HW 6 Chapter 4

Thursday, December 10, 2009

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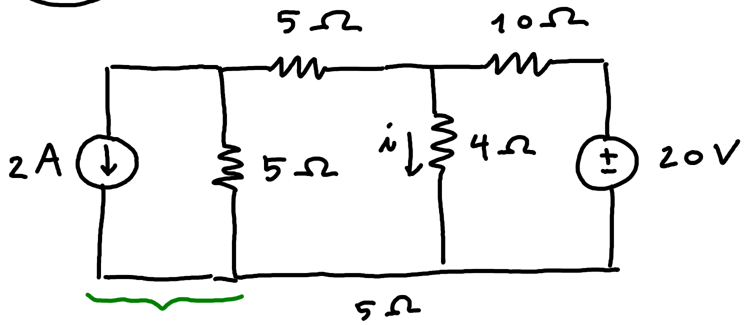
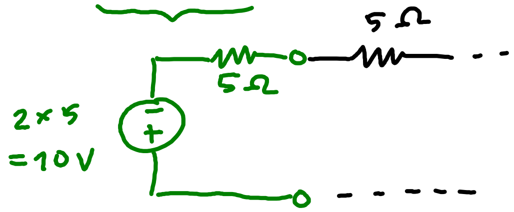
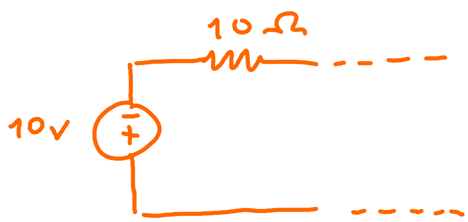
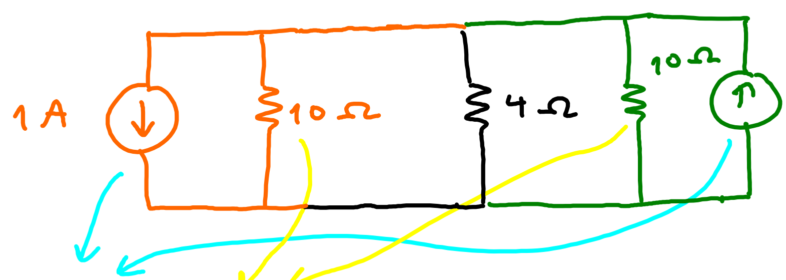
4.22

