The circuit above is exposed to the input voltage $V_i$ as shown. Sketch the output, $V_o$. At what times does $V_o = 348$ mV?

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

Output is a rising exponential

Time constant: $\tau = 145.8$ ms

At time $\Delta t$ after $t = 121$.

$348 = 471(1 - exp(-\Delta t/\tau))$

$\frac{348}{471} = 1 - exp(-\Delta t/\tau)$

$1 - \frac{348}{471} = exp(-\Delta t/\tau)$

$\Delta t = -\tau log\left(1 - \frac{348}{471}\right)$

$t = 121 + 195.8 = 316.8$ 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)?

$$H(\omega) = \frac{2.7 + \frac{1}{j\omega54.0}}{3.6 + \frac{1}{j\omega48.5} + 2.7 + \frac{1}{j\omega54.0}}$$

$$H(\omega) = \frac{2.7 + 0.0185}{6.3 + 0.0391}$$

$$H(\omega) = 0.4286 \frac{1 + \frac{1}{j\omega20.02}}{1 + \frac{1}{j\omega4.06}}$$

- What is $H(\omega)$ when $\omega = 0$ (DC)? Answer = 0.4286

- What is $H(\omega)$ when $\omega \to \infty$ (HF)? Answer = 0.09
In the circuit above, $V_1$ is 2.3 V, and $V_2$ is 1.1 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:
- $2.3 - i_1 3.4 + 1.1 - (i_1 + i_2) 2.7 = 0.$
- $3.4 = i_1 6.1 + i_2 2.7$
- $i_1 = \frac{3.4 - i_2 2.7}{6.1} = 0.56 - i_2 0.44$

Loop 2:
- $1.1 - (i_1 + i_2) 2.7 - i_2 57.8 - i_2 48.5 = 0.$
- $1.1 = i_1 2.7 + i_2 109$
- $1.1 = 1.51 - i_2 1.19 + i_2 109.00 = 1.51 + i_2 107.81$
- $-0.41 = i_2 107.81$
- $i_2 = -0.0038$
- $V_o = -i_2 57.8 = 0.21964$ (What is the value of $V_o$?)
- $i_1 = 0.56 - i_2 0.44 = 0.561672$
- $i_1 + i_2 = 0.557872$ (How much current flows out of $V_1$?)