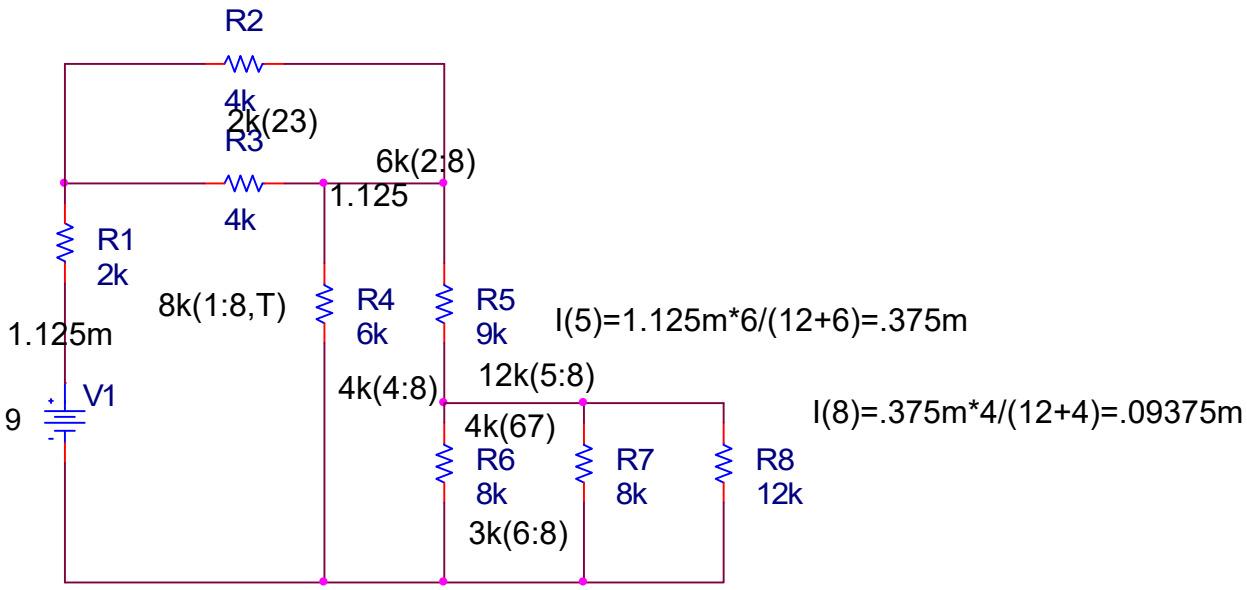
Hayden Fuller

1) Equivalent Circuits/Circuit Reduction



In the above circuit determine:

a. The equivalent resisance seen by the voltage source.

8k

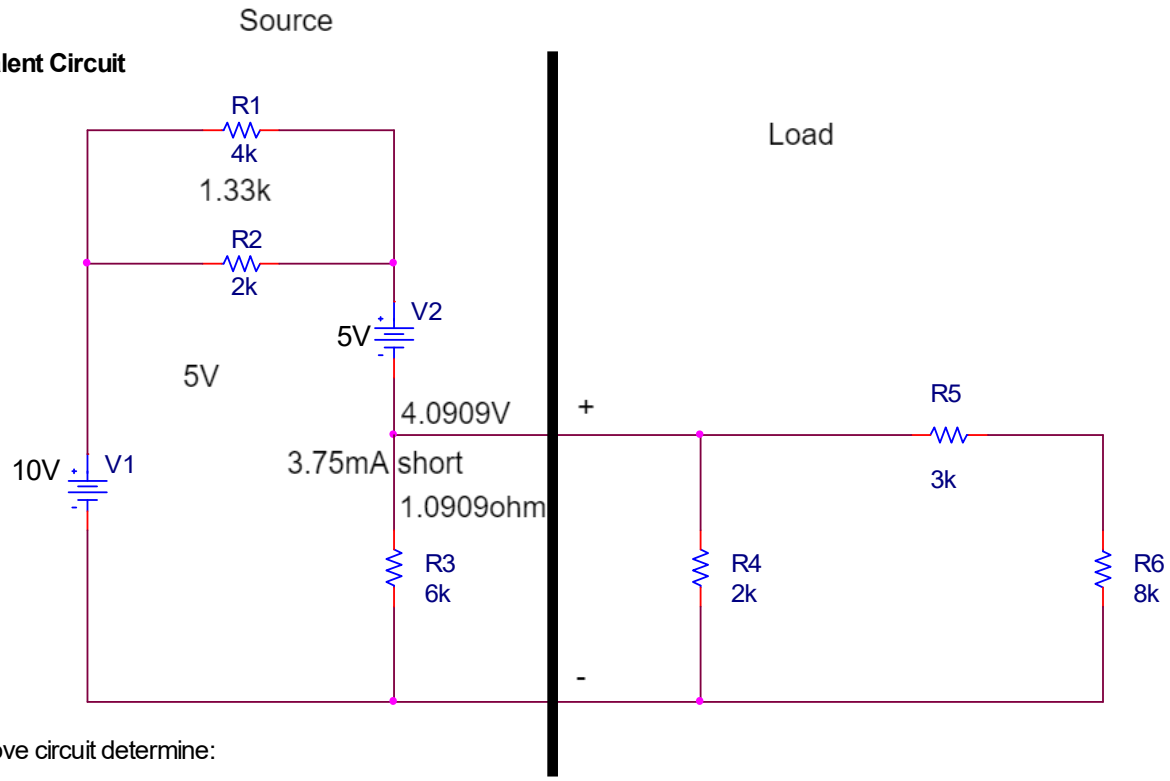
b. Find the current through the voltage source.

