47. Relative Risk and Odds Ratio In a clinical trial of 2103 subjects treated with Nasonex, 26 reported headaches. In a control group of 1671 subjects given a placebo, 22 reported headaches. Denoting the proportion of headaches in the treatment group by p_t and denoting the proportion of headaches in the control (placebo) group by p_c, the *relative risk* is p_t/p_c. The relative risk is a measure of the strength of the effect of the Nasonex treatment. Another such measure is the *odds ratio,* which is the ratio of the odds in favor of a headache for the treatment group to the odds in favor of a headache for the control (placebo) group, found by evaluating the following:

$$\frac{p_t/(1 - p_t)}{p_c/(1 - p_c)}$$

The relative risk and odds ratios are commonly used in medicine and epidemiological studies. Find the relative risk and odds ratio for the headache data. What do the results suggest about the risk of a headache from the Nasonex treatment?

48. Flies on an Orange If two flies land on an orange, find the probability that they are on points that are within the same hemisphere.

49. Points on a Stick Two points along a straight stick are randomly selected. The stick is then broken at those two points. Find the probability that the three resulting pieces can be arranged to form a triangle. (This is possibly the most difficult exercise in this book.)

4-3 Addition Rule

Key Concept In this section we present the *addition rule* as a tool for finding $P(A \text{ or } B)$, which is the probability that either event A occurs or event B occurs (or they both occur) as the single outcome of a procedure. To find the probability of event A occurring or event B occurring, we begin by adding the number of ways that A can occur and the number of ways that B can occur, but we add without double counting. That is, we do not count any outcomes more than once. The key word in this section is *or,* which generally indicates *addition* of probabilities. Throughout this text we use the *inclusive or,* which means either one or the other or both. (Except for Exercise 41, we do not consider the *exclusive or,* which means either one or the other but not both.)

In Section 4-2 we presented the basics of probability and considered events categorized as *simple* events. In this and the following section we consider *compound events.*

DEFINITION A **compound event** is any event combining two or more simple events.

Notation for Addition Rule

$P(A \text{ or } B) = P(\text{in a single trial, event } A \text{ occurs or event } B \text{ occurs or they both occur})$

In Section 4-2 we considered simple events, such as the probability of getting a false positive when 1 test result is randomly selected from the 1000 test results listed in Table 4-1, reproduced on the next page for the convenience and pleasure of the reading audience. In Example 1 we consider P(positive test result *or* a subject uses drugs) when 1 of the 1000 test results is randomly selected. Follow the reasoning used in Example 1 and you will have a basic understanding of the addition rule that is the focus of this section.

Proportions of Males/Females

It is well known that when a baby is born, boys and girls are not equally likely. It is currently believed that 105 boys are born for every 100 girls, so the probability of a boy is 0.512. Kristen Navara of the University of Georgia conducted a study showing that around the world, more boys are born than girls, but the difference becomes smaller as people are located closer to the equator. She used latitudes, temperatures, unemployment rates, gross and national products from 200 countries and conducted a statistical analysis showing that the proportions of boys appear to be affected only by latitude and its related weather. So far, no one has identified a reasonable explanation for this phenomenon.