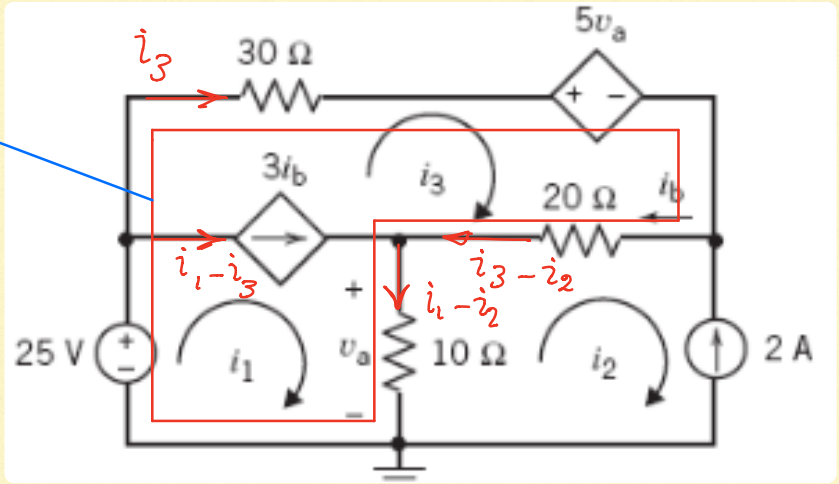
Solution of assignment by Emad Gad

Supermesh



$$i_2 = -2\ A \qquad -(1)$$

$$v_a = 10 \times (i_1 - i_2) = 10 i_1 + 20$$

$$i_b = i_3 - i_2 = i_3 + 2$$

KVL @ Supermesh:

$$-25 + 30 \times i_3 + 5 \times (10 i_1 + 20) + 20 \times (i_3 - i_2) + 10 \times (i_1 - i_2) = 0 \qquad -(2)$$

From the supermesh

$$i_1 - i_3 = 3 i_b$$

$$i_1 - i_3 = 3 (i_3 + 2)$$

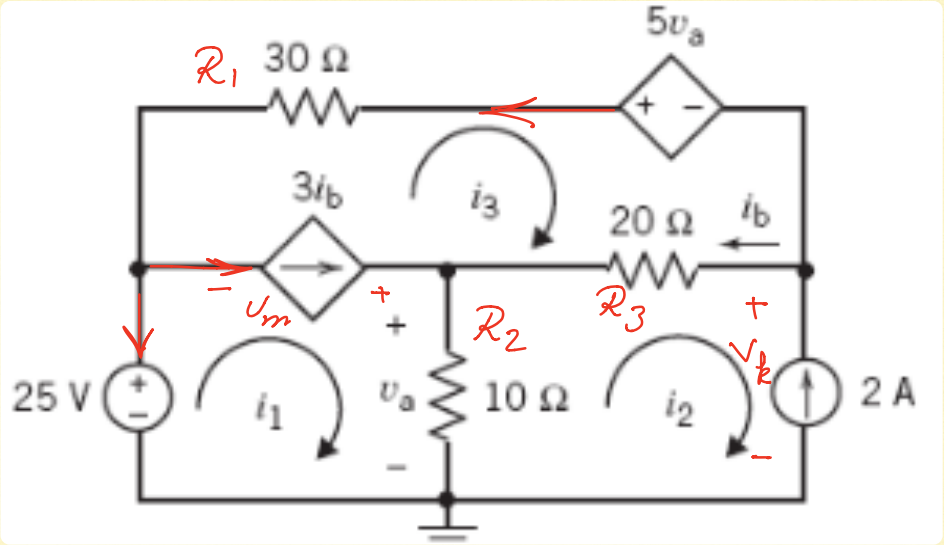
$$i_1 = 4 i_3 + 6 \qquad -(3)$$

Substituting from (3) and (1) into (2) gives i_3

$$i_3 = -1.7069$$

and from (3) we get i_1

$$i_1 = -0.8276$$



To compute the voltage accross the 2A independent source, v_k, we apply KVL à mesh (2)

