5.2 The op amp in the circuit in Fig. P5.2 is ideal.

P

a) Calculate v_o if $v_a = 4$ V and $v_b = 0$ V.

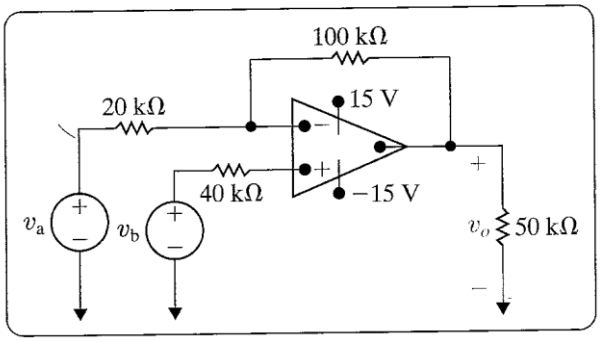
b) Calculate v_o if $v_a = 2$ V and $v_b = 0$ V.

c) Calculate v_o if $v_a = 2$ V and $v_b = 1$ V.

d) Calculate v_o if $v_a = 1$ V and $v_b = 2$ V.

e) If $v_b = 1.6$ V, specify the range of v_a such that the amplifier does not saturate.

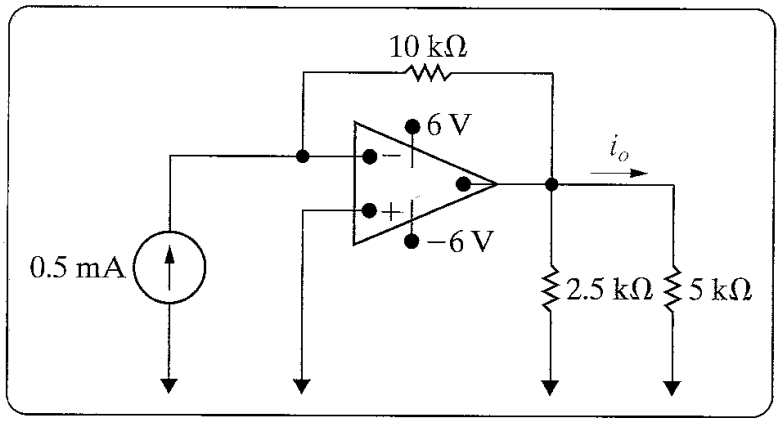
Figure P5.2



5.3 Find i_o in the circuit in Fig. P5.3 if the op amp is ideal.

P

Figure P5.3



5.5 The op amp in the circuit in Fig. P5.5 is ideal. Calculate the following:

P

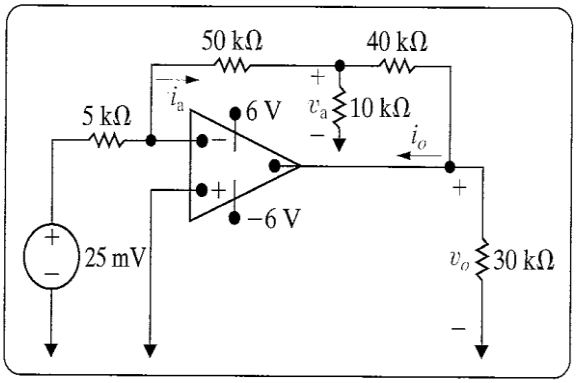
a) v_a

b) v_o

c) i_a

d) i_o

Figure P5.5



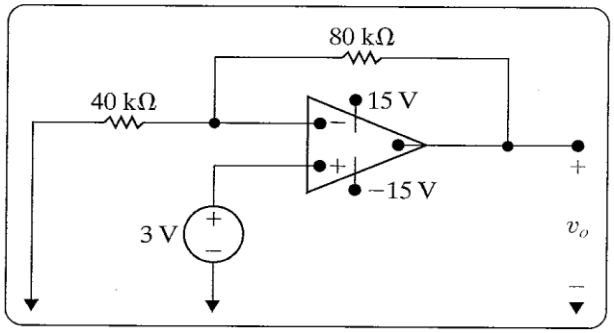
5.7 The op amp in the circuit of Fig. P5.7 is ideal.

P

a) What op amp circuit configuration is this?

b) Calculate v_o.

