

1.6 The Beginnings of Calculus

While functions, graphs, and computers are part of the general fabric of mathematics, we can also abstract from the *SIR* model some important aspects of the calculus itself. The first of these is the idea of a **rate of change**. In this chapter we just assumed the idea was intuitively clear. However, there are some important questions not yet answered; for example, how do you deal with a quantity whose rate of change is itself always changing? These questions, which lead to the fundamental idea of a **derivative**, are taken up in chapter 3.

Rate equations – more commonly called **differential equations** – lie at the very heart of calculus. We will have much more to say about them, because many processes in the physical, biological, and social realms can be modelled by rate equations. In our analysis of the *SIR* model, we used rate equations to estimate future values by assuming that rates stay fixed for a whole day at a time. The discussion called “there and back again” on page ?? points up the shortcomings of this assumption. In chapter 2 we will develop a procedure, called Euler’s method, to address this problem. In chapter 4 we will return to differential equations in a general way, equipped with Euler’s method and the concept of the derivative.

