

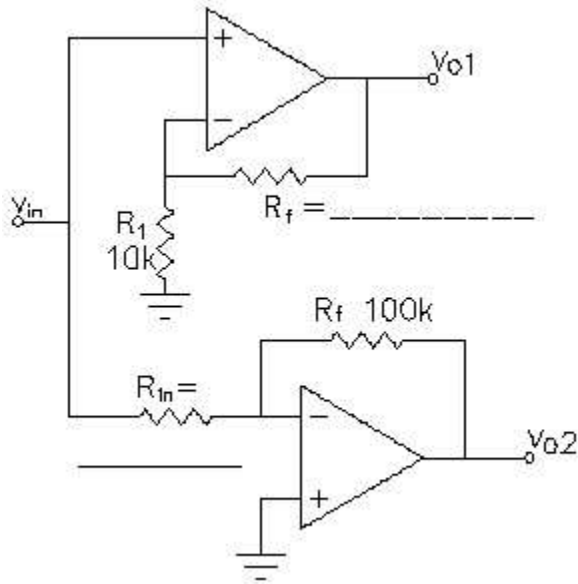
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Name: _____

You may work right on these pages.

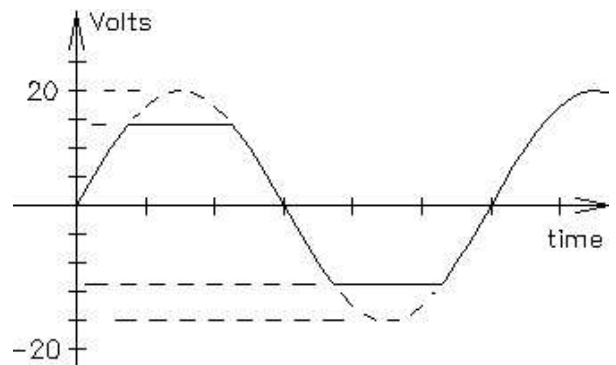
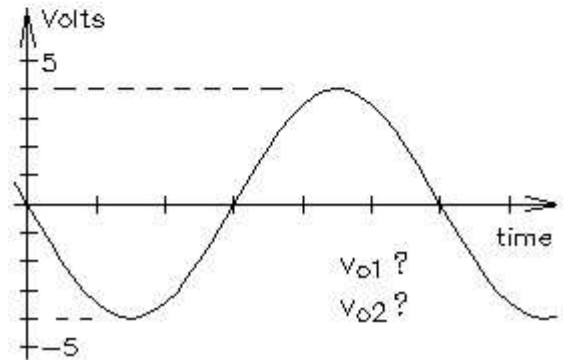
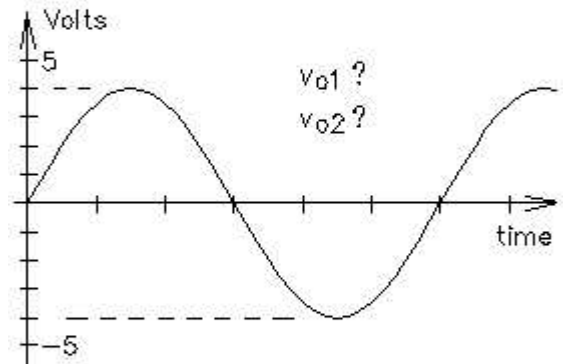
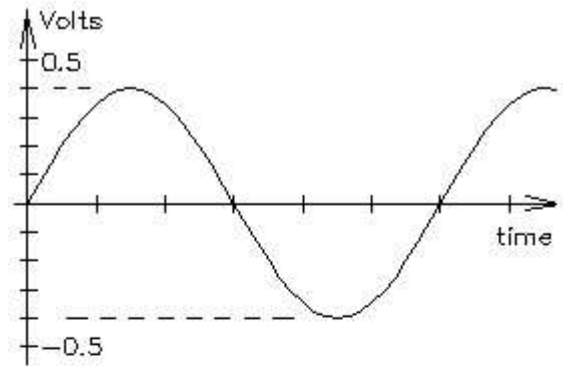
1. The same input voltage (shown right) is connected to several different op-amp circuits.

a) The output voltages are also shown. Indicate which output voltage is v_{o1} and which is v_{o2} by circling the correct answer at each waveform.

