The circuit above is exposed to the input voltage $V_i$ as shown. Sketch the output, $V_o$. At what times does $V_o = 165\, \text{mV}$?

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

Output is a falling exponential

Time constant: $\tau = 103.6\, \text{ms}$

At time $\Delta t$ after $t = 128$.

\[
165 = 288e^{-\Delta t/\tau}
\]

\[
\frac{165}{288} = e^{-\Delta t/\tau}
\]

\[
\Delta t = -\tau \log \left(\frac{165}{288}\right)
\]

\[
t = 128 + 57.7 = 185.7\, \text{ms}
\]
$V_i$ 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)?

\[ H(\omega) = \frac{2.8 + \frac{1}{j\omega 37.0}}{2.6 + \frac{1}{j\omega 39.4} + 2.8 + \frac{1}{j\omega 37.0}} \]
\[ H(\omega) = \frac{2.8 + 0.0270}{5.4 + 0.0524} \]
\[ H(\omega) = 0.5185 \frac{1 + \frac{1}{j\omega 13.23}}{1 + \frac{1}{j\omega 3.63}} \]

- What is $H(\omega)$ when $\omega = 0$ (DC)? Answer = 0.5185
- What is $H(\omega)$ when $\omega \to \infty$ (HF)? Answer = 0.14
In the circuit above, $V_1$ is 4.8 V, and $V_2$ is 6.1 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:

- $4.8 - i_1 1.7 + 6.1 - (i_1 + i_2) 2.8 = 0$.
- $10.9 = i_1 4.5 + i_2 2.8$
- $i_1 = \frac{10.9 - i_2 2.8}{4.5} = 2.42 - i_2 0.62$

Loop 2:

- $6.1 - (i_1 + i_2) 2.8 - i_2 59.4 - i_2 39.4 = 0$.
- $6.1 = i_1 2.8 + i_2 101.6$
- $6.1 = 6.78 - i_2 1.74 + i_2 101.60 = 6.78 + i_2 99.86$
- $-0.68 = i_2 99.86$
- $i_2 = -0.0068$
- $V_o = -i_2 59.4 = 0.40392$ (What is the value of $V_o$?)
- $i_1 = 2.42 - i_2 0.62 = 2.424216$
- $i_1 + i_2 = 2.417416$ (How much current flows out of $V_1$?)