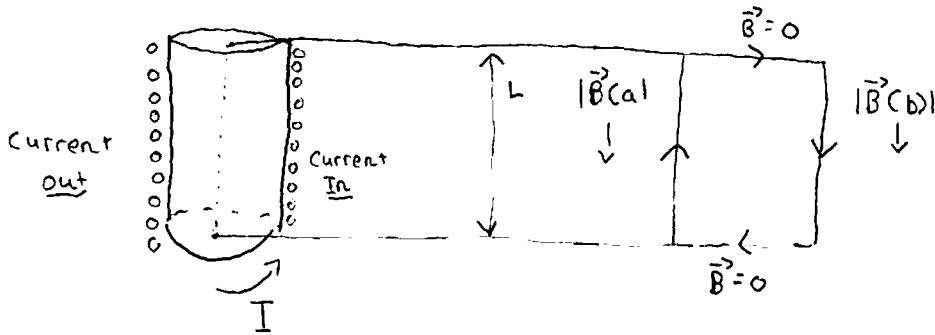


# Infinite Solenoid

$\chi$  loops / unit length



$$\oint \vec{B} \cdot d\vec{\ell} = \mu_0 I_{enc}$$

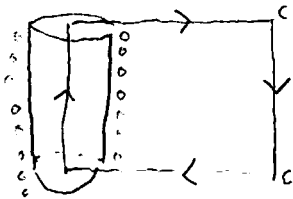
$$(-B(a)L) + B(b)L = \mu_0 I_{enc} = 0 \quad (\text{no current outside cylinder})$$

$$B(b)L - B(a)L = 0$$

$$B(a) = B(b)$$

Far away, the solenoid looks like a simple line of current.  $B(\infty) = 0$ ,  
 $\therefore \vec{B} = 0$  outside.

Inside:



$$\vec{B}_{center} \cdot L = 0 \cdot C + 0 \cdot L + 0 \cdot C = \mu_0 I_{enc} = \mu_0 \chi L I$$

$\therefore$

$$\vec{B}_{center} = \mu_0 \chi I \Rightarrow \text{everywhere inside}$$