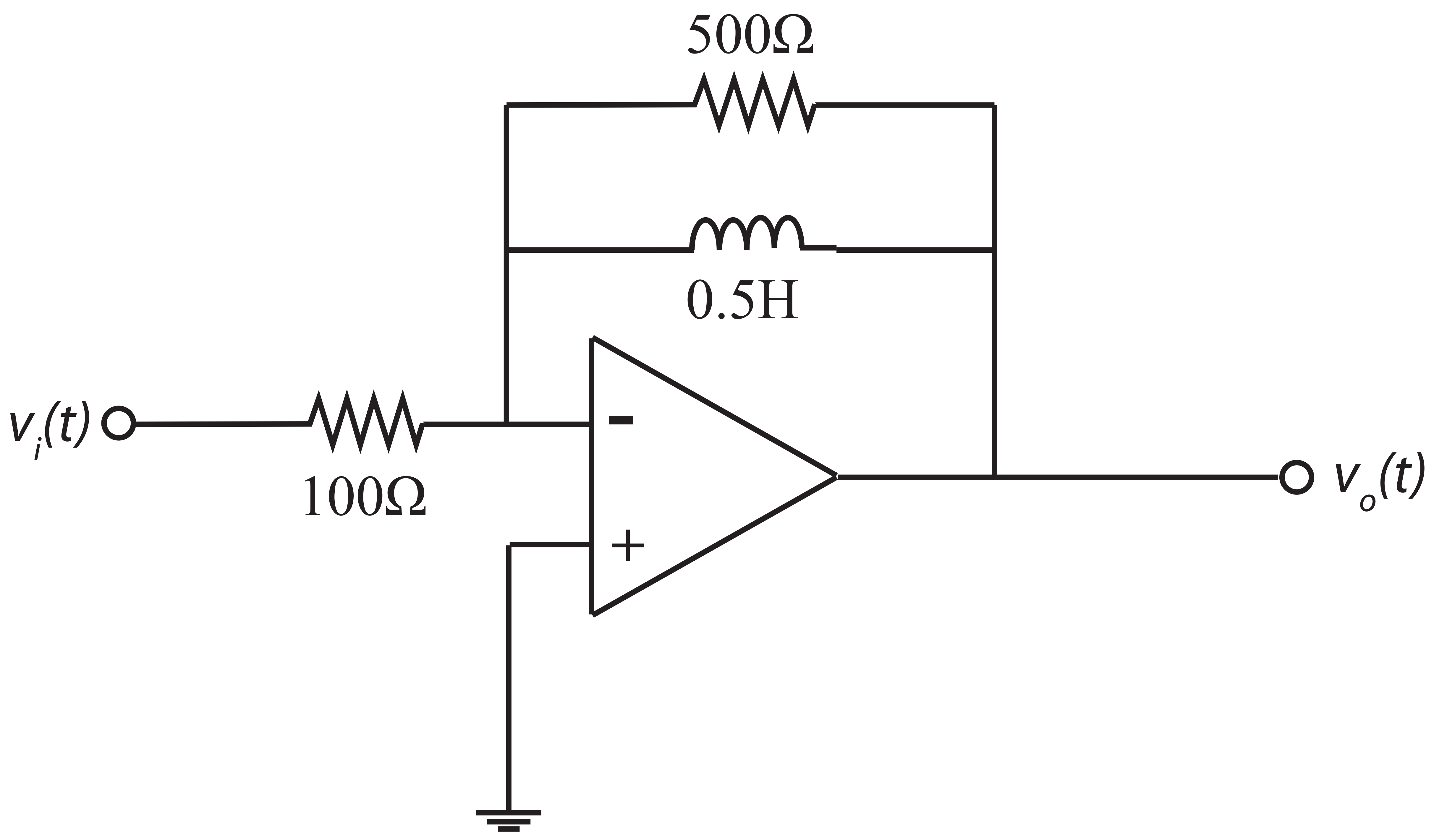
Let $v_i(t) = \cos(10^3\, t)$





$$V_i = 1$$

$$\frac{1}{100} + \frac{V_o}{500} + \frac{V_o}{j500} = 0$$

$$\frac{V_o}{500}(1 - j) = \frac{-1}{100}$$

