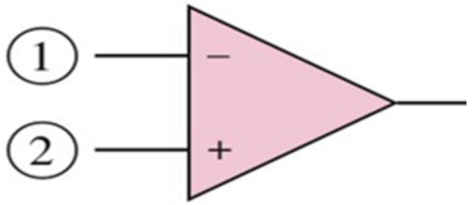
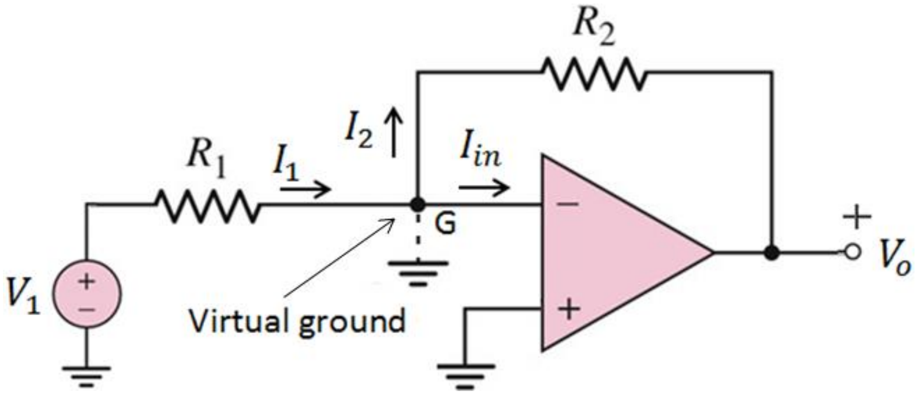
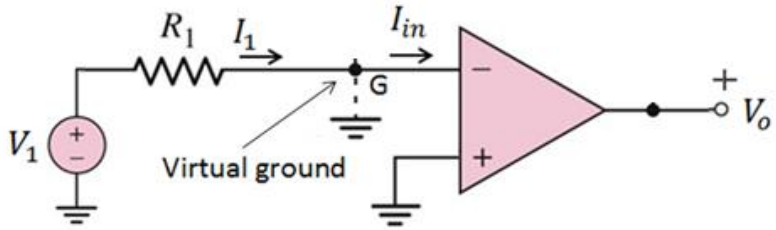
INVERTING AMPLIFIER

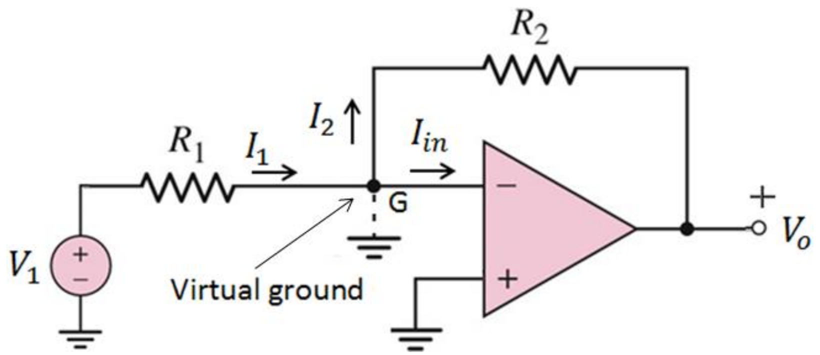


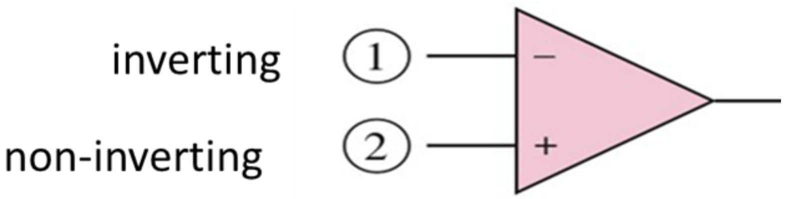


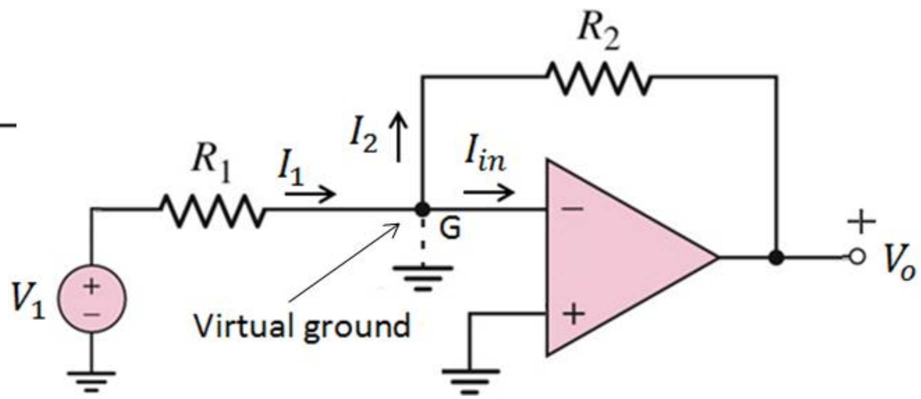
We want the open loop gain to be equal to ∞ which means that $v_2 = v_1$

the input resistance to be equal to ∞, hence there is no current going into the op-amp









Voltage at node 1 (inverting) = voltage at node 2 (non-inverting)

KCL at node 1:

