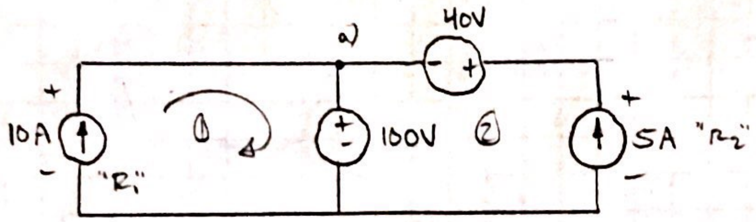
ENGR 221 HW #2 | 4/17/20 | Sean Lai

CH 2: #'s 3, 7, 26, 35, 40, 41

③

Given:



Find: if valid → power developed by current sources
else → explain why it's not valid

Solution:

KVL: ① $10A \cdot R_1 - 100V = 0 \rightarrow R_1 = 10\Omega$

② $100V + 40V - 5A \cdot R_2 = 0$
$5A \cdot R_2 = 140 \rightarrow R_2 = 28\Omega$

using R's:

$P_{10} = I^2 R_1$
$P_{10} = 1000W$

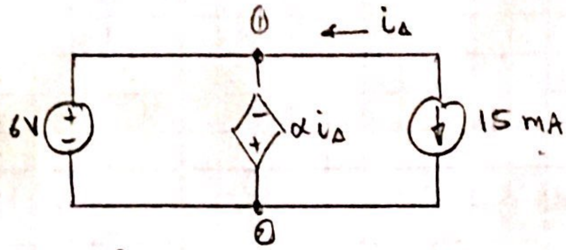
$P_5 = I^2 R_2$
$P_5 = 700W$

power developed because voltage rise in direction of current

→ $\boxed{P_{10} = -1000W \quad P_5 = -700W}$ supplied power

7

Given:



Find: a) value of α to make this valid
b) for α, power associated by current source
c) is current source supplying or absorbing power

Solution:

a) from node 1 to 2, 6V voltage drop:

$\rightarrow \alpha i_\Delta = -6V$ and $i_\Delta = -15mA$ from figure

$$\rightarrow \alpha = \frac{-6V}{-15mA}$$

$$\boxed{\alpha = 0.4\ V/mA = 400\ \frac{V}{A}}$$

b) $P = iV$

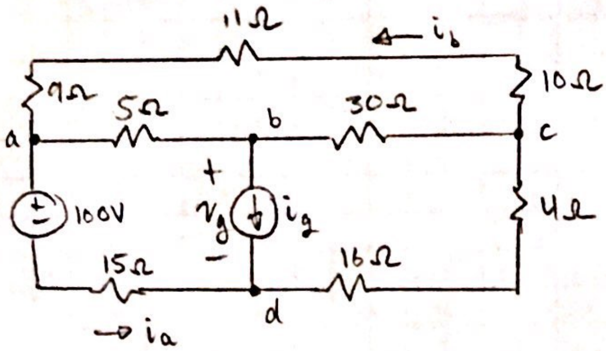
$P = (+0.015A)(6V)$

$P = 0.09W$ or $\boxed{90mW}$

c) power is absorbed since sign of P is +.

(26)

Given:



$i_a = 4A$
$i_b = -2A$

Find: a) i_g
b) P dissapated in each R
c) v_g
d) show $P_{i_g} = \Sigma P_R + P_{100V}$

Solution:

a) $v_{ad} = 100V + (15\Omega)(4A)$
$= 160V$

$v_{ac} = +i_b(-9-11-10)$
$= +(-2A)(-30\Omega)$
$= 60V$

$v_{cd} = v_{ad} - v_{ac} = 100V$

$i_{cd} = \frac{100V}{(4+16)\Omega}$

$i_{cd} = 5A$

$i_{bc} = i_b + i_{cd}$
$= -2A + 5A$
$= 3A$

$i_a = i_b + i_{ba}$
$i_{ba} = i_a - i_b$

$i_{ba} = 4A - -2A$
$i_{ba} = +6A$

$i_{db} = i_{ba} + i_{bc}$
$= 6A + 3A$
$i_{db} = 9A$

$\rightarrow$

$i_a = 4A$
$i_b = -2A$
$i_{cd} = 5A$
$i_{bc} = 3A$
$i_{ba} = 6A$
$i_{db} = 9A \rightarrow \boxed{i_g = -9A}$ by PSC.

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(26) continued

b)
$$P_9 = i_b^2 \cdot 9\Omega = 2^2A \cdot 9\Omega \rightarrow P_9 = 36W$$
$$P_{11} = i_b^2 \cdot 11\Omega = 2^2A \cdot 11\Omega \rightarrow P_{11} = 44W$$
$$P_{10} = i_b^2 \cdot 10\Omega = 2^2A \cdot 10\Omega \rightarrow P_{10} = 40W$$
$$P_5 = i_{ba}^2 \cdot 5\Omega = 6^2A \cdot 5\Omega \rightarrow P_5 = 180W$$
$$P_{30} = i_{bc}^2 \cdot 30\Omega = 3^2A \cdot 30\Omega \rightarrow P_{30} = 270W$$
$$P_4 = i_{cd}^2 \cdot 4\Omega = 5^2A \cdot 4\Omega \rightarrow P_4 = 100W$$
$$P_{15} = i_a^2 \cdot 15\Omega = 4^2A \cdot 15\Omega \rightarrow P_{15} = 240W$$
$$P_{16} = i_{cd}^2 \cdot 16\Omega = 5^2A \cdot 16\Omega \rightarrow P_{16} = 400W$$

