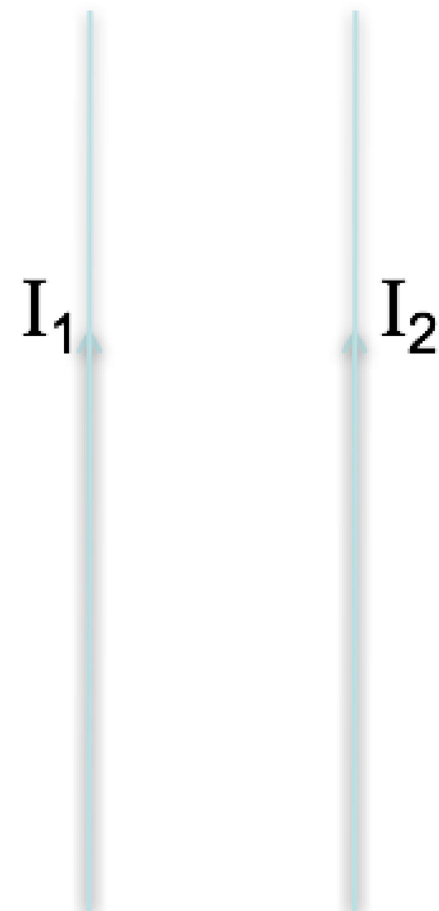
I have two very long, parallel wires each carrying a current I_1 and I_2, respectively. In which direction is the force on the wire with the current I_2?

