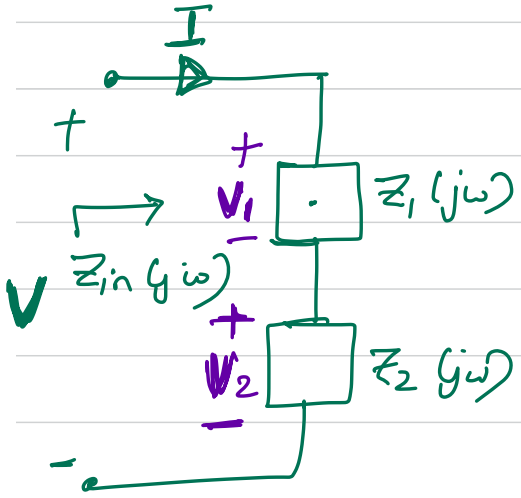
"DC" ⟷ resistance → Conductance ⟷

resistance → Impedance → Admittance ⟷

Impedance → $Z(j\omega)$ ⟷

Admittance → $Y(j\omega) = \frac{1}{Z(j\omega)}$ ⟷

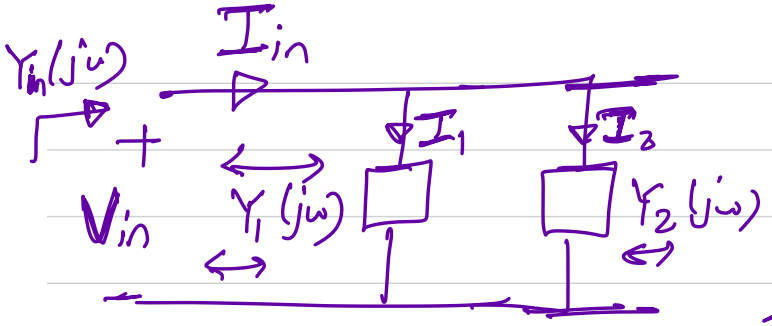


$$Z_{in}(j\omega) = \frac{V}{I} = Z_1(j\omega) + Z_2(j\omega) \quad \longleftrightarrow$$

$$I = \frac{V}{Z_1(j\omega) + Z_2(j\omega)}$$

$$\sum V_i = V \quad \longleftrightarrow$$

$$\left\{ V_i = \frac{Z_i(j\omega)}{Z_1(j\omega) + Z_2(j\omega)} V \right\} \quad \longleftrightarrow$$

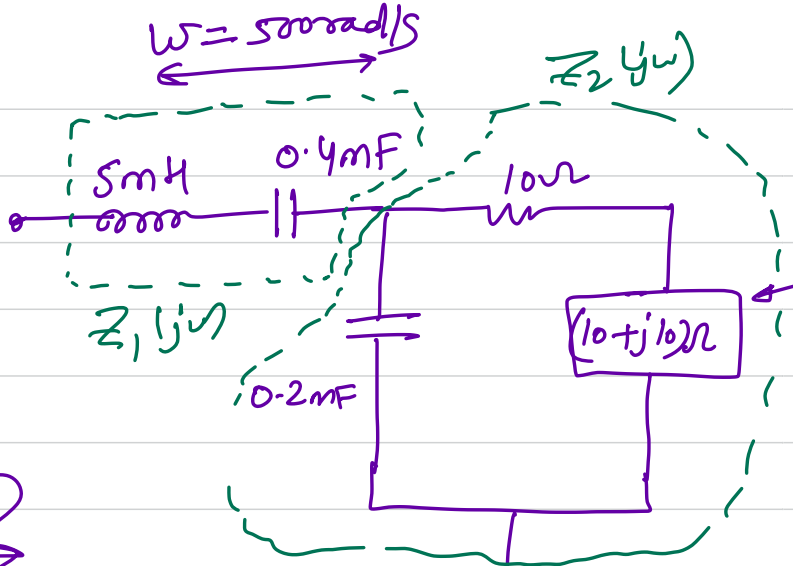


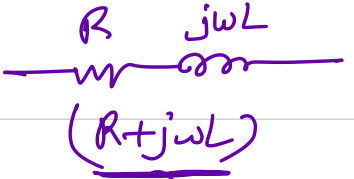
$$Y_{in}(j\omega) = Y_1(j\omega) + Y_2(j\omega)$$

$$I_i = \frac{Y_i(j\omega)}{Y_1(j\omega) + Y_2(j\omega)} I$$

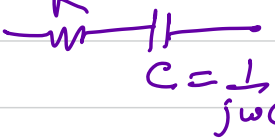
$$I_2 = \frac{Z_1(j\omega)}{Z_1(j\omega) + Z_2(j\omega)}$$

