

Lesson Plan

NEUROHEADWAY

Neuroscience Into Education

What is a sequence?

A **sequence** is a string of objects, like numbers, that follow a particular pattern.

A real sequence is represented as u_n and for each n we associate a real number, for example:

- ▶ The sequence of even numbers can be given by $u_n = 2n$

$$u_1 = 2 \quad u_2 = 4 \quad u_3 = 6 \quad u_4 = 8 \quad u_5 = 10$$

- ▶ The sequence of the odd numbers can be given by $u_n = 2n - 1$

$$u_1 = 1 \quad u_2 = 3 \quad u_3 = 5 \quad u_4 = 7 \quad u_5 = 9$$

1

The Fibonacci's sequence

One of the most famous sequences is the **Fibonacci sequence**.

The Italian mathematician Leonardo Fibonacci launched the following challenge:

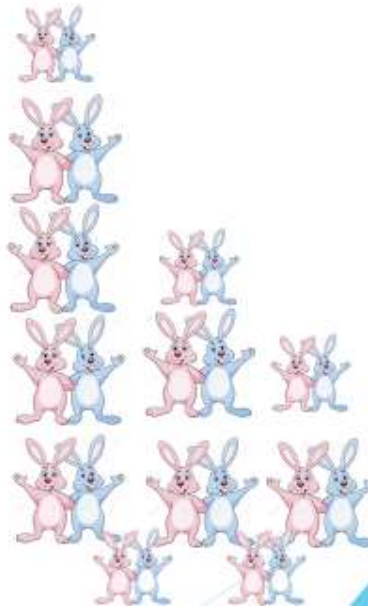
- ▶ A farmer has a couple of baby rabbits
- ▶ Say rabbits are able to mate at the age of one month and pregnancy takes one month.
- ▶ Thus, at the end of its second month, a female can produce another pair of rabbits.
- ▶ Rabbits never die, and a mating pair always produces one new pair (one male, one female) every month from the second month on.
- ▶ Question: if we start with a new pair from birth, how many pairs will there be in one year?



2

The Fibonacci's sequence

- ▶ January: a couple of baby rabbits
- ▶ February: the babies grow and are ready to have bays in one month
- ▶ March: a couple of adult rabbits and a couple of baby rabbits
- ▶ April: the babies grow and the old couple have 2 one more couple
- ▶ May: the babies grow and the old couples have 2 one more couple



3

The Fibonacci's sequence

How many rabbits we have in December?



This is a sequence defined by recurrence

Did you find a general expression?

$$u_1 = 1, \quad u_2 = 1$$

$$u_n = u_{n-1} + u_{n-2}$$

4

The Arithmetic Sequence

Imagine that a farmer's chickens lay eggs according to the following succession:

- ▶ 1st day: 5 eggs
- ▶ 2nd day: 8 eggs
- ▶ 3rd day: 11 eggs
- ▶ 4th day: 14 eggs
- ▶ 5th day: 17 eggs

Can we write the general formula to the number of eggs in any day?

$$u_n = 3n + 2$$

Arithmetic sequence



5

The Arithmetic Sequence

How many eggs the farmer will have in the n^{th} day?

n	un
1	5
2	8
3	11
4	14
5	17
6	20
7	23
8	26
9	29
10	32
11	35
12	38
13	41
14	44
15	47

n	un
16	50
17	53
18	56
19	59
20	62
21	65
22	68
23	71
24	74
25	77
26	80
27	83
28	86
29	89
30	92

n	un
31	95
32	98
33	101
34	104
35	107
36	110
37	113
38	116
39	119
40	122
41	125
42	128
43	131
44	134
45	137

Easily we see that the number of eggs will grow infinitely when n grows infinitely too!...

$$\lim_{n \rightarrow \infty} (3n + 2) = +\infty$$



6