

■ PROBABILITY FORMULA CHEAT SHEET

Factorial

$$n! = n \times (n-1) \times (n-2) \times \dots \times 1$$

Permutation (Order Matters)

$$nPr = n! / (n-r)!$$

Used when arrangement/order matters.

Combination (Order Does NOT Matter)

$$nCr = n! / (r!(n-r)!)$$

Used when selecting items without caring about order.

Probability Distribution Condition

Sum of all probabilities must equal 1.

$$\sum f(x) = 1$$

Example (From Your Question)

(a) $f(x)=c(x^2+4)$: sum values then set $c_{\text{total}}=1$

(b) $f(x) = c \times C(2, x) \times C(3, 3-x)$: use combination formula

Combination Formula (Used in b part)

$$C(n,r)=n!/(r!(n-r)!)$$

Examples:

$$C(2,0)=1, C(2,1)=2, C(2,2)=1$$

$$C(3,3)=1, C(3,2)=3, C(3,1)=3$$

Quick Summary

Permutation \rightarrow Order matters

Combination \rightarrow Order does NOT matter

Probability distribution \rightarrow Total probability = 1

Diagram:

Permutation vs Combination

[illegible]


 $\downarrow \downarrow$
 $ABC \neq BAC$
 $\{A, B\} = \{B, A\}$