(ENG) Math behind Abstract Art

Introduction

Step 1 - Motivational Stage

Step 2 - Investigational Stage

Step 3 - Consolidation Stage

Introduction

#In-class activity #Online activity #Artwork #Paintings

Function graphs are very different. In elementary school, graphs are usually straight lines. Each function has its own rules for drawing a graph, but if we don't know them, we can help ourselves differently. For example, we can always make a table of values for a specific functional regulation, with the help of which we can draw a graph.

During the activities related to abstract art, pupils will learn about a versatile method with which they can draw a graph of any function. Then, they will use their knowledge to create abstract works of art.

Learning Objectives

- [ ] Learn about the table of function values, with the help of which they can draw any graph
- [ ] Use the knowledge from value tabulation to create an abstract work of art

ACTIVITY DETAILS

Activity Details

Connection of the activity with Art

Function graphs are always some lines that determine a particular function's type. Lines are also a prevalent element in works of art, significantly often seen in abstract art.

Link to local, national School Curriculum

Functions/Compose table and draw a graph variables

Equipment required

- A computer connected to the Internet
- a pen
- crayons
- a sheet of paper
- a ruler
- graph paper

Duration of activity

45 minutes

Sources

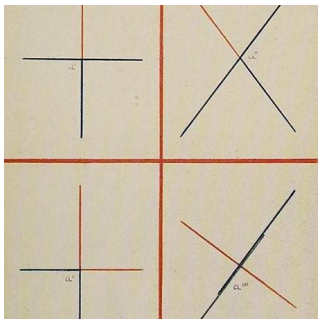
- Picture 1: Kārlis Johansons 1921 Graphic Representation of a Construction source: https://upload.wikimedia.org/wikipedia/commons/3/38/K%C4%81rlis_Johansons_1921_Graphic_Representation_of_a_Construction.jpg free for commercial use
- Picture 2: Composition with Large Red Plane, Yellow, Black, Gray, and Blue, (1921) author: Piet Mondrian source: https://study.com/learn/lesson/abstract-vs-representational-art-concepts-differences-examples.html free for commercial use
- Picture 3: Graph of function y1 = 1.5x, own photo
- Picture 4: Graph of function y2 = 3x, own photo
- Picture 5: Graphs of functions as art, own photo made with GeoGebra

Step 1 - Motivational Stage

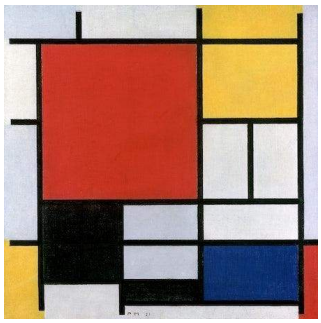
Explain to pupils:

In mathematics, a line has a vast meaning: we want to narrow more into a line, a half-line, a straight line, or a curve. However, each graph of a function is also a line. Sometimes, it is a straight line, but it can also be a curve.

In art, however, the line is one of the seven elements used primarily in painting and drawing. In primary school, we focus on straight lines in mathematics, but they are not so common in the arts. However, straight lines stand out and are most noticeable in abstract works. Abstract works of art became more commonplace in the 20th century, and the artists who made them used technology, mathematics and science as an inspiration.



Picture 1: Kārlis Johansons 1921 Graphic Representation of a Construction



Picture 2: Composition with Large Red Plane, Yellow, Black, Gray, and Blue

Explain to pupils:

These lines and line segments represent a graph of the function or just a part of it if they are placed in the coordinate system. This means that you could compose your abstract work from various functions.

Ask pupils:

"However, how to draw a graph of such functions?"

"Can we also draw a graph of some function without a line?"

Problem (task)

Ask pupils:

We want to draw an abstract work related to function graphs. We have some function rules, and we will paint the resulting geometric shapes inside to get an interesting picture.

$$y_1 = 1.5$$

$$y_2 = 3x$$

$$y_3 = 2x + 2$$

$$y_4 = \frac{x}{2} - 1$$

$$y_5 = x^2 - 3$$

"How should we draw graphs of these functions, and what will be the final painting?"

Consolidation of already known content

Ask pupils:

Draw a coordinate system and mark its parts. Draw the following points: A 3, -2, B (-1, 4) and C(-1.5, 2.5).

