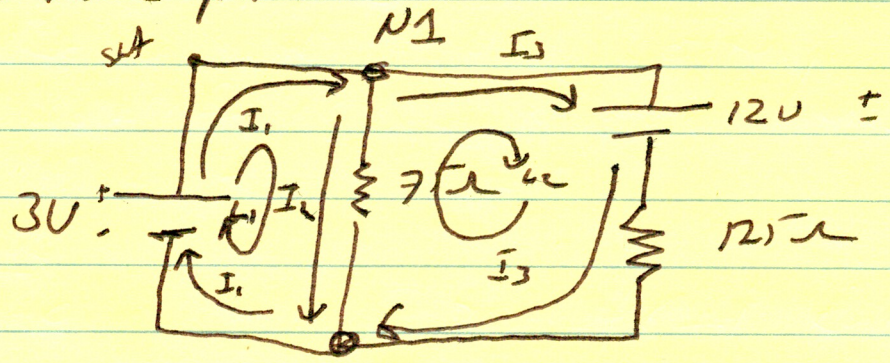
- Need to use with multiple batteries
- Use when can't solve for Equivalent resistance

Make sure students see videos on eboard

3/5/17

Kirchoff's Loop Rule



(1) Identify the nodes (N_1 & N_2) we use conventional current: +flow
(2) Identify Direction of Current - Direction of the current is arbitrary
If you get a positive Ans. for the current, you chose the right direction
If you get a negative Ans for the current, the current is following in the opposite direction
(3) Need to make a Voltage loop
(Arbitrary Also)
(4) Apply current rule into the Junction $\Sigma I = 0$
(same as cons. of Charge)
Sum of Current Entering Node is equal to sum of Current leaving node

$I_1 = +$ Out $= -$

N_1: $I_1 - I_2 - I_3 = 0$

$I_1 = I_2 + I_3$

N_2: $I_2 + I_3 - I_1 = 0$

$I_1 = I_2 + I_3$

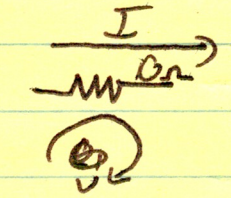
Same Eqn only need 1

$v = IR$

5. Voltage Rule (Apply to Each loop) & Ohms Law
Sum of the Voltages across elements in the loop is equal to zero $\Sigma V = 0$

$v=IR$ ★ Voltage with current Ya get a Voltage Drop (−)

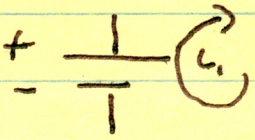
$-10I$ Pot. Decrease



− V & I same Dir (−Ans)

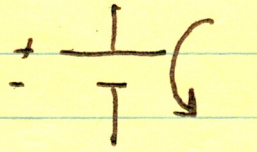
Ex

$+5V$ pot. Gain



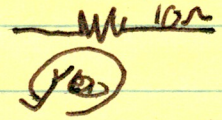
: Neg to Pos. terminal ⊕ Voltage gain (+Ans)

$-5V$ pot. Decr



: Pos. to Neg terminal ⊖ Voltage loss (−Ans)

$V=IR$ $+10I$ gain Energy



Voltage & Current opposite Directions
Voltage Gain (+Ans)

$U = qV$

$v=IR$

L_1: $-75I_2 + 3V = 0$

$-75I_2 + 3 = 0$

$-75I_2 = -3$

L_2: $-12V \oplus 12\Omega I_3 + 7\Omega I_2 = 0$

$-12 \oplus 12\Omega I_3 + 7\Omega I_2 = 0$

$12\Omega I_3 + 7\Omega I_2 = 12$

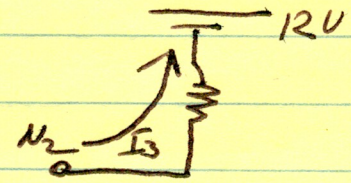
(6) Solve the 3 Eqns

N_1: $I_1 = I_2 + I_3$

L_1: $-75I_2 + 3 = 0$

L_2: ~~$-120I_3 + 45$~~ $-12 + 125I_3 + 75I_2 = 0$

L_1: $\frac{3}{75} = \frac{75I_2}{75}$ $\quad \boxed{I_2 = 0.04A}$



L_2: $-12 - 125I_3 + 75I_2 = 0$

$-12 - 125I_3 + 75(0.04A) = 0$

$-12 - 125I_3 + 3 = 0$

$I_3 = \frac{12-3}{-125} = -0.072A$

~~$I_3 = -0.072A$~~

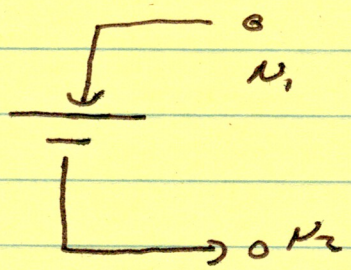
$\boxed{I_3 = -.072A}$

- Magnitude of Current is .072A
- We chose neg dir for I_3
- Doesn't mean anything

