
THE COUNTING PRINCIPLE

A certain **computer password** must contain exactly 4 characters:

1st character: any uppercase letter of the English alphabet

2nd character: any uppercase letter different from the 1st character

3rd character: any digit

4th character: any digit different from the 3rd character



How many distinct passwords can be formed? Stay tuned; we'll find out.

□ *THE COUNTING PRINCIPLE*

EXAMPLE 1:

A. Joey has 4 belts and 2 caps. How many ways can he choose a belt and a cap? Let's list them all:

b1, c1	b1, c2	b2, c1	b2, c2
b3, c1	b3, c2	b4, c1	b4, c2

We see **8 ways** to choose his belt and cap. What's the shortcut? Just multiply 4 by 2, and we have 8 ways.

- B. A new design for a license plate has 3 slots, consisting of a letter, a digit from 0 to 9, and another letter different from the first letter. How many license plates can be formed?

There are **26** possibilities for the first slot (we're using English).


There are **10** possibilities for the second slot (there are 10 digits from 0 to 9).

There are **25** possibilities for the third slot (the letter in the third slot must differ from the letter in the first slot — that leaves just 25 possibilities).

Therefore, there are $26 \times 10 \times 25 =$

6,500 possible license plates

Homework

1. Anita has 3 skirts, 4 blouses, and 2 caps. How many different outfits can Anita create from these items?
2. James can choose 1 of 4 flavors of ice cream, 1 of 3 kinds of nuts, and 1 of 5 toppings. How many different ice cream sundaes can James create? 
3. A license plate has 4 slots. The first slot is a vowel (AEIOU), the second slot is a vowel different from the first, the third slot is any digit, and the fourth slot is any letter different from the first two. How many different license plates can be formed?
4. Maria can choose 1 of 3 CPUs for her new computer, 1 of 4 different hard drives, 1 of 5 different monitors, and 1 of 7 different mice. How many different ways can Maria choose the

components for her computer? In other words, how many different computer “configurations” can she choose from?

5. A license plate has three slots. The first slot is any consonant (a letter that’s not a vowel). The second slot is a digit from 0 to 9. The third slot is a digit from 0 to 9 that must be different from the digit in the second slot. How many distinct license plates can be formed?
6. At a pizza restaurant, a customer can choose 1 of 3 types of crust, 1 of 5 kinds of sauce, and 1 of 12 toppings. How many different pizza combinations can a customer choose?
7. How many different ways can 5 students be arranged in a line for a photograph?
8. Two dice are rolled at the same time. How many different outcomes are possible?
9. An ice cream shop offers 4 different types of cones and 10 different flavors of ice cream. If a customer orders an ice cream cone with one scoop, how many different combinations of cone and ice cream flavor are possible?
10. Now we solve the problem stated in the Introduction:

A computer password must contain exactly 4 characters —

1st character: any uppercase letter of the alphabet

2nd character: any uppercase letter different from the 1st character

3rd character: any digit

4th character: any digit different from the 3rd character

How many distinct passwords can be formed?

4

11. Joe has 3 pairs of shoes, 5 pairs of pants, 4 shirts, and 8 pairs of sunglasses. How many different “outfits” can Joe create?

12. True/False:

If a family of five ducks is trying to line up in all possible orders, but the papa duck must be in the first slot, then there are 24 ways the family of ducks can line up.

13. True/False:

Suppose a 3-slot license plate must have a digit in the first slot, a vowel in the second slot, and any digit different from the first slot in the third slot. In that case, 500 distinct license plates are possible.

Solutions

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|-------------------------|-----------------------|
| 1. 24 outfits | 2. 60 sundaes |
| 3. 4,800 license plates | 4. 420 configurations |
| 5. 1,890 license plates | 6. 180 pizzas |
| 7. 120 arrangements | 8. 36 outcomes |
| 9. 40 cones | 10. 58,500 passwords |
| 11. 480 outfits | 12. T |
| 13. F | |

"The whole purpose of education is to turn mirrors into windows."

Sydney J. Harris