Illustration 1
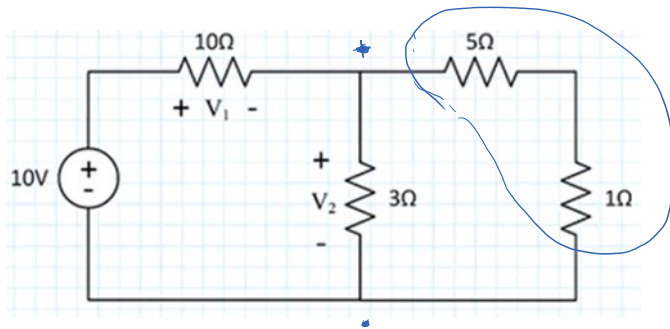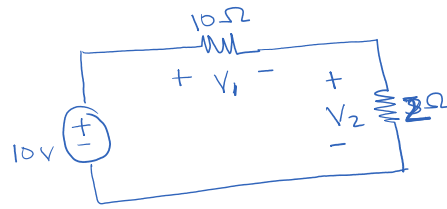
Find voltage V_1 and V_2 as marked in the given circuit using voltage division rule.

$$(5+1) \| 3 = 2\Omega$$
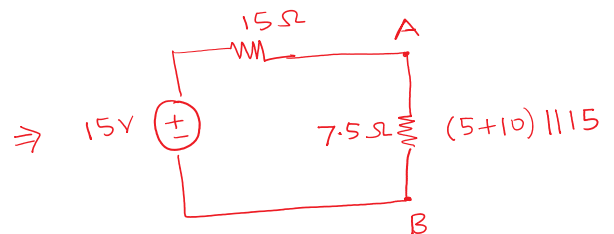
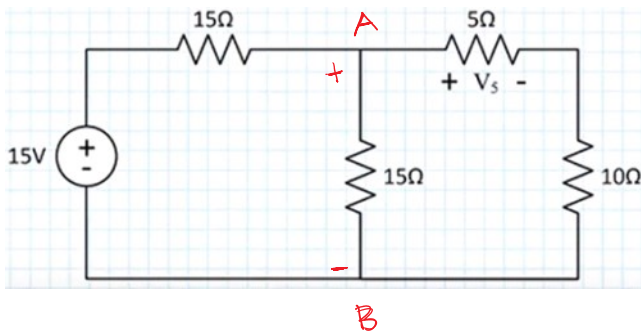$$V_1 = V * \frac{R_1}{R_1 + R_2} = 10 * \frac{10}{10+2} = \frac{100}{12} = 8.333 \, V$$

$$V_2 = V * \frac{R_2}{R_1 + R_2} = \frac{10 * 2}{10+2} = 1.667 \, V$$

Illustration 2

Find voltage V_5 as marked in the given circuit using voltage division rule.
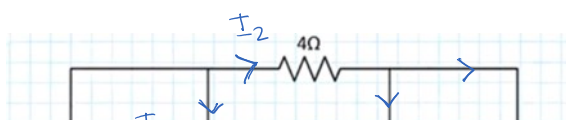

$$\Rightarrow \quad (5+10) \| 15$$

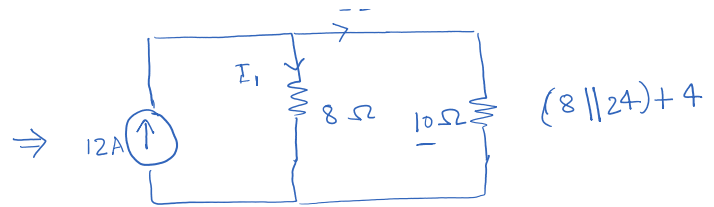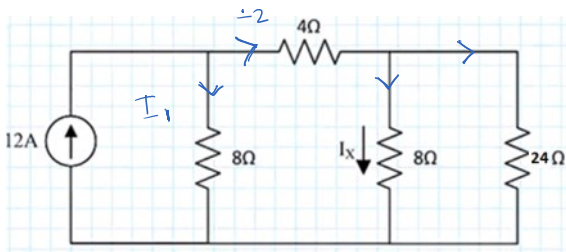$$V_{AB} = \frac{15 * 7.5}{15 + 7.5} = 5 \, V$$

$$\Rightarrow \quad V_5 = 5 * \frac{5}{10+5} = 1.667 \, Volts$$

Illustration 3

Find current I_x as marked in the given circuit using current division rule.

