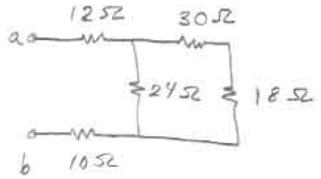
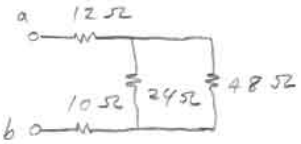
HW #3

3.7

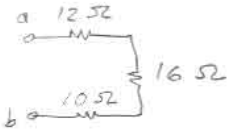
a)



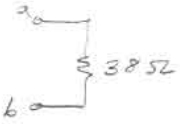
$\Rightarrow$



$$\frac{24 \times 48}{24+48} = 16\,\Omega \Rightarrow$$



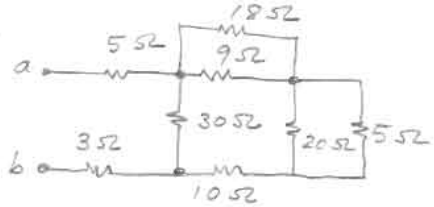
$\Rightarrow$



$\therefore \boxed{R_{eq} = 38\,\Omega}$

3.8

a)

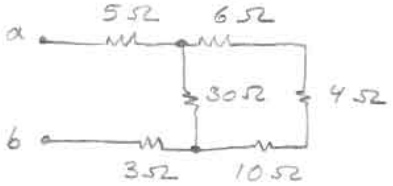


$18 /\!/ 9 \neq 20 /\!/ 5$

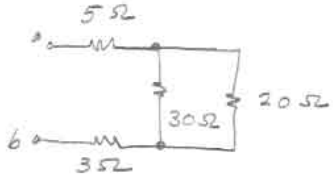
$\Downarrow$ $\qquad$ $\Downarrow$

$$\frac{18 \times 9}{18+9} = 6\,\Omega \qquad \frac{20 \times 5}{20+5} = 4\,\Omega$$

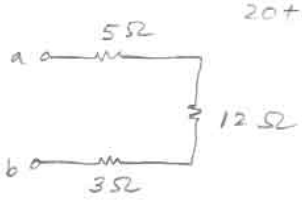
$\Downarrow$



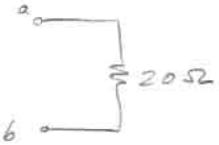
$\Rightarrow$



$20 /\!/ 30 \Rightarrow \frac{20 \times 30}{20+30} = 12\,\Omega \Rightarrow$

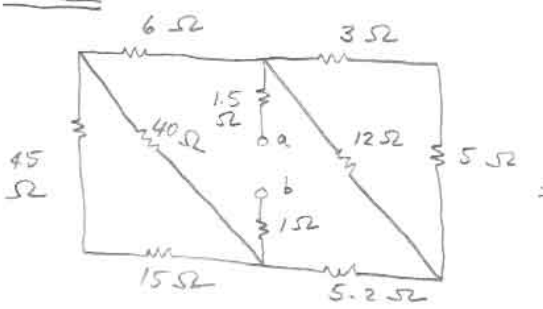


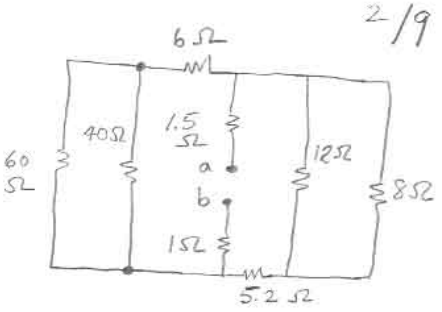
$\Rightarrow$



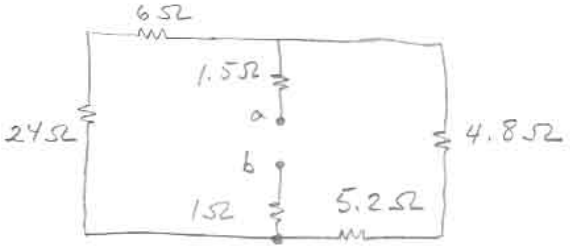
$\therefore \boxed{R_{eq} = 20\,\Omega}$

