Engin 11 Exam 1 Review

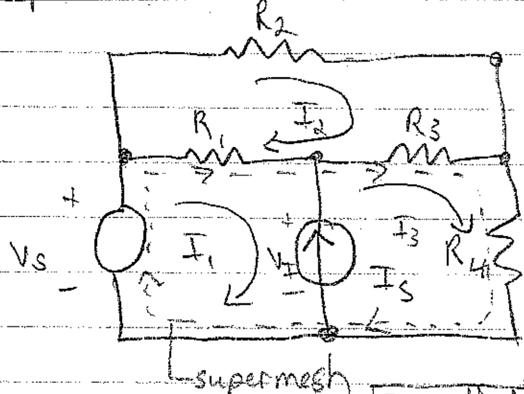
Ch.1-4 Topics to know:

- V ÷
- I ÷
- Ohm's Law
- KVL
- KCL
- Supermesh/Supernode
- Thevenin/Norton
- R in series + parallel
- Source Transformation
- Max Power Transfer Thm.
- Superposition
- Dependent Sources

Will be given: (if asked)

- Δ-Y or Y-Δ

Supermesh



Find power dissipated across R_4 (P_4)

① $V_S - (I_1 - I_2)R_1 - V_I = 0$

② $-R_2 I_2 - R_3(I_2 - I_3) - R_1(I_2 - I_1) = 0$

③ $-R_3(I_3 - I_2) - R_4 I_3 + V_I = 0$

④ $I_3 - I_1 = I_S$

2 methods to solve

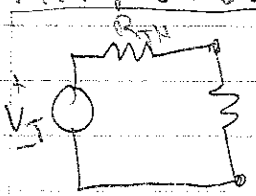
$$\sum_{\text{supermesh loop}} V = V_S - R_1(I_1 - I_2) - R_3(I_3 - I_2) - R_4(I_3) = 0$$

$$\sum_{\text{loop2}} V = 0 = -R_2 I_2 - R_3(I_2 - I_3) - R_1(I_2 - I_1)$$

Supermesh equation: $I_3 - I_1 = I_S$

$$P_{R_4} = R_4 I_3^2$$

Max. power delivered to R_4



$R_4 = R_{TH}$

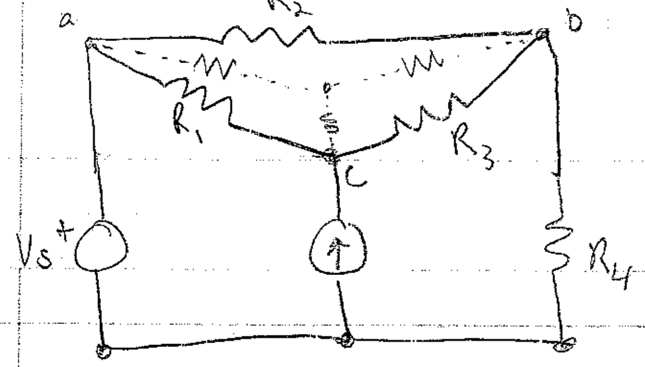
Note: If: Then:

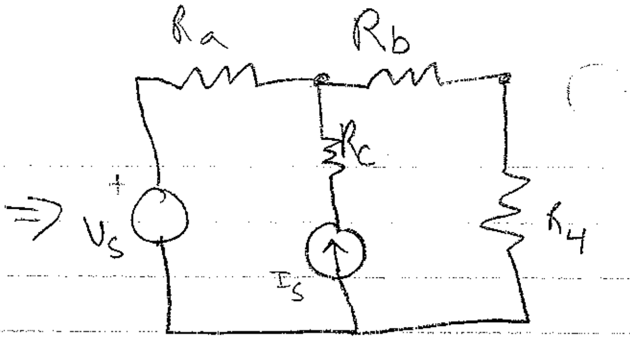
$V_S \to 0 \Rightarrow$ S.C.

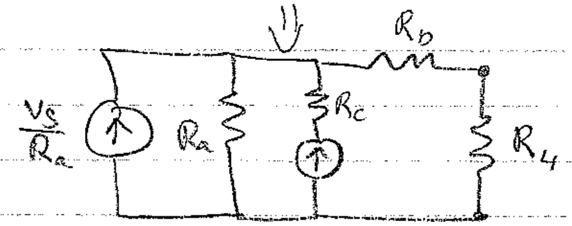
$I_S \to 0 \Rightarrow$ O.C.

