8.15 It is easy to construct a current source using an inverting amplifier configuration. Verify that the current in R_L is independent of the value of R_L, assuming that the op-amp stays in its linear operating region, and find the value of this current.

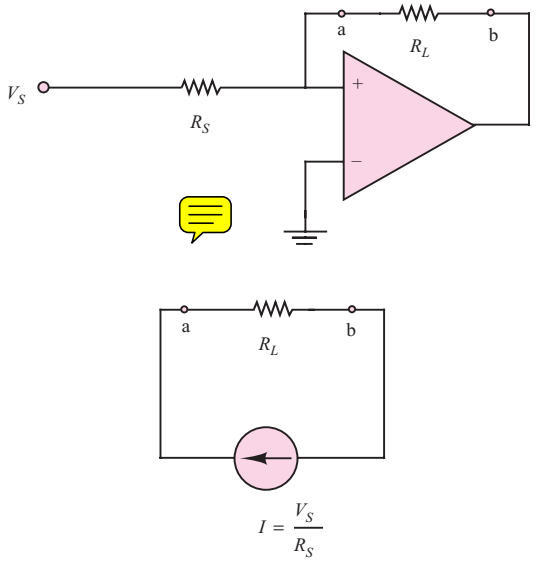

Figure P8.15

8.16 A "super diode" or "precision diode," which eliminates the diode offset voltage, is shown in Figure P8.16. Determine the output signal for the given input signal, $V_{\text{in}}(t)$.

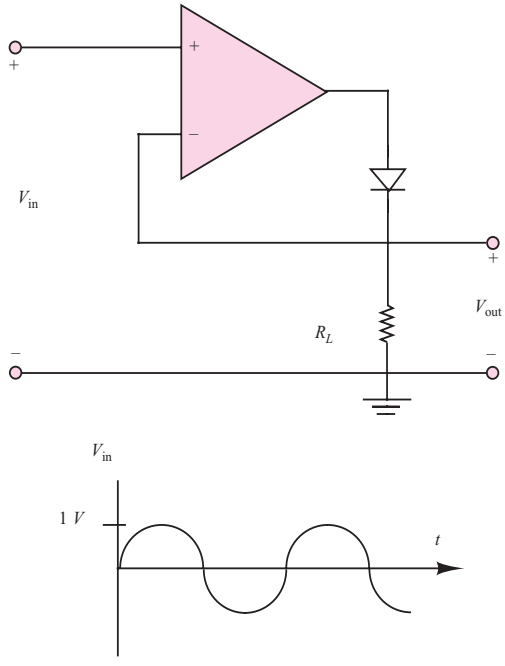

Figure P8.16

8.17 Determine the response function $\frac{V_2}{V_1}$ for the circuit of Figure P8.17.

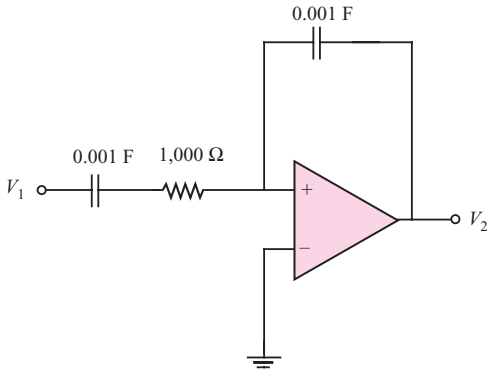

Figure P8.17

8.18 Time delays are often encountered in engineering systems. They can be approximated using Euler's definition as

$$e^{-sT} = \lim_{N \to \infty} \left[\frac{1}{\frac{sT}{N} + 1} \right]^N$$

If $T = 1$, and $N = 1$, then the approximation can be implemented by the circuit of Problem 8.17 (see Figure P8.17), with the addition of a unity gain inverting amplifier to eliminate the negative sign. Modify the circuit of Figure P8.17 as needed and use it as many times as necessary to design an approximate time delay for $T = 1$ and $N = 4$ in Euler's definition of the exponential.

8.19 Show that the circuit of Figure P8.19 is a noninverting summer.

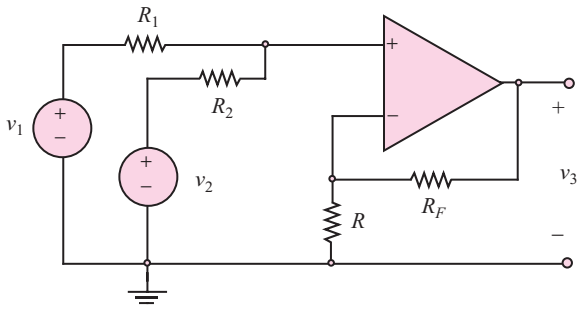

Figure P8.19

8.20 For the circuit of Figure P8.20, find the voltage v and the current i.