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 $t = 4.4\, \text{ms}$?

All voltages in V

- Sketch the input $V_+$ as a function of the voltage input $V_i$.
  
  Waveform at $V_+$ is an decreasing exponential, starting at $V_+ = 0.87 - 0.33 = 0.54$
  
  $\Delta t = 4.4 - 1.7 = 2.7$
  
  $\tau = RC = 24.1 \times 34.3 = 826.63\, \mu\text{s} = 0.83\, \text{ms}$
  
  $V_+(4.4) = 0.54e^{-\Delta t/\tau} = 0.0209$

- 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, $G = 1 + 79/28 = 3.82$
  
  Waveform at $V_o$ is an decreasing exponential, starting at $V_+ = 3.82 \times 0.54 = 2.06$

- What is $V_o$ at $t = 4.4\, \text{ms}$?
  
  $V_+(4.4) = 2.06e^{-\Delta t/\tau} = 0.080$
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 mV

- Sketch the input $V_+$ as a function of the voltage input $V_i$.
  $V_+$ is the voltage-divider output from $V_i$.
  $V_+ = \left[\frac{5.9}{(5.9 + 24.1)}\right] V_o = 0.197 V_o$
  Thus, output goes from $V_+ = 0.197 \times 23.68 = 4.66$ to $V_+ = 0.197 \times 62.92 = 12.40$

- Sketch the output $V_o$ as a function of the voltage input $V_i$ (label times and voltages).
  Gain, $G = G = 1 + (1400 || 1400)/37 = 19.92$
  Thus, output goes from $V_o = 0.197 \times 23.68 \times G = 92.9$ to $V_o = 0.197 \times 62.92 \times G = 246.9$

- What is $V_o$ at $t = 3.6 \text{ ms}$?
  $V_o = 0.197 \times 62.92 \times G = 246.9$
The op-amp is ideal, with $V_{CC} = 15\, \text{V}$ and $V_{EE} = -15\, \text{V}$.
Input $V_A = -9\, \text{mV}$ (constant over time).

![Circuit Diagram]

- Sketch the output $V_o$ as a function of the voltage input $V_i$. (label times and voltages)
- What is $V_o$ at $t = 3.6\, \text{ms}$?

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

$$V_o = -\left(\frac{2000}{3.6} V_A + \frac{2000}{28} V_B\right) = -(555.6V_A + 71.4V_B)$$

Thus, the output goes from

$V_o = -[555.6(-9) + 71.4(35)] = 2501 = 2.50\, \text{V}$ to

$V_o = -[555.6(-9) + 71.4(49)] = 1502 = 1.50\, \text{V}$

**Test:** Is $V_o \geq V_{CC}$ or $V_o \leq V_{EE}$?

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

$V_o = -(555.6(-9) + 71.4(49) = 1502 = 1.50\, \text{V}$