

# Chapter 1

## E U C L I D E A N V E C T O R S

This book has two objectives. One is to present the basic concepts and techniques of **linear algebra**, which is the study of ordered lists of numbers and their applications to lines, planes, and related topics. These techniques are useful in solving a variety of problems arising in mathematics, computer science, engineering, physics, chemistry, statistics, economics, business and other areas. A second objective is to describe and illustrate a number of mathematical thinking processes that arise not only in linear algebra, but also in many other mathematical subjects, such as discrete mathematics, abstract algebra, advanced calculus, and the like. Understanding these thinking processes greatly reduces the time and frustration involved in learning advanced mathematics. You can also use these thinking processes to solve mathematical problems in general, as you will see in this chapter for solving the following problem.

### **The Routing Problem of Best Paper Products**

Best Paper Products supplies local-area businesses with a variety of paper products. Each day, a truck leaves the warehouse to make deliveries to a number of customers. The order in which the deliveries are made is determined manually by plotting the locations of the day's customers on a map and then rotating a horizontal line drawn through the warehouse in the counterclockwise direction 360 degrees, picking up each customer in turn. You have been asked to automate this procedure on their computer system.