EECE 2150 - Circuits and Signals: Biomedical Applications Fall 2023
Quiz 5

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The figure shows an amplifier circuit using an ideal op-amp, with the exception that the supply voltage rails are $\pm 9\,\mathrm{V}$. The resistors are $R_1 = 2\,\mathrm{k}\Omega$ and $R_2 = 30\,\mathrm{k}\Omega$. The voltage source has $R_s \approx 0\,\Omega$.

1. What is the gain of the amplifier?

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2. If $v_s = 0.3\,\mathrm{V}$, what is the output voltage?

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3. If $v_s = 0.3\,\mathrm{V} \times \cos 2\pi f t$ with $f = 1000\,\mathrm{Hz}$, write an equation for the output voltage.

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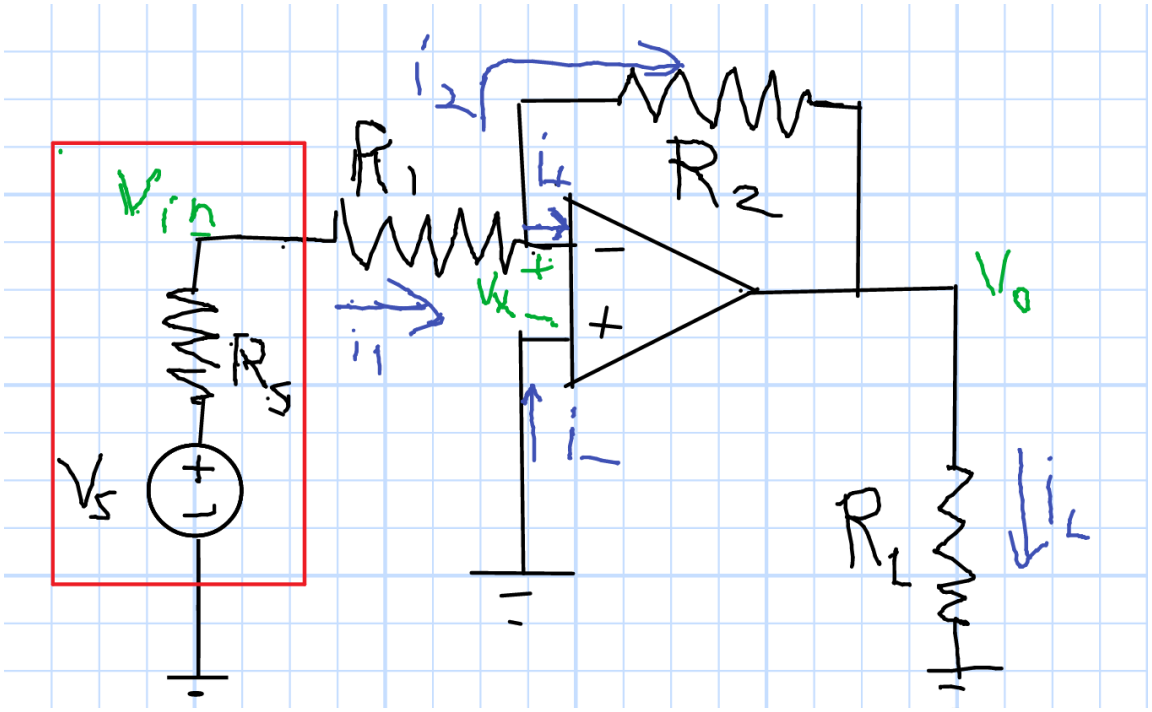
4. Now we change the input to $v_s = 1\,\mathrm{V} \times \cos 2\pi f t$, keeping the frequency the same. To view this signal on the oscilloscope, select the best time base of the following three for the horizontal setting.

☐ $5\,\mu$sec/division ☐ $500\,\mu$sec/division ☐ 500 msec/division

5. We connect the input to Channel 1 of the oscilloscope with a setting of 100 mV/divison and the output to Channel 2 at 5 V/division. Sketch what we would see on the oscilloscope.


i_2
R_1
R_2
i_4
V_{in}
R_s
i_1
V_4
V_o
V_s
i_L
R_L
i_L

Solution

1.
$$-\frac{R_2}{R_1} = -15$$

2.
$$-15 \times v_s = -4.5\,\mathrm{V}$$

3.
$$v_{out} = -4.5 \cos 2\pi f t.$$

4. $500\,\mu$sec/division. This gives us 2 divisions per cycle.

5.