A. Up
B. Down
C. Right
D. Left

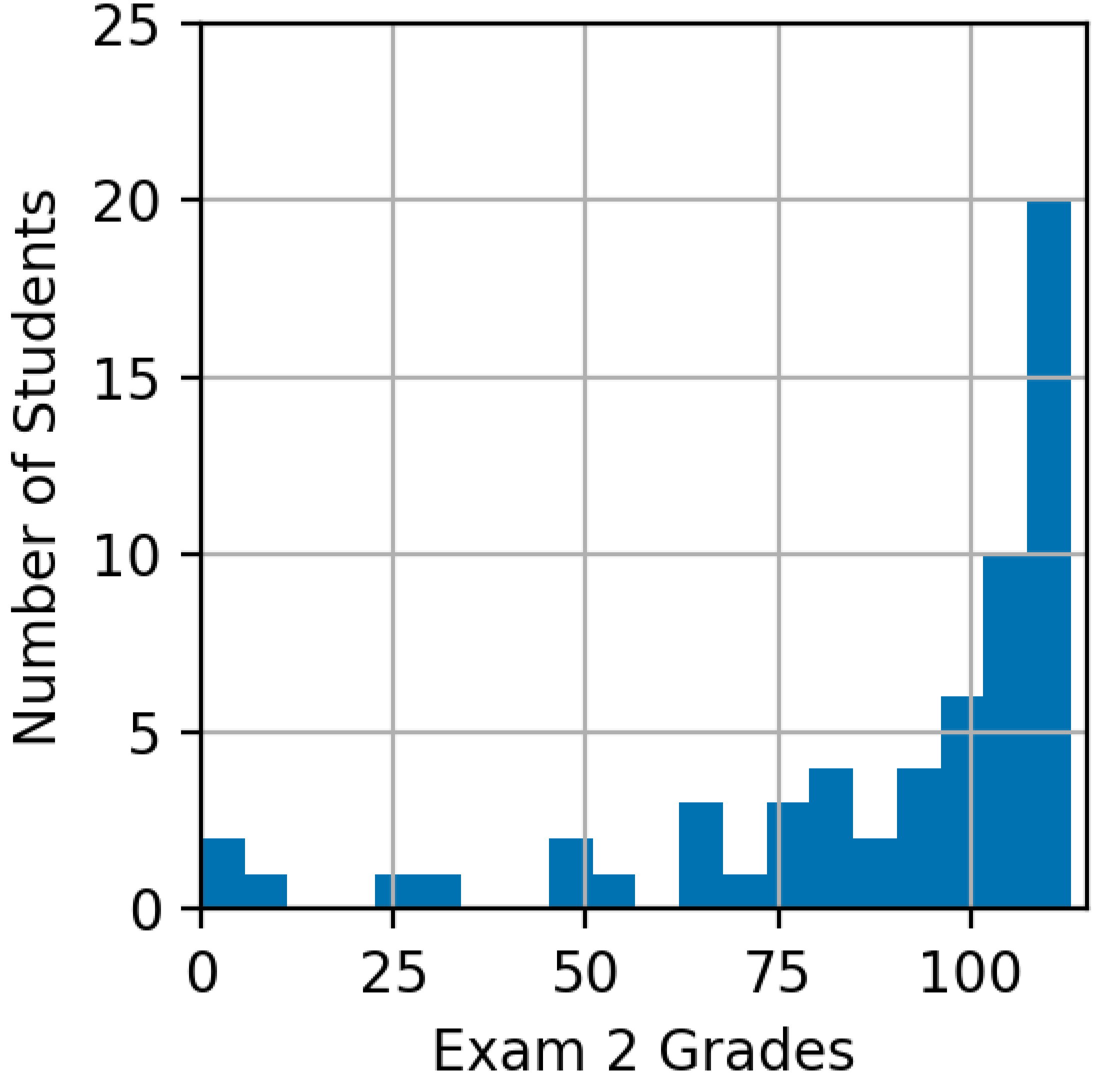
E. Into or out of the page



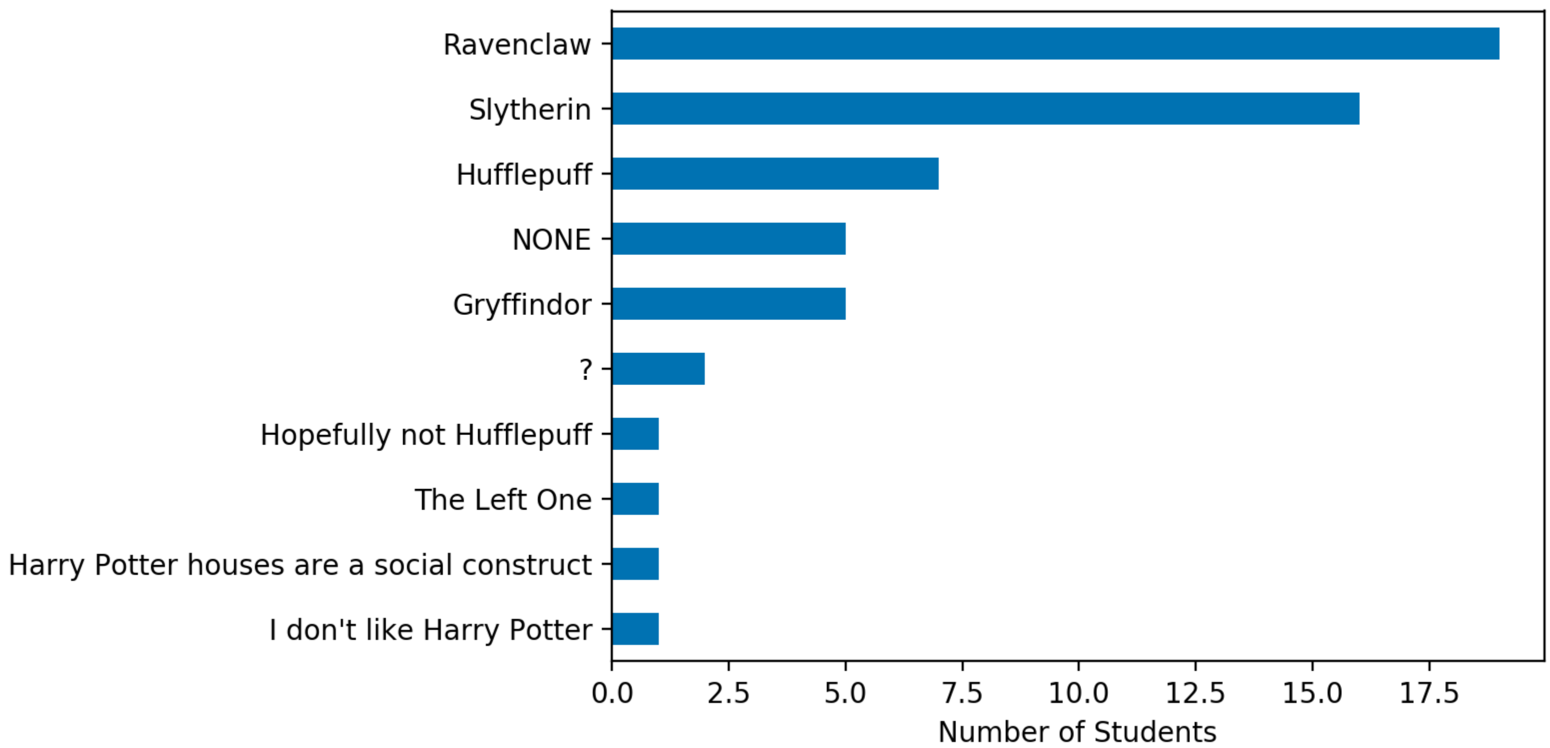
ANNOUNCEMENTS

- Exam 2 Graded
  - Average: 88.8%

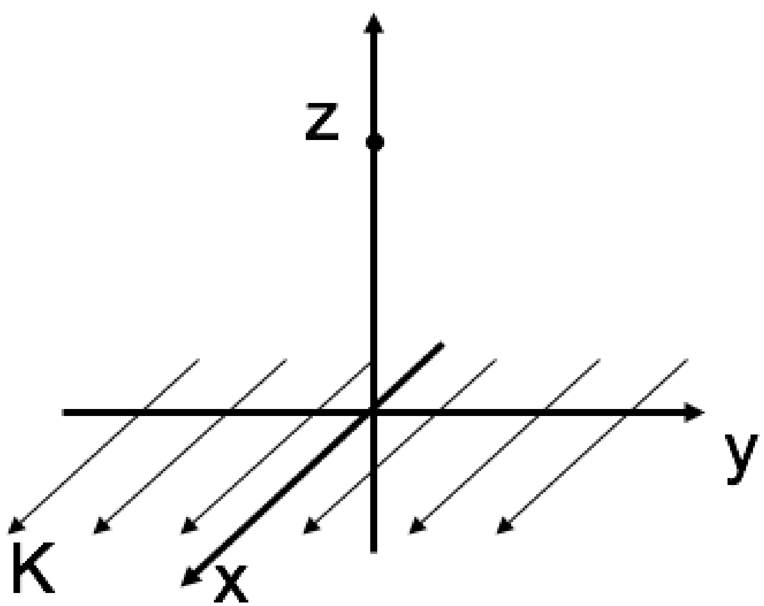
HISTOGRAM



POTTER HOUSES

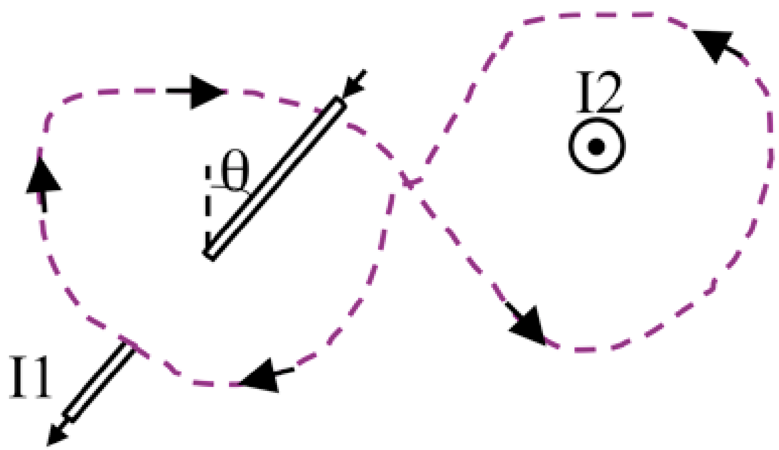


Consider the B-field a distance z from a current sheet (flowing in the +x-direction) in the z = 0 plane. The B-field has:



A. y-component only
B. z-component only
C. y and z-components
D. x, y, and z-components
E. Other

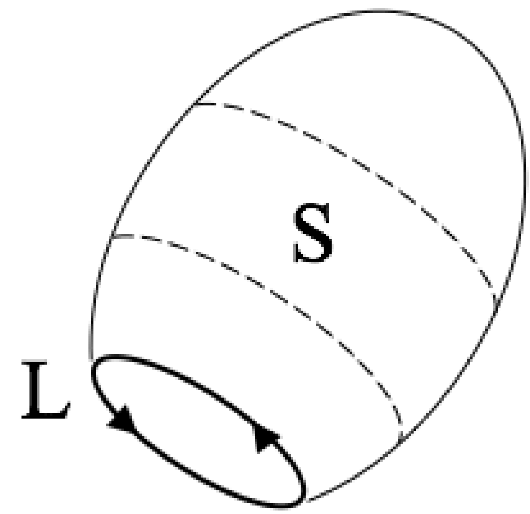
What is $\oint \mathbf{B} \cdot d\mathbf{l}$ around this purple (dashed) Amperian loop?



A. $\mu_0(|I_2| + |I_1|)$
B. $\mu_0(|I_2| - |I_1|)$
C. $\mu_0(|I_2| + |I_1| \sin\theta)$
D. $\mu_0(|I_2| - |I_1| \sin\theta)$