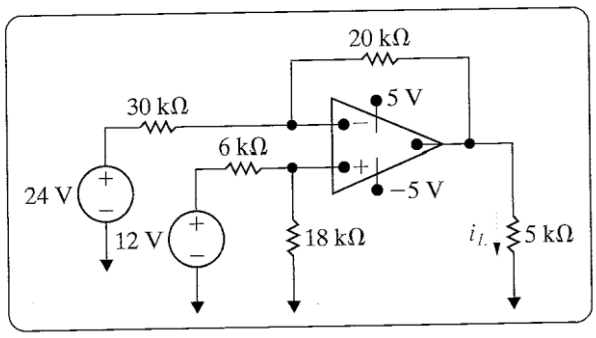
Figure P5.7



5.8 Find i_L (in microamperes) in the circuit in Fig. P5.8.

P

Figure P5.8



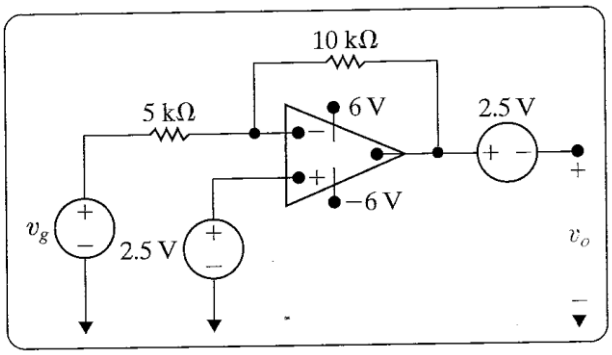
5.9 ◆ A circuit designer claims the circuit in Fig. P5.9 will produce an output voltage that will vary between ±5 as v_g varies between 0 and 5 V. Assume the op amp is ideal.

P

a) Draw a graph of the output voltage v_o as a function of the input voltage v_g for $0 \leq v_g \leq 5$ V.

b) Do you agree with the designer's claim?

Figure P5.9



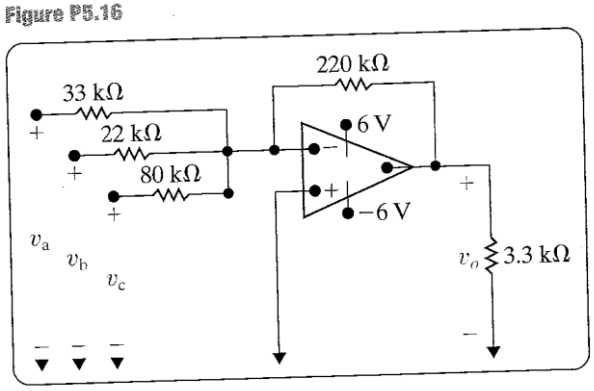
5.16 The op amp in Fig. P5.16 is ideal.

a) What circuit configuration is shown in this figure?

b) Find v_o if $v_a = 1.2$ V, $v_b = -1.5$ V, and $v_c = 4$ V.

c) The voltages v_a and v_c remain at 1.2 V and 4 V, respectively. What are the limits on v_b if the op amp operates within its linear region?

Figure P5.16



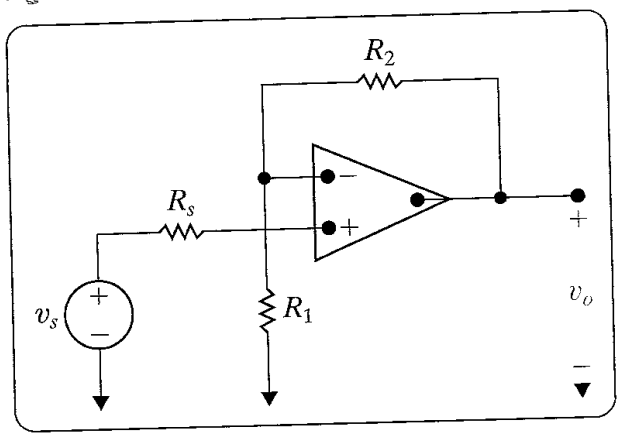
5.20 Assume that the ideal op amp in the circuit seen in Fig. P5.20 is operating in its linear region.

a) Show that $v_o = [(R_1 + R_2)/R_1]v_s$.

b) What happens if $R_1 \to \infty$ and $R_2 \to 0$?

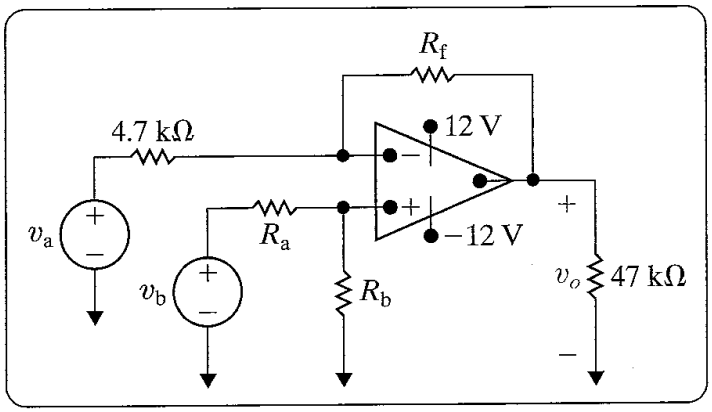
c) Explain why this circuit is referred to as a voltage follower when $R_1 = \infty$ and $R_2 = 0$.

Figure P5.20



5.32 Design the difference-amplifier circuit in Fig. P5.32 so that $v_o = 10(v_b - v_a)$, and the voltage source v_b sees an input resistance of 220 kΩ. Specify the values of R_a, R_b, and R_f. Use the ideal model for the op amp.

Figure P5.32



5.33 Select the values of R_b and R_f in the circuit in Fig. P5.33 so that

$$v_o = 2000(i_b - i_a).$$

The op amp is ideal.

Figure P5.33