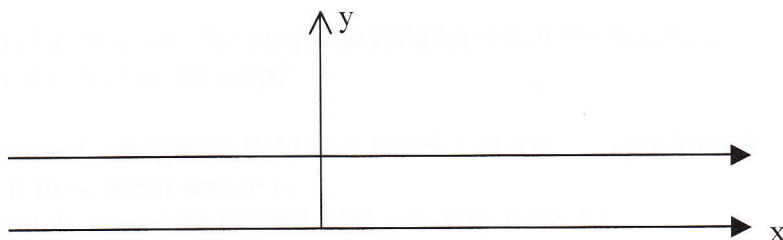


1. Proton 1 is on the x-axis, moving in the $+x$ direction. Proton 2 is on the y-axis, moving in the $+y$ direction. Each proton exerts a magnetic force on the other. Are these forces equal and opposite?

2.



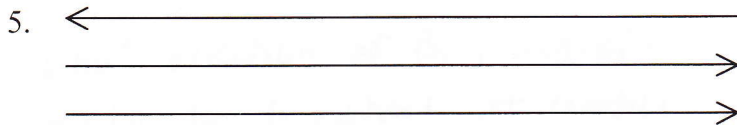
Two infinitely long wires carry equal currents of 2.0 A to the right. The lower wire is along the x-axis; the upper wire is 2.0 cm from the lower wire, measured along the y-axis. Determine the magnitude and direction of the magnetic field at the following locations.

- a. $y = 1.0$ cm
- b. $y = 1.5$ cm
- c. $y = 3.5$ cm
- d. $y = -1.0$ cm

3. Repeat the previous problem, only with the current in the upper wire reversed, so that it goes to the left.

4. In problem 2, the z-axis is upward, out of the page. Determine the magnitude and direction of the magnetic field at the following locations.

- a. $x = 0, y = 0, z = 2.0$ cm.
- b. $x = 0, y = 1.0$ cm, $z = 2.0$ cm.
- c. $x = 2.0$ cm, $y = 1.0$ cm, $z = 2.0$ cm.



Three infinitely long wires carry currents of 2.0 A in the directions shown. The separation between adjacent wires is 2.5 cm.

Determine the magnitude and direction of the force exerted on a 25-cm segment of each wire.

6. The magnetic field on the axis of a circular loop is given by the equation

$$B_x = \frac{\mu_0 I a^2}{2(x^2 + a^2)^{3/2}}$$

where I is the current in the loop, a is the radius of the loop, and the axis of the loop lies along the x -axis.

For what value of x does the magnetic field have half the magnitude of the magnetic field at the center of the loop?

7. It is desired to create a magnetic field $B = 0.025$ T at a certain position A . What current is needed if the current source is

- An infinitely long wire located 2.00 cm away from A ?
- A current loop of radius 2.00 cm, centered on A ?
- An infinite solenoid of radius 2.00 cm, with 10,000 turns of wire per meter?

8. An infinitely long wire carries the same current as a 20.0 cm segment of wire. The two wires are parallel, with the segment above. The segment has a mass of 1.00 gm. The current is turned on, and it is observed that the two wires repel each other.

- Are the currents in the same direction, or in opposite directions?
- It is observed that the segment is in equilibrium at a distance of 1.00 cm above the long wire. How much current is being carried by the two wires?
- If the current doubled, at what new separation between the wires will equilibrium occur?

9.