$$R \| R \Rightarrow \frac{R}{n+1}$$

$$R \| \frac{R}{n} \Rightarrow \frac{R}{n+1}$$

$$(8 \| 4) + 4$$

Top circuit diagrams and work

-2
4Ω
I_1
$12A$ (source)
8Ω I_x 8Ω 24Ω

$\Rightarrow$ $12A$ (source) I_1 8Ω 10Ω $(8 \| 24) + 4$

$$I_2 = 12 * \frac{8}{8+10} = 5.333 A$$

4Ω $I_2 = 5.333 A$

$12A$ (source) I_1 8Ω I_x 8Ω 24Ω

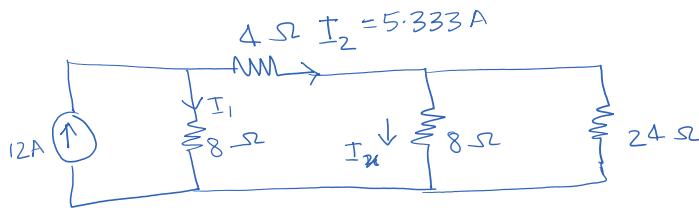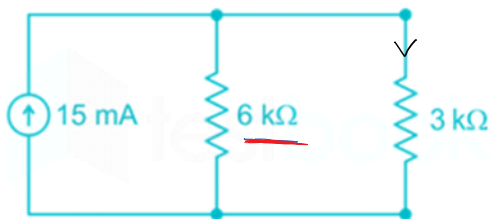$$I_x = \frac{5.333 * 24}{(24+8)} = \boxed{4A}$$

Illustration 4

Find current in 6 KΩ resistor by converting current source to a voltage source.

The voltage across and current through a resistance (in the converted circuit) cannot be computed if that resistance is involved in the source conversion.

15 mA (source)   6 kΩ   3 kΩ

$\Rightarrow$ $15\,mA$ (source) $3K\Omega$ $6k\Omega$ $\Rightarrow$ $45v$ (source) $5mA$ $3k\Omega$ I $6k\Omega$

$$I_{3k\Omega} = \frac{15mA * 6k\Omega}{9k\Omega} = 10\,mA \checkmark$$

$$I_{6k\Omega} = \frac{15mA * 3k\Omega}{9k\Omega} = 5mA \quad \text{Correct}$$

$$V_s = 15 \times 10^{-3} * 3 \times 10^{3} = 45 V$$

$$I_{6k\Omega} = \frac{45}{(3+6)k\Omega} = 5mA = I_{3k\Omega}$$
Correct   How?

