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IE - 3201

II Problem solving

1.) Given

$R_1 = 4\Omega$

$R_2 = 2\Omega$

$I_1 = 0.2A$

Solution:

$E = IR$

$E = 0.2A\,(4\Omega)$

$\boxed{E = 0.8V}$

$I_2 = \frac{V}{R}$

$= \frac{0.8}{2}$

$\boxed{I_2 = 0.4A}$

2.) Series $= 15\Omega$

Parallel $= \frac{56}{15}\Omega$

$R = R_1 + R_2$

$15\Omega = R_1 + R_2$

$R = \frac{(R_1)(R_2)}{R_1 + R_2}$

$\frac{56}{15}\Omega = \frac{(R_1)(R_2)}{R_1 + R_2}$

$\left(\frac{1}{R} = \frac{R_1 + R_2}{R_1 + 1}\right)$

$R = \frac{(R_1)(R_2)}{R_1 + R_2}$

$\frac{56}{15}\Omega = \frac{(R_1)(R_2)}{15\Omega}$

$56\Omega\,(15\Omega) = 15\Omega\,(R_1)(R_2)$

$56\Omega = (R_1)(R_2)$

$\frac{R_1 R_2}{R_1} = \frac{56\Omega}{R_2}$

$R_1 = \frac{56}{R_2}$

$15\Omega = R_1 + R_2$

$15\Omega = \frac{56\Omega}{R_2} + R_2$

$15\Omega = \frac{56\Omega + R_2^2}{R_1}$

$(R_2)15\Omega = 56\Omega + R_2^2$

$R_2^2 - 15R_2 + 56 = 0$

$(R_2 - 8)(R_2 - 7) = 0$

$R_2 = 8$

$R_2 = 7$

* if $R_2 = 8$; $R_1 = 7$
* if $R_2 = 7$; $R_1 = 8$

$\boxed{R_1 = 7 \quad R_2 = 8 \quad \text{or} \quad R_1 = 8 \quad R_2 = 7}$

3.) Solution:

$V_L - V_1 - V_m = 0$

$12 - V_1 - 8 = 0$

$12 - 8 = V_1$

$4 = V_1$

$\boxed{V_1 = 4V}$

$V_m - V_2 - V_R = 0$

$8 - V_2 - 2 = 0$

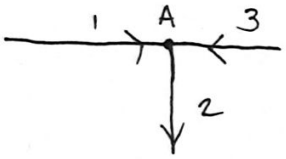
$8 - 2 = V_2$

$6 = V_2$

$\boxed{V_2 = 6V}$

4.) Find

$V_A = ?$



$A_1 = 6.59$

$A_2 = 3.85$

$I_1 - I_2 + I_3 = 0$

$$\frac{V_C - V_A}{R_1} - \frac{V_A - V_B}{R_2} + \frac{V_D - V_A}{R_3} = 0$$

$$\left(\frac{12 - V_A}{8.2} - \frac{V_A - 0}{10} + \frac{6 - V_A}{5.6} = 0\right) 5740$$

$700(12 - V_A) - 574(V_A - 0) + 1025(6 - V_A) = 0$

$8400 - 700V_A - 574V_A + 6150 - 1025V_A = 0$

$-700V_A - 574V_A - 1025V_A = -8400 - 6150$

$$\frac{-2299V_A}{-2299} = \frac{-14550}{-2299}$$

$V_A = 6.328838625$

$\boxed{V_A = 6.33V}$

5.) Solution :

Loop 1

$5V - I_1(1) - 2(I_1 - I_2) = 0$

$5V - I_1 - 2I_1 + 2I_2 = 0$

$5 - 3I_1 + 2I_2 = 0 \rightarrow 3I_1 + 2I_2 + 5 = 0$ (eq.1)

Loop 2

$2(I_1 - I_2) - I_2(3) - 4(I_2 - I_3) = 0$

$2I_1 - 2I_2 - 3I_2 - 4I_2 + 4I_3 = 0$

$2I_1 - 9I_2 + 4I_3 = 0$ (eq.2)

* Combine eq1 & 2

$2 \left[-3I_1 + 2I_2 + 5 = 0 \right]$

$-3 \left[2I_1 - 9I_2 + 4I_3 = 0 \right]$

$-6I_1 + 4I_2 + 10 = 0$

$-6I_1 + 27I_2 - 12I_3 = 0$

$-23I_2 + 12I_3 + 10 = 0$ (eq.4)

Loop 3

$4(I_2 - I_3) - I_3(5) - 10 = 0$

$4I_2 - 4I_3 - 5I_3 - 10 = 0$

$4I_2 - 9I_3 - 10 = 0$ (eq.3)

Eq.1 = $3I_1 + 2I_2 + 5 = 0$

Eq.2 = $2I_1 - 9I_2 + 4I_3 = 0$

Eq.3 = $4I_2 - 9I_3 - 10 = 0$

Eq.4 = $-23I_2 + 12I_3 + 10 = 0$

$I_1 = -1.54A$

$I_2 = 0.19A$

$I_3 = -1.19A$