① $I_1 = 1mA$

② $R_4(I_2 - I_1) + R_3(I_2) + R_2(I_2 - I_3) = 0$

③ $R_2(I_3 - I_2) + R_1(I_3) + V_1 = 0$

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$1K(I_2 - 1mA) + 1K(I_2) + 1K(I_2 - I_3) = 0$

$1K(I_3 - I_2) + 1K(I_3) + 10 = 0$

---

$I_2 - 1mA + I_2 + I_2 - I_3 = 0$

$I_3 - I_2 + I_3 + \frac{10}{1K} = 0$

---

$3I_2 - I_3 = 1mA$

$-I_2 + 2I_3 = -10mA$

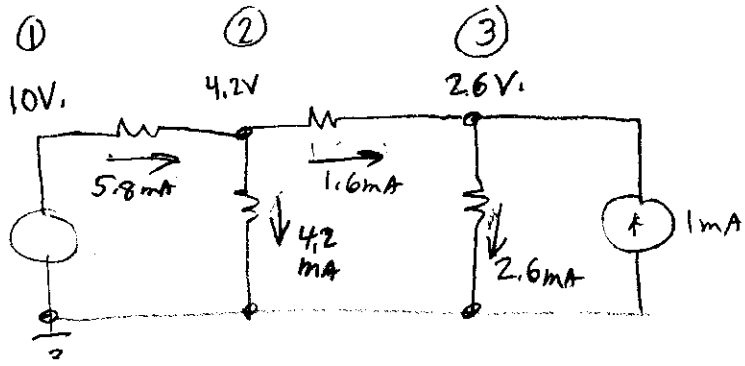
$$\rightarrow \left[\begin{array}{cc|c} 3 & -1 & 1 \\ -1 & 2 & -10 \end{array}\right]$$

$$\left[\begin{array}{cc|c} 1 & -\frac{1}{3} & \frac{1}{3} \\ 0 & \frac{5}{3} & -\frac{29}{3} \end{array}\right]$$

$$\left[\begin{array}{cc|c} 1 & 0 & -\frac{8}{5} \\ 0 & 1 & -\frac{29}{5} \end{array}\right]$$

$I_2 = -1.6mA = -\frac{8}{5}mA$

$I_3 = -5.8mA = -\frac{29}{5}mA$




$V_2 = (4.2mA)(1K) = 4.2$

$V_3 = (2.6mA)(1K) = 2.6$

(2) $I_1(-R_4) + I_2(R_2 + R_3 + R_4) + I_3(-R_2) = 0$

(3) $I_2(-R_2) + I_3(R_1 + R_2) + 10 = 0$

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$1\,mA(-1K) + I_2(3K) + I_3(-1K) = 0$

$I_2(-1K) + I_3(2K) + 10 = 0$

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$3I_2 - I_3 = 1\,mA$

$-I_2 + 2I_3 = -10\,mA$

| | | |
|---|---|---|
| -0 | 1 | Correct |
| -1 | 4 | simple math or sign error |
| -2 | 3 | multiple errors, substitution, etc, etc. |
| -4 | 5 | Loops have only own current |
| -6 | 2 | Did sum of voltages, but nothing else, ~~[illegible]~~ just "$V_1 + V_2 + V_3 = 0$" |
| -9 | 3 | I can't figure out, or completely wrong |