

Gauss' Law for magnetism, $\nabla \cdot \mathbf{B} = 0$ suggests we can generate a potential for \mathbf{B} . What form should the definition of this potential take (Φ and \mathbf{A} are placeholder scalar and vector functions, respectively)?

A. $\mathbf{B} = \nabla \Phi$

B. $\mathbf{B} = \nabla \times \Phi$

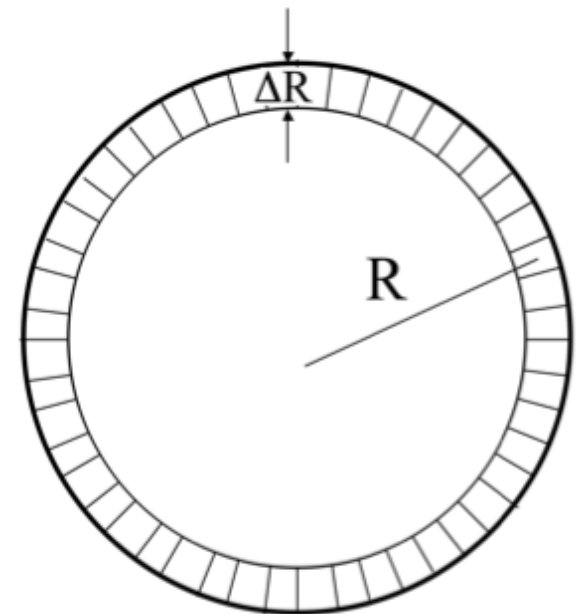
C. $\mathbf{B} = \nabla \cdot \mathbf{A}$

D. $\mathbf{B} = \nabla \times \mathbf{A}$

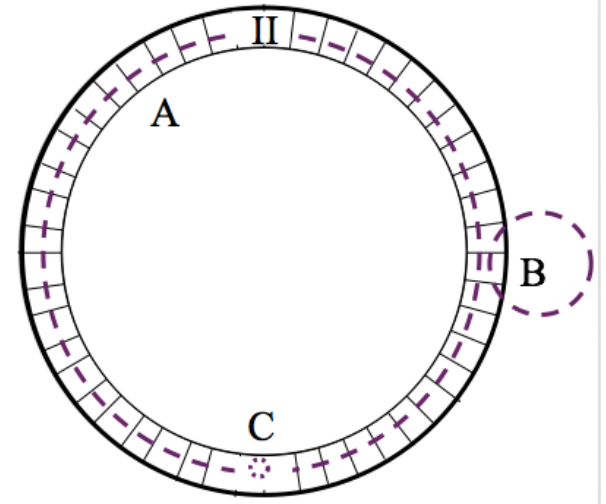
E. Something else?!

Consider a toroid, which is like a finite solenoid connected end to end. In which direction do you expect the B field to point?

- A. Azimuthally ($\hat{\phi}$ direction)
- B. Radially (\hat{s} direction)
- C. In the \hat{z} direction (perp. to page)
- D. Loops around the rim
- E. Mix of the above...



Which Amperian loop would you draw to find B “inside” the Torus (region II)?



- A. Large "azimuthal" loop
- B. Smallish loop from region II to outside (where $B=0$)
- C. Small loop in region II
- D. Like A, but perp to page
- E. Something entirely different

With $\nabla^2 \mathbf{A} = -\mu_0 \mathbf{J}$, we can write (in Cartesian coordinates):

$$\nabla^2 A_x = -\mu_0 J_x$$

Does that also mean in spherical coordinates that

$$\nabla^2 A_r = -\mu_0 J_r?$$

A. Yes

B. No

We can compute \mathbf{A} using the following integral:

$$\mathbf{A}(\mathbf{r}) = \frac{\mu_0}{4\pi} \int \frac{\mathbf{J}(\mathbf{r}')}{\mathfrak{R}} d\tau'$$

Can you calculate that integral using spherical coordinates?

- A. Yes, no problem
- B. Yes, r' can be in spherical, but \mathbf{J} still needs to be in Cartesian components
- C. No.

For a infinite solenoid of radius R , with current I , and n turns per unit length, which is the current density \mathbf{J} ?

A. $\mathbf{J} = nI\hat{\phi}$

B. $\mathbf{J} = nI\delta(r - R)\hat{\phi}$

C. $\mathbf{J} = \frac{I}{n}\delta(r - R)\hat{\phi}$

D. $\mathbf{J} = \mu_0 nI\delta(r - R)\hat{\phi}$

E. Something else?!