1. Jackson 2.14

2. Jackson 2.25(a)

3. Consider a 2-D wedge-shaped conducting object with inner radius $a$ and outer radius $b$ and azimuthal extent $\beta$. The potential is maintained at zero at the inner and outer radii and $\phi = 0$. The potential is maintained at $V$ at $\phi = \beta$.

(a) Construct a set of basis functions that can be used to solve for $\Phi$ inside the object. Use functions that are periodic in radius $\rho$ and exponential in azimuthal angle $\phi$. Derive the orthogonality relation for your basis functions. Sketch the $\rho$ dependence of the three lowest order eigenfunctions.

(b) Use your basis functions to solve for $\Phi$ inside the object. Sketch the electric field.

4. Consider a rectangular, grounded conducting box of dimensions $a$ in the $x$ and $y$ directions and $c$ in the $z$ direction.

(a) A charge $q$ is placed in the center of the box. What is the electric field acting on the charge? Why?

(b) The particle is displaced a small distance $\Delta z \ll c$ along the $z$ direction from the center of the box. Calculate the electric field acting on the charge first for arbitrary $a/c$ and then for $a/c \gg 1$ and $a/c \ll 1$. Hint: you need to eliminate the self-field of the charge. How do you do this?

(c) Calculate the motion of the charge (mass $m$) while $\Delta z \ll c$. Qualitatively describe what happens when $\Delta z$ is not small.