

Con  $\frac{1}{\text{tin} + \frac{1}{\text{ued} + \frac{1}{1 + \frac{1}{\text{Frac} + \frac{1}{\text{tions}}}}}}$

Project 4

Lead by:

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*in English...*

$$a = 2 + \frac{1}{1 + \frac{1}{2 + \frac{1}{1 + \frac{1}{1 + \frac{1}{4}}}}}$$

What is a  
continued  
fraction?

42 = 0 + 1

How do we get there?

$\frac{1}{7} + \frac{3}{7} = \frac{4}{7}$

$\frac{1}{8} + \frac{4}{8} = \frac{5}{8}$

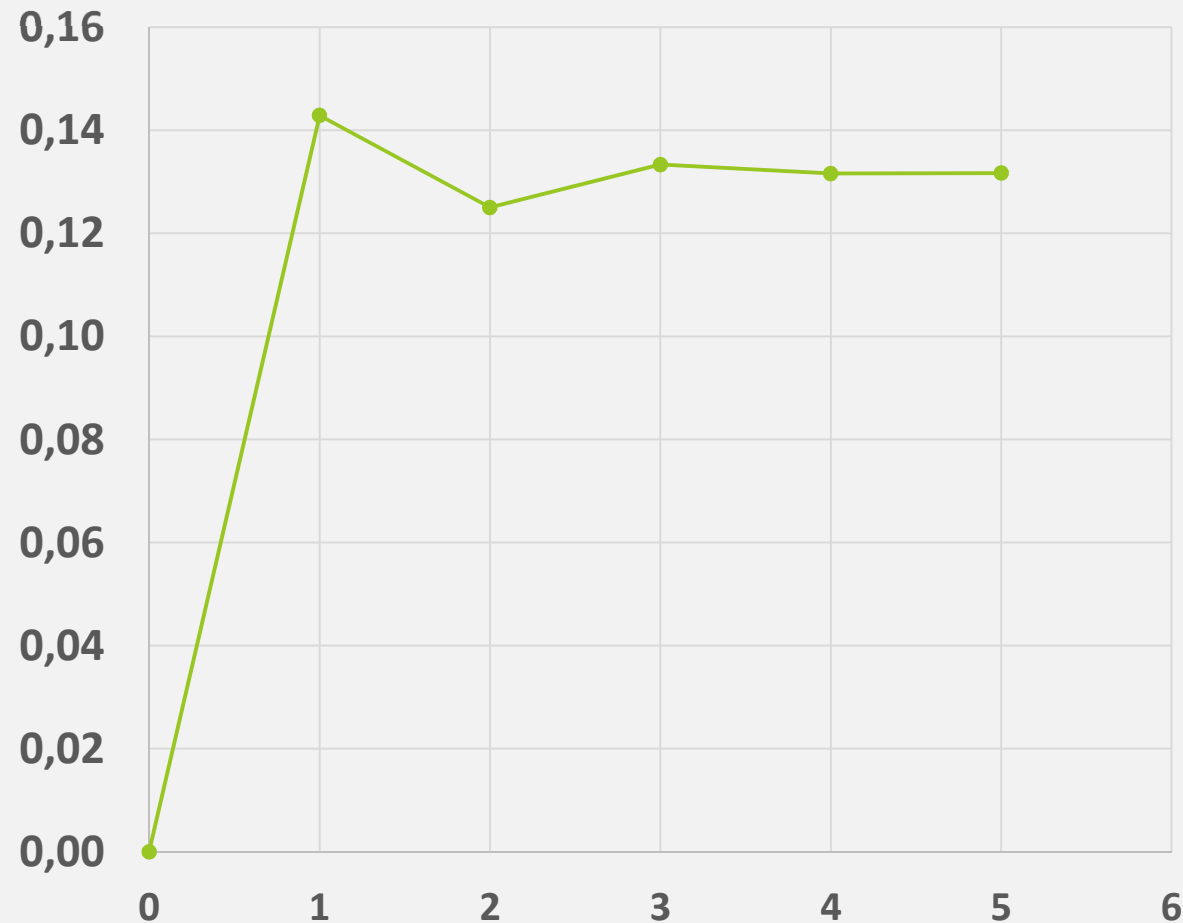
$\frac{2}{15} + \frac{5}{15} = \frac{7}{15}$

