SHARING INSPIRATION 2019

THE POWER OF REALIZATION

T³ EUROPE

Sharing inspiration

- Sharing information
- Sharing visions
- Sharing discussions
- Sharing solutions

The realization of inspiration

The power of realzation

- Realizing suitable curricula
- Realizing a fruitful use of technology
- Realizing efficient pedagogical approaches
- Realizing necessary political decisions

Round 1: Classroom Implementation

Moderator: **Helmut Heugl**

WS 1

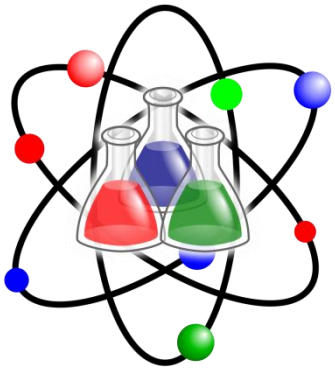
***Curriculum*:** French Senior High Schools' Curriculum: New generation of curricula in grade 10 where the purpose is to integrate some aspect of STEM
Robert Cabane

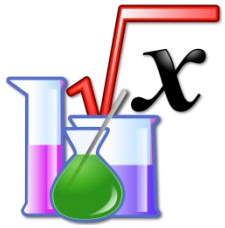
WS 2

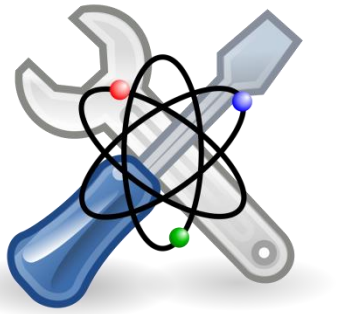
***Content*:** Common Framework: Which natural science and mathematics competences need to be found in our society?
Jürgen Langlet

WS 3

***Classroom Practice*:** Innovating STEM classroom practices
Agueda Gras-Velazquez

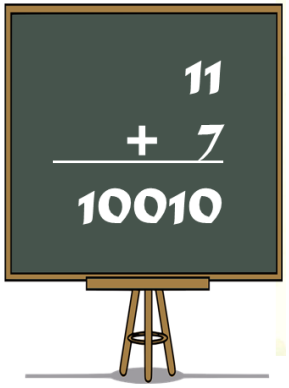






The role of STEM

- **S**cience
- **T**echnology
- **E**ngineering
- **M**athematics

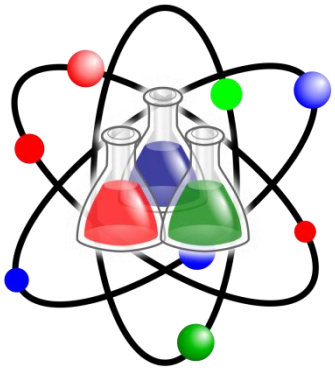


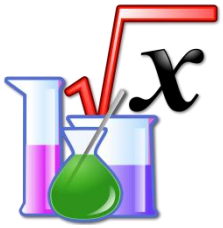
in the age of technology and digitalisation

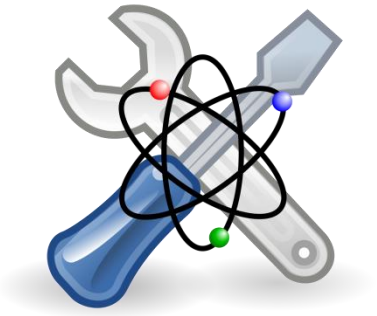
STEM in the age of technology, digitalization and automation

Thesis 1: In the age of technology STEM-subjects – Science, Technology, Engineering and Mathematics – are an indispensable part of the general school curriculum.

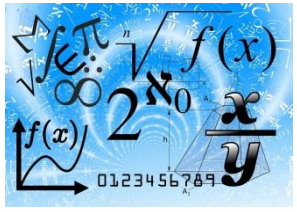
Question 1: What should be taught today and what should students actually learn in these subjects? Which competences are currently necessary? What are the appropriate pedagogical approaches for a successful STEM education?





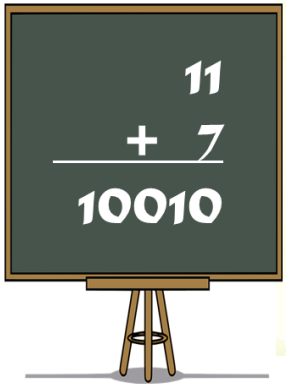


Two examples



indicating such evolutionary changes

of the role of STEM



in the age of technology and digitalisation

Example 1: Applying a loan for buying a house

For buying a house the bank offered a special sort of loans. The rate of interest p was 3.5%. Depending on the index „Euribor“ this rate at most can rise to 6%.

I needed a loan k of € 140 000 and I wanted to repay the loan with yearly instalments in 30 years.

