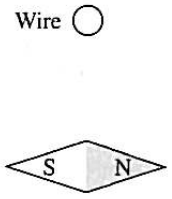
Name Date

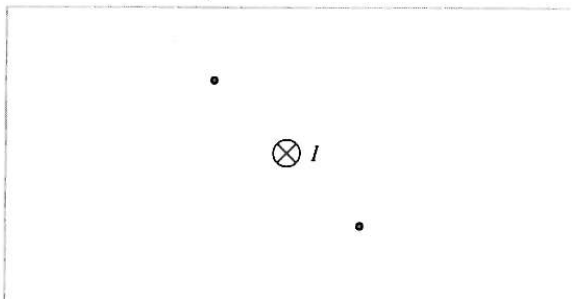
Magnetic Fields due to Currents

1. The figure shows a wire directed into the page and a nearby compass needle. Is the wire's current going into the page or coming out of the page? Explain.

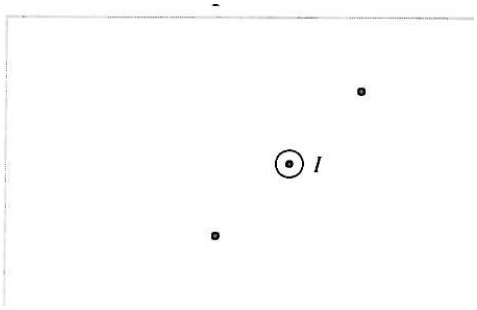


2. For each of the current-carrying wires shown, draw a compass needle in its equilibrium position at the positions of the dots. Label the poles of the compass needle.

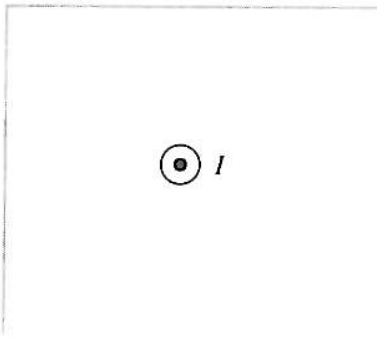
a.



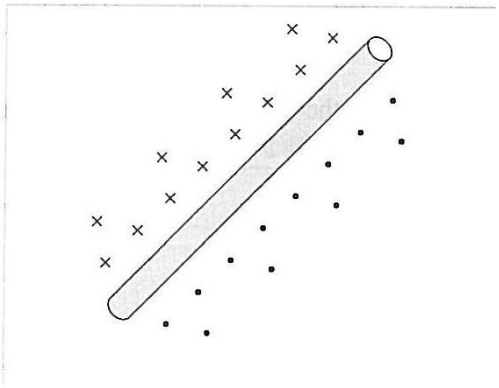
b.



3. The wire below is perpendicular to the page. Draw magnetic field *lines*, then show the magnetic field *vectors* at a few points around the wire.

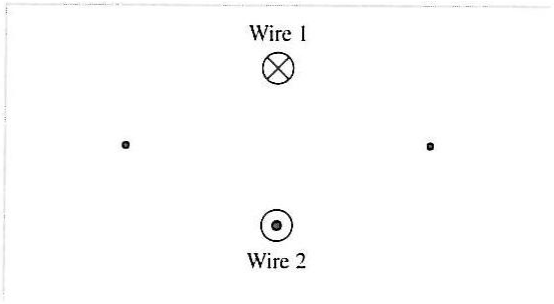


4. Use an arrow to show the current direction in the wire to the right.

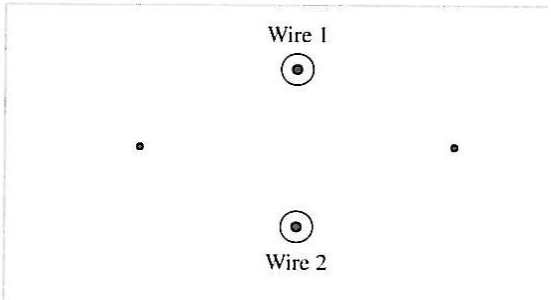


5. Each figure below shows two long straight wires carrying equal currents into and out of the page. At each of the dots, show and label the fields $\mathbf{B}_1$ and $\mathbf{B}_2$ of each wire and the net magnetic field $\mathbf{B}_{net}$.

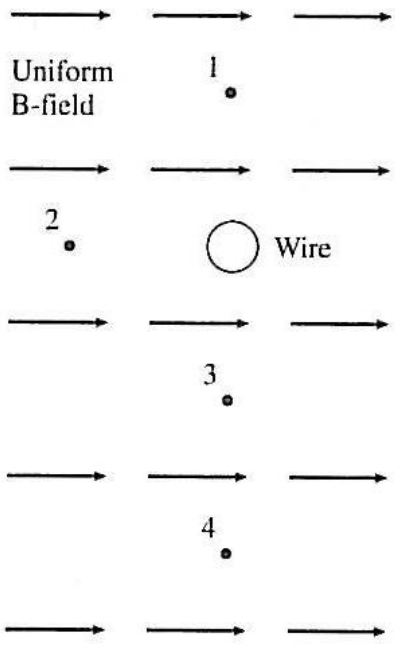
a.



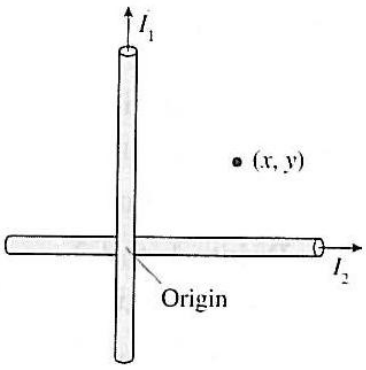
b.



6. A long straight wire, perpendicular to the page, passes through a uniform magnetic field. The *net* magnetic field at point 3 is zero.
   a. On the figure, show the direction of the current in the wire.
   b. Points 1 and 2 are the same distance from the wire as point 3; point 4 is twice as distant. Construct vector diagrams at points 1, 2, and 4 to determine the net magnetic field at each point.



7. Suppose you need to find the magnetic field near the intersection of two long, straight wires. Assume that one wire lies directly on top of the other. Let the intersection of the wires be the origin of a coordinate system and let the point of interest, which is in the same plane, have coordinates (x,y). Recall that the magnetic field is a vector, having both magnitude and direction.



   a. What is the direction of magnetic field $\mathbf{B}_1$ due to current I_1? Explain.

   b. Write an expression for the magnitude of $\mathbf{B}_1$.

   c. What is the direction of magnetic field $\mathbf{B}_2$ due to current I_2? Explain.

   d. Write an expression for the magnitude of $\mathbf{B}_2$.

   e. What are the only two possible directions for the net magnetic field at this point?

   f. Would knowing $I_1 > I_2$ be enough information to determine the direction of the net magnetic field? Why or why not.