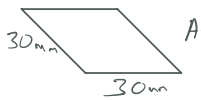
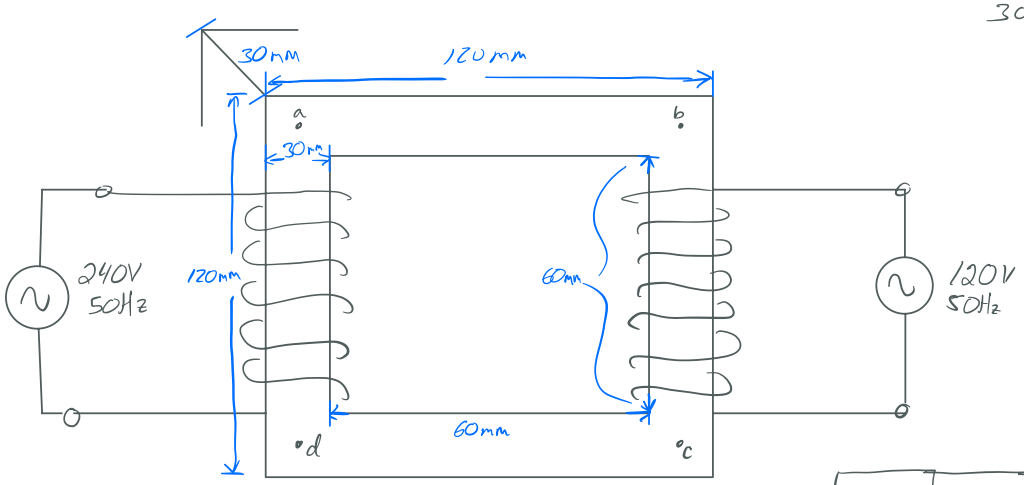
E Mach HW2

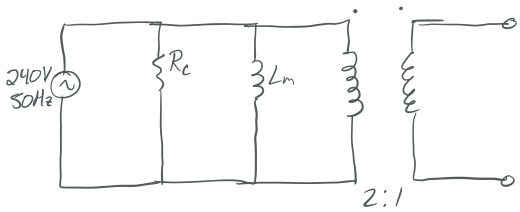


$A = 30_m \times 30_m = 900\,mm$

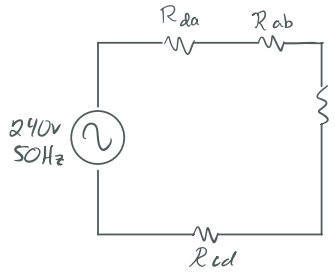
$A = 9 \times 10^{-4}\ m^2$



800:400 turns



a) Core Reluctance, $\mu_1 = 1500$ $\mu_0 = 4\pi \times 10^{-7}$



$R_{ab} = R_{bc} = R_{cd} = R_{da}$

$R_t = 4(R_{ab}) \Rightarrow 4(5.3051\,K) \Rightarrow \boxed{R_t = 212.206\,K\Omega}$

$R_{ab} = \frac{\ell}{\mu A} = \frac{90 \times 10^{-3}}{(4\pi \times 10^{-7})(1500)(9 \times 10^{-4})} \rightarrow \underline{R_{ab} = 5.3051\,K\Omega}$

b) L_m Reffered by primary $\left(\frac{N_p^2}{\mathcal{R}}\right)$

$L_m = \frac{(800)^2}{212.206K}$

$\boxed{L_m = 3.0159\ [H]}$

c) $jX_m = ?$

$L_m \rightarrow X_m = \omega L_m$, $\omega = 2\pi f$

$X_m = (2\pi \cdot 50)(3.0159)$

$\boxed{X_m = 947.482\angle 90^\circ\ \Omega}$

d) I_m

$I_m = \frac{V_p}{R_c \| L_m X_m}$

$I_m = \frac{240}{947.482} \Rightarrow \boxed{I_m = 253.303\,mA}$

e) $\lambda = ?$ $\lambda_p = Li$

$\lambda_p = (3.0159)(253.303mA)$

$\boxed{\lambda_p = 0.7639\ wb}$

f) $\varphi = \frac{\mathcal{F}}{\mathcal{R}} = \frac{N_p I_m}{\mathcal{R}}$, $B = \frac{\varphi}{A}$

$\varphi = \frac{(800)(253.303mA)}{212.206K\Omega} \Rightarrow \boxed{\varphi = 954.9296 \times 10^{-6}\ wb}$

$B = \frac{954.9296\ \mu wb}{9 \times 10^{-4}} \Rightarrow \boxed{B = 1.061\ T}$