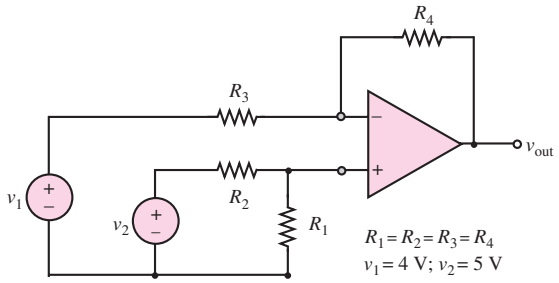

Figure P8.20

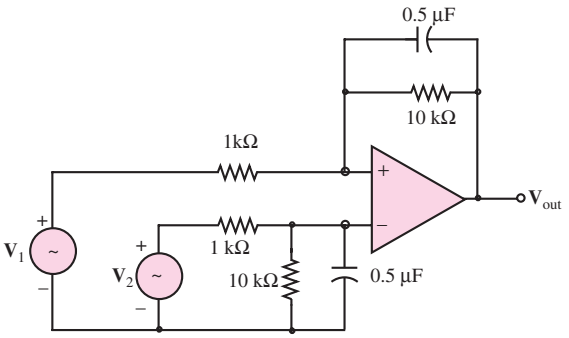

Figure P8.22

8.21 Differential amplifiers are often used in conjunction with the Wheatstone bridge. Consider the bridge shown in Figure P8.21, where each resistor is a temperature-sensing element and the change in resistance is directly proportional to a change in temperature—that is, $\Delta R = \alpha(\pm\Delta T)$, where the sign is determined by the positive or negative temperature coefficient of the resistive element.

a. Find the Thévenin equivalent that the amplifier sees at point a and point b. Assume that $|\Delta R|^2 \ll R_o$.

b. If $|\Delta R| = K\,\Delta T$, with K a numerical constant, find an expression for $v_{out}\,(\Delta T)$, that is v_{out} as a function of change in temperature.

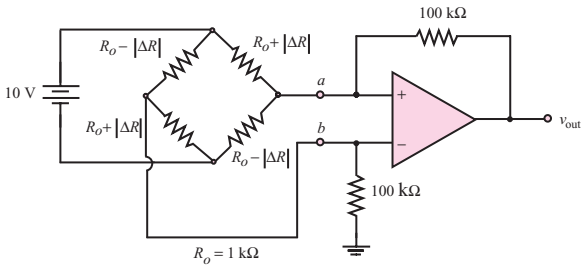

Figure P8.21

8.22 Consider the circuit of Figure P8.22.

a. If $v_1 - v_2 = \cos(1{,}000t)$ V, find the peak amplitude of v_{out}.

b. Find the phase shift of v_{out}.

[*Hint*: Use phasor analysis.]

8.23 Find an expression for the gain of the circuit of Figure P8.23.

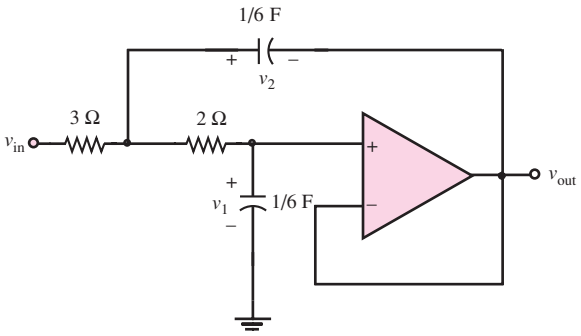

Figure P8.23

8.24 In the circuit of Figure P8.24, it is critical that the gain remain within 2 percent of its nominal value of 16. Find the resistor R_S that will accomplish the nominal gain requirement, and state what the maximum and minimum values of R_S can be. Will a *standard* 5 percent tolerance resistor be adequate to satisfy this requirement? (See Table 2.1 for resistor standard values.)

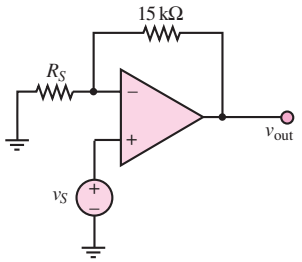

Figure P8.24