E. $\mu_0(|I_2| + |I_1| \cos\theta)$

Stoke's Theorem says that for a surface S bounded by a perimeter L, any vector field $\mathbf{B}$ obeys:

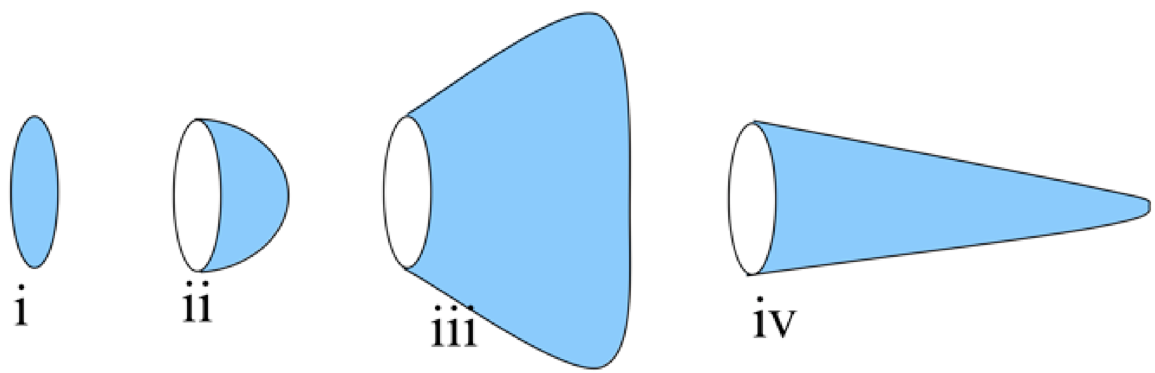
$$\int_S (\nabla \times \mathbf{B}) \cdot dA = \oint_L \mathbf{B} \cdot d\mathbf{l}$$



Does Stoke's Theorem apply for any surface S bounded by a perimeter L, even this balloon-shaped surface S?

