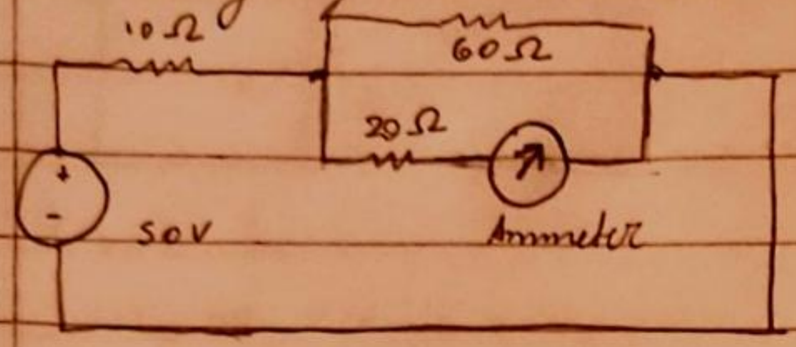
Engr 65 Homework

1. Reading of the Ammeter



A. Consider KCL

$\frac{I_m - 50}{10} + \frac{I_m}{20} + \frac{I_m}{60} = 0$

$\frac{6(I_m - 50) + 3(I_m) + I_m}{60}$

$\frac{6I_m - 300 + 3I_m + I_m}{60}$

$\frac{10I_m - 300}{60} = 0$

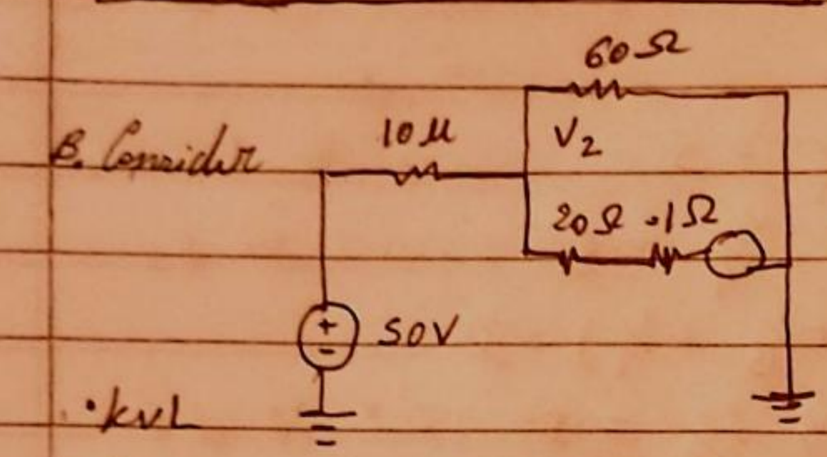
$10I_m - 300 = 0$

$I_m = 30A$

II. Consider $I_1 = \frac{I_m}{20} = 30/20 = 1.5A$

Consider $I = \frac{V_x}{20.1}$

$\frac{300.57}{20.1} = 14.95V$



B. Consider

• KVL

↳ Consider $\frac{I_m}{10} - 50 + \frac{I_m}{60} + \frac{I_m}{20+0.1} = 0$

↳ $\frac{V_x}{10} - \frac{50}{10} + \frac{V_x}{60} + \frac{V_x}{20+0.1} = 0$

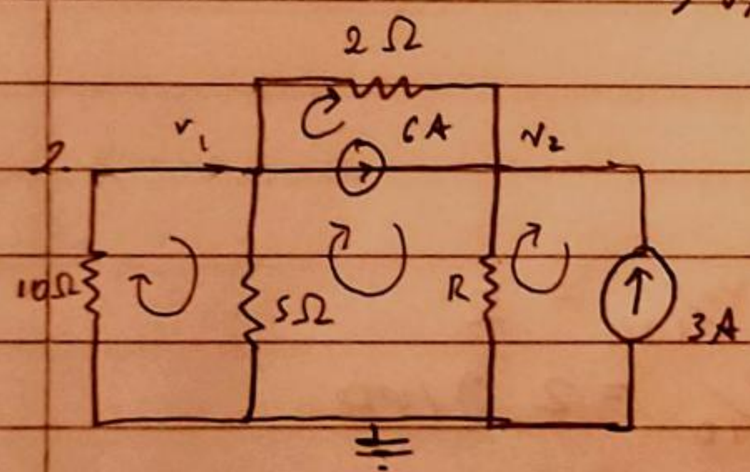
↳ $(V_x/10 + 10V_x/60 + 10V_x/20)10 = 50)10$

