



Erasmus+

Co-funded by the Erasmus+ Programme of the European Union



I CHOOSE
CONSCIOUSLY

SCENARIO 5

INTRODUCING FUNCTIONS AND THEIR PRACTICAL USE

TARGET GROUP
STUDENTS AGED **12-18**

Objectives of the educational project:

- * introducing functions,
- * distinguishing functions from relations,
- * describing functions,
- * perceiving functions in practical models,
- * using information and communication technologies in practice.

End products of the educational project:

- * the student gives the definition of a function,
- * distinguishes functions from relations,
- * describes functions,
- * presents function graphs,
- * uses functions practically,
- * draws functions using information-communication tools.

SUGGESTED LESSON PLAN

PROJECT STAGE	SUGGESTED ACTIVITIES	DAY/ WORKSTAGE	TIME
1 TOPIC SELECTION AND DETERMINING PROJECT OBJECTIVES	1. Introducing functions. a) Examples of relations. Appendix 1. b) Distinguishing relations from functions. Appendix 2.	1	120 min. 60 min. 60 min.
	2. Ways to describe functions: function graphs. a) Presenting different descriptions of functions. b) Graph functions using information-communication technology.	2	120 min. 60 min. 60 min.
2 PROJECT REALIZATION	3. Practical function models in daily life. a) Preparing the students to implement the project.	3	30 min.
	4. Choosing the project and collecting data.	4	approx. 5 hours
3 PROJECT PRESENTATION	5. Presenting and evaluating the chosen projects.	5	60 min.
	6. Test.	6	60 min.
4 PROJECT EVALUATION			
ALTOGETHER			Approximately 12 teaching hours
ADDITIONAL COMMENTS			*** asterisks indicate division between days

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TOPIC SELECTION AND DETERMINING PROJECT OBJECTIVES

1. INTRODUCTION

a) Examples of relations

time: 60 min.

The teacher divides the students into groups and gives out materials.

Appendix 1 – Exercise

Exercise 1

The elements of set A are letters, the elements of set B are numbers. List some examples of elements of set A assigned to elements of set B. You do not have to use all of the letters, numbers, arrows.

b) Distinguishing relations from functions

time: 60 min.

The teacher starts the discussion:

- *| *Do all the letters have assigned numbers?*
- *| *Does each number have an assigned letter?*
- *| *Does each letter have exactly one assigned number?*
- *| *Is each number assigned to exactly one letter?*

The teacher indicates a special type of relations.

Each element from set A is assigned exactly one element from set B. Such a relation is called a function.

The students construct various relations that are function, or are not. In the teaching process, the teacher uses one of the teaching methods: **Metaplan. Appendix 2.** This method is based on a graphic description of the discussion, conducted by the students in cooperation with the teacher. The leading topic will be the comparison of relations that are functions, or are not.

2. WAYS TO DESCRIBE FUNCTIONS: FUNCTION GRAPHS

a) Showing different descriptions of functions

time: 60 min.

The teacher presents different ways of presenting functions.

Functions can be presented in different ways.

1. A function described with a table.

Example 1:

x	1	3	4	6
f(x)	0	1	1	5

1

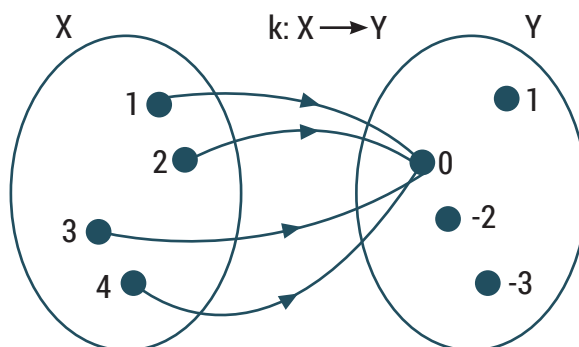
TOPIC SELECTION AND DETERMINING PROJECT OBJECTIVES

a) Showing different descriptions of functions

time: 60 min.

