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 $t = 4.0$ 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 $V_+ = 0.84 - 0.20 = 0.64$
  
  $\Delta t = 4.0 - 1.2 = 2.8$
  
  $\tau = RC = 26.4 \times 24.1 = 636.24 \mu s = 0.64$ ms
  
  $V_+(4.0) = 0.64e^{-\Delta t/\tau} = 0.0081$

- 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, $G = 1 + \frac{74}{30} = 3.47$
  
  Waveform at $V_o$ is an decreasing exponential, starting at $V_+ = 3.47 \times 0.64 = 2.22$

- What is $V_o$ at $t = 4.0$ ms?
  
  $V_+(4.0) = 2.22e^{-\Delta t/\tau} = 0.028$
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 $t = 4.6\, \text{ms}$?

All voltages in mV

- Sketch the input $V_+$ as a function of the voltage input $V_i$.
  $V_+$ is the voltage-divider output from $V_i$.  
  $V_+ = \left[\frac{5.6}{5.6 + 26.4}\right] V_o = 0.175 V_o$  
  Thus, output goes from $V_+ = 0.175 \times 23.45 = 4.10$ to $V_+ = 0.175 \times 60.91 = 10.66$

- Sketch the output $V_o$ as a function of the voltage input $V_i$ (label times and voltages)
  Gain, $G = \frac{G}{1500} = 1 + \frac{(1500||1500)}{30} = 26.00$
  Thus, output goes from $V_o = 0.175 \times 23.45 \times G = 106.7$ to $V_o = 0.175 \times 60.91 \times G = 277.1$

- What is $V_o$ at $t = 4.6\, \text{ms}$?
  $V_o = 0.175 \times 60.91 \times G = 277.1$
The op-amp is ideal, with $V_{CC} = 15\, \text{V}$ and $V_{EE} = -15\, \text{V}$.
Input $V_A = -4\, \text{mV}$ (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 $t = 4.6\, \text{ms}$?

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

$$V_o = - \left( \frac{1900}{4.0} V_A + \frac{1900}{30} V_B \right) = -(475.0V_A + 63.3V_B)$$

Thus, the output goes from
$V_o = -[475.0(-4) + 63.3(22)] = 507 = 0.51\, \text{V}$ to
$V_o = -[475.0(-4) + 63.3(46)] = -1012 = -1.01\, \text{V}$

Test: Is $V_o \geq V_{CC}$ or $V_o \leq V_{EE}$?
- What is $V_o$ at $t = 4.6\, \text{ms}$?
$V_o = -(475.0(-4) + 63.3(46)) = -1012 = -1.01\, \text{V}$