Th 4th week

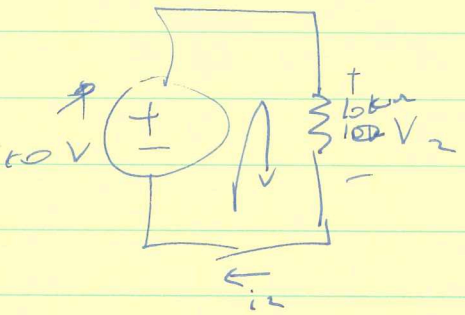
~~This is 2nd week~~

KCL $\sum_{n=1}^{N} i_n = 0$ node

KVL $\sum_{n=1}^{M} v_n = 0$ Loop v_n = voltage drop

~~As you go around loop~~ if

e.g. $\rightarrow i_1$



2 nodes ~~V_2 10~~

KVL $-10V + V_2 = 0$

$\Rightarrow V_2 = 10V$

KCL $\Rightarrow i_1 = i_2$

Ohm's law $V_2 = i_2 R \Rightarrow i_2 = \frac{10V}{10k\Omega} = 1mA$

Done. Know I, V everywhere.

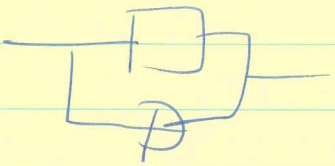
Absolute V vs relative?

Stands for any circuit element (Resistor or source)

2 circuit elements connected like this

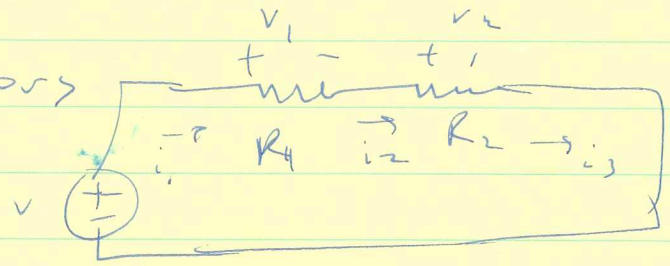
are said to be in series.

2 circuit elements connected like this



are said to be in parallel.

Series resistors



$i_1 = i_2 = i_3$ call i

$V_1 = iR_1$

$V_2 = iR_2$

$-V + V_1 + V_2 = 0$ Level

R_1 R_2 V knowns

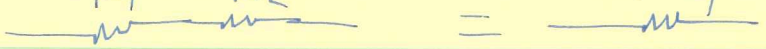
i V_1 V_2 not known.

3 eqns, 3 unknown. general theorem

linear algebra

$$i = \frac{V}{R_1 + R_2}$$

$$R_{eq} = R_1 + R_2$$

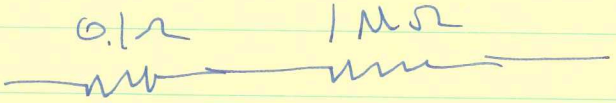
$\Rightarrow$ 

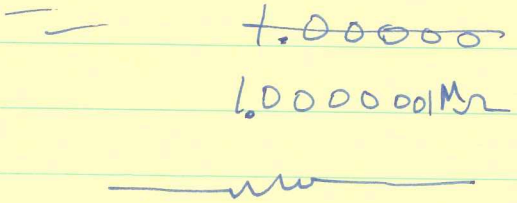
N resistors in series $R_{eq} = \sum_n R_n$

Analog voltage divider.

Elaborate

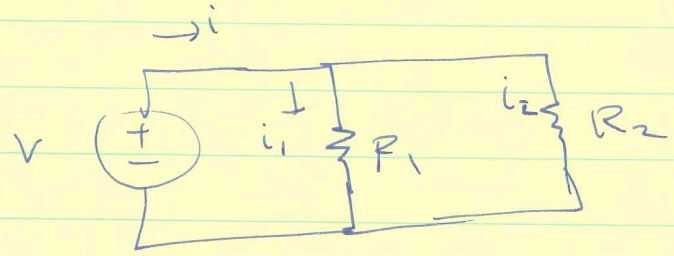
Very important example





Be reasonable. Ignore 0.1Ω

Parallel resistors



$$V = i_1 R_1 = i_2 R_2$$

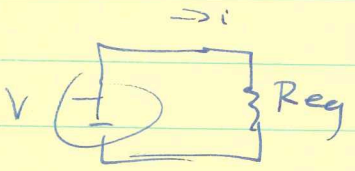
$$i_1 = V/R_1 = V/R_2$$

KCL $\Rightarrow$ $i = i_1 + i_2$

$$i = \frac{V}{R_1} + \frac{V}{R_2} = V\left(\frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{V}{R_{eq}}$$