Q



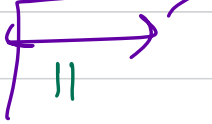


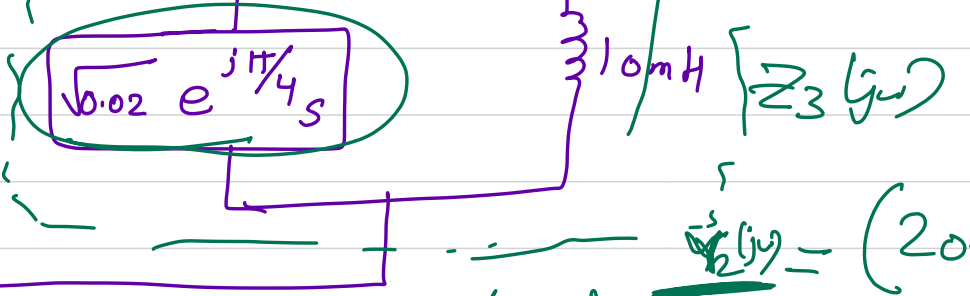
$L = \frac{10}{\omega}$



$R + \frac{1}{j\omega C} \Rightarrow \left(R \ominus \frac{j}{\omega C}\right)$

$Z_{in}(j\omega)$





$X_L = j\omega L$

$Y_L = \frac{1}{j\omega L} = \frac{-j}{\omega L}$

$\frac{1}{j\omega C} = X_C$

$j\omega C = Y_C(j\omega)$

$Y_2(j\omega) = (20 + j10)^{-1} + j\omega C$

$Y_2(j\omega)$ $Z_2(j\omega) = (5 - j10)\Omega$ $Y_2(j\omega) = 0.04 + j0.08$

$$Z_1(j\omega) = \left(j\omega L + \frac{1}{j\omega C}\right) = j\omega L - \frac{j}{\omega C}$$