$\frac{2}{5} + \frac{3}{5} = \frac{5}{5} = 1$

$\frac{2}{8} + \frac{3}{8} = \frac{5}{8}$

$\frac{5}{38}$

## Approximation of rational numbers



$$0 = 0$$

$$\frac{1}{7} = 0,14285\dots$$

$$\frac{1}{8} = 0,125$$

$$\frac{2}{15} = 0,13333\dots$$

$$\frac{5}{38} = 0,13157\dots$$

$$\frac{42}{319} = 0,13166\dots$$

(**Best** approximation with the **smallest denominator**)

# Approximation of irrational numbers

$\pi$

$$\pi = 3 + \frac{1}{7 + \frac{1}{15 + \frac{1}{1 + \frac{1}{292 + \frac{1}{1 + \dots}}}}} = 3.1415926\dots$$

$$\frac{355}{113} = 3 + \frac{1}{7 + \frac{1}{15 + \frac{1}{1}}} = 3.1415929\dots$$

# Where can we use continued fractions?

- Approximation of **numbers**
- Integer solutions of equations
- Electric schemes

## How to:

- Compare knots
- Improve the **calendar**
- {exactly} approximate your **age**

## What we actually did...

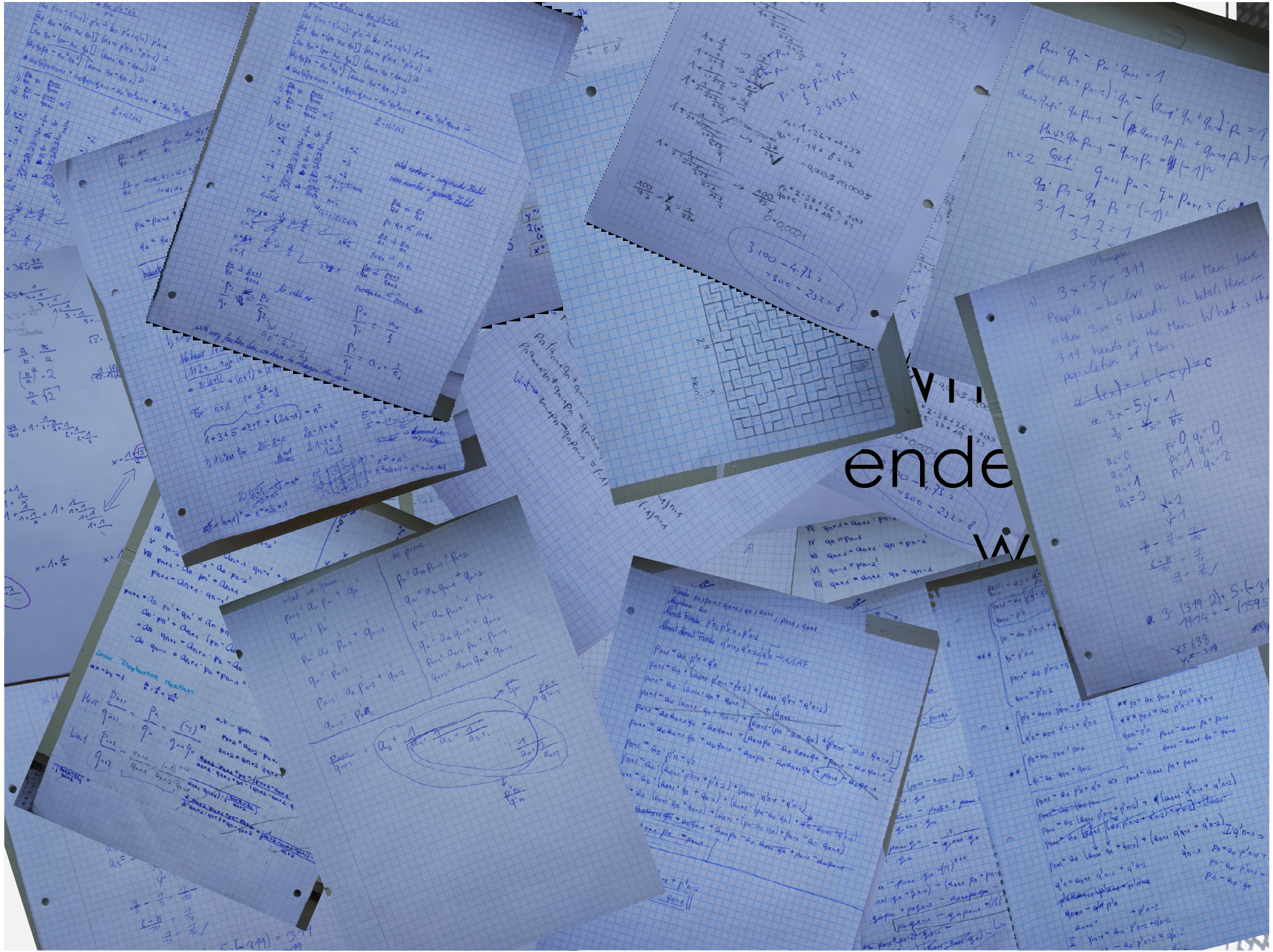
- Solved the following problems:
    - „In how many ways can we spend **10.000€** on **bikes?**“
    - „How many people with three or five hands live on **Mars?**“
  - Nose-Stretching Algorithm
  - Induction
- 
- Dealing with operators **+** & **-**
  - *Handwriting* issues
  - Struggling with PowerPoint...