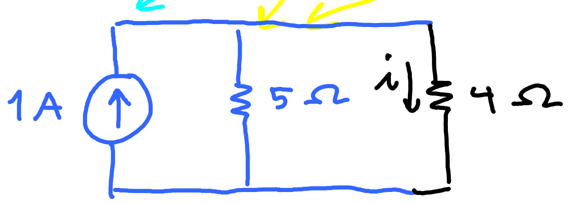






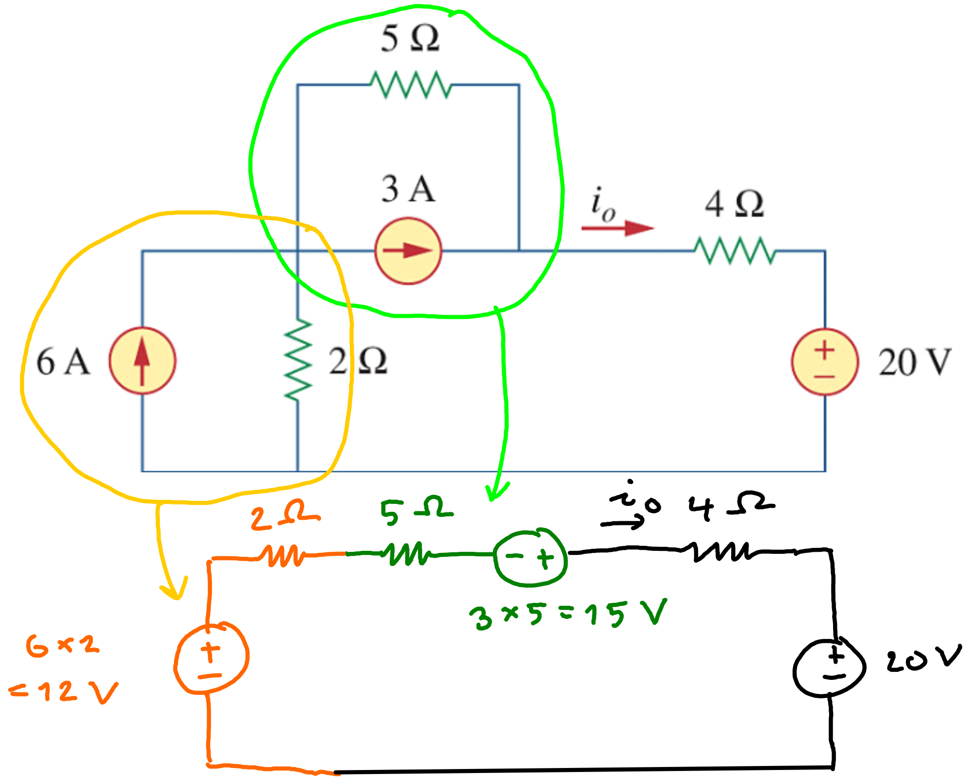


$\frac{20}{10} = 2A$



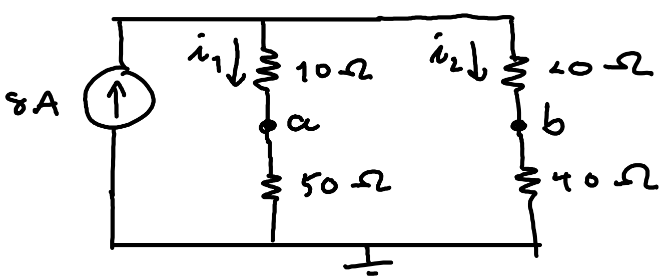
$$i = \frac{\frac{1}{4}}{\frac{1}{4} + \frac{1}{5}} \times 1 = \boxed{\frac{5}{9}\ A}$$

4.26



$$i_o = \frac{12+15-20}{2+5+4} = \boxed{\frac{7}{11}\ A}$$

(4.59) For V_{TH} :



Because $10+50 = 20+40 = 60\ \Omega$,

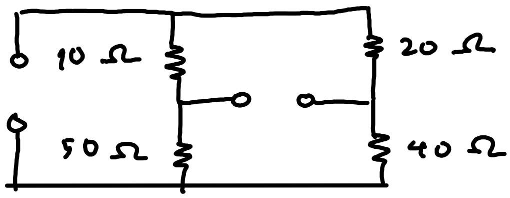
$$i_1 = i_2 = \frac{8}{2} = 4\ A.$$

So, $V_a = 50 \times i_1 = 200\ V$

$v_b = 40 \times i_2 = 160\ V$

$$v_{ab} = 200-160 = 40\ V = V_{TH}$$

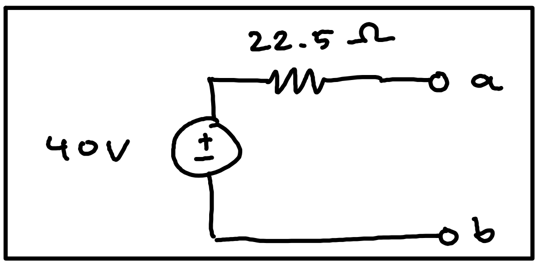
For R_{TH} :



$$R_{TH} = (10+20)\,//\,(50+40) = 30 // 90$$

$$= \frac{30 \times 90}{30+90} = \frac{\cancel{30} \times 90}{\cancel{120}_{4}} = \frac{45}{2}\,\Omega = 22.5\,\Omega$$

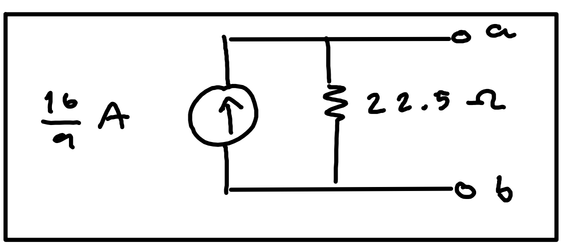
So, the Thevenin equivalent is given by



We use $I_N = \frac{V_{TH}}{R_{TH}} = \frac{40}{45/2} = \frac{80}{45} = \frac{16}{9}\,A \approx 1.778\,A$

