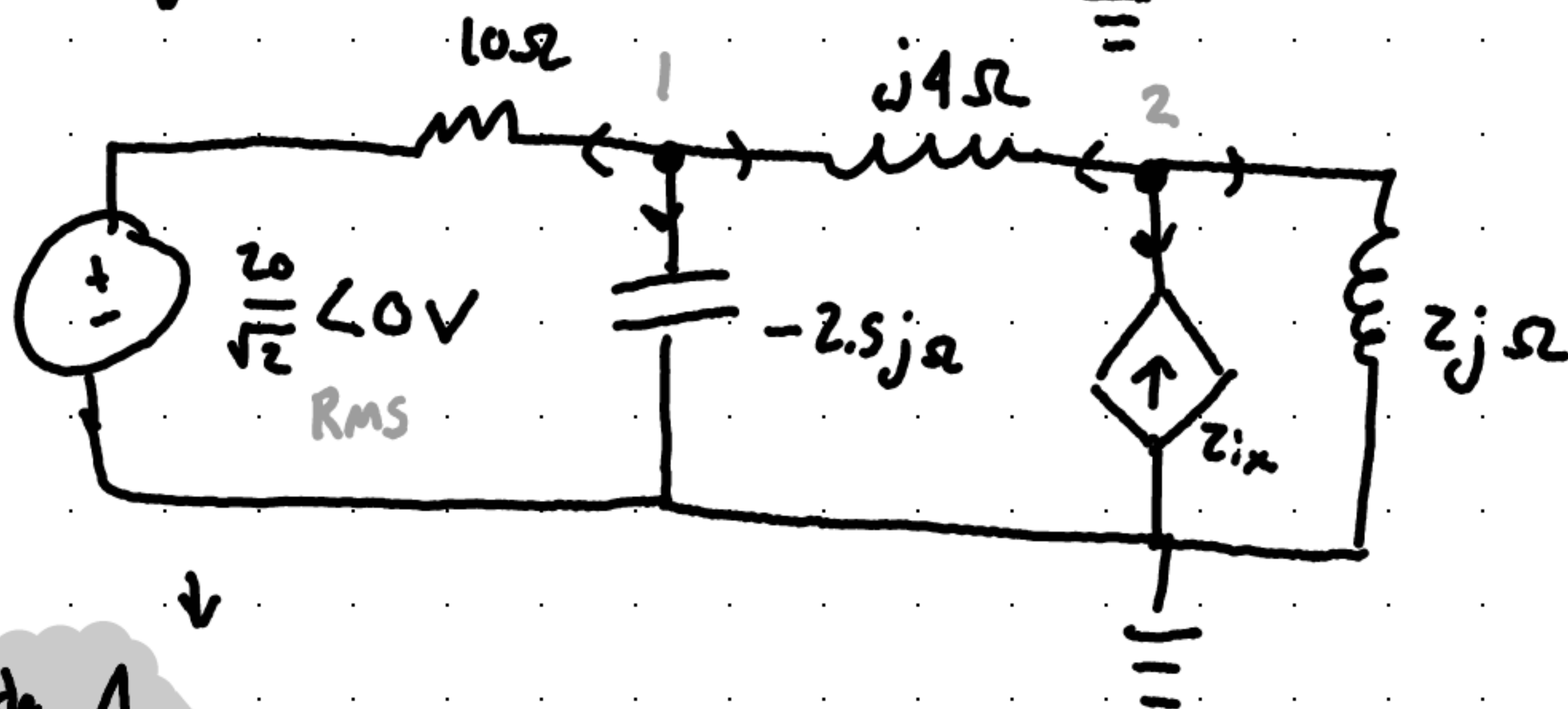
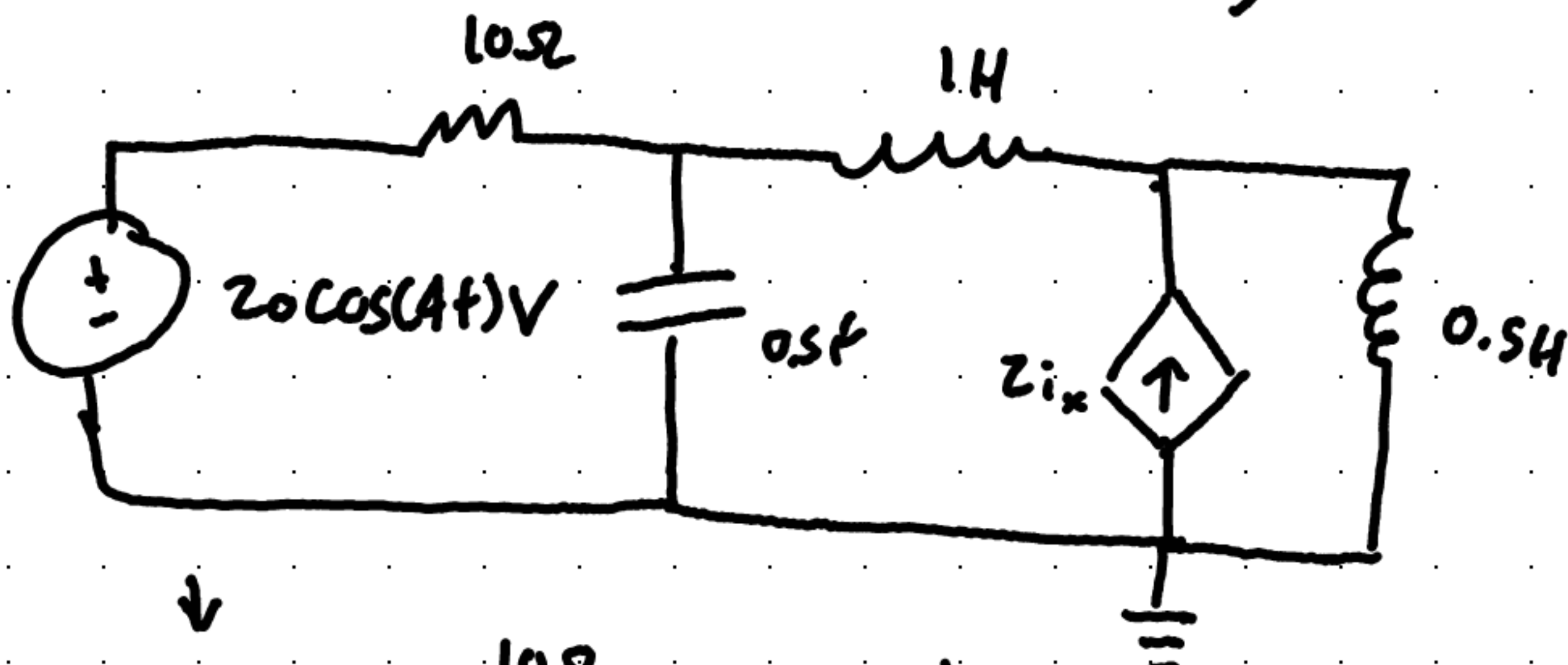


