

MATH CLUB ASSIGNMENT 1: WELCOME TO THE CLUB!

SEP 26, 2026

WELCOME TO THE NEW SEMESTER AT SCHOOLNOVA!!

The math club is where we solve challenging but enjoyable problems from all areas of math — usually the problems that are not part of the standard school curriculum.

We will participate in some olympiads, and these problems will help you get ready for these competitions.

I ask that each student bring a notebook (preferably quad ruled), pencils and a folder or binder to keep old assignments — you will need them!

If you have any questions, please contact me by email: kirillov@schoolnova.org.

You might have seen some of these problems before. If so, let me know, and I will give you other problems to work on.

PROBLEMS

1. During daytime, a snail climbs 10cm up a post. During the night, it slides down 9cm. How long will it take the snail to reach the top of the pole if the height of the pole is 1m?
2. A rectangular bar of chocolate consists of $m \times n$ squares. You want to break it into mn individual squares. At each step, you may pick up one piece you have and break it along any of the vertical or horizontal lines separating the squares.

How many breaks do you need? What is the fastest way to do it?

3. Consider the sequence of numbers 1, 11, 111, 1111, $\dots$,
 - (a) Prove that among these numbers, there are two whose difference is divisible by 179
 - *(b) Prove that one of these numbers is divisible by 179.
4. Nine points (all distinct, no three on the same line) are placed inside a square with side length 2. Show that one can choose 3 of these points which form a triangle of area $\leq \frac{1}{2}$.
5. Solve the equation

$$2025 - 2(2025 - 2(2025 - 2(2025 - 2x))) = x$$

6. What is the units digit of 2023^{2023} ?
7.
 - (a) In how many zeros does $90!$ end?
 - (b) What are the last two non-zero digits of $90!$?
8. Find the remainder when 2^{100} is divided by
 - (a) by 7
 - (b) by 55
 - (c) by 1001
9. You have postal stamps of two denominations: 50 cent stamps and 36 cent stamps.
 - (a) If you use stamps as money, and are allowed to get change, using same kinds of stamps, what is the smallest value you can pay?
 - (b) If you are using stamps to put on an envelope, what values you can make using these two kinds of stamps?
10. We have 7 books and 12 backpacks. How many ways are there of distributing them in these scenarios?
 - (a) Books are identical, backpacks are distinct, and we can put at most one book in any backpack.
 - (b) Books and backpack all distinct, and we can put at most one book in any backpack.
 - (c) Books and backpacks are all distinct, we can place any number of books in any backpack (including 0).
 - (d) Books are identical, backpacks are distinct, and we can put an arbitrary number of books in any backpack (including 0).

11. Eight players A through H have reached the quarter finals of the women's US open tennis championship. How many ways are there to pair them up to play the quarter final games against each other?
12. How many sequences of letters A, B of length 25 can one write if A's are not allowed to be next to each other? What if you are allowed at most two A's in a row?
13. We know that $x + (1/x) = 3$. Find $x^8 + (1/x^8)$.