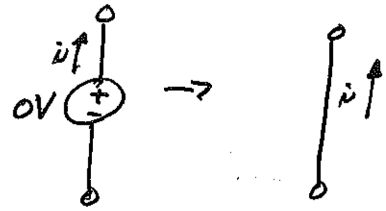
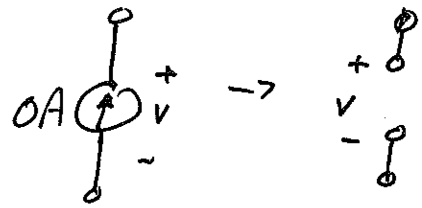
Recitation 7 - 10/21/2014

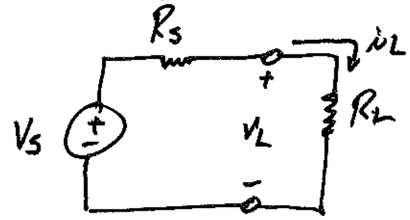
- If voltage drop is 0V, then current flows and acts like a short circuit.

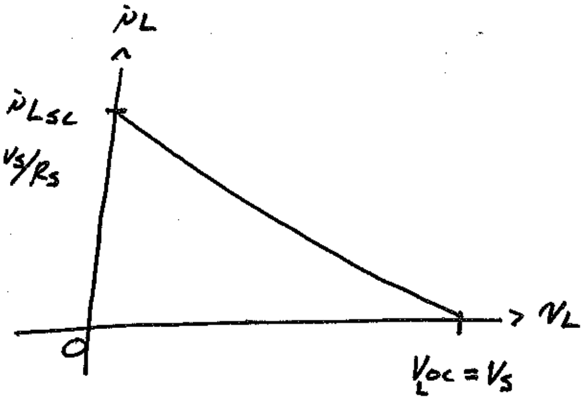


- If ~~[illegible]~~ no current is flowing, then voltage can appear across terminals.



Practical Voltage Sources:





$V = IR$

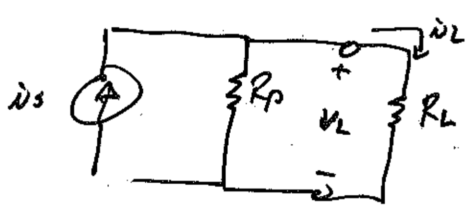
$R_S \to 0$ $\quad i_{Lsc} = \dfrac{V_S}{R_S}$ → i_{Lsc} is maximized because there is no resistance.

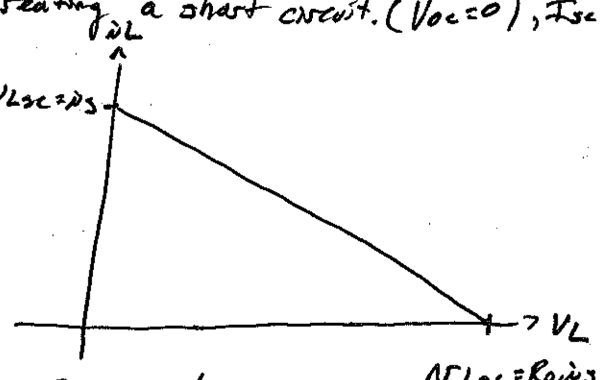
$R_S \to \infty$ $\quad i_{Lsc} = \dfrac{V_S}{R_S}$ → i_{Lsc} goes to ϕ since current will not flow through a resistor of ∞.

Thus, if $R_L = \infty$, no current flows, creating an open circuit ($I_{sc} = 0$) V_{oc} maximized

if $R_L = 0$, then all current flows, creating a short circuit. ($V_{oc} = 0$), I_{sc} is maximized.

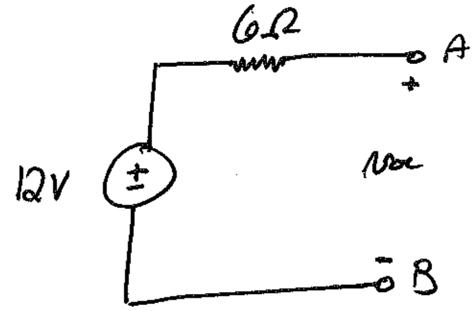
Practical Current Source:





