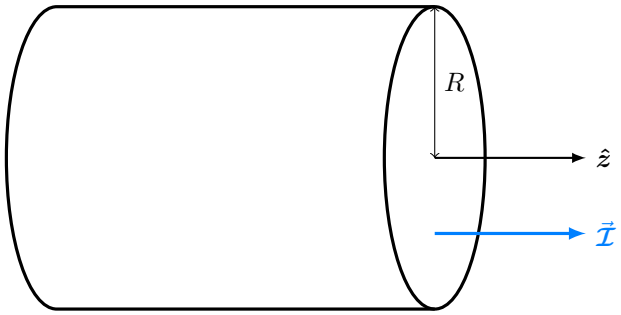
1. A long (infinite) wire of radius R carries a uniformly distributed current $\mathcal{I}_0$ in the $\hat{\boldsymbol{z}}$ direction. (The axis of the wire coincides with the z axis.) Assume that $\boldsymbol{\nabla} \cdot \vec{\mathbf{A}} = 0$ (the Coulomb gauge) and choose that $\vec{\mathbf{A}} = 0$ at the edge of the wire.



   (a) The magnitude of the vector potential inside the wire could be given by:

$$A = c\mathcal{I}_0 \left(1 - \frac{s^2}{R^2}\right)$$

   I'm just telling you this at the moment. It works. If you trust me.

   i. In what direction would $\vec{\mathbf{A}}$ be pointing? How do you know?

   ii. What is the value of c? To determine this you'll probably need to look up or determine what the magnetic field looks like inside the wire.

   iii. Show that this magnetic vector potential is consistent with all the requirements of the magnetic vector potential and obeys the given assumptions and boundary conditions.

   (b) What is the magnetic vector potential outside of the wire? Think about what method you can use to find this, because some might not apply to this situation. Show explicitly that your solution still obeys the Coulomb gauge and boundary conditions and gives the correct value of $\vec{\mathbf{B}}$ outside the wire.