

10.1 Exercises

✓ CONCEPT CHECK

1. A probability experiment, or a _____, is any process with a result determined by chance.
2. The _____ is the set of all possible outcomes for a given probability experiment.
3. Each path of branches in a _____ indicates a single possible outcome.
4. The Law of Large Numbers says that the greater the number of trials, the closer the _____ probability will be to the _____ probability.
5. True or False: The probability of something occurring can never be 1.

💡 PRACTICE

Create a tree diagram to list the outcomes in each sample space.

6. Find the sample space for the gender of each child in regard to birth order for a family with three children.
7. In picking out a new car, there are several choices to make. The color can be red, white, or silver. The seats can be cloth or leather. Finally, it can have a sunroof, a moonroof, or neither. Find the sample space for the possible new car combinations using a tree diagram.
8. Use a tree diagram to find the sample space for tossing a coin three times.
9. Four students are randomly selected from an algebra class and asked whether they suffer from math anxiety. Find the sample space for the possible outcomes of the survey using a tree diagram.

Identify the sample space for each of the following experiments.

10. A coin is flipped and then a single die is rolled.
11. Choosing a number from all positive two-digit integers where the digits are repeated (for example, 11).
12. Five marbles are in a bag, one of each of the following colors: blue (B), clear (C), green (G), yellow (Y), and red (R). Two marbles are drawn consecutively. Assume that the first marble is not put back in the bag before the second marble is drawn. Order of the selection matters. In other words, BG and GB are two different selections.

13. When choosing an outfit, you have a choice of 3 shirts: white (W), black (B), or patterned (P); a choice of 2 types of jeans: faded (F) or dark wash (D); and a choice of 4 pairs of shoes: sandals (S), running shoes (R), climbing boots (C), or mules (M). List the sample space in regard to the outfits (combination of shirt, jeans, and shoes) you could pick from.
14. When ordering pizza for a party, you have the choice between three restaurants: Dominos (D), Pizza Hut (P), and Papa John's (J); a choice of delivery (d) or store pickup (p); and side options of breadsticks (b), wings (w), or salad (s).
15. Tickets for an outdoor orchestra concert can be purchased for pavilion seating (P) or lawn seating (L). When purchasing tickets, you can choose to pay extra for a parking pass for the close lot (C) or opt for the free general parking pass (G). You can also add on meal and drink vouchers (M) or choose not to purchase any food vouchers (N).
16. You are purchasing a jigsaw puzzle from a local bookstore. The puzzles come in four sizes: 200 piece (2), 500 piece (5), 1000 piece (10), and 1200 piece (12). Each puzzle size has five images to choose from: space (S), landscapes (N), cars (C), animals (A), and bridges (B).
17. A small company is choosing packaging materials for a new product. For the box, the options are a recycled cardboard box (C), a recycled plastic box (P), or a box made from new materials (N). For the instruction manual, the options are a card with a link to online instructions (O) or a fully printed manual (M). Finally, the box can be sealed with temper resistant stickers (T) or staples (S).

Determine whether each probability is experimental or classical.

18. In order to find the percentage of bass that Troy had in his pond this spring, he decided to spend three days catching a total of 15 fish each day and counting how many of those were bass.
19. Jason wants to know how likely he is to win a raffle if he bought 3 of the 1000 tickets that were sold.
20. Virginia wants to know how likely it is for her to win a backgammon game if she only needs to roll a double six to win.
21. Emre wants to see how many students own a smartphone. He surveys 100 college freshmen at a Winter Welcome event and asks what kind of phone they carry.
22. Richard wants to determine the probability that a red Skittle will appear in a bag of regular Skittles, so he purchases 20 bags of Skittles and counts how many red Skittles are in the bags.
23. Rita volunteers at a local shelter and wonders what the probability is that someone chooses to adopt a cat from the local shelter today, so she counts how many total animals they have for adoption and the total number of cats available for adoption.

 APPLICATIONS

Calculate each experimental probability. Round your answer to the nearest millionth, if necessary.

24. A news organization asked a selection of voters exiting a polling place their age bracket in order to paint a picture of turn out on election day. Here's the record of the results collected so far.

Voting Age			
17–29	30–44	45–64	65 and Older
9	8	32	15

- What is the probability that the next voter to exit will be between 30 and 44?
 - What is the probability that the next voter to exit will be in either of the youngest two age groups?
 - What is the probability that the next voter to exit will be under 65?
25. The blood types of 200 people are collected at a doctor's office. The table shows the breakdown of patients per blood type. If a person from this group is selected at random, what is the probability that this person has type O blood?

Blood Type Survey Results	
Blood Type	Number of Patients
A	50
B	65
O	70
AB	15

26. As students were exiting the student center on campus, Vicki took note whether they were listening to headphones. The table shows results that she collected.

Based on Vicki's data, what is the probability that a randomly selected student will have headphones in their ears when exiting the student center?

Data for Students Exiting the Student Center	
	Number of Students
Headphones	33
No Headphones	51

27. A sample of 500 active-duty military showed that 82 of them suffered from Post Traumatic Stress Disorder (PTSD). However, 95 of those studied reported that they would be too embarrassed to seek mental health services.
- Based on this sample, if a soldier is chosen at random, what is the probability that he/she suffers from PTSD?
 - Based on this sample, if a soldier is chosen at random, what is the probability that he/she would be willing to seek mental health services?

28. The owner of a parking lot takes an inventory of the 150 cars parked in the lot one evening. The table shows the breakdown of cars by brand. If a car from this group is randomly selected, what is the probability that it is a Nissan?