$R_p \to \infty$ $(i_s) = 0$

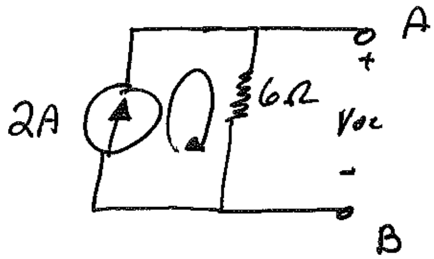
$R_p \to 0$ (i_s is maximized)



$V_{oc} = ?$ measure voltage from A to B = 12V

$I_{sc} = ?$ attach short from A to B and measure current flow as

$$I_{sc} = \frac{V_{oc}}{6} = \frac{12V}{6} = 2A = I_{sc}$$



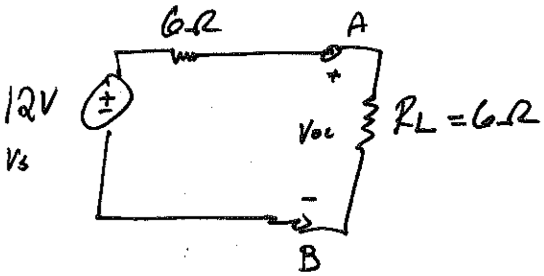
V_{oc}? Measuring V_{oc} from nodes A + B is the same as measuring the voltage across the 6Ω resistor (because in parallel)

$\therefore V_{oc} = 2A \cdot 6\Omega = 12V = V_{oc}$

$I_{sc} = ?$ put a short between A + B + measure current flow. All 2A will flow through wire.

$\therefore I_{sc} = 2A.$

See the source transformation / Norton + Thevenin equivalent!



V_{RL} is measured as ~~6~~ 6V

I_{RL} is measured as 1A

$$V_s \times \frac{R_L}{R_s+R_L} = 6V \Rightarrow V_s \times \frac{\cancel{6}}{6+R_s} = \cancel{6}$$

$$\cancel{V_{RL} = V_s \times \frac{R_L}{R_s+R_L}}$$

$$V_s = 6+R_s$$

$$\cancel{I_{RL} = \frac{V_s}{R_L+R_s}} =$$

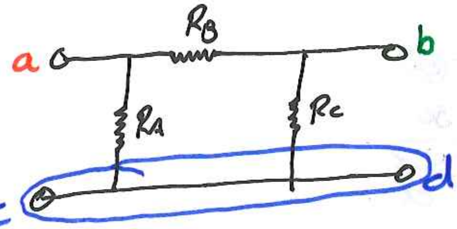
$$\cancel{I_{RL} = \frac{V_s}{R_s+R_L}}$$

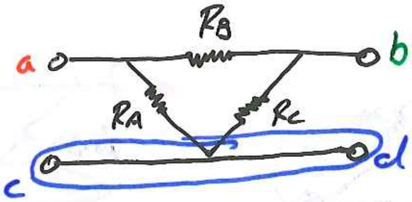
$$1A = \frac{6+R_s}{6+R_s}$$

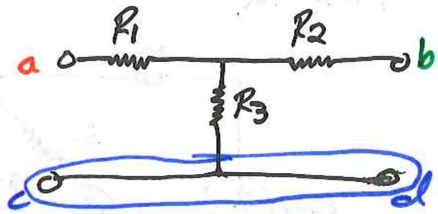
$$\cancel{\frac{6}{1} = V_s \times \frac{R_L}{R_s+R_L}}$$

① Remove load + find voltage across it to find V_{TH}
② set voltage source to 0V + find equivalent resistance from A to B.

Delta- WYE







WYE -to- Delta

$$R_A = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_2}$$

$$R_B = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_3}$$

$$R_B = \frac{R_1R_2 + R_2R_3 + R_3R_1}{R_1}$$

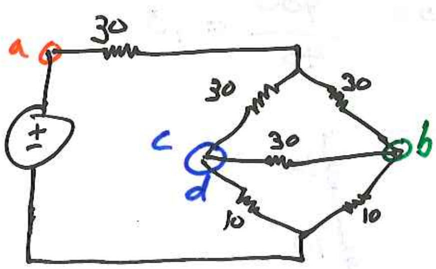
Delta -to- WYE

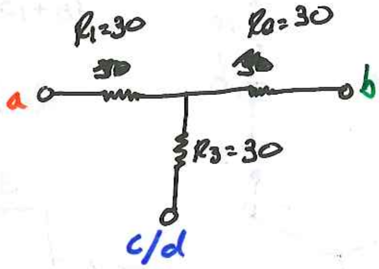
$$R_1 = \frac{R_A R_B}{R_A + R_B + R_C}$$

