

Permutations

Starter

1. How many ways are there of arranging the letters A, B and C?

Working: There are 3 options for 1st position, 2 options for 2nd position and only 1 option for the 3rd position.
Ways of arranging = $3 \times 2 \times 1 = 6$

2. How many different arrangement of eight books can be made on a bookshelf?

Working: 1st position has 8 options,, 2nd position has 7 options etc.
Ways of arranging = $8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 40320$

- E.g. 1** How many arrangements can be made from the letters of the word PRINCE if:

- (a) there are no restrictions
- (b) the first letter must be a consonant
- (c) the last letter must be a vowel

Working:

- (a) $6! = 720$
- (b) 1st place: 4 options (PRNC)
2nd-6th places: $5!$
Total arrangements = $4 \times 5! = 480$
- (c) 1st place: 2 options (IE)
2nd-6th places: $5!$
Total arrangements = $2 \times 5! = 240$

- E.g. 2** How many different number plates can be formed if each is to contain the 3 letters A, C and E followed by four digits 4, 5, 7 and 8?

Working: The 3 letters can be arranged in $3!$ ways
The 4 digits can be arranged in $4!$ ways
So the total ways is $3! \times 4! = 144$

- E.g. 3** How many numbers greater than 4000 can be formed from the integers 1, 3, 5 and 7 using each digit once only?

Working: The first digit must be a 5 or a 7 so 2 ways
There are 3 digits left so $3!$
Total ways = $2 \times 3! = 12$

- E.g. 4** (a) How many numbers are there between 1245 and 5421 which contain each of the digits 1, 2, 4, and 5 once and once only?
- (b) One of these numbers is chosen at random. Find the probability that it is:
- (i) divisible by 5
 - (ii) greater than 3000

Working: (a) $4! = 24$

- (b) (i) 5 must be the last digit so we are arranging 3 digits
Number of ways to arrange 3 digits = $3! = 6$

$$P(\text{divisible by 5}) = \frac{6}{24} = \frac{1}{4}$$

- (ii) The first digit must be a 4 or a 5 so 2 ways
Arrangement of the other 3 digits = $3! = 6$
Total ways = $2 \times 6 = 12$

$$P(\text{greater than 3000}) = \frac{12}{24} = \frac{1}{2}$$

Video: [Permutations of n different items](#)

[Solutions to Starter and E.g.s](#)

Exercise

p6 1B Qu 1i, 2i, 3-9, (10-11 red)