Electricity and Magnetism, PHYS 350 Problem set 5:

1. Problem 5.31 (5.30).
2. Problem 5.34 (5.33).
3. Problem 5.37 (5.35+5.36).
4. Problem 5.36 (5.37).
5. Problem 6.1 (6.1).
6. Problem 6.7 (6.7).
7. Problem 6.9 (6.9).
8. Problem 6.15 (6.15).
9. Problem 6.17 (6.17).
10. Problem 7.8 (7.8).
11. Problem 7.15 (7.15).
12. A magnetohydrodynamic (MHD) generator is a device that has been proposed for generating power from flow of ionized plasma, e.g., in nuclear fusion reactors. The plasma flows in the z direction through a rectangular pipe, whose cross section is parallel to the x-y plane, and there is a magnetic field $\underline{B} = B\hat{x}$ in the plasma ($\hat{x}$ is the unit vector in the x direction). The x, y, z dimensions of the pipe are w, h, l respectively. The walls at $x = \pm w/2$ are insulating, and the walls at $y = \pm h/2$ are conducting.

a) Show that the potential between the conducting walls is $V = vBh$, where v is the fluid velocity.
b) Suppose the conducting walls are connected by a wire with resistance R. Determine the current in the wire, if ρ is the resistivity of the plasma.
(Hint: There are currents in series in the wire and in the plasma.)

Optional problems E:

E1. Problem 5.24 (5.23).
E2. Problem 5.41 (5.39).
E3. Problem 6.8 (6.8).
E4. Problem 6.25 (6.23).
E5. Problem (7.16).
E6. Problem 7.18 (7.18).

(Numbers from Griffiths book 4th edition; 3rd edition numbers in parentheses)