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LESSON
39 Compound Probability

CC.2.4.7.B.3

PART 1 Introduction

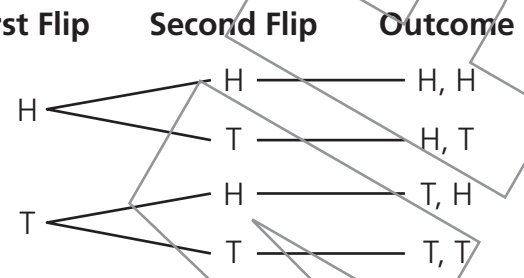
A **compound event** is made up of more than one simple event. For example, flipping a coin is a simple event. Flipping a coin and spinning a spinner is a compound event.

A sample space is the set of all possible outcomes.

The probability of a compound event can be found by creating the sample space. One kind of sample space is a **tree diagram.**

What is the probability of a coin landing tails up both times if you flip it twice?

Make a tree diagram with *H* for heads and *T* for tails. Start with the first flip and list the two possible outcomes. Then show the two possible outcomes for the second flip.



Each outcome is on a separate branch of the "tree" in the tree diagram.

There are 4 possible outcomes for two flips, and only 1 outcome consists of both flips being tails. So the probability of a coin landing tails up both times is $\frac{1}{4}$.

A table or list is another way to find the sample space of a compound event.

What is the probability of a coin landing heads up every time if you flip it 3 times?

Make a table to show the possible outcomes. Start with the first flip. It can result in heads or tails. Then go to the second and third flips.

There are 8 possible outcomes. There is only 1 outcome that involves all heads: HHH. So the probability of getting all heads is $\frac{1}{8}$.

Coin Flip 1	Coin Flip 2	Coin Flip 3	Outcome
Heads	Heads	Heads	HHH
		Tails	HHT
	Tails	Heads	HTH
		Tails	HTT
Tails	Heads	Heads	THH
		Tails	THT
	Tails	Heads	TTH
		Tails	TTT

Suppose, instead, you wanted to know the probability of at least 2 heads. Count the outcomes with HH or HHH in them. There are 4, so the probability of at least 2 heads is $\frac{4}{8}$.

Some experiments are too involved or impossible to carry out. In such cases, you can take advantage of a **simulation,** an experiment designed to find the probability of a compound event. Simulations can be created with coin flips, number cubes, and computers or calculators that generate lists of random numbers.

Think About It

How are lists, tables, and tree diagrams useful for organizing the results of an experiment?

_____

_____

PART 2 Focused Instruction

Calculate the probability of a compound event by multiplying the probability of each event together.

➤ Andrea places 4 chocolates and 5 caramels in a bag. What is the probability of randomly selecting a chocolate, putting it back, and then selecting a caramel? Write this probability as a percentage.

How many total pieces of candy are in the bag? _____

How many pieces of chocolate are there in the bag? _____

What is the probability of selecting a piece of chocolate? _____

How many pieces of caramel are there in the bag? _____

What is the probability of selecting a piece of caramel? _____

What number sentence multiplies the probability of selecting a chocolate and the probability of selecting a caramel? _____

What is the compound probability of both events happening? Round your answer to the nearest hundredths place. _____

To multiply fractions, multiply the numerators and multiply the denominators.

A simulation can help you find compound probability.

➤ Ichiro gets up to bat exactly 2 times each game. What is the likelihood that Ichiro will get a hit 2 times in one game?

How many possible outcomes are there when Ichiro gets up to bat? _____

What are the outcomes? _____

The computer-generated random numbers below simulate Ichiro's outcomes in 50 games. Each two-digit number represents a single baseball game.

93 63 69 53 01 57 16 12 77 55 94 76 58 85 05 71 71 46 47 99 16 40 93 32 91

38 72 95 72 68 56 91 85 30 97 19 30 23 45 77 79 21 24 42 87 51 08 38 01 13

Let odd digits represent hits and even digits represent no hits. Circle the two-digit numbers that have two odd digits.