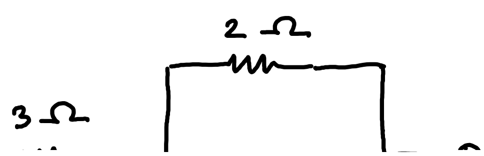
$$R_N = R_{TH} = 22.5\,\Omega$$

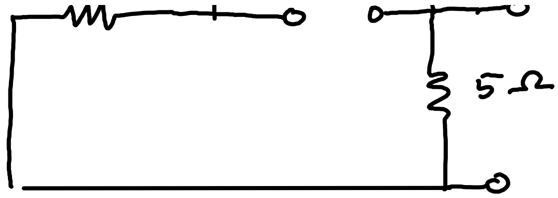
So, the Norton equivalent is given by



4.66

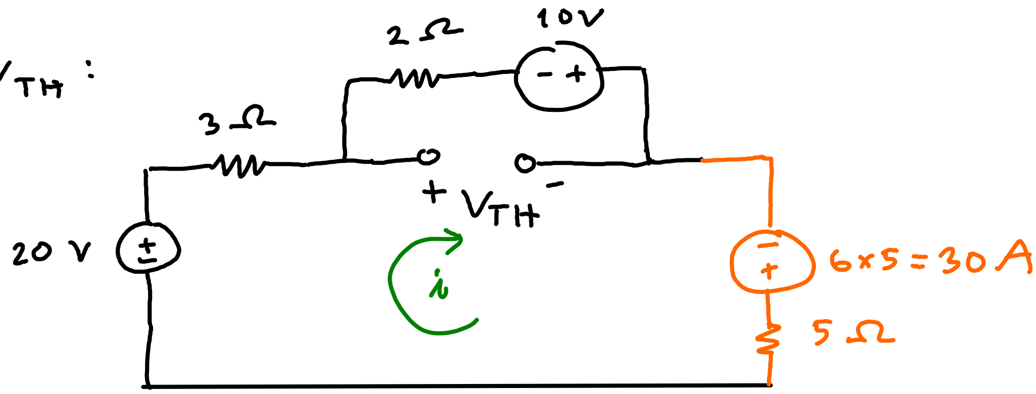
R_{TH} :





$$R_{TH} = 2 // (3+5) = 2 // 8 = \frac{2\times 8}{10} = 1.6\ \Omega$$

V_{TH} :



$$i = \frac{20+10+30}{3+2+5} = 6\ A$$

$$V_{TH} = -10 + 2\times 6 = 2\ V$$

So, max power $= \frac{V_{TH}^2}{4R_{TH}} = \frac{\cancel{4}\,2}{\cancel{4}\times 1.6} = \frac{10}{16} = \boxed{\frac{5}{8}\ W}$

$\approx 0.625\ W$

HW 6 Chapter 5

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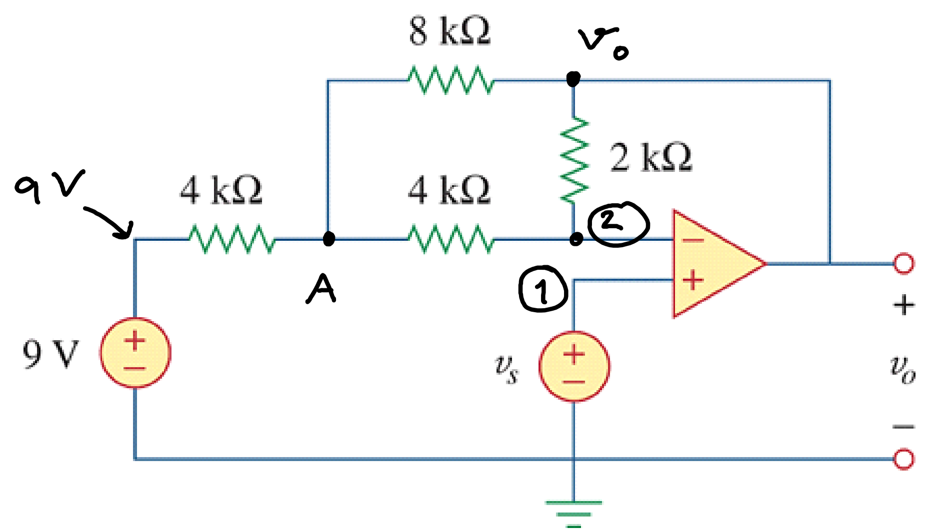
5.20



1. $v_+ = v_s$

2. $v_- = v_+ = v_s$ by Rule # 2.

