CAT 2026 Permutation and Combination

Formula sheet, tricks and 10 practice questions | CatMock

1. Core formulas

Concept	Formula / rule
Fundamental principle	Independent steps: multiply (m x n). Either-or cases: add (m + n).
Factorial	n! = n x (n-1) x ... x 1; 0! = 1
Permutation (order matters)	nPr = n! / (n-r)!
Combination (order does not matter)	nCr = n! / [r! (n-r)!]
Useful identities	nCr = nC(n-r); nCr + nC(r-1) = (n+1)Cr; nPr = nCr x r!
All n objects, with repeats	n! / (p! q! r!) for p, q, r identical items of each kind
Repetition allowed	r positions, n choices each: n^r
Circular arrangement	(n-1)! (clockwise and anticlockwise different); (n-1)!/2 when they are the same (necklace)
Distinct objects into groups	Unequal groups of a, b, c: n! / (a! b! c!). Equal groups of size a (k groups): n! / [$(a!)^k$ k!]
Identical objects, distinct boxes	Zero allowed: (n+r-1)C(r-1). At least one each: (n-1)C(r-1)
Distinct objects, distinct boxes (none empty)	Inclusion-exclusion: r^n - rC1 $(r-1)^n$ + rC2 $(r-2)^n$ - ...
Derangements	D(n) = n! [1 - 1/1! + 1/2! - ... + $(-1)^n$/n!]; D(3)=2, D(4)=9, D(5)=44
Geometry counting	Diagonals of n-gon: n(n-3)/2. Triangles from n points, k collinear: nC3 - kC3. Rectangles in m x n grid of squares: (m+1)C2 x (n+1)C2
Grid paths	a steps right, b steps up: (a+b)Ca

2. Seven tricks that save time

1. **Order test:** swap two chosen items. If the outcome changes, use permutation; if not, use combination.

2. **Glue method:** items that must stay together become one block. Arrange blocks, then arrange inside the block.

3. **Gap method:** for 'never together', arrange the other items first, then choose gaps (n items make n+1 gaps).

4. **Complement method:** for 'at least one', compute total minus 'none'.

5. **Fixed relative order:** if k items must appear in one fixed order, divide the total arrangements by k!.

6. **Stars and bars:** identical items into distinct boxes. Convert each condition into a minimum of one per box first.

7. **Casework with a restricted place:** fill the most restricted place first (zero in the first digit, even last digit).

Always check: Are objects identical or distinct? Is repetition allowed? Does order matter? Is there a restriction on a place?

3. Practice questions (try each in about 2 minutes)

Q1. How many 3-digit numbers can be formed from the digits 0, 1, 2, 3, 4, 5, without repeating any digit, that are divisible by 5?

Q2. In how many ways can the letters of the word COMMITTEE be arranged?

Q3. A team of 5 is to be chosen from 6 boys and 4 girls so that it has at least 2 girls. In how many ways can this be done?

Q4. 7 people sit around a circular table. In how many ways can they sit if two particular people must not sit next to each other?

Q5. Find the number of positive integer solutions of a + b + c + d = 15.

Q6. 4 boys and 3 girls are to be seated in a row so that all three girls sit together. How many arrangements are possible?

Q7. There are 12 points in a plane, of which 5 are collinear and no other three are collinear. How many triangles can be formed using these points as vertices?

Q8. A person walks from (0,0) to (6,4), moving one unit right or one unit up at each step. How many different paths pass through the point (3,2)?

Q9. In how many ways can 3 different numbers be chosen from 1, 2, 3, ..., 20 so that their sum is even?

Q10. In how many ways can 5 different gifts be given to 3 children so that every child gets at least one gift?

4. Answer key

Q	Answer	Method
1	36	Last digit 0: 5x4 = 20. Last digit 5: 4 choices for the first digit (not 0, not 5), 4 for the middle = 16. Total 36.
2	45360	9! / (2! 2! 2!) because M, T and E repeat twice.
3	186	Total 10C5 = 252, minus 0 girls (6) and 1 girl (4 x 6C4 = 60) = 186.
4	480	Fix one person: 6! = 720. Together: 5! x 2 = 240. Not together: 480.
5	364	Each variable at least 1: 14C3 = 364.
6	720	Block of girls plus 4 boys = 5 units: 5! x 3! = 720.
7	210	12C3 - 5C3 = 220 - 10 = 210.
8	100	(0,0) to (3,2): 5C2 = 10. (3,2) to (6,4): 5C2 = 10. Product 100.
9	570	All even: 10C3 = 120. One even, two odd: 10 x 10C2 = 450. Total 570.
10	150	$3^5 - 3 \times 2^5 + 3 = 243 - 96 + 3 = 150$.

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