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?

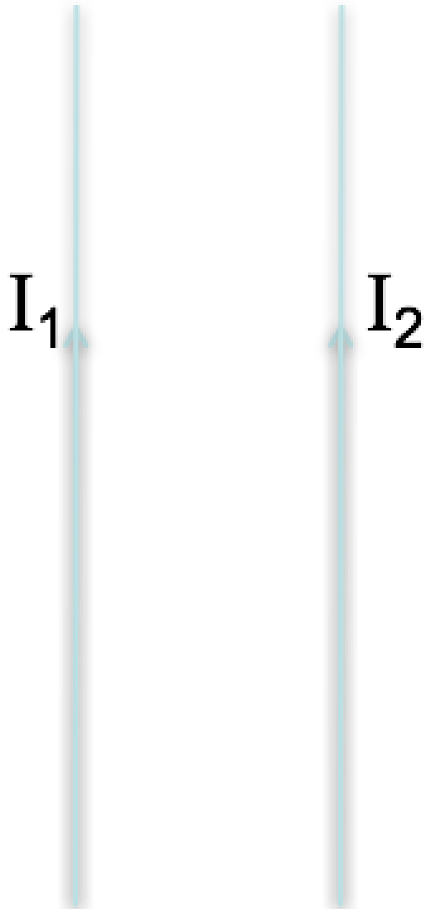
A. Up

B. Down

C. Right

D. Left

E. Into or out of the page



What is the magnitude of $\dfrac{d\mathbf{l} \times \hat{\mathfrak{R}}}{\mathfrak{R}^2}$?

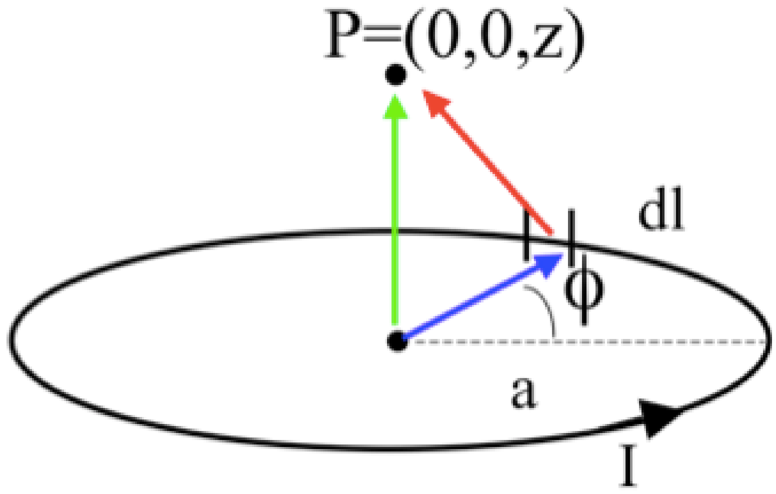
A. $\dfrac{dl \sin \phi}{z^2}$

B. $\dfrac{dl}{z^2}$

C. $\dfrac{dl \sin \phi}{z^2+a^2}$

D. $\dfrac{dl}{z^2+a^2}$

E. something else!



What is $d\mathbf{B}_z$ (the contribution to the vertical component of $\mathbf{B}$ from this $d\mathbf{l}$ segment?)

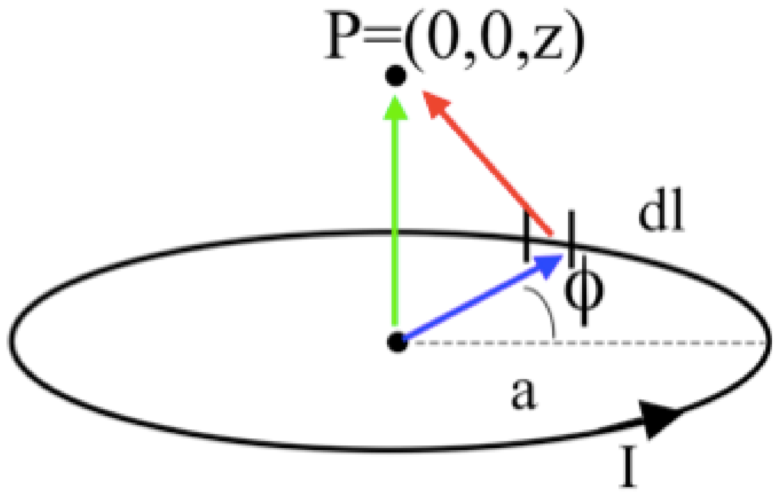
A. $\frac{dl}{z^2+a^2}\frac{a}{\sqrt{z^2+a^2}}$

