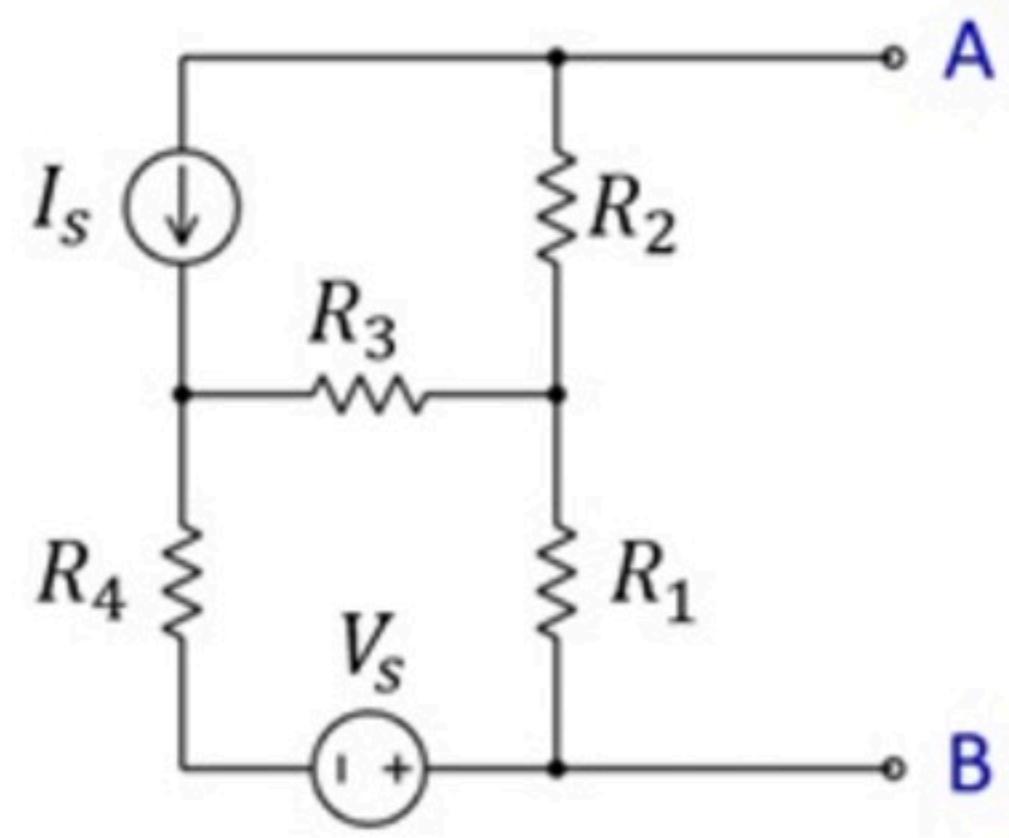
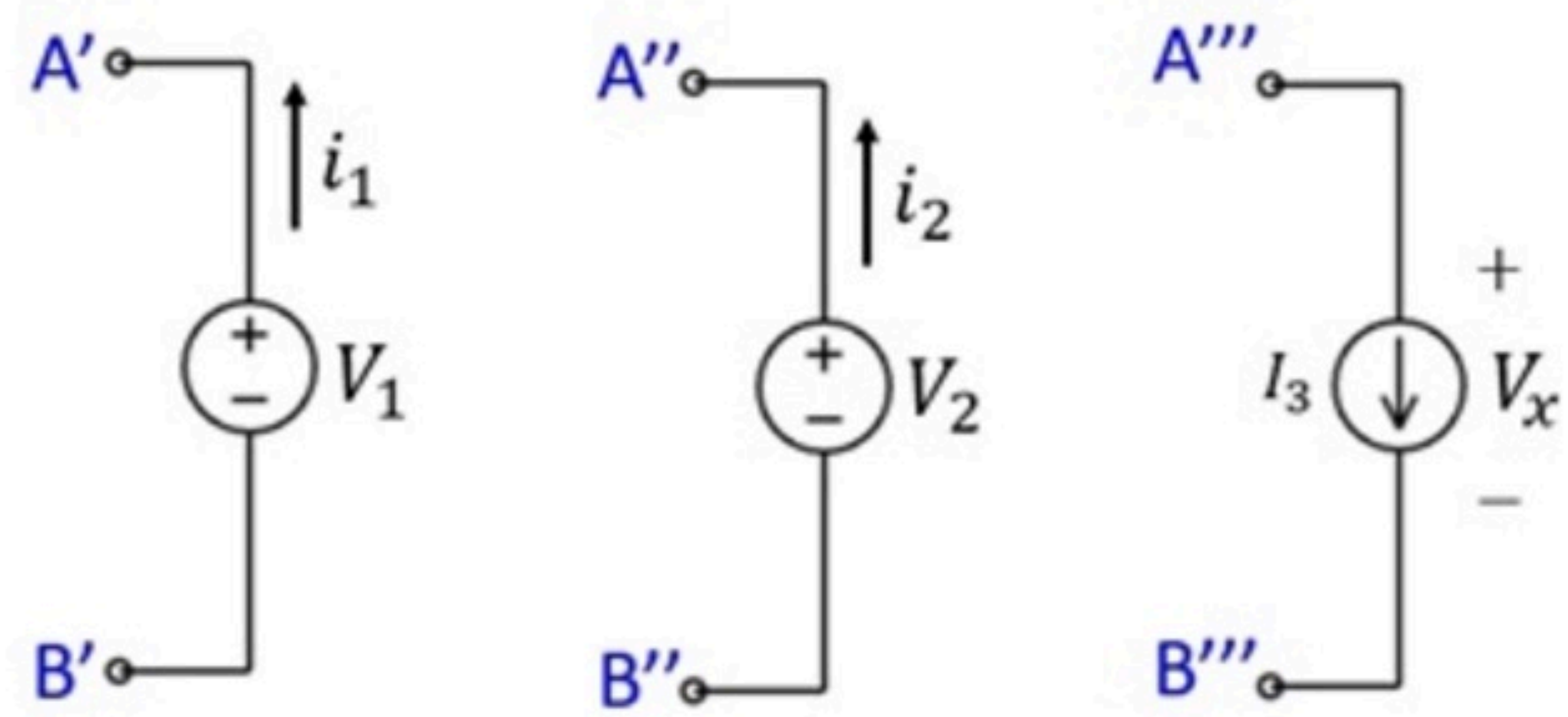
Circuit theorems 013

