EE 202 (122)

HW1 **KEY**

Due Monday 11/2/2013

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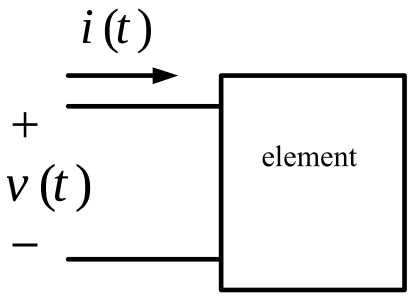
Q1 The current entering the terminal of an element and the voltage across it are



$$v(t)=\begin{cases} 20te^{-40t} & t\geq 0 \\ 0 & t<0 \end{cases} \qquad i(t)=\begin{cases} 50te^{-40t} & t\geq 0 \\ 0 & t<0 \end{cases}$$

Find the followings:

(a) The total charges entering the element (in milli coulombs) ?

(b) Find the time when the power delivered to the element is maximum ?

(c) Find the maximum power delivered to the element ?

(d) Find the total energy delivered to the element ?

(a) Since $\text{q(t)}=\int_{-\infty}^{t} i(\tau)d\tau \Rightarrow$ then $\text{q}_{\text{Total}} = \int_{-\infty}^{\infty} 50\tau e^{-40\tau}d\tau$

using intrgration by parts or intgration table $\text{q}_{\text{Total}} = 31.2500$ mC

(b) $\text{p(t)} = \text{v(t)i(t)} = \begin{cases} 1000t^2 e^{-80t} & t\geq 0 \\ 0 & t<0 \end{cases} \Rightarrow \dfrac{\text{dp(t)}}{\text{d(t)}} = 1000te^{-80t} - 80{,}000t^2e^{-80t} = 0$

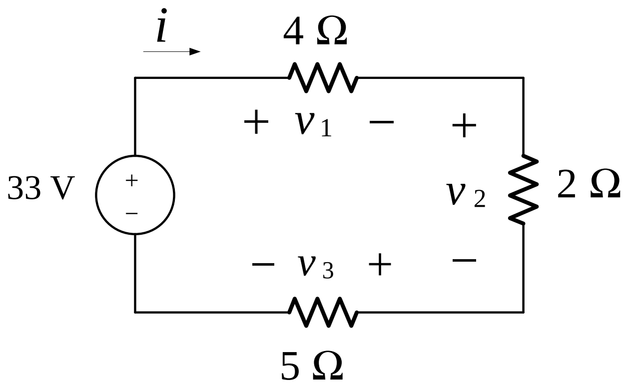
$\Rightarrow 1-40t = 0 \Rightarrow t = \dfrac{1}{40}$ s = 25 ms

(c) $\text{P}_{\text{max}} = \text{p(25 ms)} = 84.5846$ mW

(d) $\text{W(t)} = \int_{-\infty}^{t} p(\tau)d\tau \Rightarrow$ then $\text{W}_{\text{Total}} = \int_{-\infty}^{\infty} 1000\tau^2 e^{-80\tau}d\tau$

using intrgration by parts or intgration table $\text{W}_{\text{Total}} = 3.9063$ mJ

Q2



For the circuit shown above , find i, v_1, v_2, v_3 ?

KVL $-33+v_1+v_2+v_3=0$

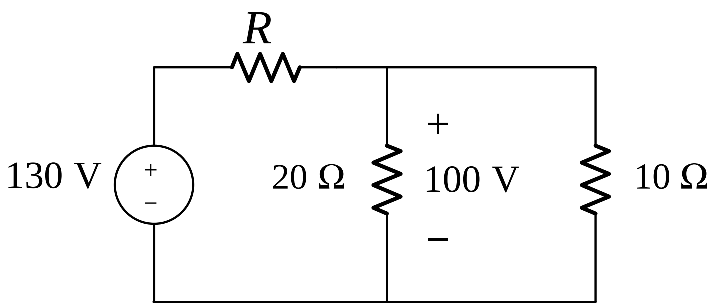
ohms $\Rightarrow -33+4i+2i+5i=0 \Rightarrow -33+11i=0 \Rightarrow i=3A$

$v_1 = 4i$ = 4(3) =12 V

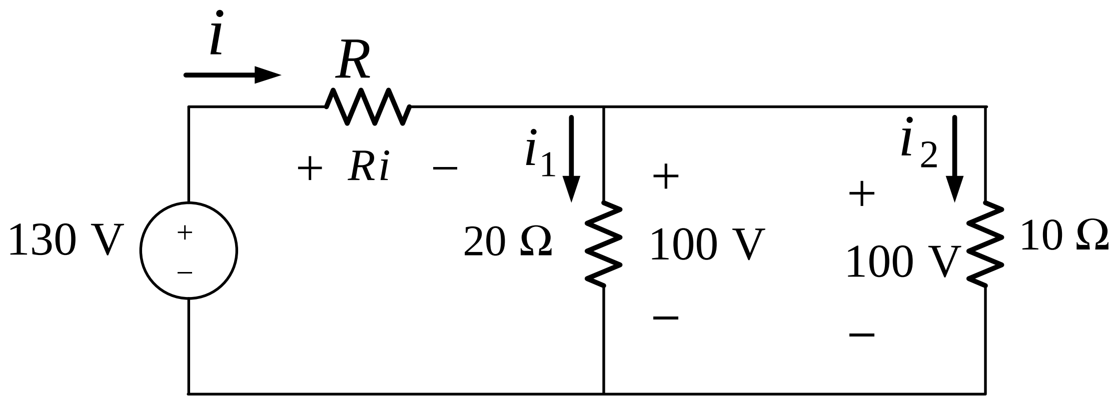
$v_2 = 2i$ = 2(3) =6 V

$v_3 = 5i$ = 5(3) =15 V

Q3



For the circuit shown above , find R ?

