

There aren't any problems in our textbook on Julia sets and the Mandelbrot set. Here are three experiments you can do on your own to become more familiar with the structures of these sets. The experiments are taken from the textbook *A First Course in Chaotic Dynamical Systems* by Robert L. Devaney.

1. Select a  $c$ -value from a bulb and determine the period of the corresponding attracting cycle. In particular, find bulbs that have an attracting  $n$ -cycle for  $n = 3, 4, 5$ . Mark the locations of the period 3, 4, and 5 bulbs on the Mandelbrot set.
2. Magnify several different bulbs attached to the main body of the Mandelbrot set. Be sure to include both the bulb and its attached antenna. For each bulb, record the period of the bulb. Then count and record the number of spokes emanating from the central junction point of the attached antenna. Is there a relationship between the period of a bulb attached to the main body of the Mandelbrot set and the number of spokes in its antenna?
3. For various bulbs attached to the main body of the Mandelbrot set, magnify the central portion of the antenna from which all the spokes emanate. Zoom in on this point several times and determine as exactly as possible the corresponding  $c$ -value. Then draw the filled Julia set for this  $c$ -value. Compare the shape of the magnified Mandelbrot set near the junction point with the corresponding filled Julia set. Are there any similarities?