

GCSE Maths: Systematic listing and the product rule (Higher): answers

GCSE Maths - Factors, Multiples and Primes - Higher - Lesson 2.5

Answers. Final answers to the worksheet questions. Full step-by-step solutions for every question are free at websink.site/gcse/maths/ch02-factors-multiples-primes-powers/higher/systematic-listing-and-the-product-rule/

Exercise 2E Systematic listing and the product rule Non-calculator

1 List all the combinations, and say how many there are.

- (a) 3 starters (soup, salad, pate) and 2 mains (fish, pasta)

Answer: 6

- (b) 2 shirts (white, blue) and 3 ties (red, green, grey)

Answer: 6

- (c) 4 colours of car (red, black, silver, white) and 2 engine sizes (1.0, 1.4)

Answer: 8

2 Write all the numbers that can be made, in order of size. How many are there?

- (a) Three-digit numbers using each of 1, 2 and 3 once.

Answer: 6 numbers: 123, 132, 213, 231, 312, 321

- (b) Two-digit numbers using the digits 4, 6 and 9, with repeats allowed.

Answer: 9 numbers: 44, 46, 49, 64, 66, 69, 94, 96, 99

- (c) Two-digit numbers using two different digits from 1, 3, 5 and 7.

Answer: 12 numbers: 13, 15, 17, 31, 35, 37, 51, 53, 57, 71, 73, 75

- (d) Three-digit even numbers using each of 1, 2, 3 and 4 at most once.

Answer: 12 numbers: 124, 132, 134, 142, 214, 234, 312, 314, 324, 342, 412, 432

3 Two fair six-sided dice are thrown. How many different pairs (first die, second die) give:

- (a) a total of 7

Answer: 6: (1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1)

- (b) a total of 5

Answer: 4: (1, 4), (2, 3), (3, 2), (4, 1)

- (c) a total of 10

Answer: 3: (4, 6), (5, 5), (6, 4)

- (d) a product of 12

Answer: 4: (2, 6), (3, 4), (4, 3), (6, 2)

4 List all the ways to make each amount using only the coins shown. You may use any number of each coin.

- (a) 20p using 10p and 5p coins

Answer: 3 ways

- (b) 40p using 20p and 10p coins

Answer: 3 ways

- (c) 30p using 20p, 10p and 5p coins

Answer: 6 ways

- 5 Amy, Ben and Cal stand in a queue. List all the different orders they can stand in.

Answer: 6

- 6 A menu has 2 starters, 3 mains and 2 desserts. A meal is one starter, one main and one dessert. List all the possible meals, and say how many there are. (Use S1, S2, M1, M2, M3, D1, D2.)

Answer: 12

- 7 Sam pays exactly 60p using only 50p, 20p and 10p coins. List the ways he can do this.

Answer: 5 ways

- 8 A spinner has the numbers 1, 2, 3. A second spinner has the numbers 1, 2, 3, 4. Both are spun and the two numbers are added. How many different pairs give a total of 5?

Answer: 3: (1, 4), (2, 3), (3, 2)

- 9 Tom says: "3 T-shirts and 2 pairs of trousers can make 5 different outfits, because $3 + 2 = 5$." Explain why he is wrong.

Answer: Each T-shirt can go with either pair of trousers, so there are $3 \times 2 = 6$ outfits.

- 10 Ella lists the three-digit numbers that can be made from the digits 1, 2 and 3 (each used once): 123, 132, 213, 321, 312. She thinks she has them all. Find the number she has missed and explain how a systematic list would have helped.

Answer: 231

- 11 A PIN has 4 digits, each from 0 to 9. Use the product rule to work out how many PINs there are:

- (a) (a) with no restriction

Answer: 10 000

- (b) (b) with no digit repeated

Answer: 5040

- (c) (c) that are even (any digits can repeat)

Answer: 5000

- 12 Work out how many of each of the following there are.

- (a) Four-digit numbers from 1000 to 9999

Answer: 9000

- (b) Three-digit odd numbers

Answer: 450

- (c) Ways to choose 3 different letters in order from the 26 letters of the alphabet

Answer: 15 600

- 13** Three-digit numbers are made from the digits 1, 2, 3, 4, 5 and 6. A digit can be used only once in a number. How many of the numbers are:

- (a) even

Answer: 60

- (b) bigger than 400

Answer: 60

- (c) starting with an odd digit

Answer: 60

- 14** Five different books are put in a row on a shelf.

- (a) In how many different orders can the books be arranged?

Answer: 120

- (b) In how many of these arrangements are books A and B at the two ends (in either order)?

Answer: 12

- 15** A password has 2 capital letters (A to Z) followed by 3 digits (0 to 9). Show that there are more than 600 000 possible passwords.

Answer: $26 \times 26 \times 10 \times 10 \times 10 = 676\,000$, which is more than 600 000

- 16** Using each of the digits 1, 2, 3 and 4 once, how many four-digit numbers are bigger than 3000? List them in order.

Answer: 12: 3124, 3142, 3214, 3241, 3412, 3421, 4123, 4132, 4213, 4231, 4312, 4321