A. Yes
B. No
C. Sometimes

Rank order $\int \mathbf{J} \cdot d\mathbf{A}$ (over blue surfaces) where $\mathbf{J}$ is uniform, going left to right:



A. iii > iv > ii > i

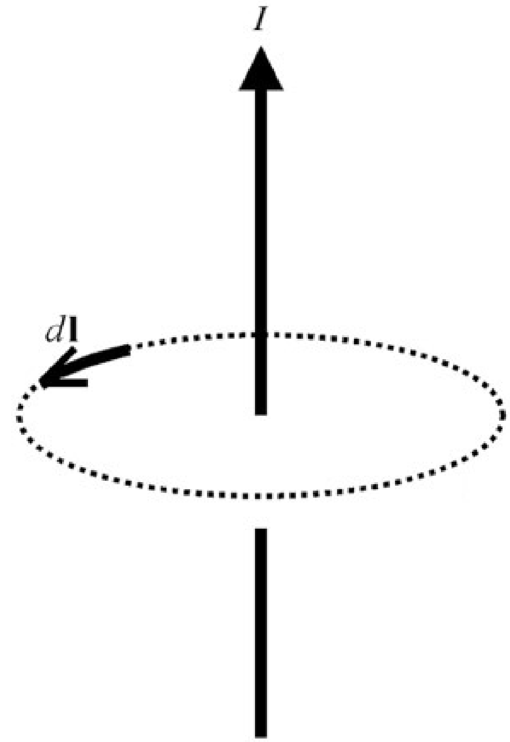
B. iii > i > ii > iv

C. i > ii > iii > iv

D. Something else!!

E. Not enough info given!!

Much like Gauss's Law, Ampere's Law is always true (for magnetostatics), but only useful when there's sufficient symmetry to "pull B out" of the integral.



So we need to build an argument for what $\mathbf{B}$ looks like and what it can depend on.

For the case of an infinitely long wire, can $\mathbf{B}$ point radially (i.e., in the $\hat{s}$ direction)?

A. Yes
B. No
C. ???

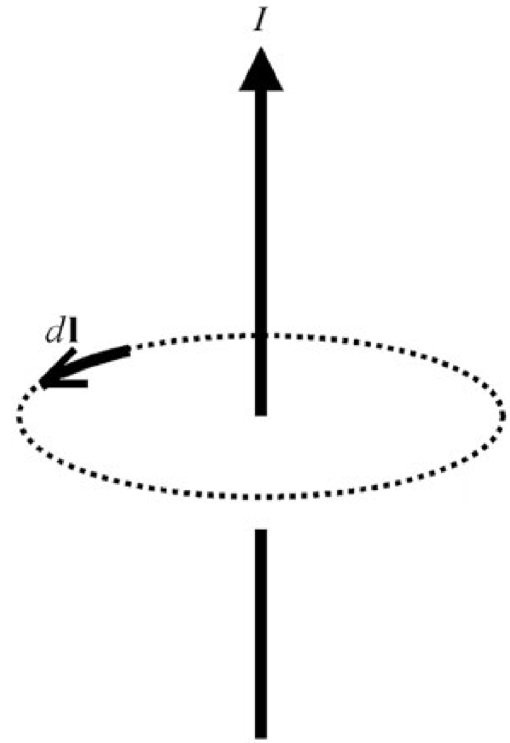
Continuing to build an argument for what $\mathbf{B}$ looks like and what it can depend on.

For the case of an infinitely long wire, can $\mathbf{B}$ depend on z or ϕ?

