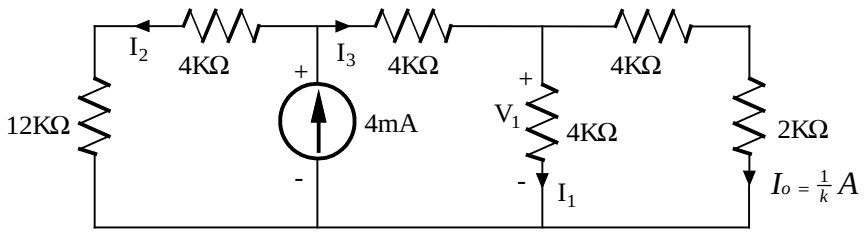
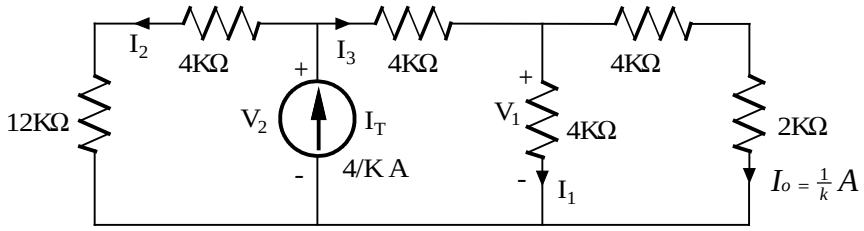
Problem 4.1

Find I_o in the circuit shown using linearity and the assumption that I_o = 1mA.



Suggested Solution



If $I_o = \frac{1}{k} A$ Then $V_2 = \frac{1}{k}(4K + 2K) = 6V$, $I_1 = \frac{6}{4k} = \frac{3}{2} mA$

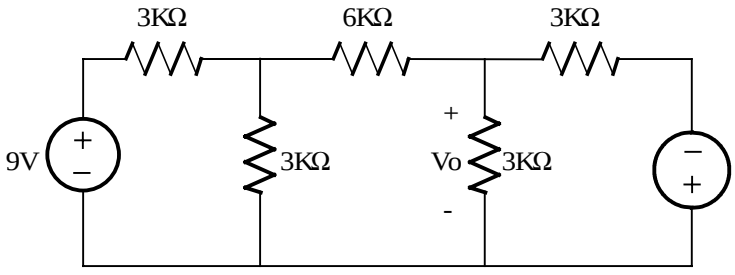
Then $I_2 = I_1 + I_o = \frac{5}{2} mA$ and $V_2 = V_1 + 4KI_2 = 16V$

Then $I_3 = \frac{V2}{4K + 12K} = 1mA \therefore I_T = I_2 + I_3 = \frac{7}{2} mA$

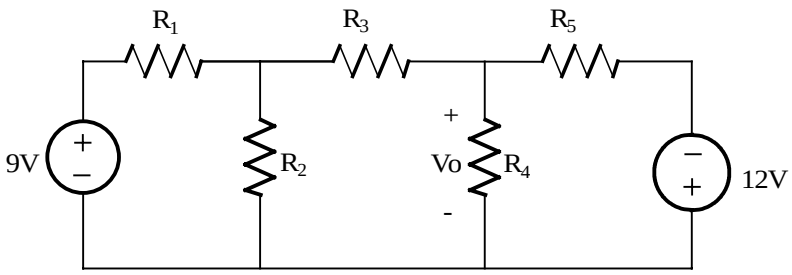
So $\frac{7/2mA}{1mA} = \frac{4mA}{x} \therefore x = \boxed{I_o = \frac{8}{7} mA}$

Problem 4.8

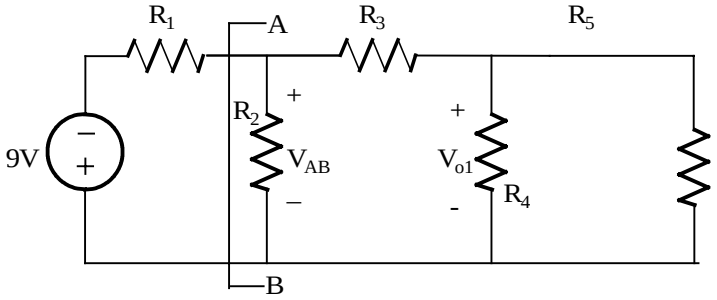
Find Vo in the network shown using superposition