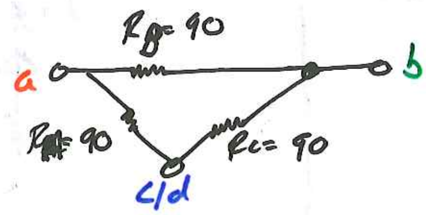
$$R_2 = \frac{R_B R_C}{R_A + R_B + R_C}$$

$$R_3 = \frac{R_A R_C}{R_A + R_B + R_C}$$

Exam 2- 22. Method 1





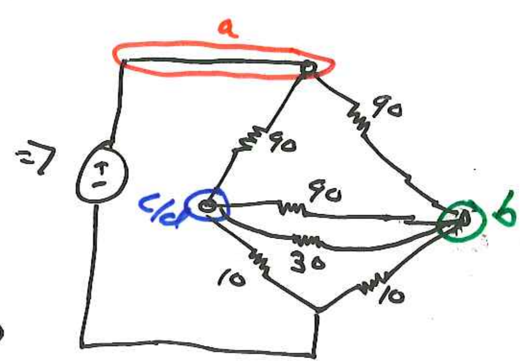


$$R_A = \frac{900 + 900 + 900}{30} = 90$$

$$R_B = \frac{900 + 900 + 900}{30} = 90$$

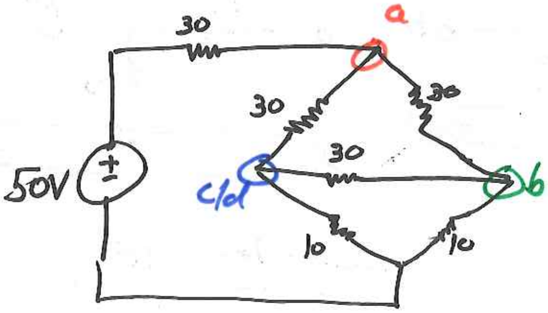
$$R_C = \frac{900 + 900 + 900}{30} = 90$$

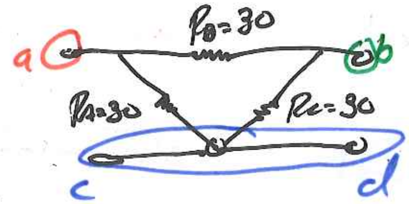
=>



Too complicated, too many steps!

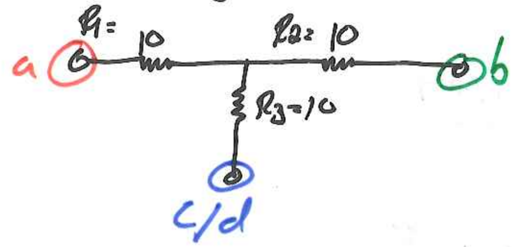
Method 2.