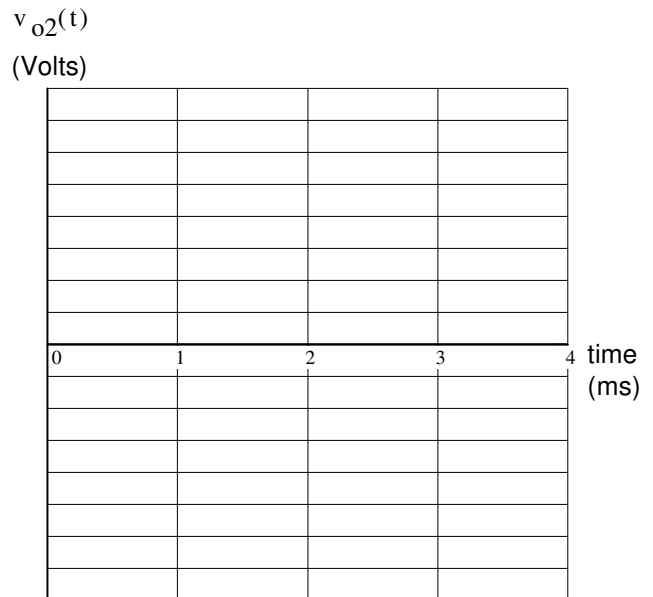
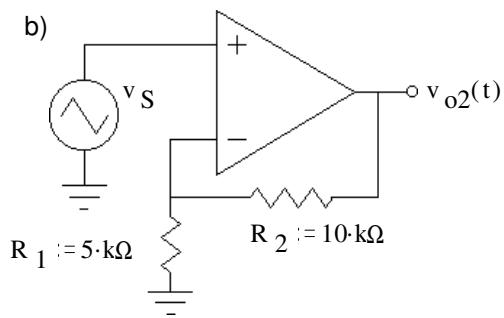
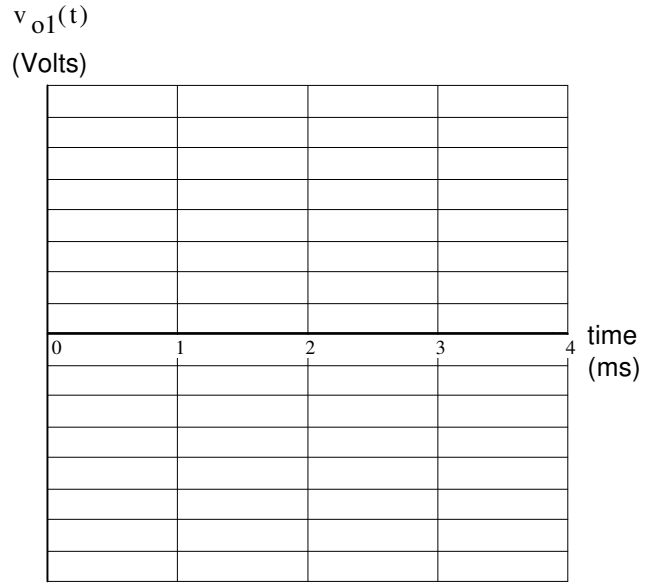
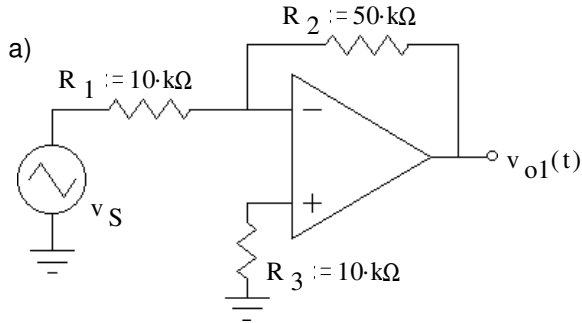
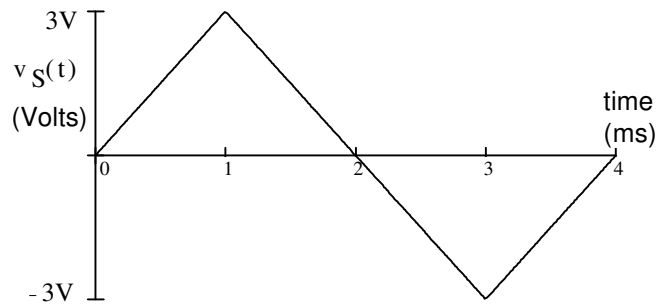


b) Find the values of the two unknown resistors.