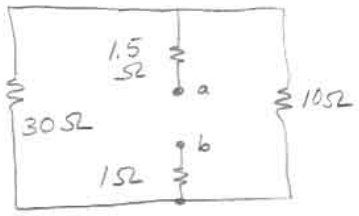
3.8 C



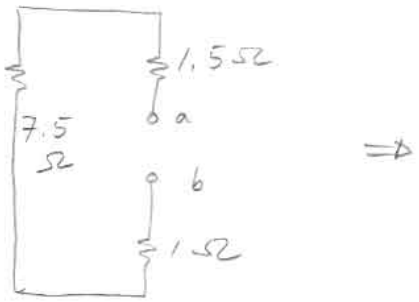


$60 // 40 \Rightarrow \frac{60 \times 40}{60+40} = 24\,\Omega$, $12 // 8 \Rightarrow \frac{12 \times 8}{12+8} = 4.8\,\Omega$





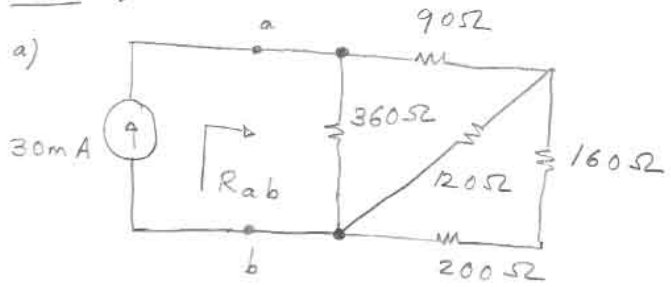
$10 // 30 \Rightarrow \frac{10 \times 30}{10+30} = \frac{300}{40} = 7.5\,\Omega$

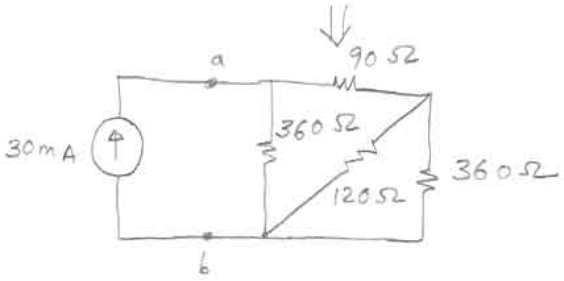


$\therefore$ $\boxed{R_{eq} = 10\,\Omega}$

3.9 a)

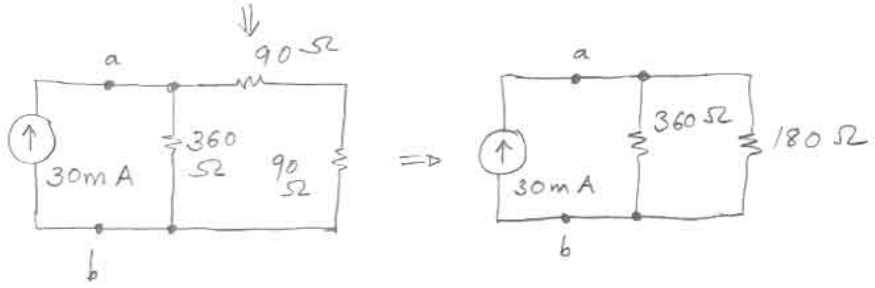
a)



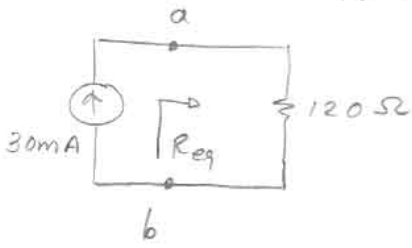


$120 // 360 \Rightarrow \frac{120 \times 360}{120+360}$

$= 90\,\Omega$

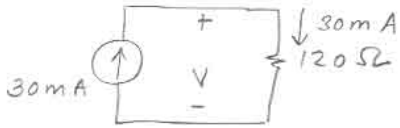


$180 // 360 \Rightarrow \frac{180 \times 360}{180+360} = 120\,\Omega$



$\therefore$ **$R_{eq} = 120\,\Omega$**

b)