9=8k*I ; I=9/8k=1.125mA

c. Find the current through resistor R8.

0.09375mA

2) Equivalent Circuit



In the above circuit determine:

a. An equivalent source (a single voltage source)

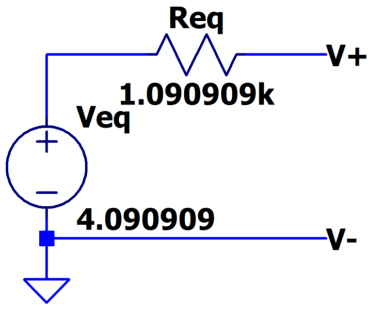
V_source=4.090909V, R_source=1.090909kohm

b. The equivalent resistance seen by the combined voltage source

R_load=(2k^-1+(3k+8k)^-1)^-1=1.6923kohm

c. The current through the voltage souce, V1

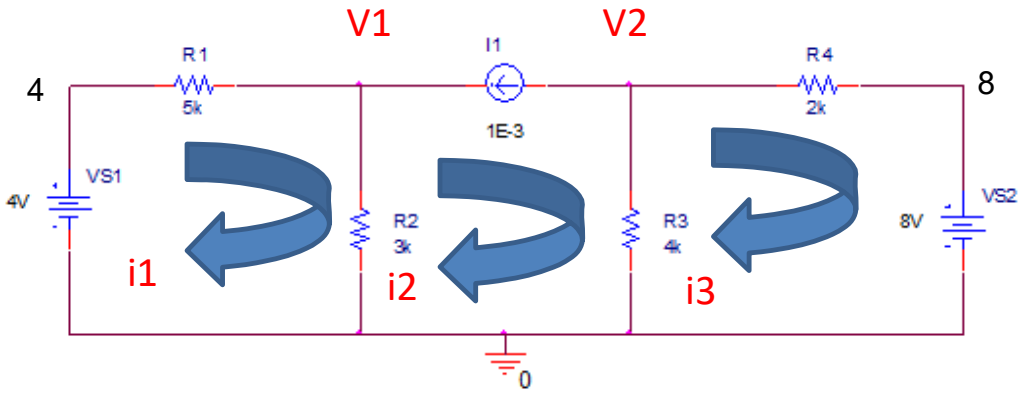
V_eqSource=I*(R_eqSource+R_load), 4.09=I*(1.09k+1.69k), I=1.4698mA



d. The current through the resistor R6

I_t=4.09/(1.09k+1.69k)=1.469mA
I=I_t*2k/(2k+11k)=.2261mA
I(R6)=0.2261

3) Node/Mesh Analysis



a. Apply node analysis to determine V1 and V2

b. Apply mesh analysis to determine i1, i2, and i3

all currents flow down or left, positive voltage on top or right
KCL: in is -, out is +
KVL: going cw, based on where you enter