Suggested Solution



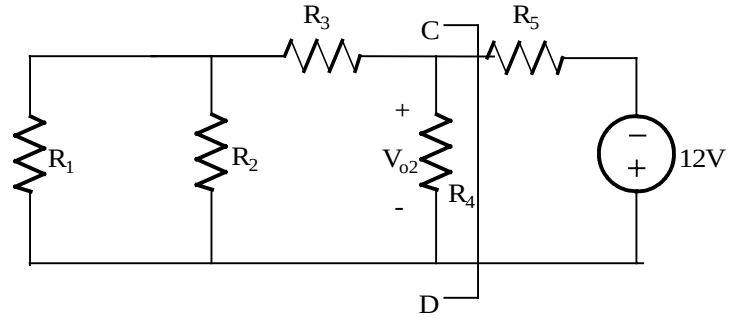
R3=6KΩ All other R=3KΩ



$R_{AB} = R_2 \,||\, [R_3 + (R_4 \,||\, R_5)] = 2.14K\Omega$

$V_{AB} = 9(\frac{R_{AB}}{R_{AB}+R_1}) = 3.75V$

$V_{01} = V_{AB}(\frac{R_4 || R_5}{(R_4 || R_5)+R_3}) = 0.75V$



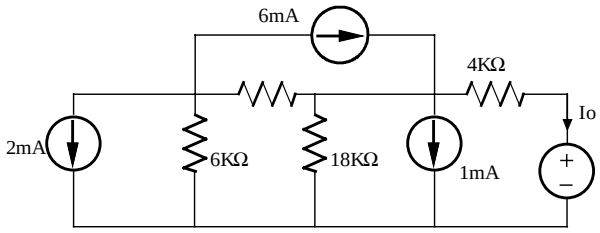
$R_{CD} = R_4 \,||\, [R_3 + (R_1 \,||\, R_2)] = 2.14K\Omega$

$V_{02} = -12(\frac{R_{CD}}{R_{CD}+R_5}) = -5V$

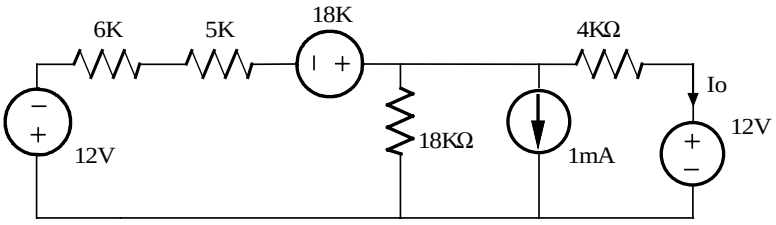
$\boxed{Vo = V_{01} + V_{02} = -4.25V}$

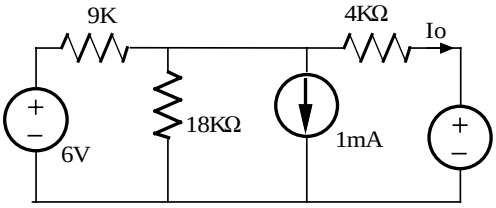
Problem 4.24

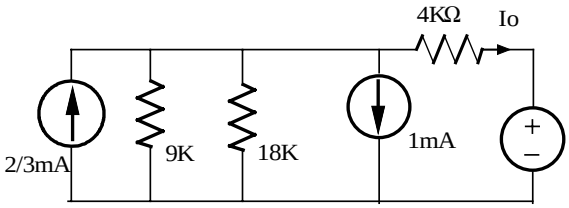
Find Io in the network shown using source transformation.

