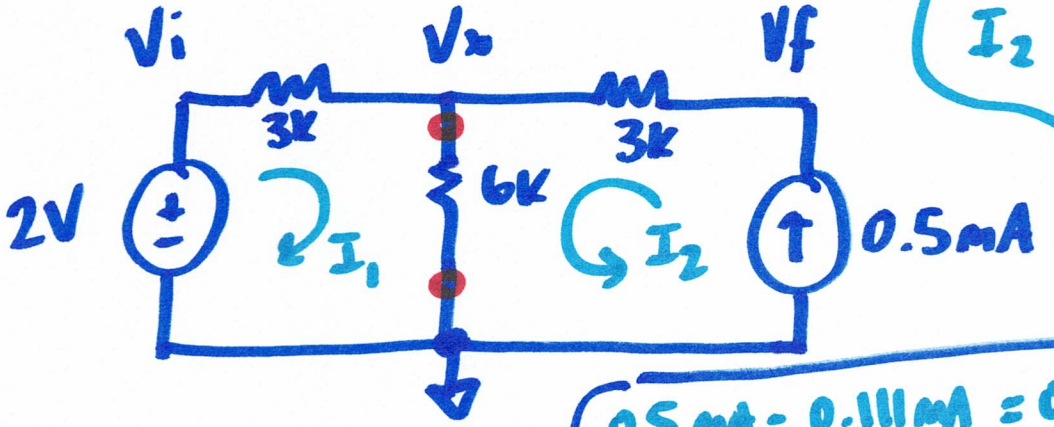
EE 220: Circuits I [Exam Review 1]

- Thevenin & Norton examples ✓
- mesh analysis / superposition ✓
- AC steady state analysis (phasor problems)
- Dependent sources ✓
- charge sharing ✓
- caps (DC open) & inductors (DC short)
- AC signals (sinusoids)

QB



I_1: $2V - I_1 \cdot 3K - (I_1 + 0.5mA) \cdot 6K = 0$

$I_2 = 0.5mA$

$2V - I_1 \cdot 9K - 3V = 0$

$-1V = +I_1 \cdot 9K$

$I_1 = \frac{1V}{9K} = -0.111mA$

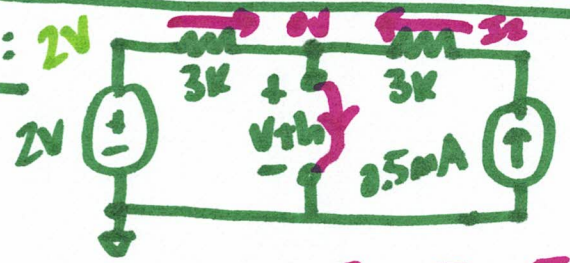
$0.5mA - 0.111mA = 0.339mA$

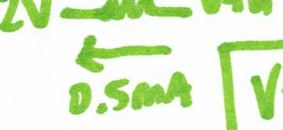
$V_x = (I_1 + I_2) \cdot 6K = \cancel{0.611mA} \cdot 6K$

$\therefore V_x = \cancel{3.66V}$ ✓ wrong!! use spice!!

$V_x = 2.33V$

Finding Vth: 2V

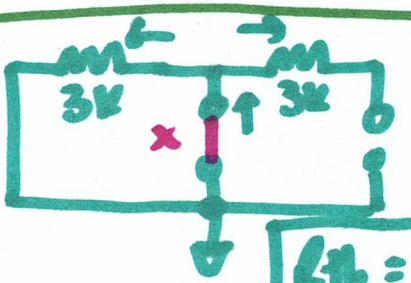




$Vth = 3.5V$

$I_1 + I_2 = I_{sc} = I_N$

Finding Rth:



$Rth = 3K$

Finding I_N:

$$I_N = \frac{Vth}{Rth} = \frac{3.5V}{3K} = 1.166mA = I_N$$

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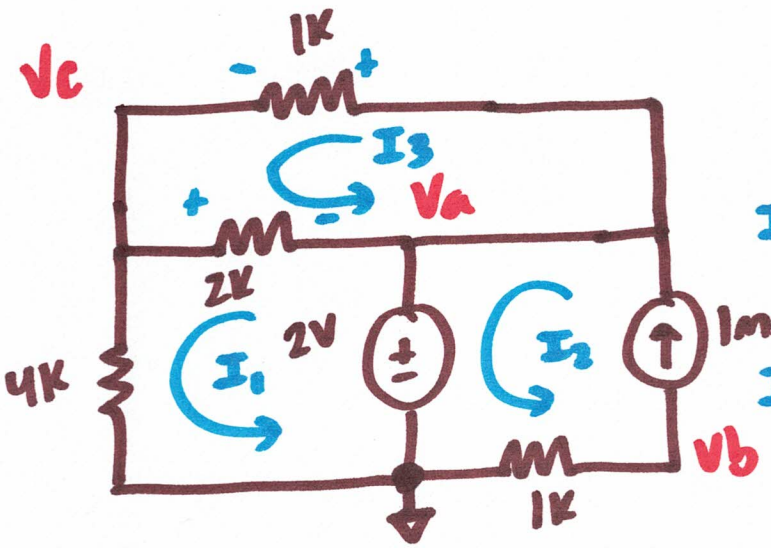
MT_P3