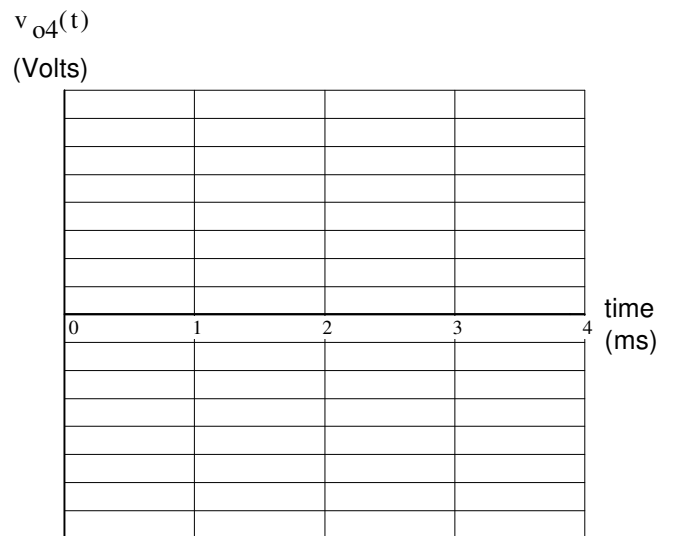
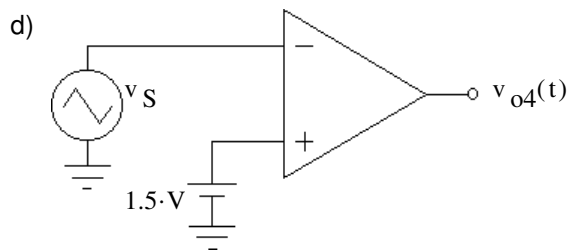
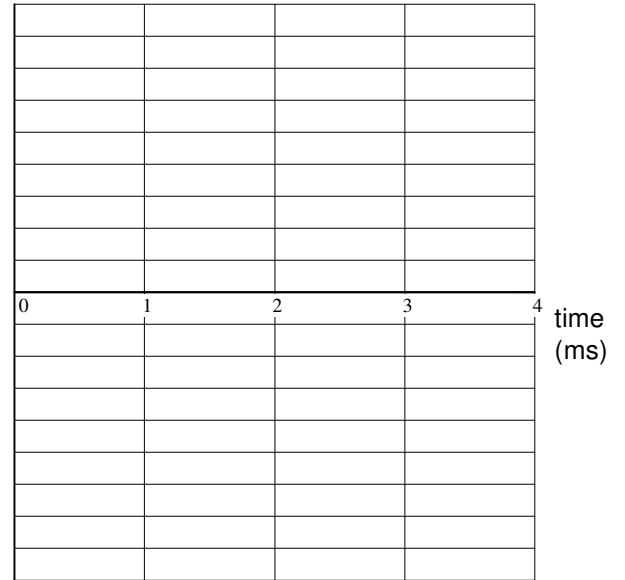
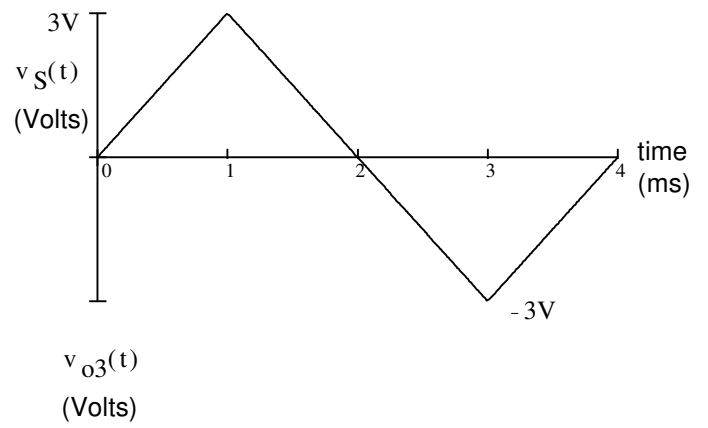
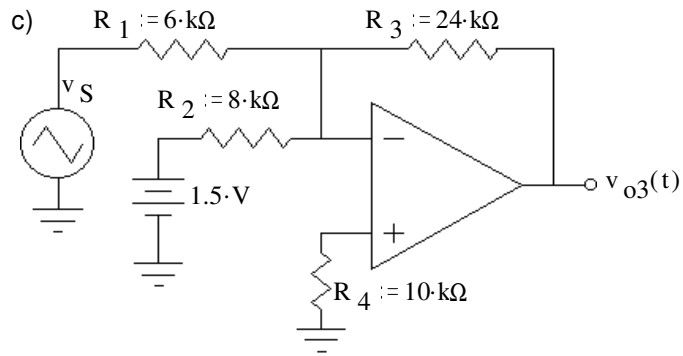
c) Design an op-amp circuit which would have the output shown at right (solid line). Draw it and specify the parts values. Specify the power supplies as well.



