# Phys 24 HW2

Zih-Yu Hsieh

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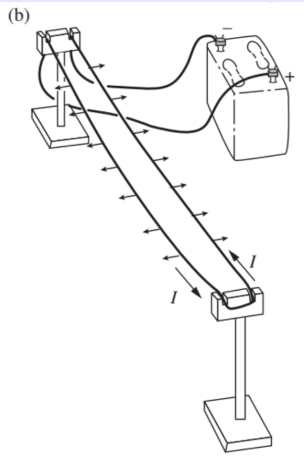
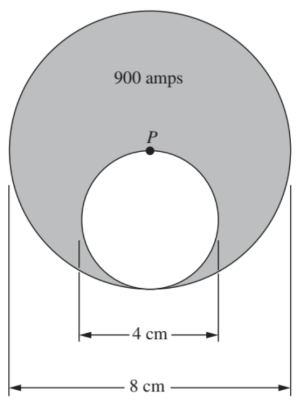
## 1

**Question 1** *Suppose the current I that flows in the circuit in the figure below is 20 amperes. The distance between the wires is 5 cm. How large is the force, per meter of length, that pushes horizontally on one of the wires?*



## 2

**Question 2** *A long copper rod 8 cm in diameter has an off-center cylindrical hole, as shown in Fig. 6.43, down its full length. This conductor carries a current of 900 amps flowing in the direction "into the paper." What is the direction, and strength in gauss, of the magnetic field at the point P that lies on the axis of the outer cylinder?*



## 3

**Question 3** *A round wire of radius $r_0$ carries a current $I$ distributed uniformly over the cross section of the wire. Let the axis of the wire be the $z$ axis, with $\hat{z}$ the direction of the current. Show that a vector poten- tial of the form $\bar{A} = A_0\hat{z}(x^2 + y^2)$ will correctly give the magnetic field $\bar{B}$ of this current at all points inside the wire. What is the value of the constant, $A_0$?*

# 4

**Question 4** *In class, we calculate the vector potential* $\bar{A}(\bar{r})$ *and the magnetic induction* $\bar{B}(\bar{r})$ *of a circular thread of current. The current density is given in cylindrical coordinates as*

$$\bar{J}(\bar{r}) = I\delta(\rho - R)\delta(z)\hat{\phi}$$

*See lecture 4, page 1.44 and continued. The calculation of the vector potential* $\bar{A}(\bar{r})$ *leads to an ellipitic integral, which cannot be solved analytically. Estimate the integral for the limit* $\rho >> R$*, by a Taylor expansion. Show that in this case a dipole field emerges!*