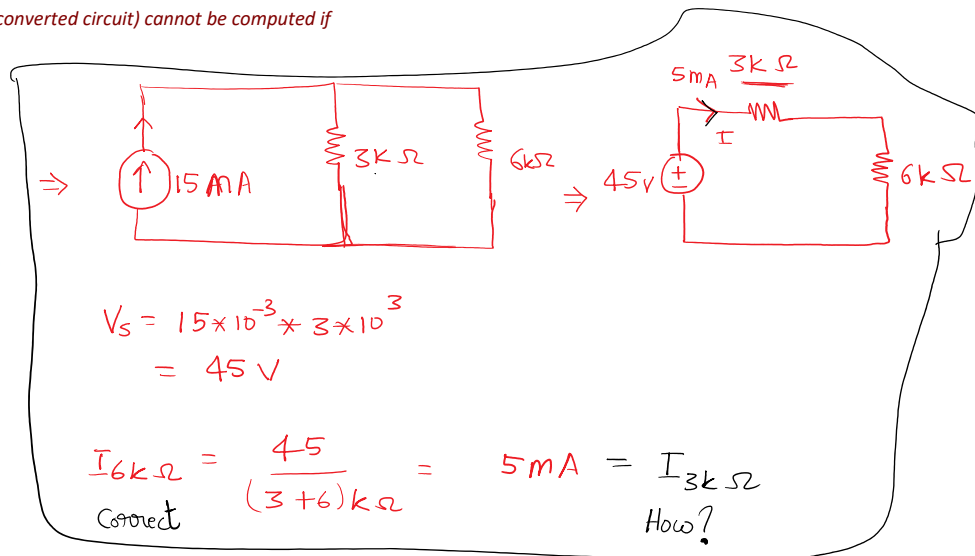## Illustration 5

Reduce the following circuit to a current source in parallel with a resistor across the terminals A & B.

