1. Engineers call for a power line with a resistance of 50 mΩ/km. What diameter wire should be used if it is made from Copper? Aluminum? (See Table 28.2 in the text for values).

2. The National Board of Fire Underwriters has fixed safe current-carrying capacities for various sizes and types of wire. For 10-gauge rubber-coated copper wire (diameter = 0.100 in), the maximum safe current is 25.0 A. At this current, find
   (a) the current density,
   (b) the electric field inside the wire,
   (c) the potential difference across 1000 ft of wire.

3. The electric potential in a certain region of space is given in SI units by
   \[ V = 9x^2 + 4xy + 7y^2. \]
   What is the electric field at \( x = 2.00 \text{ m}, y = 0, z = 0 \)?

4. Estimate the magnitude and direction of the electric field at the point P for the equipotential lines shown. The distances are in centimeters. Assume there is no variation of the equipotential lines in the \( z \)-direction.

Conversion: 2.54 cm = 1 inch (exactly, using the modern definition of the inch). It is worth memorizing this conversion. One foot is, of course, 12 inches (also exact, by definition).