Assignment 3

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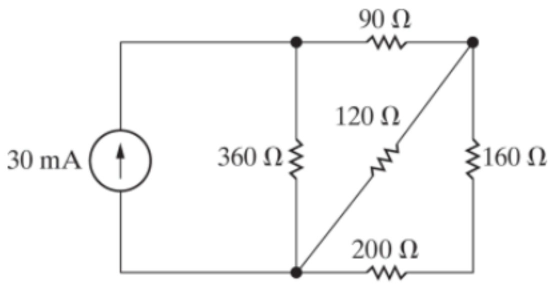
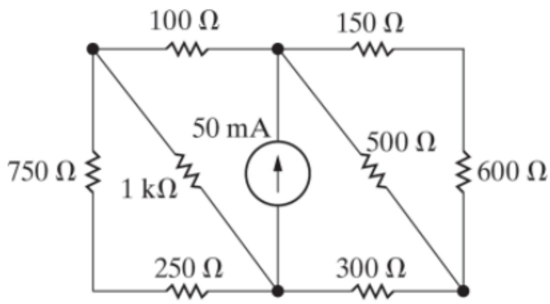
9/18/2020

Chapter 3

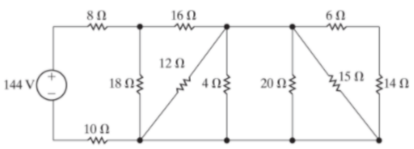
7 In the circuits in Fig. P3.7 (a)-(d), find the equivalent resistance seen by the source and the power delivered by the source.



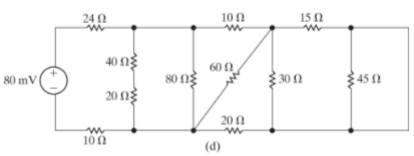
(a)



(b)



(c)



(d)

a) Resistance $= 360||((200+160)||120+(200+160)||120) = 120Ohm$
   Power Delivered $= 120(30)^2 = 108mW$

b) Resistance $= ((250+750)||1000)+100||((600+150)||500+(600+150)||500) = 300Ohm$
   Power Delivered $= 300(50)^2 = 750mW$

c) Resistance $= 8 + (18||(16 + ((((6 + 14)||15)||20||4)||12))) + 10 = 27Ohm$
Power Delivered $= \frac{(144)^2}{27} = 768W$

d) Resistance $= 24 + (30||60||80) + (((15||30) + 20)||60) = 6Ohm$
Power Delivered $= \frac{(144)^2}{27} = 106.67uW$

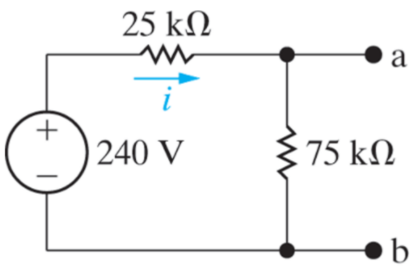
10 a) Find an expression for the equivalent resistance of two resistors of value R in series.
$R_{eq} = R + R = 2R$

b) Find an expresion for the quivalent resistance of n resistors of value R in series.
$R_{eq} = R + R + R + ... + R = nR$

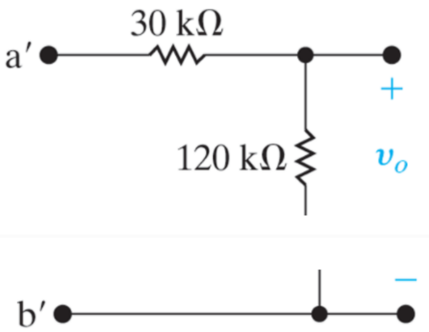
c) Using the results of (a), design a resistive network with an equivalent resistance of 3 kOhm using two resistors with the same value from Appendix H.
$R + R = 2R = 3000$
$R = 1500Ohm$

d) Using the results of (b), design a resistive network with an equivalent resistance of 4 kOhm using a minimum number of identical resistors from Appendix H.
$nR = 4R = 4000$
$R = 1000Ohm$

16 a) The voltage divider in Fig. P3.16 (a) is loaded with the voltage divider shown in Fig. P3.16 (b); that is, a is connected to a', and b is connected to b'. Find v_o.



