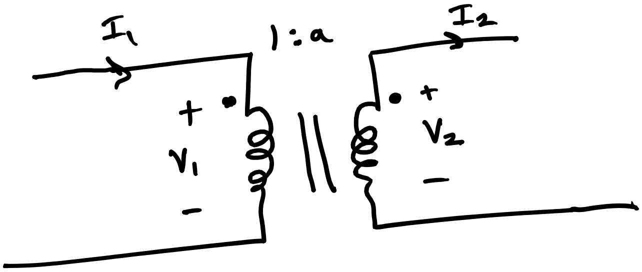
Review



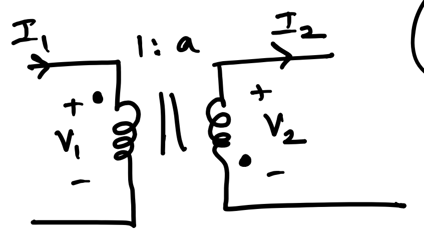
$a = \frac{N_2}{N_1}$

case 1: M opposite

$z_{in} = \frac{z_L}{a^2}$

$\frac{V_2}{V_1} = a$

$\frac{I_2}{I_1} = \frac{1}{a}$



$a = \frac{N_2}{N_1}$

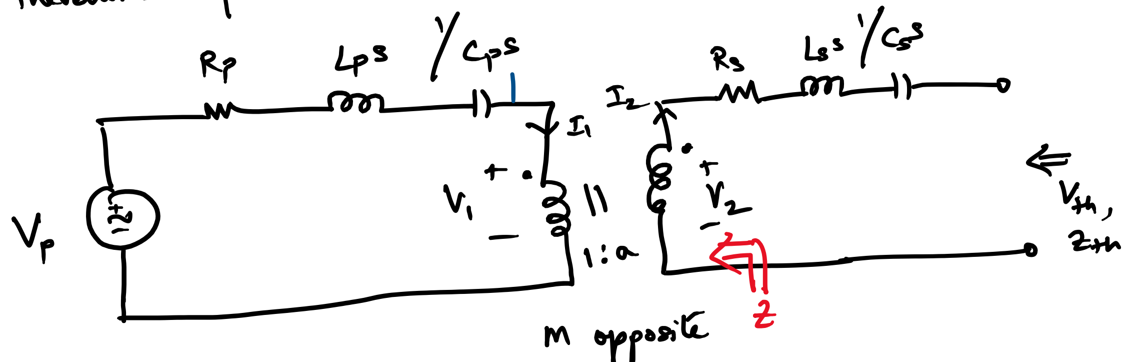
case 2: M same

$z_{in} = \frac{z_L}{a^2}$

$\frac{V_2}{V_1} = -a$

$\frac{I_2}{I_1} = -\frac{1}{a}$

→ Find Thevenin's equivalent across terminals



Without coupled coils

$V_{th} = 0$

$Z_{th} = R_s + sL_s + \frac{1}{C_s s}$

With coupled coils

$I_2 = 0 \Rightarrow I_1 = 0 \Rightarrow V_1 = V_p \Rightarrow V_2 = aV_p$

$\Rightarrow V_{th} = aV_p$

$Z_{th} = z + R_s + sL_s + \frac{1}{sC_s}$

$= a^2\left(R_p + sL_p + \frac{1}{sC_p}\right) + R_s + sL_s + \frac{1}{sC_s}$

Power across primary.

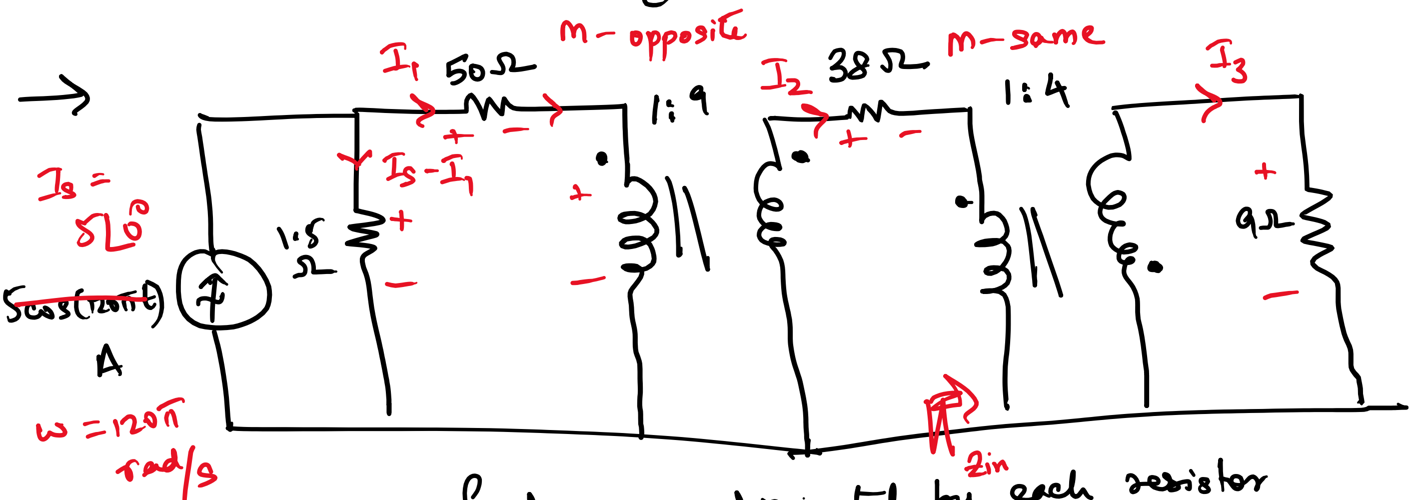
$$P_p = \mathrm{Re}\{V_{1rms} I_{1rms}^*\}$$