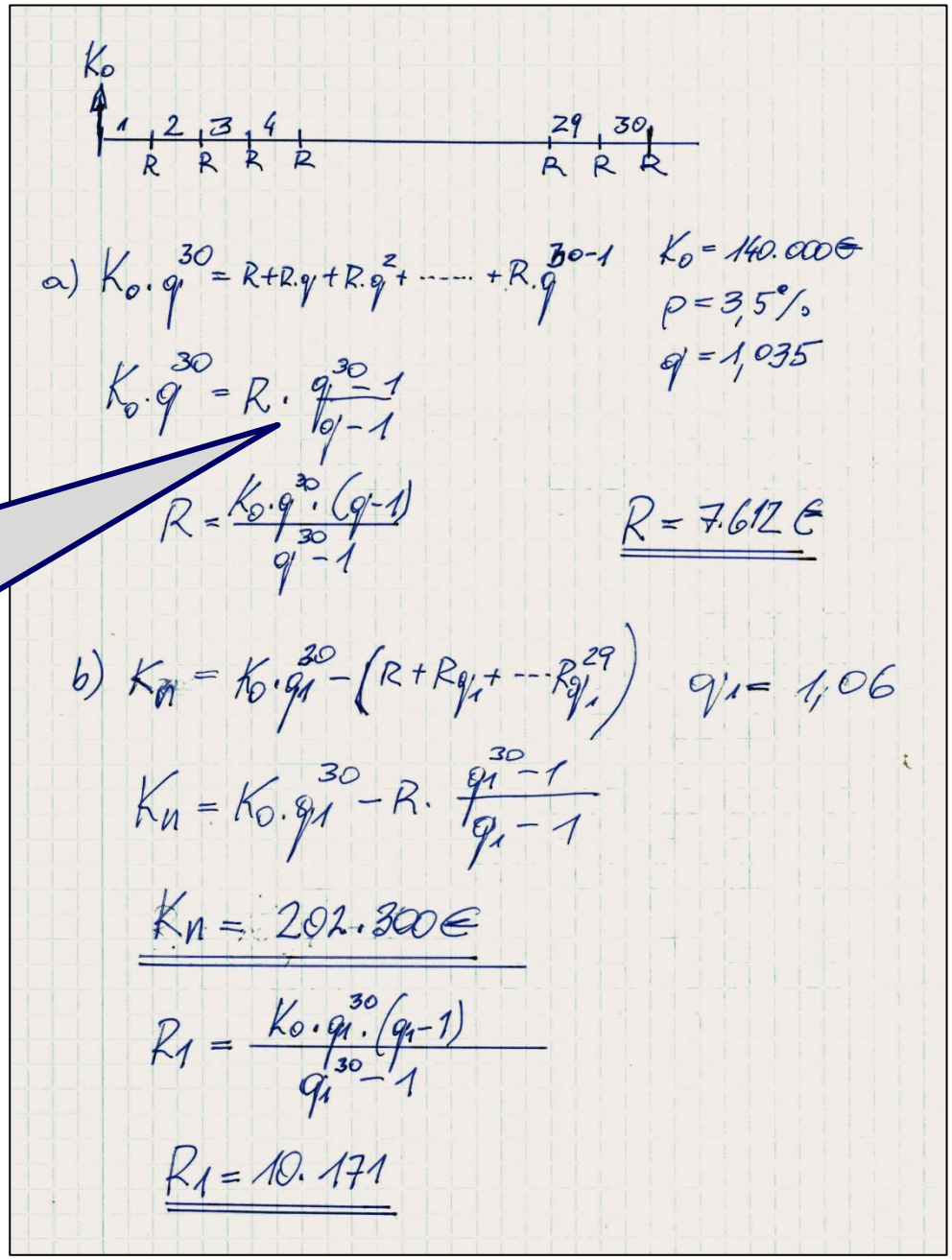
a) How much amounts the yearly instalment r paid at the end of the year?

b) What happens if the rate of interest would rise to 6%?. How much will than the yearly installment amount if we still want to repay the loan in 30 years?

Solution in traditional mathematics education

(not before 10th grade)

Necessary are geometric series and for the calculation of the number of years logarithms



Solution by using technology (e.g. 8th grade)

1st phase: Modeling

real problem

A loan k payed in yearly instalments

structuring: „What happens every year ?

real model or „word formula“

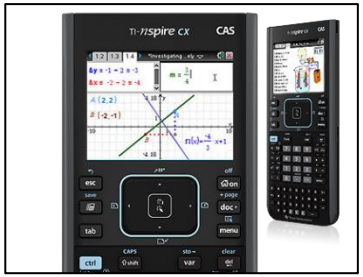
Interest is charged on the loan k and the instalment r is deducted