$V_{c1} + V_{c2} = V_c$



$I_2 = 1mA$

I_3: $-I_3 \cdot 1K - (I_3 - I_1) \cdot 2K = 0$

I_1: $2V - (I_1 - I_3) \cdot 2K - I_1 \cdot 4K = 0$

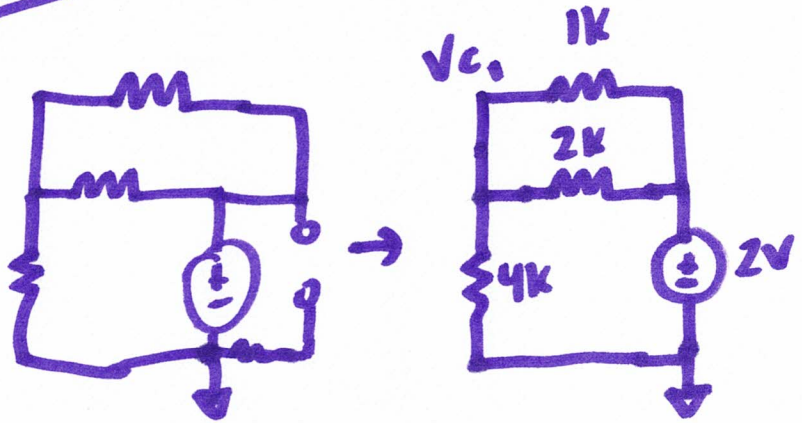
$\vdots$

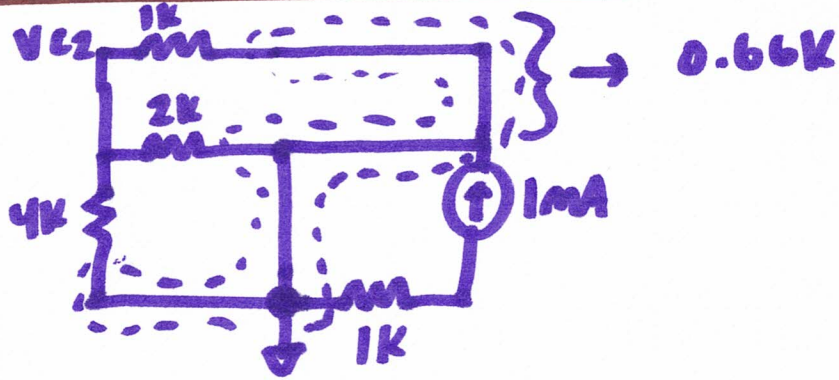
$I_1 = \text{something} \cdot I_3$

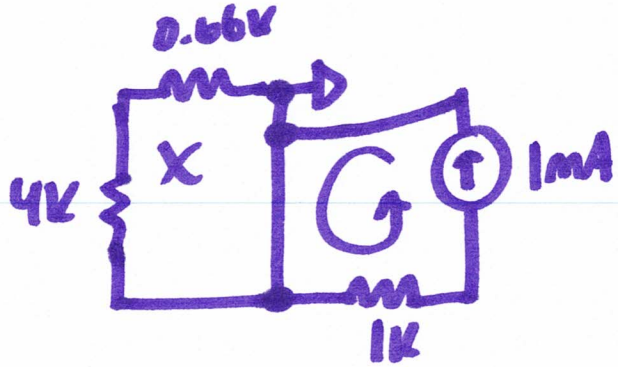
Mesh

Superposition

$2V\left(\frac{4K}{0.66K + 4K}\right) = V_{c1}$







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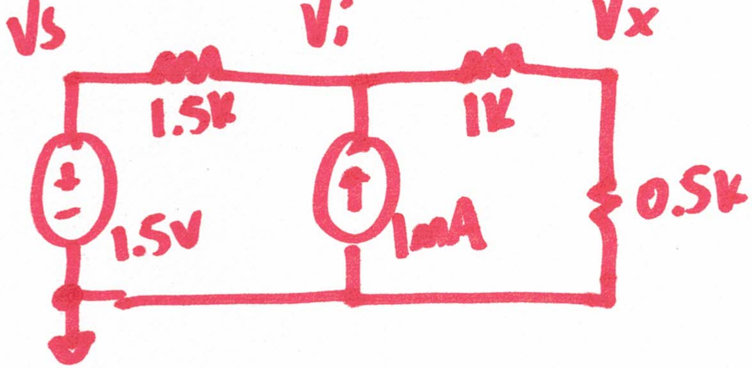
