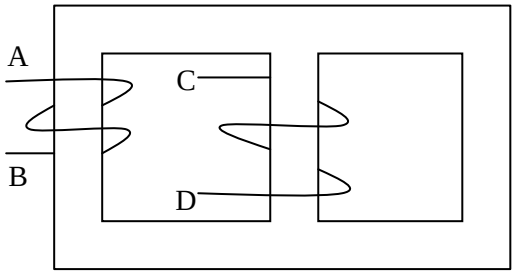
Name: _____

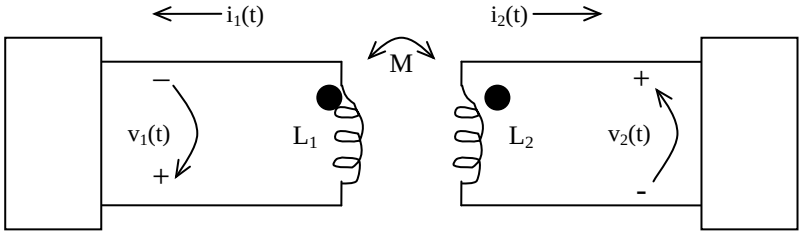
EE 303, Quiz 3, Fall 2017, Dr. McCalley. Time: 20 minutes, closed book, closed notes, no communication devices

1. (20 pts) Determine the placement of the dots for the coupled coils shown in figure below.



Solution: Recall: Current entering the dotted terminals should produce fluxes in the same directions. Therefore correct answer is either (A and C) or (B and D).

2. (30 pts) Write the equations for $v_1(t)$ and $v_2(t)$ for the circuit below.



Solution:

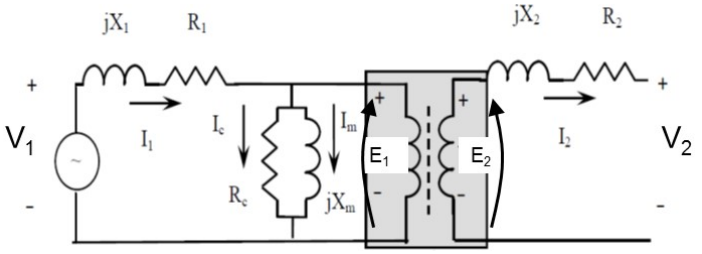
$$v_1(t) = L_1 \frac{di_1(t)}{dt} + M \frac{di_2(t)}{dt}; \qquad v_2(t) = -L_2 \frac{di_2(t)}{dt} - M \frac{di_1(t)}{dt}$$

3. (20 pts) The model to the right represents a power transformer.
   a. What physical effect does R_1 represent? Where in the transformer does this effect take place?

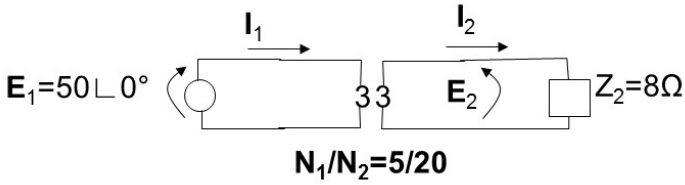
      Solution: R_1 represents real power losses in the primary winding of the transformer.

   b. What physical effect does R_2 represent? Where in the transformer does this effect take place?

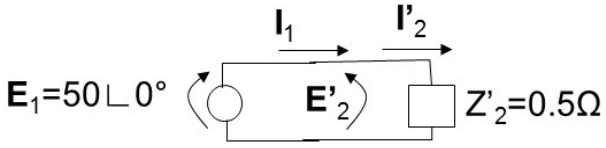
      Solution: R_2 represents real power losses in the secondary winding of the transformer.



4. (30 pts) Identify the value of Z_2', i.e., the load impedance referred to the primary. Redraw the below circuit showing the load impedance referred to the primary, and identify on the diagram $\mathbf{E}_1$, $\mathbf{I}_1$, $\mathbf{E}_2$', $\mathbf{I}_2$' and Z_2'. Determine the values of the phasor quantities (magnitude and angle) for $\mathbf{E}_2$', $\mathbf{I}_2$', and $\mathbf{E}_2$, and $\mathbf{I}_2$.



Solution: $Z_2' = (5/20)^2(8) = 0.5$ ohms



$$E_2' = 50\angle 0°$$

$$I_2' = \frac{50\angle 0°}{0.5} = 100\angle 0°$$

$$E_2 = E_2' \frac{N_2}{N_1} = 50\angle 0° \frac{20}{5} = 200\angle 0° v$$

$$I_2 = I_2' \frac{N_1}{N_2} = 100\angle 0° \frac{5}{20} = 25\angle 0° A$$