These are due Friday, 7 March.

1. A point charge of magnitude $q = 4.5$ nC is moving with speed $v = 3.6 \times 10^7$ m/s parallel to the x axis along the line $y = 3$ m. Find the magnetic field at the origin produced by this charge when the charge is at the point $x = -4$ m, $y = 3$ m.

2. A circular loop of radius 5.0 cm has 12 turns and lies in the yz plane. It carries a current of 4 A in the direction such that the magnetic moment of the loop is along the x axis. Find the magnetic field on the x axis at

   (a) $x = 0$;

   (b) $x = 15$ cm;

   (c) $x = 3$ m.

3. A small bar magnet of magnetic moment $\mu = 0.03\ \mathrm{A} \cdot \mathrm{m}^2$ is placed at the center of the loop in the previous problem. The bar magnet's magnetic moment lies in the xy plane and makes an angle of 30°with the x axis. Neglecting any variation in B over the region of the magnet, find the torque on the magnet.

4. Find the magnetic field at the center of a solenoid of length 20 cm, radius 1.4 cm, and 600 turns that carries a current of 4 A.

5. Find the magnetic field at the center of a square current loop of side $L = 50$ cm carrying a current of 1.5 A.

6. A long, straight wire carrying a current of 1.7 A in the positive z direction lies along the line $x = -3$ cm, $y = 0$. A similar wire carrying a current of 1.7 A in the positive z direction lies along the line $x = +3$ cm, $y = 0$. Find the magnetic field at a point P on the y axis at $y = 6$ cm.

7. A long, straight wire of radius R carries a current I that is uniformly distributed over the cross sectional area of the wire. Find the magnetic field both outside and inside the wire.