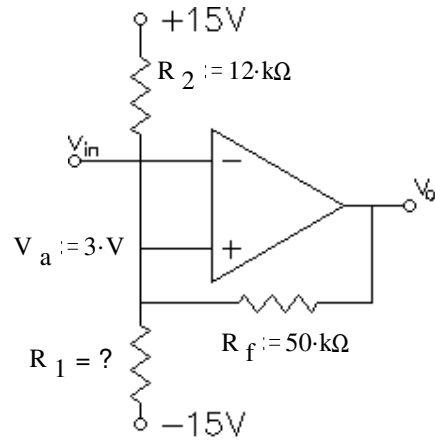
2. The same input signal (at right) is connected to several op-amp circuits below. Sketch the output waveform for each circuit. Clearly label important voltage levels on each output. If I can't easily make out what your peak values are, I'll assume you don't know. Don't forget to show inversions. All op-amps are powered by $\pm 12\text{ V}$ power supplies.



2. continued, the input is repeated at right.
 All op-amps are powered by $\pm 12\text{ V}$ power supplies.



3. a) Select R_1 to give a +3V switching level when the output is +13V.



b) Find the other switching level (when the output is -13V).

Hint 1: $I_f + I_2 = I_1$

$$\frac{-13\text{V} - V_a}{50\text{k}\Omega} + \frac{15\text{V} - V_a}{12\text{k}\Omega} = \frac{V_a - (-15\text{V})}{15\text{k}\Omega}$$

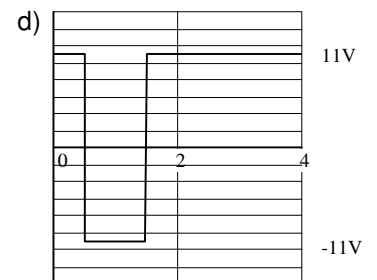
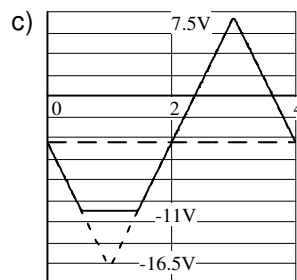
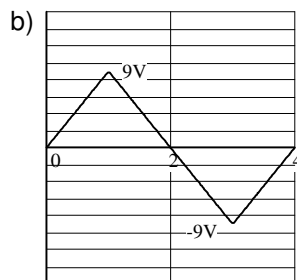
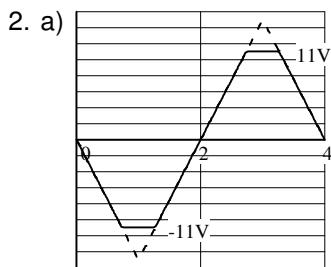
multiply both sides by $300\text{k}\Omega$

Solve this equation for V_a

Hint 2: Understand this equation before Exam 2

Answers 1. a) v_{o1} v_{o2} b) $R_f := 90\text{k}\Omega$ $R_{in} := 10\text{k}\Omega$

c) A noninverting amplifier with $R_f = 49 \cdot R_1$ $R_1 > 100\Omega$ $R_f < 1\text{M}\Omega$ Power supplies are $\pm 15\text{V}$



3. a) $15\text{k}\Omega$ b) -0.06V