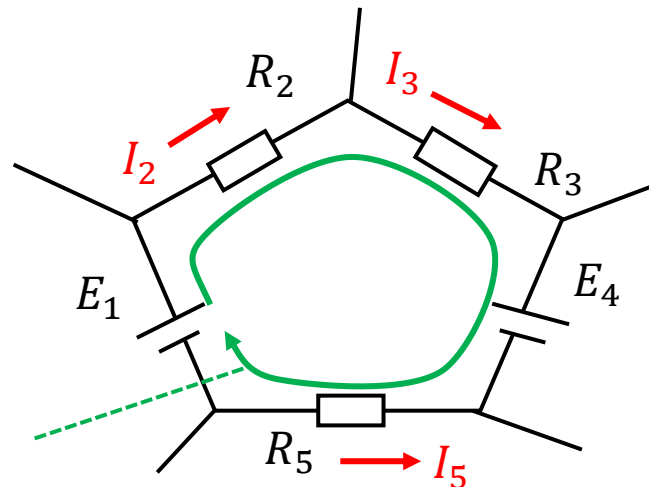


電験三種 オンライン講座

直流回路(3) 回路と電圧

キルヒホッフの電圧則

回路網中の**任意の閉路**を一巡するとき、起電力の総和と電圧降下の総和は等しい



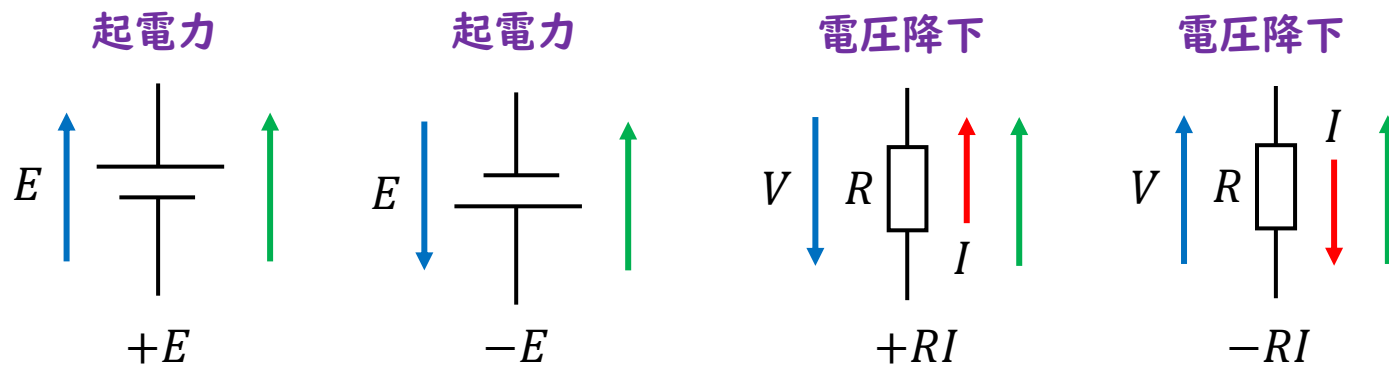
<ポイント1>
電流ループとその向き
自分を決める

$$E_1 - E_4 = R_2 I_2 + R_3 I_3 - R_5 I_5$$

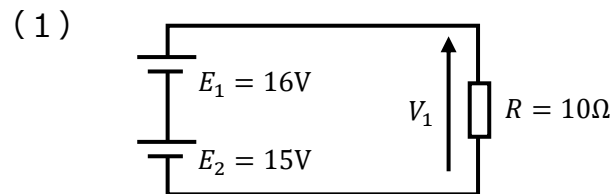
(起電力の総和) = (電圧降下の総和)