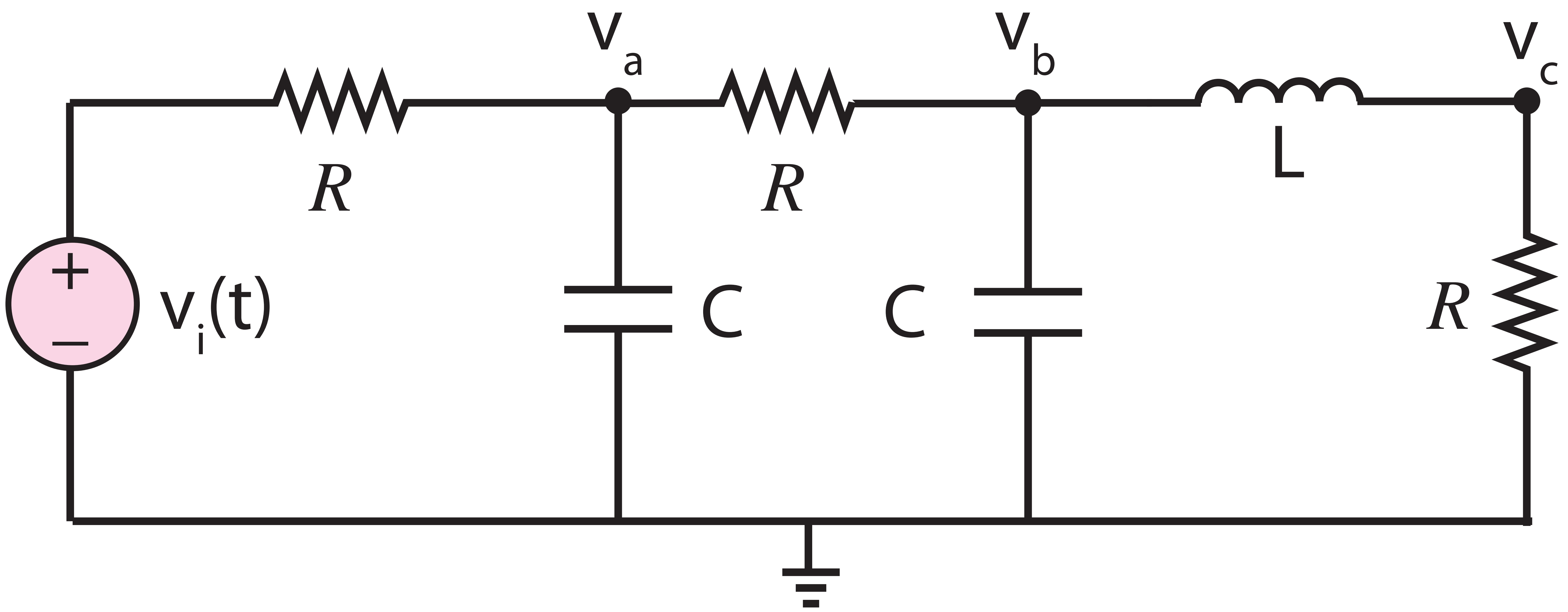
$$V_o = 5\frac{1}{-1 + j} = \frac{5}{\sqrt{2}}\angle(-1 - j)$$

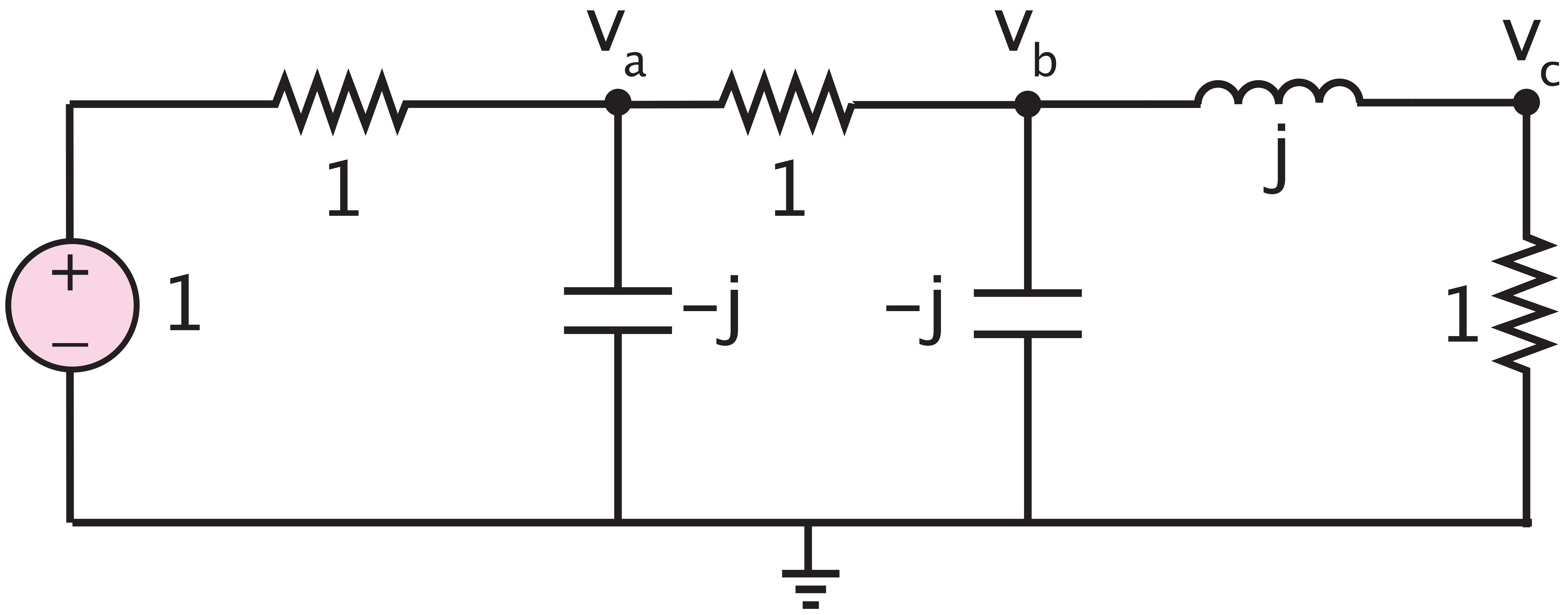
$$V_o = \frac{5}{\sqrt{2}}\angle\frac{-3\pi}{4}$$