a)
V1: I(R1)+I(R2)-.001=0
V2: .001+I(R3)-I(R4)=0
i1: -4-V(R1)+V(R2)=0
i3: -V(R3)-V(R4)+8

V1: I(R1)+I(R2)-.001=0
V2: .001+I(R3)-I(R4)=0
i1: -4-5000*I(R1)+3000*I(R2)=0
i3: -4000*I(R3)-2000*I(R4)+8=0

R1: I=-0.125mA V=-0.625
R2: I=1.125mA V=3.375
R3: I=1mA V=4
R4: I=2mA V=4

V1=3.375
V2=4

b)
i1: -4-V(R1)+V(R2)=0
i2: i2=-.001
i3: -V(R3)-V(R4)+8=0

i1: -4-5000*I(R1)+3000*I(R2)=0
i2: i2=-.001
i3: -4000*I(R3)-2000*I(R4)+8=0

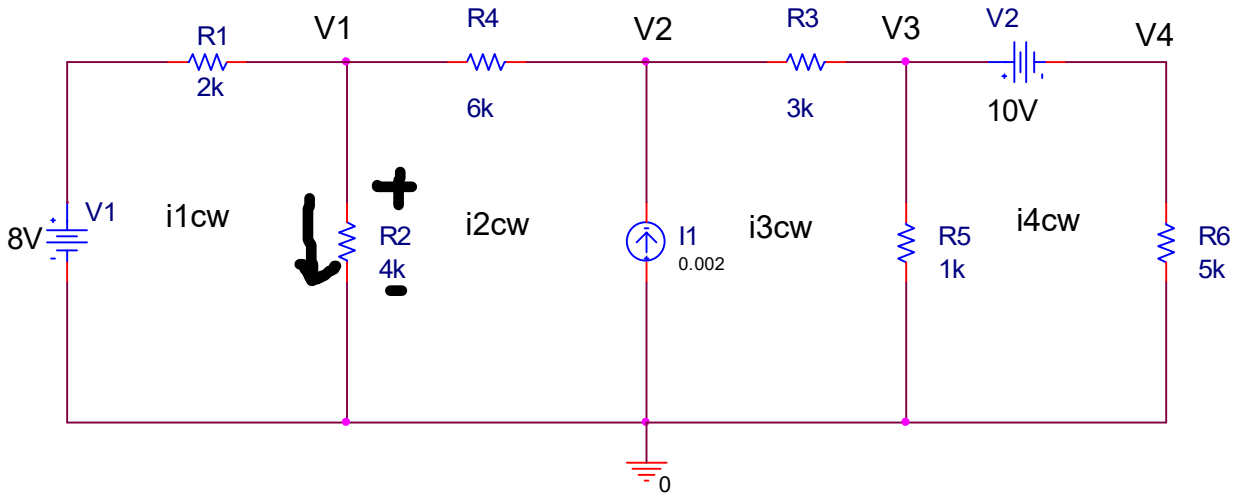
i1: -4-5000*(-i1)+3000*(i1-i2)=0
i2: i2=-.001
i3: -4000*(i2-i3)-2000*(-i3)+8=0

i1: 8000*i1-3000*i2=4
i2: i2=-.001
i3: -4000*i2+6000*i3=-8

i1=0.125mA
i2=-1mA
i3=-2mA

all currents flow down or left, positive voltage on top or right
KCL: in is -, out is +
KVL: going cw, based on where you enter

4) Superposition



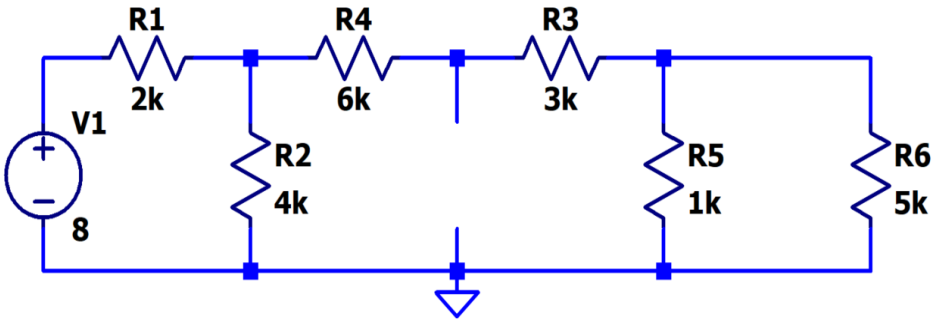
a. Use any method to determine the voltage across R2 (node, mesh, circuit reduction, source transformation...)