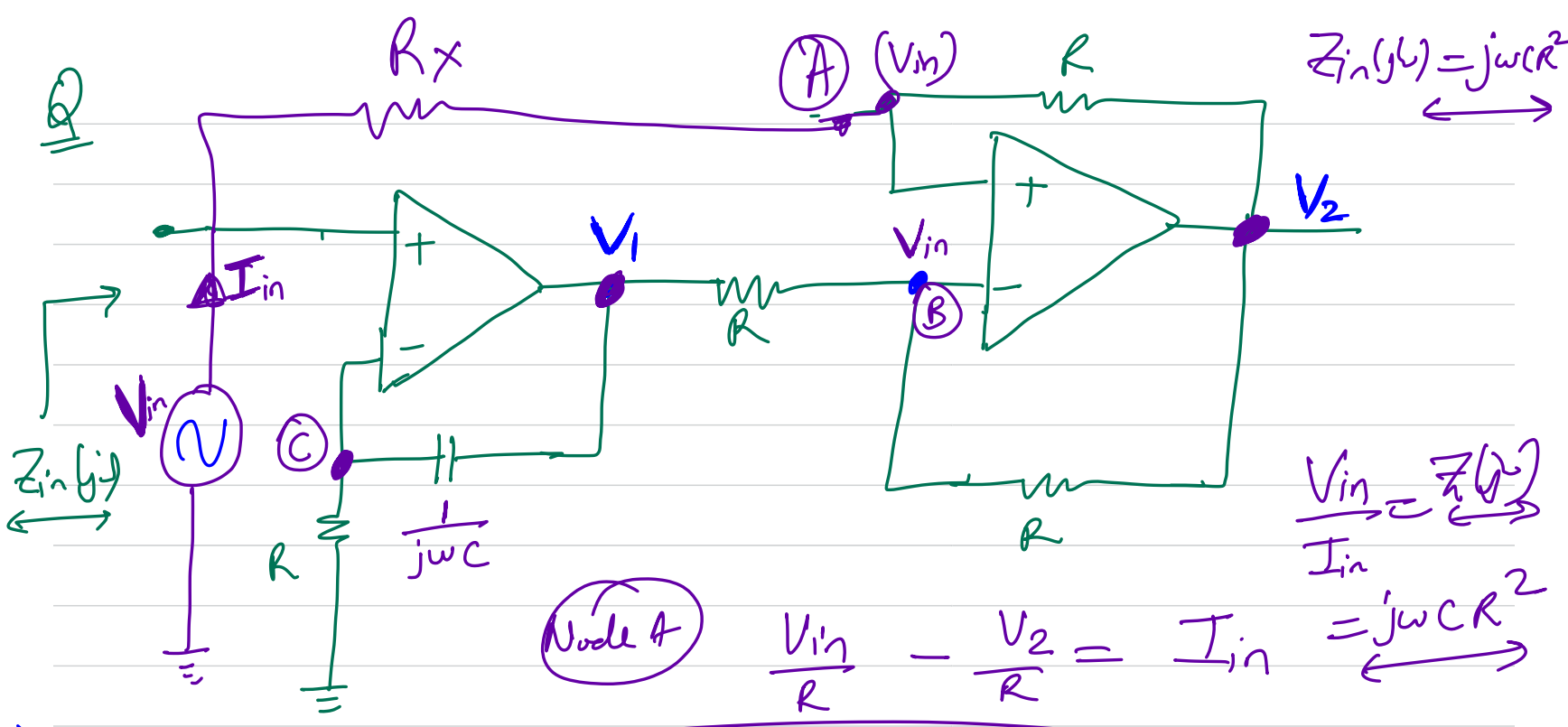
$$= j\left(\omega L - \frac{1}{\omega C}\right)$$

$$Y_3(j\omega) = \left\{\sqrt{0.02}\, e^{j\pi/4} - \frac{j}{\omega L}\right\}$$

$Z_1(j\omega) = -2.5j$

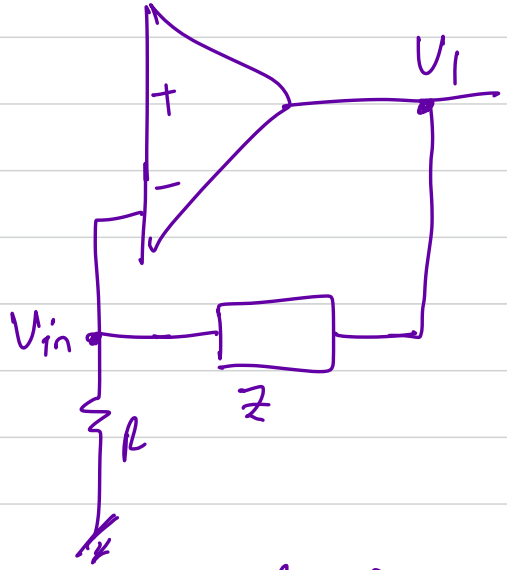
$$Y_3(j\omega) = (0.1 - j0.1)^{-1} \rightarrow Z_3(j\omega) = (5 + j5)\,\Omega$$

$$Z_{in} = Z_1 + Z_2 \| Z_3 = (10 - j7.5)\,\Omega = 12.5\angle -36.87^\circ$$


Rx
A
(Vin)
R
Zin(jω) = jωCR²
V2
V1
Vin
Iin
B
C
R
1/jωC
Zin(jω)
Vin/Iin = Zin(jω)
Node A
Vin/R − V2/R = Iin = jωCR²
Node B
Vin(2/R) − V2/R − V1/R = 0
V2 = Vin(jωC − 1/R)/jωC

Node $\{V_{in}\{\frac{1}{R}+j\omega C\}-V_1 j\omega C=0\}$ ✓

$$V_1=\left\{\frac{V_{in}\left(\frac{1}{R}+j\omega C\right)}{(j\omega C)}\right\}$$