↳ $V_x + 1/6 + 100/20.1) = 500$

↳ $V_x + 0.16V_x + .77$

↳ $1.6635V_x = 500 = 300.57 V$

$V_1 =$



I. KVL $\left(\frac{V_1}{10} + \frac{V_1}{5} + \frac{V_1 - V_2}{2} + 6 = 0\right)10$

↳

$-V_1 + 2V_1 + 5V_1 - 5V_2 + 60 = 0$

↳ $8V_1 - 5V_2 + 60 = 0$

II. KVL $\left(\frac{V_2}{8} + \frac{V_2 - V_1}{2} = 3 + 6\right)$

↳ $V_2 + 4V_2 - 4V_1 = 72$

↳ $5V_2 - 4V_1 = 72$

III. $8V_1 - 5V_2 + 60 = 72$

$-4V_1 + 5V_2 + 0 = 0$

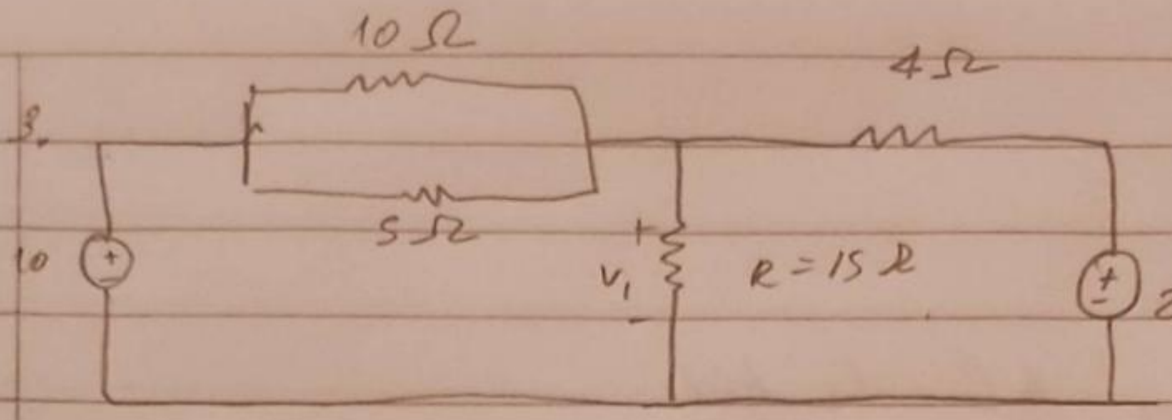
$4V_1 + 60 = 72$; $V_1 = 3V$

↳ $5V_2 - 4(3) = 72$

↳ $5V_2 = 84$

↳ $V_2 = 84/5 = 16.8$

Thus, $V_1 = 3V$; $V_2 = 16.8V$



3. $V_1: \frac{15(V_1 - 10)}{(10 // 5)} + \frac{V_1 - 0}{R} + \frac{V_1 - 20}{4} = 0$ - KVL

↳ $\frac{15(V_1 - 10)}{50} + V_1/15 + V_1/4 = 5$

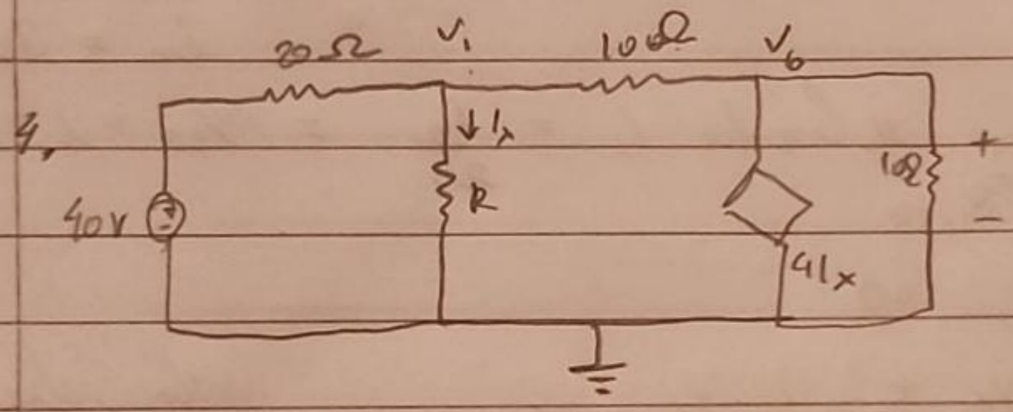
↳ $\frac{15}{50} V_1 - 3 + V_1/15 + V_1/4 = 5$