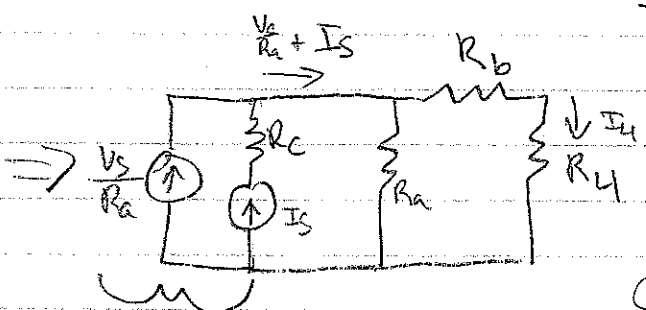
* can't "look in" to a circuit to find R_{TH} if there are dependent sources

$\Delta \rightarrow Y$





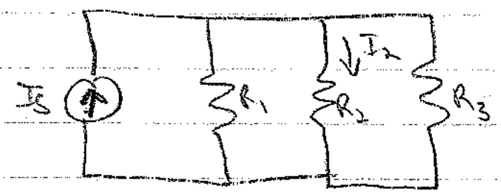




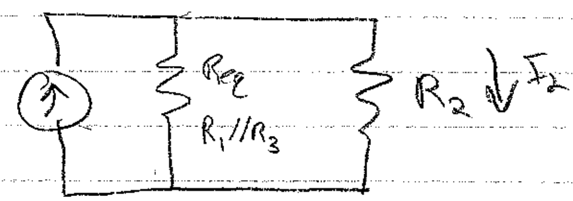
Don't need to worry about R_c, we want to know about R_4

Can find I_4 w/ current ÷

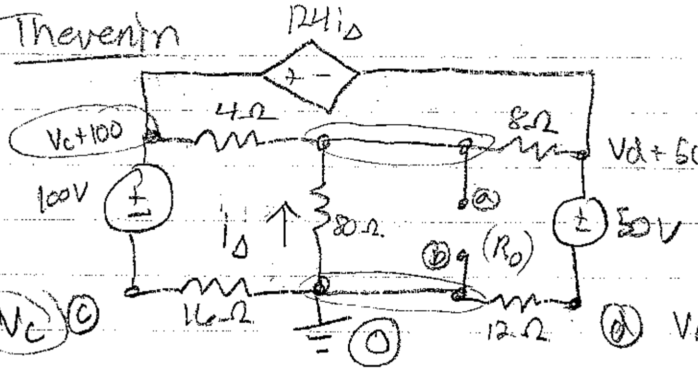
Current divider



⇒



Thevenin



$V_{oc} = V_T = V_{ab}$

ⓓ $V_d = (V_c + 100) - 124 i_\Delta - 50$ or $V_c + 50 - 124 i_\Delta$

① $\dfrac{0 - V_a}{80} = i_\Delta$

Unknown: V_a, V_c, i_Δ

② $\sum_a i = 0 = \dfrac{(V_c+100) - V_a}{4} - \dfrac{V_a}{80} - \dfrac{\left[V_a - \left\{(V_c+100) - 124\left(\frac{-V_a}{80}\right)\right\}\right]}{8}$

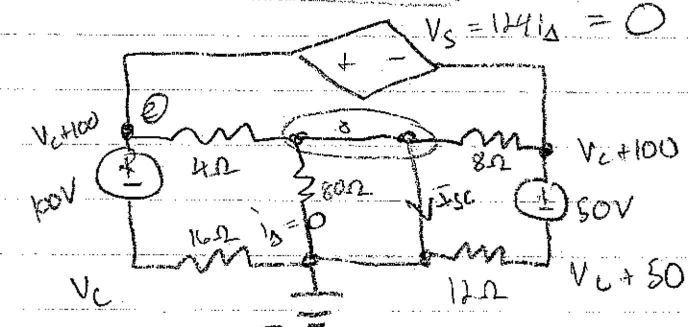
③ $\sum_b i = 0 = \dfrac{V_c}{16} + \dfrac{V_a}{80} + \dfrac{V_c + 50 - 124\left(\frac{-V_a}{80}\right)}{12}$

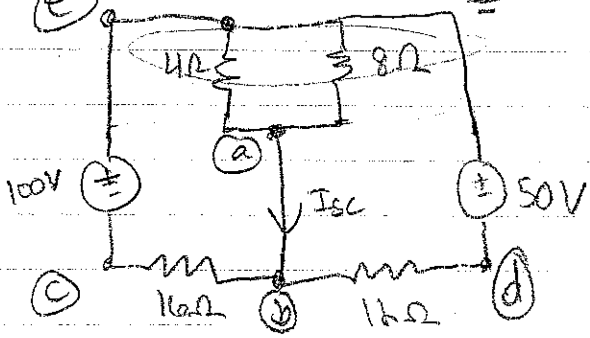
2 eq., 2 unk. $V_a = ? = V_{oc} = V_T$

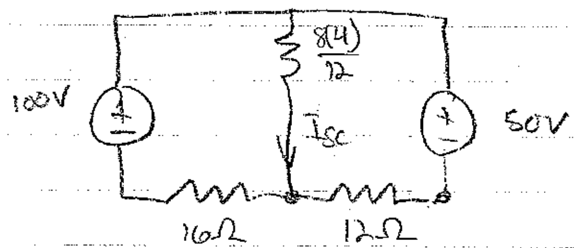
$V_{oc} = V_T$ $\qquad R_{TH} = \dfrac{V_{oc}}{I_{sc}}$