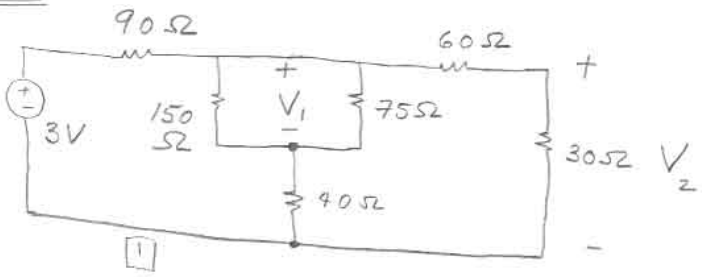
$V = 30m \times 120 = 3.6\,V$

$\therefore P_{30mA} = -iV = -(30 \times 10^{-3}) \times 3.6$

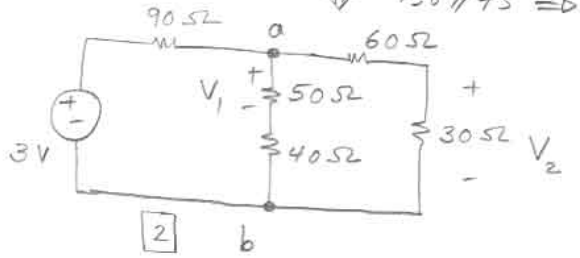
$= -0.108\,W$

$\therefore$ Power delivered by the source = 0.108 W

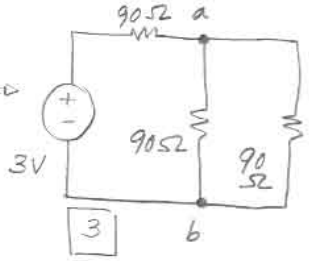
3.25



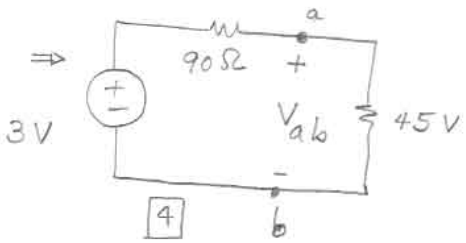
$\Downarrow$ $150 // 75 \Rightarrow \frac{150 \times 75}{150+75} = 50\Omega$



$\Rightarrow$



$\Rightarrow$



$90 // 90 = \frac{1}{2} \times 90 = 45\Omega$

VDR in circuit [4] $\Rightarrow V_{ab} = \frac{45}{45+90} \times 3 = 1V$

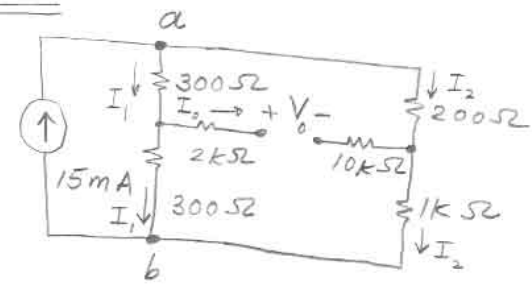
" " " [2] $\Rightarrow V_1 = \frac{50}{50+40} \times V_{ab}$

$= \frac{50}{90} \times 1 = \frac{5}{9} V$

" " " " $\Rightarrow V_2 = \frac{30}{30+60} \times V_{ab} = \frac{30}{90} \times 1 = \frac{1}{3} V$

$\therefore$ $V_1 = \frac{5}{9} V$ & $V_2 = \frac{1}{3} V$

326

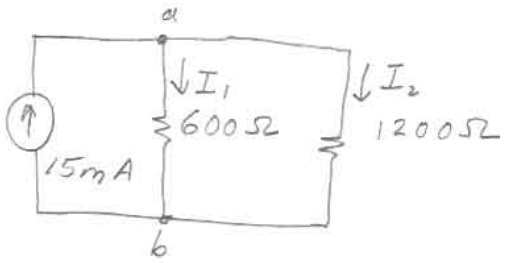


1

$I_0 = 0$ A because no current passes through the "open circuit".

∴ The current I_1 passes through the two 300Ω resistors (i.e. they are in series).

∴ The current I_2 passes through 200Ω & 1kΩ (i.e. 200Ω & 1kΩ are in series).