3. At A $\quad \dfrac{v_A - 9}{4} + \dfrac{v_A - v_o}{8} + \dfrac{v_A - v_s}{4} = 0$

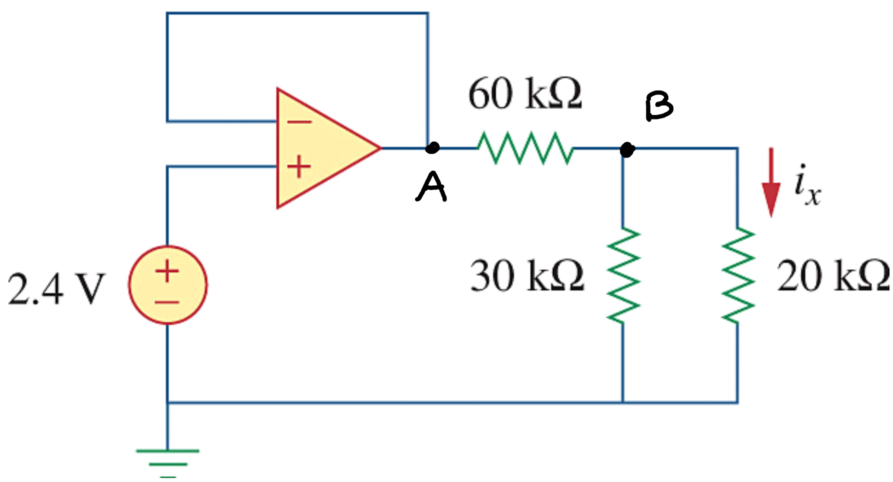
At (−) $\quad \dfrac{v_s - v_A}{4} + \dfrac{v_s - v_o}{2} = 0$

$$\Rightarrow v_A = \frac{7}{11} v_s$$

$$v_o = \frac{13}{11} v_s - \frac{18}{11}$$

If $v_s = 0$, we have $\boxed{v_o = -\frac{18}{11}\ V}$

5.30 This is a voltage follower. So, $v_A = 2.4\ V$



$$V_B = \frac{20/\!/30}{60+20/\!/30} \times v_A = \frac{12}{72} v_A = \frac{1}{6} v_A = 0.4\ V$$

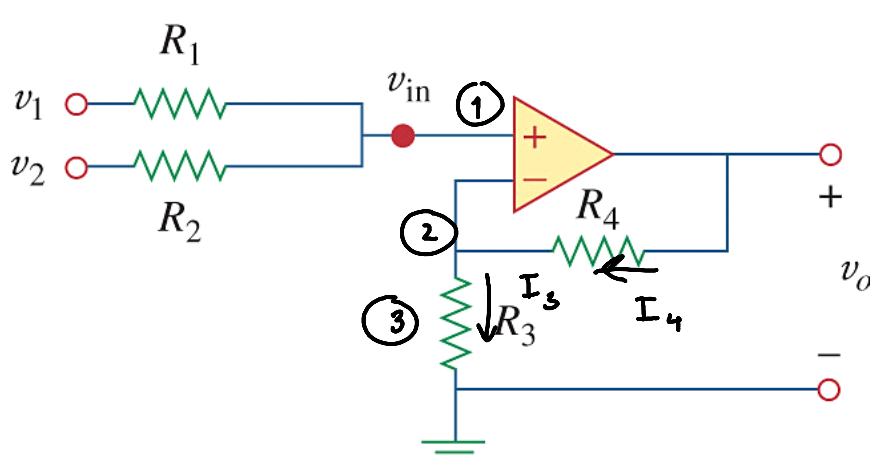
$$i_x = \frac{V_B}{20k} = \frac{0.4}{20k}$$

$$20/\!/30 = \frac{20\times 30}{20+30} = \frac{60\cancel{0}}{5\cancel{0}} = 12$$

$$= 0.02\ mA = \boxed{20\,\mu A}$$

$$P = i_x \times v_B = 0.4\,V \times 20\,\mu A = \boxed{8\,\mu W}$$

5.34



1 $i_+ = 0$. so, $\dfrac{v_{in} - v_1}{R_1} + \dfrac{v_{in} - v_1}{R_2} = 0$

$$v_{in}\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{v_1}{} + \frac{v_2}{}$$

$$v_{in} = \frac{R_2 v_1 + R_1 v_2}{R_1 + R_2}$$

(2) $v_- = v_+ = v_{in}$

(3) $I_3 = \frac{v_-}{R_3} = \frac{v_{in}}{R_3}$

(4) $I_4 = I_3$ because $i_- = 0$

(5) $v_o = v_- + I_4 R_4 = v_{in} + \frac{v_{in}}{R_3} R_4$

$$= v_{in}\left(1 + \frac{R_4}{R_3}\right)$$

$$= \boxed{\left(1 + \frac{R_4}{R_3}\right)\left(\frac{R_2 v_1 + R_1 v_2}{R_1 + R_2}\right)}$$

(5.37) $v_o = -\left(\frac{30}{10} \times 1 + \frac{30}{20} \times 2 + \frac{30}{30} \times (-3)\right) = \boxed{-3V}$

(This is a summer.)

(5.47) $R_1 = 2k,\ R_2 = 30k,\ R_3 = 2k,\ R_4 = 20k$

$\frac{R_2}{R_1} = 15,\quad \frac{R_3}{R_4} = \frac{1}{10}$

$$v_o = -15 v_1 + \frac{1+15}{1+\frac{1}{10}} v_2 = -15 + \frac{160}{11} \times 2$$

$$\approx \boxed{14.09\ V}$$