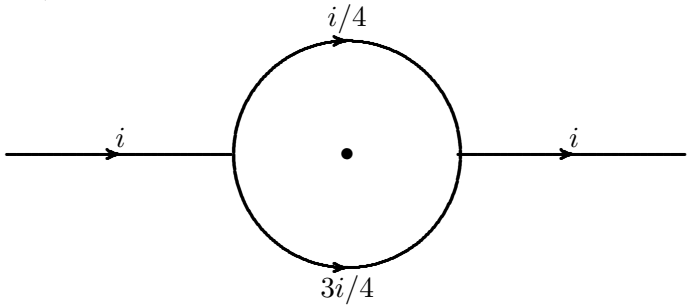
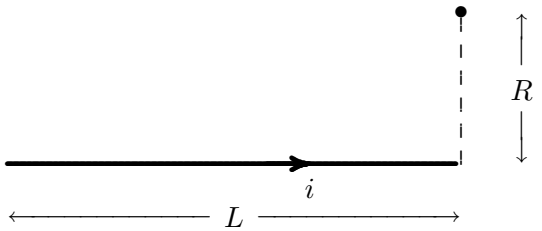
Problems
Chapter 9

1. In a physics laboratory a long straight wire is set up along the east-west direction with a current of 20A flowing westwards. At a point 10cm directly below the wire, the magnetic field is measured to be zero. What is the direction and magnitude of the Earth's magnetic field in this laboratory?

2. The figure below shows an arrangement of current carrying wires. The straight sections each carry a current of i. The current splits unevenly in the semicircular sections. The upper semicircle carries a current of $i/4$ and the lower semicircle a current of $3i/4$. If the current directions are as shown and the radius of the circle is r, find the magnetic field (direction and magnitude) at the center of the circle.



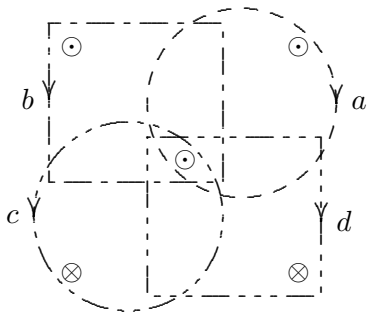
3. The figure below shows a segment of a wire of length L. The current in the wire is i. Find the magnetic field (direction and magnitude) a perpendicular distance R from one end of the wire.



4. Two long straight parallel wires are placed a distance d apart. The currents in the wires are in the same direction with magnitudes i and $2i$. Find the points at which the net magnetic field is zero.

5. A simple-minded current measuring device has a fixed long straight horizontal wire with a known curent i_0 flowing in it. The unknown current i is driven in the opposite direction through a second wire parallel to the first. The second wire has a finite length L and it is balanced directly above the first such that the gravitational force on it exactly cancels the magnetic force (This is an unstable equilibrium. So, think of ways this can be done without the wire falling off to the side.). If the equilibrium distance between the wires is d and the mass of the second wire is m, find i in terms of i_0, L and d.

6. The figure below shows 5 wires with currents going into and out of the page as shown. The magnitude of each current is i. Find $\oint \vec{\mathbf{B}} \cdot d\vec{\mathbf{s}}$ along each of the four paths labelled a, b, c and d in the directions shown.



7. A long solenoid has 5000 turns of wire. Its length is 2.00m and its diameter 3.00cm. If a current of 3.00A flows in it, find the magnitude of the magnetic field inside it.