$I_{sc} = I_N$

$I_{sc} = ?$







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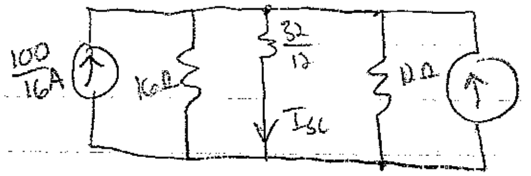
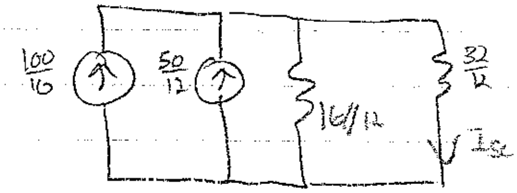
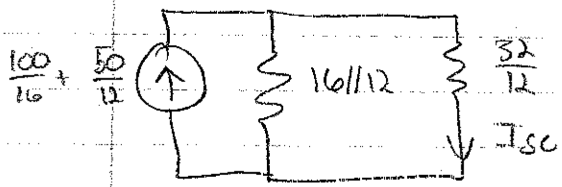


$\Rightarrow$

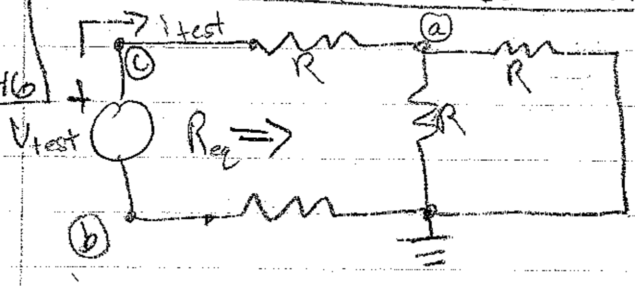




Then current divider

$$R_O = R_T = \frac{V_T}{I_{sc}} = R \text{ for max power transfer}$$

Alternate method from pg. 146



Apply V_{test} + find i_{test}

Then $R_{eq} = \frac{V_{test}}{I_{test}}$

$$\sum_a i = \frac{V_b + V_{test} - V_a}{R} - \frac{2V_a}{R} = 0$$

$$\sum_{ground} i = \frac{2V_a}{R} + \frac{V_b}{R} = 0$$

$$V_b = -2V_a$$

$$\sum_a i = -3V_a + V_{test} - 2V_a = 0$$

$$V_a = \frac{V_{test}}{5}$$

$$V_c = -2V_a + V_{test} = \left(-\frac{2}{5}+1\right)V_{test} = \frac{3}{5}V_{test}$$

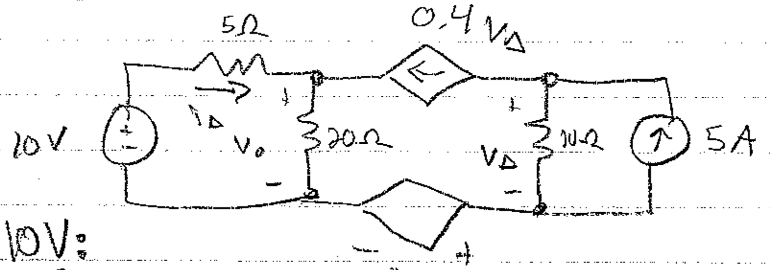
$$i_{test} = \frac{\frac{3}{5}V_{test} - \frac{1}{5}V_{test}}{R} = \frac{2V_{test}}{5R}$$

$$R_{eq} = \frac{V_{test}}{\frac{2V_{test}}{5R}} = \frac{5}{2}R$$

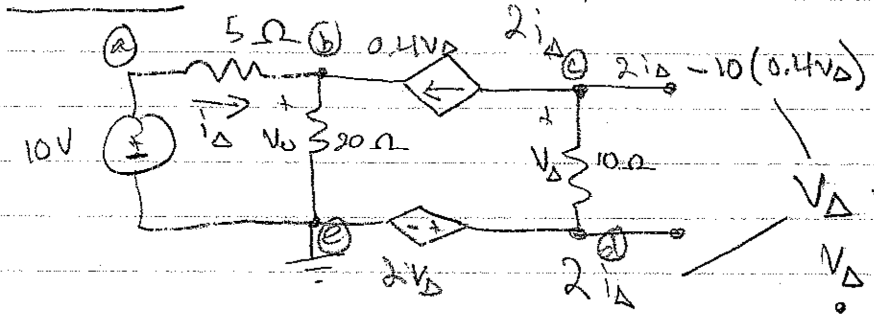
Check:

$= \frac{5}{2}R$ ✓

Ex. 4.13 pg 154



From 10V:



$$V_\Delta = V_c - V_d = \frac{2i_\Delta - 4v_\Delta - 2i_\Delta}{10}$$

$$V_\Delta = -.4V_\Delta$$

$$\therefore v_\Delta = 0$$

and $V_0 = \frac{20}{25}(10) = 8V$