<ポイント2>
起電力(電源)と電圧降下で
正負の符号の考え方が違う

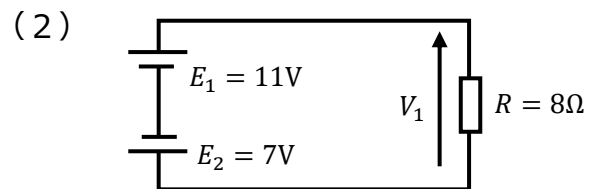
- ← 電位差
- 電流の向き
- 任意経路の向き



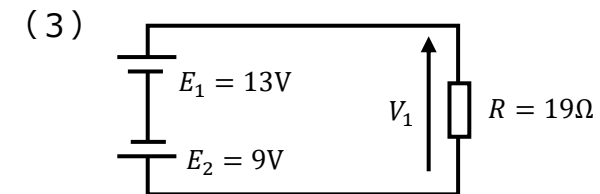
練習問題 I



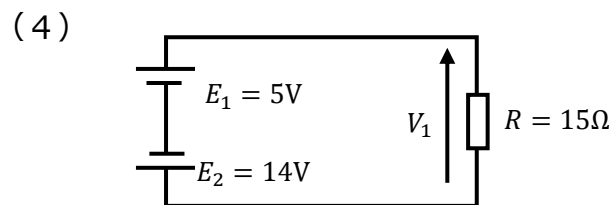
Ans. $v_1 =$ _____



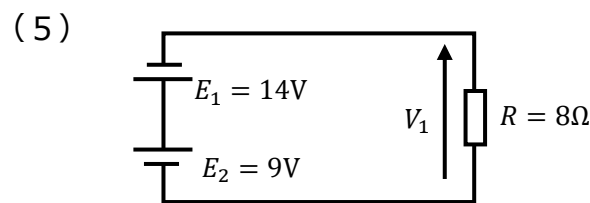
Ans. $v_1 =$ _____



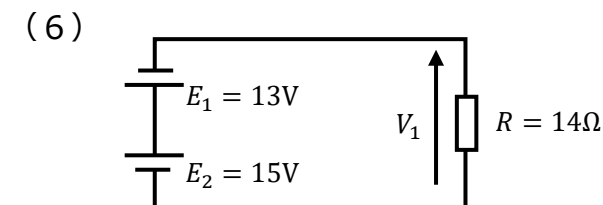
Ans. $v_1 =$ _____



Ans. $v_1 =$ _____

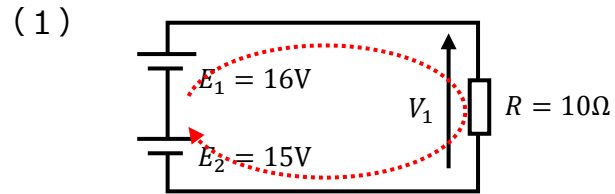


Ans. $v_1 =$ _____



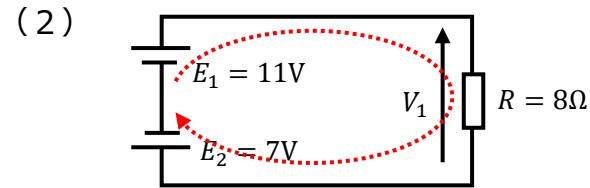
Ans. $v_1 =$ _____

練習問題 I (解説)



