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 $t = 3.5 \text{ ms}$?

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 $V_+ = 0.51 - 0.31 = 0.2$
  $\Delta t = 3.5 - 1.1 = 2.4$
  $\tau = RC = 37.8 \times 29.5 = 1115.1 \mu \text{s} = 1.12 \text{ ms}$
  $V_+(3.5) = 0.2e^{-\Delta t/\tau} = 0.0235$

- 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, $G = 1 + 45/29 = 2.55$
  Waveform at $V_o$ is an decreasing exponential, starting at $V_+ = 2.55 \times 0.2 = 0.51$

- What is $V_o$ at $t = 3.5 \text{ ms}$?
  $V_+(3.5) = 0.51e^{-\Delta t/\tau} = 0.060$
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 $t = 3.4$ 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 $V_i$.
  $$V_+ = \left[\frac{3.4}{3.4 + 37.8}\right] V_o = 0.083V_o$$
  Thus, output goes from $V_+ = 0.083 \times 20.14 = 1.67$ to $V_+ = 0.083 \times 60.35 = 5.01$

- Sketch the output $V_o$ as a function of the voltage input $V_i$. (label times and voltages)
  Gain, $G = G = 1 + (1500\|1500)/36 = 21.83$
  Thus, output goes from $V_o = 0.083 \times 20.14 \times G = 36.5$ to $V_o = 0.083 \times 60.35 \times G = 109.3$

- What is $V_o$ at $t = 3.4$ ms?
  $V_o = 0.083 \times 60.35 \times G = 109.3$
The op-amp is ideal, with \( V_{CC} = 15 \) V and \( V_{EE} = -15 \) V.
Input \( V_A = -3 \) 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 \( t = 3.4 \) 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

\[
V_o = - \left( \frac{1100}{5.7} V_A + \frac{1100}{29} V_B \right) = - (193.0 V_A + 37.9 V_B)
\]

Thus, the output goes from
\[
V_o = -[193.0(-3) + 37.9(33)] = -672 = -0.67 \text{ V to}
\]
\[
V_o = -[193.0(-3) + 37.9(13)] = 86 = 0.09 \text{ V}
\]

Test: Is \( V_o \geq V_{CC} \) or \( V_o \leq V_{EE} \)?

- What is \( V_o \) at \( t = 3.4 \) ms?
\[
V_o = -(193.0(-3) + 37.9(13)) = 86 = 0.09 \text{ V}
\]