MESH ANALYSIS

Friday, November 5, 2021 10:38 AM

Exercise1

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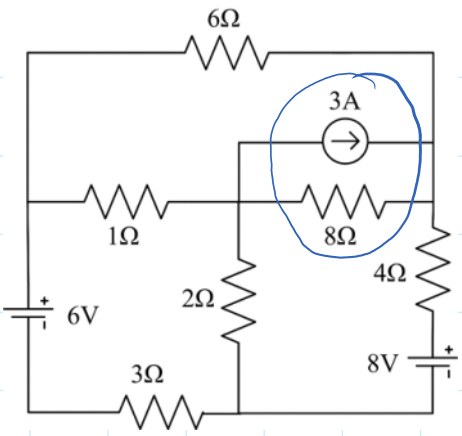
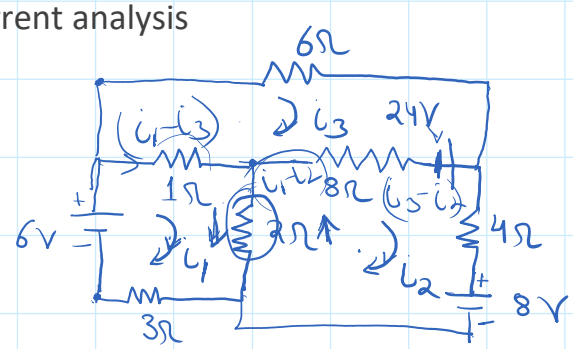
Determine the power drawn by 2 ohm resistor using Mesh current analysis





$6 - 1(i_1 - i_3) - 2(i_1 - i_2) - 3i_1 = 0$

$6i_1 - 2i_2 - i_3 = 6$ — (1)

$-8(i_2 - i_3) + 24 - 4i_2 - 8 - 2(i_2 - i_1) = 0$

$-2i_1 + 14i_2 - 8i_3 = 16$ — (2)

$-6i_3 - 24 - 8(i_3 - i_2) - 1(i_3 - i_1) = 0$

$-i_1 - 8i_2 + 15i_3 = -24$ — (3)

$i_1 = 0.99A$

$i_2 = 0.587A$

$i_3 = -1.22A$

$P = i^2R$

$= (0.99 - 0.587)^2 \times 2$

$= 0.324W$

Exercise2

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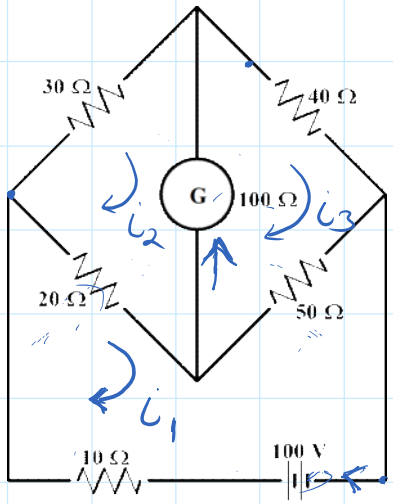
- Determine the current through the galvanometer "**G**"



$100 - 10i_1 - 20(i_1 - i_2) - 50(i_1 - i_3) = 0$

$80i_1 - 20i_2 - 50i_3 = -100$ — (1)

$+30i_2 + 100(i_2 - i_3) + 20(i_2 - i_1) = 0$

$-20i_1 + 150i_2 - 100i_3 = 0$ — (2)

$+40i_3 + 50(i_3 - i_1) + 100(i_3 - i_2) = 0$

$-50i_1 - 100i_2 + 190i_3 = 0$ — (3)

$80i_1 + 20i_2 + 50i_3 = -100$

$i_1 = 1.677\,A$ ✓ $\quad 2.23\,A$ ✓

$i_2 = 0.262\,A$ ✓ $\quad 1.06\,A$ ✓

$i_3 = 0.579\,A$ ✓ $\quad 1.14\,A$ ✓

$i_G = i_3 - i_2$

$= 1.14 - 1.06$

$= 0.08\,A$ ✓

Exercise3

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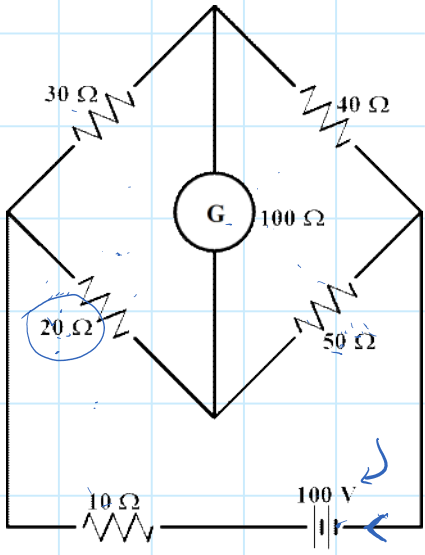
How to write the network equations by inspection?



$$80i_1 - 20i_2 - 50i_3 = 100$$

$$-20i_1 + 150i_2 - 100i_3 = 0$$

$$-50i_1 - 100i_2 + 190i_3 = 0$$

$$\begin{bmatrix} 80 & -20 & -50 \\ -20 & 150 & -100 \\ -50 & -100 & 190 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 100 \\ 0 \\ 0 \end{bmatrix}$$