Nodal Analysis in AC:

Find I_x in the circuit by using nodal analysis



Node 1

$$\frac{V_1 - \frac{20}{\sqrt{2}} \angle 0}{10} + \frac{V_1}{-2.5j\Omega} + \frac{V_1 - V_2}{4j\Omega} = 0$$

$$i_x = \frac{V_1}{-2.5j}$$

Node 2

$$\frac{V_2 - V_1}{4j\Omega} + \frac{V_2}{2j\Omega} - 2\left(\frac{V_1}{-2.5j}\right) = 0$$

$$(1 + 1.5)V_1 + 2.5jV_2 = \frac{20}{\sqrt{2}} \angle 0^\circ \quad \text{Eqn 1}$$

$$-V_1 - 8j\left(\frac{V_1}{-2.5j}\right) + 3V_2 = 0 \quad \text{Eqn 2}$$

$$\begin{bmatrix} 1 + 1.5j & 2.5j \\ 2.2 & 3 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} \frac{20}{\sqrt{2}} \angle 0^\circ \\ 0 \end{bmatrix}$$

Cramer's Rule

$$V_1 = \frac{D_1}{D} \quad V_2 = \frac{D_2}{D} \quad \leftarrow \text{Determinant}$$

$$D_1 = \begin{bmatrix} \frac{20}{\sqrt{2}} \angle 0^\circ & 2.5j \\ 0 & 3 \end{bmatrix} =$$

$$D_2 = \begin{bmatrix} 1 + 1.5j & \frac{20}{\sqrt{2}} \angle 0^\circ \\ 2.2 & 0 \end{bmatrix} =$$