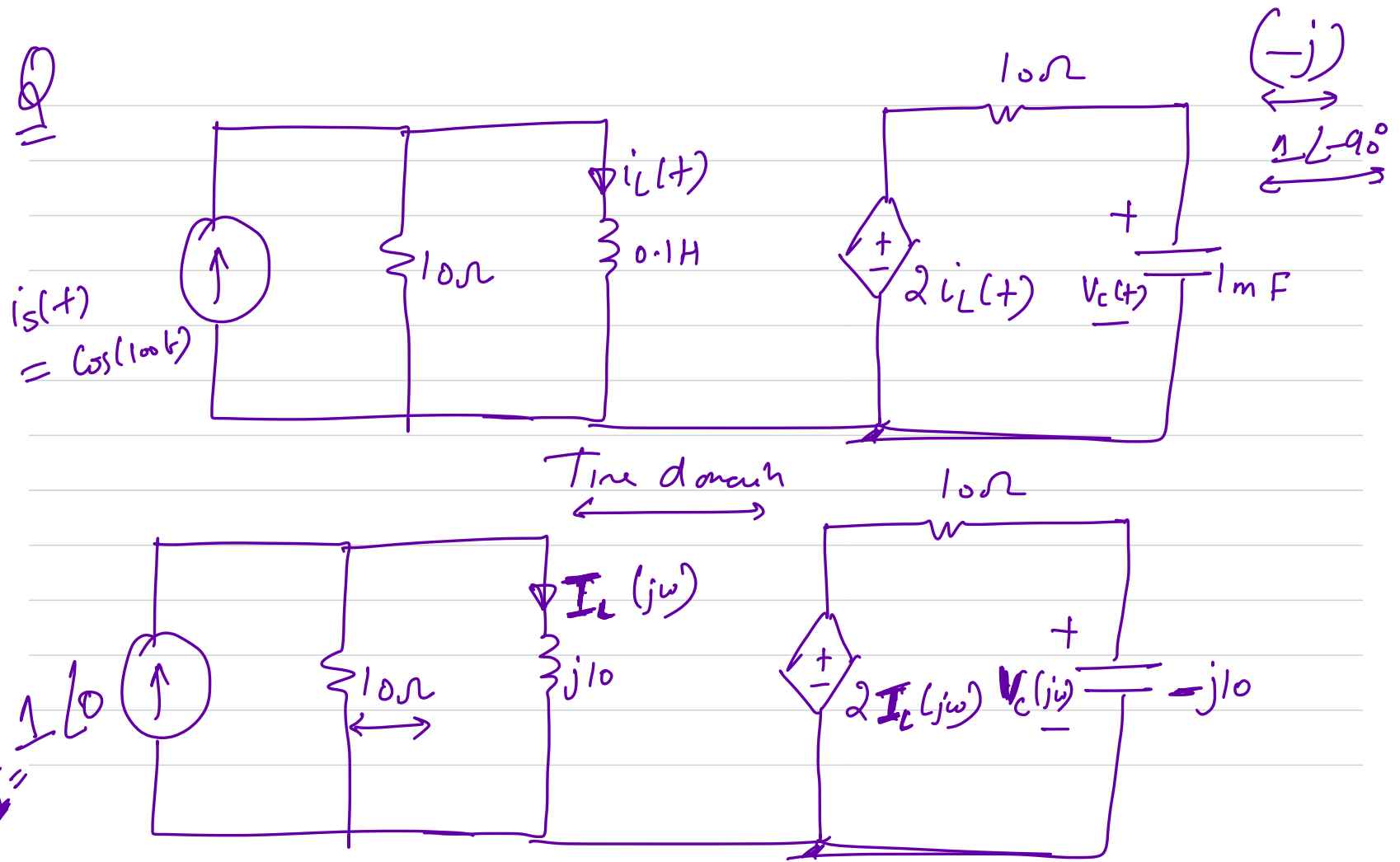


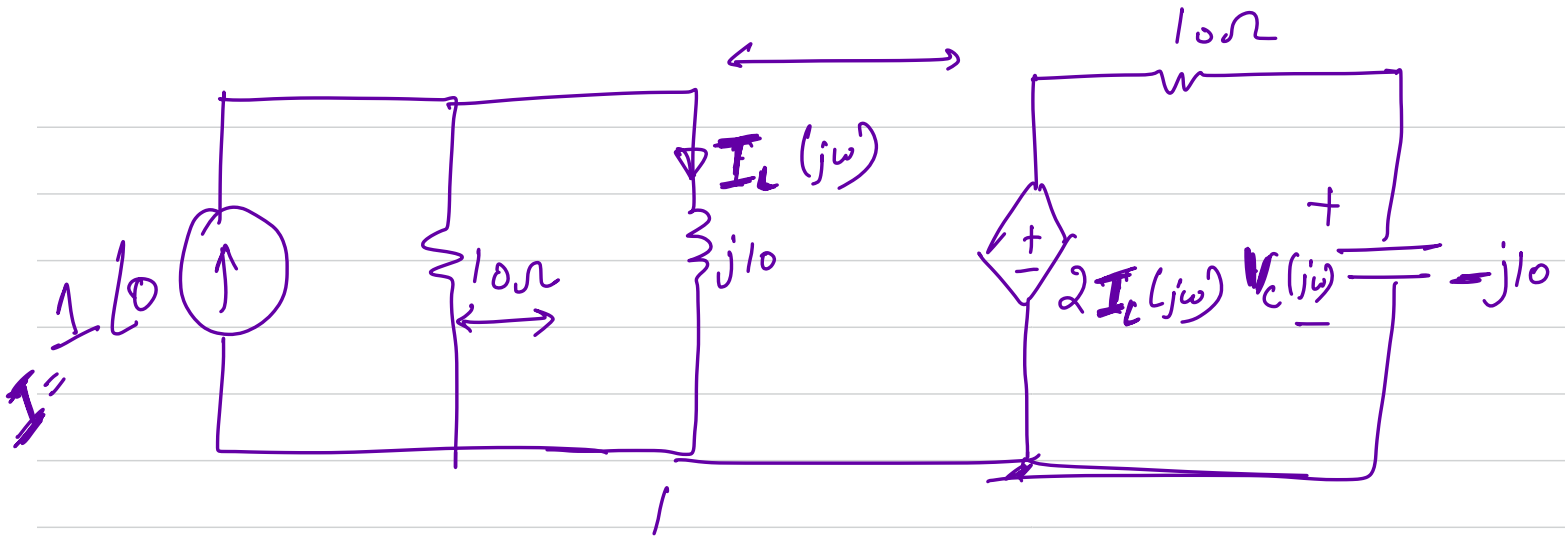
$$\frac{V_{in}-V_1}{Z}+\frac{V_{in}}{R}=0$$

