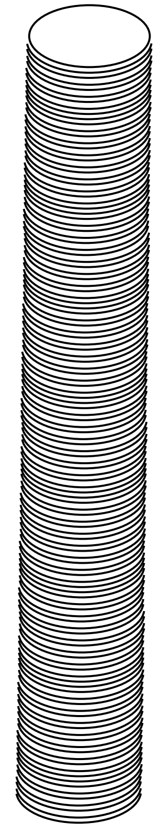


Consider a very long solenoid of radius ***R***, with n turns per unit length and carrying a current I.

(A) Make a sketch of the *magnitude* of the B-field as a function of distance from the center, both inside and outside the solenoid.

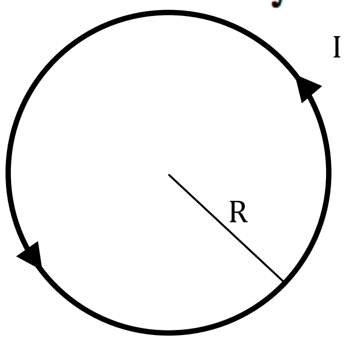
(B) From Ampere's Law, one can show that the B-field inside the solenoid is $B = \mu_0 n I$. [You can prove this later, if you have extra time.]

Suppose the current I in the coil of wire initially starts at a large value and is decreasing with time, so that the *B-field decreases* inside the solenoid according to the equation $B = B_0 - Ct$ (where C is a positive constant with appropriate units). Where in space is the **electric** field *zero*, and where is it *non-zero*?
[Inside the solenoid? Outside? Everywhere?]

Make a quick sketch of what you think this induced E-field would look like. Just use your intuition for now, and we'll check with calculations later.

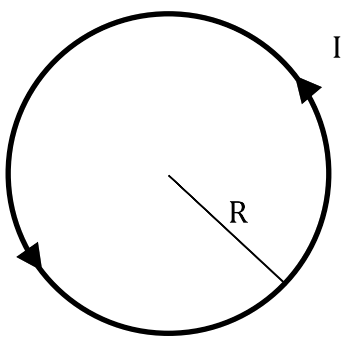
(C) Use Faraday's law in integral form to compute the electric field *inside* the solenoid. Be sure to specify in the diagram the surface you're using for the integrals, and the direction of the induced E-field.

$$\oint \vec{\mathbf{E}} \cdot d\vec{\ell} = -\frac{d}{dt}\iint \vec{\mathbf{B}} \cdot d\vec{\mathbf{a}}$$



Top View of Solenoid

(D) Use Mr. Faraday to compute the E-field *outside* the solenoid.



Top View of Solenoid

(E) Make a sketch of the magnitude of the *E-field* as a function of distance from the center, both inside and outside the solenoid.