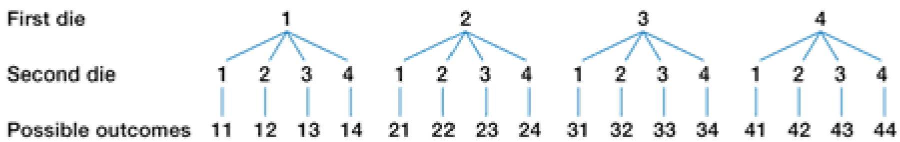
Lesson 12–3

Example 1 **Probability**

Suppose that two tetrahedral dice are rolled. The tetrahedral dice have four sides numbered 1, 2, 3, and 4. What is the probability that both dice show an even number?

You can use a tree diagram to find the sample space.



There are 16 possible outcomes. You can confirm this with the Fundamental Counting Principle. There are 4 possible results for the first die and 4 for the second die, so there are $4 \cdot 4$ or 16 possible outcomes. Four of these outcomes, 22, 24, 42, and 44, are a success, so $s = 4$. The other twelve outcomes are failures, so $f = 12$.

$$P(\text{two evens}) = \frac{s}{s+f}$$ Probability formula

$$= \frac{4}{4+12} \text{ or } \frac{1}{4}$$ $s = 4, f = 12$

The probability of rolling two even numbers is $\frac{1}{4}$. This probability can also be written as a decimal, 0.25, or a percent, 25%.

Example 2 **Probability with Combinations**

Devin has a collection of 40 model vehicles which consists of 25 different cars and 15 different trucks. He randomly selects 8 to display on the shelf in his room. What is the probability that he selects 3 cars and 5 trucks?

Step 1 Determine how many 8–vehicle selections meet the conditions.

$C(25, 3)$ Select 3 cars from the car collection. Their order does not matter.

$C(15, 5)$ Select 5 trucks from the truck collection. Their order does not matter.

Step 2 Use the Fundamental Counting Principle to find the number of successes.

$$C(25, 3) \cdot C(15, 5) = \frac{25!}{22!\ 3!} \cdot \frac{15!}{10!\ 5!} \text{ or } 6{,}906{,}900$$

Step 3 Find the total number of possible 8–vehicle selections.

$$C(40, 8) = \frac{40!}{32!\ 8!} \text{ or } 76{,}904{,}685$$

$s + f = 76{,}904{,}685$

$$P(\text{3 cars and 5 trucks}) = \frac{s}{s+f}$$ Probability formula

$$= \frac{6{,}906{,}900}{76{,}904{,}685}$$ Substitute.

$$\approx 0.08981$$ Use a calculator.

The probability of selecting 3 cars and 5 trucks is about 0.08981 or 9.0%.

Example 3 **Odds**

EDUCATION For the 1997–98 school year in the U.S., Iowa had the highest high school graduation rate at about 89% while Georgia had the lowest rate at about 51%. These statistics are calculated according to students that should have graduated in that year.

a. What are the odds that a person who should have graduated in 1998 in Iowa actually graduated?

Eighty–nine percent means that eighty–nine out of one hundred of the students graduated, so the number of successes is 89. The number of failures is 100 – 89 or 11.

odds of student graduating = $s : f$ — Odds formula
= 89 : 11 — $s = 89$, $f = 11$

The odds of a student who should have graduated in 1998 in Iowa actually graduating are 89 : 11.

b. What are the odds that a person who should have graduated in 1998 in Georgia actually graduated?

Fifty–one percent means that fifty–one out of one hundred of the students graduated, so the number of successes is 51. The number of failures is 100 – 51 or 49.

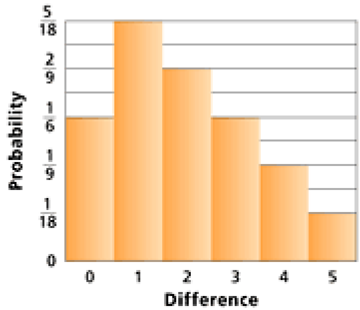
odds of student graduating = $s : f$ — Odds formula
= 51 : 49 — $s = 51$, $f = 49$

The odds of a student who should have graduated in 1998 in Georgia actually graduating are 51 : 49.

Example 4 **Probability Distribution**

Suppose two dice are rolled. The table and the relative–frequency histogram show the distribution of the difference of the numbers rolled. The difference is always calculated as a positive difference.

Difference	0	1	2	3	4	5
Probability	$\frac{1}{6}$	$\frac{5}{18}$	$\frac{2}{9}$	$\frac{1}{6}$	$\frac{1}{9}$	$\frac{1}{18}$



a. **Use the graph to determine which outcome is least likely. What is its probability?**

The least probability in the graph is $\frac{1}{18}$. The least likely outcome is 5.

b. **Use the table to determine the probability of rolling a difference of 4. What difference has a probability that is twice the probability of rolling a difference of 4?**

According to the table, the probability of a difference of 4 is $\frac{1}{9}$. The probability of rolling a 2 is twice that probability or $\frac{2}{9}$.

c. **What are the odds of rolling a difference of 1?**

Step 1 Identify s and f.

$$P(\text{rolling a } 1) = \frac{5}{18}$$

$$= \frac{s}{s + f} \qquad s = 5, f = 13$$

Step 2 Find the odds.

$$\text{Odds} = s : f$$

$$= 5 : 13$$

So, the odds of rolling a difference of 1 are 5 : 13.