



Erasmus+
Programme Your Future



COMPUTATIONAL THINKING - LESSON SCRIPT

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Lesson information: Subject: Mathematics
Duration: 2 x 45 min
Grade/level: 2nd grade of middle school/3rd educational stage
Age: 14-15
Topic: How much is 2 to the power of 1000?

The curriculum specifications and requirements: The core curriculum of teaching Maths for the 3rd educational stage.
Powers.
Pupil:
1) Calculates powers of rational numbers which have natural exponents;
2) Writes as one power: products and quotients of powers which have the same base, products and quotients of powers which have the same exponents and power of power (with natural exponents).

The aims of the lesson: Pupil:
● knows the definition of power which has natural exponent
● can calculate powers who have natural exponents
● can write power as involution of power and change the base and exponent of power
● solves a problem with the use of the computer

Previous knowledge: The section in the core curriculum of teaching Maths for the 2nd educational stage(grades 4-6) concerning powers:
Point no 2. Calculations concerning natural numbers.
Pupil:
10) calculates the squares and hexahedrons of natural numbers.

The forms of work:

- working in pairs
- individual work
- group work

The methods of work:

- optimization of solving the problem
- practical method
- moderated discussion

Teaching aids:	<ul style="list-style-type: none">● the ICT classroom with the access to the Internet (one computer for two students)● the teacher's computer with projector and interactive board● programming learning tool from Scratch.com.
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The range of using ICT:	<ul style="list-style-type: none">● practising and consolidating the skill of calculating● presenting the data in a graphic way● presenting information
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The course of lesson:

- Teacher activities
- Pupil activities
- The schedule

1. Introduction - organisational activities.
Greeting the pupils, checking the register, giving the topic of the lesson and introducing the aims of the lesson.
5 min

2. Stating the problem:

How can we reduce the amount of product's factors while calculating power 2^{1000} ?

Students write power 2^{1000} in their notebooks. Teacher displays supplementary questions on the screen:

How to calculate power 2^{1000} (use the definition of power which has natural exponent)?

How many times do we have to multiply to calculate power 2^{1000} ?

Which quality of involution should be used to reduce the amount of factors of multiplying?

What is the smallest number of multiplying factors we can obtain while calculating power 2^{1000} ?

What should we obtain as a result of solving the problem?

5 min

3. Developing the topic of the lesson.

Students discuss under the guidance of teacher. Teacher supervises given answers. He/She can give students a hint if they don't know the final conclusion: to reduce the amount of product's factors in involution we have to use involution of power.

Next students write on the board and in their notebooks different options of changing the base of power 2^{1000} (for example, 2 to the power of $2 \cdot 500$, 2 to the power of $4 \cdot 250$, 2 to the power of $5 \cdot 200$, 2 to the power of $8 \cdot 125$, 2 to the power of $10 \cdot 100$, 2 to the power of $20 \cdot 50$, 2 to the power of $25 \cdot 40$, 2 to the power of $50 \cdot 20$, 2 to the power of $100 \cdot 10$, 2 to the power of $200 \cdot 5$, 2 to the power of $250 \cdot 4$, 2 to the power of $500 \cdot 2$) and they give the amount of factors in each multiplying.

In the end students choose that kind of calculating power 2^{1000} which gives the opportunity to use the smallest amount of multiplying.

30 min

4. Coding problem in Scratch program.

Students work in pairs with the use of computers. They open program chosen by teacher (link below) in Scratch application. They test how this program works. It calculates power 2^{1000} and gives the number of multiplying operations. Next students' task is to modify this program so that it calculates the number of multiplying on the basis of given pair of power's exponents (point no 3)*.

40 min

5. Evaluation.

Students test the correctness of their programs. They change exponents of power 2 and check the amount of multiplying operations. As a result students come to the conclusion that the solution of problem can be optimized and they can find a way to solve any problem faster.

10 min

Specific information:

- Programs
- Links
- Etc

- Scratch programming environment, from M.I.T.:
<https://scratch.mit.edu>
- Offline scratch editor can be downloaded at:
<https://scratch.mit.edu/scratch2download/>

*The teacher can show also the program creating in C++ language. He can show compiled file (program_power.exe) or source code of this program (program_power.cpp). Then the teacher need Dev-C++ program on his computer. It is redisplayed on the GNU General Public Licence.

Attachments:

- Worksheets
- Programs
- files necessary
- Etc

- program_power.pdf
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