N_1: $I_1 = I_2 + I_3$

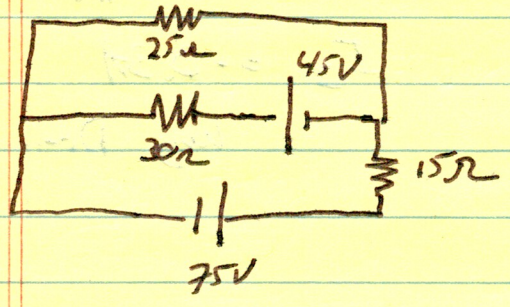
$0.04A - 0.072A$

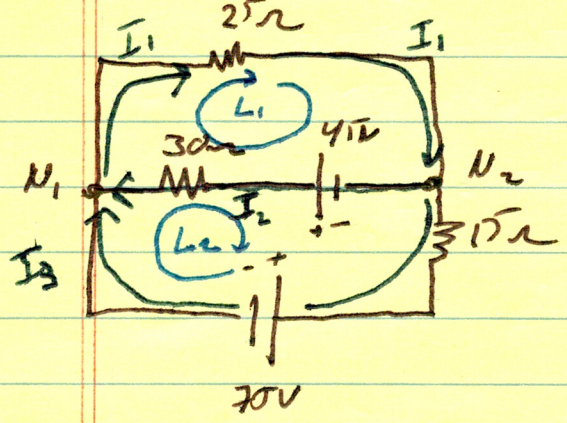
$\boxed{I_1 = -0.032A}$



Ex. #2

Find the curr & Direct of Curr on the 3 branches of the circuit:





① Id Nodes

② Id Dir. of Curr fr each Branch

③ Curr Rule @ Nodes

Sum of curr Entr = Sum of Curr Leave

N_1: $I_2 + I_3 - I_1 = 0$

$I_1 = I_2 + I_3$

N_2: $I_1 - I_2 - I_3 = 0$] Don't Need to do N_1

$I_1 = I_2 + I_3$

④ Volt Loops w/ this Law $V = IR$

Start at N_1

L_1 $-25I_1 + 45 - 30I_2 = 0$

L_2 $30I_2 - 45 - 15I_3 - 75 = 0$

L_1 Solve for I_1 $-25I_1 = -45 + 30I_2$

$I_1 = 1.8 - 1.2I_2$

L_2 $30I_2 - 45 - 15I_3 - 75 = 0$

$-15I_3 = 120 - 30I_2$

$I_3 = -8 + 2I_2$

N_1: $I_1 = I_2 + I_3$ or $I_2 = I_1 - I_3$

$I_2 = 1.8 - 1.2I_2 - (-8 + 2I_2)$

$1.8 - 1.2I_2 + 8 - 2I_2$

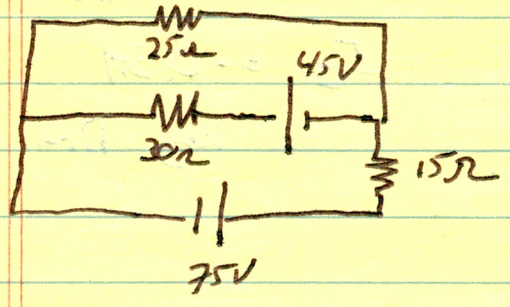
$I_2 = 9.8 - 3.2I_2$

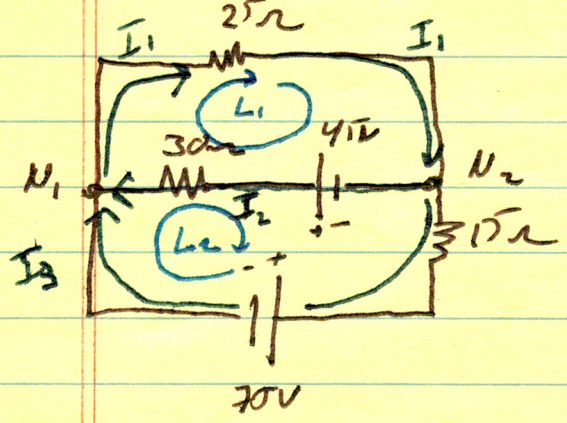
$4.2I_2 = 9.8$

$\boxed{I_2 = 2.3A}$

Ex. #2

Find the curr & Direct of Curr on the 3 branches of the circuit:





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$I_1 = 1.8 - 1.2I_2$

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$-15I_3 = 120 - 30I_2$

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N_1: $I_1 = I_2 + I_3$ or $I_2 = I_1 - I_3$

$I_2 = 1.8 - 1.2I_2 - (-8 + 2I_2)$

$1.8 - 1.2I_2 + 8 - 2I_2$

$I_2 = 9.8 - 3.2I_2$

$4.2I_2 = 9.8$

$\boxed{I_2 = 2.3A}$