

12.7



LABORATORY PROJECT: FAMILIES OF SURFACES

This project can be completed anytime after you have studied Section 12.7 in the textbook.

In this project you will discover the interesting shapes that members of families of surfaces can take. You will also see how the shape of the surface evolves as you vary the constants.

1. Use a computer to investigate the family of functions

$$f(x, y) = (ax^2 + by^2)e^{-x^2-y^2}$$

How does the shape of the graph depend on the numbers a and b ?

2. Use a computer to investigate the family of surfaces $z = x^2 + y^2 + cxy$. In particular, you should determine the transitional values of c for which the surface changes from one type of quadric surface to another.
3. Members of the family of surfaces given in spherical coordinates by the equation

$$\rho = 1 + 0.2 \sin m\theta \sin n\phi$$

have been suggested as models for tumors and have been called *bumpy spheres* and *wrinkled spheres*. Use a computer to investigate this family of surfaces, assuming that m and n are positive integers. What roles do the values of m and n play in the shape of the surface?