EXERCISES FOR CHAPTER VI

VI.1. Vertical and horizontal antenna at the altitude h over an infinitely conductive ground. Show that the formulas (31.16) and (31.17) for the two *electric* antennas:

$$\text{a)}\quad \Pi = \Pi_z = \frac{e^{ikR}}{R} + \frac{e^{ikR'}}{R'}, \qquad \text{b)}\quad \Pi = \Pi_x = \frac{e^{ikR}}{R} - \frac{e^{ikR'}}{R'},$$

satisfy the conditions (31.15) for the vanishing of the tangential component of $\mathbf{E}$ in the entire plane $z = 0$.

In the same manner show that the formulas (31.19) and (31.20) for the two *magnetic* antennas:

$$\text{c)}\quad \Pi = \Pi_z = \frac{e^{ikR}}{R} - \frac{e^{ikR'}}{R'}, \qquad \text{d)}\quad \Pi = \Pi_x = \frac{e^{ikR}}{R} + \frac{e^{ikR'}}{R'}$$

satisfy the conditions (35.1) for the vanishing of the tangential electric component.

VI.2. Behavior of the electric force lines for a Zenneck wave in the neighborhood of the earth's surface. Show that the lines of force in the air are bent forward, i.e., in the direction of propagation and that the lines of force in the earth are *dragged behind.*

VI.3. Simplified computation of the power needed for the vertical and horizontal antenna. Prove the expressions (36.16) and (36.16a) by determining the work $\mathbf{E}jl$ done per unit of time by the field strength $\mathbf{E}$ and the current j for the length l of the antenna.