1. Absolution
What are the solutions $x \in \mathbb{R}$ of the equation
$$|x + 1| - |x| + 3|x - 1| - 2|x - 2| = x + 2?$$

2. Non-repetitive integers
How many positive integers have no repeated digits in their decimal representation?

3. Optically optimal
A picture $h$ metres high is hung on a high wall such that the bottom of the picture is $a$ metres above the ground. A person stands on the ground at a distance $x$ metres from the foot of the wall, viewing the picture. If the person’s eye level is $b$ metres above the ground, assuming $a \geq b$, find an expression for the viewing angle of the picture in terms of $x$, $a$, $b$ and $h$. Hence find, for fixed $a$, $b$, $h$, the distance $x$ from the foot of the wall that a person should stand such that the viewing angle is largest.

4. Limiting sine times
Evaluate
$$\sum_{n=1}^{\infty} \sin\left(\frac{x}{3^n}\right) \sin\left(\frac{2x}{3^n}\right).$$

5. Zeroing in on an integer
Let $p(x)$ be a polynomial with integer coefficients such that $p(2) = 13$ and $p(10) = 5$.
If there exists an integer $n$ such that $p(n) = 0$, what is $n$?
6. Triangular circulation

Four equal circles are drawn inside an equilateral triangle of side length 2 units. Each circle touches two of the other circles and only one side of the triangle. Find the exact common radius of the circles.

7. Integer surprise

An integer \( n > 0 \) is said to be surprising if, when written (in the decimal system) to the right of any positive integer, the resulting number is divisible by \( n \).

What are all surprising integers?

8. Battleship 1-D

A ship, represented by a point, moves in uniform motion along the real line \( \mathbb{R} \). At any moment, the ship’s position and speed are not known. The only information available is the following:

(i) its position at time \( t = 0 \) is an integer \( x \).
(ii) the speed (measured per minute) is an integer \( v \).

Every minute from \( t = 0 \), we drop a bomb on a lattice point (i.e. a point with coordinate \( n \in \mathbb{Z} \)). If the ship is there, it sinks and we have won.

Is there a strategy guaranteeing the sinking of the ship in finite time?

9. Parity game

Alice chooses 2000 distinct numbers from the set of integers from 1 to 3000. Ben then tries to find among these 2000 numbers, 1000 integers whose parity alternates when they are ordered from smallest to largest. If Ben is able to achieve his objective, he wins; otherwise, Alice wins.

Assuming they each use an optimal strategy, who of Alice or Ben is assured of winning, whatever their opponent does?

10. Multinomial integers

What are the solutions of the equation

\[
x_1^{2015} + 2^1 x_2^{2015} + 2^2 x_3^{2015} + \cdots + 2^{2014} x_{2015}^{2015} = 2014 x_1 x_2 x_3 \cdots x_{2015}
\]

for \( x_1, x_2, x_3, \ldots, x_{2015} \in \mathbb{Z} \)?