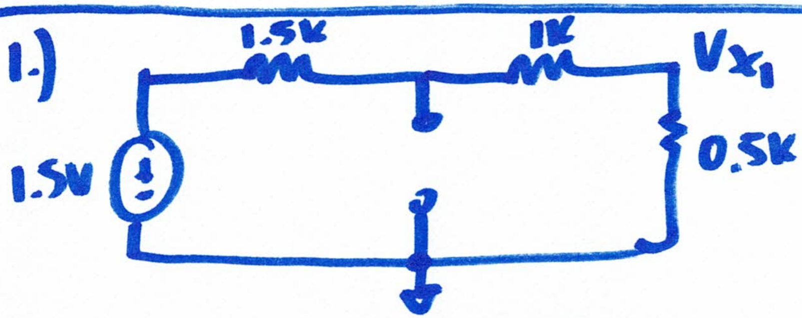
Baker F17 MT P.2



$$V_x = V_{x_1} + V_{x_2}$$

$$V_x = \underline{0.25} + \underline{0.25} = 0.5V$$

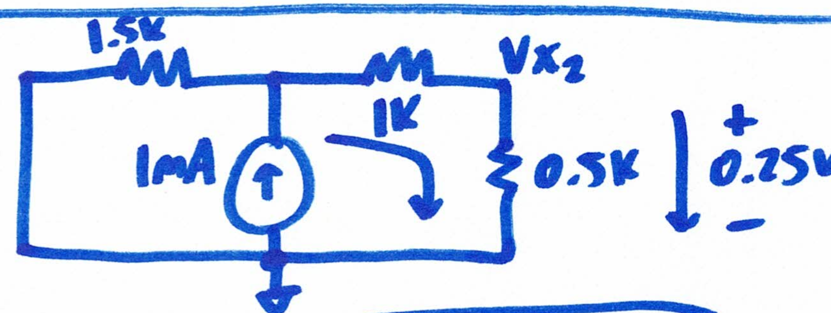
1.)



$$V_{x_1} = 1.5V\left(\frac{0.5K}{2.5K + 0.5K}\right) = 1.5V\left(\frac{1}{6}\right)$$

$$V_{x_1} = 0.25V$$

2.)



$$V_{x_2} = 0.25V$$

$$V_x = 0.25 + 0.25 = 0.5V$$

Dependent Sources

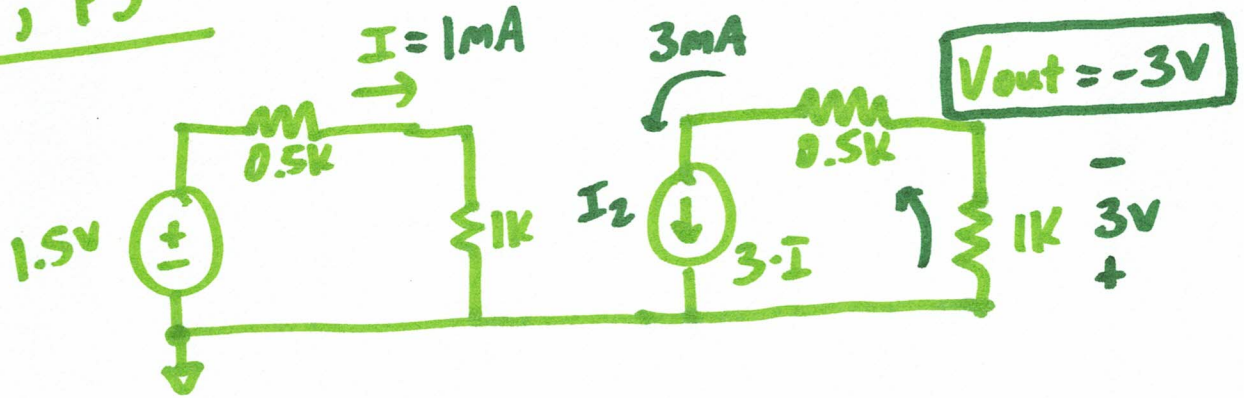
CCVS → current controlled voltage source