How many numbers have two odd digits? _____

How many two-digit numbers are generated?

_____

Remember that the numbers represent something. So 1 and 3, for example, both represent a hit. They do not represent different numbers of hits.

Complete the ratios to show the experimental probability: $\frac{\square}{\square} = \frac{\square}{\square} =$ _____

The experimental probability of Ichiro getting 2 hits in one game is _____.

Use what you know about compound probability to answer these questions.

1 A bag has tiles numbered either 1 or 2. A tile is randomly chosen from the bag and put back. This is repeated twice to yield a three-digit number. How many possible three-digit numbers can result?

_____

2 List the sample space for question 1.

_____

Solve the following problems.

1 A spinner has equal-sized spaces and contains the colors red, blue, yellow, and green in equal numbers. If the arrow is spun twice, what is the chance of getting 2 blues? Write your answer as a percent.

To find the chance, convert the probability from a decimal to a percent.

Answer _____%

2 A number cube is rolled twice.

Part A List the sample space.

When listing the outcomes, hold the first number constant while changing the other.

Part B How many possible outcomes are there?

Answer _____

3 A food truck sells ice cream cones. It offers sugar cones and waffle cones, and chocolate, vanilla, strawberry, and mint ice cream. Create a tree diagram to find the probability that a random customer will order mint ice cream in a waffle cone. Write the probability as a fraction.

List the types of cones first, and then use the branches to show the possible flavors of ice cream in each cone.

Answer _____

Solve the following problems.

1 Tyler rolls a pair of 1–6 number cubes. He hopes to get a combination of 4.

Part A What combinations add to 4? List them.

Answer _____

Part B What is the percent chance of rolling a combination that adds to 4? Write your answer rounded to the nearest whole percent.

Answer _____%

2 Two-thirds of the gumballs in a jar are red. How can a 1–6 number cube be used to find the probability that a gumball chosen at random from the jar will be red?

A Let the number 1 represent a red gumball.

B Let the numbers 2 and 3 represent a red gumball.

C Let the numbers 1, 2, and 3 represent a red gumball.

D Let the numbers 1, 2, 3, and 4 represent a red gumball.

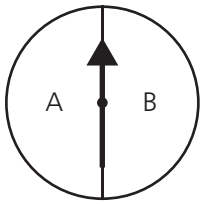
3 Griffin wants to know the probability that in a family of 3 children, the 2 oldest children are boys. For each trial, he flips a coin 3 times to conduct the simulation shown below.

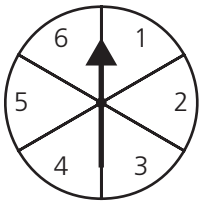
HHH HTH TTH HTT HHT THH HTT THT HHT TTT
HHH THH HHT HTT HTH THH TTT THH HHT THT

H represents a boy, and T represents a girl. Based on this simulation, what is the probability that the 2 oldest children are boys?

Answer _____

4 Xue spins the arrow on each spinner once.





Part A Create a tree diagram to represent the possible outcomes of spinning each arrow once.

Part B Xue will win a prize if he lands on B and an even number. Use the tree diagram to calculate the probability of Xue winning a prize.

Answer _____

5 Guests at a banquet have a choice of chicken or fish for an entrée. They can choose carrots, broccoli, or spinach for the vegetable. Create a list or table to show the sample space for possible meal combinations.

6 A train is early $\frac{1}{6}$ of the time, on time $\frac{1}{2}$ of the time, and late $\frac{1}{3}$ of the time. Darcy wants to know the probability that the train will be late two times in a row.

Part A Explain how two 1–6 number cubes can be used to simulate this situation.

_____

_____

_____

_____

_____

_____

Part B Use two 1–6 number cubes to perform a simulation of 40 trials to find the probability that the train is late two times in a row.

Part C Write the probability you found as a percent. Show your work.

Answer _____%