1Ω $2V$ $2/_2 = 1A$

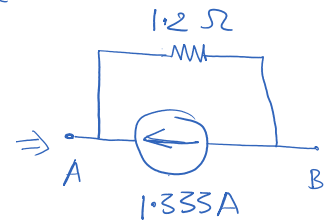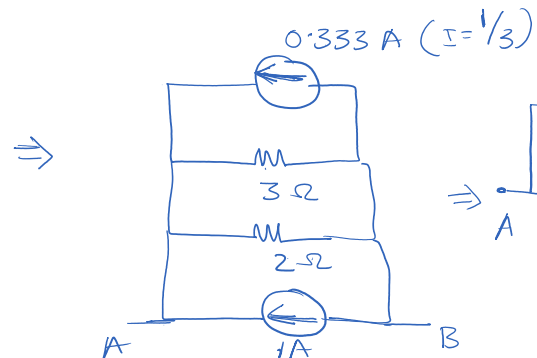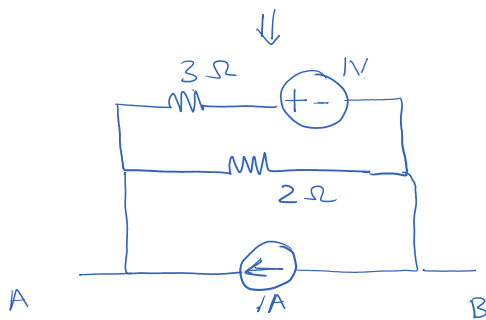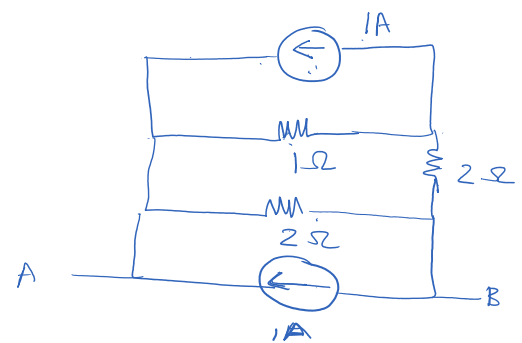Reduce the following circuit to a current source in parallel with a resistor across the terminals A & B.
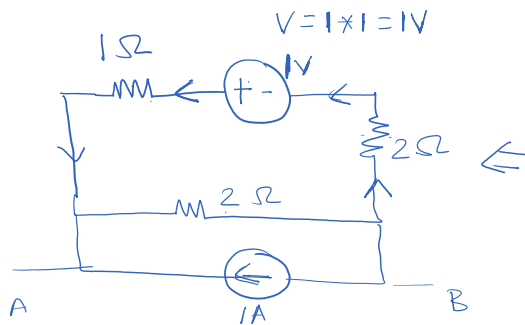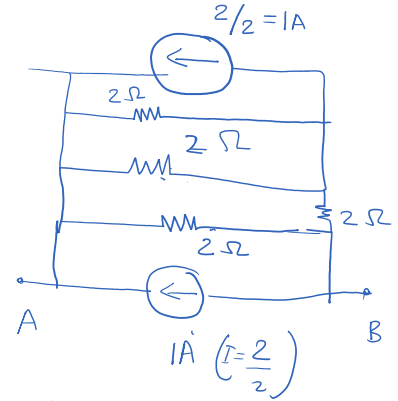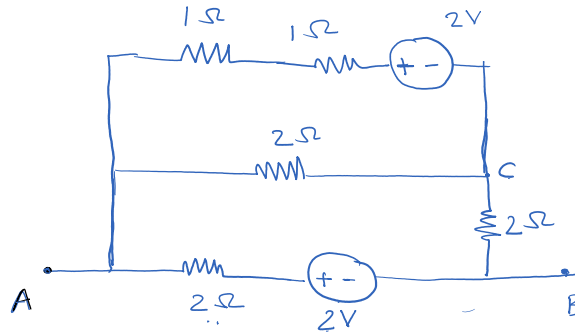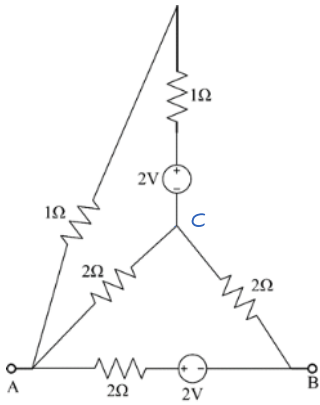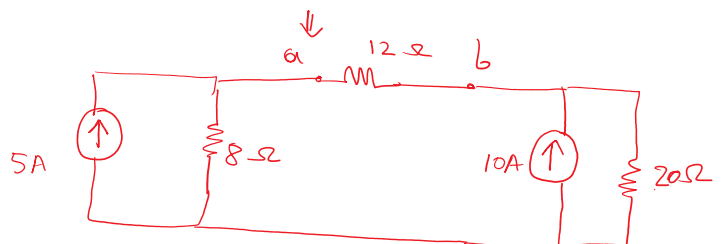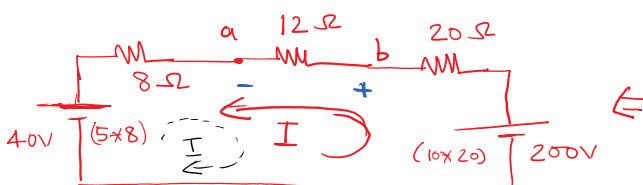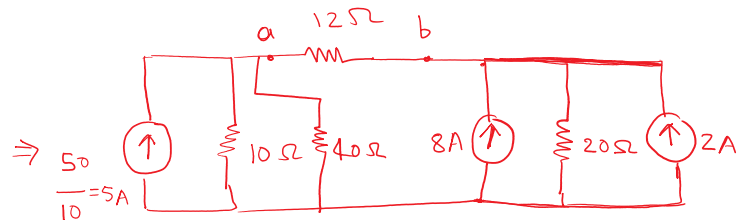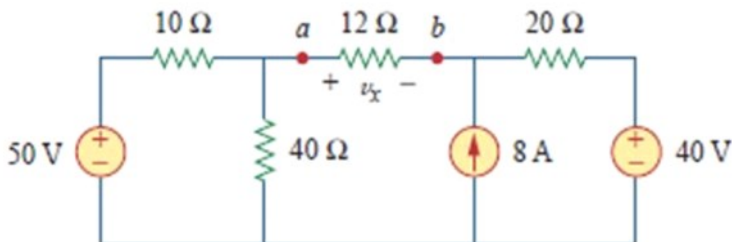

Illustration 6

Find the voltage across 12 Ω resistor (i.e., V_x) by source transformation method.

