

Solve Exercises 1-3 using the Fundamental Counting Principal with two groups of items.

1. The model of the car you are thinking of buying is available in nine different colors and three different styles (hatchback, sedan, or station wagon). In how many ways can you order the car?
2. In how many ways can a casting director choose a female lead and a male lead from five female actors and six male actors?
3. For a temporary job between semesters, you are painting the parking spaces for a new shopping mall with a letter of the alphabet and a single digit from 1-9. The first parking space is A1 and the last parking space is Z9. How many parking spaces can you paint with distinct labels?

Solve Exercises 4-11 using the Fundamental Counting Principal with three or more groups of items.

4. A pizza can be ordered with three choices of size (small, medium, or large), four choices of crust (thin, thick, crispy, or regular), and six choices of topping (ground beef, sausage, pepperoni, bacon, mushroom, or onions). How many one-topping pizzas can be ordered?
5. An apartment complex offers apartments with four different options, designated by A through D.

A	B	C	D
One bedroom	One bathroom	First floor	Lake view
Two bedrooms	Two bathrooms	Second floor	Golf course view
Three bedrooms			No special view

How many apartment options are available? Describe two such options.

6. There are three highways from city A to city B, two highways from city B to city C, and four highways from city C to D. How many different highway routes are there from city A to city D?
7. A car model comes in nine colors, with or without air conditioning, with or without a sun roof, with or without automatic transmission, and with or without antilock brakes. In how many ways can the car be ordered with regard to these options?
8. You are taking a multiple-choice test that has eight questions. Each of the questions has three answer choices, with one correct answer per question. If you select one of these three choices for each question and leave nothing blank, in how many ways can you answer the question?
9. The local seven-digit telephone numbers in Inverness, California have 669 as the first three digits. How many different telephone numbers are possible in Inverness?
10. How many different four-letter radio station call numbers can be formed if the first letter must be W or K?
11. A social security number contains nine digits, such as 074-66-7795. How many different social security numbers can be formed?

Use the Fundamental Counting Principle to solve Exercises 12-17.

12. Five singers are to perform on a weekend evening at a night club. How many different ways are there to schedule their appearance?
13. In how many different ways can a police department arrange eight suspects in a police lineup if each lineup contains all eight people?
14. As in exercise 12, five singers are to perform at a night club. One of the singers insists on being the last performer of the evening. If this singer's request is granted, how many different ways are there to schedule the appearance?
15. You need to arrange ten of your favorite photographs on the mantel above a fireplace. How many ways can you arrange the photographs, assuming that the order of the pictures makes a difference to you?

16. In the *Cambridge Encyclopedia of Language* (Cambridge University Press, 1987), author David Crystal presents five sentences that make a reasonable paragraph regardless of their order. The sentences are as following:

Mark had told him about the foxes.

John looked out the window.

Could it be a fox?

However, nobody had seen one for months.

He thought he saw a shape in the bushes.

How many different five-sentence paragraph can be formed if the paragraph begins with “He thought he saw a shape in the bushes” followed by “Mark had told him about the foxes”?

17. A camp counselor and six campers are to be seated along a picnic bench. In how many ways can be done if the counselor must be seated in the middle and a camper who has a tendency to engage in food fights must sit to the counselor’s immediate left?

In Exercises 18- 27, evaluate each factorial expression.

18. $\frac{12!}{10!}$

19. $\frac{31!}{28!}$

20. $\frac{17!}{9!}$

21. $\frac{700!}{699!}$

22. $\frac{106!}{104!}$

23. $6! - 3!$

24. $(6 - 3)!$

25. $\left(\frac{45}{9}\right)!$

26. $\frac{8!}{(8-5)!}$

27. $\frac{17!}{(17-)!}$

In Exercises 28-31, us the formula for ${}_nP_r$ to evaluate each expression.

28. ${}_7P_3$

29. ${}_{10}P_4$

30. ${}_9P_9$

31. ${}_6P_0$

Use the formula for ${}_nP_r$ to solve the Exercises 32-35.

32. A corporation has seven members of its board of directors. In how many different ways can it elect a president, vice president, secretary, and treasurer?
33. Suppose you are asked to make a list, in order of preference, the three best movies you have seen this year. If you saw 20 movies during the year, in many ways can the three best be chosen and ranked?
34. In a production of *West Side Story*, eight actors are considered for the male roles of Tony, Riff, and Bernardo. In how many ways can the director cast the male roles?
35. How many arrangements can be made using four of the letters of the word COMBINE if no letter is to be used more than once?

Use the formula for the number of permutations of duplicate items to solve Exercises 36-37

36. In how many distinct ways can the letters of the word SCIENCE be arranged?
37. In how many distinct ways can the letters of the word TENNESSEE be arranged?