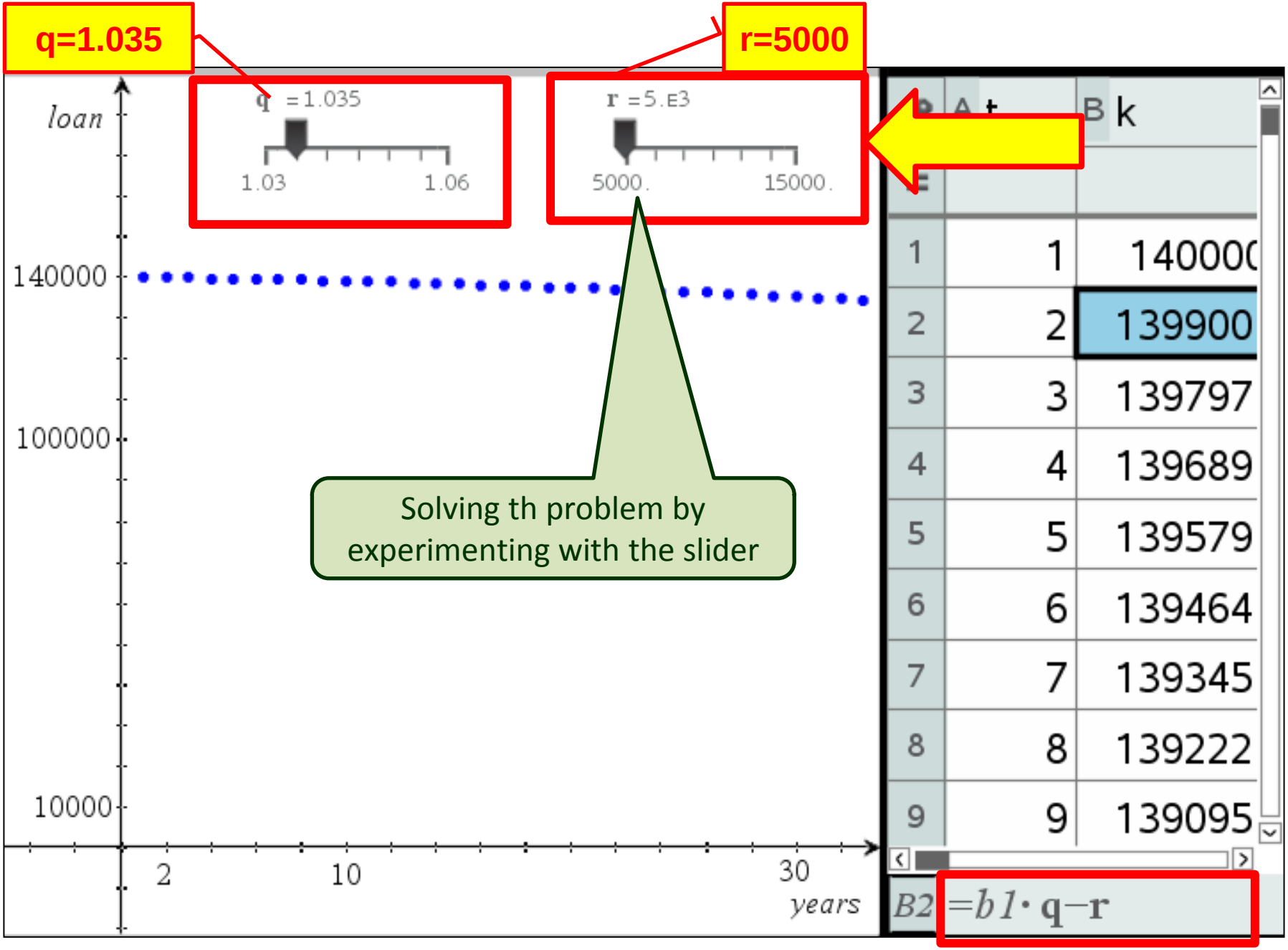
mathematizing: Translating into the mathematical language

mathematical model

$$k_{new} = k_{old}.(1+p/100) - r$$

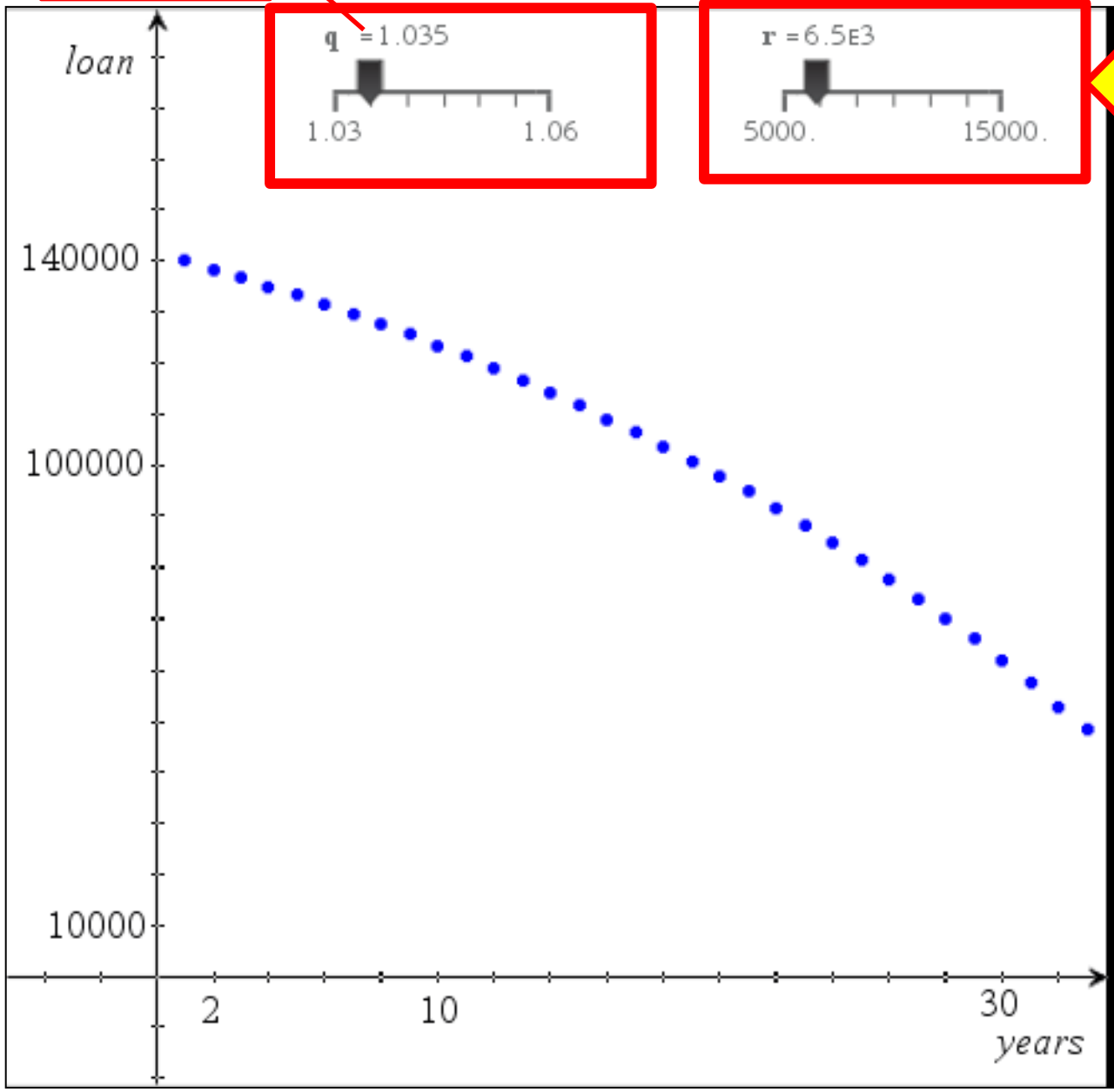
2nd phase: Using technology for simulating and visualizing and interpreting