$$-10 \times (i_1 - i_2) - 20 \times (i_3 - i_2) + v_k = 0$$

$$v_k = 10(i_1 - i_2) + 20(i_3 - i_2)$$

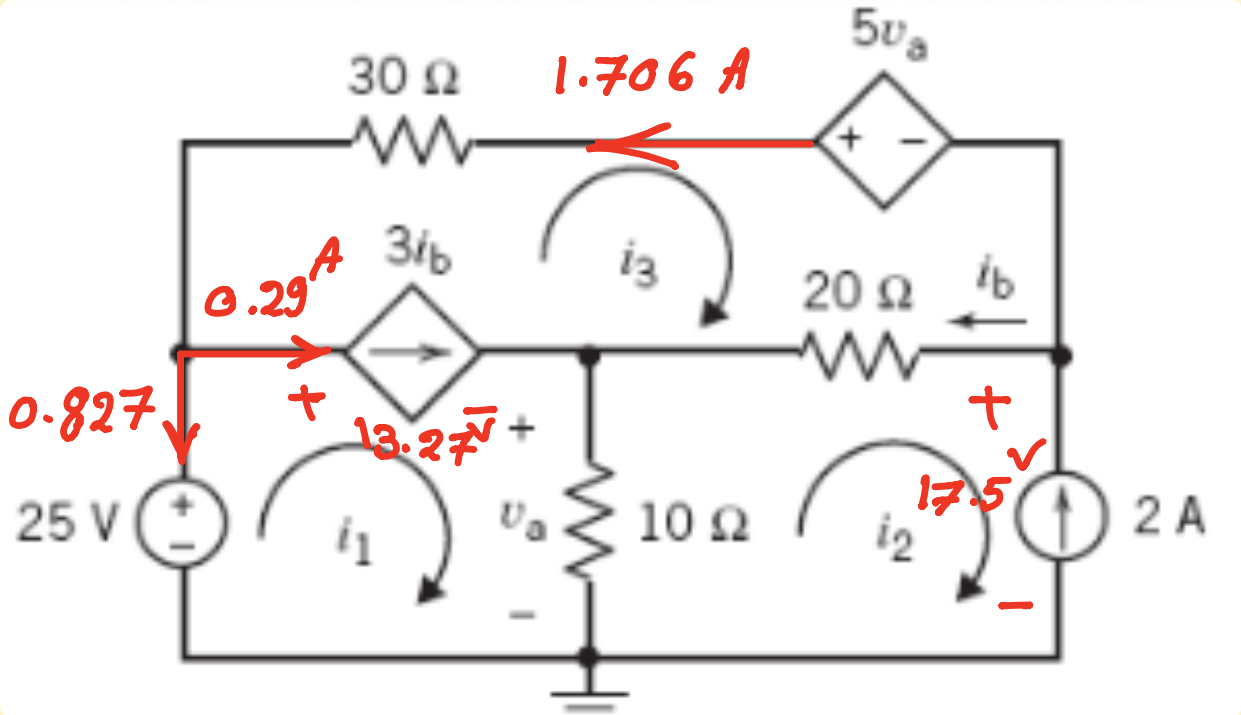
$$= 17.58\ V$$

To compute the voltage accross the dependent current source, v_m, we apply KVL à mesh (1)

$$-25 - v_m + v_a = 0$$

$$v_m = -25 + v_a = -13.27$$

We can now place all the values of the voltage and currents in the circuit after adjusting for the signs.



Now we can see that

25 V absorbs power → 20.68 W

5 V_a dependent source delivers power → −100 W

3 i_b dependent source absorbs power → 11.67 W

2 A source delivers power → −35.17 W

net power = net power delivered -
net power absorbed
= 102.86 W

The power naturally absorbed the resistor must add up to 102.86 W
This is confirmed by the table below.

	A	B	C	D	E
1	Element	Current	Voltage	Power (negative for power delieverd and positive for power absorbed)	
2	Indendent Voltage Source	0.82758621	25	20.68965517	
3	Indendent Current Source	2	17.5862069	-35.17241379	
4	Dependent Voltage Source	1.70689655	58.6206897	-100.059453	
5	Dependent Current Source	0.87931034	13.2758621	11.67360285	
6	R1	1.70689655		87.40487515	
7	R2	1.17241379		13.74554102	
8	R3	0.29310345		1.718192628	
9	Net Power delivered			-102.8686088	
10	Net Power absorbed by resistors			102.8686088	
11					

Correct