2

CDR in circuit 2 $\Rightarrow I_1 = \frac{1200}{1200+600} \times 15\text{mA}$

$= 10\text{mA}$

" " " " $\Rightarrow I_2 = \frac{600}{1200+600} \times 15\text{mA}$

$= 5\text{mA}$

3.26 (continued)

KVL in upper right circuit [1] ⇒

$$-V_o - 2000 I_o - 300 I_1 + 200 I_2 + 10000 I_o = 0$$

$(I_o = 0 \;,\; I_1 = 10\,mA \;,\; I_2 = 5\,mA)$

$$\therefore \; -V_o - 300\left(10\times10^{-3}\right) + 200\left(5\times10^{-3}\right) = 0$$

$$\therefore \; V_o = -3 + 1 = -2\,V$$

We can also apply KVL in the lower right circuit [1] ⇒

$$-300 I_1 + V_o + 1000 I_2 = 0$$

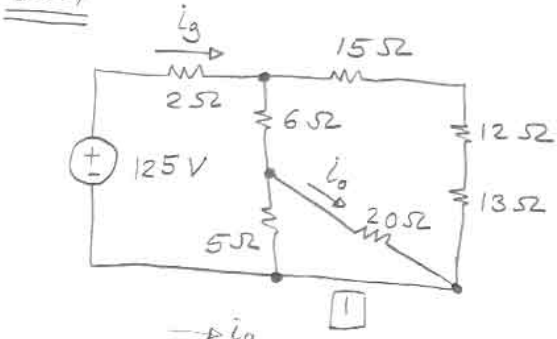
(again because $I_o = 0$, the voltage drops across 2kΩ & 10kΩ are both zero)

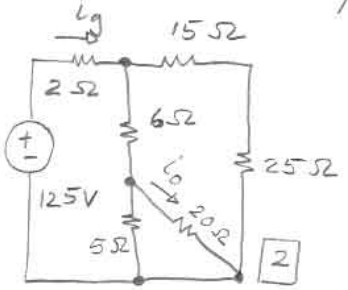
$$-300 \times \left(10\times10^{-3}\right) + V_o + 1000 \times \left(5\times10^{-3}\right) = 0$$

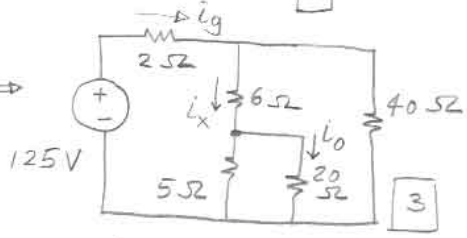
$$-3 + V_o + 5 = 0$$

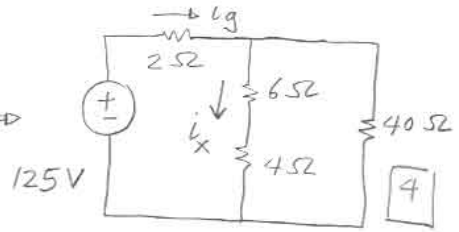
$$\Rightarrow \; V_o = -2\,V$$ (same answer).

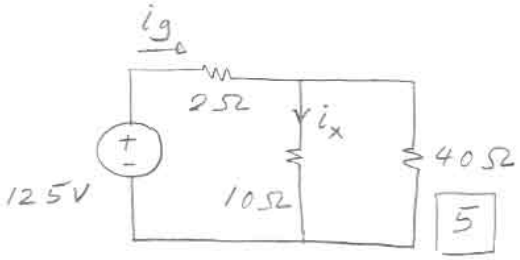
3.27

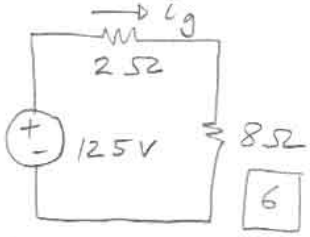












Using circuit [6] $\Rightarrow$ $\boxed{i_g = \frac{125}{10} = 12.5\,A}$

CDR in circuit [5] $\Rightarrow$ $i_x = \frac{40}{10+40} \times i_g$

$= \frac{40}{50} \times 12.5 = 10\,A$

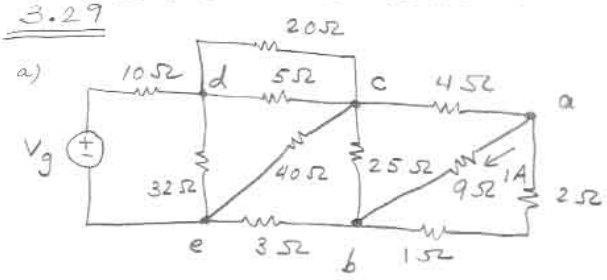
CDR in circuit [3] $\Rightarrow$ $i_o = \frac{5}{5+20} \times i_x$