q=1.035
r=5000
q =1.035
1.03
1.06
r =5.E3
5000.
15000.
loan
140000
100000
10000
2
10
30
years
Solving th problem by experimenting with the slider
A t
B k
1 1 140000
2 2 139900
3 3 139797
4 4 139689
5 5 139579
6 6 139464
7 7 139345
8 8 139222
9 9 139095
B2 =b1·q−r

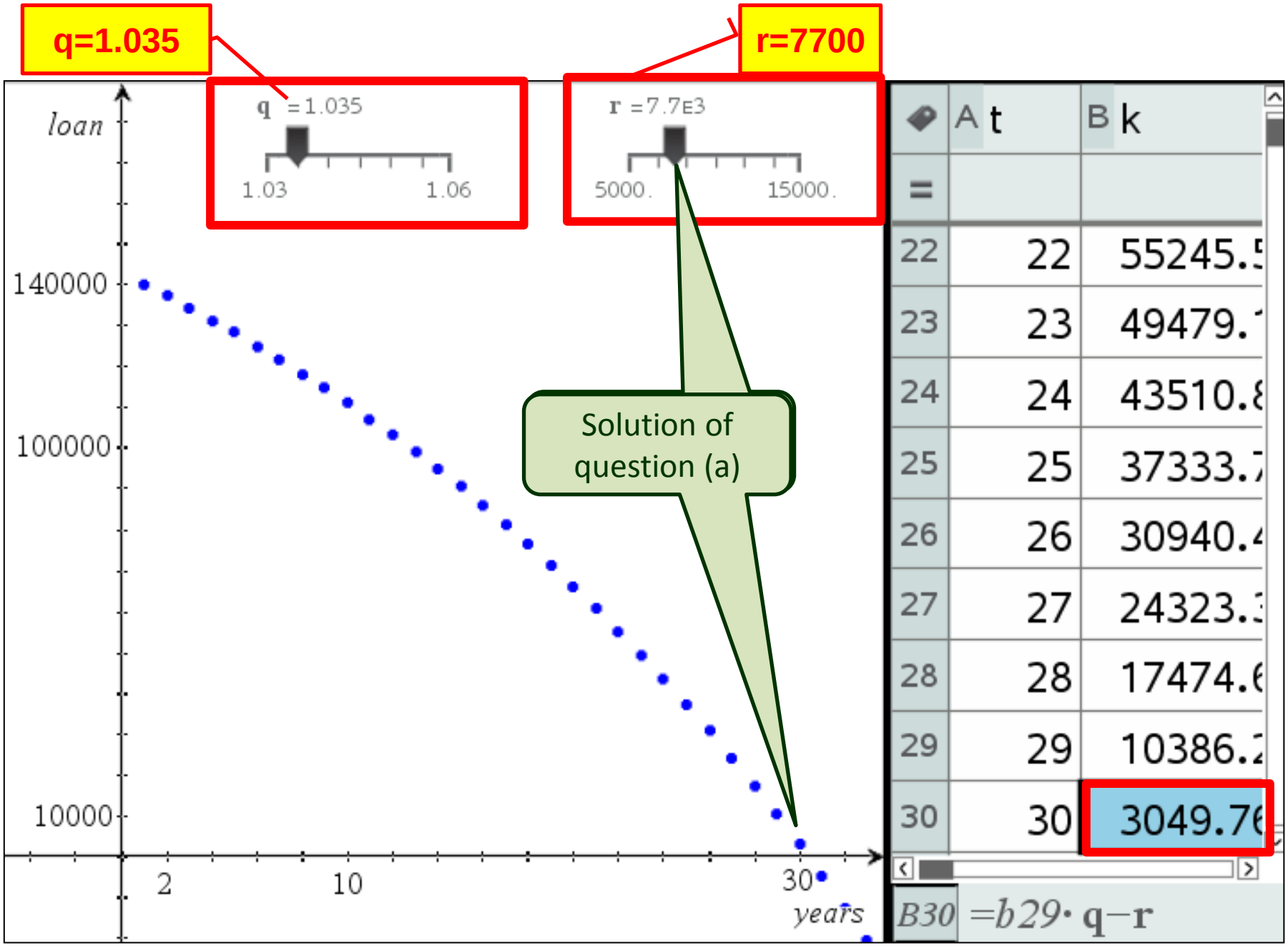
q=1.035

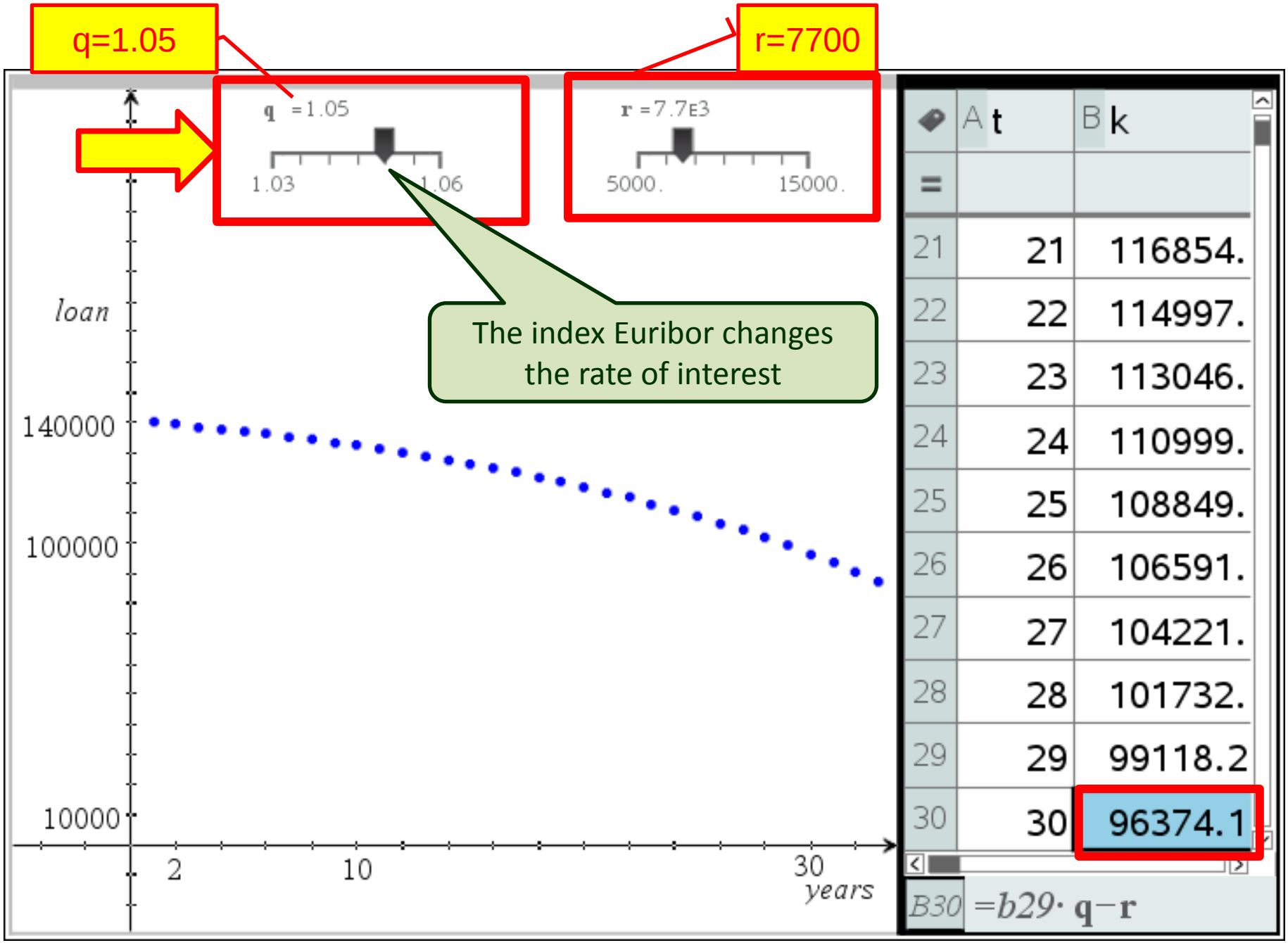
r=6500

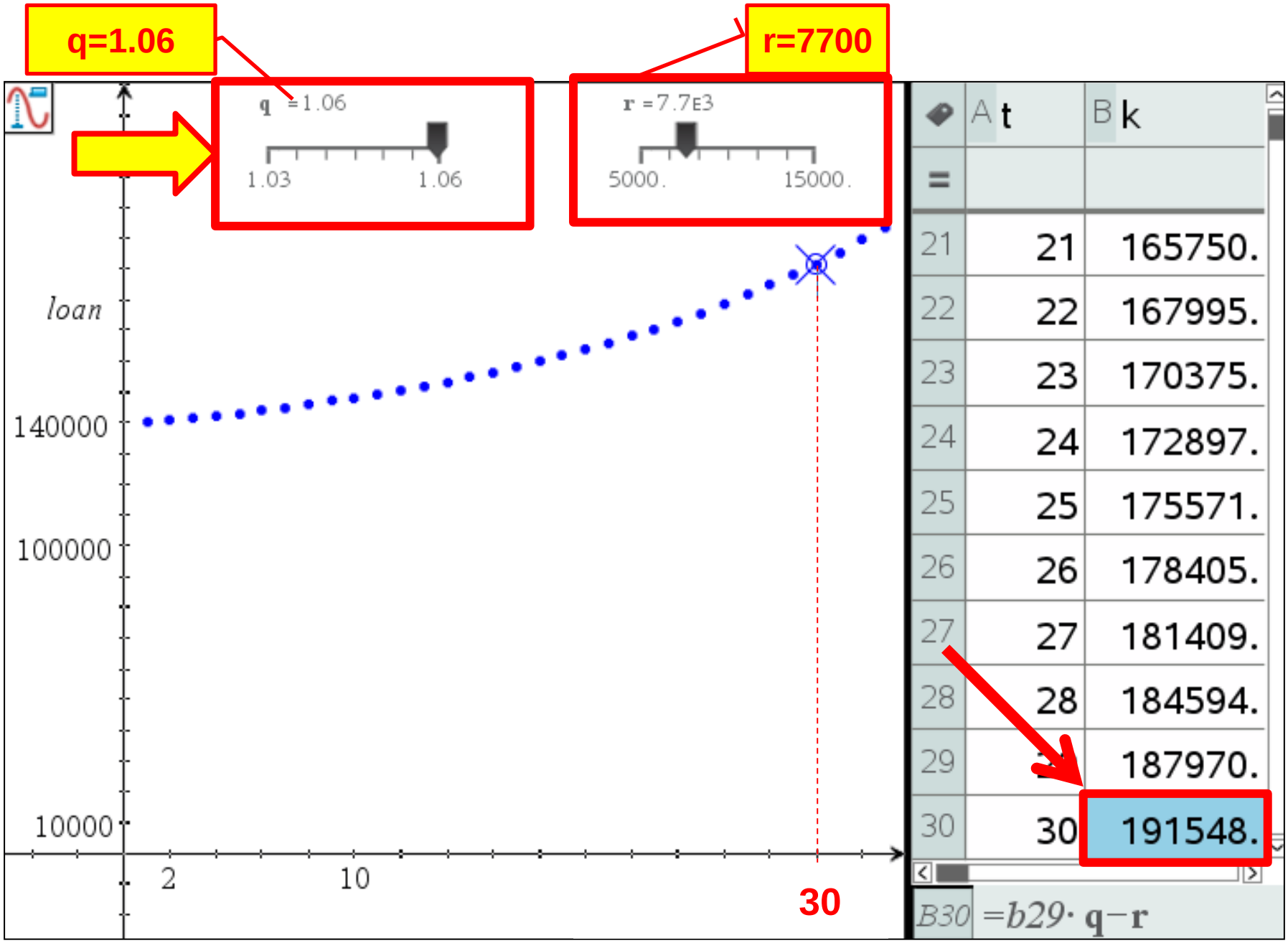


