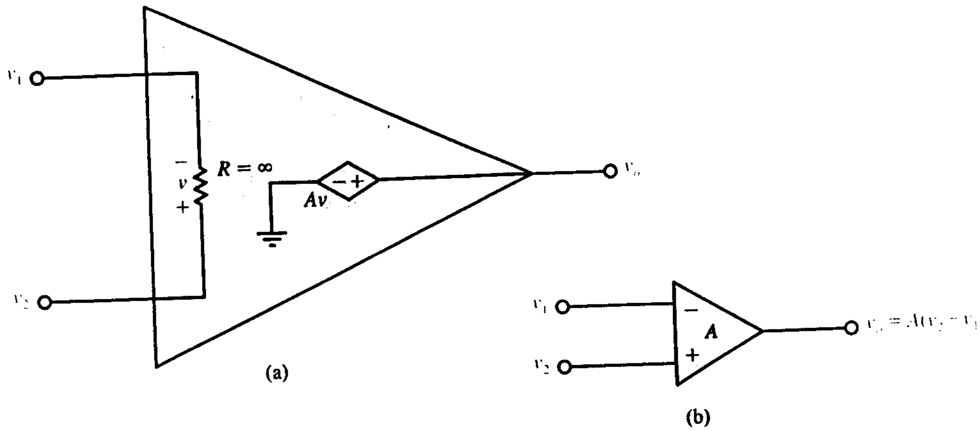

Fig. 2.13 Model and circuit symbol of an ideal amplifier having gain *A*.

Example 2.7

Let us find v_o for the ideal amplifier circuit shown in Fig. 2.14*a*. The explicit form of this circuit is shown in Fig. 2.14b.

In the circuit given in Fig. 2.14, the noninverting input is at the reference potential, that is, $v_2 = 0$ V. Furthermore, since node v_s and node v_o are constrained by voltage sources (independent and dependent, respectively), in using nodal analysis we sum

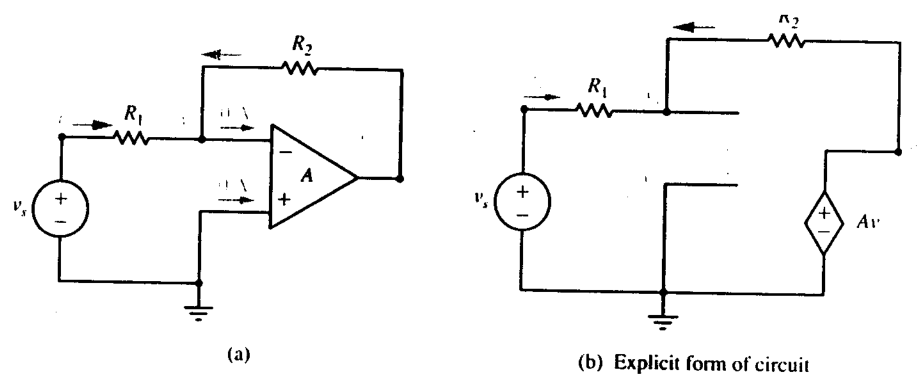

Fig. 2.14 (*a*) Ideal-amplifier circuit, and (*b*) explicit form of the circuit.

currents only at node v_1 (the inverting input). Since the amplifier inputs draw no current, by KCL,

$$i_1 + i_2 = 0$$

By Ohm's law

$$\frac{v_s - v_1}{R_1} + \frac{v_o - v_1}{R_2} = 0 \quad \Rightarrow \quad R_2 v_s = (R_1 + R_2)v_1 - R_1 v_o \tag{2.23}$$

But due to the amplifier, $v_o = A(v_2 - v_1) = -Av_1$, so

$$v_1 = \frac{-v_o}{A} \tag{2.24}$$

and substituting this into Eq. 2.23, we get

$$R_2 v_s = (R_1 + R_2)\frac{-v_o}{A} - R_1 v_o = -\left[\frac{1}{A}(R_1 + R_2) + R_1\right]v_o$$

Thus,

$$v_o = \frac{-R_2 v_s}{R_1 + (1/A)(R_1 + R_2)} \tag{2.25}$$