

# 7-2

## Theoretical and Experimental Probability



### Connection: Making Fair Decisions

Essential question: How can you use probability to help you make fair decisions?

### COMMON CORE Standards for Mathematical Content

CC.9-12.S.MD.6(+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).\*

**Probability** is the measure of how likely an event is to occur. Each possible result of a probability experiment or situation is an **outcome**. The **sample space** is the set of all possible outcomes. An **event** is an outcome or set of outcomes.

Experiment or Situation	Rolling a number cube	Spinning a spinner
		
Sample Space	{1, 2, 3, 4, 5, 6}	{red, blue, green, yellow}

**Equally likely outcomes** have the same chance of occurring. When you toss a fair coin, heads and tails are equally likely outcomes. **Favorable outcomes** are outcomes in a specified event. For equally likely outcomes, the **theoretical probability** of an event is the ratio of the number of favorable outcomes to the total number of outcomes.

Each letter of the word **PROBABLE** is written on a separate card. The cards are placed face down and mixed up. What is the probability that a randomly selected card has a consonant?

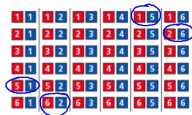
#### Theoretical Probability

For equally likely outcomes,

$$P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{number of outcomes in the sample space}}$$

$$P(\text{consonant}) = \frac{5}{8} = 62.5\%$$

Two number cubes are rolled. What is the probability that the difference between the two numbers is 4?



36 total

$$P(\text{difference is 4}) = \frac{4}{36} = \frac{1}{9}$$

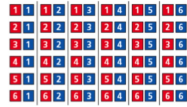
A red number cube and a blue number cube are rolled. If all numbers are equally likely, what is the probability of the event?

The sum is 6.



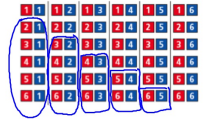
$$P(\text{sum is 6}) = \frac{5}{36}$$

★ A red number cube and a blue number cube are rolled. If all numbers are equally likely, what is the probability of the event? The difference is 6.



$$P(\text{difference is 6}) = \frac{0}{36}$$

★ A red number cube and a blue number cube are rolled. If all numbers are equally likely, what is the probability of the event?



P (red cube greater than blue)

$$P(\text{red cube greater}) = \frac{15}{36} = \frac{5}{12}$$

The sum of all probabilities in the sample space is 1. The **complement** of an event  $E$  is the set of all outcomes in the sample space that are not in  $E$ .

#### Complement

The probability of the complement of event  $E$  is  
 $P(\text{not } E) = 1 - P(E)$ .

★ There are 25 students in study hall. The table shows the number of students who are studying a foreign language. What is the probability that a randomly selected student is not studying a foreign language?

Language	Number
French	6
Spanish	12
Japanese	3

25 total

$$1 - \frac{21}{25} = \frac{4}{25}$$

★ In a box of 25 switches, 3 are defective. What is the probability of randomly selecting a switch that is not defective?

$$1 - \frac{3}{25}$$

$$\frac{22}{25}$$

★ Two integers from 1 to 10 are randomly selected. The same number may be chosen twice. What is the probability that both numbers are less than 9?

The probability that both numbers are less than 9, is

$$\frac{8}{10} \cdot \frac{8}{10} = \frac{64}{100} = \frac{16}{25}, \text{ or } 64\%.$$