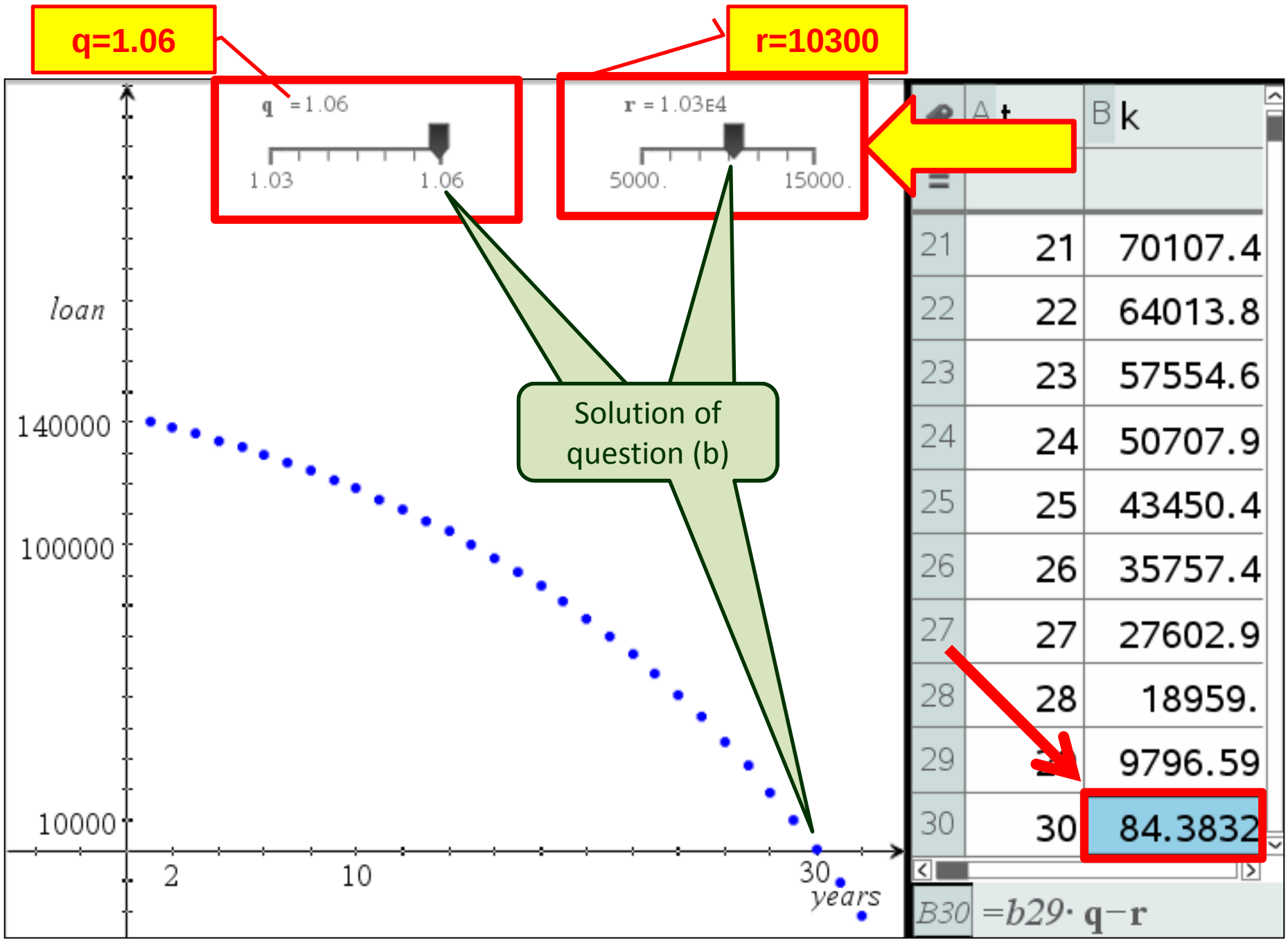
	B k
21	21 94752.5
22	22 91568.8
23	23 88273.8
24	24 84863.3
25	25 81333.6
26	26 77680.2
27	27 73899.
28	28 69985.5
29	29 65935.
30	30 61742.7

