Lecture 9 07/12/04

REVIEW

(1.) Midterm → Chap's 1-5

Skip : Mesh Analysis, all "Practical Perspectives"

No Δ-Y

(2) what does the midterm cover?

Midterm : 100 pts

→ You get x pts for writing name & SID

$x \leq 5$

(1) Nodal Analysis → solve circuit (only 2x2 system)

or Just set up equations

(2) Thevenin / Norton

(3) Solve circuit → any method

(Hard?) → (4) Op-Amp → Go through HW3 problems

5.17 or 5.18 are good practice!

Midterm is easier than HW

" " way ~~easy~~ easier than review

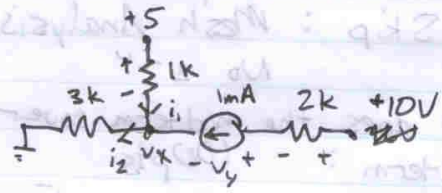
Cheat Sheet?

KCL, KVL, Ohm's Law, Power, Thevenin, Norton, Op-Amp

Steps to nodal analysis

Sample Problem

Find v_x:



Sol'n: DO NODAL

① Define reference ✓

② Label node voltages ✓

③ Write KCL @ each unknown node

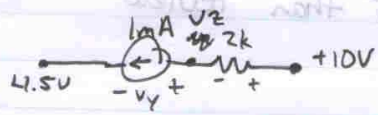
@ v_x $\quad 1mA + i_1 = i_2$

$$i_1 = \frac{5 - v_x}{1000} \qquad i_2 = \frac{v_x}{3000}$$

$$.001 + \frac{5 - v_x}{1000} = \frac{v_x}{3000} \Rightarrow 3 + 15 - 3v_x = v_x$$

$$4v_x = 18 \Rightarrow \boxed{v_x = 4.5V}$$

v_y:

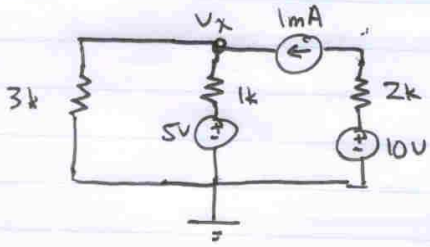


$$v_z = 10 - 2000(.001)$$
$$= 8V$$

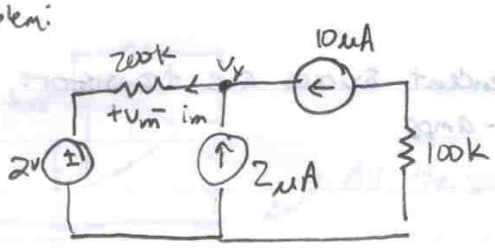
$$v_y = v_z - 4.5 = 8 - 4.5V$$

$$\boxed{v_y = 3.5V}$$

Redraw Circuit:



An easy problem:



KVL around loop 1

$$2 - v_m - v_y = 0$$

KCL @ v_y $\quad i_m = 10\mu A + 2\mu A = 12\mu A$

$$v_m = -i_m R$$
$$= -(12\mu A)(200k)$$
$$= -(1.2\times10^{-5})(2\times10^{5}\,\Omega)$$
$$= -2.4\,V$$

$$2 - v_m - v_y = 0$$
$$v_y = 2 - -2.4 \Rightarrow \boxed{v_y = 4.4\,V}$$

Review Problems

#9. How do you find V_{oc}?

Is there any independent source?

<u>NO</u> $\Rightarrow V_{oc} = 0$

Thevenin Equivalent is only a resistor

Send in a test voltage to find the equivalent resistance

In reality, dependent sources are transistors, no op-amps

Problem 5

$V_{ab} = -5$

$i = g_m v_x = \frac{v_x}{\left(\frac{1}{g_m}\right)}$ $\quad v_x = \frac{1}{g_m} i$ $\quad \frac{1}{g_m} \triangleq R$

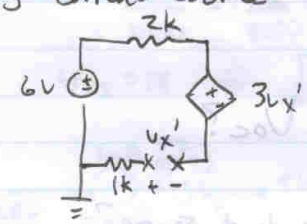
Problem 6: Current source = 2mA

Can we do superposition?

Golden Rule: DO NOT KILL DEPENDENT SOURCES

Using superposition:

Killing current source



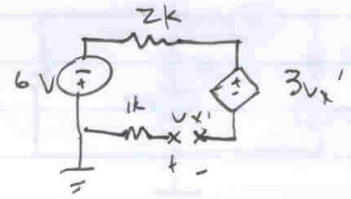
This is an open circuit

$\ominus$ $6 - 0 - 3v_x' + v_x' \rightarrow v_x' = 3V$

Then kill voltage, but return current source

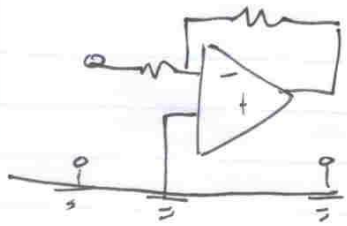
Trick: avoid superposition if you have several dependent sources

What if:



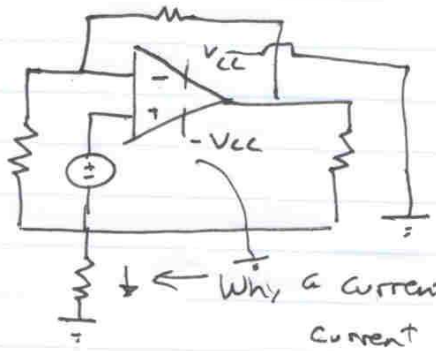
is there a current from voltage source to ground? No

→ Still not a complete loop



All the same ground

5.15 from book



Why a current here if no actual current goes to the ground?

Because power supplies also grounded
– current travels back

Voltage polarity across a current source