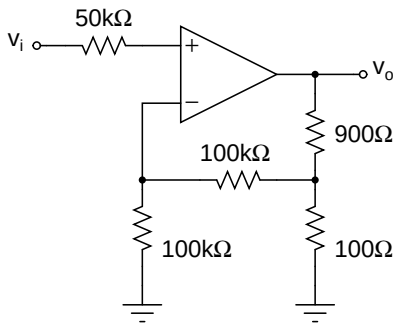
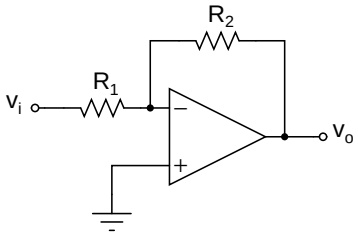
Operational Amplifiers Practice Problems

1. The operational amplifier in the following circuit is ideal.



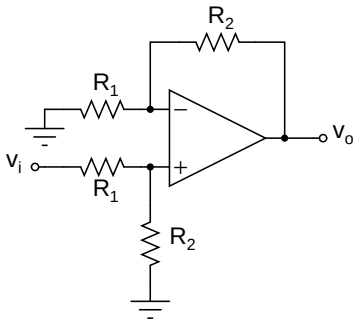

   Find the circuit's gain $A_v = \frac{v_o}{v_i}$.

2. The amplifier shown in the following sketch has a voltage gain $A_v = -100$ and input resistance $R_{in} = 10k\Omega$.



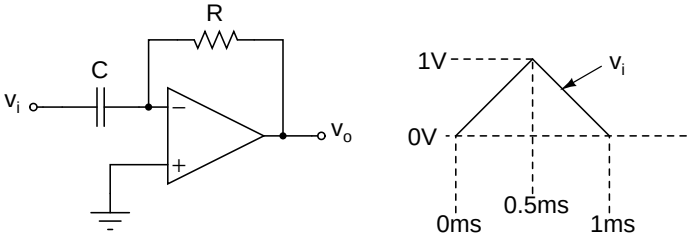

   Determine $R_1$ and $R_2$ assuming an ideal operational amplifier.

3. The amplifier shown in the following sketch has a voltage gain $A_v = +100$ and input resistance $R_{in} = 10k\Omega$.



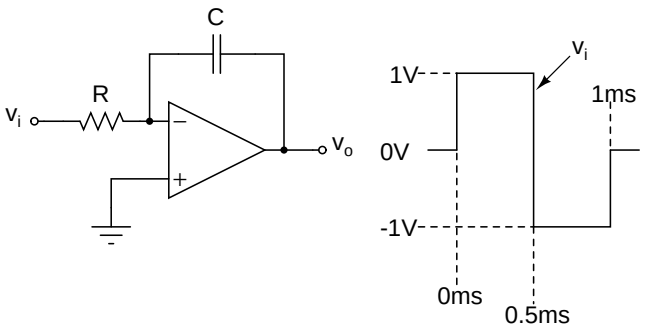

   Determine $R_1$ and $R_2$ assuming an ideal operational amplifier.

4. For the circuit shown in the following sketch, $R = 1k\Omega$ and $C = 1\mu F$. The opamp is ideal.



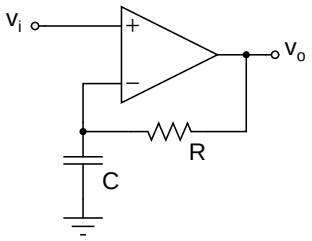

   Draw the output waveform when the input voltage is the one shown on the right hand side of the figure.

5. For the circuit shown in the following sketch, $R = 1k\Omega$ and $C = 1\mu F$.




Draw the output waveform when the input voltage is the one shown on the right hand side of the figure.

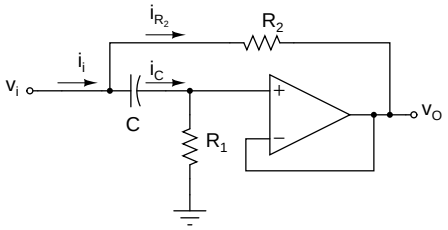
6. For the following circuit



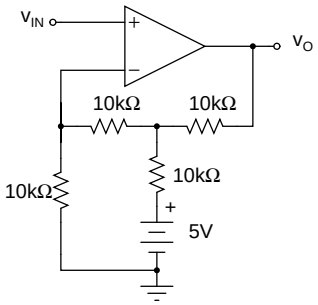

(a) Derive an expression for $v_o$ in terms of $v_i$ and the component values. Notice that $v_i$ does not need to be sinusoidal.

(b) Find an expression for $v_o$ in terms of the Laplace operator $s$, valid when $v_i$ is sinusoidal.

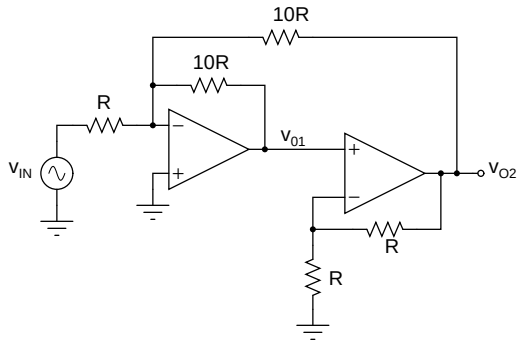
7. Determine the input impedance $Z_{in} = \frac{v_i}{i_i}$ for the following circuit. Assume an ideal opamp.



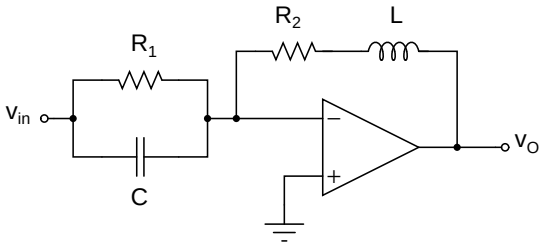

8. Find $v_O$ in terms of $v_{IN}$ for the following circuit.




9. Find $\frac{v_{O1}}{v_{IN}}$ and $\frac{v_{O2}}{v_{IN}}$ for the following circuit.




10. For the following circuit, express the output voltage $v_O$ as a differential equation of $v_{in}$ in terms of the component values.




11. Assuming ideal operation of the amplifiers ($A_v = \infty$), find the expression for $I_L$ in terms of the differential voltage $v_2 - v_1$ and the resistors $R_x$, $R_1$, and $R_2$.