$$= \mathrm{Re}\left\{33.33 \times \frac{1}{3}\right\} = 11.11 \text{ W}$$

Power across secondary

$$P_s = \mathrm{Re}\{V_{2rms} I_{2rms}^*\}$$

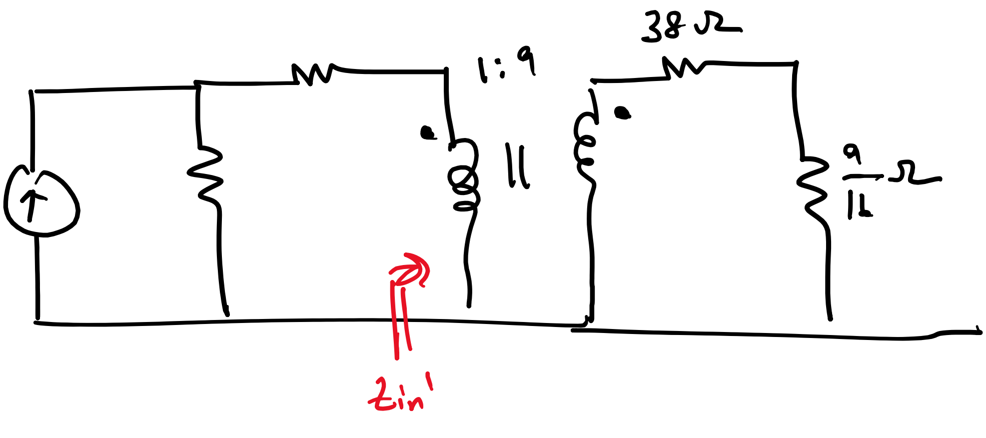
$$= \mathrm{Re}\left\{333.33 \times \frac{1}{30}\right\} = 11.11 \text{W}$$



find power dissipated by each resistor

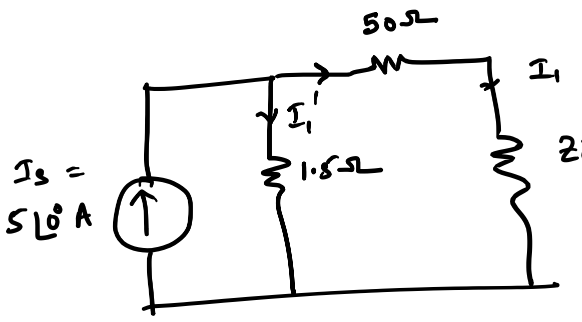
Stage 1 : Find Zin

$$Z_{in} = \frac{Z_L}{a^2} = \frac{9}{4^2} = \frac{9}{16} \Omega$$



Stage 2

$$Z_{in}' = \frac{Z_L'}{a^2} = \frac{38 + \frac{9}{16}}{81}$$



$$Z_{in}' = \left(\frac{38}{81} + \frac{1}{9\times 16}\right)\Omega$$

$$= 0.476\ \Omega$$

$$I_1 = \frac{I_s \times 1.5}{1.5 + 50 + 0.476} = 0.14 A$$

$$P_{50\Omega} = \frac{1}{2} I_1^2 \times R = \frac{1}{2} \times 0.14^2 \times 50 = 0.5205\ W$$

$$I_1' = I_s - I_1 = 5 - 0.14 = 4.86\ A$$

$$P_{1.5\Omega} = \frac{1}{2} \times 4.86^2 \times 1.5 = 17.6834\ W$$

$$\frac{I_2}{I_1} = \frac{1}{a} = \frac{1}{9} \Rightarrow I_2 = \frac{0.14}{9} = 0.016\ A$$

$$P_{38\Omega} = \frac{1}{2} \times \frac{(0.14)^2}{81} \times 38 = 0.0049\ W$$

$$\frac{I_3}{I_2} = \frac{-1}{a} = \frac{-1}{4} \Rightarrow I_3 = -\frac{1}{4} \times \frac{0.14}{9} = -0.0040 A$$

$$P_{9\Omega} = \frac{1}{2} I_3^2 \times 9 = \frac{1}{2} \times (-0.0049)^2 \times 9 = 7.23\times 10^{-5}\ W$$