$$\left\{V_{in}\left(\frac{1}{Z}+\frac{1}{R}\right)-\frac{V_1}{Z}=0\right\}$$

$$V_{in}\left\{\frac{1}{R}+j\omega C\right\}-V_1 j\omega C=0$$

$$Z=\left(\frac{1}{j\omega C}\right)$$

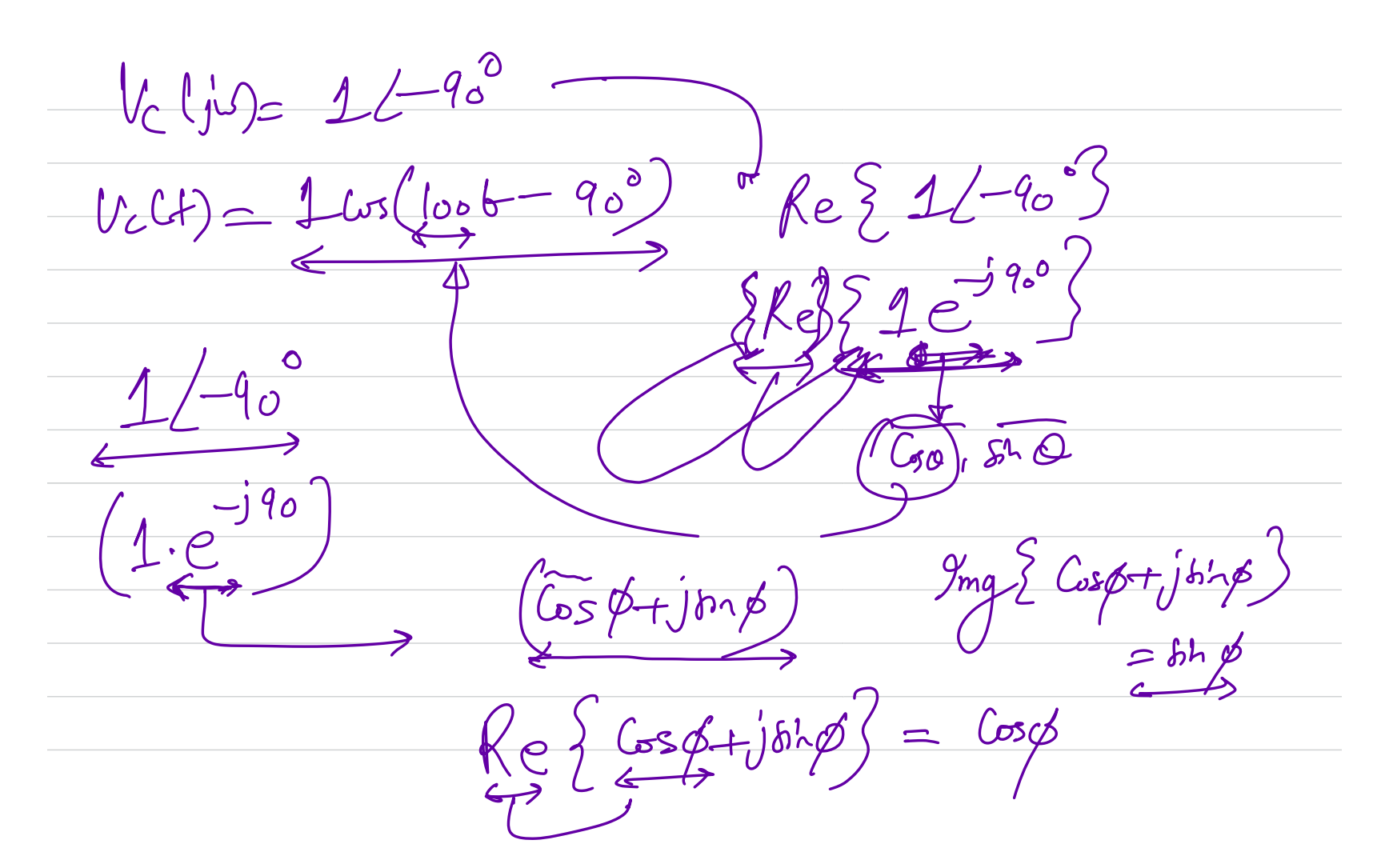

$i_s(t) = \cos(100t)$
10Ω
$i_L(t)$
0.1H
10Ω
$2i_L(t)$
$V_c(t)$
1mF
$(-j)$
$1\angle -90°$
Time domain
$1\angle 0$
10Ω
$I_L(j\omega)$
$j10$
10Ω
$2I_L(j\omega)$
$V_c(j\omega)$
$-j10$

