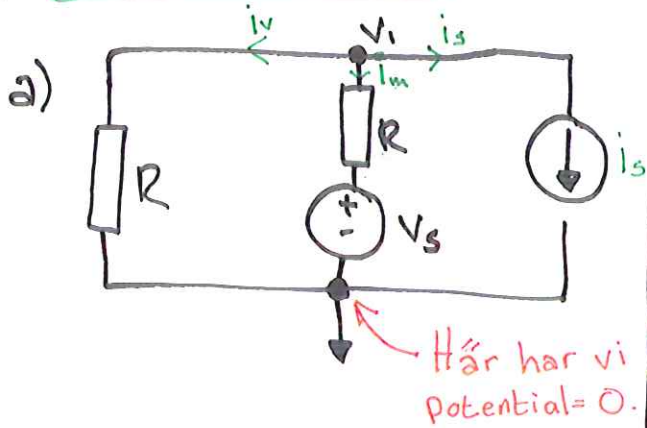


KAPITEL 4

4.1 Bestäm V_1



Kirchoffs strömlag

$$i_v + i_m + i_s = 0$$

$$\Leftrightarrow \frac{V_1}{R} + \frac{V_1 - V_s}{R} + i_s = 0$$

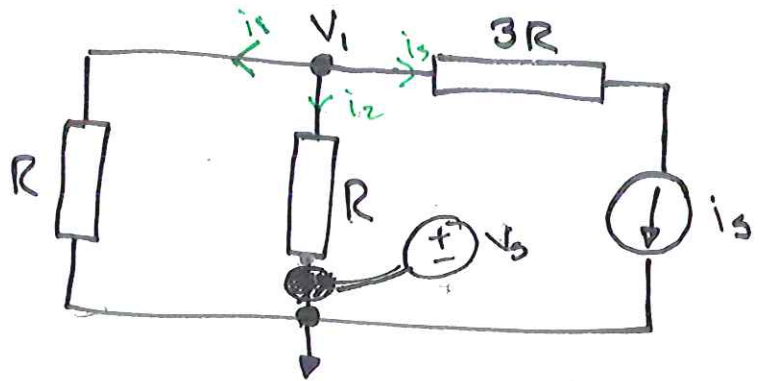
$$\Leftrightarrow V_1 = \frac{V_s - R i_s}{2}$$