B. $\frac{dl}{z^2+a^2}$

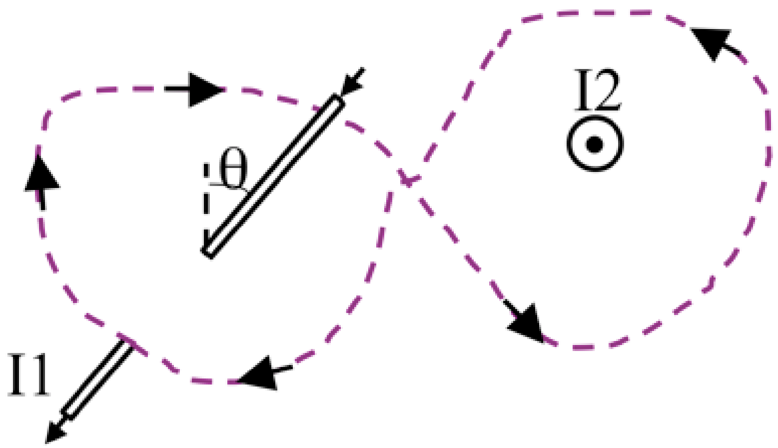
C. $\frac{dl}{z^2+a^2}\frac{z}{\sqrt{z^2+a^2}}$

D. $\frac{dl\cos\phi}{\sqrt{z^2+a^2}}$

E. Something else!



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

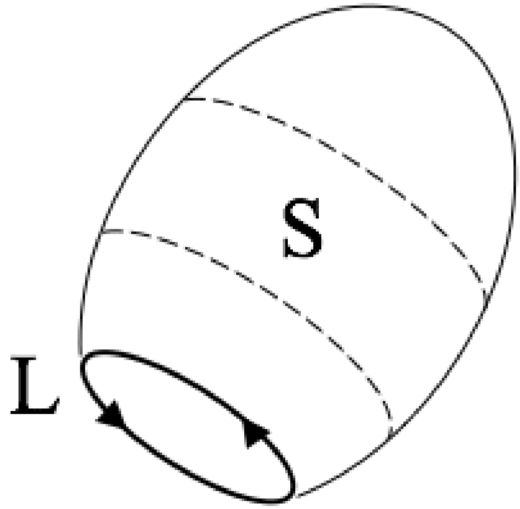


A. $\mu_0(|I_2| + |I_1|)$
B. $\mu_0(|I_2| - |I_1|)$
C. $\mu_0(|I_2| + |I_1| \sin\theta)$
D. $\mu_0(|I_2| - |I_1| \sin\theta)$
E. $\mu_0(|I_2| + |I_1| \cos\theta)$

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

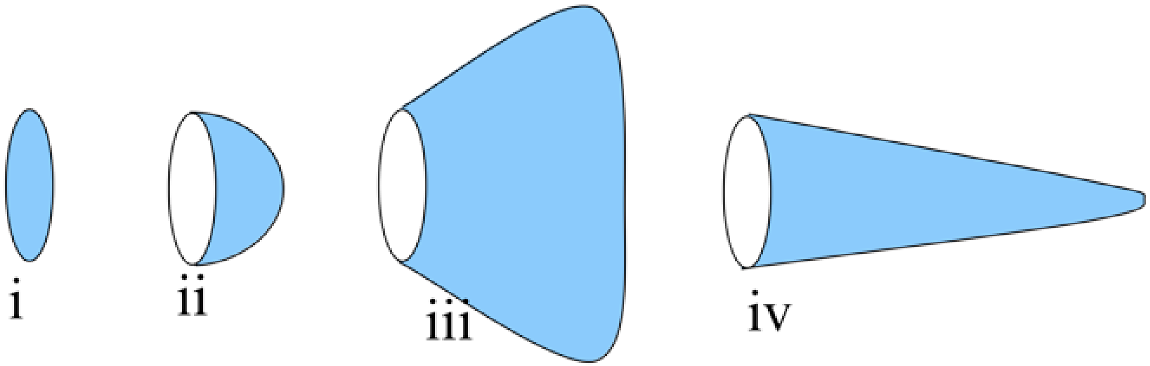
$$\int_S (\nabla \times \mathbf{B}) \cdot dA = \oint_L \mathbf{B} \cdot d\mathbf{l}$$

