WS2

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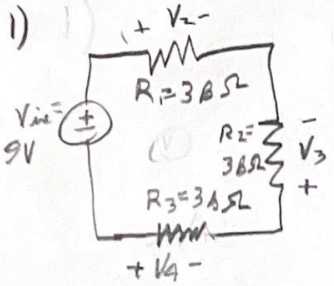
1)



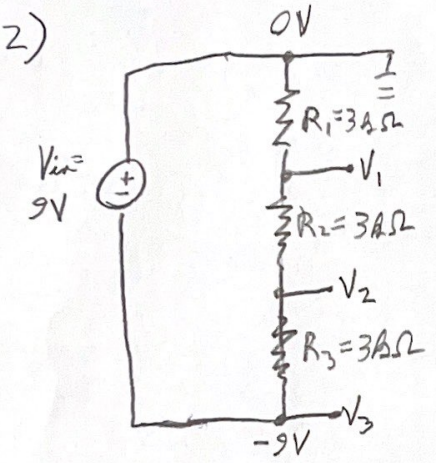
$R_t = R_1 + R_2 + R_3 = 3+3+3 = 9\Omega\Omega$

$V_2 = \frac{R_2}{R_t} V_{in} = \frac{3}{9} \cdot 9V = 3V$

$V_3 = V_4 = \frac{-(R_3 = R_4)}{R_t} V_{in} = \frac{-3}{9} 9V = -3V$

$\boxed{V_2 = 3V \quad V_3 = V_4 = -3V}$

2)



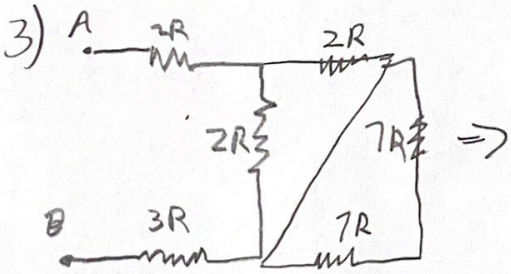
$I = V_{in}/(R_1+R_2+R_3) = 9/(9\Omega\Omega) = 1mA$

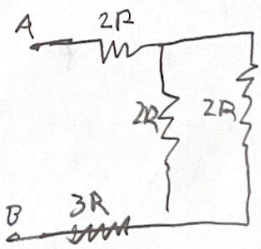
Equal V drop across each resistor as in series w/ same resistance

$V_1 = -3V$, $V_2 = V_1 - 3V$, $V_3 = V_2 - 3V$

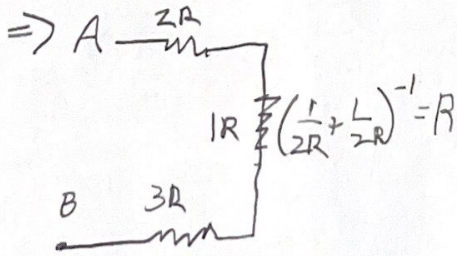
$\boxed{V_1 = -3V \text{ , } V_2 = -6V \text{ , } V_3 = -9V}$

3)

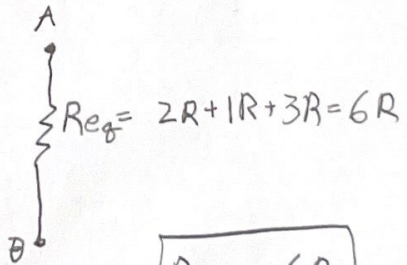




- short bypasses both 7R resistors
- extend node to show parallelism



$\left(\frac{1}{2R} + \frac{1}{2R}\right)^{-1} = R$



$\boxed{R_{eq} = 6R}$

WS2: cont

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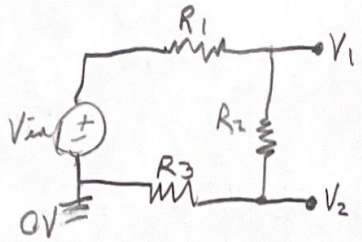
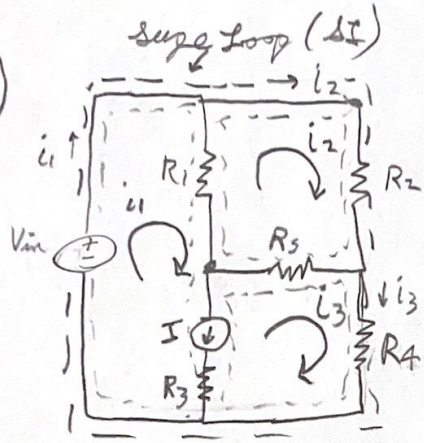
4)



VDR: $V_2 = \frac{R_3}{R_1+R_2+R_3} V_{in}$

$V_1 = \frac{R_2+R_3}{R_1+R_2+R_3} V_{in}$

5)



$V_{in} = 7V$ $I = 7mA$

$R_1 = 1k\Omega$ $R_2 = 2k\Omega$ $R_3 = 2k\Omega$

$R_4 = 1k\Omega$ $R_5 = 3k\Omega$

[ ] = loop

- $I = i_1 - i_3 = 7mA$ ← current through I

L2: $-R_2 i_2 - R_5(i_2 - i_3) - R_1(i_2 - i_1) = 0$

$\Rightarrow -2000 i_2 - 3000 i_2 + 3000 i_3 - 1000 i_2 + 1000 i_1 = 0$

$\Rightarrow -2i_2 - 3i_2 + 3i_3 - 1i_2 + 1i_1 = 0 \Rightarrow i_1 - 6i_2 + 3i_3 = 0$

SL: $V_{in} - R_2 i_2 - R_4 i_4 = 0 \Rightarrow V_{in} = 2000 i_2 + 1000 i_3 = 7V$

$\Rightarrow 2i_2 + i_3 = 7e{-}3$

a)
$$\begin{bmatrix} 1 & 0 & -1 \\ 1 & -6 & 3 \\ 0 & 2 & 1 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} 7e{-}3 \\ 0 \\ 7e{-}3 \end{bmatrix}$$

b) Solved w/ numpy in python 3

$i_1 = 9mA$

$i_2 = 2.5mA$

$i_3 = 2mA$