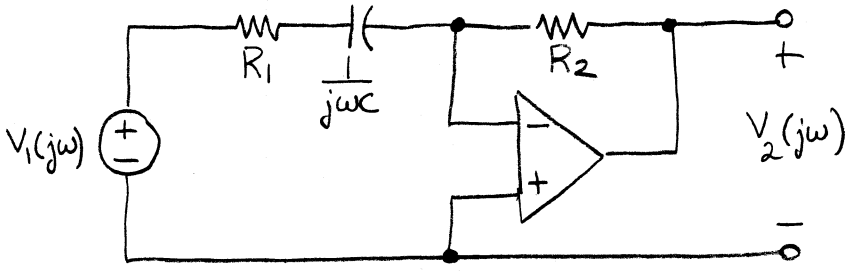
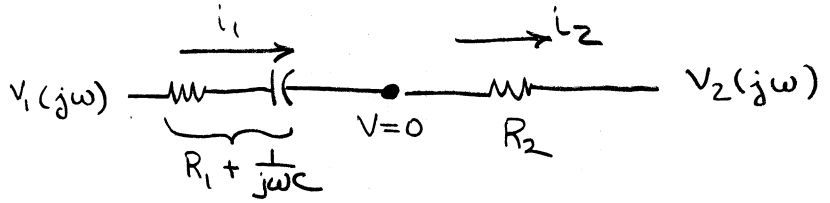
Design Example 12-6

Show that the transfer function $T(j\omega) = \dfrac{V_2(j\omega)}{V_1(j\omega)}$ of the circuit shown below has a high-pass gain characteristic.



We solve by using KCL at the inverting node.



From KCL $i_1 = i_2$

$$\frac{V_1(j\omega) - 0}{R_1 + \frac{1}{j\omega C}} = \frac{0 - V_2(j\omega)}{R_2}$$

$$R_2 V_1(j\omega) = -V_2(j\omega)\left[R_1 + \frac{1}{j\omega C}\right] = -V_2(j\omega)\left[\frac{j\omega R_1 C + 1}{j\omega C}\right]$$

Cross-multiplying and re-arranging

$$T(j\omega) = \frac{V_2(j\omega)}{V_1(j\omega)} = -\frac{j\omega R_2 C}{1 + j\omega R_1 C}$$

$$20\log_{10}|T(j\omega)| = 20\log_{10}|\omega R_1 C| - 20\log_{10}|1 + j\omega R_1 C|$$