The circuit above is exposed to the input voltage $V_i$ as shown. Sketch the output, $V_o$. At what times does $V_o = 233$ mV?

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

Output is a falling exponential

Time constant: $\tau = 96.4$ ms

At time $\Delta t$ after $t = 59$.

\[
233 = 613e^{-\Delta t/\tau}
\]

\[
\frac{233}{613} = e^{-\Delta t/\tau}
\]

\[
\Delta t = -\tau \log \left(\frac{233}{613}\right)
\]

\[
t = 59 + 93.3 = 152.3 \text{ ms}
\]
$V_i$ 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)?

\[
H(\omega) = \frac{1.7 + \frac{1}{j\omega56.7}}{1.5 + \frac{1}{j\omega55.6} + 1.7 + \frac{1}{j\omega56.7}}
\]

\[
H(\omega) = \frac{1.7 + \frac{0.0176}{j\omega}}{3.2 + \frac{0.0356}{j\omega}}
\]

\[
H(\omega) = 0.5312 + \frac{1}{1 + \frac{1}{j\omega33.42}}
\]

- What is $H(\omega)$ when $\omega = 0$ (DC)? Answer = 0.5312
- What is $H(\omega)$ when $\omega \to \infty$ (HF)? Answer = 0.14
In the circuit above, $V_1$ is 1.3 V, and $V_2$ is 5.8 V.

- What is the value of $V_o$?
- How much current flows out of $V_1$?

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

Loop 1:

- $1.3 - i_1 3.7 + 5.8 - (i_1 + i_2) 1.7 = 0$.
- $7.1 = i_1 5.4 + i_2 1.7$
- $i_1 = \frac{7.1 - i_2 1.7}{5.4} = 1.31 - i_2 0.31$

Loop 2:

- $5.8 - (i_1 + i_2) 1.7 - i_2 42.3 - i_2 55.6 = 0$.
- $5.8 = i_1 1.7 + i_2 99.6$
- $5.8 = 2.23 - i_2 0.53 + i_2 99.60 = 2.23 + i_2 99.07$
- $3.57 = i_2 99.07$
- $i_2 = 0.0360$
- $V_o = -i_2 42.3 = -1.5228$ (What is the value of $V_o$?)
- $i_1 = 1.31 - i_2 0.31 = 1.29884$
- $i_1 + i_2 = 1.33484$ (How much current flows out of $V_1$?)