$= \frac{5}{25}(10) = 2\,A$

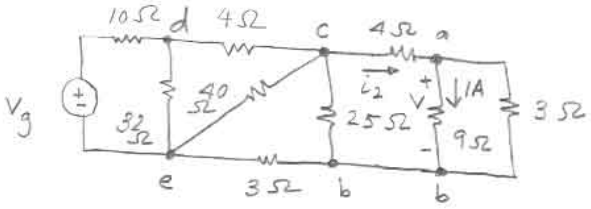
$\therefore$ $\boxed{i_o = 2\,A}$

3.29

a)

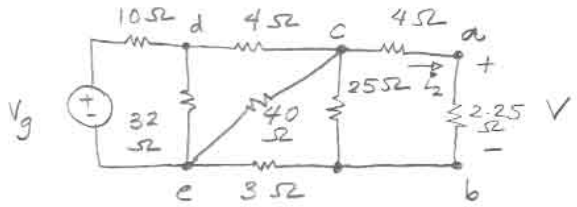


$5 // 20 = \frac{5 \times 20}{20+5} = 4\Omega$

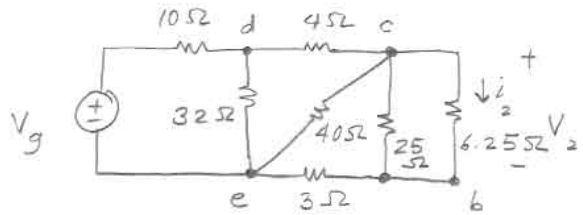


$V = 1 \times 9 = 9V$

$9 // 3 = \frac{9 \times 3}{9+3} = 2.25\Omega$



$i_2 = \frac{V}{2.25} = \frac{9}{2.25} = 4A$

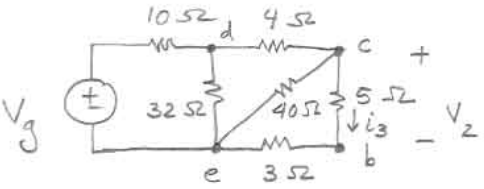


$V_2 = 6.25 \times i_2$

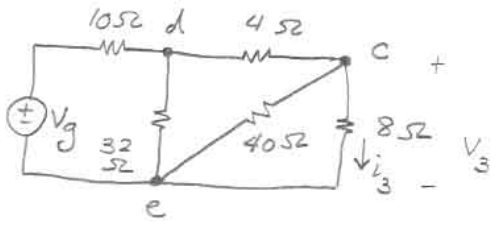
$= 6.25 \times 4 = 25V$

$25 // 6.25 = \frac{25 \times 6.25}{25+6.25}$

$= 5\Omega$

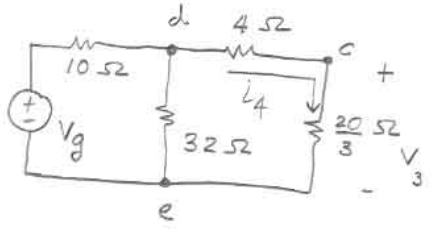


$i_3 = \frac{V_2}{5} = \frac{25}{5} = 5A$



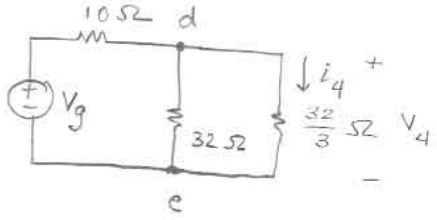
$V_3 = 8\, i_3 = 8 \times 5 = 40\,V$

$40 // 8 = \frac{40 \times 8}{40+8} = \frac{20}{3}\,\Omega$



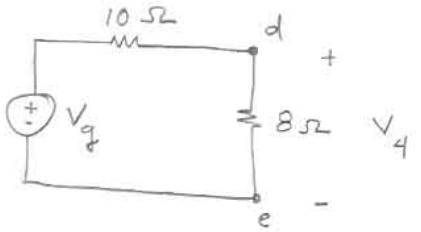
$i_4 = \frac{V_3}{(20/3)} = 40 \times \frac{3}{20}$

$= 6\,A$



$V_4 = \frac{32}{3}\, i_4 = \frac{32}{3} \times 6$

$= 64\,V$



$32 // \frac{32}{3} = \frac{32 \times \frac{32}{3}}{32 + \frac{32}{3}} = 8\,\Omega$

KVL $\quad V_4 = \frac{8}{18} \times V_g \Rightarrow V_g = \frac{18}{8} V_4 = \frac{18}{8} \times 64$

$$\boxed{V_g = 144\,V}$$