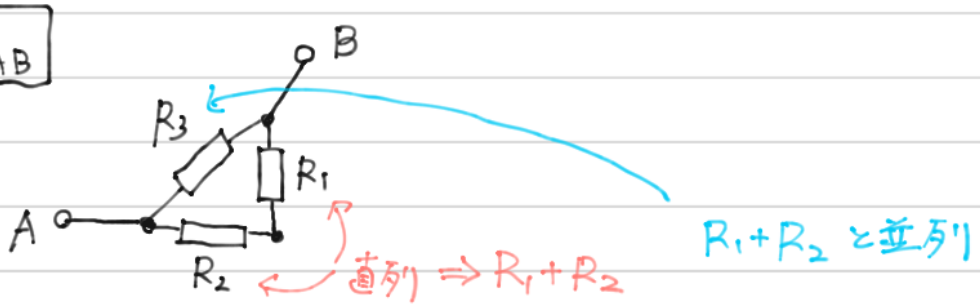
301　合成抵抗の公式を使う練習と捉えよう．

(1)

(a)

R_{AB}



R_1+R_2 と R_3 の並列の合成をすると

$$\frac{1}{R_{AB}}=\frac{1}{R_1+R_2}+\frac{1}{R_3}=\frac{R_3+(R_1+R_2)}{(R_1+R_2)R_3}$$

$$\therefore R_{AB}=\frac{(R_1+R_2)R_3}{R_1+R_2+R_3}$$ ← (1) ⑥

R_{BC}

同様にして

$$\frac{1}{R_{BC}}=\frac{1}{R_1}+\frac{1}{R_2+R_3}$$

$$\therefore R_{BC}=\frac{R_1(R_2+R_3)}{R_1+R_2+R_3}$$ ← (ロ) ④

R_{CA}

同様にして

$$\frac{1}{R_{CA}}=\frac{1}{R_1+R_3}+\frac{1}{R_2}$$

$$\therefore R_{CA}=\frac{R_2(R_1+R_3)}{R_1+R_2+R_3}$$ ← (1) ⑤

301 (1) 続き

(b) 図2での R_{AB}, R_{BC}, R_{CA} を考えると

$$R_{AB} = R_a + R_b \quad \leftarrow R_c \text{は関与しない}$$
$$R_{BC} = R_b + R_a$$
$$R_{CA} = R_a + R_c$$

これが(α)の値と等しいとすると

R_{AB}
$$R_a + R_b = \frac{(R_1+R_2)R_3}{R_1+R_2+R_3}$$

R_{BC}
$$R_b + R_c = \frac{R_1(R_2+R_3)}{R_1+R_2+R_3}$$

R_{CA}
$$R_a + R_c = \frac{R_2(R_1+R_3)}{R_1+R_2+R_3}$$

3式を辺々たすと

$$2(R_a+R_b+R_c) = \frac{(R_1+R_2)R_3 + R_1(R_2+R_3) + R_2(R_1+R_3)}{R_1+R_2+R_3}$$
$$= \frac{2(R_1R_2 + R_2R_3 + R_3R_1)}{R_1+R_2+R_3}$$

$$\therefore R_a+R_b+R_c = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1+R_2+R_3}$$

301 (1)(b) 続き

$$\Rightarrow R_a = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1+R_2+R_3} - (R_b+R_c)$$

$$= \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1+R_2+R_3} - \frac{R_1(R_2+R_3)}{R_1+R_2+R_3}$$

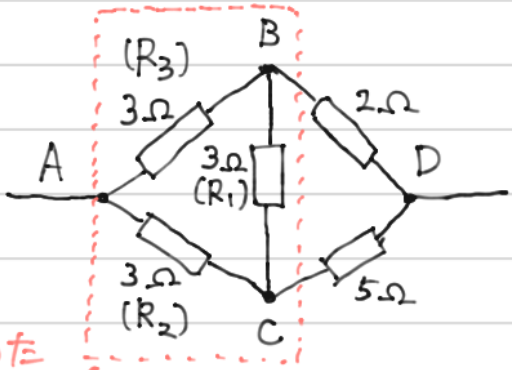
$$= \frac{R_2R_3}{R_1+R_2+R_3} \quad (=)\ ②$$

同様にして

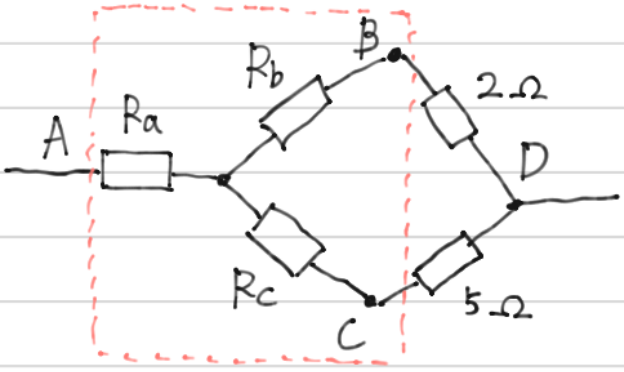
$$\Rightarrow R_b = \frac{R_3R_1}{R_1+R_2+R_3} \quad (ホ)\ ③$$

$$R_c = \frac{R_1R_2}{R_1+R_2+R_3} \quad (ヘ)\ ①$$

(2)