2. A function can be shown with a graph.

Example 2:



3. A function can be shown with a description.

Example 3:

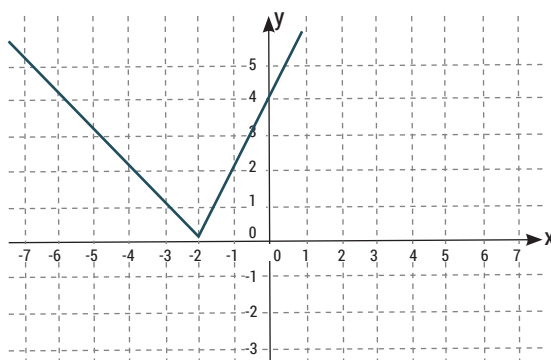
Each prime number has a square number assigned.

4. A function can be shown with an equation.

Example 4:

$$f(x) = x^2 + 4x + 7.$$

5. A function can be shown with a graph.



b) Function graphs using information-communication technology

time: 60 min.

There is a free program at <https://www.wolframalpha.com/> to draw function graphs. The WolframAlpha portal is very friendly and has many uses. The teacher together with the students performs examples.

1

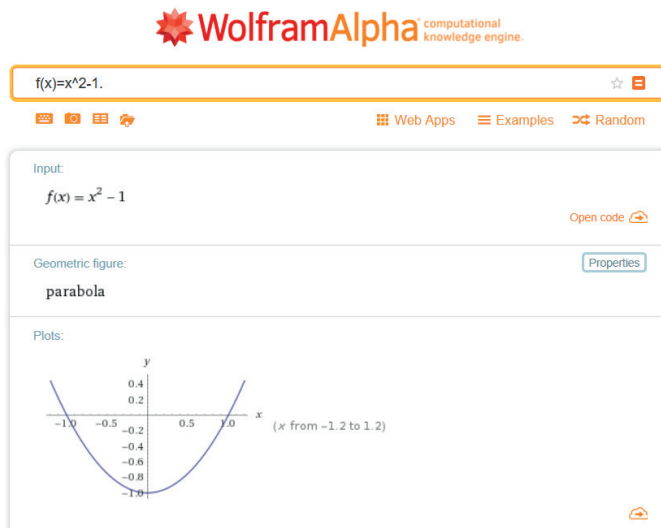
TOPIC SELECTION AND DETERMINING PROJECT OBJECTIVES

b| Function graphs using information-communication technology

time: 60 min.

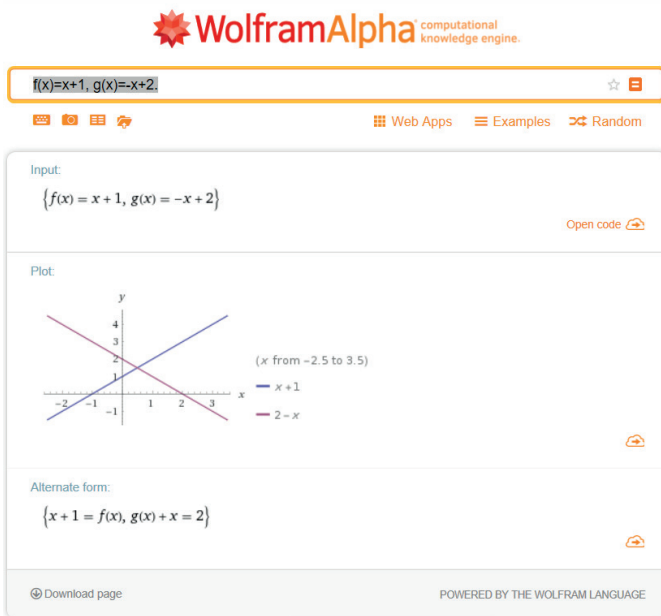
Example 1:

Draw the function: $f(x)=x^2-1$.



Example 2:

Draw the function: $f(x)=x+1, g(x)=-x+2$.



Task for students:

There are functions: $f(x)=x+1, g(x)=-x+2$.

Draw a graph of the functions: $f(x) \cdot g(x), f(x)+g(x), f(x)-g(x)$.

1

TOPIC SELECTION AND DETERMINING PROJECT OBJECTIVES

3. PRACTICAL FUNCTION MODELS IN DAY-TO-DAY LIFE

a) Preparing the students to implement the project

time: 30 min.

A project is an undertaking, which consists of a set of activities characterised by having a starting date, specific goals and limitations, established responsibilities (obligations) of the participants, a budget, schedule of activities and a date of completion¹.