$$V_o(t) = \frac{5}{\sqrt{2}}\cos(10^3 t - 135^o)$$

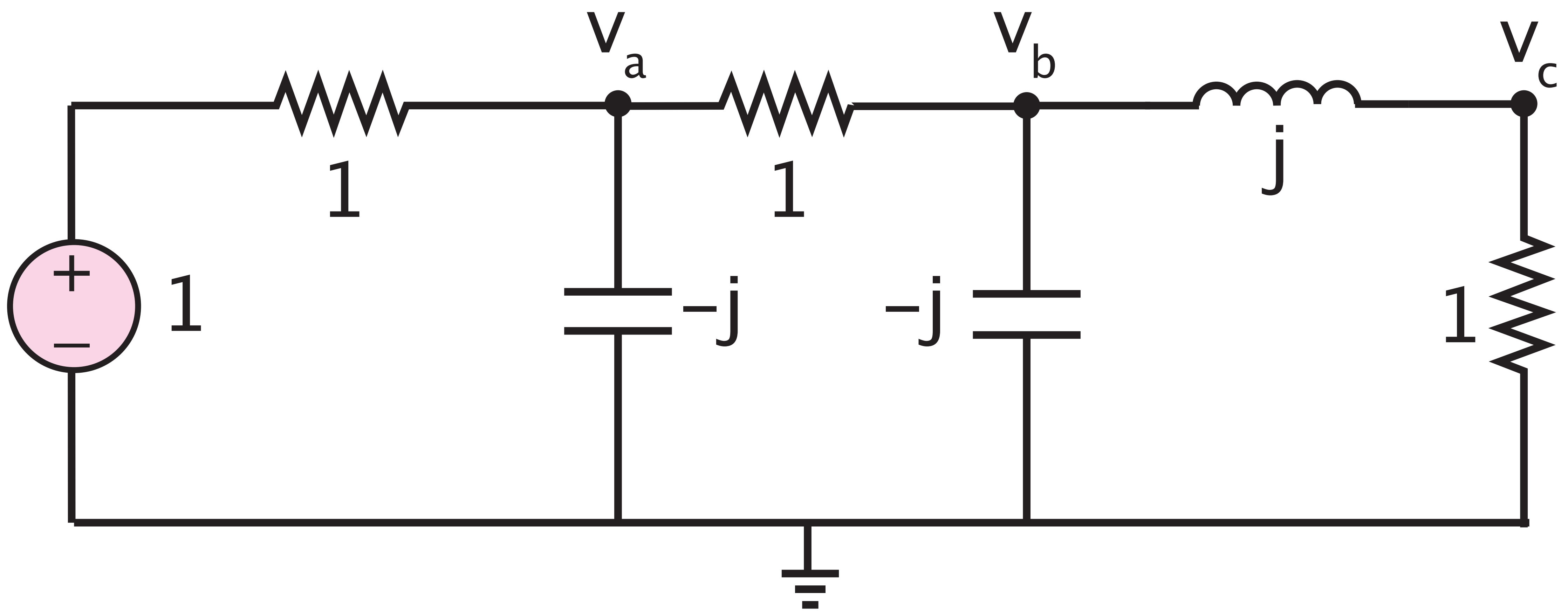
Using the Node Voltage method and the impedances of each element, setup a system of phasor domain equations in terms of nodes a, b, and c

Let $R = 1\ \Omega$, $C = 1$ F, $L = 1$H, and $V_i(t) = \cos(t)$





v_a
v_b
v_c
1
1
j
+
−
1
−j
−j
1



$$\underbrace{\begin{bmatrix} 2+j & -1 & 0 \\ -1 & 1 & j \\ 0 & j & 1-j \end{bmatrix}}_{\mathbf{G(j}\omega)} \underbrace{\begin{bmatrix} V_a(j\omega) \\ V_b(j\omega) \\ V_c(j\omega) \end{bmatrix}}_{\mathbf{V(j}\omega)} = \underbrace{\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}}_{\mathbf{I(j}\omega)}$$

$$\underbrace{\begin{bmatrix} \sqrt{5}\angle 26.56^o & \angle 180^o & 0 \\ \angle 180^o & 1\angle 0^o & \angle 90^o \\ 0 & \angle 90^o & \sqrt{2}\angle -45^o \end{bmatrix}}_{\mathbf{G(j}\omega)} \underbrace{\begin{bmatrix} V_a(j\omega) \\ V_b(j\omega) \\ V_c(j\omega) \end{bmatrix}}_{\mathbf{V(j}\omega)} = \underbrace{\begin{bmatrix} \angle 0^o \\ 0 \\ 0 \end{bmatrix}}_{\mathbf{I(j}\omega)}$$