

# Maths for Computer Science

## Computing the sum of cubes

Training class MoSIG1

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## The target problem

Definition:

Sum of the  $n$  first cubes:

$$C_n = \sum_{k=1}^n k^3$$

## A preliminary problem

- Compute the sum of the first  $n$  odd numbers by different methods
  - Double counting (Fubini)
  - Gauss trick
  - etc.

## Sum of cubes

Provide an asymptotic analysis

Compute the sum for the first 5 integers and deduce an expression

- Find the value by the undetermined coefficient method
- Check the previous value by recurrence

Proposition:

for all integer  $n$ ,

$$\Delta_n^2 = \sum_{k=1}^{\Delta_n} (2k - 1) = \sum_{k=1}^n k^3 \quad (1)$$

The objective is to provide an inductive geometrical proof of this result.