Section 13.3 Events Involving “And”; Conditional Probability

# Objective 1: Find the Probability of One Event and a Second Event Occurring

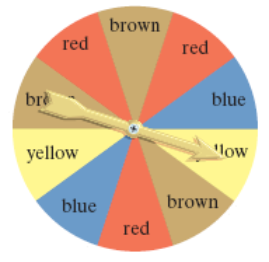
Two events are **independent events** if the occurrence of either of them has no effect on the probability of the other. For example, if a fair coin is tossed twice in succession, the outcome of the first toss has no effect on the outcome of the second toss.

**“And” Probabilities with Independent Events**

If *A* and *B* are independent events, then .

This rule can be extended to cover three or more independent events.

a. For the spinner shown below, it is equally probable that the pointer will land on any one of the regions when spun. If the pointer lands on a boundary line, spin again.



i. If the pointer is spun twice, what is the probability it will land on blue then red?

ii. If the pointer is spun three times, what is the probability it will land on blue, then brown, and then yellow?

iii. If the pointer is spun twice, what is the probability it will land on a color other than brown on each spin.

b. A single die is rolled twice.

i. Find the probability of rolling a 4 and then a 6.

ii. Find the probability of rolling an odd number and then a number greater than 2.

**The Probability of an Event Happening at Least Once**



c. The probability that a certain state will be hit by a major tornado (category F4 or F5) in any single year is . Use this information to answer the following:

i. What is the probability that the state will be hit by a major tornado three years in a row?

ii. What is the probability that the state will *not* be hit by a major tornado four years in a row?

ii. What is the probability that the state will be hit by a major tornado at least once in the next 5 years?

Two events are **dependent events** if the occurrence of one of them has an effect on the probability of the other.

**“And” Probabilities with Dependent Events**

If *A* and *B* are dependent events, then .

This rule can be extended to cover three or more dependent events.

d. Consider a political discussion group consisting of 10 Democrats, 12 Republicans, and 3 Independents.

i. Suppose that two group members are randomly selected, in succession, to attend a political convention. Find the probability of selecting no Independents.

ii. Suppose that three group members are randomly selected, in succession, to attend a political convention. Find the probability of selecting an Independent followed by two Republicans.

# Objective 2: Compute Conditional Probabilities

**Conditional Probability**

The probability of event *B*, assuming *A* has already occurred*,* is called the **conditional probability** of *B*, given *A*. This probability is denoted .

It is helpful to think of the conditional probability  as the **probability that event *B* occurs if the sample space is restricted to the outcomes associated with event *A***.

**Formula for Conditional Probability**



a. The numbered disks shown are placed in a box and one disk is selected at random.

the green disks are labeled 1, 3, 4, 5, 7. 
the blue disks are labeled 2, 6, 8.

Find the probability of each of the following:

i. an even number is selected, given that a green disk is selected.

ii. an odd number, given that a blue disk is selected.

iii. a number less than 5, given a green disk is selected.

iv. a green disk is selected, given that an even number is selected.

v. a blue disk, given that the number selected is at least 6.

b. A single card is drawn from a standard 52-card deck. Find the probability that the card is

i. red, given that it is a four.

ii. a face card, given that it is a spade.

iii. the 10 of hearts, given that it is red.