MATHEMATICS · GRADES 10-12

Fundamental counting principle

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you count up all the combinations, like outfits from your shirts and pants or meals from a menu, without listing every single one. Instead of writing out every possible combination, you multiply the number of choices at each step and get the total straight away. That is how a restaurant knows how many meal combinations its menu offers, how a shop counts the ways to build a custom order, and how you work out how many passwords or lock codes are possible.



Rule

Fundamental counting principle: if one choice has m options and the next has n options, there are m × n combinations in total.

Multiply the number of choices at each step.

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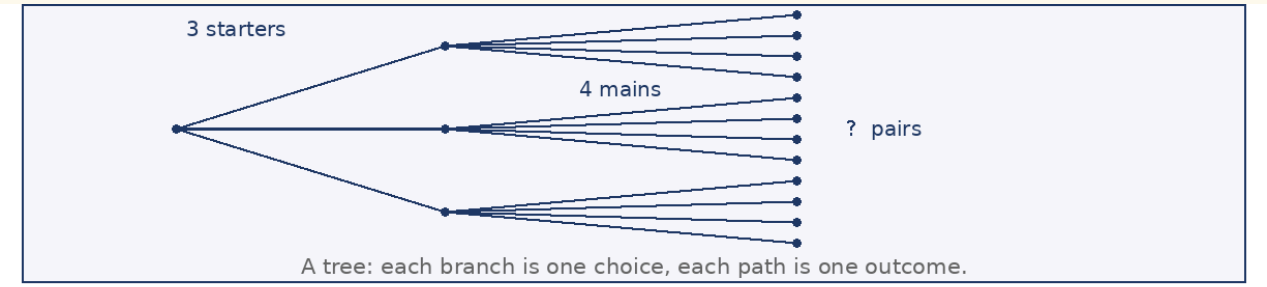
Worked examples

EXAMPLE 1

Q A menu has 3 starters and 4 mains. How many starter-main pairs?



A tree: each branch is one choice, each path is one outcome.

SOLUTION

Choose a starter first: 3 choices.

For each starter, choose a main: 4 choices.

Multiply: 3 × 4 = 12 pairs

EXAMPLE 2

Q A code has 2 letters, each with 26 choices, and 1 digit with 10 choices. How many codes?

SOLUTION

Multiply the choices stage by stage: 26 × 26 × 10

26 × 26 = 676

676 × 10 = 6760 codes

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Practice questions

1. A shop sells 4 shirts and 3 pairs of pants. How many outfits?

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2. A code has 2 letters. There are 676 possible codes. How many choices are there for each letter?

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3 Which gives more outcomes: rolling a die and tossing a coin, or tossing a coin three times?

- A Die and coin
- B Coin three times
- C They are equal
- D Cannot tell

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4 A meal has 2 soups, 5 mains, 3 desserts. How many meals?

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5 A password has 3 digits, each 0 to 9. How many passwords?

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6 What is the fundamental counting principle?

- **A** Multiply the number of choices at each stage
- **B** Add the number of choices at each stage
- **C** List every combination one by one
- **D** Divide the total by the number of stages

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7 A car comes in 3 colours and 2 engines, but 1 colour is sold out. How many versions are there now?

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8 How many 2-letter codes can be made from 26 letters if the two letters must be different?

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9 A license plate has 2 letters (26 each) and 2 digits (10 each). How many plates?

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10 A wardrobe has 6 tops and 4 skirts. Only 2 of the tops are red. How many outfits use a red top?

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ANSWER KEY

1. 12

2. 26

3. Die and coin

4. 30

5. 1000

6. Multiply the number of choices at each stage

7. 4

8. 650

9. 67600

10. 8

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