The circuit above is exposed to the input voltage $V_i$ as shown. Sketch the output, $V_o$. At what times does $V_o = 431$ mV?

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

Output is a rising exponential

Time constant: $\tau = 72.8$ ms

At time $\Delta t$ after $t = 109$.

$431 = 677(1 - \exp(-\Delta t/\tau))$

$\frac{431}{677} = 1 - \exp(-\Delta t/\tau)$

$1 - \frac{431}{677} = \exp(-\Delta t/\tau)$

$\Delta t = -\tau \log\left(1 - \frac{431}{677}\right)$

$t = 109 + 73.7 = 182.7$ 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)?

$H(\omega) = \frac{1.6 + \frac{1}{j\omega45.5}}{3.0 + \frac{1}{j\omega58.9} + 1.6 + \frac{1}{j\omega45.5}}$

$H(\omega) = \frac{1.6 + 0.0220}{4.6 + 0.0390}$

$H(\omega) = 0.3478 \frac{1 + \frac{1}{j\omega28.41}}{1 + \frac{1}{j\omega5.57}}$

- What is $H(\omega)$ when $\omega = 0$ (DC)? Answer = 0.3478
- What is $H(\omega)$ when $\omega \to \infty$ (HF)? Answer = 0.07
In the circuit above, $V_1$ is 1.8 V, and $V_2$ is 4.0 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:
- $1.8 - i_12.6 + 4.0 - (i_1 + i_2)1.6 = 0$.
- $5.8 = i_14.2 + i_21.6$
- $i_1 = \frac{5.8 - i_21.6}{4.2} = 1.38 - i_20.38$

Loop 2:
- $4.0 - (i_1 + i_2)1.6 - i_254.6 - i_258.9 = 0$.
- $4.0 = i_11.6 + i_2115.1$
- $4.0 = 2.21 - i_20.61 + i_2115.10 = 2.21 + i_2114.49$
- $1.79 = i_2114.49$
- $i_2 = 0.0156$
- $V_o = -i_254.6 = -0.85176$ (What is the value of $V_o$?)
- $i_1 = 1.38 - i_20.38 = 1.374072$
- $i_1 + i_2 = 1.389672$ (How much current flows out of $V_1$?)