B30 =b29· q−r

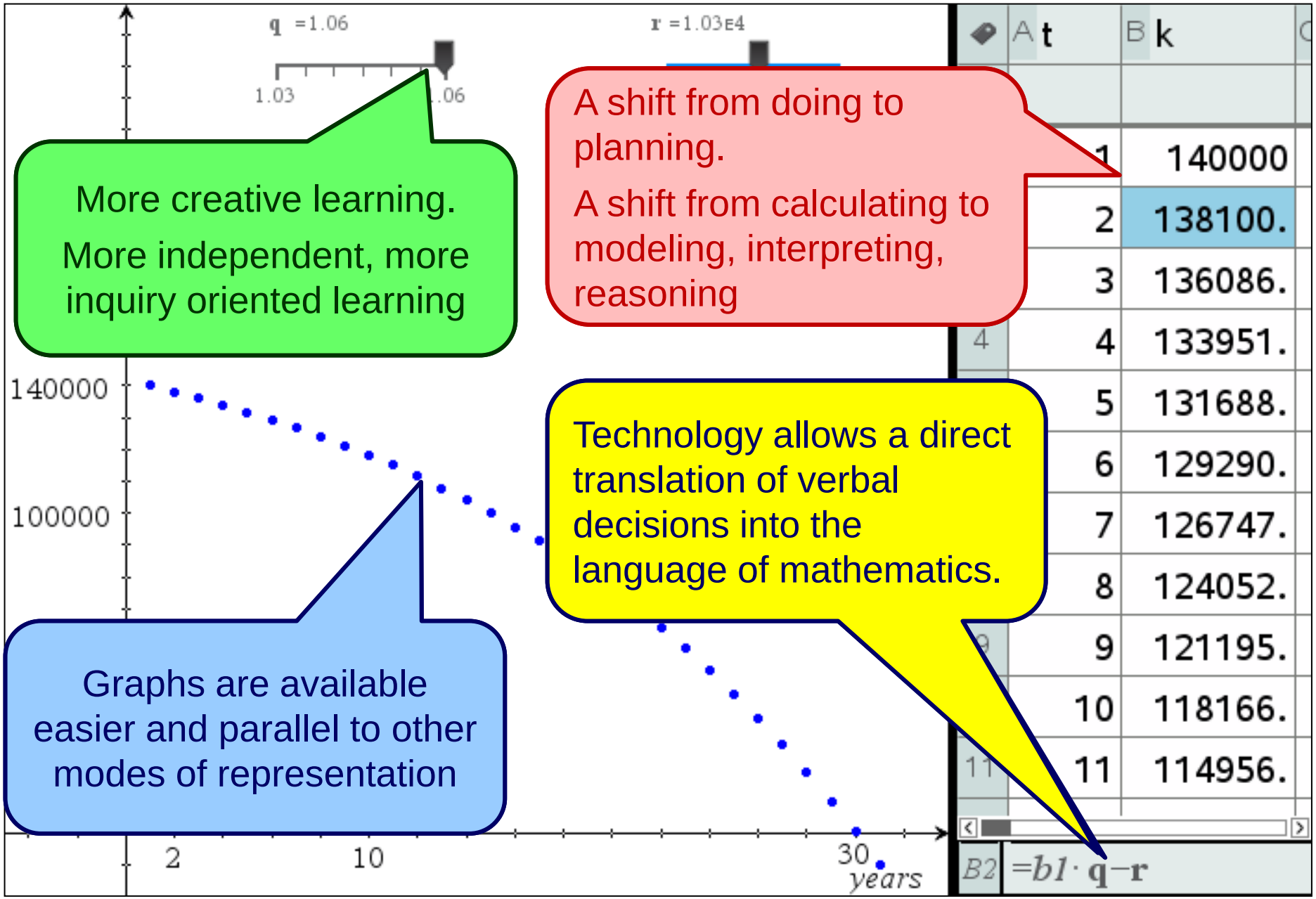

q=1.035
r=7700
q =1.035
1.03
1.06
r =7.7E3
5000.
15000.
loan
140000
100000
10000
2
10
30
years
Solution of question (a)
A t
B k
22 22 55245.
23 23 49479.
24 24 43510.
25 25 37333.
26 26 30940.
27 27 24323.
28 28 17474.
29 29 10386.
30 30 3049.76
B30 =b29· q−r


q=1.05
r=7700
q =1.05
1.03
1.06
r =7.7E3
5000.
15000.
The index Euribor changes the rate of interest
loan
140000
100000
10000
2
10
30
years
A t
B k
21 21 116854.
22 22 114997.
23 23 113046.
24 24 110999.
25 25 108849.
26 26 106591.
27 27 104221.
28 28 101732.
29 29 99118.2
30 30 96374.1
B30 =b29· q−r


q=1.06
r=7700
q =1.06
1.03
1.06
r =7.7E3
5000.
15000.
loan
140000
100000
10000
2
10
30
A t
B k
21 21 165750.
22 22 167995.
23 23 170375.
24 24 172897.
25 25 175571.
26 26 178405.
27 27 181409.
28 28 184594.
29 29 187970.
30 30 191548.
B30 =b29· q−r


q=1.06
r=10300
q =1.06
1.03
1.06
r = 1.03E4
5000.
15000.
loan
140000
100000
10000
2
10
30
years
Solution of question (b)
A t
B k
21 21 70107.4
22 22 64013.8
23 23 57554.6
24 24 50707.9
25 25 43450.4
26 26 35757.4
27 27 27602.9
28 28 18959.
29 9796.59
30 30 84.3832
B30 =b29· q−r

Several roles of technology



More creative learning.