$$200 - 20I - 12I - 8I - 40 = 0$$

$$I = 4A$$

$$V_{ba} = 4 * 12 = 48 \text{ Volts}$$

$$V_x = V_{ab} = -V_{ba} = -48 \text{ Volts}$$
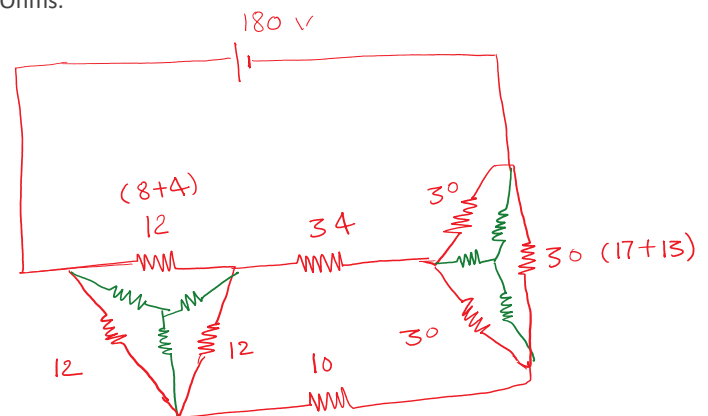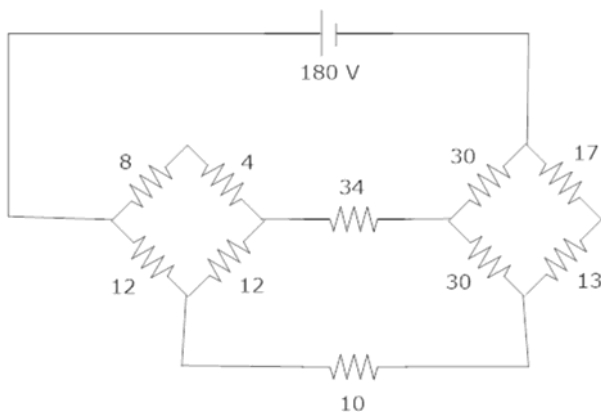
$$\Rightarrow 40 + 8I + 12I + 20I - 200 = 0$$

$$I = 4A$$

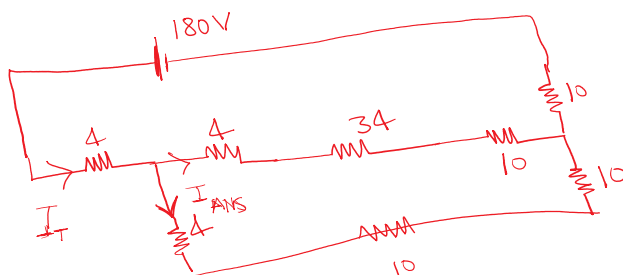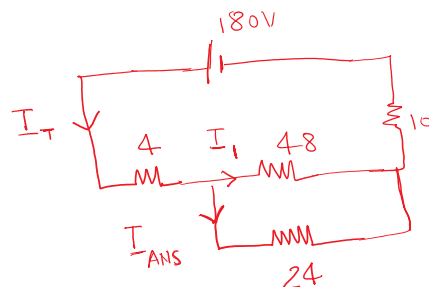$$40 - 8I - 12I - 20I - 200 = 0$$

$$I = -4A$$

Quiz Question

Determine current flowing through 10 Ohm resistor. All resistances are in Ohms.

$$\text{Balanced } Y-\Delta : \quad R_\Delta = 3R_Y \quad \text{or} \quad R_Y = \frac{R_\Delta}{3}$$

$$I_T = \frac{180}{4 + (48 \| 24) + 10} = 6A$$

$$I_{ANS} = I_T * \frac{48}{48 + 24} = \frac{6 * 48}{72}$$

$$\text{or} \quad \boxed{I_{ANS} = 4A}$$