

Electrical Circuit (1)

Introduction (week2 class1)

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Chapter 2 Basic Laws 29

2.1	Introduction	30
2.2	Ohm's Law	30
2.3	†Nodes, Branches, and Loops	35
2.4	Kirchhoff's Laws	37
2.5	Series Resistors and Voltage Division	43
2.6	Parallel Resistors and Current Division	45
2.7	†Wye-Delta Transformations	52
	Delta to Wye Conversion	
	Wye to Delta Conversion	
2.8	†Applications	58
	2.8.1 Lighting Systems	
	2.8.2 Design of DC Meters	
2.9	Summary	64
	Review Questions	66
	Problems	67
	Comprehensive Problems	78

Series Resistors and Voltage Division

$$v_1 = iR_1, \quad v_2 = iR_2$$

$$-v + v_1 + v_2 = 0$$

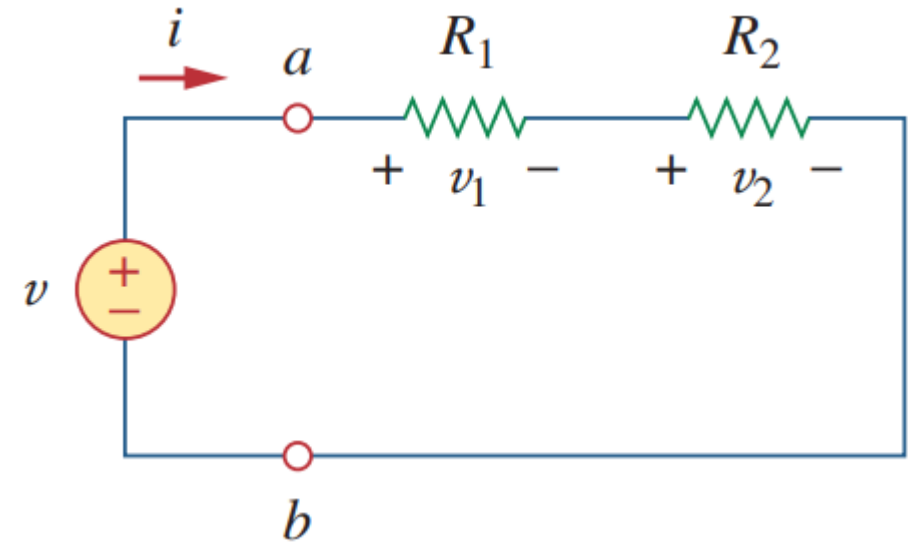
$$v = v_1 + v_2 = i(R_1 + R_2)$$

$$i = \frac{v}{R_1 + R_2}$$

$$R_{\text{eq}} = R_1 + R_2$$

$$R_{\text{eq}} = R_1 + R_2 + \cdots + R_N = \sum_{n=1}^N R_n$$

