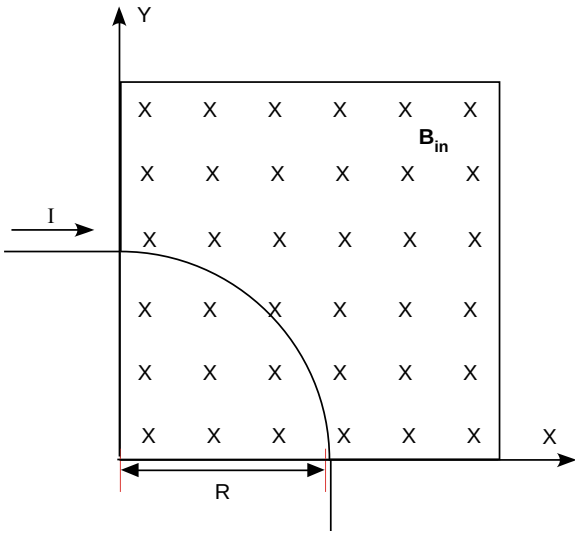
DO NOT TURN THIS PAGE!!!!!

Name: _____

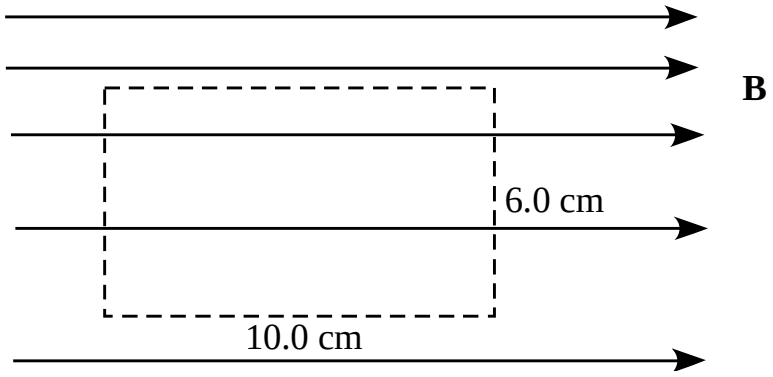
Physics 4B/Winter 2010
Exam 3

Make sure to show all work in complete detail! NO CREDIT will be given if NO work is shown!

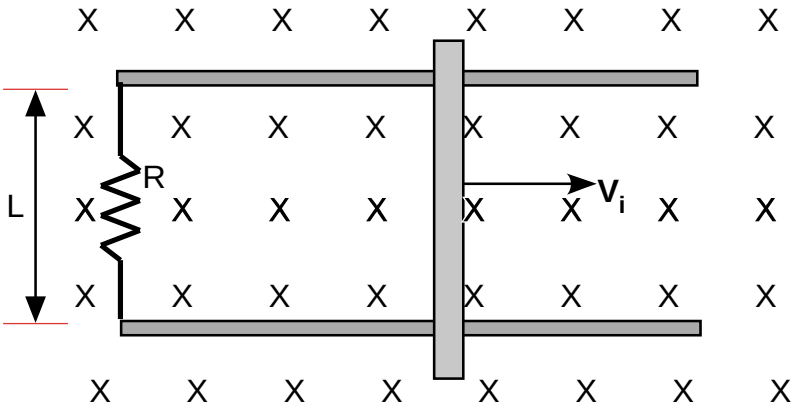
1. A wire carrying 1.5 A passes through a region containing a 2.0 T magnetic field. The wire is perpendicular to the field and makes a quarter-circle turn of radius $R = \frac{1}{\sqrt{2}}$ as it passes through the field region as shown below. Find the magnitude and direction of the magnetic force on this section of wire. Use the coordinate system shown and take the +z-axis out of the page. (Hint: *DO NOT INTEGRATE*!!!)



2. The figure below shows a non-uniform magnetic field that varies along the y-axis. At the top and bottom of the rectangular loop shown the field strengths are 3.0 T and 1.0 T respectively.
   a) Calculate the amount of current that flows through the area bounded by the loop.
   b) In what direction does the current flow?
   c) What is the source of the **B**-field shown.



3. The conducting rod shown below has mass M and length L and can move on two frictionless, parallel rails in the presence of a uniform **B**-field directed into the page as shown. The bar is given an initial velocity $\mathbf{V_i}$ to the right and is released from rest at t = 0.
   a) Find the velocity of the rod as a function of time.
   b) Find the magnitude and direction of the induced current as a function of time.



4. A long, straight wire as shown below carries a constant current I. A metal bar with length L is moving at a constant velocity **V** as shown. Point '*a'* is a distance '*d'* from the wire.
   a) Derive an expression for the EMF induced in the bar.
   b) Which point '*a'* or '*b'* is at a higher potential?