

5.2 Permutations and combinations

Name: _____ Class: _____ Date: _____ **Total: 11 marks**

KEY WORDS permutations and combinations 排列与组合 • combination 组合 • permutation 排列

Objective

Build the skills to answer exam questions on **permutations and combinations** 排列与组合 — counting arrangements (order matters) and selections (order does not), including repeated objects and restrictions.

You must be able to:

- use ${}^n P_r$ for arrangements and ${}^n C_r$ for selections
- arrange objects with repeats (divide by each repeat factorial)
- count with restrictions (e.g. items together / not together)

1 Worked examples

■ Arrangements & selections



Counting outcomes underlies both combinatorics and probability

Arranging 3 of 4 objects (${}^4 P_3$)

$$\boxed{4} \times \boxed{3} \times \boxed{2} = 24$$

1st pick 2nd pick 3rd pick

Choosing 3 of 4 (order ignored): ${}^4 C_3 = \frac{{}^4 P_3}{3!} = 4$

$${}^n P_r = n! / (n - r)! \quad \cdot \quad {}^n C_r = {}^n P_r / r!$$

Arrange (order matters, ${}^n P_r$) versus choose (order ignored, ${}^n C_r$)

Arrangements of NEEDLESS (8 letters, E×3, S×2): $\frac{8!}{3!2!} = 3360$.

Choosing 3 from 10 (order doesn't matter): ${}^{10} C_3 = \frac{10!}{3!7!} = 120$.

2 Practice

2.1 Evaluate ${}^7 P_3$. [1]

2.2 Evaluate ${}^8 C_2$. [1]

3 Exam-style questions

3.1 The number of ways to arrange the letters of BANANA is: [1]

- | | |
|---|---|
| A | B |
| C | D |
- A 720
B 120
C 60
D 360

3.2 A committee of 4 is chosen from 7 women and 5 men.

(a) Find the number of possible committees.

[2]

(b) Find the number that contain exactly 2 women and 2 men.

[3]

3.3 Find the number of arrangements of the 7 letters of PICTURE in which the three vowels (I, U, E) are all together.

[3]