A. Yes

B. No

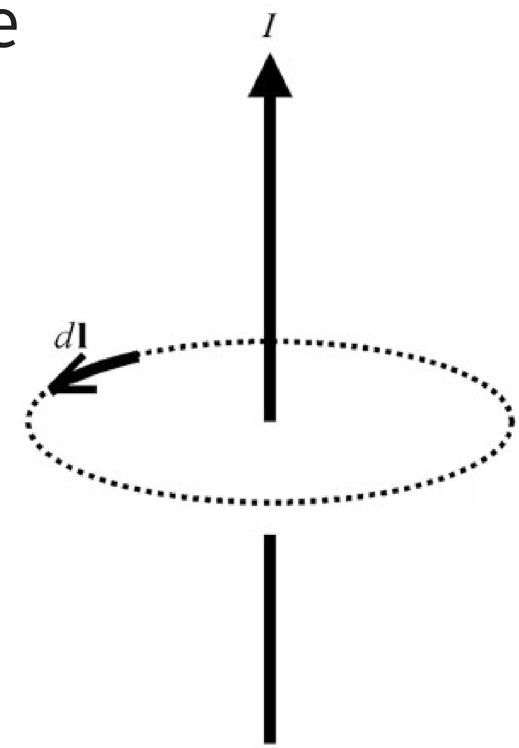
C. ???



Finalizing the argument for what $\mathbf{B}$ looks like and what it can depend on.

For the case of an infinitely long wire, can $\mathbf{B}$ have a $\hat{z}$ component?

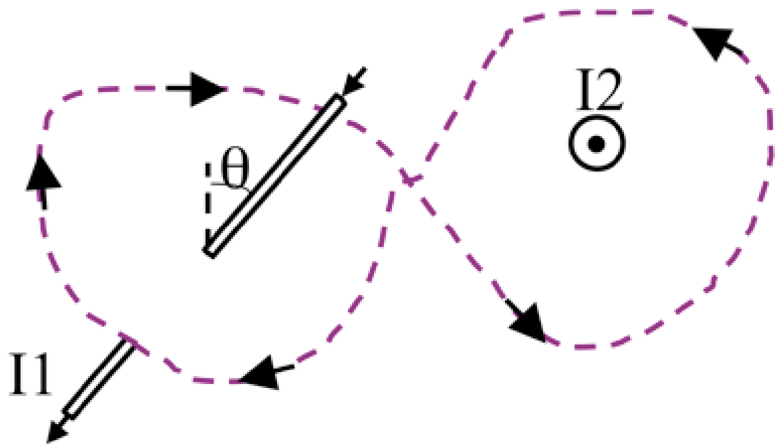
A. Yes
B. No
C. ???



For the infinite wire, we argued that $\mathbf{B}(\mathbf{r}) = B(s)\hat{\phi}$. For the case of an infinitely long **thick** wire of radius a, is this functional form still correct? Inside and outside the wire?

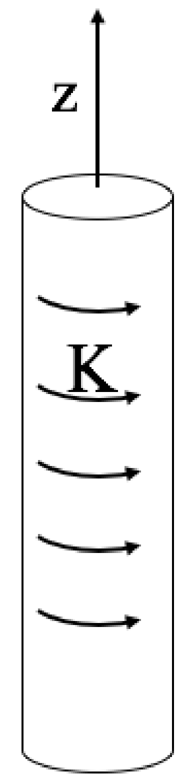
A. Yes
B. Only inside the wire ($s < a$)
C. Only outside the wire ($s > a$)
D. No

What is $\oint \mathbf{B} \cdot d\mathbf{l}$ around this purple (dashed) Amperian loop?



A. $\mu_0(|I_2| + |I_1|)$
B. $\mu_0(|I_2| - |I_1|)$
C. $\mu_0(|I_2| + |I_1| \sin\theta)$
D. $\mu_0(|I_2| - |I_1| \sin\theta)$
E. $\mu_0(|I_2| + |I_1| \cos\theta)$

An infinite solenoid with surface current density K is oriented along the z-axis. To use Ampere's Law, we need to argue what we think $\mathbf{B}(\mathbf{r})$ depends on and which way it points.

