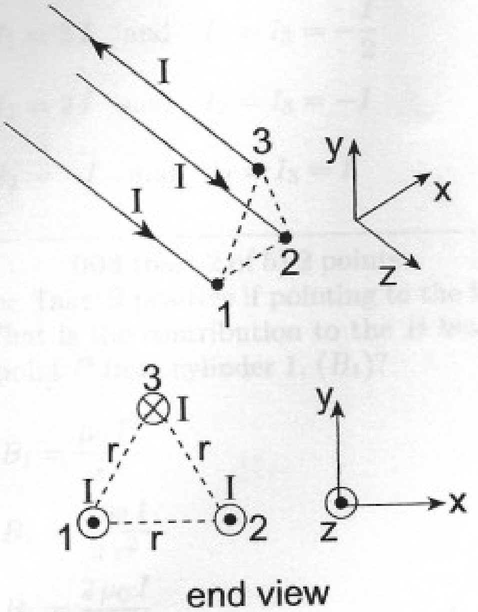


Find the magnitude of the net force per unit length exerted on the upper wire (wire 3) by the other two wires. Answer in units of N/m.

006 (part 2 of 2) 5 points

Note: Measure your angles in the standard way counter-clockwise from the positive x-axis.

What angle does the net force on the upper wire (wire 3) make with the positive x-axis?

1. $\theta = 300°$

2. $\theta = 270°$

3. $\theta = 240°$

4. $\theta = 0°$

5. $\theta = 90°$

6. $\theta = 120°$

7. $\theta = 30°$

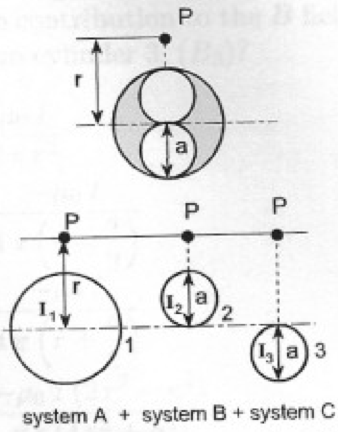
8. $\theta = 210°$

9. $\theta = 180°$

10. $\theta = 60°$

007 (part 1 of 5) 2 points

A long cylindrical conductor of radius a has 2 cylindrical cavities of diameter a through its entire length as shown in the first figure. A current I is directed out of the page and is uniform through the cross-section of the conductor. We are interested in determining the magnetic field at P. Using the principle of superposition, we can break up this problem into 3 simpler problems as shown in the figure: the entire cylinder and the two cylindrical holes.



Let the positive current be the one directed out of the page. Let I_1 be the current in cylinder 1, and so on.

Which of the following is mathematically equivalent to the problem we are trying to solve?

1. $I_1 = 2\,I$ and $I_2 = I_3 = -\dfrac{I}{2}$

2. $I_1 = I$ and $I_2 = I_3 = -\dfrac{I}{2}$

3. $I_1 = 2I$ and $I_2 = I_3 = -\dfrac{I}{4}$

4. $I_1 = I$ and $I_2 = I_3 = -\dfrac{I}{4}$

5. $I_1 = 4\,I$ and $I_2 = I_3 = -\dfrac{I}{4}$

6. $I_1 = I$ and $I_2 = I_3 = 0$

7. $I_1 = 3\,I$ and $I_2 = I_3 = -I$

8. $I_1 = 3\,I$ and $I_2 = I_3 = -\dfrac{I}{2}$

9. $I_1 = 2\,I$ and $I_2 = I_3 = -I$

10. $I_1 = -I$ and $I_2 = I_3 = I$

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008 (part 2 of 5) 2 points

Note: Take B positive if pointing to the left.

What is the contribution to the B field at the point P from cylinder 1, (B_1)?

1. $B_1 = \dfrac{\mu_0\, I^2}{\pi\, r}$

2. $B_1 = \dfrac{4\,\mu_0\, I}{\pi\, r^2}$

3. $B_1 = \dfrac{2\,\mu_0\, I}{\pi\, r}$

4. $B_1 = \dfrac{\mu_0\, I}{\pi\, r}$

5. $B_1 = \dfrac{\mu_0\, I}{\pi\, r^2}$

6. $B_1 = \dfrac{\mu_0\, I}{2\,\pi\, r}$

7. $B_1 = \dfrac{\mu_0\, I}{4\,\pi\, r}$

8. $B_1 = \dfrac{2\,\mu_0\, I}{\pi\, r^2}$

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009 (part 3 of 5) 2 points

What is the contribution to the B field at the point P from cylinder 2, (B_2)?

1. $B_2 = \dfrac{\mu_0\, I}{\pi\, r}$

2. $B_2 = \dfrac{2\mu_0\, I}{\pi\, r^2}$

3. $B_2 = \dfrac{-\mu_0\, I}{4\,\pi\left(r + \dfrac{a}{2}\right)}$

4. $B_2 = \dfrac{-\mu_0\, I\,(2\,r^2 - a^2)}{\pi\, r\,(4\,r^2 - a^2)}$

5. $B_2 = \dfrac{-\mu_0\, I}{2\,\pi\left(r + \dfrac{a}{2}\right)}$

6. $B_2 = \dfrac{-\mu_0\, I}{4\,\pi\left(r - \dfrac{a}{2}\right)}$

7. $B_2 = \dfrac{\mu_0\, I}{2\,\pi\, r}$

8. $B_2 = \dfrac{\mu_0\, I}{\pi\, r^2}$

9. $B_2 = \dfrac{-\mu_0\, I\,(2\,r^2 - a^2)}{2\,\pi\, r\,(4\,r^2 - a^2)}$

10. $B_2 = \dfrac{\mu_0\, I}{2\,\pi\, r^2}$

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010 (part 4 of 5) 2 points

What is the contribution to the B field at the point P from cylinder 3, (B_3)?

1. $B_3 = \dfrac{\mu_0\, I}{2\,\pi\, r^2}$

2. $B_3 = \dfrac{-\mu_0\, I}{4\,\pi\left(r - \dfrac{a}{2}\right)}$

3. $B_3 = \dfrac{-\mu_0\, I}{4\,\pi\left(r + \dfrac{a}{2}\right)}$

4. $B_3 = \dfrac{-\mu_0\, I\,(2\,r^2 - a^2)}{\pi\, r\,(4\,r^2 + a^2)}$

5. $B_3 = \dfrac{\mu_0\, I}{2\,\pi\, r}$

6. $B_3 = \dfrac{-\mu_0\, I\,(2\,r^2 - a^2)}{\pi\, r\,(4\,r^2 - a^2)}$

7. $B_3 = \dfrac{\mu_0\, I}{\pi\, r}$

8. $B_3 = \dfrac{\mu_0\, I}{4\,\pi\, r^2}$

9. $B_3 = \dfrac{2\,\mu_0\, I}{\pi\, r^2}$

10. $B_3 = \dfrac{\mu_0\, I}{\pi\, r^2}$

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011 (part 5 of 5) 2 points

What is the resulting B field at P for the original problem?

1. $B = \dfrac{\mu_0\, I\,(2\,r^2 - a^2)}{\pi\, r\,(4\,r^2 - a^2)}$

2. $B = \dfrac{\mu_0\, I}{2\,\pi\, r}$