$I_1 - I_2 - I_{in} = 0$

$(V_1 - 0) / R_1 = (0 - V_o) / R_2$

$V_i / R_1 = - V_o / R_2$

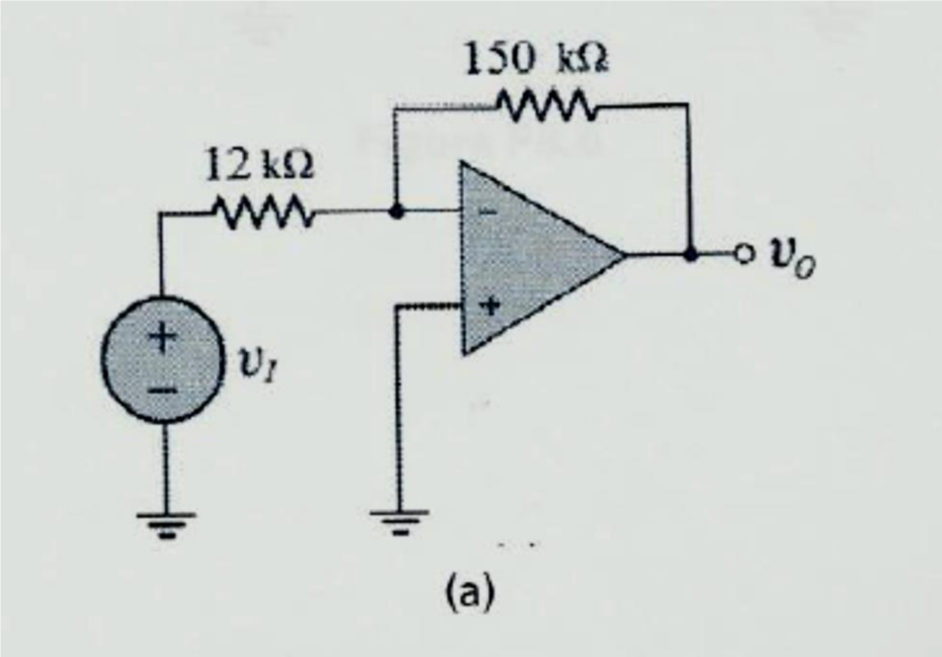
$$\frac{V_o}{V_i} = -\frac{R_2}{R_1}$$

Voltage gain, $A_v = \frac{V_O}{V_i} = -\frac{R_2}{R_1}$

Input Resistance, $R_i = \frac{V_i}{I_1} = R_1$

Output resistance, $R_o = \frac{V_o}{I_2} = R_2$

Example 1



KCL at node 1:

$I_1 - I_2 - I_{in} = 0$

$(V_i - 0) / 12k = (0 - V_o) / 150k$

$V_i / 12 = - V_o / 150$

$$\frac{V_o}{V_i} = \frac{-150}{12}$$

Gain = $-(R_2 / R_1) = -(150/12) =$ **-12.5**

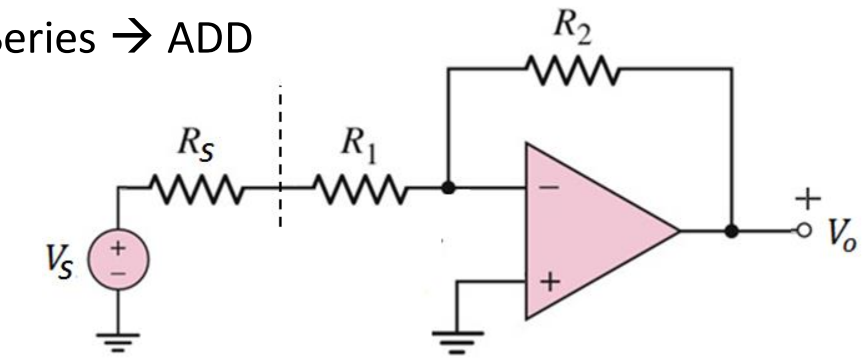
Example 2

A voltage source V_S with source resistance $R_S = 1.5\ k\Omega$ is connected to the input of an op-amp inverting amplifier circuit

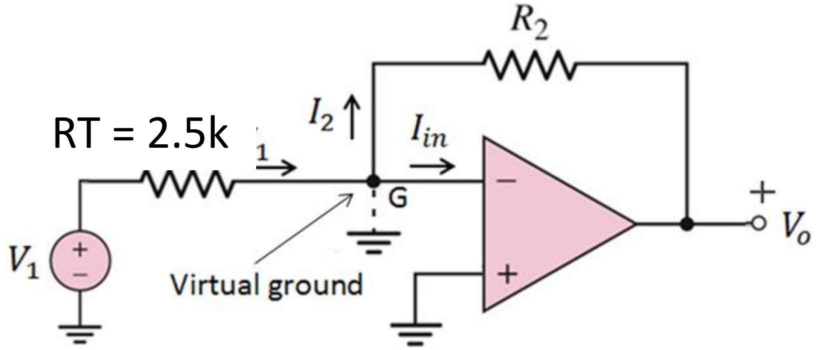
(a) If the $R_1 = 1.0\ k\Omega$ and $R_2 = 15.0\ k\Omega$ then calculate the voltage gain, V_O / V_S

(b) Determine the output voltage V_o for the source voltage $V_S = 45$ mV

Series → ADD



Answers:
(a) - 6
(b) - 0.27 V



V_O / V_S=-6

Vo/45mV = -6

Vo = -270 mV=-0.27V