Matter and Motion – Wed. Mar. 7, 2018
Physics Quiz #14 – Revision Edition Name:____________________________

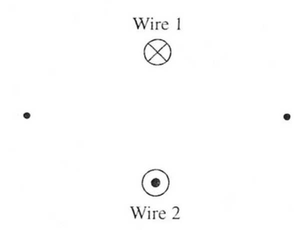
The following information pertains to questions 1 through 3. At some time *t*=0, an electron (q_e=-1.6 x 10^{-19} C) has a velocity of $\vec{v} = 4.0\frac{m}{s}\hat{\imath} - 3.0\frac{m}{s}\hat{\jmath}$. It moves in a region of space with a uniform magnetic field in the +z direction, $\vec{B} = +1.5 \text{ T } \hat{k}$.

1. [2 points] Why will be the shape of its subsequent trajectory be a circle (and not a parabola, straight line or helix)?

2. [4 points] At *t*=0, what is the magnetic force on the electron? Express your answer as a vector with appropriate units.

3. [2 points] As the electron moves through the magnetic field in the absence of other forces, why will its speed remain unchanged?

4. [4 points] In the figure to the right, Wire 1 carries current *I* into the page and Wire 2 carries current *I* out of the page. At each of the two dots shown, draw and label three vectors that represent the magnetic field $\vec{B}_1$ at the dot due to the current in Wire 1, the magnetic field $\vec{B}_2$ due to the current in Wire 2, and the total magnetic field $\vec{B}_{total}$. Pay close attention to directions and relative magnitudes.



5. [4 points] At the center of a tight, circular coil of wire, the magnetic field has a magnitude of 3.0 mT. The coil has a mean radius of 3.0 cm, and it is supplied by a power supply with a current of 2.8 A. About how many turns of wire make up this coil? (Note that this is not a solenoid! This is very similar to Problem 7 of the Week 18 homework. Note further that the field at the center of a circular loop of current has magnitude $B = \frac{\mu_0 I}{2R}$, which can be derived via the Biot-Savart law.)

6. [4 points] In the figure below, a current *I=4.0* A runs on a straight wire from infinitely far away on the left, along the quarter-circle of radius *R=5.0 cm*, then runs "up" along an infinitely long straight wire. What is the magnetic field at the center of the quarter-circle? Be sure to give both the direction and appropriate units.