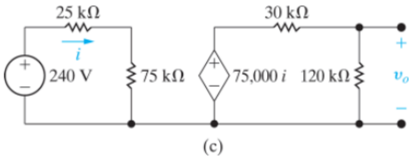
(a)



(b)

$75kOhm||(120kOhm + 30kOhm) = 50kOhm$
$v_{o_1} = \frac{50kOhm}{(75kOhm)} * 240V = 160V$
$v_o = \frac{120kOhm}{150kOhm} * v_{o_i} = 128V$

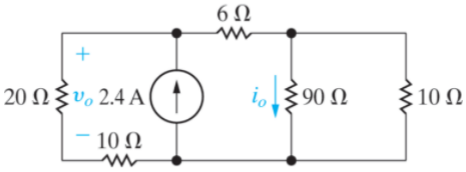
b) Now assume the voltage divider in Fig. P3.16 (b) is connected to the voltage divider in Fig. P3.16 (a) by means of a current-controlled voltage source as shown in Fig. P3.16 (c). Find v_o.



$i = \frac{240V}{100kOhm} = 2.4mA$
$v_o = \frac{120}{150} * 75000i = 144V$

c) What effect does adding the dependent-voltage source have on the operation of the voltage divider that is connected to the 240 V source?
$v_{o_1} = 0.95 * 240V = 180V$

19 For the current divider circuit in Fig. P3.19 calculate



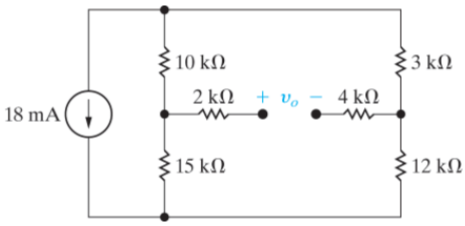
a) i_o and v_o.

$$\begin{aligned} R_{eq} &= (10+20)||(6+(90||10)) \\ &= 10Ohm \\ v_{2.4A} &= 10i \\ &= 2.4 * 10 \\ &= 24V \\ v_o &= v_{20Ohm} \\ &= (24) * \frac{10}{10+20} \\ &= 16V \\ v_{90Ohm} &= 24 * (\frac{(90||10)}{6+(90||10)}) \\ &= 14.4V \\ i_o &= \frac{v_{90Ohm}}{90} \\ &= 0.16A \end{aligned}$$

b) the power dissipated in the 6 Ohm resistor.
$P_{6Ohm} = \frac{(v_{2.4A} - v_{90Ohm})^2}{6} = \frac{(24-14.4)^2}{6} = 15.36W$

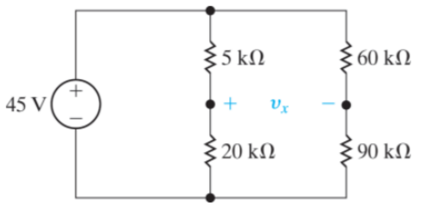
c) the power developed by the current source.
$P_{2.4A} = -(V_{2.4A})(i_{2.4A}) = -(2.4)(24) = -57.6W$

31 Find v_o in the circuit in Fig. P3.31 using voltage and/or current division.



$$
\begin{aligned}
i_1 &= \tfrac{-(18mA)(3k+12k)}{(3k+12k)+(10k+15k)} \\
&= -6.75mA \\
v_{15k} &= i_1(15k) \\
&= -101.25V \\
i_2 &= i_s - i_1 \\
&= -11.25mA \\
v_{12k} &= (i_{12k})(12k) \\
&= -135V \\
v_o &= v_{15kOhm} - v_{12kOhm} \\
&= 33.75V
\end{aligned}
$$

32



a) Find the voltage v_x in the circuit in Fig. P3.32 using voltage and/or current division.

$$
\begin{aligned}
v_{20kOhm} &= 45 * \tfrac{20kOhm}{(20kOhm+5kOhm)} \\
&= 36V \\
v_{90kOhm} &= 45 * \tfrac{90kOhm}{(90kOhm+60kOhm)} \\
&= 27V \\
v_x &= v_{20kOhm} - v_{90kOhm} \\
&= 9V
\end{aligned}
$$

b) Replace the 45V source with a general voltage source equal to V_s. Assume V_s is positive at the upper terminal. Find v_x as a function of V_s.

$$
\begin{aligned}
v_{20k} &= \tfrac{20k}{(20k+5k)}(V_s) \\
&= 0.8V_s \\
v_{90k} &= \tfrac{90k}{(90k+60k)}(V_s) \\
&= 0.6V_s \\
v_x &= v_{20k} - v_{90k} \\
&= 0.2V_s
\end{aligned}
$$