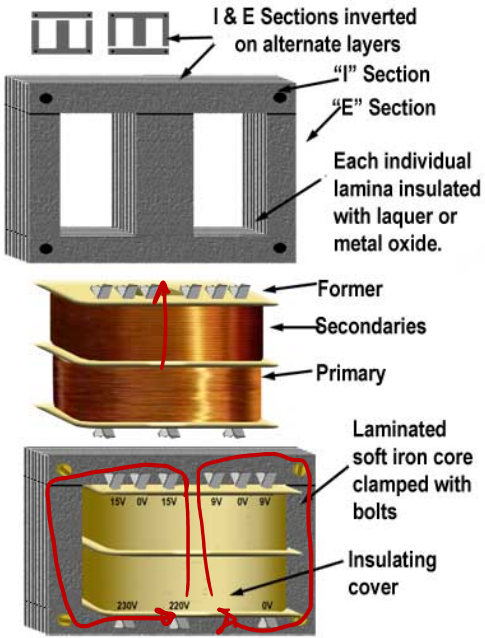
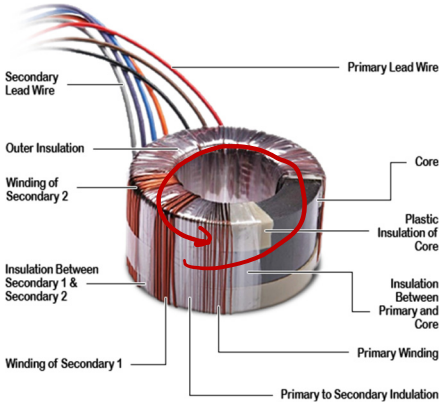
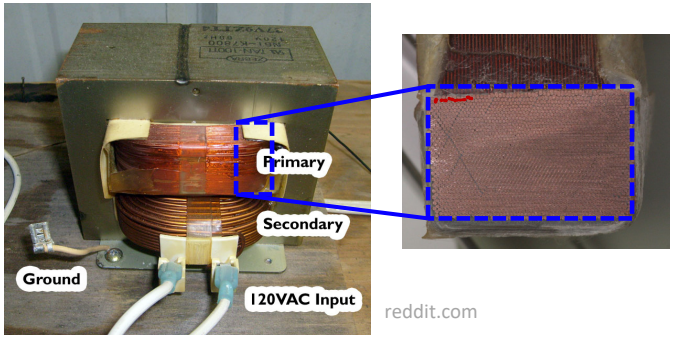
Example Transformer



