The 1φ transformer shown here has the following ratings and parameters:
100 / 200 volts
$R_{eq,p} = 0.2 \ \Omega$, $X_{eq,p} = 0.75 \ \Omega$
$R_{c,p} = 300 \ \Omega$ and $X_{m,p} = 80 \ \Omega$.

1. [5 points] With a primary voltage of 100 volts what is the core loss in watts?

[Watts indicates real power; $P_{core} = \frac{|V_p|^2}{R_{c_p}} = \frac{100^2}{300} = 33.3$ watts]

2. [5 points] Compare relative magnitudes of the following 3 impedances associated with a transformer:
   - $Z_{core} = R_c || jX_m$ represents the non-ideal magnetic effects of the core
     [Ideally $\rightarrow \infty$]
   - $Z_{eq} = R_{eq} + jX_{eq}$ represents resistance & leakage reactance of the windings
     [Ideally $\rightarrow 0$]
   - $Z_{load}$ represents the impedance of the load

When all 3 of these impedances are referred to the same side of the transformer, which one of the following inequalities best represents the relationship among these impedances:

$|Z_{core}| < |Z_{load}| < |Z_{eq}|$

3. [10 points] Consider the 1φ transformer given above. If the transformer has a primary voltage of 106 @ +5° volts and a secondary voltage of 200 @ 0° volts, what is the secondary current (magnitude and angle)?

$a = \frac{100}{200} = 1/2$
by KVL $V_p = \frac{I_s}{a} * (R_{eq,p} + jX_{eq,p}) + a * V_S$

$106 @ +5^0 = (2I_s) * (0.2 + j0.75) + (1/2) * 200 @ 0^0 \Rightarrow I_s = 6.96 @ -16.3^0$ amps