1. The op-amps are powered by $\pm 12 \text{ V}$ power supplies. What output do you expect?

**SHOW WORK**

![Circuit Diagram]

2. The same input signal (at right) is connected to several op-amp circuits. Sketch the output waveforms for the circuits shown.

   a) Op amp powered by $\pm 12 \text{ V}$ power supplies.

![Circuit Diagram]
2. b) \[ R_1 = 6 \, \text{k}\Omega \]
\[ R_2 = 27 \, \text{k}\Omega \]
\[ R_3 = 90 \, \text{k}\Omega \]
\[ v_S \]
\[ v_{ob}(t) \]
\[ 10 \, \text{V} \]
\[ -10 \, \text{V} \]

3. c) \[ R_1 = 8 \, \text{k}\Omega \]
\[ R_2 = 1 \, \text{k}\Omega \]
\[ v_S \]
\[ v_{oc}(t) \]
\[ 9 \, \text{V} \]
\[ -3 \, \text{V} \]

**Answers**

1. 5.25 V

2. a) \((0 \, \text{ms}, -4 \, \text{V})\) to \((3 \, \text{ms}, -4 \, \text{V})\) to \((3 \, \text{ms}, 4 \, \text{V})\) to \((9 \, \text{ms}, 4 \, \text{V})\) to \((9 \, \text{ms}, -4 \, \text{V})\) to \((12 \, \text{ms}, -4 \, \text{V})\)

b) \((0 \, \text{ms}, -3 \, \text{V})\) to \((2 \, \text{ms}, -9 \, \text{V})\) to \((4 \, \text{ms}, -9 \, \text{V})\) to \((9 \, \text{ms}, 6 \, \text{V})\) to \((12 \, \text{ms}, -3 \, \text{V})\)

c) \((0 \, \text{ms}, 8 \, \text{V})\) to \((1.5 \, \text{ms}, 8 \, \text{V})\) to \((1.5 \, \text{ms}, -2 \, \text{V})\) to \((4.5 \, \text{ms}, -2 \, \text{V})\) to \((4.5 \, \text{ms}, 8 \, \text{V})\) to \((12 \, \text{ms}, 8 \, \text{V})\)