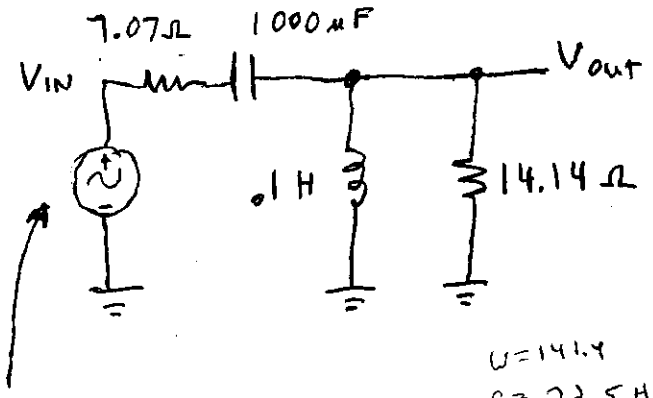
Name Key

(9C)

- Find the phasor representation of the circuit, and Vin and Vout in both phasor and time-domain representations.



$1 \cos(141.4t + \frac{\pi}{2})$

$\omega = 141.4$

$f = 22.5$ Hz

Hint: $\sqrt{2} = 1.414$ $\frac{1}{\sqrt{2}} = .707$

$Z_C = \frac{1}{j\omega C} = \frac{1}{j(141.4)(.001)} = -j\,7.07$

$Z_L = j\omega L = j(141.4)(.1) = j14.14$

$Z_{LOAD} = \frac{1}{\frac{1}{14.14} + \frac{1}{j14.14}} = \frac{1}{\;}$

$= \frac{Z_L Z_R}{Z_L + Z_R} = \frac{(j14.14)(14.14)}{14.14 + j14.14} = \frac{j200}{14.14 + j14.14}$

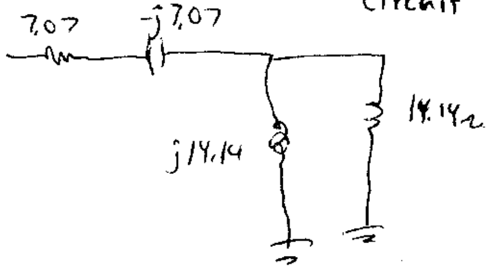
$= \frac{200\angle 90^\circ}{20\angle 45^\circ} = 10\angle 45^\circ = 7.07 + j7.07$

$\frac{V_{OUT}}{V_{IN}} = \cancel{\frac{\frac{j200}{14.14 + j14.14}}{\frac{j200}{14.14 + j14.14} + 7.07 - j7.07}}$

$\frac{V_{OUT}}{V_{IN}} = \frac{7.07 + j7.07}{7.07 + j7.07 + 7.07 - j7.07} = \frac{7.07 + j7.07}{14.14} = \frac{10\angle 45^\circ}{14.14\angle 0} = .707\angle 45^\circ$

$V_{out} = (.707\angle 45)(1\angle 90) = .707\angle 135^\circ$

Phasor representation of circuit



V_{IN} (time domain) $= 1\cos(141.4t + \frac{\pi}{2})$

V_{IN} (phasor) $= 1\angle\frac{\pi}{2}$ $1\angle 90$

V_{OUT} (time domain) $= .707\cos(141.4t + \frac{3\pi}{4})$

V_{OUT} (phasor) $= .707\angle 135^\circ = .707\angle\frac{3\pi}{4}$

③ $$\frac{V_{OUT}}{R_L} + \frac{V_{OUT}}{j\omega L} + \frac{V_{OUT} - V_2}{\frac{1}{j\omega C}} = 0$$

② $$\frac{V_2 - V_{OUT}}{\frac{1}{j\omega C}} + \frac{V_2 - V_{IN}}{R_1} = 0$$

③ $$V_{OUT}\left(\frac{1}{R_L} + \frac{1}{j\omega L} + j\omega C\right) - V_2\left(j\omega C\right) = 0$$

② $$V_2\left(j\omega C + \frac{1}{R_1}\right) - V_{OUT}\left(j\omega C\right) - V_{IN}\left(\frac{1}{R_1}\right) = 0$$

$$V_2 = \frac{V_{out}(j\omega C) + V_{IN}\left(\frac{1}{R_1}\right)}{j\omega C + \frac{1}{R_1}}$$

V_{OUT} (