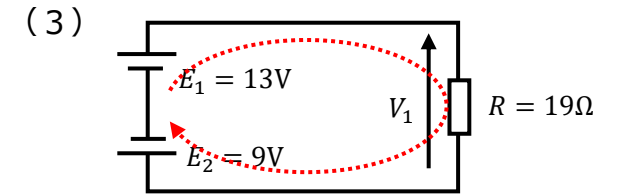
$$V_1 = E_1 + E_2 = 16 + 15 = 31V$$

Ans. $v_1 = 31V$



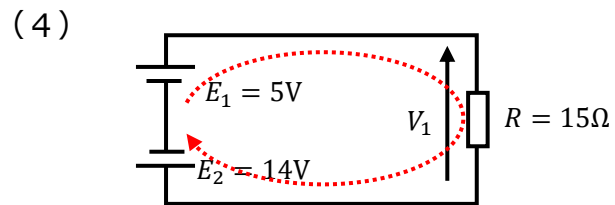
$$V_1 = E_1 - E_2 = 11 - 7 = 4V$$

Ans. $v_1 = 4V$



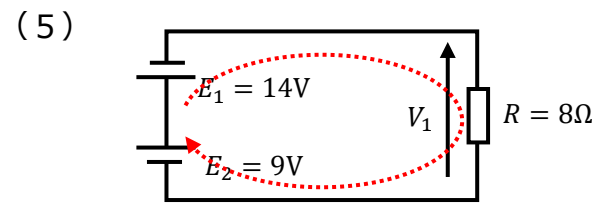
$$V_1 = E_1 - E_2 = 13 - 9 = 4V$$

Ans. $v_1 = 4V$



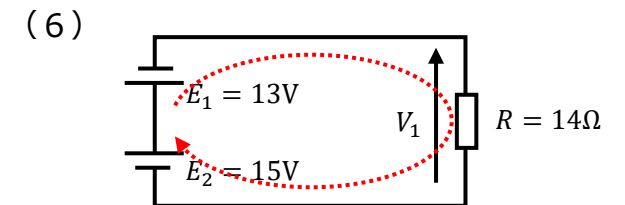
$$V_1 = E_1 - E_2 = 5 - 14 = -9V$$

Ans. $v_1 = -9V$



$$V_1 = -E_1 + E_2 = -14 + 9 = -5V$$

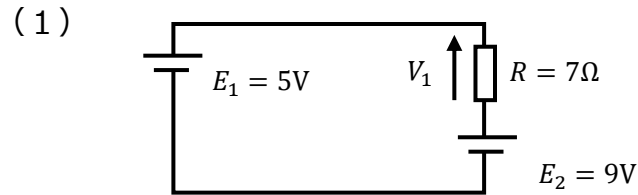
Ans. $v_1 = -5V$



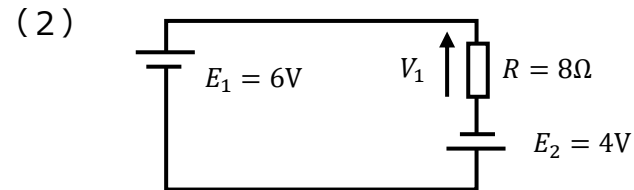
$$V_1 = -E_1 + E_2 = -13 + 15 = 2V$$

Ans. $v_1 = 2V$

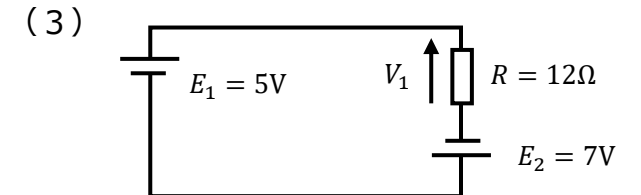
練習問題2



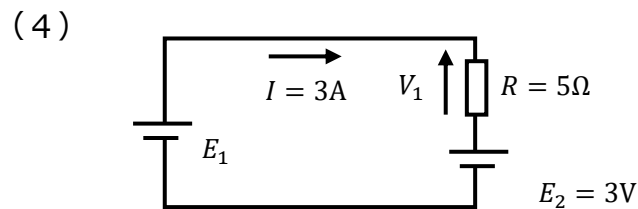
Ans. $V_1 =$ _____



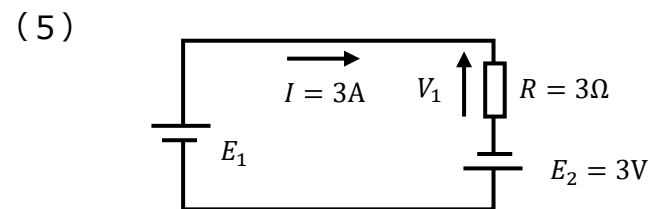
Ans. $V_1 =$ _____



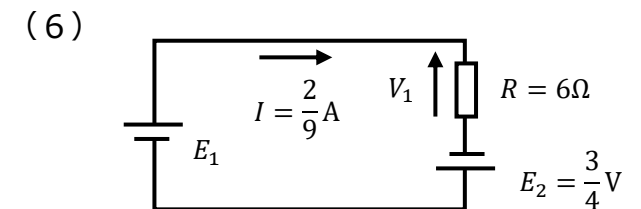
Ans. $V_1 =$ _____



Ans. $E_1 =$ _____

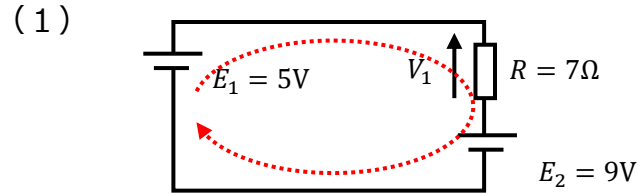


Ans. $E_1 =$ _____



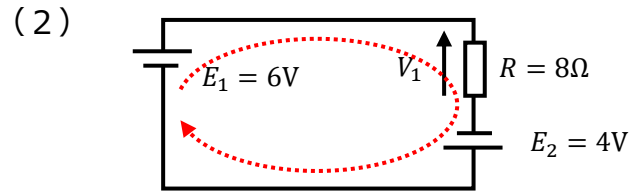
Ans. $E_1 =$ _____

練習問題2 (解説)



