1. [1 point] In a transformer there are two coils of wires – the primary coil and the secondary coil. Which of the following physical quantities must be the same for the two coils?

a. the number of turns in the coils
b. the voltages for the two coils
c. the currents for the two coils
d. the power for the two coils
e. none of the above quantities has to be the same for the two coils

D
2. [1 point] A loop of wire is laying flat in the plane of the page, and there is an external magnetic field that is directed out of the page, as shown below. Which of the following would NOT induce a current within the loop?

a. increasing the magnetic field  

b. decreasing the magnetic field  

c. increasing the area of the loop  

d. decreasing the area of the loop  

e. rotating the loop, so that the right edge of the loop goes into the page and the left edge of the loop comes out of the page  

F  

3. [2 points] When a given resistor is connected to a wall outlet (120 V rms voltage and 60 Hz) it has a maximum (peak) power output of 85 watts. What is the value of the resistance?

\[ P_{\text{max}} = 85 \text{ watts} \]
\[ V_{\text{rms}} = 120 \text{ V} \]
\[ R = ? \]

\[
\begin{align*}
V_{\text{max}} &= \sqrt{3} V_{\text{rms}} = \sqrt{3} (120 \text{ V}) = 207.8 \text{ V} \\
I_{\text{max}} &= P_{\text{max}} / V_{\text{max}} = 85 / 207.8 = 0.41 \text{ A} \\
R &= V_{\text{max}} / I_{\text{max}} = 207.8 / 0.41 = 500 \Omega
\end{align*}
\]

4. [3 points] The loop in the figure has an induced current in the direction illustrated. The resistance of the loop is 0.5 Ω. If the loop is within a magnetic field that is directed out of the page, and changing at a rate of 3.2 T/s, what is the value of the induced current in amps?

\[
\begin{align*}
|\mathbf{E}| &= N / \Delta \Phi = N (\mathbf{B}_f \cdot \mathbf{A} - \mathbf{B}_i \cdot \mathbf{A}) = NA (\mathbf{B}_f - \mathbf{B}_i) \\
E &= A \frac{\partial \mathbf{B}}{\partial t} = 170 \text{ mT/s} (3.2 \text{ A}) \\
E &= 0.001 \text{ V} \\
E &= IR \\
I &= E / R = 0.001 / 0.5 = 0.002 \text{ A} \\
I &= 0.002 \text{ A}
\end{align*}
\]

b. [1 point] Is the magnetic field increasing or decreasing?  

decreasing  

\[
\text{Band B within the loop}
\]