b) Kirchoffs strömlag

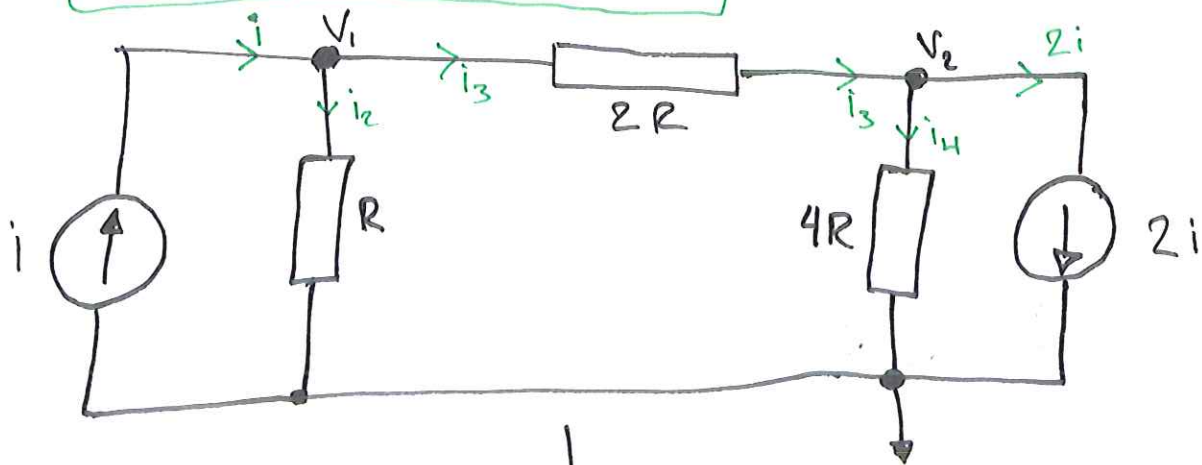
$$i_1 + i_2 + i_s = 0 \quad i_s = i_3$$

$$\Leftrightarrow \frac{V_1 - 0}{R} + \frac{V_1 - V_s}{R} + i_s = 0$$

$$\Rightarrow V_1 = \frac{V_s - R i_s}{2}$$



4.2

Bestäm v_1 och v_2 Vid punkt 1

$$-i + i_2 + i_3 = 0$$

$$\Leftrightarrow -i + \frac{v_1 - 0}{R} + i_3 = 0$$

$$\Leftrightarrow -i + \frac{v_1}{R} + \frac{v_1 - v_2}{2R} = 0$$

Vid punkt 2

$$2i + i_4 - i_3 = 0$$

$$\Leftrightarrow 2i + \frac{v_2 - 0}{4R} - i_3 = 0$$

$$\Leftrightarrow 2i + \frac{v_2}{4R} - \frac{v_1 - v_2}{2R} = 0$$

$$\Rightarrow$$

Svar:

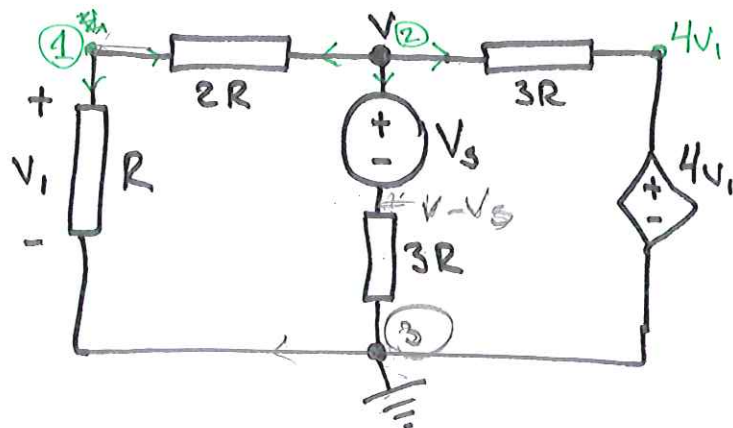
$$v_1 = -\frac{2}{7} Ri$$

$$v_2 = -\frac{20}{7} Ri$$

4.5 Bestäm v som funktion av v_s

$$\textcircled{1} \quad \frac{v_1 - v}{2R} + \frac{v_1 - 0}{R} = 0 \Rightarrow v = 3v_1$$

$$\textcircled{2} \quad \frac{v - v_1}{2R} + \frac{v - v_s}{3R} = 0$$



$$\textcircled{3} \quad \frac{0 - v_1}{R} + \frac{0 - (v - v_s)}{3R} + \frac{4v_1 - v}{3R} = 0$$

$$\Leftrightarrow -3v_1 - v + v_s + 4v_1 - v = 0$$

$$\Leftrightarrow v_1 + v_s - 2v = 0$$

$$\Leftrightarrow v = \frac{1}{2}(v_1 + v_s) = \frac{1}{2}\left(\frac{v}{3} + v_s\right)$$

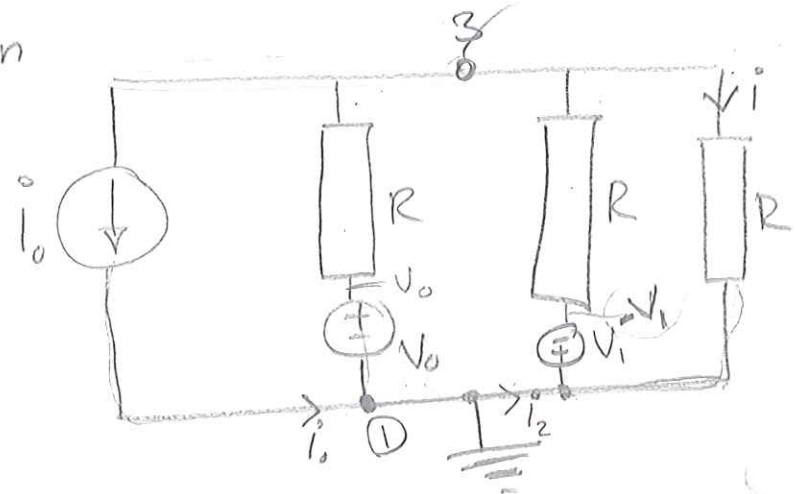
$$\Leftrightarrow v - \frac{v}{6} = \frac{1}{2}v_s$$

