The circuit above is exposed to the input voltage $V_i$ as shown. Sketch the output, $V_o$. At what times does $V_o = 240 \text{ mV}$?

(Resistances in kΩ. Voltages in V. Current in mA)

Output is a falling exponential

Time constant: $\tau = 65.5 \text{ ms}$

At time $\Delta t$ after $t = 54$.

\[
240 = 475 \exp(-\Delta t/\tau)
\]

\[
\frac{240}{475} = \exp(-\Delta t/\tau)
\]

\[
\Delta t = -\tau \log \left(\frac{240}{475}\right)
\]

$\quad t = 54 + 44.7 = 98.7 \text{ ms}$
$V_i$ is a sinusoidal waveform with frequency $\omega = 2\pi f$.

- Calculate a (simplified) expression for $H(\omega) = \frac{V_o}{V_i}$
- What is $H(\omega)$ when $\omega \to 0$ (very low frequency)?
- What is $H(\omega)$ when $\omega \to \infty$ (HF)?

- Calculate a (simplified) expression for $H(\omega) = \frac{V_o}{V_i}$

$$H(\omega) = \frac{1.5 + \frac{1}{j\omega 43.7}}{2.2 + \frac{1}{j\omega 48.8} + 1.5 + \frac{1}{j\omega 43.7}}$$

$$H(\omega) = \frac{1.5 + 0.0229}{3.7 + 0.0434}$$

$$H(\omega) = 0.4054 \frac{1 + \frac{1}{j\omega 29.11}}{1 + \frac{1}{j\omega 6.23}}$$

- What is $H(\omega)$ when $\omega = 0$ (DC)? Answer = 0.4054
- What is $H(\omega)$ when $\omega \to \infty$ (HF)? Answer = 0.09
In the circuit above, \( V_1 \) is 2.1 V, and \( V_2 \) is 6.9 V.

- What is the value of \( V_o \)?
- How much current flows out of \( V_1 \)?

(Resistances in k\( \Omega \). Voltages in V. Current in mA)

Loop 1:
- \( 2.1 - i_1 2.4 + 6.9 - (i_1 + i_2)1.5 = 0 \).
- \( 9 = i_1 3.9 + i_2 1.5 \)
- \( i_1 = \frac{9 - i_2 1.5}{3.9} = 2.31 - i_2 0.38 \)

Loop 2:
- \( 6.9 - (i_1 + i_2)1.5 - i_2 40.9 - i_2 48.8 = 0 \).
- \( 6.9 = i_1 1.5 + i_2 91.2 \)
- \( 6.9 = 3.46 - i_2 0.57 + i_2 91.20 = 3.46 + i_2 90.63 \)
- \( 3.44 = i_2 90.63 \)
- \( i_2 = 0.0380 \)
- \( V_o = -i_2 40.9 = -1.5542 \) (What is the value of \( V_o \)?)
- \( i_1 = 2.31 - i_2 0.38 = 2.29556 \)
- \( i_1 + i_2 = 2.33356 \) (How much current flows out of \( V_1 \)?)