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 $t = 4.3$ 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 $V_+ = 0.72 - 0.39 = 0.33$
  $\Delta t = 4.3 - 1.4 = 2.9$
  $\tau = RC = 30.3 \times 32.2 = 975.66 \mu s = 0.98$ ms
  $V_+(4.3) = 0.33e^{-\Delta t/\tau} = 0.0171$

- 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, $G = 1 + 42/29 = 2.45$
  Waveform at $V_o$ is an decreasing exponential, starting at $V_+ = 2.45 \times 0.33 = 0.81$

- What is $V_o$ at $t = 4.3$ ms? 
  $V_+(4.3) = 0.81e^{-\Delta t/\tau} = 0.042$
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 $t = 4.2\, \text{ms}$?

All voltages in mV

- Sketch the input $V_+$ as a function of the voltage input $V_i$.
  $V_+$ is the voltage-divider output from $V_i$.
  $V_+ = [3.2/(3.2 + 30.3)] \times V_i = 0.096V_i$
  Thus, output goes from $V_+ = 0.096 \times 22.21 = 2.13$ to $V_+ = 0.096 \times 61.54 = 5.91$

- Sketch the output $V_o$ as a function of the voltage input $V_i$. (label times and voltages)
  Gain, $G = G = 1 + (1500||1500)/40 = 19.75$
  Thus, output goes from $V_o = 0.096 \times 22.21 \times G = 42.1$ to $V_o = 0.096 \times 61.54 \times G = 116.7$

- What is $V_o$ at $t = 4.2\, \text{ms}$?
  $V_o = 0.096 \times 61.54 \times G = 116.7$
The op-amp is ideal, with $V_{CC} = 15\,\text{V}$ and $V_{EE} = -15\,\text{V}$.

Input $V_A = -6\,\text{mV}$ (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 $t = 4.2\,\text{ms}$?

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

$$V_o = -\left(\frac{1100}{4.5} V_A + \frac{1100}{29} V_B\right) = -(244.4V_A + 37.9V_B)$$

Thus, the output goes from

$V_o = -[244.4(-6) + 37.9(41)] = -87 = -0.09\,\text{V}$ to

$V_o = -[244.4(-6) + 37.9(34)] = 178 = 0.18\,\text{V}$

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

- What is $V_o$ at $t = 4.2\,\text{ms}$?

$V_o = -(244.4(-6) + 37.9(34)) = 178 = 0.18\,\text{V}$