Step 2 - Investigational Stage

STUDENTS' TASKS

1

Task 1

Explain:

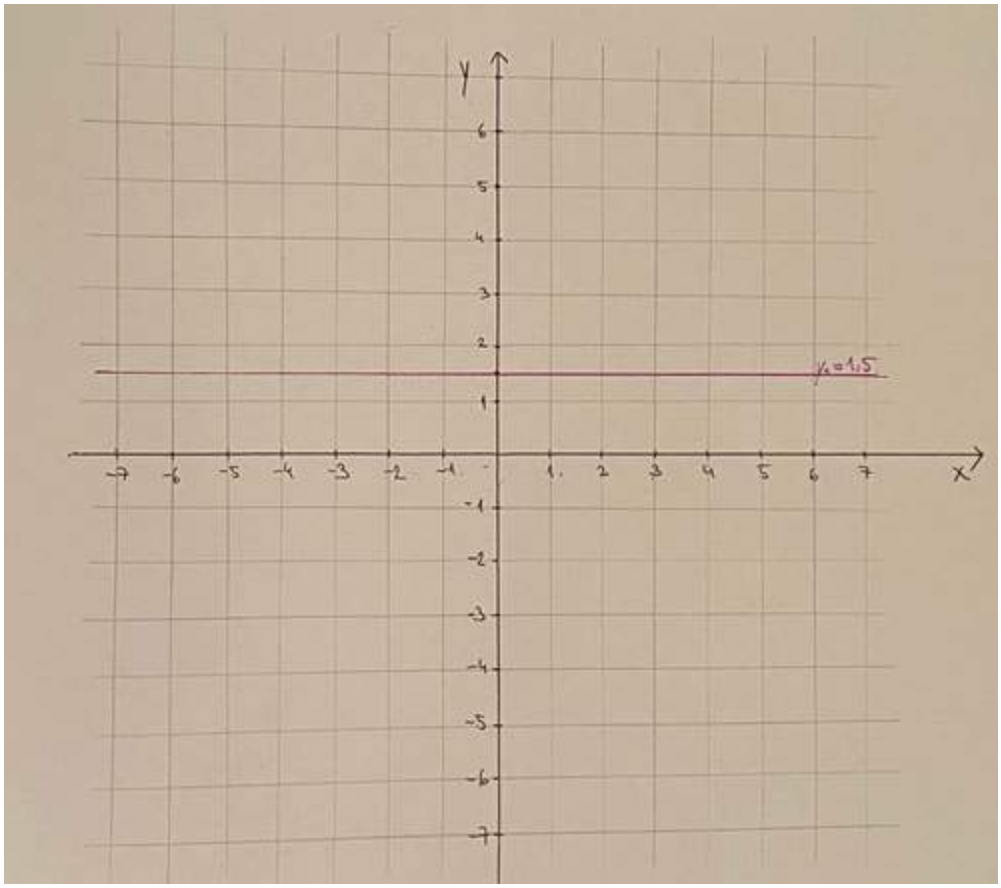
In the task above, we notice transcripts for five functions that we don't yet know what they look like. We see, however, that they differ significantly in form.

Ask pupils:

"So which one would you know how to draw?"

Explain:

You've probably already noticed that the most specific function is y1=1.5. We know all the exact places in the coordinate system where this function is. So, draw the coordinate system and graph of the function y1. You would get the following picture:



Picture 3: Graph of function y1 = 1.5x, own photo

Ask pupils:

"How do we draw the other graphs of functions?"

2

Task 2

Explain:

We can look at the values of the function for a particular x.

Let's look at the function y2=3x. When x=0, the function has the value:
y2=3·0=1. So the line graph goes through the point T(0,0). To make it easier to draw the whole graph of the function, we will draw a few points that will define the graph. For better transparency, we will table the values:

x	y2=3x
-2	
-1	

0	
1	
2	

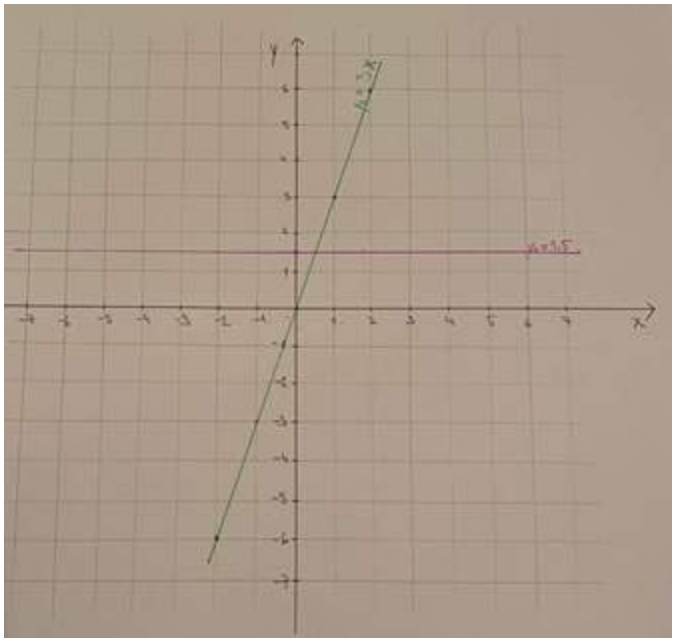
This is a basic table that will be the same for all functions. Define an independent variable x and calculate its value y, which is written in the right column. The ordered pairs in the lines (x, y) are the coordinates of the points lying on the graph.

x	y2=3x
-2	-6
-1	-3
0	0
1	3
2	6

We obtained the coordinates of the points lying on the function's graph (y2).

