Chapter Review

Summary

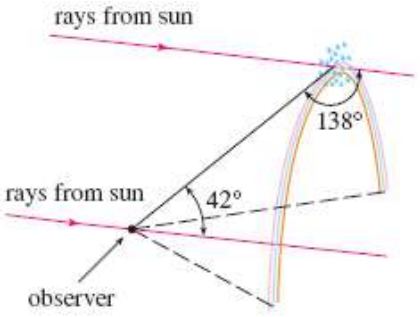
We have seen that the concept of a limit arises in trying to find the area of a region, the slope of a tangent to a curve, the velocity of a car, or the sum of an infinite series. In each case the common theme is the calculation of a quantity as the limit of other, easily calculated quantities. It is this basic idea of a limit that sets calculus apart from other areas of mathematics. In fact, we could define calculus as the part of mathematics that deals with limits.

After Sir Isaac Newton invented his version of calculus, he used it to explain the motion of the planets around the sun. Today calculus is used in calculating the orbits of satellites and spacecraft, in predicting population sizes, in estimating how fast oil prices rise or fall, in forecasting weather, in measuring the cardiac output of the heart, in calculating life insurance premiums, and in a great variety of other areas. We will explore some of these uses of calculus in this text.

In order to convey a sense of the power of the subject, we end this preview with a list of some of the questions that you will be able to answer using calculus:

1. How can we explain the fact, illustrated in Figure 12, that the angle of elevation from an observer up to the highest point in a rainbow is $42°$? (See The Calculus of Rainbows.)

   Figure 12

2. How can we explain the shapes of cans on supermarket shelves? (See The Shape of a Can.)

3. Where is the best place to sit in a movie theater? (See Where to Sit at the Movies.)

4. How can we design a roller coaster for a smooth ride? (See Building a Better Roller Coaster.)

5. How far away from an airport should a pilot start descent? (See Where Should a Pilot Start Descent?.)

6. How can we fit curves together to design shapes to represent letters on a laser printer? (See Bézier Curves.)

7. How can we estimate the number of workers that were needed to build the Great Pyramid of Khufu in ancient Egypt? (See Exercise 34.)

8. Where should an infielder position himself to catch a baseball thrown by an outfielder and relay it to home plate? (See Calculus and Baseball.)

9. Does a ball thrown upward take longer to reach its maximum height or to fall back to its original height? (See Which Is Faster, Going Up or Coming Down?.)

10. How can we explain the fact that planets and satellites move in elliptical orbits? (See 13.3 Exercises.)

11. How can we distribute water flow among turbines at a hydroelectric station so as to maximize the total energy production? (See Hydro-Turbine Optimization.)

12. If a marble, a squash ball, a steel bar, and a lead pipe roll down a slope, which of them reaches the bottom first? (See Roller Derby.)