The circuit above is exposed to the input voltage $V_i$ as shown. Sketch the output, $V_o$. At what times does $V_o = 305$ mV?

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

Output is a rising exponential

Time constant: $\tau = 173.2$ ms

At time $\Delta t$ after $t = 113$.

$305 = 648(1 - exp(-\Delta t/\tau))$

$\frac{305}{648} = 1 - exp(-\Delta t/\tau)$

$1 - \frac{305}{648} = exp(-\Delta t/\tau)$

$\Delta t = -\tau log\left(1 - \frac{305}{648}\right)$

$t = 113 + 110.2 = 223.2$ 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)?

\[ H(\omega) = \frac{4.0 + \frac{1}{j\omega43.3}}{2.0 + \frac{1}{j\omega57.4} + 4.0 + \frac{1}{j\omega43.3}} \]
\[ H(\omega) = \frac{4.0 + 0.0231}{6 + 0.0405} \]
\[ H(\omega) = 0.6667 \left( 1 + \frac{1}{j\omega10.82} \right) \left( 1 + \frac{1}{j\omega4.12} \right) \]

- What is $H(\omega)$ when $\omega = 0$ (DC)? Answer = 0.6667
- What is $H(\omega)$ when $\omega \to \infty$ (HF)? Answer = 0.25
In the circuit above, $V_1$ is 5.6 V, and $V_2$ is 3.9 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:
- $5.6 - i_1 2.3 + 3.9 - (i_1 + i_2) 4.0 = 0.$
- $9.5 = i_1 6.3 + i_2 4.0$
- $i_1 = \frac{9.5 - i_2 4.0}{6.3} = 1.51 - i_2 0.63$

Loop 2:
- $3.9 - (i_1 + i_2) 4.0 - i_2 55.8 - i_2 57.4 = 0.$
- $3.9 = i_1 4.0 + i_2 117.2$
- $3.9 = 6.04 - i_2 2.52 + i_2 117.20 = 6.04 + i_2 114.68$
- $-2.14 = i_2 114.68$
- $i_2 = -0.0187$
- $V_o = -i_2 55.8 = 1.04346$ (What is the value of $V_o$?)
- $i_1 = 1.51 - i_2 0.63 = 1.521781$
- $i_1 + i_2 = 1.503081$ (How much current flows out of $V_1$?)