(1)でまとめた
おきかえ



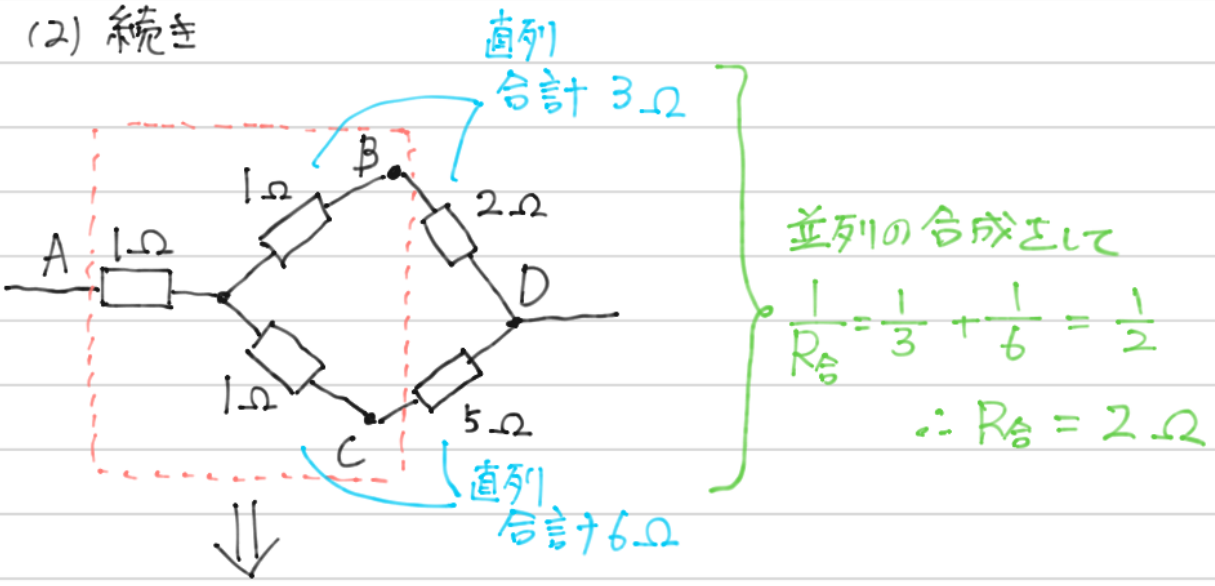
ここで

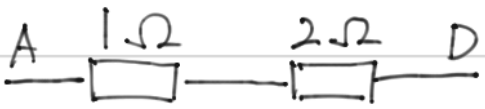
$$R_a = \frac{R_2R_3}{R_1+R_2+R_3} = \frac{3\cdot 3}{3+3+3} = 1\ [\Omega]$$

同様に

$$R_b = 1\ [\Omega] \qquad R_c = 1\ [\Omega]$$

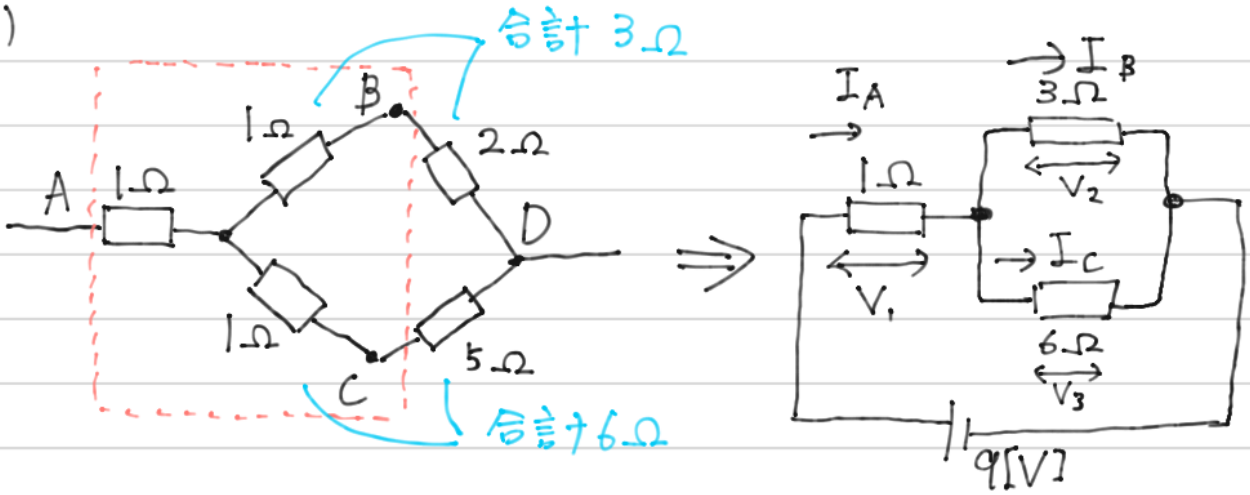
301 (2) 続き





AD間は 3Ω 並 (1)

(4)



$I_A = I_B + I_C$ … ①

$9 = 1\cdot I_A + 3I_B$ … ②

$9 = 1I_A + 6I_C$ … ③

} V=RIで暗算して キルヒホッフ則

①を②、③に代入して

$9 = 4I_B + I_C$ … ②′

$9 = I_B + 7I_C$ … ③′

②′より $I_C = 9 - 4I_B$. これを③′に代入して

$9 = I_B + 7(9 - 4I_B)$

$\therefore I_B = 2.0\,[A]$ 並