$$v_n = \frac{R_n}{R_1 + R_2 + \cdots + R_N} v$$



$$v = iR_{\text{eq}}$$

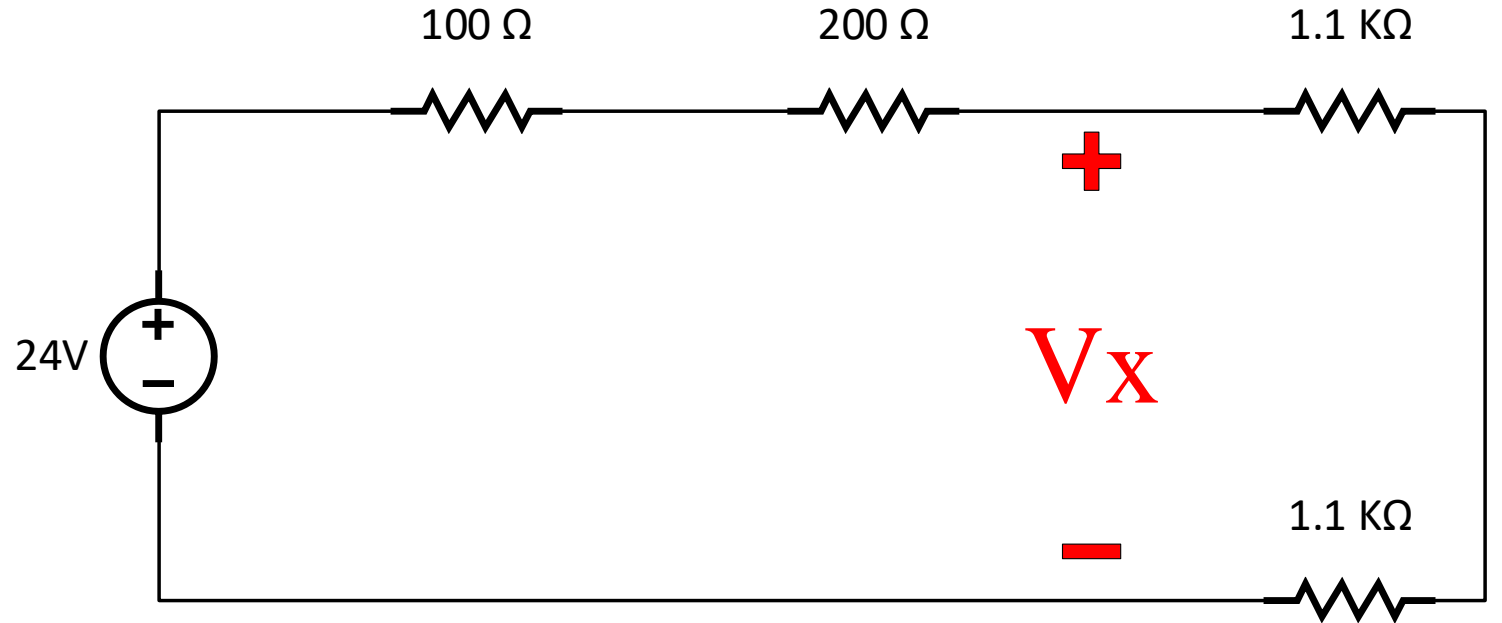
$$v_1 = \frac{R_1}{R_1 + R_2} v, \quad v_2 = \frac{R_2}{R_1 + R_2} v$$

Series Resistors and Voltage Division

Find V_x ?

$$V_x = V_s \frac{R_3 + R_4}{R_1 + R_2 + R_3 + R_4}$$

$$V_x = 24 \frac{1100 + 1100}{100 + 200 + 1100 + 1100} = 17.6 \text{ V}$$



Parallel Resistors and Current Division

$$v = i_1 R_1 = i_2 R_2$$

$$i_1 = \frac{v}{R_1}, \quad i_2 = \frac{v}{R_2}$$

$$i = i_1 + i_2$$

$$i = \frac{v}{R_1} + \frac{v}{R_2} = v \left(\frac{1}{R_1} + \frac{1}{R_2} \right) = \frac{v}{R_{\text{eq}}}$$

$$\frac{1}{R_{\text{eq}}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R_{\text{eq}}} = \frac{R_1 + R_2}{R_1 R_2}$$

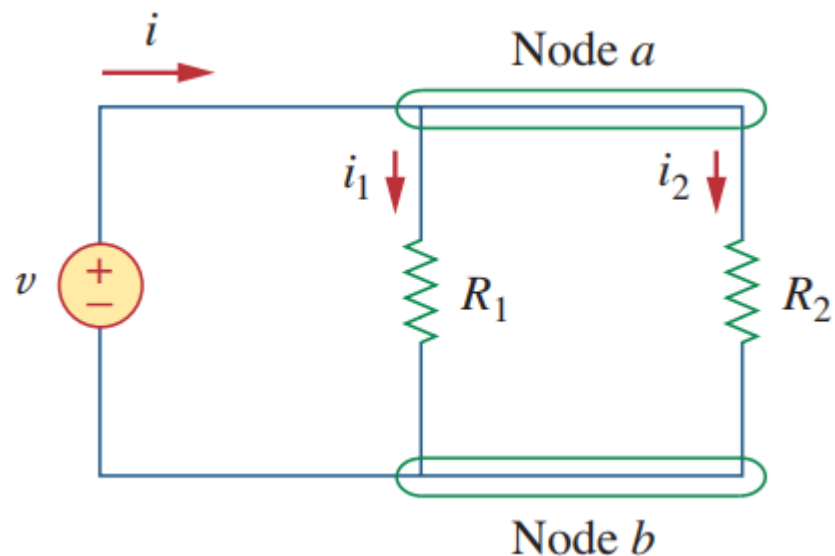
$$R_{\text{eq}} = \frac{R_1 R_2}{R_1 + R_2}$$