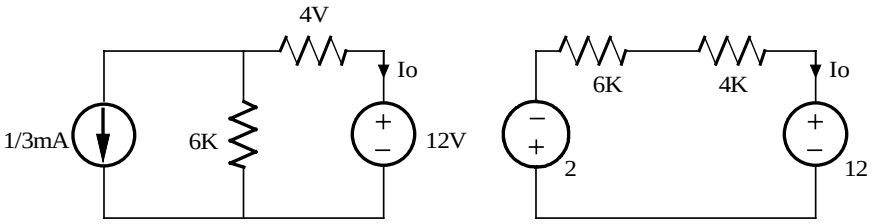


Suggested Solution





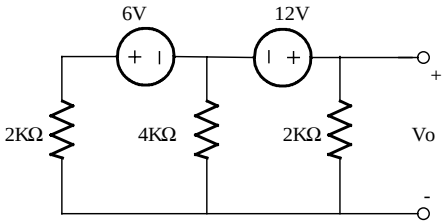




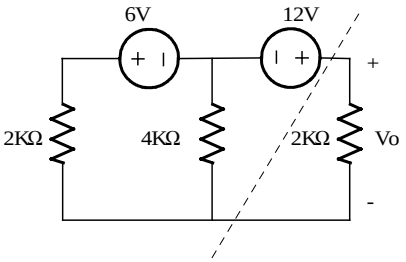
Io = -14/10K=-7/5mA

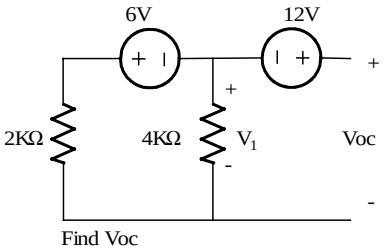
Problem 4.33

Use Thevenin's Theorem to find Vo in the network shown.



Suggested Solution

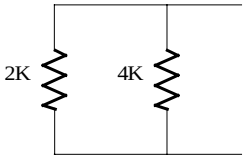




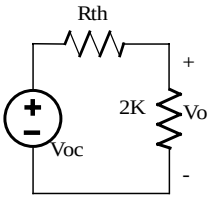
$V_1 = - 6 [4K / (4K + 2K)]$
$V_1 = - 4V$

$Voc = 12 + V_1$

Find Voc



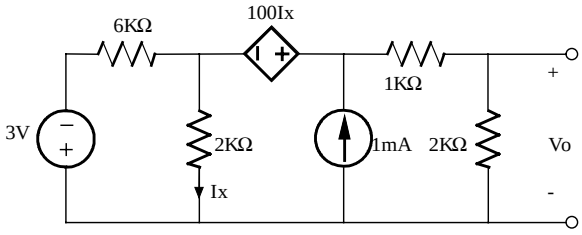
Rth = 2K || 4K = 1.33KΩ



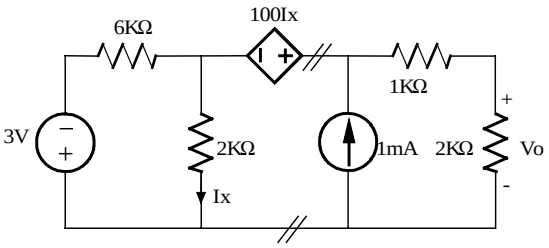
Vo = 4.8V

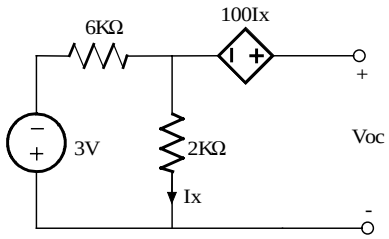
Problem 4.58

Find Vo in the network shown using Thevenin's Theorem.