http://www.learnabout-electronics.org/ac_theory/transformers03.php



https://www.altrancorp.com/products/toroidal-power-transformers/



reddit.com

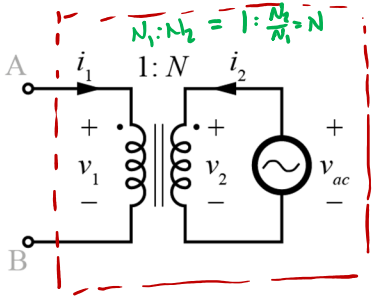
Transformer Reflection

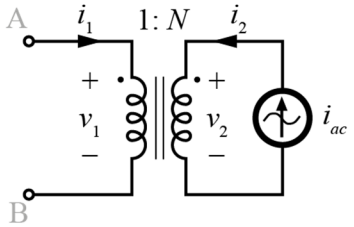
$\frac{v_1}{1} = \frac{v_2}{N}$

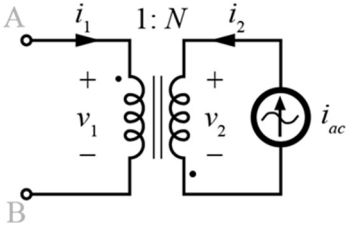
$1 i_1 + N i_2 = \phi$

$v_1 = \frac{v_2}{N}$

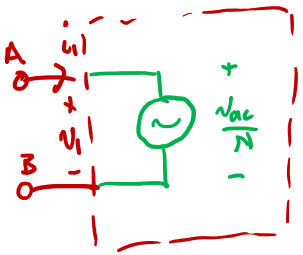
$i_1 = -N i_2$



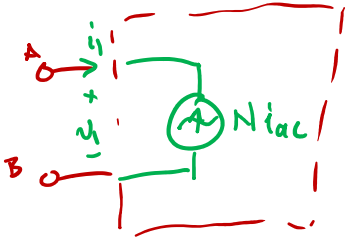




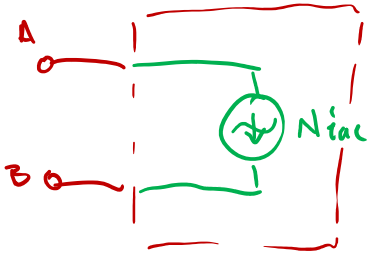
equivalent circuit @ primary



$v_1 = \frac{v_2}{N}$

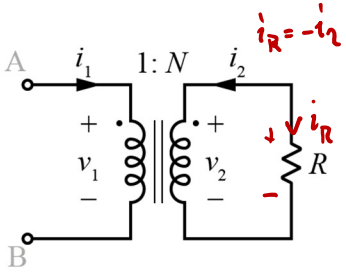


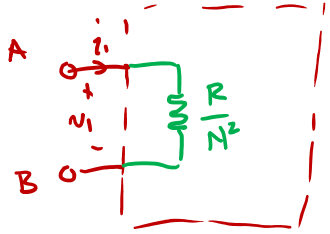
$i_1 = -N i_2$



$v_1 = \frac{v_2}{N}$

$i_1 = -N i_2$

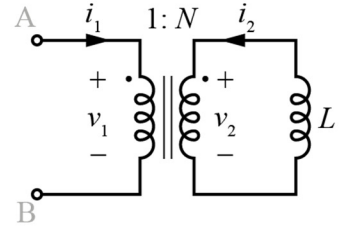


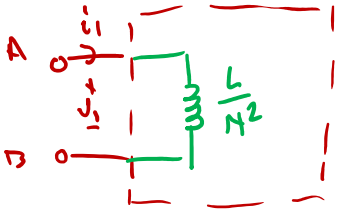


$v_2 = (-i_2) R$

$N v_1 = \left(\frac{1}{N}\right) i_1 R$

$v_1 = \left(\frac{1}{N^2} R\right) i_1$

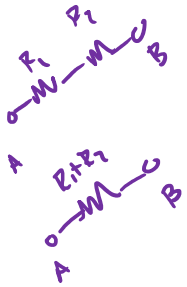


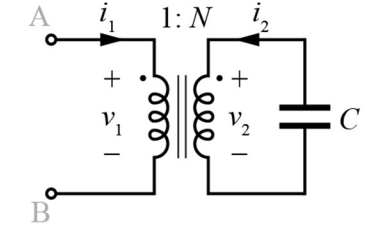


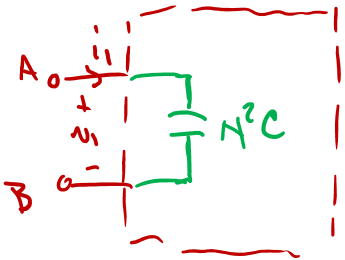
$v_2 = L \frac{d(-i_2)}{dt}$

$N v_1 = L \frac{d}{dt}\left(\frac{1}{N} i_1\right)$

$v_1 = \frac{1}{N^2} L \frac{di_1}{dt}$





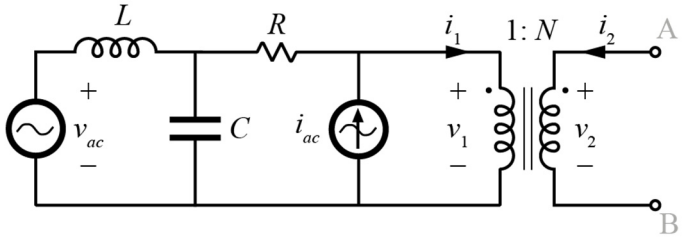


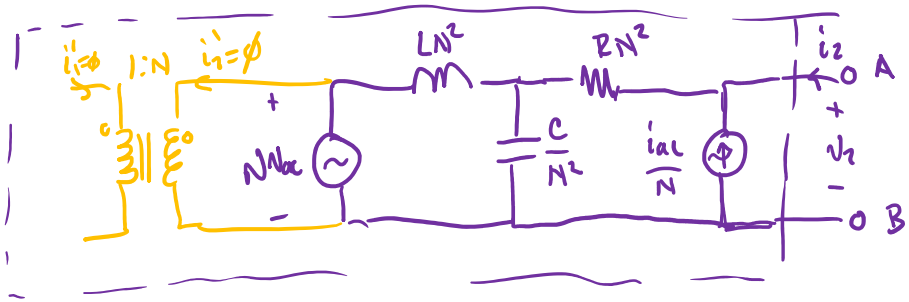
$-i_2 = C \frac{dv_2}{dt}$

$\frac{1}{N} i_1 = C \frac{d}{dt} N v_1$

$i_1 = N^2 C \frac{dv_1}{dt}$

Example Circuit Simplification

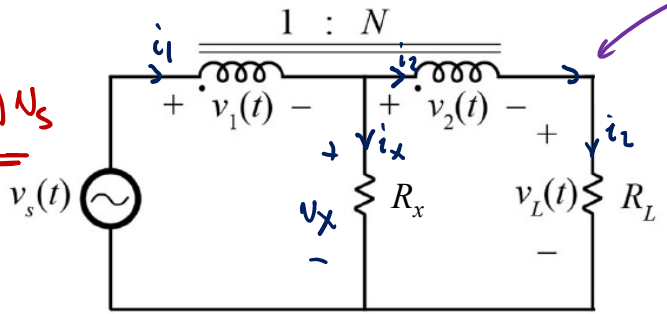




Ideal Transformer Example

Autotransformer (variac)

$v_L = f(N, R_L, R_x) v_s$



solve for $v_L(t)$

Transformer equations

$$v_1 = \frac{v_2}{N}$$

$$i_1 = -N i_2$$

other elements

$$v_x = i_x R_x$$

$$v_L = i_2 R_L$$

KVL:

$$v_x = v_2 + v_L$$

$$v_s = v_1 + v_2 + v_L$$

KCL:

$$i_1 = i_2 + i_x$$