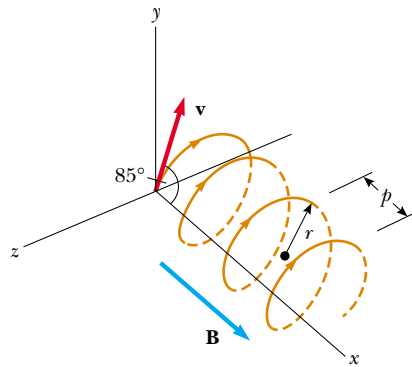


## Problem Set 4: Mostly Magnetic

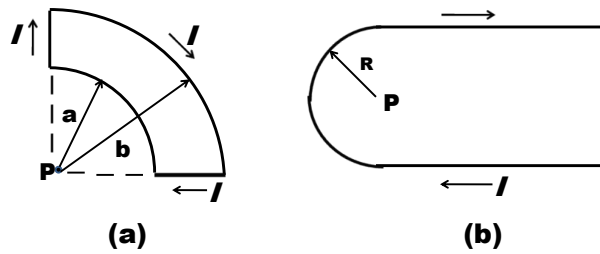
**Instructions:**

1. Answer all questions below. Show your work for full credit.
2. All problems are due Tuesday 24 July 2012 by the end of the day (11:59pm if electronically submitted, by 5pm as a hard copy)
3. You may collaborate, but everyone must turn in their own work.

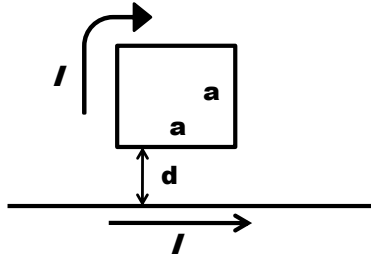
1. A uniform magnetic field of magnitude 0.150 T is directed along the positive  $x$  axis. A positron (a positively-charged electron) moving at  $5.00 \times 10^6$  m/s enters the field along a direction that makes an angle of  $85^\circ$  with the  $x$  axis. The motion of the particle is expected to be a helix in this case. Calculate the pitch  $p$  and radius  $r$  of the trajectory.



2. Find the magnetic field at point P for each of current configurations shown below. Hint for a: Magnetic due to the straight portions is zero at P. Hint for b: Two half-infinite wires make one infinite straight wire. Hint c: use superposition and symmetry!



3. Find the force on a square loop (side  $a$ ) placed as shown below, near an infinite straight wire. Both loop and wire carry a steady current  $I$ .



4. What is the induced EMF between the ends of the wingtips of a Boeing 737 when it is flying over the magnetic north pole? The internet has most of the numbers you require.
5. Show that, if the condition  $R_1 R_2 = L/C$  is satisfied by the components of the circuit below, the difference in voltage between points  $A$  and  $B$  will be zero at any frequency.