The teacher discusses the following points with the students:

1. *Set the goals for the project.*
2. *Project starting date.*
3. *Date of the completion of the project.*
4. *Time allocated for the project.*
5. *Place of performance.*
6. *Responsibilities in and responsibility for the project.*
7. *Presentation and evaluation of the project.*

2

PROJECT REALIZATION

4. CHOOSING THE PROJECT AND COLLECTING DATA

time: approx. 5 hours.

The teacher gives the students an example of the project, for example: Observation of the weather. He/she asks them to prepare papers on the above topic, suggests what tools might be needed to measure the weather and indicates factors that affect the weather (including temperature, pressure, rainfall).

Then the students conduct weather measurement condition for 2 weeks. The teacher can divide the students into groups or outsource individual work.

If the students are divided into groups, then each group will take one measurement, e.g., temperature, pressure, rainfall.

Students work with the data and prepare their presentations.

Literature

^[1] Frączkowski K.: Zarządzanie projektem informatycznym. (...). Wrocław. Oficyna Wydawnicza Politechniki Wrocławskiej. 2003. (English translation: Managing an Information Technology Project)

3

PROJECT PRESENTATION

5. PRESENTATION AND EVALUATION OF THE CHOSEN PROJECTS

time: 60 min.

The students prepare a presentation of their observations and then print their work or use multimedia tools to present their work. The teacher suggests the method of presentation evaluation to the students: **Appendix 3.**

4

PROJECT EVALUATION

6. TEST

time: 60 min.

The teacher uses the test to measure the effects of his/her teaching. **Appendix 4.**

LIST OF PROJECT APPENDIXES

APPENDIX 1

EXERCISE

APPENDIX 2

METAPLAN

APPENDIX 3

PRESENTATION EVALUATION

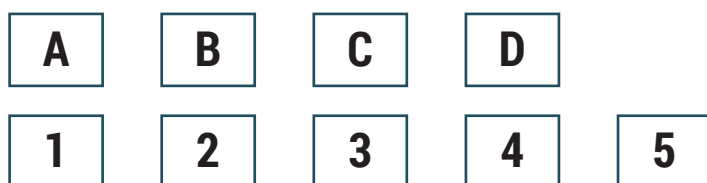
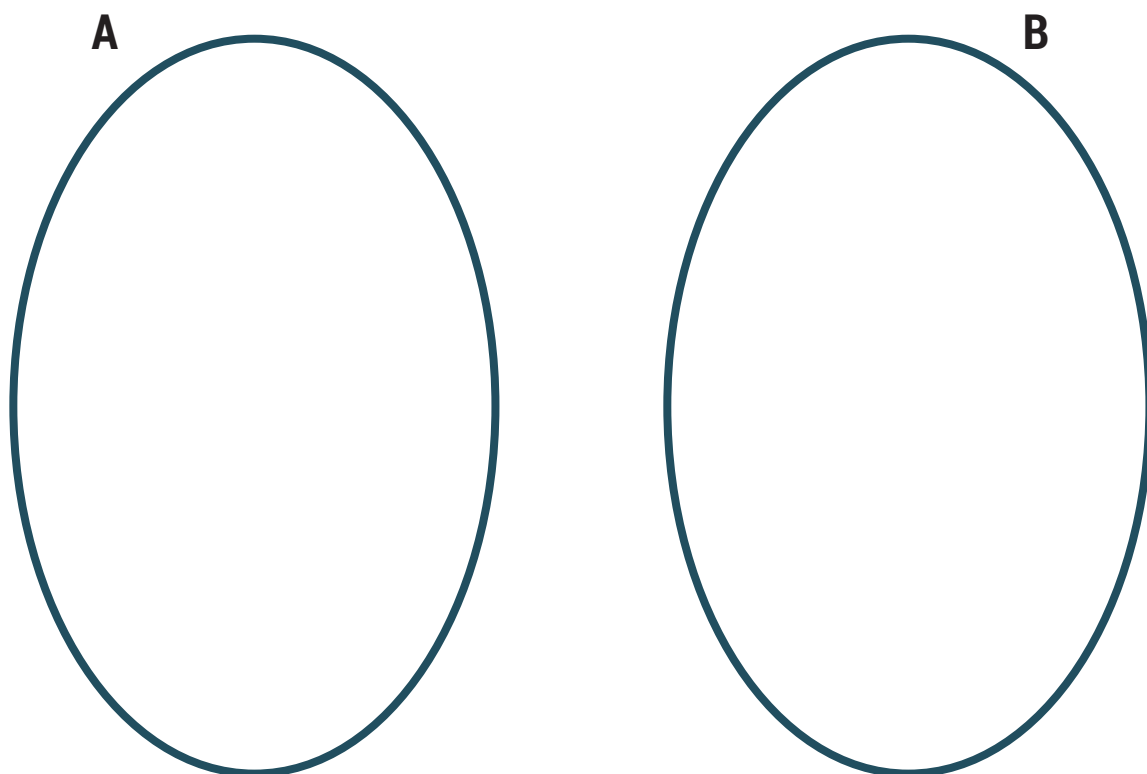
APPENDIX 4

