

Product Rule Counting

GCSE Maths · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Zara has a red, a blue and a green top, and black or white jeans. List every outfit. How many are there?

Step 1 · Fix each top in turn

Red-Black, Red-White

Step 2 · Then the next top

Blue-Black, Blue-White

Step 3 · Then the last top

Green-Black, Green-White

Answer: 6 outfits

Check: $3 \text{ tops} \times 2 \text{ jeans} = 6$ ✓

2. Now try one with the steps

A PIN has 4 digits, each from 0 to 9, and digits may repeat. How many PINs are possible?

Step 1 · Each position has 10 choices

Step 2 · Product rule

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. A café sells 4 kinds of sandwich and 3 kinds of drink. How many different sandwich-and-drink meals are there? [1]

2. Write a systematic list of all the 2-letter arrangements of A, B and C with no letter repeated. How many are there? [2]

3. A coin is flipped and a six-sided dice is rolled. How many different outcomes are there? [1]

4. Write down every 3-digit number that uses the digits 2, 5 and 7 once each. How many are there? [2]

5. A number plate has 3 letters (A–Z) followed by 2 digits (0–9). Letters and digits may repeat. How many plates are possible? [2]

6. 5 runners are in a race. In how many ways can gold, silver and bronze be awarded? [2]

7. A code uses 4 different letters from A, B, C, D, E and F. How many codes are possible? [2]

8. In how many different orders can the five letters of MATHS be arranged? [2]

9. How many 3-digit numbers have every digit odd? Digits may repeat. [2]

10. How many 3-digit numbers (100 to 999) are multiples of 5? [3]

11. Using the digits 1 to 8 without repetition, how many 4-digit even numbers can be made? [3]

12. 8 people meet and each shakes hands once with every other person. How many handshakes are there? [3]

13. A restaurant has some starters and 5 mains. There are 35 possible starter-and-main meals. How many starters are there? [2]

14. A password is 2 letters (A–Z, repeats allowed) followed by 3 digits with no digit repeated. How many passwords are possible? [3]

15. Explain why there are more 4-digit PINs when digits may repeat than when they may not. [2]

4. Before you hand it in

3 tops and 4 trousers give $3 + 4 = 7$ outfits

Each of the 3 tops goes with each of the 4 trousers: $3 \times 4 = 12$. Add only when you choose ONE thing from either group.

5 runners for 1st, 2nd and 3rd: $5 \times 5 \times 5 = 125$

Without repetition the choices fall each time: $5 \times 4 \times 3 = 60$.

Even numbers from 1–6, no repeats: $6 \times 5 \times 3 = 90$

By the last place, some even digits may already be used. Fill the restricted (last) place first: $3 \times 5 \times 4 = 60$.

8 people shaking hands: $8 \times 7 = 56$ handshakes

Ana shaking Ben's hand is the same shaking Ana's. Divide by 2: $56 \div 2 = 28$.