↳ $3/10 V_1 + V_1/15 + V_1/4 = 8$

↳ $V_1 (3/10 + 1/15 + 1/4) = 8$

↳ $V_1 \, 37/60 = 8$

↳ $V_1 = \frac{8 \cdot 60}{37} = 12.97 V$



4. 1. ↳ KVL at V_1

↳ $\frac{V_1 - 40V}{20 V} + \frac{V_1}{25} + \frac{V_1 - V_0}{10 V} = 0$

↳ $V_1 \left[1/20 + 1/25 + 1/10 \right] - V_0/100 = 2$

↳ $\left(V_1 (17/100) - V_0/10 = 2 \right) 100$

↳ $V_1 (19) - 10 V_0 = 200$

11. KVL at V_0

↳ $\frac{V_0 - V_1}{10} - 4ix + \frac{V_0}{10 V} = 0$

↳ $\frac{V_0}{10} - \frac{V_1}{10} - 4\left[\frac{V_1}{25}\right] + \frac{V_0}{10} = 0$

↳ $\frac{V_0}{10} - V_1/10 - 4V_1/25 + V_0/10 = 0$

↳ $V_0 (2/10) + V_1 (13/50) = 0$

$\frac{V_0}{5} = -13/50 \, V_1$

↳ $V_0 = (-13/50 \, V_1) 5$

↳ $V_0 = 1.3 V_1$

III. $V(19) - 10(1.3 V_1) = 200$

↳ $V_1 (19) - 13 V_1 = 200$

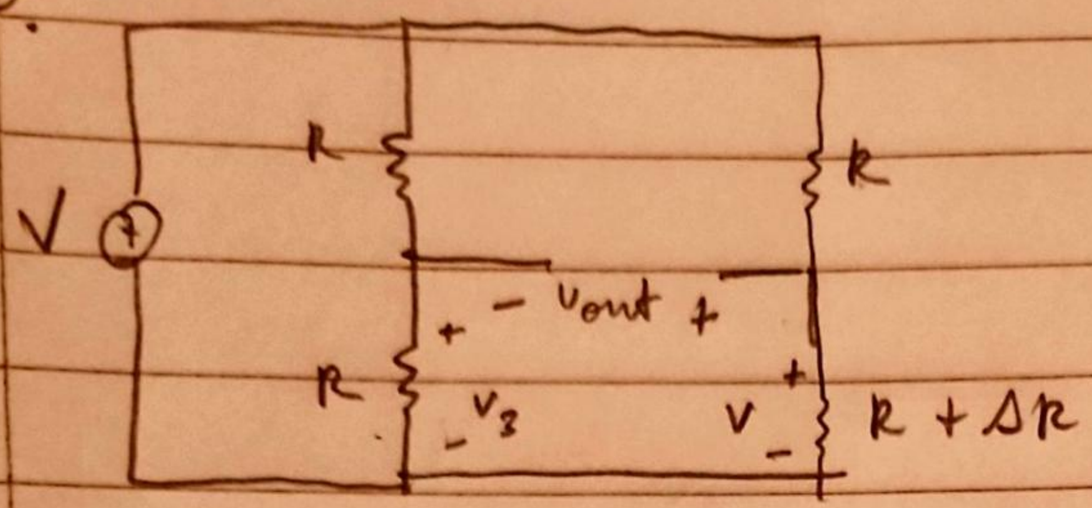
$V_1 (6) = 200 = 33.3 V$

$V_0 \; 1.3(33.3) = V_0$

↳ $V_0 = 43.33 V$

$\therefore i = V_1/R = 33.3/25 = 1.33 A$ ✓

5.



i. kVl in loop

↳ $-V_3 - V_{out} + V_x = 0$

↳ $V_{out} = V_x - V_3$

ii. Voltage division

a) ↳ $V_x = V\left(\frac{R+\Delta R}{R+R+\Delta R}\right) = V\left(\frac{R+\Delta R}{2R+\Delta R}\right)$

b) ↳ $V_3 = V\left(\frac{R}{R+R}\right) = \frac{VR}{2R} = V/2$

iii. Thus, $V_{out} = V\left(\frac{R+\Delta R}{2R+\Delta R}\right) - V/2$

↳ $V\left(\frac{R+\Delta R}{2R+\Delta R} - \frac{1}{2}\right) = V\left(\frac{2R+2\Delta R - 2R - \Delta R}{2(2R+\Delta R)}\right)$

↳ Thus, $V_{out} = V\left[\frac{\Delta R}{4R+\Delta R}\right]$ ✓