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

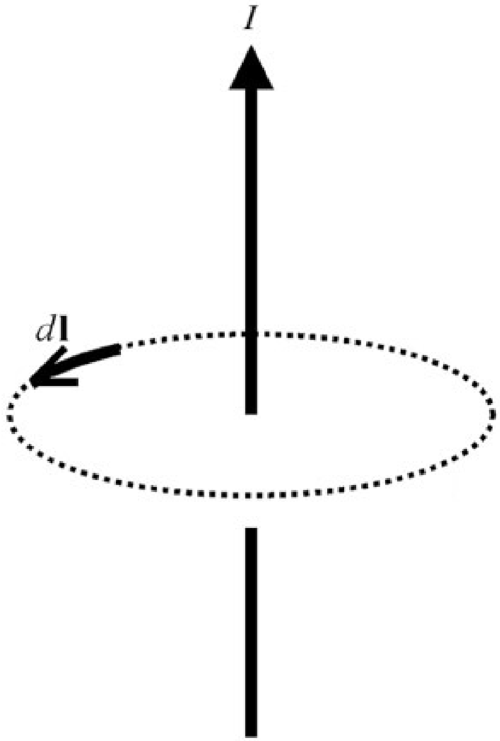
D. Something else!!

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. ???

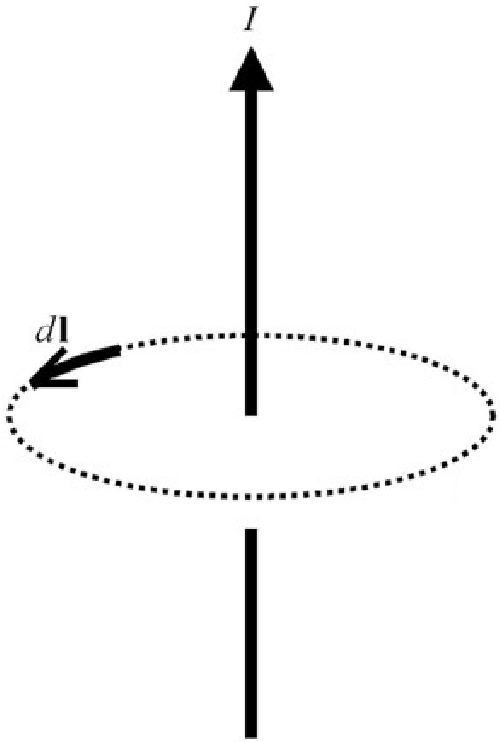
Continuing to build an argument for what $\mathbf{B}$ looks like and what it can depend on.

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

A. Yes

B. No

C. ???



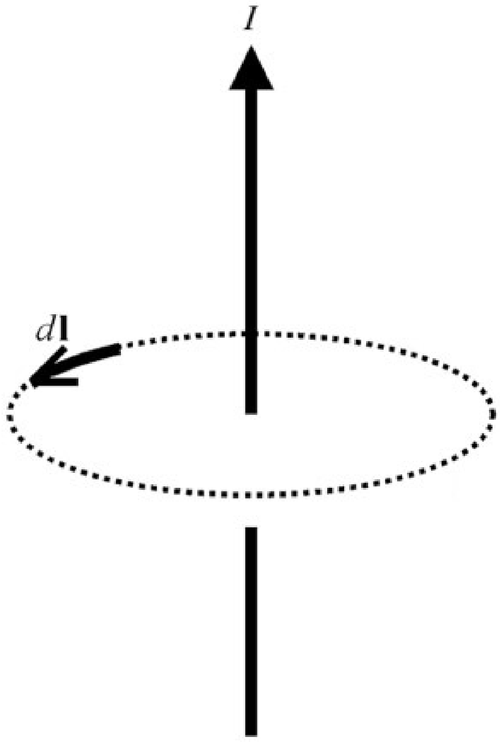
Finalizing the argument for what $\mathbf{B}$ looks like and what it can depend on.

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