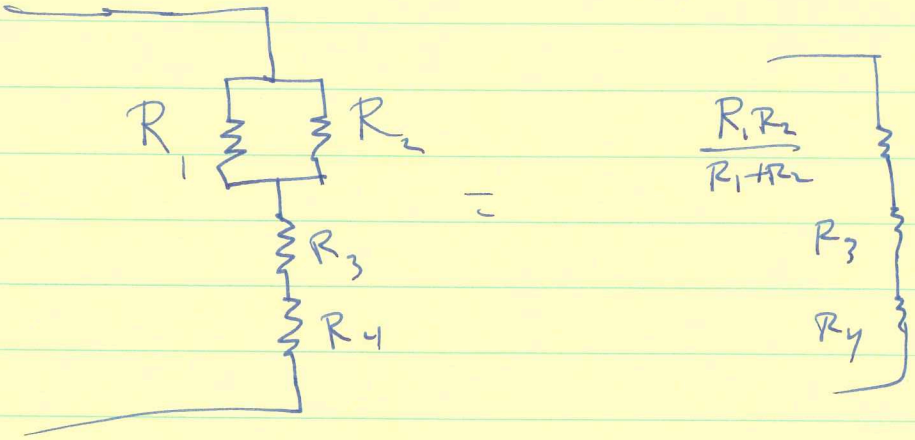
$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} \iff R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$$

N in parallel $\quad \frac{1}{R_{eq}} = \sum_n \frac{1}{R_n}$

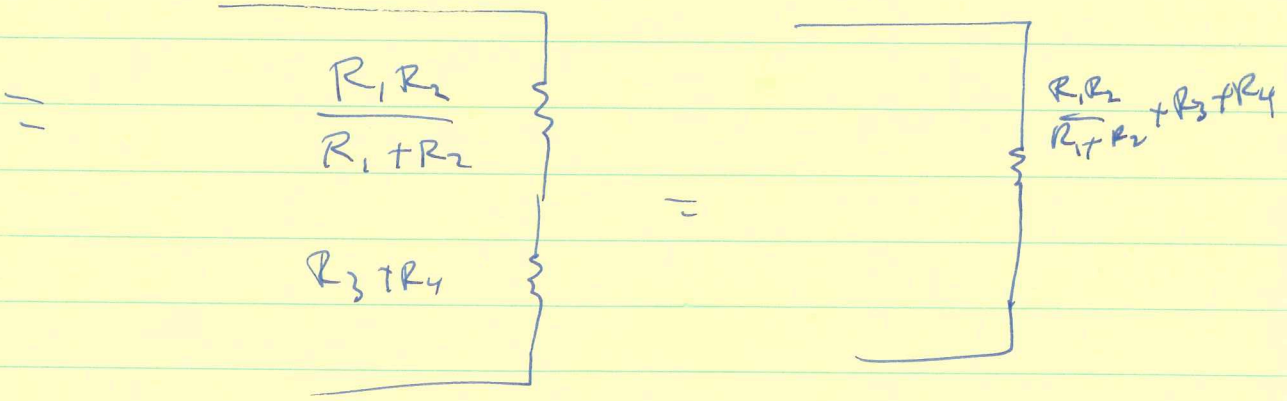


$R_1 \| R_2$ means
R_1 in parallel with R_2

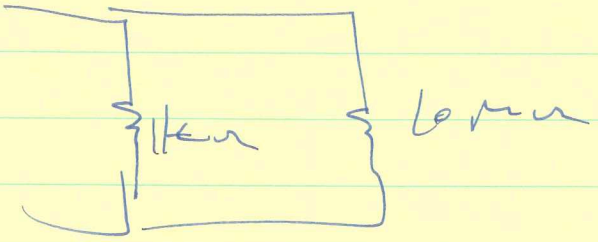
eg.



What is R_{eq}?



Important example



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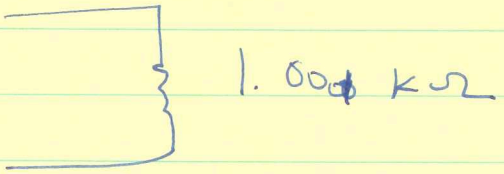
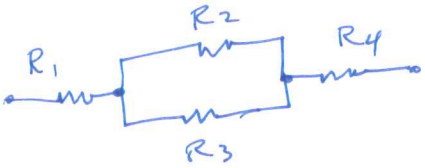
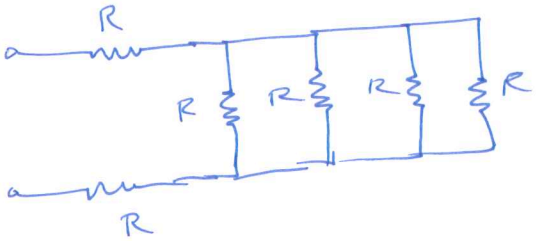


be reasonable. Ignore 10 Ω.

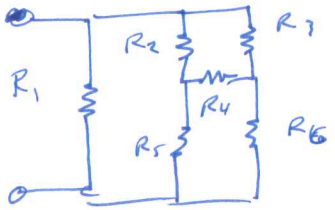
Eg.



$R_{eq} = ?$



$R_{eq} = ?$



$R_{eq} = ?$

Tease:

$R_{ab} = ?$