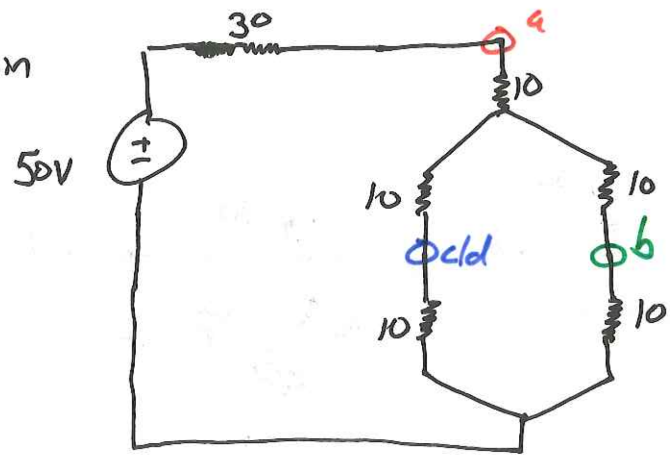


$R_1 = \frac{30^2}{90}$; $R_2 = \frac{30^2}{90}$; $R_3 = \frac{30^2}{90}$

$R_1 = R_2 = R_3 = 10\,\Omega$



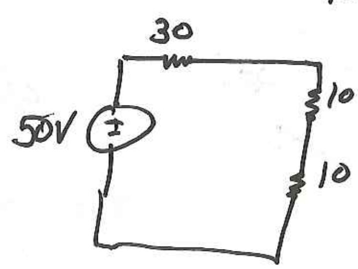
Resultant



$10 + 10 = 20$

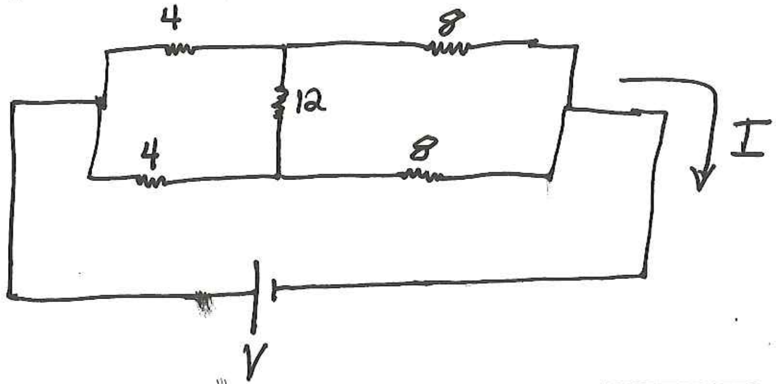
$10 + 10 = 20$

$20 \| 20 = \frac{400}{40} = 10$

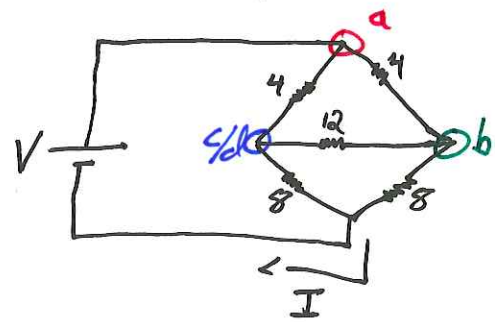


$R = 30 + 10 + 10 = 50$

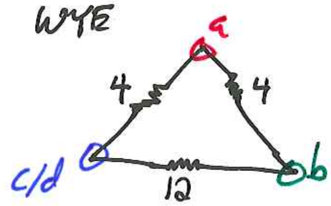
Example



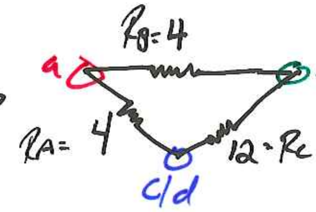
This circuit is Equivalent to:



Convert Delta to WYE



→ Rotate →

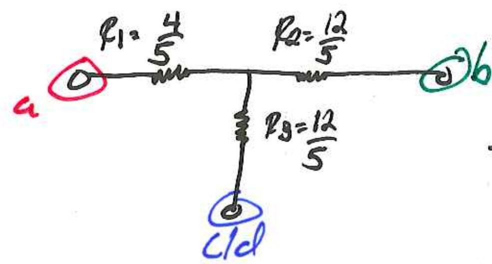


$$R_1 = \frac{(4)(4)}{20} = \frac{4}{5}$$

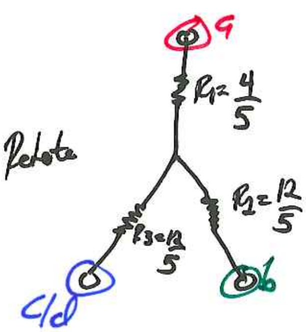
$$R_2 = \frac{(4)(12)}{20} = \frac{12}{5}$$

$$R_3 = \frac{(4)(12)}{20} = \frac{12}{5}$$

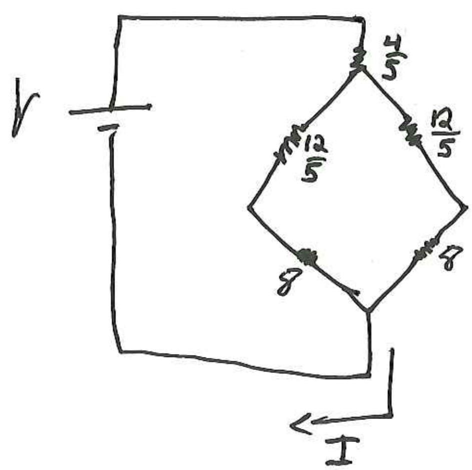
→



→ Rotate



connect this back to the circuit



$$\frac{12}{5} + 8 = \frac{52}{8} \quad ; \quad \frac{52}{8} \parallel \frac{52}{8} \cdot \frac{\left(\frac{52}{8}\right)\left(\frac{52}{8}\right)}{\frac{52}{8} + \frac{52}{8}}$$

$$= \frac{13}{4}$$

$$\frac{13}{4} + \frac{4}{5} = 4.05\,\Omega$$

$$\therefore \ I = \frac{V}{4.05\,\Omega}$$