$$\Leftrightarrow \frac{5v}{6} = \frac{1}{2}v_s \Rightarrow \boxed{v = \frac{3}{5}v_s}$$

4.6 Bestäm strömmen i

Vi bestämmer potentialen där uppe.

$$V = R \cdot i$$



~~$$\textcircled{1} \quad \frac{V_0 - R i}{R} - i_0 + i_2 = 0$$~~

~~$$\textcircled{2} \quad \frac{-V_1 - R i}{R} - i_1 - i_2 = 0$$~~

~~$$\Leftrightarrow \begin{cases} V_0 - R i - R i_0 + R i_2 = 0 \\ -V_1 - 2R i - i_2 = 0 \Rightarrow i_2 = -V_1 - 2R i \end{cases}$$~~

~~$$V_0 - R i - R i_0 + R(-V_1 - 2R i)$$~~

$$\textcircled{3} \quad i_0 + \frac{R i - V_0}{R} + \frac{R i - (-V_1)}{R} + i = 0$$

$$\Rightarrow \boxed{i = -\frac{i_0}{3} + \frac{V_0 - V_1}{3R}}$$

2.11

$$V = Ri$$

$$R = \frac{V}{i} = \frac{5}{6} \Omega$$

Vi beräknar potentialen steg för steg.

Potential vid:

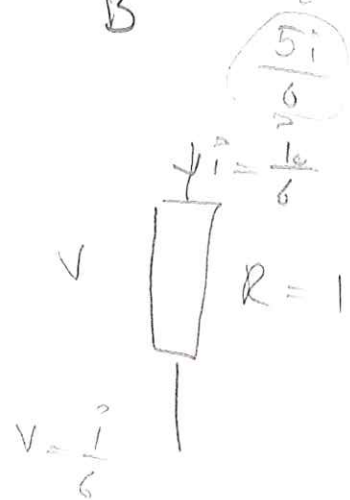
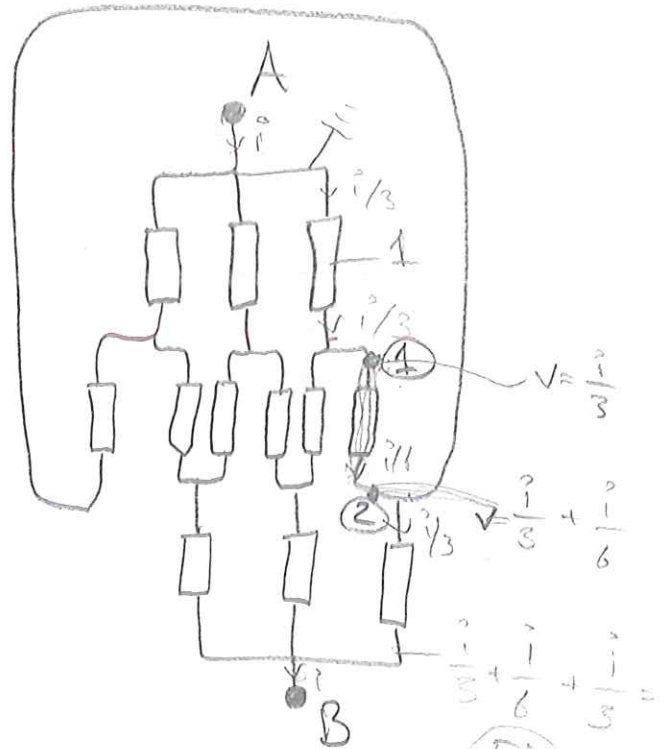
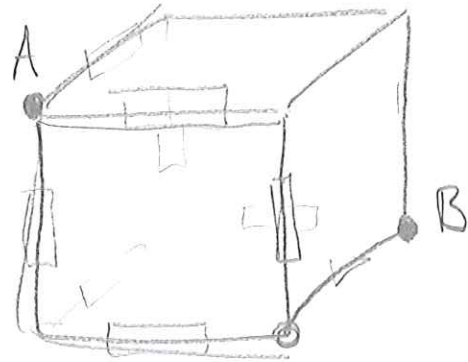
$$A : 0$$

