The circuit above is exposed to an input voltage $V_i$ as shown. Sketch the output, $V_o$. At what times does $V_o = 54$ mV?

(Resistances in kΩ. Voltages in V. Current in mA)
Output is a falling exponential
Time constant: $\tau = 167.0$ ms
At time $\Delta t$ after $t = 73$.

\[
\frac{54}{110} = \exp\left(-\frac{\Delta t}{\tau}\right)
\]

\[
\Delta t = -\tau \log\left(\frac{54}{110}\right)
\]

\[
t = 73 + 118.8 = 191.8 \text{ ms}
\]
$V_i$ 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 $H(\omega) = \frac{V_o}{V_i}$

$$H(\omega) = \frac{3.2 + \frac{1}{j\omega 52.2}}{2.2 + \frac{1}{j\omega 30.5} + 3.2 + \frac{1}{j\omega 52.2}}$$

$$H(\omega) = \frac{3.2 + 0.0192}{5.4 + 0.0519}$$

$$H(\omega) = 0.5926 \frac{1 + \frac{1}{j\omega 16.28}}{1 + \frac{1}{j\omega 3.67}}$$

- What is $H(\omega)$ when $\omega = 0$ (DC)? Answer = 0.5926
- What is $H(\omega)$ when $\omega \to \infty$ (HF)? Answer = 0.13
In the circuit above, \( V_1 \) is 1.9 V, and \( V_2 \) is 3.7 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:
- \( 1.9 - i_1 3.2 + 3.7 - (i_1 + i_2) 3.2 = 0. \)
- \( 5.6 = i_1 6.4 + i_2 3.2 \)
- \( i_1 = \frac{5.6 - i_2 3.2}{6.4} = 0.88 - i_2 0.50 \)

Loop 2:
- \( 3.7 - (i_1 + i_2) 3.2 - i_2 45.8 - i_2 30.5 = 0. \)
- \( 3.7 = i_1 3.2 + i_2 79.5 \)
- \( 3.7 = 2.82 - i_2 1.60 + i_2 79.50 = 2.82 + i_2 77.90 \)
- \( 0.88 = i_2 77.90 \)
- \( i_2 = 0.0113 \)
- \( V_o = -i_2 45.8 = -0.51754 \) (What is the value of \( V_o \)?)
- \( i_1 = 0.88 - i_2 0.50 = 0.87435 \)
- \( i_1 + i_2 = 0.88565 \) (How much current flows out of \( V_1 \)?)