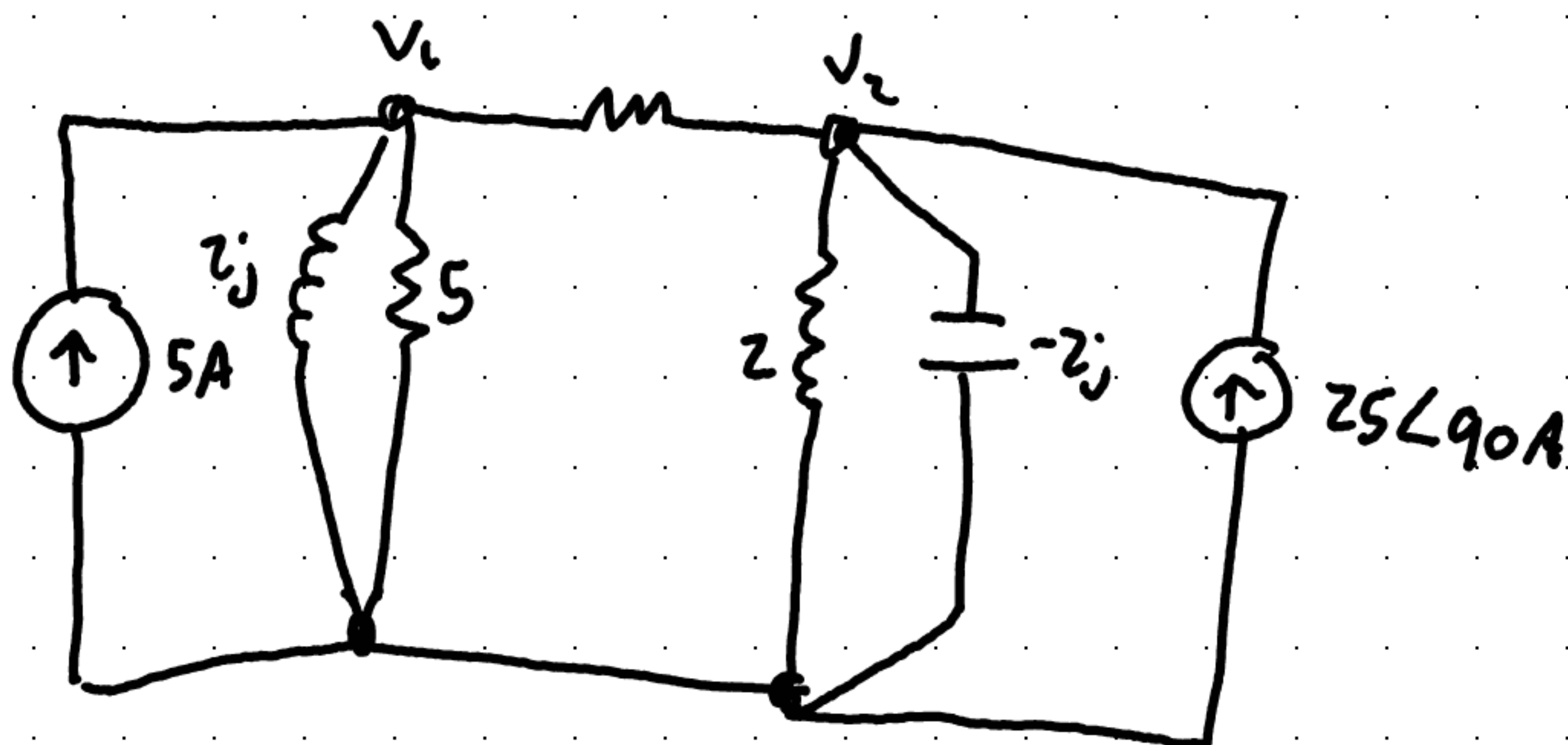
$$D = 3 - j$$

Solve, and fill in

Remember to convert back to time domain.

Nodal Matrix by inspection

- Load into matrix by Admittance



$$\overset{A}{\begin{bmatrix} \frac{1}{5} + \frac{1}{4} + \frac{1}{j2} & -\frac{1}{4} \\ -\frac{1}{4} & \frac{1}{2} + \frac{1}{4} + \frac{1}{-j2} \end{bmatrix}} \overset{x}{\begin{bmatrix} V_1 \\ V_2 \end{bmatrix}} = \overset{B}{\begin{bmatrix} +5 \\ 25\angle 90 \end{bmatrix}}$$

Can use Cramer's Rule to solve this, just as before.

Thev & Norton

- Replace Voltage Sources with Short Circuits, and Current Sources with Open Circuits