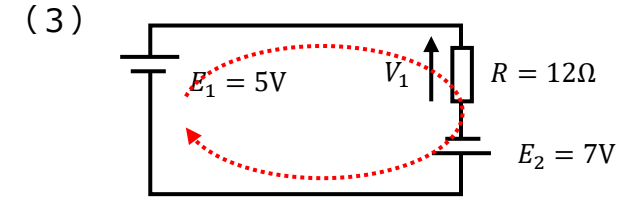
$$V_1 = E_1 - E_2 = 5 - 9 = -4V$$

Ans. $V_1 = -4V$



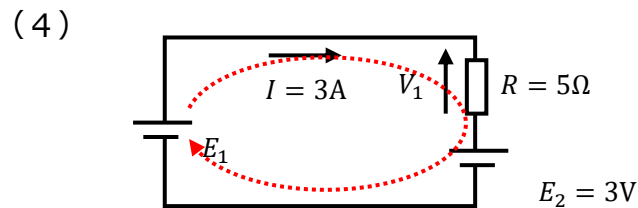
$$V_1 = E_1 + E_2 = 6 + 4 = 10V$$

Ans. $V_1 = 10V$



$$V_1 = E_1 + E_2 = 5 + 7 = 12V$$

Ans. $V_1 = 12V$

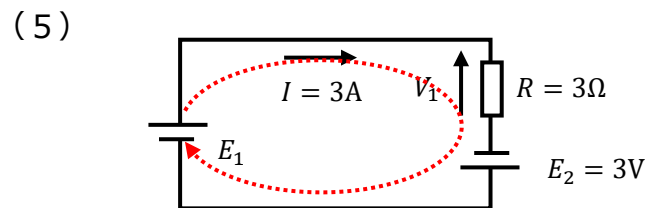


$$V_1 = RI = 5 \times 3 = 15V$$

$$V_1 = E_1 - E_2 \rightarrow E_1 = V_1 + E_2$$

$$E_1 = V_1 + E_2 = 15 + 3 = 18V$$

Ans. $E_1 = 18V$

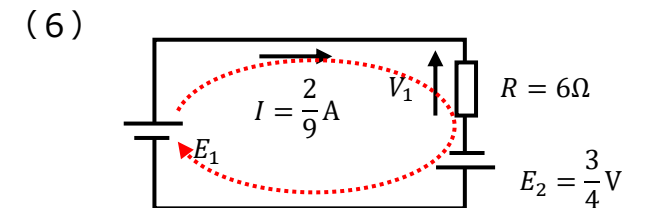


$$V_1 = RI = 3 \times 3 = 9V$$

$$V_1 = E_1 + E_2 \rightarrow E_1 = V_1 - E_2$$

$$E_1 = V_1 - E_2 = 9 - 3 = 6V$$

Ans. $E_1 = 6V$



$$V_1 = RI = 6 \times \frac{2}{9} = \frac{4}{3}V$$

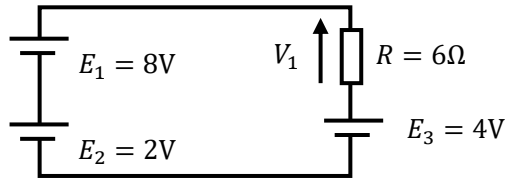
$$V_1 = E_1 + E_2 \rightarrow E_1 = V_1 - E_2$$

$$E_1 = V_1 - E_2 = \frac{4}{3} - \frac{3}{4} = \frac{16}{12} - \frac{9}{12} = \frac{7}{12}V$$

Ans. $E_1 = \frac{7}{12}V$

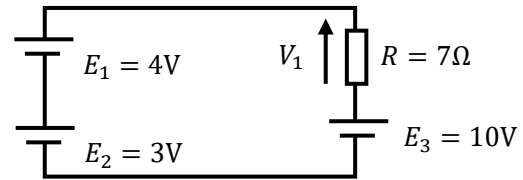
練習問題3

(1)



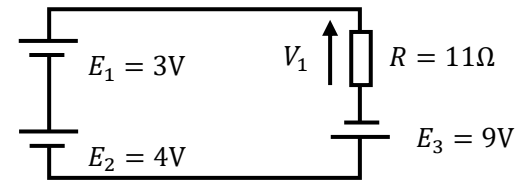
Ans. $v_1 =$ _____

(2)



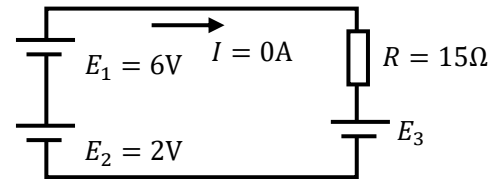
Ans. $v_1 =$ _____

(3)



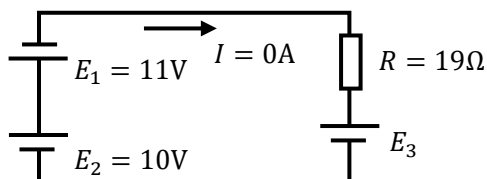
Ans. $v_1 =$ _____

(4)



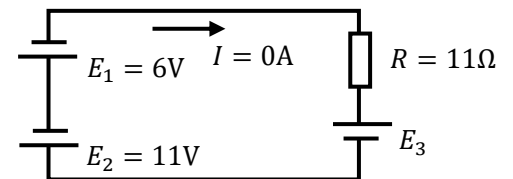
Ans. $E_3 =$ _____

(5)



Ans. $E_3 =$ _____

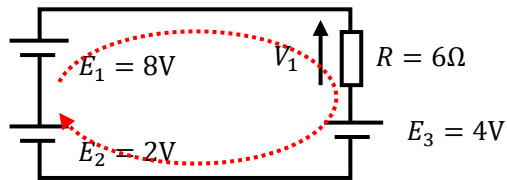
(6)