Suggested Solution





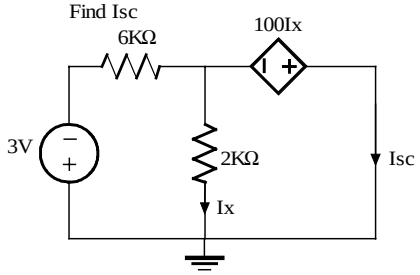
Ix = - 3/8K = - 0.38 mA

3 + (6K)Ix - (1K)Ix + Voc = 0

Voc = - 1.13V

Rth = Voc / Isc = 2.25 KΩ

Find Isc

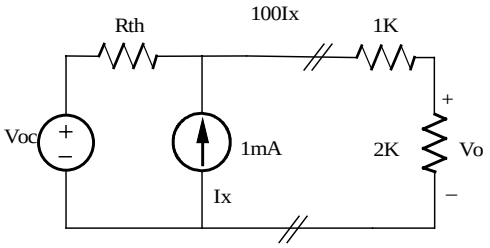


Vx = 2000Ix

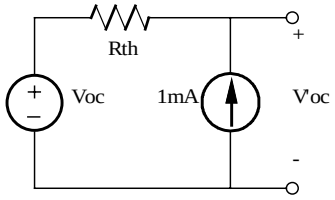
Vx = - 1000 Ix

Vx = 0 and Ix = 0A

Now, -3 / 6K = Isc => Isc = -0.5mA



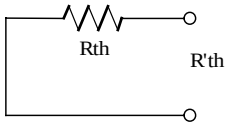
Find Voc



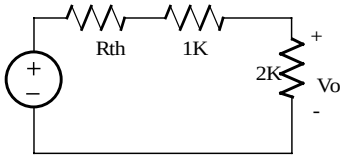
Voc = -1.13V, Rth = 2.25K

V'oc = (1m)Rth + Voc

V'oc = 1.13V



R'th = Rth

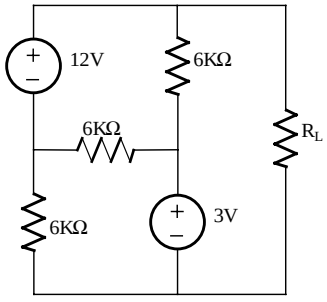


V'oc = V'oc[2K / (2K+1K+R'th)]

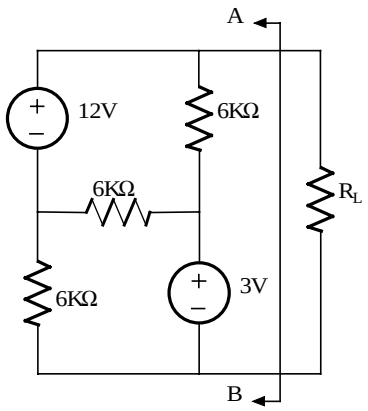
Vo = 0.43V

Problem 4.70

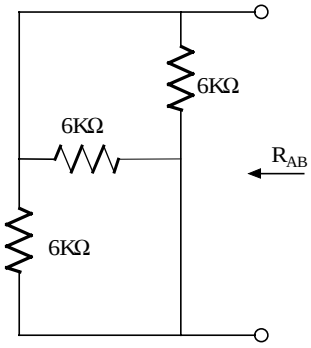
Find R_L for maximum power transfer and the maximum power that can be transferred in the network shown.



Suggested Solution



Find R_{AB}

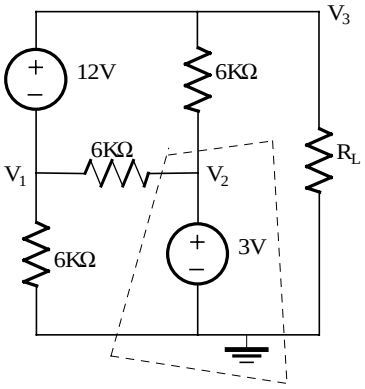


All 3 Resistors are attached to both node A and node B, so,

$R_{AB} = 6K \,||\, 6K \,||\, 6K$

$R_{AB} = 2K\Omega$

Find maximum load tranfer



$V_3 - V_1 = 12V$

$V_2 = 3V$

At supernode:

$(V_3 - V_2) / 6K + (V_1 - V_2) / 6K + V_3 / 2K + V_1 / 6K = 0$

Yields:

$V_3 = 5V$

$P_L = V^2_3 / R_{AB}$

PL = 12.5 mW