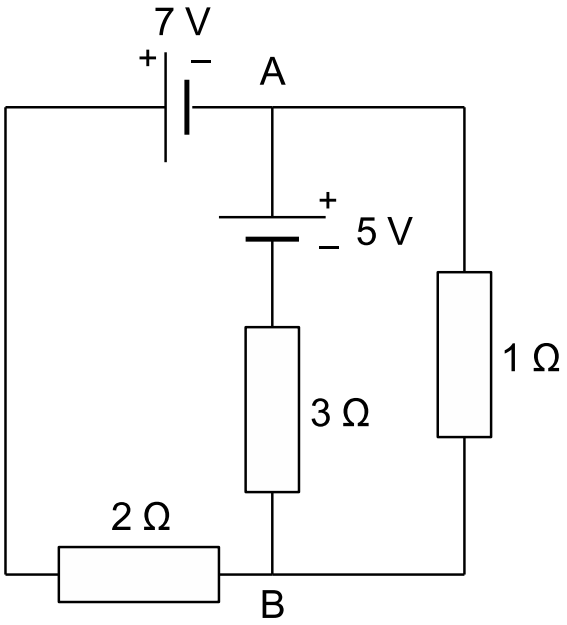
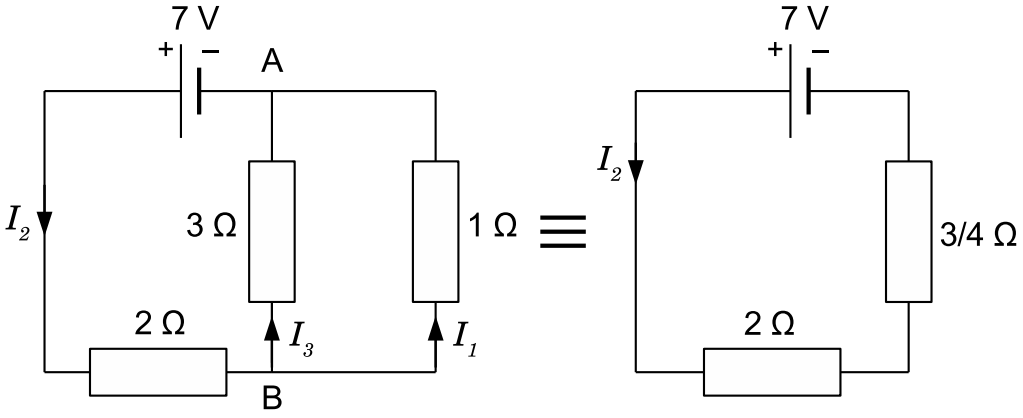
Q3: Use circuit shown below and the superposition theorem.



A3 *(i) Consider the 7 V source.*

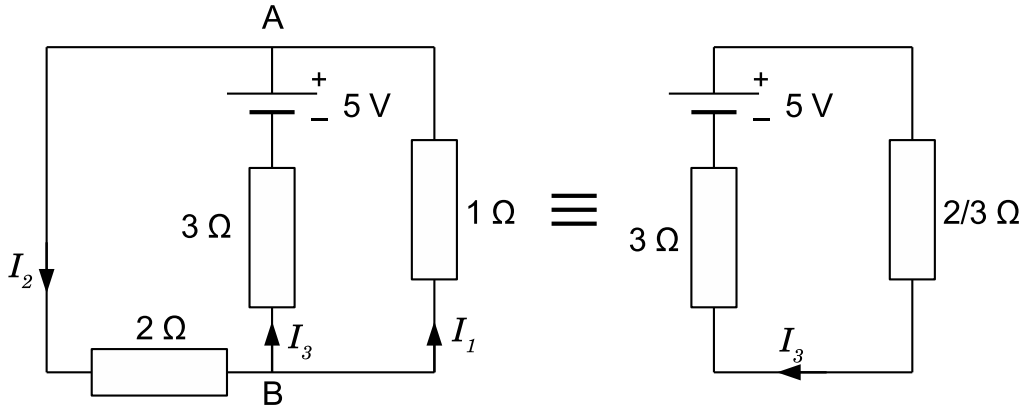


Current through the 2 Ω resistor: $I_2 = \frac{V}{R} = \frac{7}{2+\frac{1}{\frac{1}{3}+1}} = \frac{7}{\frac{11}{4}} = \frac{28}{11}$ A $\rightarrow$. **[1]**

Current through the 3 Ω resistor: $I_3 = \frac{28}{11} \times \frac{1}{4} = \frac{7}{11}$ A $\uparrow$ (using the current splitter rule). **[1]**

Current through the 1 Ω resistor: $I_1 = \frac{28}{11} - \frac{7}{11} = \frac{21}{11}$ A $\uparrow$. **[1]**

Consider the 5 V source.



Current through the 3 Ω resistor: $I_3 = \frac{V}{R} = \frac{5}{3+\frac{1}{\frac{1}{2}+1}} = \frac{5}{\frac{11}{3}} = \frac{15}{11}$ A. ↑ **[1]**

Current through the 2 Ω resistor: $I_2 = \frac{15}{11} \times \frac{1}{3} = \frac{5}{11}$ A →. (current splitter) **[1]**

Current through the 1 Ω resistor: $I_1 = \frac{15}{11} - \frac{5}{11} = \frac{10}{11}$ A ↓. **[1]**

∴ by superposition,

$I_2 = \frac{\overrightarrow{28}}{11} + \frac{\overrightarrow{5}}{11} = \frac{\overrightarrow{33}}{11} = \overrightarrow{3A}$.
$I_3 = \frac{7}{11} \uparrow + \frac{15}{11} \uparrow = \frac{22}{11} \uparrow = 2A \uparrow$.
$I_1 = \frac{21}{11} \uparrow + \frac{10}{11} \downarrow = \frac{11}{11} \uparrow = 1A \uparrow$. **[1]**

(ii) Potential between points A and B. Going from B to A $= -I_3R + 5V = (-2)(3) + 5V = -1\ V$. **[1]**

(iii) Power supplied by each battery:
7V: I_2 * 7 = 3*7 = 21 W; 5V: I_3 * 5 = 2*5 = 10 W. **[2]**