CCCS → current controlled current source

VCVS → voltage controlled voltage source

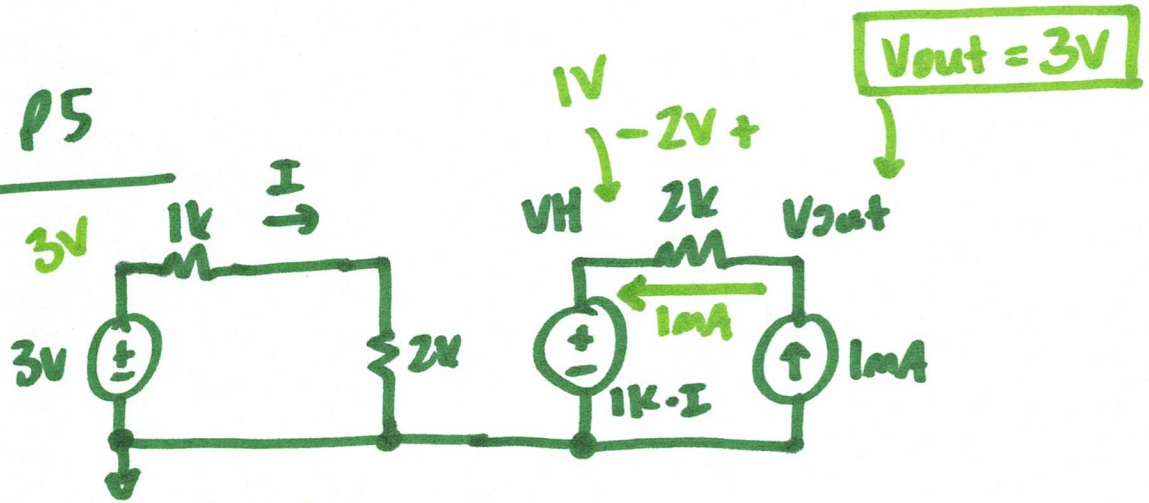
VCCS → voltage controlled current source

Baker F17 MT, P5



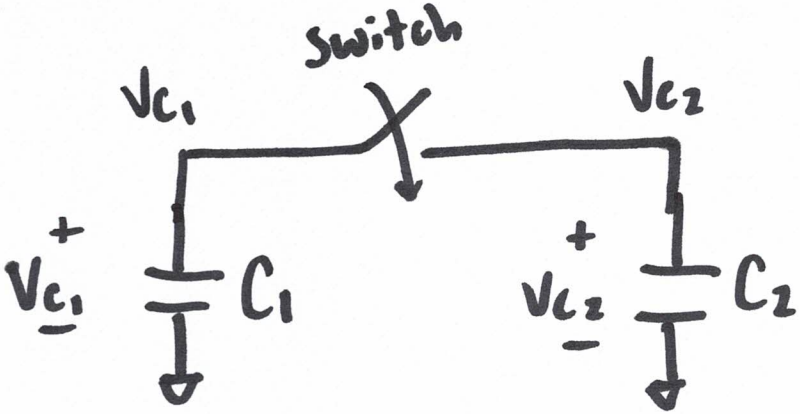
$$I = \frac{1.5V}{1.5k} = 1mA$$

Baker F16 MT, P5



$$I = \frac{3V}{3k} = 1mA$$

~~Yellow~~ Charge Sharing



$$C_{new} = C_1 + C_2$$

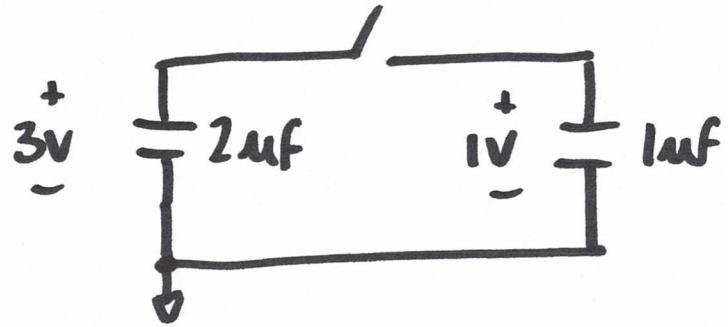
$$V_{new} = \frac{Q_{TOT}}{C_1 + C_2}$$

$$Q_1 = C_1 V_{C_1} \qquad Q_2 = C_2 \cdot V_{C_2}$$

$$C \cdot V = Q$$

$$V = \frac{Q}{C}$$

$$Q_{TOT} = Q_1 + Q_2$$



$Q_{TOT} = 7\mu C$

$C_F = 3\mu F$

$Q_1 = 3V \cdot 2\mu F = 6\mu C$ $\qquad$ $Q_2 = 1V \cdot 1\mu F = 1\mu C$

$$C_F \cdot V_F = Q_{TOT} \rightarrow V_F = \frac{Q_{TOT}}{C_F} = \frac{7\mu C}{3\mu F}$$

$V_F = 2.33\,V$

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