Ans. $E_3 =$ _____

練習問題3 (解説)

(1)

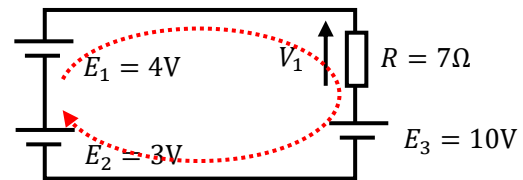


$$V_1 = E_1 + E_2 - E_3$$

$$V_1 = 8 + 2 - 4 = 6V$$

Ans. $V_1 = 6V$

(2)

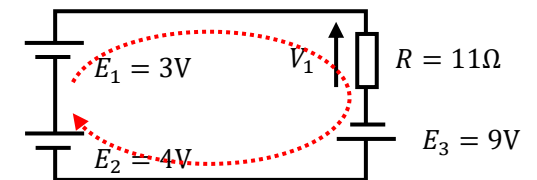


$$V_1 = E_1 + E_2 - E_3$$

$$V_1 = 4 + 3 - 10 = -3V$$

Ans. $V_1 = -3V$

(3)

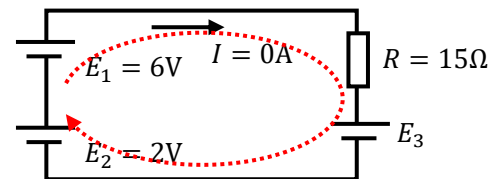


$$V_1 = E_1 + E_2 + E_3$$

$$V_1 = 3 + 4 + 9 = 16V$$

Ans. $V_1 = 16V$

(4)

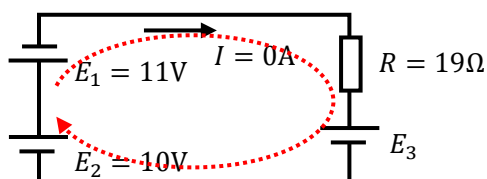


$$E_1 + E_2 - E_3 = 0V$$

$$E_3 = E_1 + E_2 = 6 + 2 = 8V$$

Ans. $E_3 = 8V$

(5)

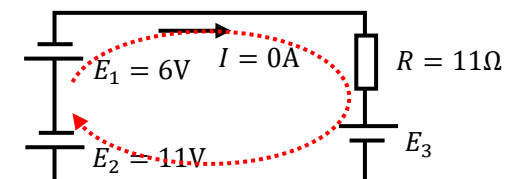


$$-E_1 + E_2 - E_3 = 0V$$

$$E_3 = -E_1 + E_2 = -11 + 10 = -1V$$

Ans. $E_3 = -1V$

(6)



$$-E_1 - E_2 - E_3 = 0V$$

$$E_3 = -E_1 - E_2 = -6 - 11 = -17V$$

Ans. $E_3 = -17V$

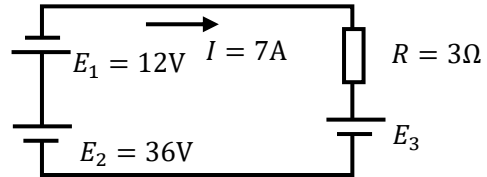
練習問題4

(1)



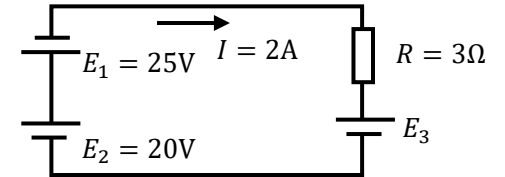
Ans. $E_3 =$ _____

(2)



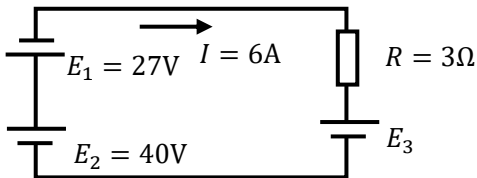
Ans. $E_3 =$ _____

(3)



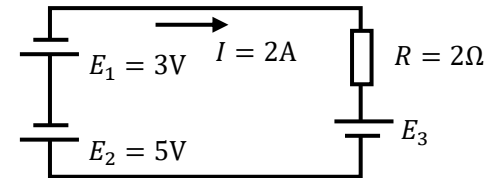
Ans. $E_3 =$ _____

(4)



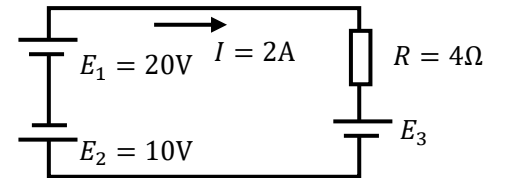
Ans. $E_3 =$ _____

(5)



