The circuit above is exposed to the an input voltage $V_i$ as shown. Sketch the output, $V_o$. At what times does $V_o = 98$ mV?

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

Output is a rising exponential

Time constant: $\tau = 85.3$ ms

At time $\Delta t$ after $t = 84$.

\[
98 = 216(1 - \exp(-\Delta t/\tau))
\]

\[
\frac{98}{216} = 1 - \exp(-\Delta t/\tau)
\]

\[
1 - \frac{98}{216} = \exp(-\Delta t/\tau)
\]

\[
\Delta t = -\tau \log\left(1 - \frac{98}{216}\right)
\]

\[
t = 84 + 51.6 = 135.6 \text{ ms}
\]
$V_i$ 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 $H(\omega) = \frac{V_o}{V_i}$

\[
H(\omega) = \frac{1.8 + \frac{1}{j\omega47.4}}{1.9 + \frac{1}{j\omega35.8} + 1.8 + \frac{1}{j\omega47.4}}
\]

\[
H(\omega) = \frac{1.8 + 0.0211}{3.7 + 0.0490}
\]

\[
H(\omega) = 0.4865 \frac{1 + \frac{1}{j\omega26.33}}{1 + \frac{1}{j\omega5.72}}
\]

- What is $H(\omega)$ when $\omega = 0$ (DC)? Answer = 0.4865
- What is $H(\omega)$ when $\omega \to \infty$ (HF)? Answer = 0.10
In the circuit above, $V_1$ is 4.3 V, and $V_2$ is 2.7 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:**

- $4.3 - i_1 2.7 + 2.7 - (i_1 + i_2) 1.8 = 0.$
- $7 = i_1 4.5 + i_2 1.8$
- $i_1 = \frac{7 - i_2 1.8}{4.5} = 1.56 - i_2 0.40$

**Loop 2:**

- $2.7 - (i_1 + i_2) 1.8 - i_2 48.4 - i_2 35.8 = 0.$
- $2.7 = i_1 1.8 + i_2 86$
- $2.7 = 2.81 - i_2 0.72 + i_2 86.00 = 2.81 + i_2 85.28$
- $-0.11 = i_2 85.28$
- $i_2 = -0.0013$
- $V_o = -i_2 48.4 = 0.06292$ (What is the value of $V_o$?)
- $i_1 = 1.56 - i_2 0.40 = 1.56052$
- $i_1 + i_2 = 1.55922$ (How much current flows out of $V_1$?)