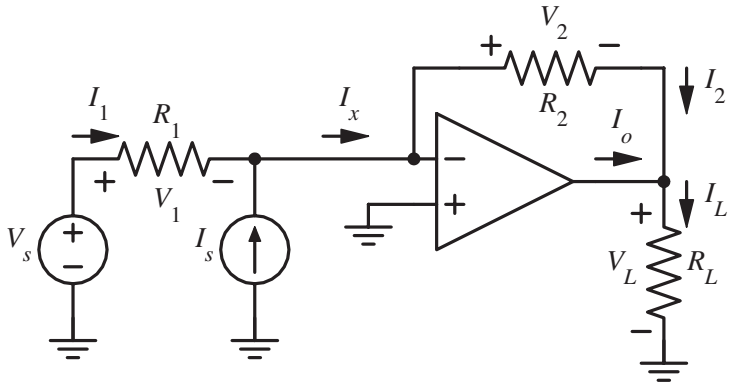
# Solution of ECE 300 Test 5 S12

The op amp is ideal. Fill in the blanks with correct numerical voltages or currents. Please be sure to check that Ohm's law is satisfied for each resistor, KCL is satisfied at each node and KVL is satisfied around each loop.

$I_1$ = _____ mA $I_x$ = _____ mA $I_2$ = _____ mA $I_L$ = _____ mA

$I_o$ = _____ mA $V_1$ = _____ V $V_2$ = _____ V $V_L$ = _____ V

$V_s = 8\text{V}$ , $I_s = 60\text{mA}$ , $R_1 = 165\Omega$ , $R_2 = 200\Omega$ , $R_L = 120\Omega$




The voltage at the inverting op amp input is zero. Therefore by KVL $V_1 = V_s = 8\text{V}$ and by Ohm's law $I_1 = V_1 / R_1 = 8\text{V}/165\Omega = 48.5\text{mA}$. By KCL, $I_x = I_1 + I_s = 48.5 + 60 = 108.5\text{mA}$. Since the input current into the op amp is zero, $I_2 = I_x = 108.5\text{mA}$, by Ohm's law $V_2 = I_2 R_2 = 108.5\text{mA} \times 200\Omega = 21.7\text{ V}$ and by KVL $V_L = -V_2 = -21.7\text{ V}$. Then by Ohm's law $I_L = V_L / R_L = -21.7\text{V}/120\Omega = -180.8\text{mA}$ and by KCL,

$$I_o = I_L - I_2 = -180.8\text{mA} - 108.5\text{mA} = -289.3\text{mA}.$$

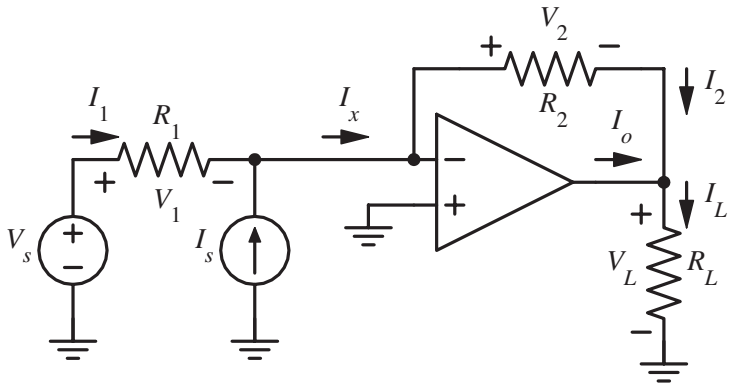
# Solution of ECE 300 Test 5 S12

The op amp is ideal. Fill in the blanks with correct numerical voltages or currents. Please be sure to check that Ohm's law is satisfied for each resistor, KCL is satisfied at each node and KVL is satisfied around each loop.

$I_1$ = _____ mA $I_x$ = _____ mA $I_2$ = _____ mA $I_L$ = _____ mA

$I_o$ = _____ mA $V_1$ = _____ V $V_2$ = _____ V $V_L$ = _____ V

$V_s = 4\text{V}$ , $I_s = 60\text{mA}$ , $R_1 = 165\Omega$ , $R_2 = 200\Omega$ , $R_L = 120\Omega$




The voltage at the inverting op amp input is zero. Therefore by KVL $V_1 = V_s = 4\text{V}$ and by Ohm's law $I_1 = V_1 / R_1 = 4\text{V}/165\Omega = 24.2\text{mA}$. By KCL, $I_x = I_1 + I_s = 24.2 + 60 = 84.2\text{mA}$. Since the input current into the op amp is zero, $I_2 = I_x = 84.2\text{mA}$, by Ohm's law $V_2 = I_2 R_2 = 84.2\text{mA} \times 200\Omega = 16.84$ V and by KVL $V_L = -V_2 = -16.84$ V. Then by Ohm's law $I_L = V_L / R_L = -16.84\text{V}/120\Omega = -140.3\text{mA}$ and by KCL,

$$I_o = I_L - I_2 = -140.3\text{mA} - 84.2\text{mA} = -224.5\text{mA}.$$

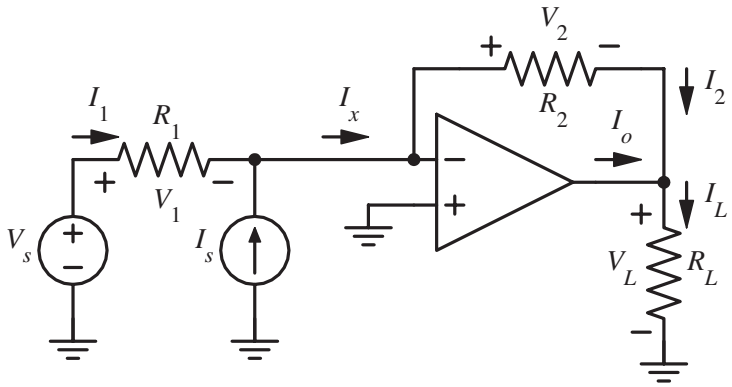
# Solution of ECE 300 Test 5 S12

The op amp is ideal. Fill in the blanks with correct numerical voltages or currents. Please be sure to check that Ohm's law is satisfied for each resistor, KCL is satisfied at each node and KVL is satisfied around each loop.

$I_1$ = _____ mA $I_x$ = _____ mA $I_2$ = _____ mA $I_L$ = _____ mA

$I_o$ = _____ mA $V_1$ = _____ V $V_2$ = _____ V $V_L$ = _____ V

$V_s = 12\text{V}$ , $I_s = 60\text{mA}$ , $R_1 = 165\Omega$ , $R_2 = 200\Omega$ , $R_L = 120\Omega$




The voltage at the inverting op amp input is zero. Therefore by KVL $V_1 = V_s = 12\text{V}$ and by Ohm's law $I_1 = V_1 / R_1 = 12\text{V}/165\Omega = 72.7\text{mA}$. By KCL, $I_x = I_1 + I_s = 72.7 + 60 = 132.7\text{mA}$. Since the input current into the op amp is zero, $I_2 = I_x = 132.7\text{mA}$, by Ohm's law $V_2 = I_2 R_2 = 132.7\text{mA} \times 200\Omega = 26.54$ V and by KVL $V_L = -V_2 = -26.54$ V. Then by Ohm's law $I_L = V_L / R_L = -26.54\text{V}/120\Omega = -221.2\text{mA}$ and by KCL,

$$I_o = I_L - I_2 = -221.2\text{mA} - 132.7\text{mA} = -353.9\text{mA}.$$