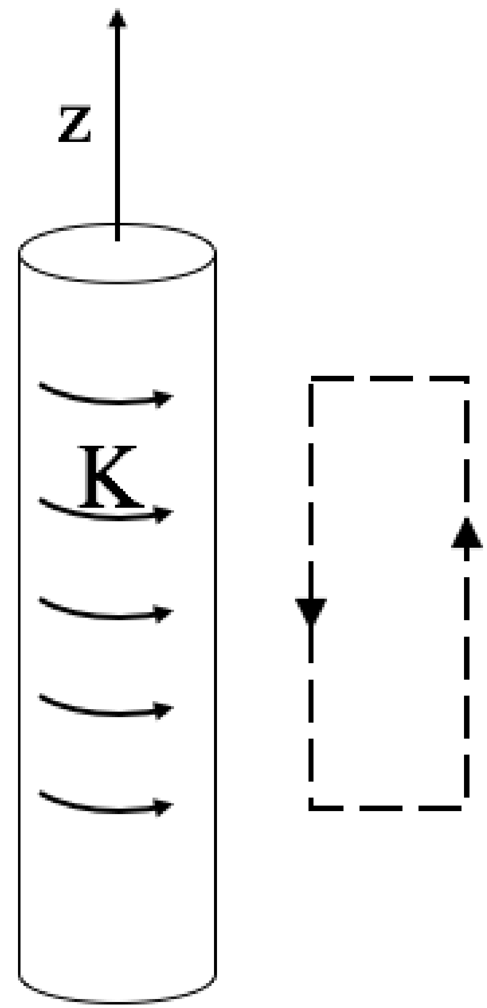


For this solenoid, $\mathbf{B}(\mathbf{r}) =$

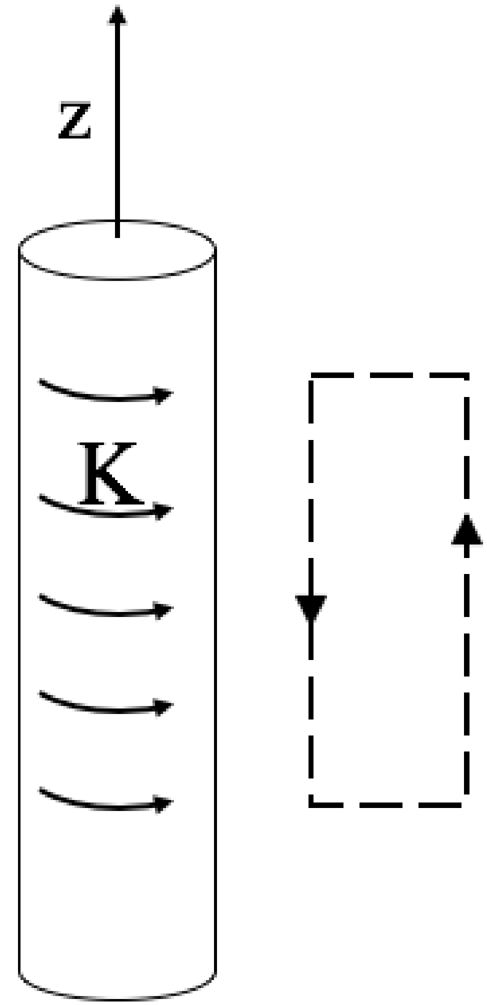
A. $B(z)\,\hat{z}$
B. $B(z)\,\hat{\phi}$
C. $B(s)\,\hat{z}$
D. $B(s)\,\hat{\phi}$
E. Something else?

An infinite solenoid with surface current density K is oriented along the z-axis. Apply Ampere's Law to the rectangular imaginary loop in the yz plane shown. What does this tell you about B_z, the z-component of the B-field outside the solenoid?

