Lesson #31: Applying Ampere's Law **Name: ______________________________**

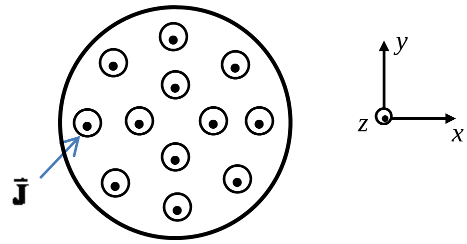
Study section 5.3 and the worked examples, then answer the following questions.

For each of the current distributions shown below, do the following:

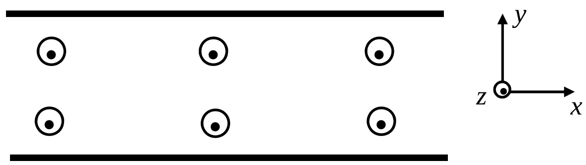
(a) neatly sketch and label the magnetic field in the region of interest;

(b) neatly sketch and label an Amperian loop that could be used with Ampere's Law to determine the magnetic field; if Ampere's law is not a useful means of determining the field, say so and explain why.

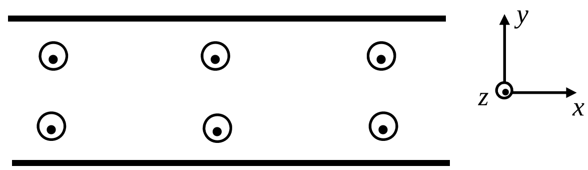
1. A wire (radius a) carrying a non-uniform current density $\vec{\mathbf{J}}(\vec{r}) = ks\,\hat{z}$, and we want to find the field inside the wire.



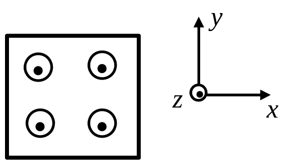
2. A slab of current, infinite in x and z but finite in y, and carrying a uniform current density $\vec{\mathbf{J}}(\vec{r}) = J_0\,\hat{z}$, and we want to find the field inside the distribution.



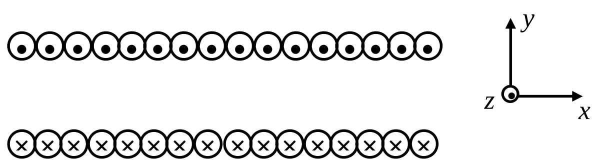
3. Repeat (2), if we want to find the field outside the distribution.



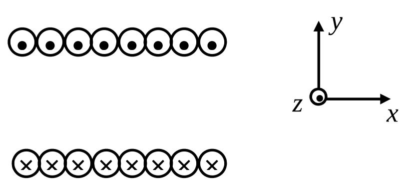
4. A wire with a square cross-section ($a \times a$), carrying a uniform current density $\vec{\mathbf{J}}(\vec{r}) = J_0\,\hat{z}$, and we want to find the field outside the wire.



5. A solenoid oriented along the x axis. The solenoid length is much larger than the radius, and we want to find the field inside the solenoid.



6. Repeat question 5, for the case where the solenoid length is about equal to its diameter.



7. For question 5, what is the field outside the solenoid, and how do you know?