VR2=5.811

b. Find VR2 using superposition. *(For each source, draw the schematic).*

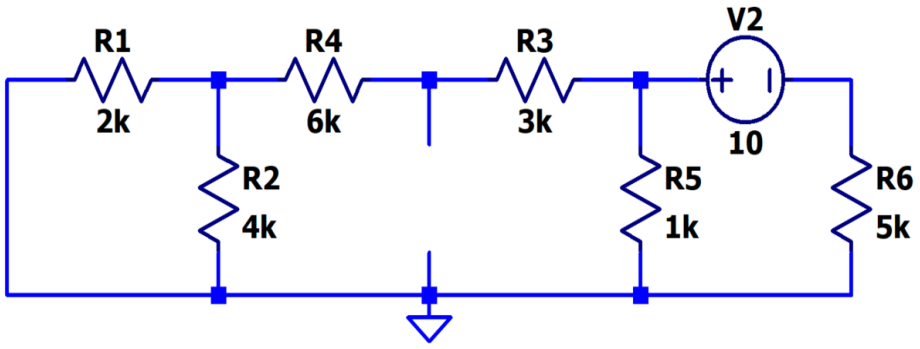
VR2_total=5.8109

nodal:
V1: I(R1)+I(R2)-I(R4)=0
V2: I(R4)+(-.002)-I(R3)=0
V34: I(R3)+I(R5)+I(R6)=0
i1: -8-V(R1)+V(R2)=0
i4: -V(R5)+10+V(R6)=0
i1-4: -8-V(R1)-V(R4)-V(R3)+10+V(R6)=0

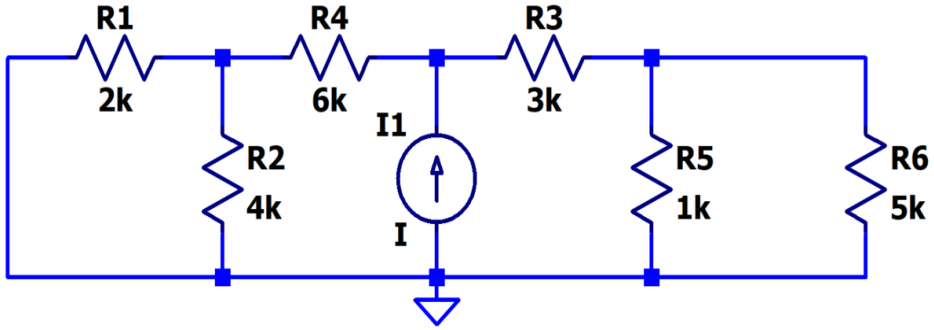


V1: I(R1)+I(R2)-I(R4)=0
V2: I(R4)-I(R3)=.002
V34: I(R3)+I(R5)+I(R6)=0
i1: -2000*I(R1)+4000*I(R2)=8
i4: -1000*I(R5)+5000*I(R6)=-10
i1-4: -2000*I(R1)-6000*I(R4)-3000*I(R3)+5000*I(R6)=-2

R1: I=-1.095mA V=-2.189
R2: I=1.453mA V=5.811
R3: I=-1.642mA V=-4.925
R4: I=0.358mA V=2.149
R5: I=3.035mA V=3.035
R6: I=-1.393mA V=-6.965



V(R2)=5.811 (again, positive on top)



superposition on next page

V1: R56=0.833k, R3-6=9.833k, R2-6=2.843k, R1-6=4.843k, I=8/4.843k=1.6517m,
V(R1)=1.6517m*2k=3.3035 V(R2)=8-3.3035=4.6965V
V2: R12=1.33k, R14=10.33k, R15=0.912k, R16=5.912k, Iv=1.69, I34=0.149, I2=0.0497m, V(R2)=0.199005V
I1: R12=1.33k, R124=7.33k, R356=3.833k, I4=0.68m, I2=0.2288557m, V(R2)=0.915423
V(R2)_total=5.8109453V