

8.4 EXERCISES

 PRACTICE

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

- Find the sample space for the gender of each child in regard to birth order for a family with three children.
- 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.
- Use a tree diagram to find the sample space for tossing a coin three times.
- 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.

Evaluate each factorial expression.

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| 5. $5!$ | 6. $9!$ | 7. $\frac{8!}{6!}$ |
| 8. $1!$ | 9. $0!$ | 10. $\frac{10!}{2!4!}$ |
| 11. $\frac{5!}{3!2!}$ | 12. $\frac{12!}{8!(3-1)!}$ | 13. $\frac{23!}{11(25-4)!}$ |

Evaluate each permutation or combination.

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| 14. ${}_8P_2$ | 15. ${}_7P_4$ | 16. ${}_5P_1$ |
| 17. ${}_4P_4$ | 18. ${}_3C_2$ | 19. ${}_{30}C_1$ |
| 20. ${}_5C_5$ | 21. $\frac{{}_3C_2}{{}_3P_2}$ | 22. $\frac{{}_5P_3}{{}_5C_3}$ |
| 23. ${}_7C_4 + {}_7C_3 + {}_7C_2 + {}_7C_1$ | 24. ${}_7P_4 + {}_7P_3 + {}_7P_2 + {}_7P_1$ | |

 APPLICATIONS

- How many three-digit area codes can be made from the digits 0 through 9? Assume that the digits may repeat and that area codes beginning with 0 are allowed.
- How many three-digit area codes can be made from the digits 0 through 9 if the first digit is not allowed to be a 0 and the digits are allowed to repeat?

27. How many six-character password codes are possible if you are allowed both lowercase letters and the digits 0 through 9, and repeating characters are allowed?
28. When ordering a new e-reader, you have several choices to make. You can choose from five price ranges, decide between Wi-Fi and 5G, choose to have a one-year or three-year warranty, and pick a black, white, or silver casing. How many possible e-readers are there for you to choose from?
29. The Youngs are planning their next family night. They always have dinner out somewhere and then do something fun together. There are two adults and four boys in the family. Each family member is allowed two meal suggestions, and each boy is allowed three activity suggestions. Assuming no family members choose the same thing, how many different family night possibilities are there?
30. If there are seven children lining up for recess, how many different ways can they line up?
31. The college's soccer team will play 11 games next fall. Each game can result in one of three outcomes: a win, a loss, or a tie. Find the total number of possible outcomes for the season record.
32. Harper is deciding on her schedule for next semester. She must take each of the following classes: English 102, College Algebra, History 102, and Biology 101. If there are 16 sections of English 102, 14 sections of College Algebra, 7 sections of History 102, and 12 sections of Biology 101, how many different possible schedules are there for Harper to choose from? Assume there are no time conflicts between the different classes.
33. If there were no restrictions on the use of the number zero, in theory, how many seven-digit telephone numbers are possible?
34. How many four-digit even whole numbers exist?
35. In the new ice creamery, several choices need to be made before tasting “a little bit of heaven,” as the advertisement suggests. First, there are three cup sizes to choose from, then 39 different ice cream flavors to decide from, and finally several mix-ins to choose from: 10 candy bars, 8 fruits, 8 nuts, and 10 cookies or cakes. If you want a medium cup with one flavor of ice cream and two mix-ins, one candy bar and one nut, how many possible choices are there for you to have your “taste of heaven”?

Determine whether to use a permutation or combination to answer each question, and then determine the total number of outcomes.

36. There are 10 board members on the Community Arts Council. In how many ways can a president and treasurer be chosen? Assume that no member can hold both positions at the same time.
37. In how many ways can a committee of five people be chosen from a pool of 120 employees?
38. If there are 84 runners in a race, in how many ways can 1st, 2nd, and 3rd place ribbons be given out?

39. Elliot has to submit three photographs for the school art show. This semester he has taken 29 photographs that he thinks are show-worthy. In how many ways can he choose the photographs to submit?
40. Avery was born on 10/15/1995. How many eight-digit codes could she make using the digits in her birthday?
41. There are 18 tenured faculty in the biology department on campus. The department needs one tenured faculty member to facilitate undergraduate research, one member to supervise graduate advising, and one to coordinate grant proposals. In how many ways can these tasks be assigned, if a member may be appointed to only one duty?
42. A service organization on campus needs a group of six students from their organization's membership of 123 students to serve as program attendants at graduation. In how many ways can the attendants be chosen?
43. In how many ways can the letters in the word STATISTICS be arranged?
44. In how many ways can the letters in the word TENNESSEE be arranged?

 **WRITING & THINKING**

45. Without calculating the permutations, decide which of the following words would produce the greatest number of four-letter arrangements.
- PASS
 - TEST
 - FAIR
 - FREE
46. Determine how many ways a group of three students from your class could be selected.
47. Count the number of possible outfits you have in your closet based on the number of pants, shirts, and pairs of shoes you have. Assume that all match well together or that you would be making your own fashion statement some days.
48. Calculate the number of ways to arrange the letters in
- your first name,
 - your last name,
 - both your first and last names.