

11 November 21

**P**roblem  
**S**olving  
**C**lub

Find a  
Pattern

# Patterns



Finding a Pattern is an extremely useful and extremely common technique for solving problems.

You can use a pattern to:

- Solve the problem directly
- Find the next step
- Make a guess at the solution

A common way of finding a pattern is by looking at small cases

# An Example

Esteban writes a list of the perfect squares.  $1, 4, 9, 16, 25, 36, 49, \dots$  After the number 1, he alternates making two negative and two positive.  $1, -4, -9, 16, 25, -36, -49, \dots$  What is the sum of the first 2022 terms in this sequence?

Let's make a list for small values and try to find a pattern.

# An Example



By Showing that the sum of the series is equal to  $n$  every 4<sup>th</sup> term, we can quickly find the sum of the first 2022 terms.

the sum of the first 2020 terms is 2020, so  
the sum of the first 2022 terms is  
 $2020 + 2021^2 - 2022^2 = -2023$

Finding and proving a pattern helped us solve the problem much quicker.

# Week 6 – Nov 11

PS  
C

1. Toothpicks are used to make rectangular grids. 31 are used in a  $1 \times 10$  grid. How many toothpicks are used in a  $43 \times 10$  grid?

2. In the Fibonacci sequence, Each term after the first is the sum of the two previous terms. 1, 1, 2, 3, 5, 8, 13, 21... How many of the first 100 terms in the sequence are odd?

3. How many ways are there to tile a  $2 \times n$  rectangle with  $2 \times 1$  blocks?