TEST

APPENDIX 1

EXERCISE

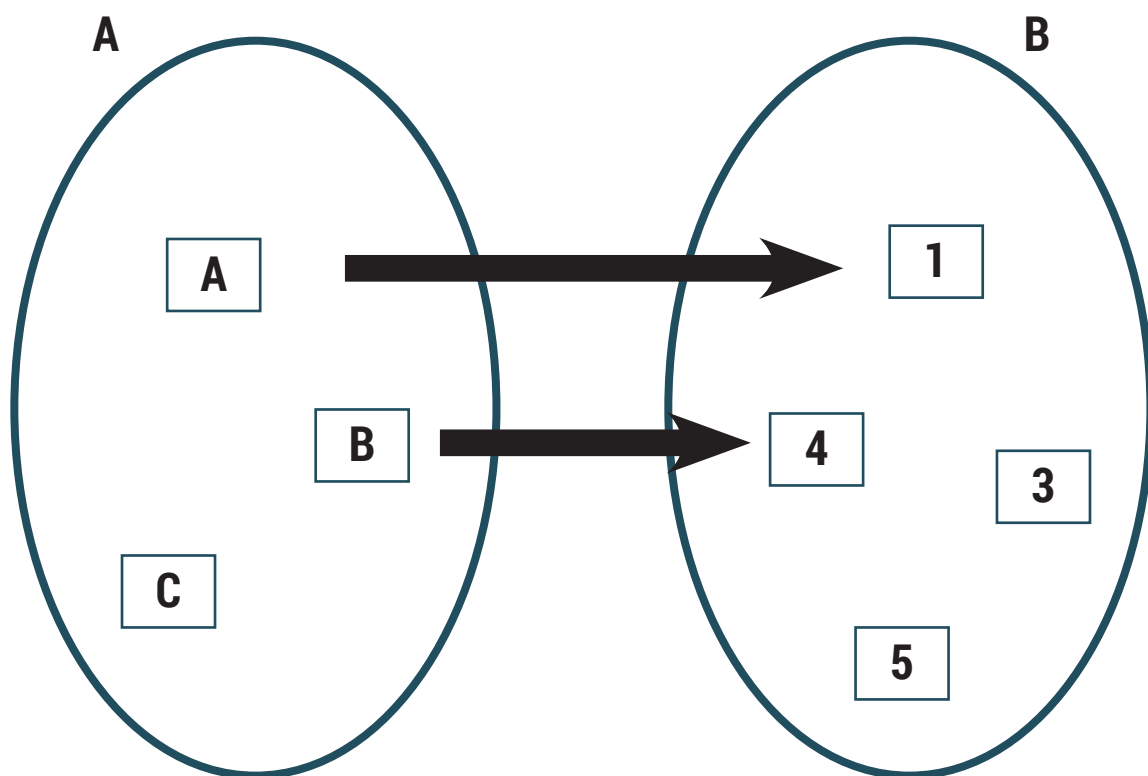
The elements of set A are letters, the elements of set B are numbers. List some examples of elements of set A assigned to elements of set B. You do not have to use all of the letters, numbers, arrows.