A. B_z is constant outside
B. B_z is zero outside
C. B_z is not constant outside
D. It tells you nothing about B_z



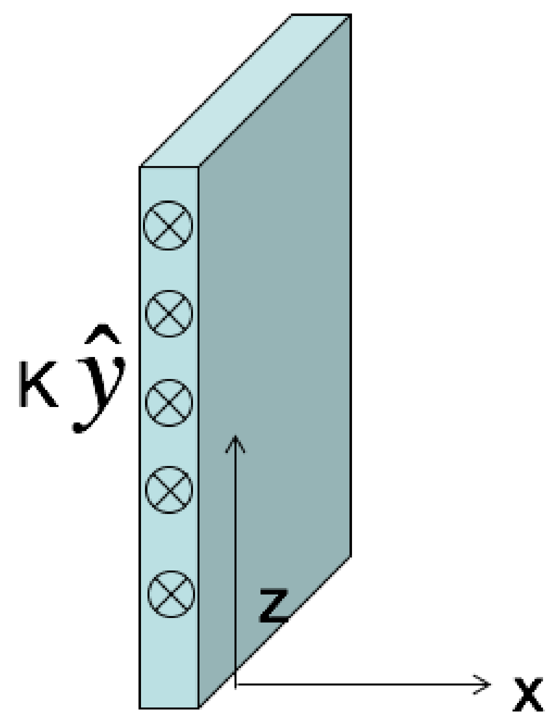
An infinite solenoid with surface current density K is oriented along the z-axis. Apply Ampere's Law to the rectangular imaginary loop in the yz plane shown. We can safely assume that $B(s \to \infty) = 0$. What does this tell you about the B-field outside the solenoid?



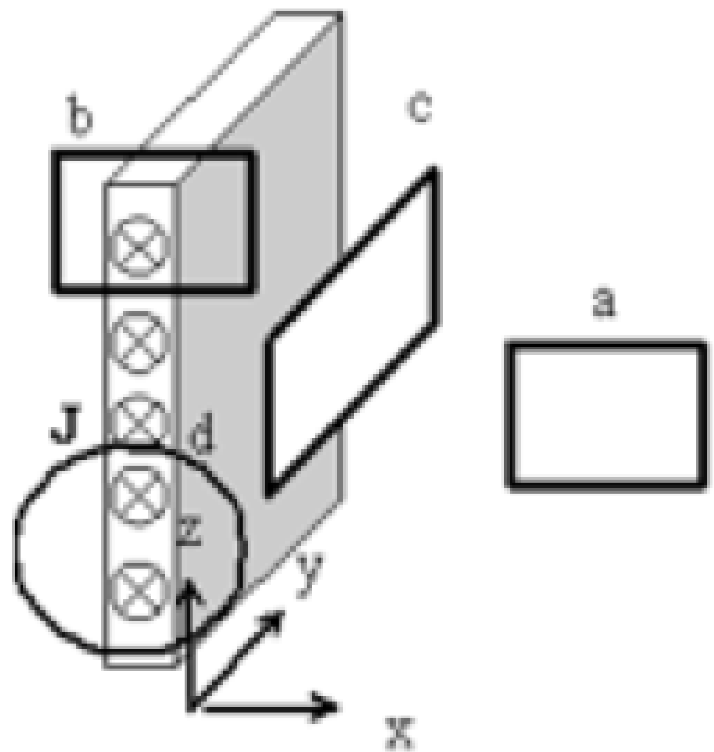
A. $|\mathbf{B}|$ is a small non-zero constant outside
B. $|\mathbf{B}|$ is zero outside
C. $|\mathbf{B}|$ is not constant outside
D. We still don't know anything about $|\mathbf{B}|$

What do we expect $\mathbf{B}(\mathbf{r})$ to look like for the infinite sheet of current shown below?

A. $B(x)\hat{x}$
B. $B(z)\hat{x}$
C. $B(x)\hat{z}$
D. $B(z)\hat{z}$
E. Something else



Which Amperian loop are useful to learn about $B(x, y, z)$ somewhere?



E. More than 1

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?!