## Some new vocabulary...

What are ...

- Numerator
- Denominator {*Determinator*, *Demoninator*,  
*Denumerator*}
- Integer {*Intiger*}
- Remainder





$(a_1 + a_n) \cdot n = S_n$   
 $(a_1 + a_2 + \dots + a_n) \cdot n = S_n$   
 $(a_1 + a_n) \cdot n = S_n$   
 $(a_1 + a_2 + \dots + a_n) \cdot n = S_n$

odd number = sum of odd numbers  
 even number = sum of even numbers  
 $S_n = \frac{n}{2} (2a_1 + (n-1)d)$   
 $S_n = \frac{n}{2} (a_1 + a_n)$   
 $a_n = a_1 + (n-1)d$   
 $S_n = \frac{n}{2} (2a_1 + (n-1)d)$   
 $S_n = \frac{n}{2} (a_1 + a_n)$

$1 + \frac{1}{2} + \frac{1}{4} + \dots$   
 $1 + \frac{1}{2} + \frac{1}{4} + \dots = \frac{1}{1 - \frac{1}{2}} = 2$   
 $1 + \frac{1}{4} + \frac{1}{16} + \dots = \frac{1}{1 - \frac{1}{4}} = \frac{4}{3}$   
 $1 + \frac{1}{8} + \frac{1}{64} + \dots = \frac{1}{1 - \frac{1}{8}} = \frac{8}{7}$

People who live on the Mars have either 3 or 5 hands. In total, there are 314 hands on the Mars. What is the population of Mars?  
 $3x + 5y = 314$   
 $x = 2, y = 62$   
 $3 \cdot 2 + 5 \cdot 62 = 314$

$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots = 1$   
 $\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \dots = \frac{1}{2}$   
 $\frac{1}{4} + \frac{1}{16} + \frac{1}{64} + \dots = \frac{1}{3}$

Linear Diophantine equations  
 $ax + by = c$   
 $ax + by = c$   
 $ax + by = c$   
 $ax + by = c$

$3 \cdot 100 - 4 \cdot 78 = 8$   
 $300 - 312 = 8$   
 $8 = 8$

$3x - 5y = 1$   
 $\frac{3}{5} - \frac{1}{5} = \frac{2}{5}$   
 $x = 2, y = 1$   
 $3 \cdot 2 - 5 \cdot 1 = 1$

$P_n = a_1 + (n-1)d$   
 $S_n = \frac{n}{2} (2a_1 + (n-1)d)$   
 $S_n = \frac{n}{2} (a_1 + a_n)$

$3 \cdot (319 \cdot 2) + 5 \cdot (-319) = 1974 - 1595 = 379$   
 $379 = 379$



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to be continued...