More independent, more inquiry oriented learning

A shift from doing to planning.

A shift from calculating to modeling, interpreting, reasoning

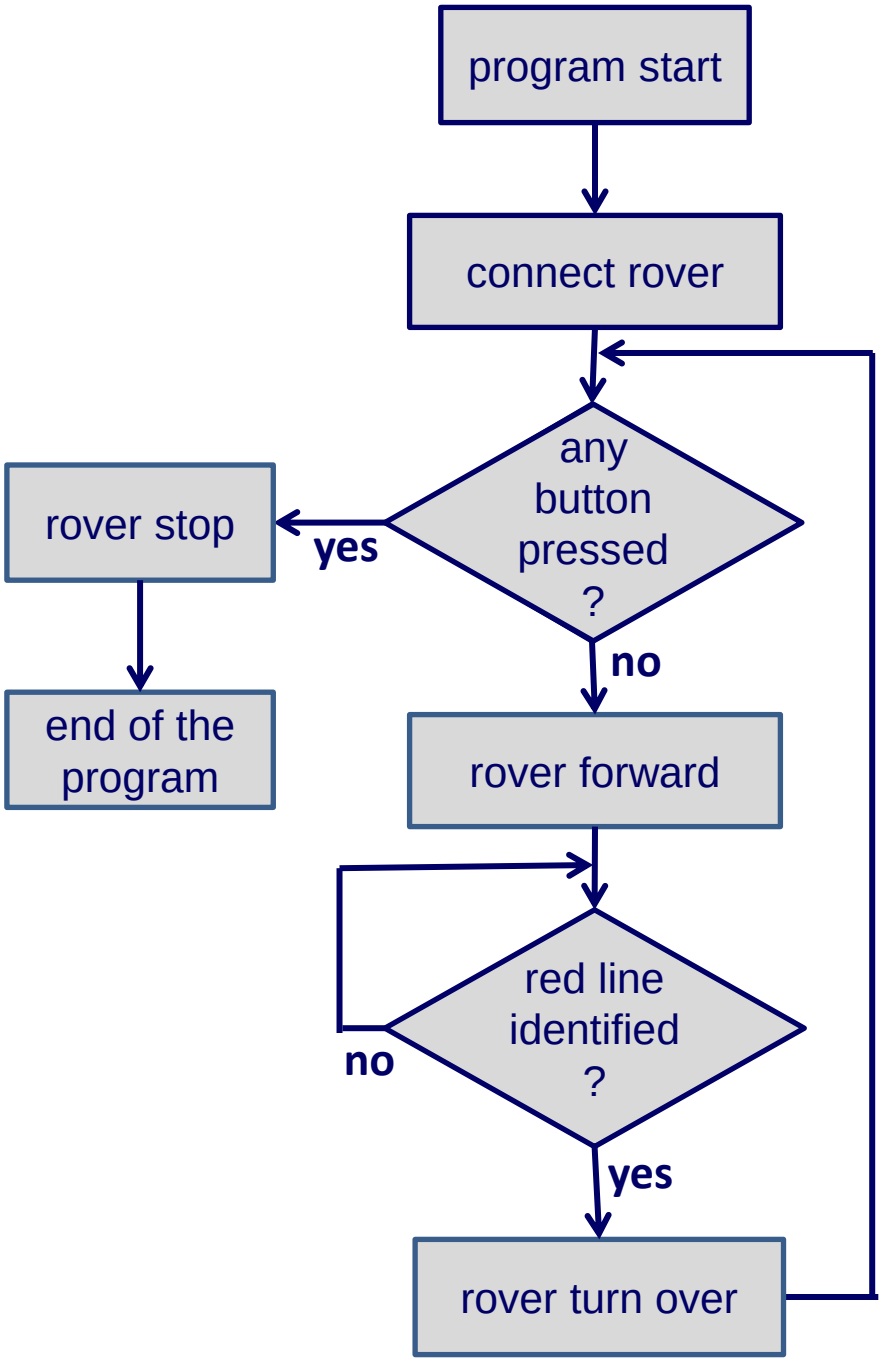
Technology allows a direct translation of verbal decisions into the language of mathematics.

Graphs are available easier and parallel to other modes of representation

Example 2:

A lawn mower in the classroom

Idea: Hans-Martin Hilbig



A verbal flow diagramm of a lawn mower for translating the idea into the language of the machine

Questions:

- ☞ Which fundamental competences are still indispensable as the foundation and prerequisite of problem solving competence? Which new competences are important and which can we forgo?
- ☞ What are the appropriate pedagogical approaches for successful STEM education?
- ☞ How will the acquisition of competence be changed by the influence of ICT (Information and communication technology)?
- ☞ What ICT-related professional development and pedagogical oriented teacher training is necessary?

10.50-12.10 **Round 1: Classroom Implementation** – Deep Dive

Workshop 1:

***Curriculum*: New generation of STEM integrated curricula**

Moderator: **Robert Cabane** (former General Math Inspector MoE France)

Workshop 2:

***Content*: Common Framework: Which natural science and mathematics competences need to be found in our society?**

Moderator: **Jürgen Langlet** (former chairman of MNU and school principal)

- *GeRRN - Common Framework of Reference for the Natural Sciences*
  Jürgen Langlet
- *Basic competencies in mathematics education*
  Dr. Hubert Langlotz (vice-principal, MNU, T^3 Germany)

Workshop 3:

***Classroom Practice*: Innovating STEM classroom practices**

Moderator: **Dr Agueda Gras-Velazquez**, Science Programme Manager, European Schoolnet