c)
$$v_g = 160V + i_{ba}(5\Omega)$$
$$= \cancel{160V} + 6A(5\Omega)$$
$$\boxed{v_g = 190V}$$

d)
$$P_{ig} = 190V \cdot -9A$$
$$= \underline{-1710W}$$

$$\Sigma P_R + P_{100V} = \underbrace{[36 + 44 + 40 + 180 + 270 + 100 + 240 + 400]W}_{\text{resistors}} + \underbrace{[100V \cdot 4A]}_{\text{voltage source}}$$

$$= \underline{+1710W}$$

$$\boxed{v_g + \Sigma P_R + P_{100V} = 0}$$

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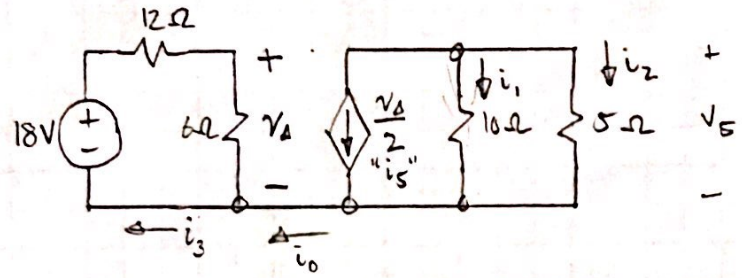
35

Given:



Find: a) i_0
b) i_1
c) i_2

Solution:

$$18V - i_3 \cdot 12\Omega - v_\Delta = 0$$

and $$v_\Delta = i_3 \cdot 6\Omega \rightarrow i_3 = \frac{v_\Delta}{6\Omega}$$

$$\rightarrow 18V - \frac{v_\Delta}{6\Omega} \cdot 12\Omega - v_\Delta = 0$$

$$18V - 3V_\Delta = 0$$

$$\rightarrow \underline{V_\Delta = 6V}$$

$$\rightarrow \underline{i_5 = \frac{V_\Delta}{2} = 3A}$$

$$-i_5 = i_1 + i_2$$

$\boxed{\text{a) } i_0 = 0 \text{, no other current path}}$

$$i_1 = \frac{V_5}{10\Omega} \qquad i_2 = \frac{V_5}{5\Omega}$$

$$\rightarrow -i_5 = \frac{V_5}{10\Omega} + 2 \cdot \frac{V_5}{10\Omega}$$

$$-10\Omega \cdot 3A = 3 \cdot V_5$$

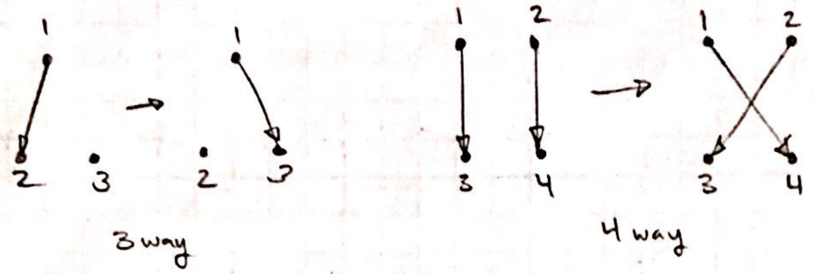
$$\rightarrow V_5 = -10V$$

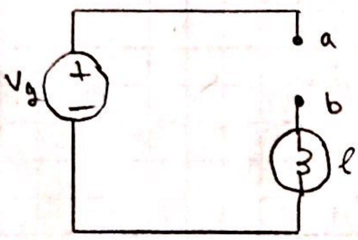
$$i_2 = \frac{V_5}{5\Omega} \qquad i_1 = \frac{V_5}{10\Omega}$$

$$\boxed{i_2 = -2A} \qquad \boxed{i_1 = -1A}$$

(40)

Given:



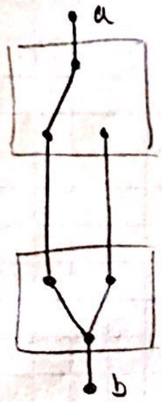


Find: a) show that two 3-way switches can attach a and b to allow ℓ to be switched on in two locations

b) show that one 4-way and two 3-way switches can be used to allow switching from three locations.

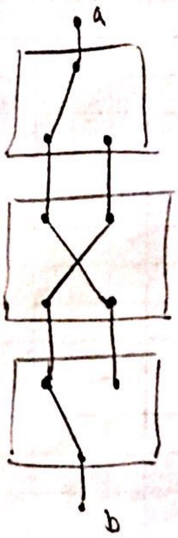
Solution:

a)



currently closed from a→b

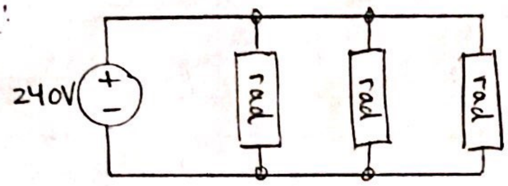
b)



currently open from a→b

(41)

Given:



$R_{rad} = 48\,\Omega$

Find: Total power for three radiators

Solution:

$$R_{eq} = \left(\frac{3}{R_{rad}}\right)^{-1}$$

$$R_{eq} = 16\,\Omega$$

$$P = \frac{V^2}{R}$$

$$\boxed{P = 3600\,W}$$

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