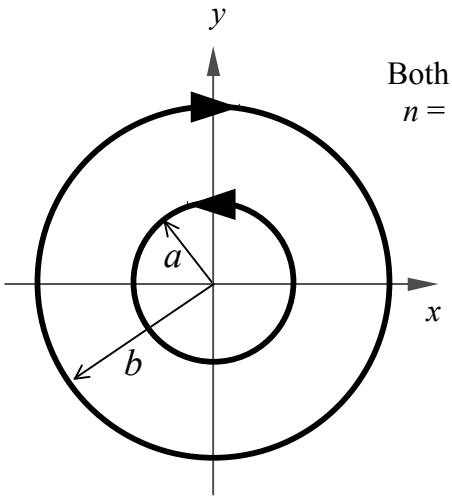
Name: _____ Sec. _____ **P212: Quiz 2, Week 9**

The figure shows two solenoids of infinite length, once placed within the other. They are both concentric with the *z*-axis and have the same number of turns *n* per meter. The inner solenoid (radius *a*) carries a current $I_a$ in the counter-clockwise direction, while the outer solenoid (radius *b*) carries a current $I_b$ in the clockwise direction.




Both solenoids have
$n$ = 5,000 turns/m

$a$ = 15 cm
$b$ = 35 cm

$I_a$ = 3 μA
$I_b$ = 8 μA

1) Find the magnitude and direction of the magnetic field ***B*** at the origin ($x$=$y$=$z$=0). **[5]**

$B = \mu_0 n (I_b - I_a)$

$B = 3.14\times10^{-8}$ T (-z direction, into page)

3 points for correct setup
1 point for correct numerical value
1 point for correct direction

2) Find the magnitude and direction of the magnetic field ***B*** at the point $x$=20 cm, $y$=0, $z$=0 **[5]**

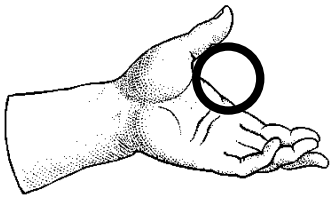
$B = \mu_0 n I_b$

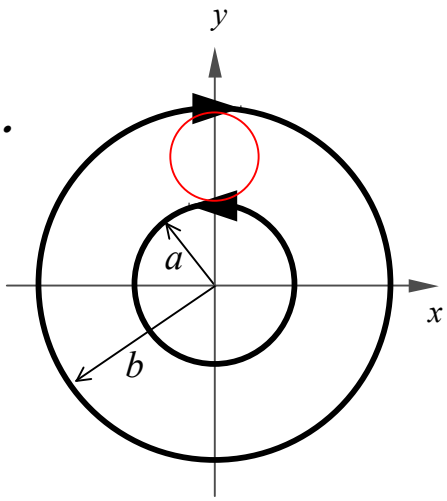
$B = 5.03\times10^{-8}$ T (-z direction, into page)

3 points for correct setup
1 point for correct numerical value
1 point for correct direction

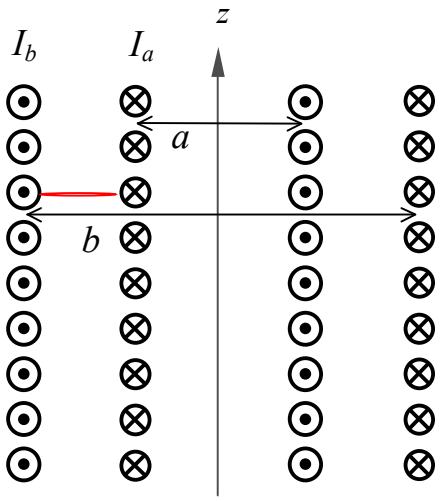
3) Suppose you have a little "pickup loop" of wire (shown below in the disembodied hand ☺). Your task is to place it in such a position and orientation that it will catch the maximum flux possible from the pair of solenoids. How would you place the loop? Please draw the loop at your chosen location on either the "**SIDE VIEW**" or "**TOP VIEW**" diagram (whichever is more convenient). **[4]**

***YOUR PICKUP LOOP …***





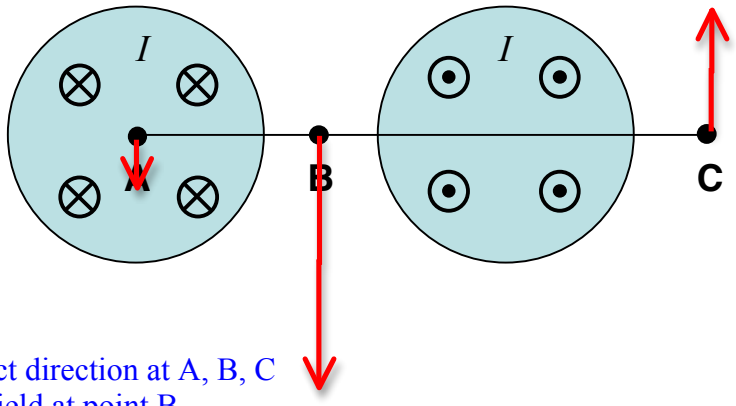

**TOP VIEW**




**SIDE VIEW**

Loop should be between the 2 solenoids and oriented in the x-y plane --> 4 points

4) The diagram below shows two cylindrical wires of infinite length, each carrying a total current *I* that is uniformly distributed across their cross-sectional areas. However, the wire on the left carries current directed into the page, while the current in the right-hand wire points out of the page. On the diagram, draw vectors showing the direction and relative magnitude of the magnetic field at each of the indicated points **A**, **B**, and **C**. (For the magnitude, use *longer vectors* to indicate *larger B fields* … and if the field is zero, just write "0".) **[6]**




1 point each for correct direction at A, B, C
1 point for strongest field at point B
2 points for |B| > |C| > |A|