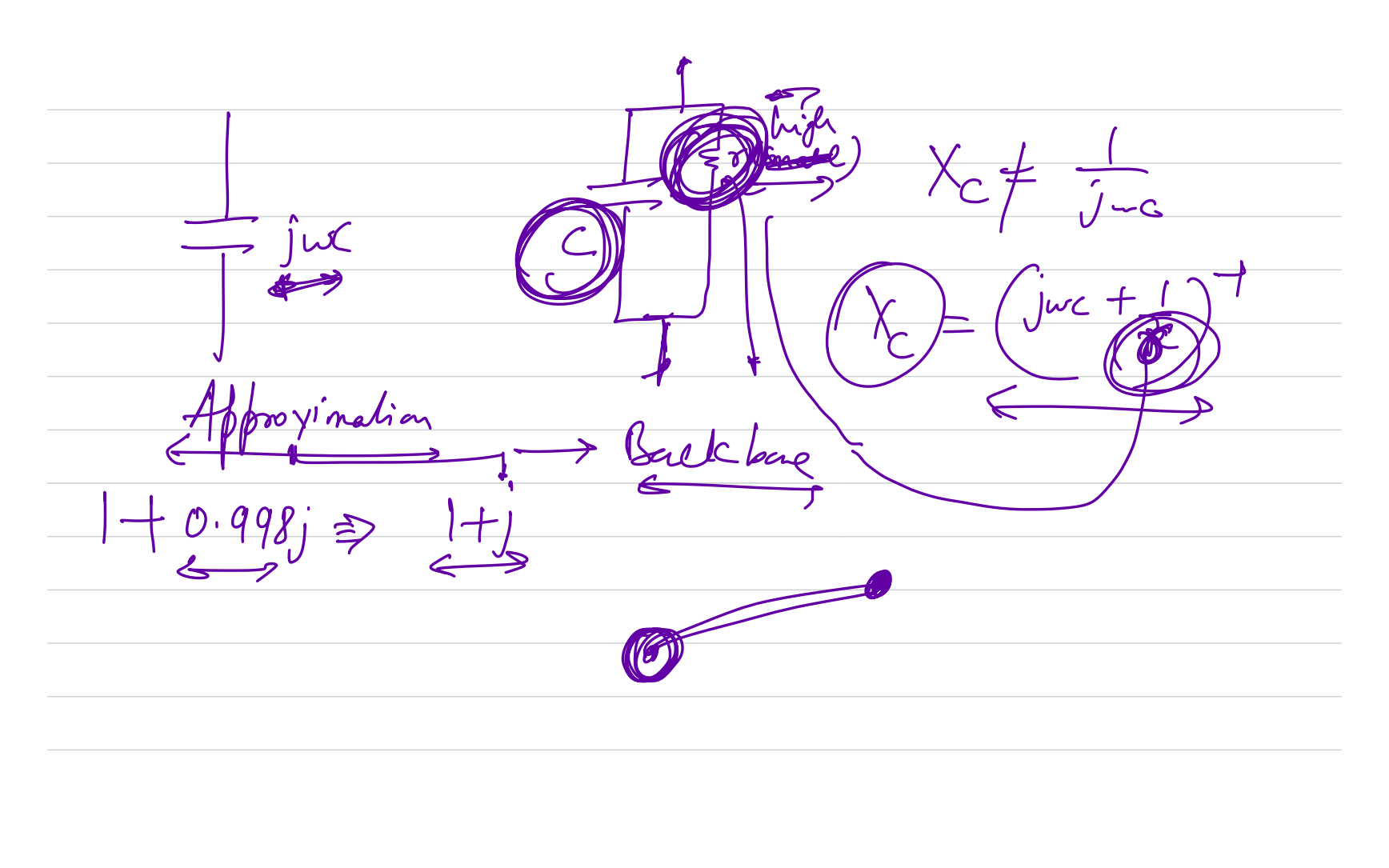


$$V_c(j\omega) = \frac{-j10}{(10\Omega - j10)} 2I_L(j\omega) = \frac{1}{\sqrt{2}}\angle -90^\circ$$

$v_c(t) =$

$$I_L(j\omega) = \frac{10\Omega}{(10\Omega + j10)} \cdot 1\angle 0 = \frac{1}{\sqrt{2}}\angle -45^\circ$$


$V_C(j\omega) = 1\angle -90^\circ$
$v_C(t) = 1\cos(100t - 90^\circ)$
$\mathrm{Re}\{1\angle -90^\circ\}$
$\{\mathrm{Re}\{1e^{-j90^\circ}\}$
$1\angle -90^\circ$
$(1\cdot e^{-j90})$
$\cos 0$, $\sin 0$
$(\cos\phi + j\sin\phi)$
$\mathrm{Img}\{\cos\phi + j\sin\phi\}$
$= \sin\phi$
$\mathrm{Re}\{\cos\phi + j\sin\phi\} = \cos\phi$


jwc
C
$X_C \neq \frac{1}{jwc}$
$X_C = (jwc + 1)^{-1}$
Approximation
Backbone
1 + 0.998j ⇒ 1 + j