Daily Combinatorics Drill #1

Sheet by David Akinyele-Aje

Section	Topic	Questions	Target time
A	Rapid Recognition	10	2 min 30 sec
B	Manipulation Drills	10	8 min
C	Substitution & Structure	8	10 min
D	Challenge	5	15 min

New toolkit today: Multiplication Principle · Factorials & Factorial Algebra · Permutations of Distinct Objects · Counting by Cases.

Attempt each question before checking answers. Time yourself. No calculators.

Section A Rapid Recognition (≤15 s each)

Evaluate or count instantly. One rule per question. Pure recognition.

1. Evaluate: $5!$.

2. Simplify: $\dfrac{8!}{6!}$.

3. A menu offers 4 starters, 5 mains and 3 desserts. How many different three-course meals are possible?

4. In how many ways can 4 different books be arranged on a shelf?

5. Evaluate: $\dfrac{6!}{4!\,2!}$.

6. How many 3-letter strings can be made from the 26 letters of the alphabet if letters may repeat?

7. How many 3-letter strings can be made if no letter may repeat?

8. Solve for n: $n! = 720$.

9. How many two-digit numbers have both digits odd?

10. Simplify: $\dfrac{(n+1)!}{(n-1)!}$.

Section B Manipulation Drills (≤50 s each)

Factorial algebra and direct counting. Set up the product, don't list outcomes.

1. In how many ways can 6 different people stand in a line? In how many of these arrangements does Amara stand first?

2. Simplify $\dfrac{n!}{(n-2)!}$ and hence solve $\dfrac{n!}{(n-2)!} = 42$.

3. A 4-digit code uses the digits 0–9. How many codes have no repeated digit?

4. How many three-digit numbers have all three digits different?

5. Gold, silver and bronze medals are awarded in a race with 8 runners. In how many ways can the medals be won?

6. How many arrangements are there of the letters of the word SPEED?

7. A flag has 3 horizontal stripes. Each stripe is one of 5 colours, and adjacent stripes must be different colours. How many flags are possible?

8. A set has 6 elements. By deciding, for each element, whether it is in or out, count the subsets of the set.

9. Solve for n: $(n+1)! = 12\,(n-1)!$.

10. A number plate consists of 2 different letters followed by 3 digits (digits may repeat). How many plates are possible?

Section C Substitution & Structure (≤90 s each)

Split into cases before you multiply. Watch for leading zeros and forced choices.

1. How many even three-digit numbers have all three digits different?

2. Six people stand in a line. Two of them, Priya and Quinn, insist on standing next to each other. How many arrangements are possible?

3. With the same six people, how many arrangements have Priya and Quinn *not* next to each other?

4. How many five-digit palindromes are there? (A palindrome reads the same forwards and backwards.)

5. Three married couples sit in a row of 6 seats so that each couple sits together. In how many ways can they be seated?

6. Using the factorisation $360 = 2^3 \cdot 3^2 \cdot 5$, count the positive factors of 360.

7. How many four-digit odd numbers have all four digits different?

8. The number of ways to arrange n different objects in a row is exactly 20 times the number of ways to arrange $n-2$ of them taken from a smaller shelf of $n-2$ objects. Find n.

Section D Challenge (SMC difficulty)

Insight over computation. If the last ones resist, sit with them — learn the tool, then return.

1. How many three-digit numbers consist of three *different even* digits and are divisible by 3? *(after SMC 2025 Q12)*

2. How many rectangles (of any size, including squares) appear in a 3×3 grid of unit squares? *(after SMC 2022 Q3)*

3. In how many ways can 8 people be split into 4 pairs? (The pairs are not labelled or ordered.)

4. In how many zeros does the number 100! end?

5. Thirty squares are drawn side by side in a line. The first and last squares are shaded, and more squares must be shaded so that both rules hold: (a) no two adjacent squares are shaded, and (b) there are never more than three consecutive unshaded squares. What is the difference between the largest and smallest possible number of shaded squares? *(after SMC 2025 Q9)*

"Before you count, decide exactly what you are counting. Every hard count is an easy count seen from the wrong side."

Found a mistake or want to contribute a sheet?
Visit the open-source project at github.com/The-CerealDev/speed-maths