Exercise4

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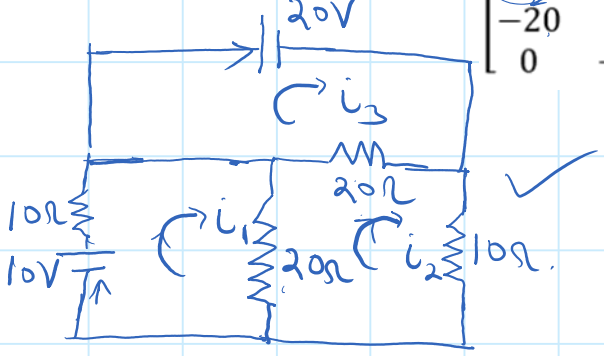
Realize the network defined by mesh current equations given below

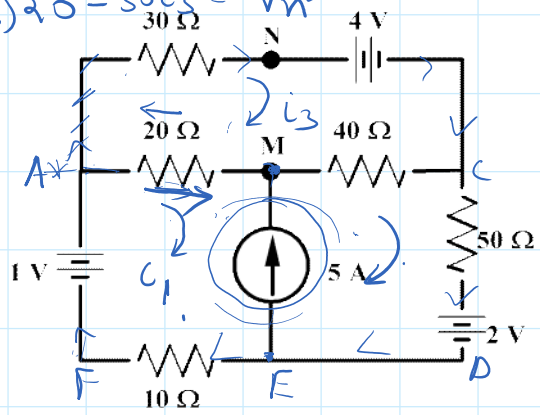
$$\begin{bmatrix} 30 & -20 & 0 \\ -20 & 50 & -20 \\ 0 & -20 & 20 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 10 \\ 0 \\ -20 \end{bmatrix}$$



Exercise5

Friday, November 5, 2021 4:24 PM

- Find the power supplied by the 5 A current source.
  Also, determine the voltage between the points M & N.



$V_m - (i_3 - i_1)20 - 30i_3 = V_N$

$V_m + (i_1 - i_3)20 - 30i_3 = V_n$

$P = VI$

$= V_{ME} \times I$

$V_E - 10i_1 + 1 - 20(i_1 - i_3) = V_M$

Super mesh

$+30i_3 + 4 + 40(i_3 - i_2)$

$+20(i_3 - i_1) = 0$

$-20i_1 - 40i_2 + 90i_3 = -4$ — (1)

$i_2 - i_1 = 5$ — (2)

$V_m + 20i_1 - 30i_3 = V_N$

$V_m - V_n = -20i_1 + 30i_3$

$1 - 20(i_1 - i_3) - 40(i_2 - i_3) - 50i_2 - 2 - 10i_1 = 0$

$-30i_1 - 90i_2 + 60i_3 - 1 = 0$

$30i_1 + 90i_2 - 60i_3 = -1$ — (3)

$i_1 = -4.004$

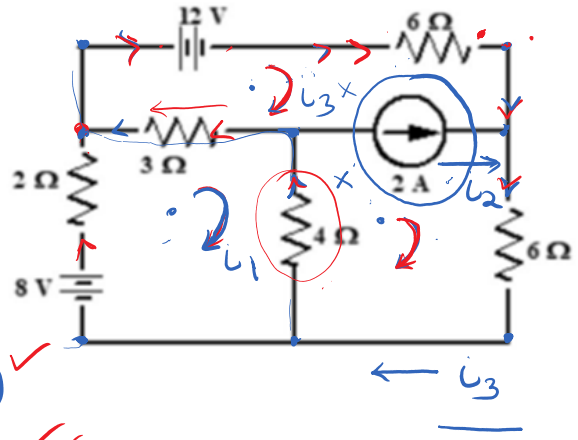
$i_2 = +0.9958$

$i_3 = -0.491$

Exercise6

Saturday, November 6, 2021 1:08 PM

Find the power supplied by 2A current source using mesh current analysis



Supermesh.

$8 - 2i_1 - 3(i_1 - i_3)$ — (1)

$-4(i_1 - i_2) = 0$ ✓

$9i_1 - 4i_2 - 3i_3 = 8$ — (1) ✓

$i_2 - i_3 = 2A$ — (2) ✓

$+12 + 6i_3 + 6i_2 + 4(i_2 - i_1) + 3(i_3 - i_1) = 0$ ✓

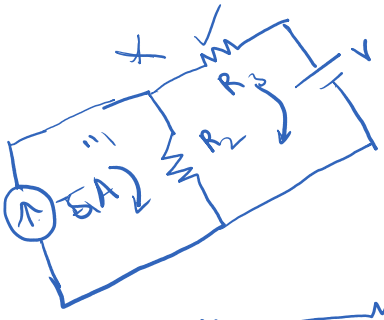
$2A \rightarrow i_2$

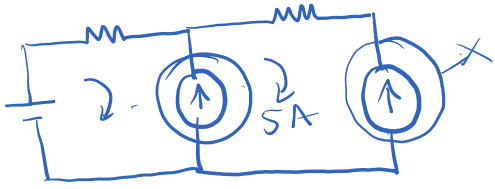
$-7i_1 + 10i_2 + 9i_3 = -12$ — (3)

$i_1 = 0.65$

$i_2 = 0.55$

$i_3 = -1.44$





$i_1 = 5A$

$i_1 - i_2 = 5A$ — (1)