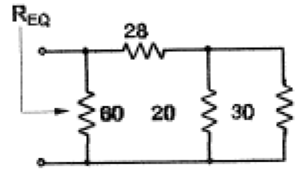
Homework Solutions 3

(2-28) Find the equivalent resistance Req in Figure P2-28

2-28 $R_{EQ} := \cfrac{1}{\cfrac{1}{60} + \cfrac{1}{28 + \cfrac{1}{\cfrac{1}{20} + \cfrac{1}{30}}}}$

$R_{EQ} = 24$



Start with the 20Ω resistor is in parallel with 30Ω resistor, now add the 28Ω resistor. That equivalent resistance calculation is in parallel with a 60Ω resistor. **Req = 24Ω.**

(2-34) A 5-mA practical current source is parallel with a 2-kΩ resistor. The voltage across the resistor is observed to be 5V. Find the source resistance of the practical current source.

2-34 $R := 2000 \quad V_R := 5 \quad i_R := \frac{V_R}{R}$

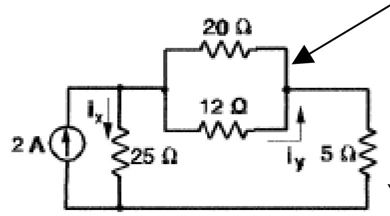
$i_R = 2.5 \times 10^{-3} \quad i_S := 5 \cdot 10^{-3}$

$i_{Rs} := i_S - i_R \quad i_{Rs} = 2.5 \times 10^{-3}$

$R_S := \frac{V_R}{i_{Rs}} \quad R_S = 2 \times 10^{3}$

Simply consider a 2-kΩ resistor to be in parallel with a 5mA current then, find the current through the resistor. Now to find the source resistance current subtract the current through the 2-kΩ resistor form the 5mA current source. Since the voltage through the resistor is 2V divide this with the sources resistance current to obtain the source resistance.

(2-44) Find Iy in figure P2-43



Start reducing the circuit by considering 20Ω resistor is in parallel with the 12Ω resistor.

After the 20Ω||12Ω reduction add the 5Ω to obtain the equivalent resistance (Req = 5Ω + (20Ω||12Ω))

In this problem the way to approach this problem is To consider that the current is being divide into two ways with a equivalent resistance and 25Ω resistor. This allows the problem to become much easier. Then after finding the values work backwards in the circuit.

20Ω||12Ω = (20×12) / (20 + 12) = 7.5Ω

Then, Req = 7.5Ω + 5Ω = 12.5Ω

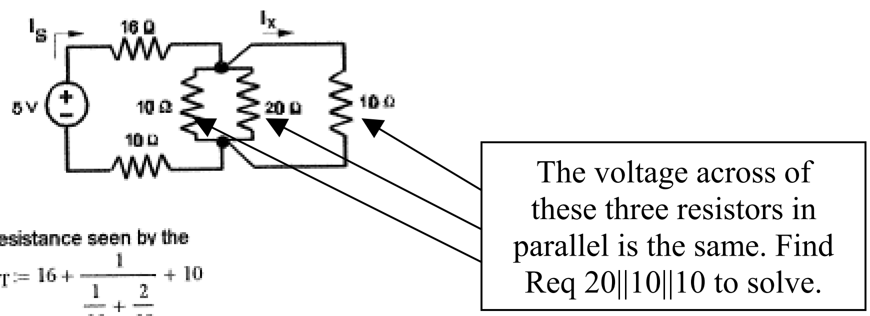
Find current through the Req by current division = [25Ω / (25Ω+ 12.5Ω)] × 2A

If the current through Req is 1.333A, then consider the current through the Req which is divided between a 12Ω and 20Ω resistor.

Therefore using current division again,

Iy = [20Ω / (20Ω + 12Ω)] × (1.333A) = <u>0.8333A</u>

(2-52) Use the circuit reduction to find Is and Ix in the circuit shown in Figure P2-51



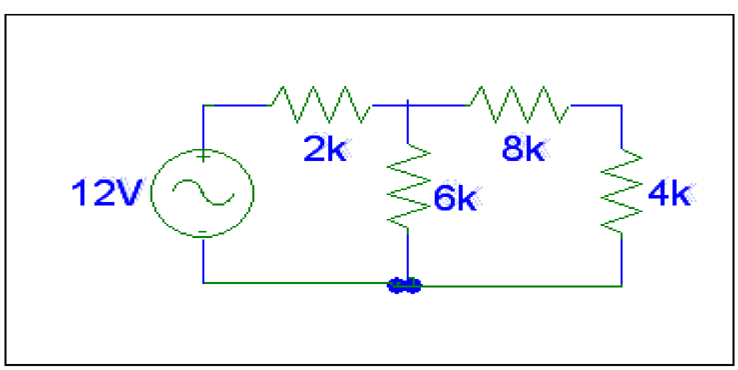
2-52 The total resistance seen by the 5-V source is $R_T := 16 + \dfrac{1}{\dfrac{1}{20} + \dfrac{2}{10}} + 10$

$R_T = 30$ hence $i_S := \dfrac{5}{R_T}$ $\quad i_S = 0.167$

$$i_x := \frac{\dfrac{1}{10}}{\dfrac{2}{10} + \dfrac{1}{20}} \cdot i_S \qquad i_x = 0.067$$

After considering the 3 resistors in parallel to be an equivalent resistance, find the voltage drops across the remaining resistor that are is series. After finding the voltage drop across the Req simply use Ohms law to find current **<u>Ix = 0.067</u>**.

(2-54) Use the circuit reduction to find Vx and Ix in the circuit shown in Figure P2-45



First reduce circuit to find the voltage at the node after the 2kΩ resistor. First add together 8 kΩ and 4 kΩ resistors because they are in series which is 12 kΩ. Now consider the 6 kΩ resistor to be in parallel with the 12 kΩ resistor:

$$12\ k\Omega \parallel 6\ k\Omega = (6 \times 12) / (6 + 12) = 4\ k\Omega$$

Now using voltage division find voltage drop across the 4 kΩ resistor.

Therefore, $[4k\Omega / (4k\Omega + 2k\Omega)] \times 12V = 8V$
Now use voltage division again to find voltage across the 4 kΩ resistor,

Thus, $V_x = [(4\ k\Omega / (4\ k\Omega + 8\ k\Omega))] \times 8V =$ **2.667 V**

Hence, the voltage drop across the 2 kΩ resistor is 2.667 V