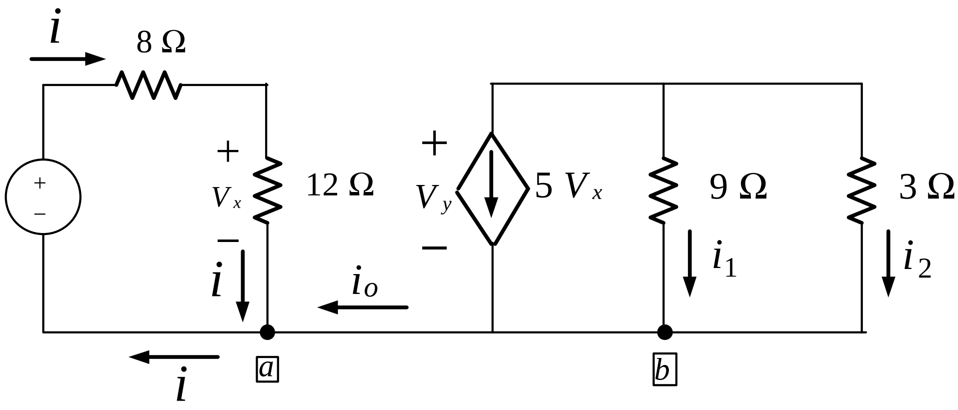


ohms $i_1 = \dfrac{100V}{20\Omega} = 5A \quad i_2 = \dfrac{100V}{10\Omega} = 10A$

KCL $i = i_1 + i_2 =$ 5+10=15A

KVL $-130 + Ri + 100 = 0 \quad \Rightarrow \quad -30 + R(15) = 0 \Rightarrow R = 2\Omega$

Q4



For the circuit shown above , find the followings:

(a) i_o ?

(b) i_1 ?

(c) i_2 ?

(d) The power deliver by the independent source ?

(d) The power absorb by the dependent source ?

(a) KCL at node **a** $\Rightarrow i + i_o - i = 0 \Rightarrow i_o = 0$

(b) KVL $-20 + 8i + 12i = 0 \Rightarrow i = 1\text{A} \Rightarrow V_x = 12(1) = 12\text{ V}$

KCL at node **b** $\Rightarrow 5V_x + i_1 + i_2 = 0 \Rightarrow 5(12) + i_1 + i_2 = 0 \Rightarrow i_1 + i_2 = -60$ (1)

however since $9i_1 = 3i_2 \Rightarrow i_2 = 3i_1$ (2)

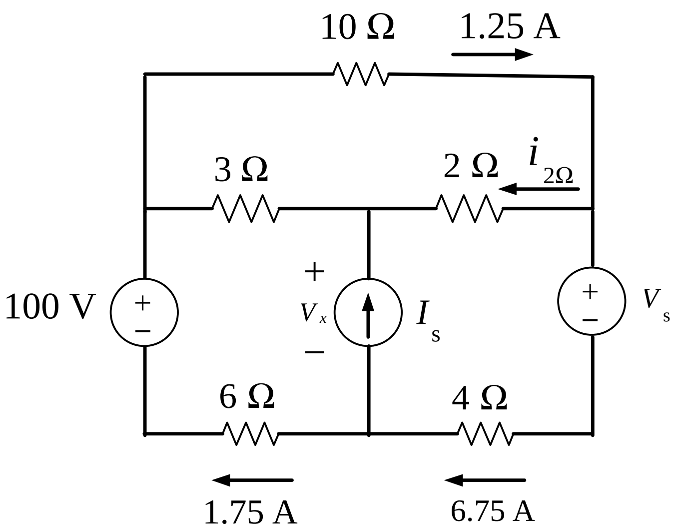
(2) $\Rightarrow$ (1) $i_1 + 3i_1 = -60 \Rightarrow i_1 = -15A$

(c) $i_2 = 3i_1 = 3(-15) = -45A$

(d) $P_{20V}^{absorbed} = -(20)i = -(20)(1) = -20\text{ W} \Rightarrow P_{20V}^{deliver} = 20\text{ W}$

(e) $P_{5V_x}^{absorbed} = (V_y)i = (9i_1)(5V_x) = [9(-15)][5(12)] = -8100\text{ W}$

Q5



For the circuit shown above , find the followings:

(a) I_s ?

(b) V_s ?

(c) The power absorb by the 2 Ω resistor ?

(d) power deliver by the independent current source ?

(a) KCL $6.75 = I_s + 1.75 \Rightarrow I_s = 5\ A$

(b) KVL $-100 + 10(1.25) + V_s + 4(6.75) + 6(1.75) = 0 \Rightarrow V_s = 50$ V

(c) KCL $1.25 = i_{2\Omega} + 6.75 \Rightarrow i_{2\Omega} = -5.5\ A$

$\Rightarrow P_{2\Omega} = 2(i_{2\Omega})^2 = 2(-5.5)^2 = 60.5\ W$

(d) KVL $-V_x - 2i_{2\Omega} + 50 + 4(6.75) = 0 \Rightarrow V_x = 88$ V

$\Rightarrow P_{I_s}^{absorbed} = -V_x I_s = -(88)(5) = -440\ \text{W} \Rightarrow P_{I_s}^{deliver} = 440\ \text{W}$