$$1 : 0 + \frac{i}{3}$$

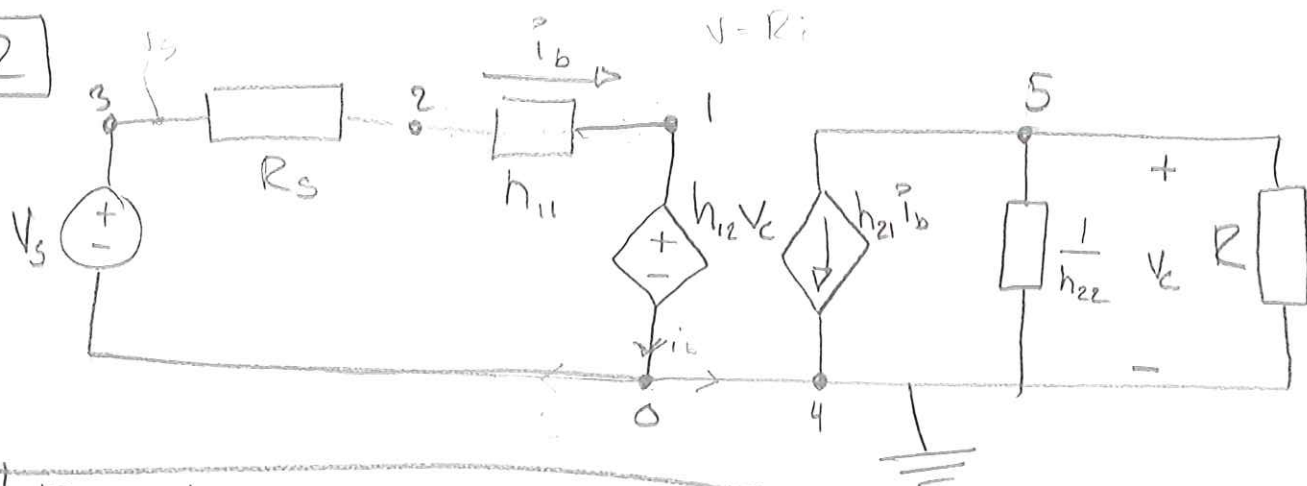
$$2 : 0 + \frac{i}{3} + \frac{i}{6}$$

$$B : 0 + \frac{i}{3} + \frac{i}{6} + \frac{i}{3} = \frac{5i}{6}$$

$$R = \frac{V}{i} = \frac{\frac{5i}{6}}{i} = \boxed{\frac{5}{6} \Omega}$$



3.2



Bestäm i_b och V_c

0: $V_0 = 0$

1: $V_1 = h_{12} V_c$

3: $V_3 = V_s$

2: $V_2 = V_s + R_s i_b$

$V_2 = h_{12} V_c + h_{11} i_b$

$$V_s + R_s i_b = h_{12} V_c - h_{11} i_b$$

4: $V_4 = 0$

5: $V_5 = V_c$

$$V_5 = -h_{21} i_b \cdot \frac{R - h_{22}}{R + h_{22}}$$

$$V_c = h_{21} i_b \frac{R}{R h_{22} + 1}$$

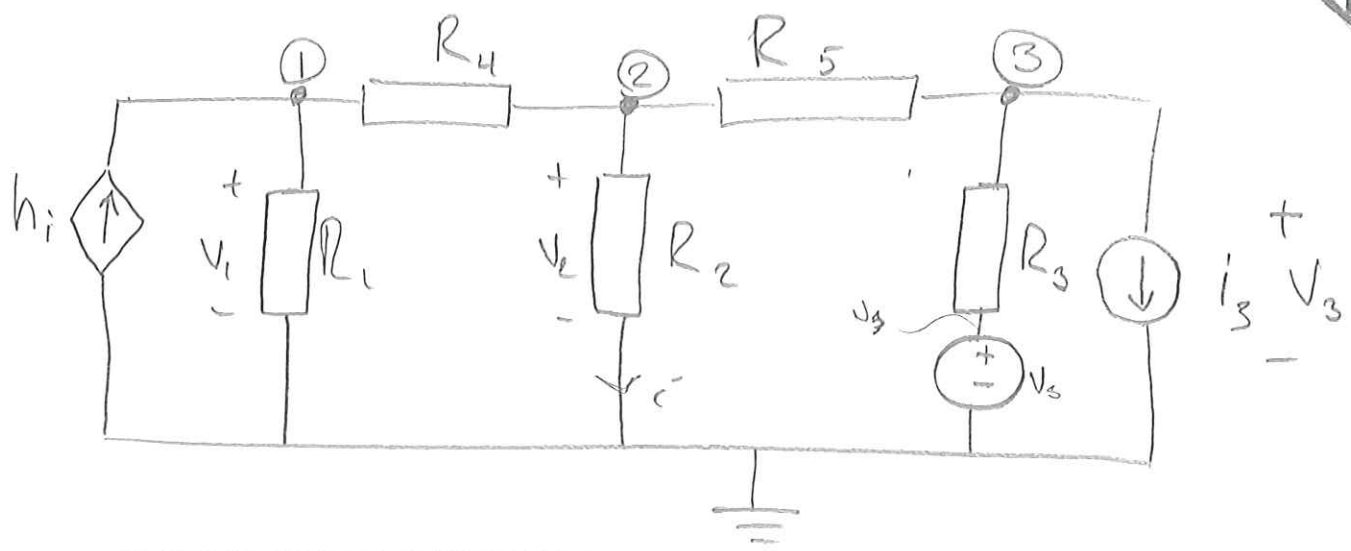
$$i_b = - \frac{R h_{22} + 1}{R h_{21}}$$

$$V_s + R_s i_b = h_{12} h_{21} i_b \frac{R}{R h_{22} + 1} - h_{11} i_b$$