No more attempts left.

Consider the circuit on the left. You are not given the values of V_S, I_S, R_1, R_2 or R_3.





You are told the value of current i_1 if V_1 is attached to this circuit, with A connected to A′ and B connected to B′.

You are also told the value of current i_2 if V_2 is attached, with A connected to A″ and B connected to B″. However, in this case, the independent sources were first turned off (i.e., $V_S = 0$ and $I_S = 0$).

Your task is to find V_x if current source I_3 is connected to the original circuit (i.e., with the independent sources V_S and I_S <u>not</u> turned off), with A connected to A‴ and B connected to B‴.

Given Variables:

V1 : 6 V

i1 : 12 A

V2 : 12 V

i2 : 12 A

I3 : -7 A

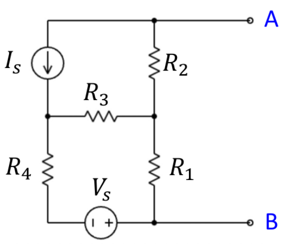
R4 : 2 ohm

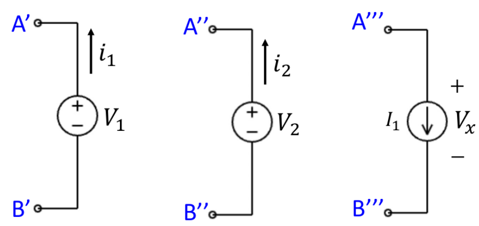
Calculate the following:

Vx (V) :

Hint: Redraw the circuit on the left as its Thevenin equivalent model

Consider the circuit on the left. You are not given the values of V_S, I_S, R_1, R_2 or R_3.





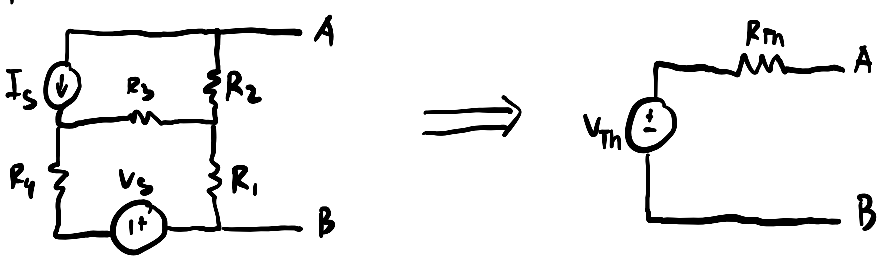
$V_1 = 15$ V
$i_1 = 6$ A
$V_2 = 10$ V
$i_2 = 5$ A
$I_1 = 5$ A
$R_4 = 2\Omega$

You are told the value of current i_1 if V_1 is attached to this circuit, with A connected to A' and B connected to B'.

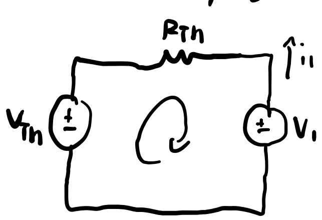
You are also told the value of current i_2 if V_2 is attached, with A connected to A'' and B connected to B''. However, in this case, the independent sources were first turned off (i.e., $V_S = 0$ and $I_S = 0$).

Your task is to find V_x if current source I_1 is connected to the original circuit (i.e., with the independent sources V_S and I_S not turned off), with A connected to A''' and B connected to B'''.

Represent the left circuit as its Thevenin equivalent circuit



when A → A', B → B'



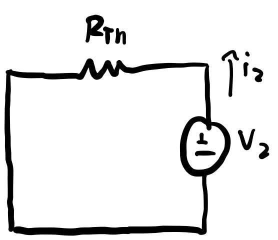
KVL: $-V_{Th} - i_1 R_{Th} + V_1 = 0$

$V_{Th} = V_1 - i_1 R_{Th}$

when A → A'', B → B'' and $V_S = 0$, $I_S = 0$

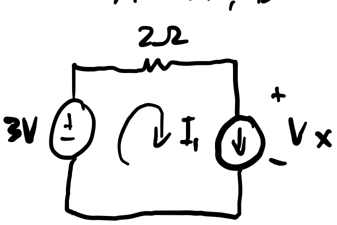
$V_{Th} = 15 - 6(2)$

$V_{Th} = 3V$



$R_{Th} = \frac{V_2}{i_2} = \frac{10}{5} = 2\Omega$

when A → A''', B → B'''



KVL: $-3 + 2I_1 + V_x = 0$

$V_x = 3 - 2(5)$

$\boxed{V_x = -7V}$