$$\frac{1}{R_{\text{eq}}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_N}$$

$$v = i R_{\text{eq}} = \frac{i R_1 R_2}{R_1 + R_2}$$

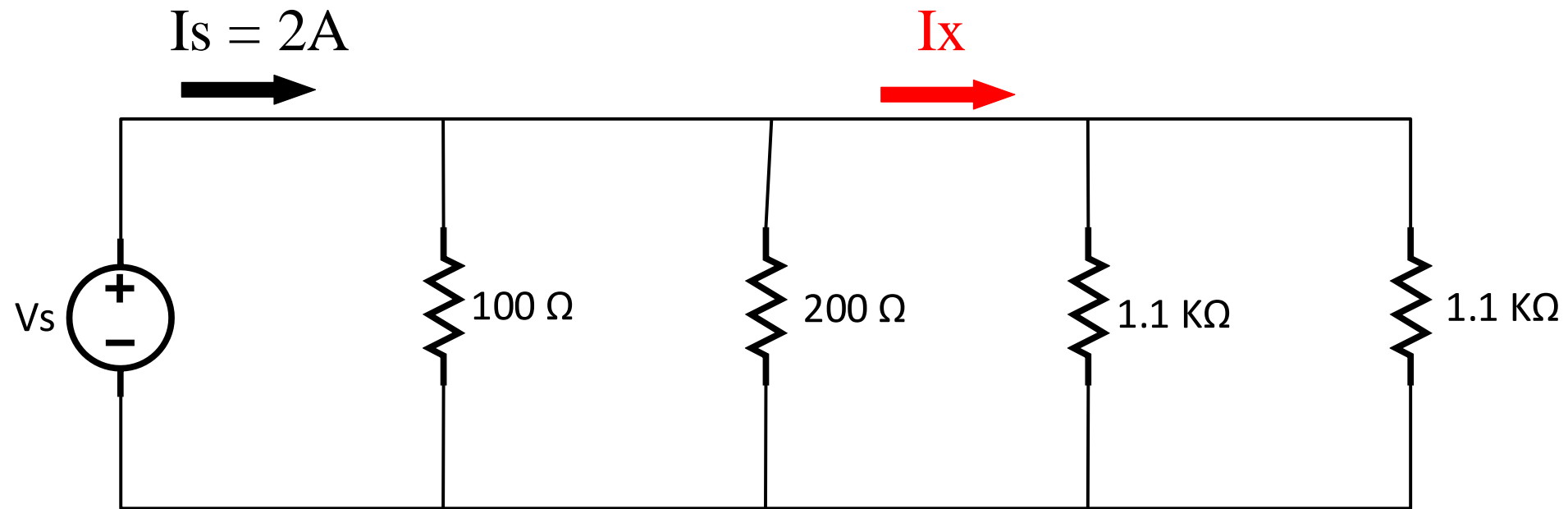
$$i_1 = \frac{R_2 i}{R_1 + R_2},$$

$$i_2 = \frac{R_1 i}{R_1 + R_2}$$



Parallel Resistors and Current Division

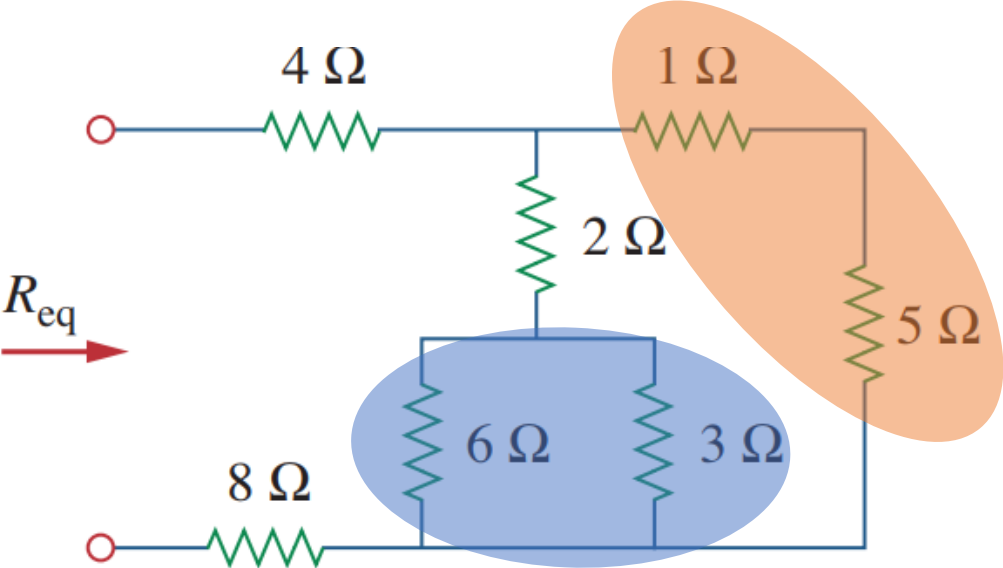
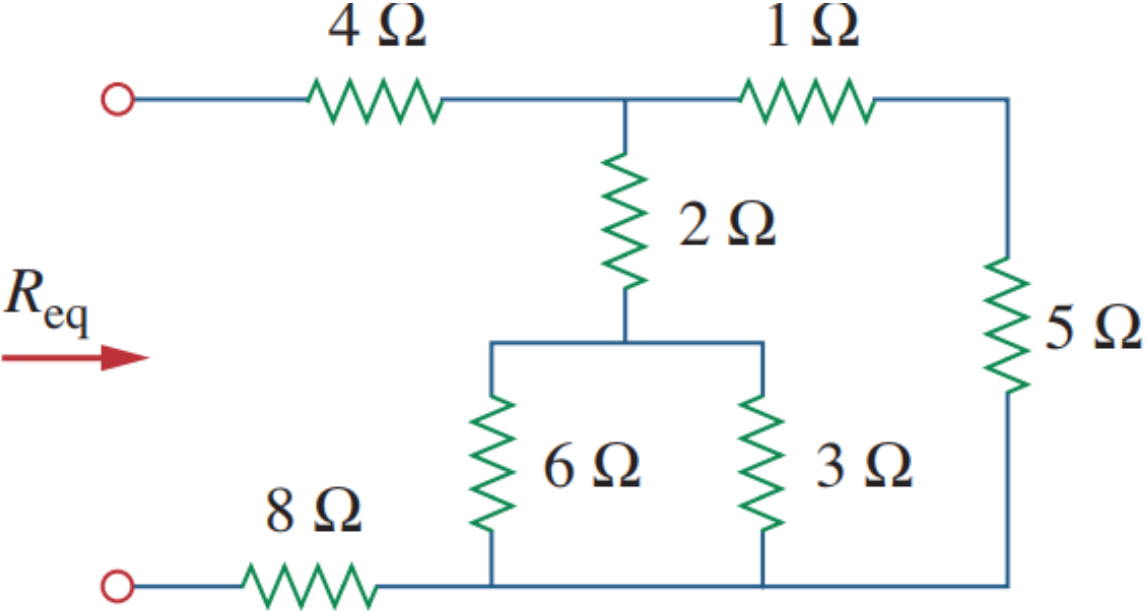
Find I_x ?



$$I_x = I_s \frac{R_{3||4}}{R_{1||2} + R_{3||4}}$$

$$I_x = 2 \frac{\frac{20000}{300}}{\frac{20000}{300} + 550} = 0.216\ \text{A}$$

Find R_{eq} ?



Find R_{eq} ?

$$6\ \Omega \parallel 3\ \Omega = \frac{6 \times 3}{6 + 3} = 2\ \Omega$$

$$1\ \Omega + 5\ \Omega = 6\ \Omega$$

$$2\ \Omega + 2\ \Omega = 4\ \Omega$$

$$4\ \Omega \parallel 6\ \Omega = \frac{4 \times 6}{4 + 6} = 2.4\ \Omega$$

$$R_{eq} = 4\ \Omega + 2.4\ \Omega + 8\ \Omega = 14.4\ \Omega$$