$$\Leftrightarrow -V_s = i_b \left(h_{12} h_{21} \frac{R}{R h_{22} + 1} - h_{11} - R_s \right)$$

$$i_b = \frac{R h_{22} + 1}{h_1 h_2 - (R_s + h_{11})(R h_{22} + 1)}$$

4.7



① $-h_i + \frac{v_1}{R_1} + \frac{v_1 - v_2}{R_4} = 0$

Annotation: $i = \frac{v_2}{R_2}$ with an arrow pointing to the current source term in the equation.

② $\frac{v_2 - v_1}{R_4} + \frac{v_2}{R_2} + \frac{v_2 - v_3}{R_5} = 0$

③ $\frac{v_3 - v_2}{R_5} + \frac{v_3 - v_s}{R_3} + i_s = 0$

$(\frac{1}{R_1} + \frac{1}{R_4})v_1 + (\frac{h}{R_2} - \frac{1}{R_4})v_2 = 0$

$-\frac{1}{R_4}v_1 + (\frac{1}{R_4} + \frac{1}{R_2} + \frac{1}{R_5})v_2 - \frac{1}{R_5}v_3 = 0$

$-\frac{1}{R_5}v_2 + (\frac{1}{R_5} + \frac{1}{R_3})v_3 = \frac{1}{R_3}v_s - i_s$