Ans. $E_3 =$ _____

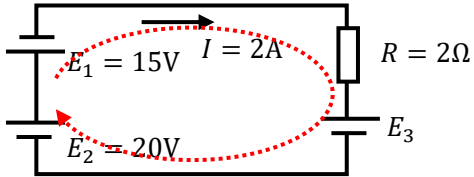
(6)



Ans. $E_3 =$ _____

練習問題4 (解説)

(1)



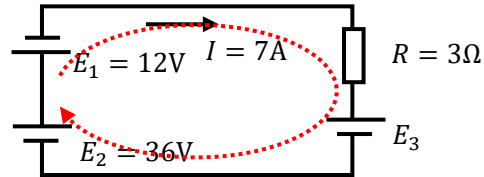
$$-E_1 + E_2 - E_3 = RI$$

$$E_3 = -E_1 + E_2 - RI = -15 + 20 - 2 \times 2$$

$$= 1V$$

Ans. $E_3 = 1V$

(2)



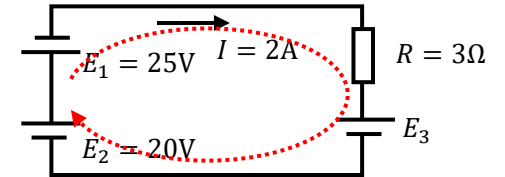
$$-E_1 + E_2 - E_3 = RI$$

$$E_3 = -E_1 + E_2 - RI = -12 + 36 - 3 \times 7$$

$$= 36 - 33 = 3V$$

Ans. $E_3 = 3V$

(3)



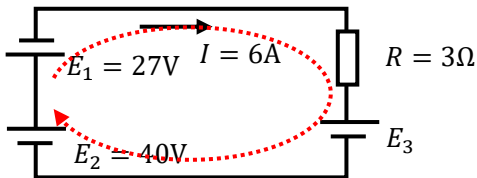
$$-E_1 + E_2 - E_3 = RI$$

$$E_3 = -E_1 + E_2 - RI = -25 + 20 - 3 \times 2$$

$$= 20 - 31 = -11V$$

Ans. $E_3 = -11V$

(4)



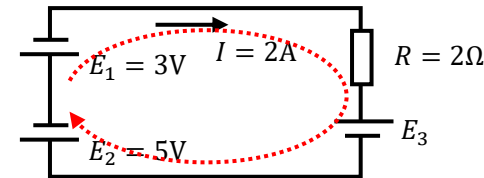
$$-E_1 + E_2 - E_3 = RI$$

$$E_3 = -E_1 + E_2 - RI = -27 + 40 - 3 \times 6$$

$$= 40 - 45 = -5V$$

Ans. $E_3 = -5V$

(5)



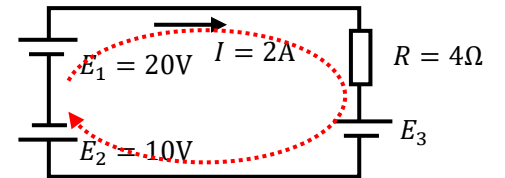
$$-E_1 - E_2 - E_3 = RI$$

$$E_3 = -E_1 - E_2 - RI = -3 - 5 - 2 \times 2$$

$$= -12V$$

Ans. $E_3 = -12V$

(6)



$$E_1 - E_2 - E_3 = RI$$

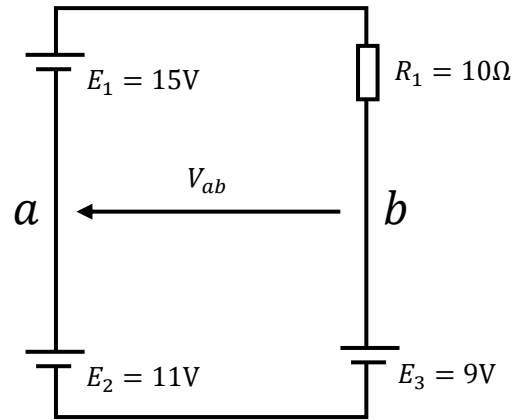
$$E_3 = E_1 - E_2 - RI = 20 - 10 - 4 \times 2$$

$$= 2V$$

Ans. $E_3 = 2V$

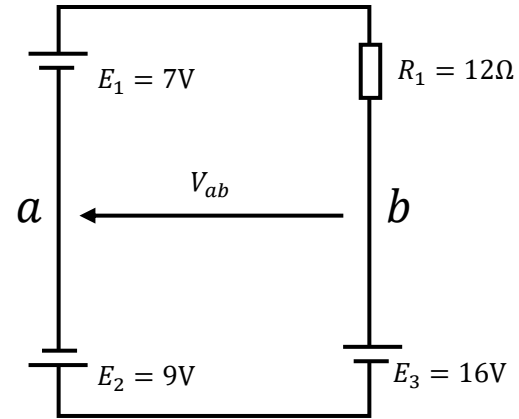
練習問題5 (解説)