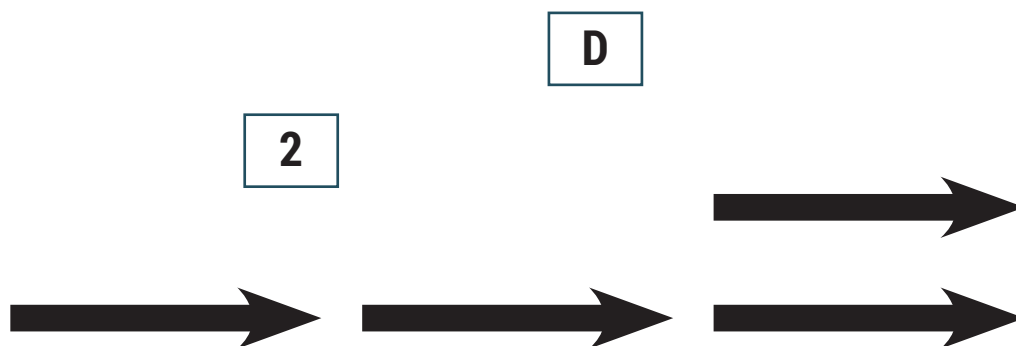
APPENDIX 1

EXERCISE

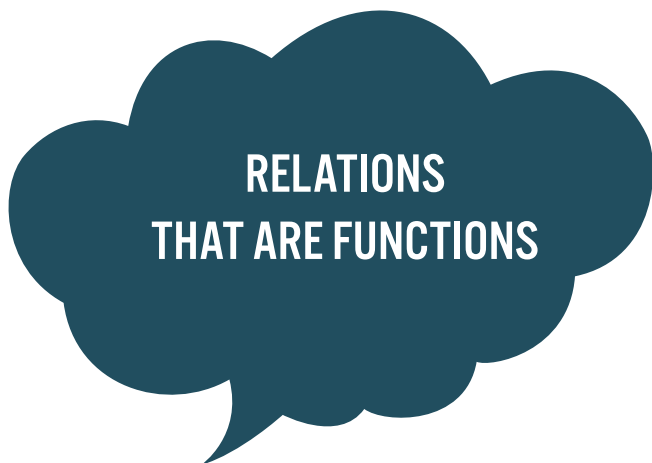
Sample answer:



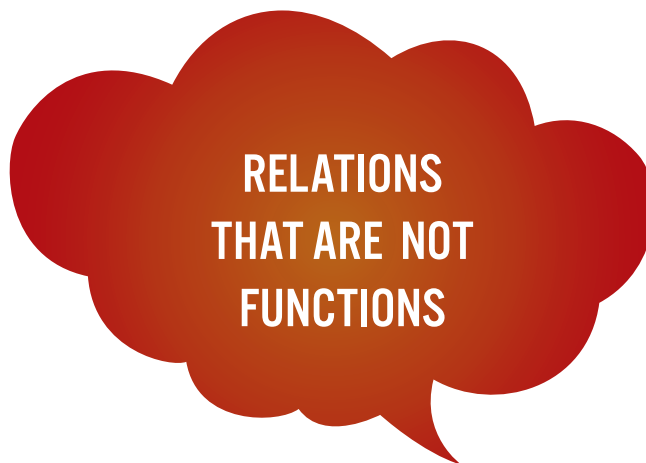
Unused elements:



APPENDIX 2 METAPLAN



- 1.....
- 2.....
- 3.....



- 1.....
- 2.....
- 3.....



Why is it not a function?

- 1.....
- 2.....
- 3.....

