The op-amp is ideal, with $V_{CC} = 10\, \text{V}$ and $V_{EE} = -10\, \text{V}$.

- Sketch the input $V_+$ as a function of the voltage input $V_i$.

- Sketch the output $V_o$ as a function of the voltage input $V_i$. (label times and voltages)

- What is $V_o$ at $t = 3.6\, \text{ms}$?

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All voltages in $\text{V}$

- Sketch the input $V_+$ as a function of the voltage input $V_i$.

  Waveform at $V_+$ is an decreasing exponential, starting at $V_+ = 0.86 - 0.28 = 0.58$

  $\Delta t = 3.6 - 1.3 = 2.3$

  $\tau = RC = 20.7 \times 38.9 = 805.23\, \mu\text{s} = 0.81\, \text{ms}$

  $V_+(3.6) = 0.58e^{-\Delta t/\tau} = 0.0339$

- Sketch the output $V_o$ as a function of the voltage input $V_i$. (label times and voltages)

  From $V_+$ to $V_o$ is a non-inverting amplifier of gain, $G = 1 + 46/21 = 3.19$

  Waveform at $V_o$ is an decreasing exponential, starting at $V_+ = 3.19 \times 0.58 = 1.85$

- What is $V_o$ at $t = 3.6\, \text{ms}$?

  $V_+(3.6) = 1.85e^{-\Delta t/\tau} = 0.108$
The op-amp is ideal, with $V_{CC} = 10$ V and $V_{EE} = -10$ V.

- Sketch the input $V_+$ as a function of the voltage input $V_i$.  
- Sketch the output $V_o$ as a function of the voltage input $V_i$. (label times and voltages)  
- What is $V_o$ at $t = 3.5$ ms?

All voltages in mV

- Sketch the input $V_+$ as a function of the voltage input $V_i$.  
  $V_+$ is the voltage-divider output from $V_i$.  
  $V_+ = [3.4/(3.4 + 20.7)] V_o = 0.141 V_o$  
  Thus, output goes from $V_+ = 0.141 \times 23.62 = 3.33$ to $V_+ = 0.141 \times 61.18 = 8.63$

- Sketch the output $V_o$ as a function of the voltage input $V_i$. (label times and voltages)  
  Gain, $G = G = 1 + (1000||1000)/34 = 15.71$  
  Thus, output goes from $V_o = 0.141 \times 23.62 \times G = 52.3$ to $V_o = 0.141 \times 61.18 \times G = 135.5$

- What is $V_o$ at $t = 3.5$ ms?  
  $V_o = 0.141 \times 61.18 \times G = 135.5$
The op-amp is ideal, with $V_{CC} = 15\,\text{V}$ and $V_{EE} = -15\,\text{V}$.
Input $V_A = -5\,\text{mV}$ (constant over time).

- Sketch the output $V_o$ as a function of the voltage input $V_i$. (label times and voltages)
- What is $V_o$ at $t = 3.5\,\text{ms}$?

All voltages in mV
- Sketch the output $V_o$ as a function of the voltage input $V_i$. (label times and voltages)
  This is an added circuit

\[
V_o = -\left(\frac{1100}{3.1}V_A + \frac{1100}{21}V_B\right) = -(354.8V_A + 52.4V_B)
\]

Thus, the output goes from
\[
V_o = -[354.8(-5) + 52.4(30)] = 202 = 0.20\,\text{V} \,\text{to}\]
\[
V_o = -[354.8(-5) + 52.4(48)] = -741 = -0.74\,\text{V}
\]

Test: Is $V_o \geq V_{CC}$ or $V_o \leq V_{EE}$?
- What is $V_o$ at $t = 3.5\,\text{ms}$?
\[
V_o = -(354.8(-5) + 52.4(48)) = -741 = -0.74\,\text{V}
\]