(1)



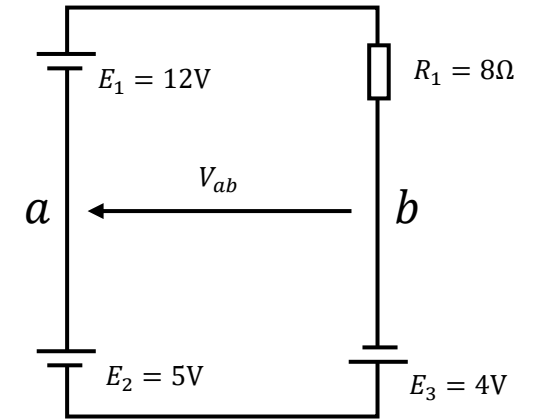
Ans. $V_{ab} =$ _____

(2)



Ans. $V_{ab} =$ _____

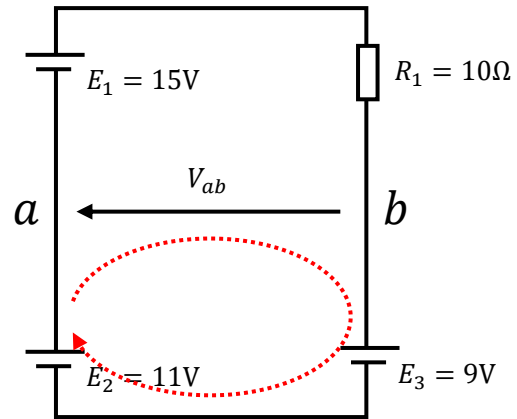
(3)



Ans. $V_{ab} =$ _____

練習問題5 (解説)

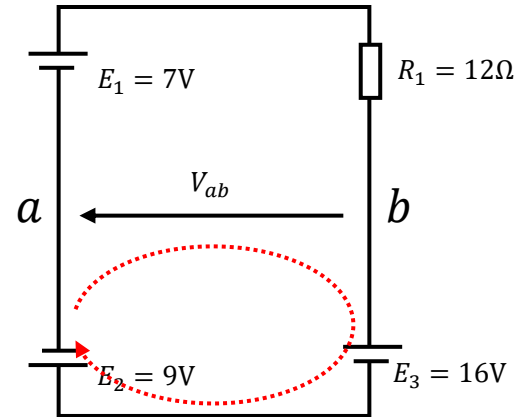
(1)



$$V_{ab} = E_2 - E_3 = 11 - 9 = 2V$$

Ans. $V_{ab} = 2V$

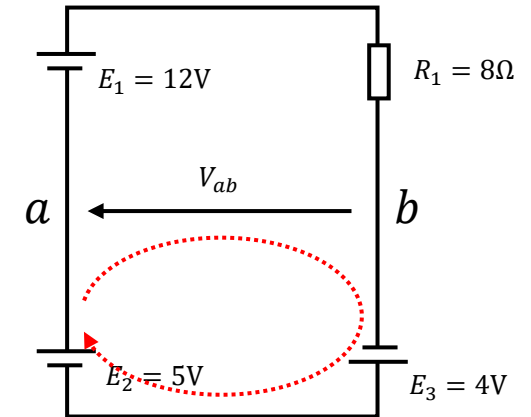
(2)



$$V_{ab} = -E_2 - E_3 = -9 - 16 = -25V$$

Ans. $V_{ab} = -25V$

(3)

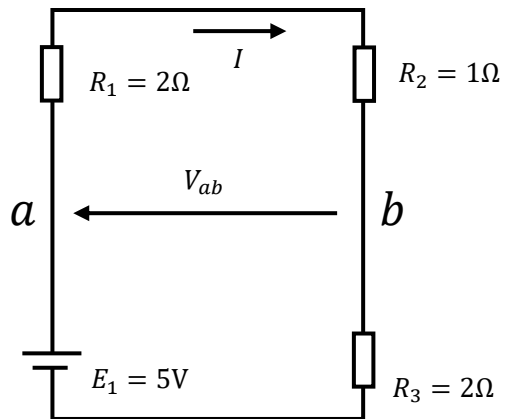


$$V_{ab} = E_2 + E_3 = 5 + 4 = 9V$$

Ans. $V_{ab} = 9V$

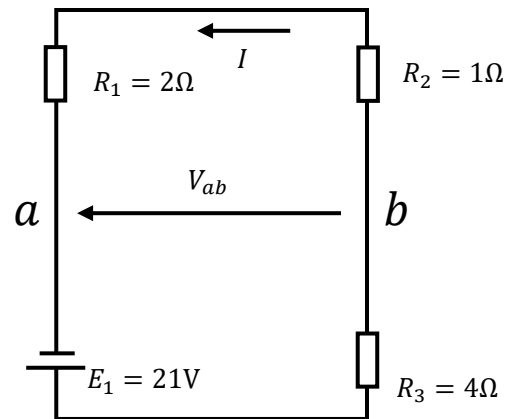
練習問題6

(1)



