1. $\frac{V_1}{3} + \frac{V_1 - 2}{1} = 2$

$V_1 + 3(V_1 - 2) = 6$

$4V_1 = 12$

$V_1 = 3V$

$V_x = V_1 - V_2$

$V_x = 3V - 2V$

$\boxed{V_x = 4V}$

2. $20\Omega + 40\Omega = 60\Omega$

$\frac{V_p - 200}{60} + \frac{V_p}{100} + \frac{V_p - V_3}{50} = \phi$

$= 5(V_p - 200) + 3V_p + 6(V_p - V_3) = \phi$

$7V_p - 3V_3 = 500$

$(V_3 - V_p) + 25 + 5V_3 - 5V_4 = \phi \rightarrow -V_p + 6V_3 - 5V_4 = -25$

$V_3 = \frac{7V_p - 500}{3}$

$-20V_3 + 21V_4 = 600$

$V_p = \frac{31600}{161}$

$\boxed{V_p = 171.5V}$

3. $\frac{V_L - V_M}{3} + \frac{V_L - V_R}{3} = 8 + 4 = 12$

$\frac{V_M - V_L}{3} + \frac{V_M - V_R}{1} + \frac{V_M}{5} + 4 = 0$

$\frac{V_R - V_L}{3} + \frac{V_R - V_M}{1} + \frac{V_R}{7} + 5 = 0$

$V_L = \frac{401}{15} V$, $V_M = \frac{53}{6} V$, $V_R = \frac{259}{30} V$

$\downarrow$

$V_M = \frac{53}{6} V \rightarrow 8.33V$

$P_D = \frac{V_R^2}{R} = \frac{\left(\frac{259}{30}\right)^2}{7} = 10.647 W$

4. $\frac{12-V}{4} + \frac{12-V}{5} = V$

$5(12-V) + 4(12-V) = 20V$

$60 - 5V + 48 - 4V = 20V$

$108 = 29V$

$\frac{108}{29} = V$

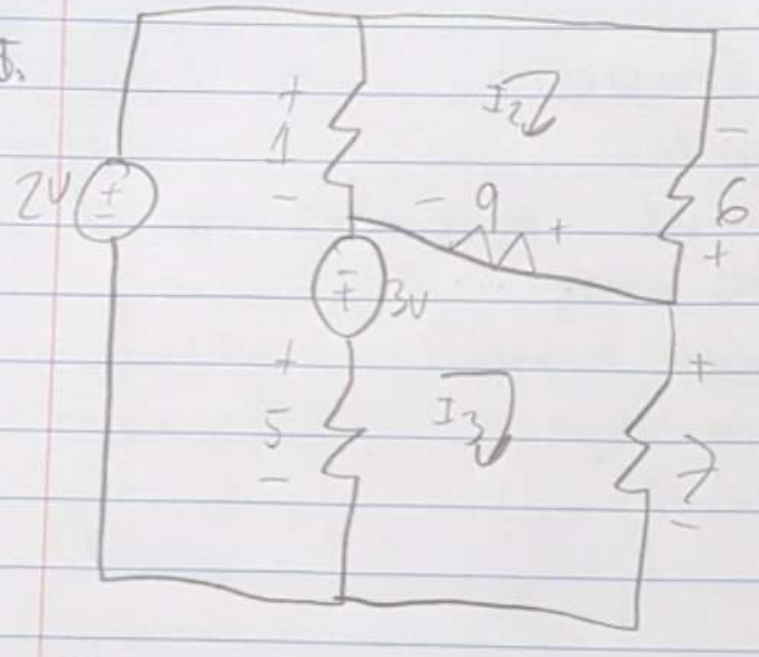
For u_1 (2V)

$\frac{12 - \frac{108}{29}}{4} = \frac{60}{29} = \boxed{2.06A}$

For u_2 (1V)

$\frac{12 - \frac{108}{29}}{5} = \frac{48}{29} = \boxed{1.65A}$

9.



$$\begin{bmatrix} -[R_1+R_5] & R_1 & -R_5 \\ -R_1 & [R_1+R_2+R_3] & -R_2 \\ -R_5 & -R_2 & [R_5+R_2+R_3] \end{bmatrix} \rightarrow \underbrace{\begin{bmatrix} -6 & 1 & -5 \\ -1 & 16 & -9 \\ -5 & -9 & 21 \end{bmatrix}}_{R} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \underbrace{\begin{bmatrix} 5 \\ 0 \\ -3 \end{bmatrix}}_{I}$$

$A = inv(R) \times I$

$$A = \begin{bmatrix} -0.55 \\ -0.24 \\ -0.38 \end{bmatrix}$$

7. a. The 1 mA source is in an op amp that isn't ideal for input current of Ø.

b. Each voltage source is a different voltage which can't be in the op amp.

8.

$$V_{out} = R_f \frac{-V_x}{R_x} = 2k\Omega \cdot \frac{-(-1)}{1k\Omega} = \boxed{2V}$$