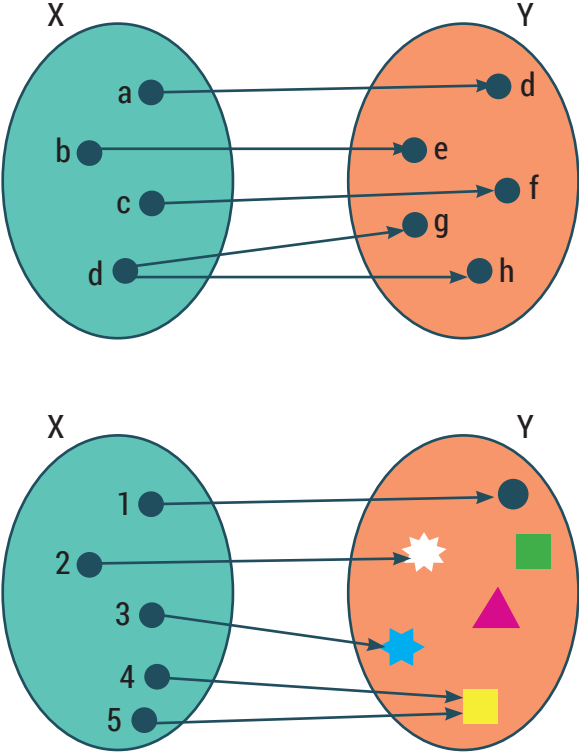
APPENDIX 3

PRESENTATION EVALUATION

PRESENTATION AREA	AWARDED NUMBER OF POINTS	NUMBER OF POINTS
COMPATIBILITY WITH THE SUBJECT	30	
SUBSTANTIVE CORRECTNESS	25	
GRAMMAR	15	
LOGICAL LAYOUT OF THE PRESENTATION	5	
ESTHETICS	5	
EVALUATION OF THE PROPOSED PRESENTATION TIME	5	
INNOVATION	10	
PRESENTATION OF CONCLUSIONS	5	
TOTAL NUMBER OF POINTS	100	

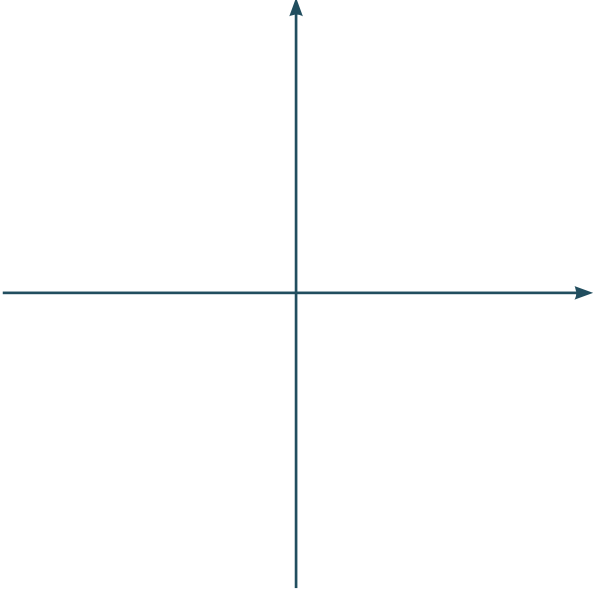
APPENDIX 4

TEST

EDUCATIONAL EFFECT	MEASUREMENT OF THE EDUCATIONAL EFFECT
DEFINES FUNCTIONS	Gives a definition of a function and an example:
DIFFERENTIATES FUNCTIONS FROM RELATIONS	Which drawing shows a function? 
DESCRIBES FUNCTIONS	Each prime number has a cubed number assigned and decreased by 5. Write down the function using an equation.

APPENDIX 4

TEST

EDUCATIONAL EFFECT	MEASUREMENT OF THE EDUCATIONAL EFFECT																
PRESENTING GRAPH FUNCTIONS	<p>Draw the graph: $f(x)=-x+3$.</p> 																
PRACTICAL USE OF FUNCTIONS	<p>Complete:</p> <table border="1" data-bbox="595 1408 1417 1572"> <tbody> <tr> <td>DAY</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> </tr> <tr> <td>TEMPERATURE IN CELCIUS DEGREES</td> <td>10</td> <td>12</td> <td>11</td> <td>10</td> <td>8</td> <td>9</td> <td>10</td> </tr> </tbody> </table> <p>The highest temperature was on:</p> <p>The lowest temperature was on:</p> <p>The average temperature of the week was:</p> <p>By how many degrees did the temperature increase from day 5 to 6?:</p>	DAY	1	2	3	4	5	6	7	TEMPERATURE IN CELCIUS DEGREES	10	12	11	10	8	9	10
DAY	1	2	3	4	5	6	7										
TEMPERATURE IN CELCIUS DEGREES	10	12	11	10	8	9	10										

APPENDIX 4

TEST

EDUCATIONAL EFFECT	MEASUREMENT OF THE EDUCATIONAL EFFECT
DRAWING GRAPHS USING TECHNOLOGY	Using Wolframalpha, draw the graph: $f(x)=x(x-3)^2$.