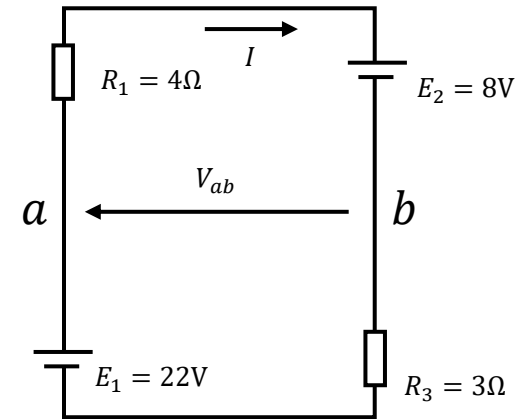
Ans. $V_{ab} =$ _____

(2)



Ans. $V_{ab} =$ _____

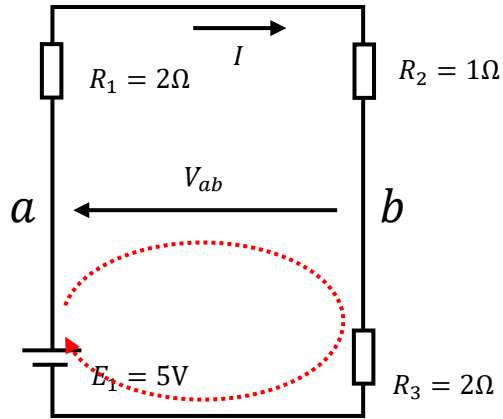
(3)



Ans. $V_{ab} =$ _____

練習問題6 (解説)

(1)



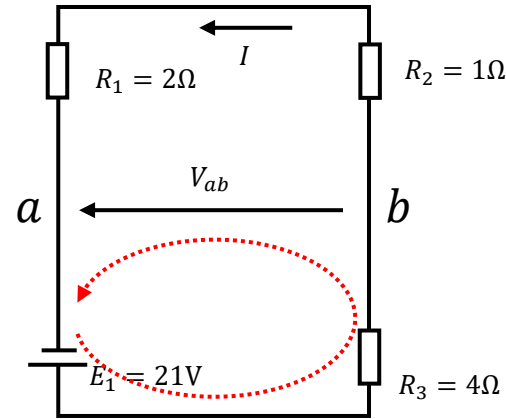
$$I = \frac{E_1}{R_1 + R_2 + R_3} = \frac{5}{2 + 1 + 2} = \frac{5}{5} = 1\text{A}$$

$$E_1 = V_{ab} + R_3 I \rightarrow V_{ab} = E_1 - R_3 I$$

$$V_{ab} = E_1 - R_3 I = 5 - 2 \times 1 = 3\text{V}$$

Ans. $V_{ab} = 3\text{V}$

(2)



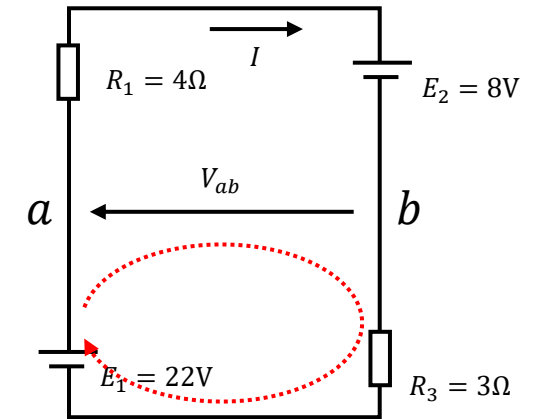
$$I = \frac{E_1}{R_1 + R_2 + R_3} = \frac{21}{2 + 1 + 4} = \frac{21}{7} = 3\text{A}$$

$$E_1 = R_3 I - V_{ab} \rightarrow V_{ab} = R_3 I - E_1$$

$$V_{ab} = R_3 I - E_1 = 4 \times 3 - 21 = -9\text{V}$$

Ans. $V_{ab} = -9\text{V}$

(3)



$$I = \frac{E_1 - E_2}{R_1 + R_3} = \frac{22 - 8}{4 + 3} = \frac{14}{7} = 2\text{A}$$

$$E_1 = V_{ab} + R_3 I \rightarrow V_{ab} = E_1 - R_3 I$$

$$V_{ab} = E_1 - R_3 I = 22 - 3 \times 2 = 16\text{V}$$

Ans. $V_{ab} = 16\text{V}$

ご聴講ありがとうございました!!