

FINAL EXAM

Average - 17.1/30.0 = 57.0%

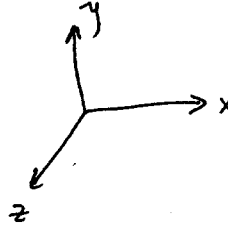
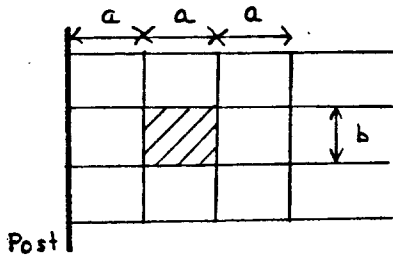
Name (print) Kristen Stoops Name (signed) S.D - 11.9

Discussion Instructor (circle one): Baselgia Morrill Reeve Stoops Zhang

Discussion Section # _____

SHOW ALL WORK!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
 Use the conversion constants and data given on the front page.

A bolt of lightning hits a metal fence post. The current in the lightning bolt is modeled as $I = I_0 \sin At$ between $t = 0$ and $t = \pi/A$. Calculate the EMF that appears around the cross hatched loop of metal fence with the dimensions shown.



$$\mathcal{E} = - \frac{d}{dt} (\Phi_M)$$

+20 { so

$$\Phi_M = \int \vec{B} \cdot d\vec{a} \quad \text{and} \quad \vec{B} = \frac{\mu_0 I}{2\pi x} \hat{z} \quad ; \quad d\vec{a} = b dx \hat{z}$$

$$\Phi_M = \frac{\mu_0 I b}{2\pi} \int_a^{2a} \frac{dx}{x} = \frac{\mu_0 I b}{2\pi} \ln\left(\frac{2a}{a}\right) = \frac{\mu_0 I b}{2\pi} \ln 2$$

+10 {

$$- \frac{d}{dt} \Phi_M = \frac{-\mu_0 b I_0 A}{2\pi} (\ln 2) (\cos At) = \mathcal{E}$$