Cars Parked in Parking Lot	
Brand	Number of Cars
Chevrolet	20
Ford	18
Honda	42
Hyundai	26
Nissan	44

29. The favorite donut flavors of 225 people are collected at a donut shop. The table shows the breakdown of the number of customers that prefer each flavor. If a flavor is selected at random, what is the probability that it is maple dipped?

Donut Flavor Survey Results	
Flavor	Number of Customers
Chocolate Sprinkle	57
Cream-filled	31
Cruller	36
Glazed	51
Jelly-Filled	32
Maple Dipped	18

30. A librarian walked through the quiet area of the university library and recorded whether students were studying or looking at their phones. The table shows the data that was collected. Based on this data, what is the probability that a randomly selected student was looking at their phone instead of studying?

Data for Students in the Library	
	Number of Students
Studying	47
Looking at Phone	22

31. A restaurant at a mall gives out free samples in hopes of gaining new customers. The employee giving out samples for an hour recorded whether the people who took a sample ordered food from the restaurant or not. The table shows the data that was collected. Based on this data, what is the probability that a person who takes a sample will order food from the restaurant?

Data for People Who Took a Sample	
	Number of People
Ordered Food	38
Did Not Order Food	77

For each situation, draw a tree diagram to determine the sample space and then calculate the given probability.

32. When ordering the three-course lasagna special at a restaurant, customers have the choice between soup (S) or salad (A) for an appetizer, meat lasagna (M) or vegetarian lasagna (V) for the main course, and cake (C) or pie (P) for dessert. What is the probability of someone ordering salad, vegetarian lasagna, and pie?
33. When picking dinnerware to add to their wedding registry, a couple decides they want white dinner plates. The couple can choose between square plates (S) or round plates (R); gold-banded plates (G), silver-banded plates (B), or plain plates (P), and glazed earthenware (E) or ceramic (C). What is the probability the couple will pick any type of glazed earthenware plates?

Calculate each classical probability. Assume individual outcomes are equally likely. Round your answer to the nearest millionth, if necessary.

34. What is the probability that, out of 235 attendees (including yourself) at a conference, you are selected to win the door prize at the opening session?
35. On an American roulette wheel, there are 18 red pockets, 18 black pockets, and 2 green pockets. What is the probability of landing on a red pocket?
36. What is the probability that a card drawn randomly from a standard deck of cards will be an ace?
37. A book contains 321 pages numbered 1, 2, 3, . . . , 321. If a student randomly opens the book, what is the probability that the page's number has all of its digits the same (ignoring single-digit page numbers)?
38. Consider a cat with a litter of four kittens. Find the probability that all four kittens are male.
39. Mason has 213 songs in a playlist. He's categorized them in the following manner: 20 from soundtracks, 8 spiritual, 31 jazz, 16 Latin American, 27 R&B, 47 rock, and 64 pop. If Mason puts his playlist on shuffle, what is the probability that the first song played is a pop song?
40. Landon decided to play a joke on his friends at work. When he stocked the vending machine with sodas, he randomly put the drinks into the different slots. If he put in 15 Diet Coke, 15 Coke, 12 Sprite, 17 Dr. Pepper, and 10 Fanta cans, what is the probability that the next person will get a Fanta drink when they put their money into the machine?
41. A shelf of fiction books contains 15 fantasy books, 12 science-fiction books, and 9 historical fiction books. What is the probability that a book selected at random is science-fiction?
42. A bag of apples picked from an orchard contains 8 Honeycrisp, 9 Gala, 7 Red Delicious, and 10 Granny Smith. If an apple is selected at random, what is the probability that it will be a gala apple?

43. To divide a class into groups for a project, numbers are placed into a box. Each student selects a number which assigns them to a group. In the box, there are six 1s, six 2s, six 3s, and six 4s. The first student selects a number at random. What is the probability that the student draws a 3?
44. An American roulette wheel has slots marked with a number 1 through 36 along with 0 and 00. The 0 and 00 slots are colored green. Half of the remaining slots are black and the other half are red. If a roulette ball randomly stops on a slot, what is the probability that the slot is red?
45. Lunch is served at a seminar and consists of a variety of sub sandwiches boxed with potato chips and a chocolate chip cookie. There are 14 turkey sandwiches, 16 ham sandwiches, and 8 roast beef sandwiches.
- What is the probability that a randomly selected lunch box contains a ham sandwich?
 - What is the probability that a randomly selected lunch box contains a chocolate chip cookie?
 - What is the probability that a randomly selected lunch box does not contain a roast beef sandwich?
46. A store sets up a display featuring the favorite movies of the employees. The display contains 12 action movies, 8 romances, 5 science-fiction movies, and 7 dramas.
- What is the probability that a randomly selected movie is a science-fiction?
 - What is the probability that a randomly selected movie is a documentary?
 - What is the probability that a randomly selected movie is not an action movie?

 **WRITING & THINKING**

47. Compare and contrast classical probability and experimental probability.

10.1 PROJECT

HOW HARD IS BASEBALL COMPARED TO OTHER SPORTS?

Many say that baseball, which is commonly called America's national pastime, is a game with a low success rate. Consider Mookie Betts, one of the greatest players the sport has ever seen. He had a batting average (BA) of .346 during the 2018 season. His batting average was the highest of all players for that year.

A player's batting average is computed by dividing the number of times a player has a hit by the player's total number of at-bats.

$$\text{BA} = \frac{\text{Number of Hits}}{\text{Number of At-Bats}}$$

Notice that this formula looks a lot like a probability where the sample space is the set of all at-bats and the event is getting a hit.