Ask pupils:

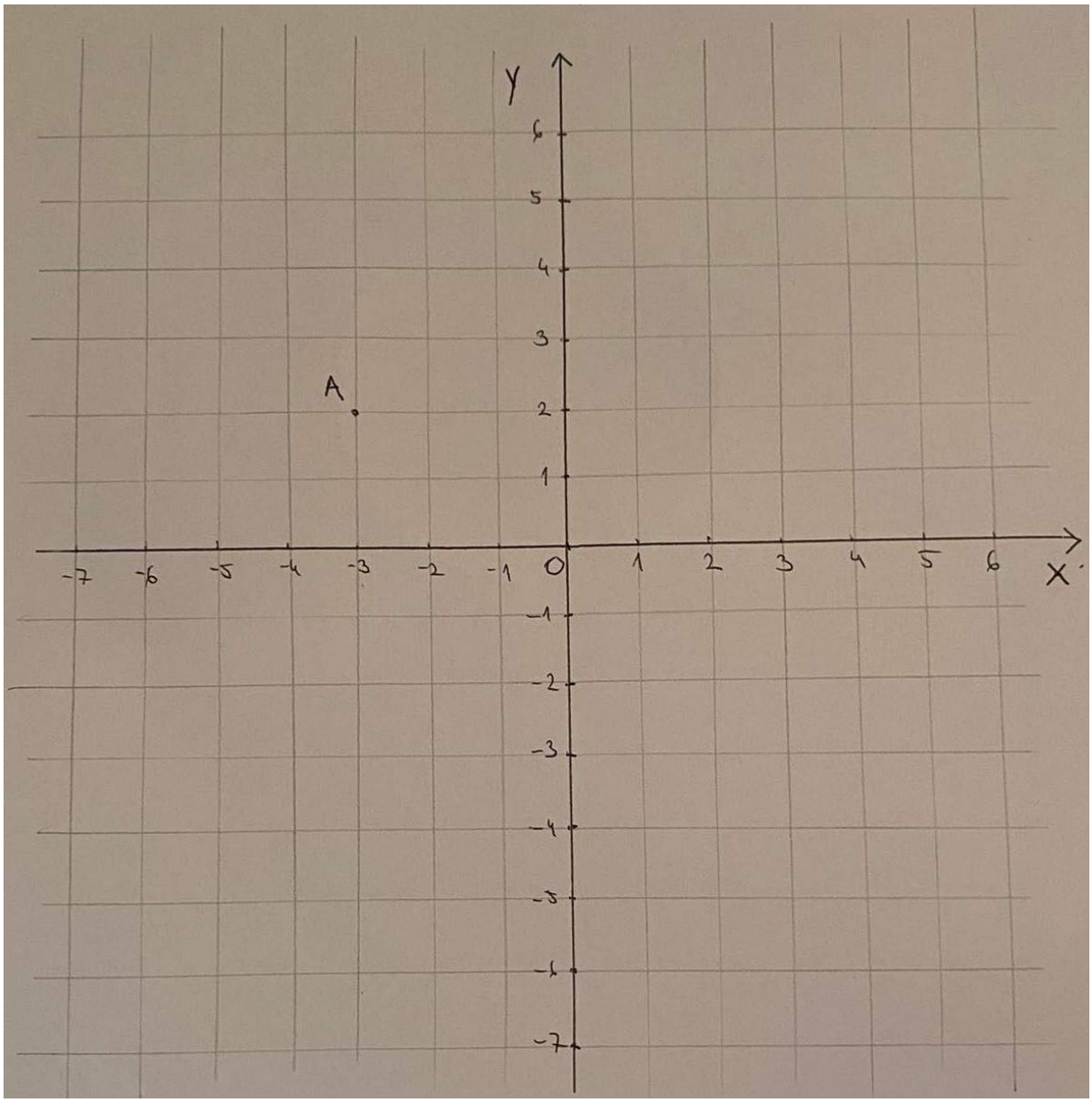
Draw points in the coordinate system and draw a line across it, not stopping at the first and last point. What is the resulting line?



Picture 4: Graph of function y2 = 3x, own photo

Mark the horizontal axis with x. We call it the abscissa. Mark the vertical axis with y, which we call the ordinate. These two axes divide the geometric plane into four quadrants, which differ in the sign of their coordinates.

However, to make it easier to determine the coordinates of points in the geometric plane, we draw a grid consisting of lines that are parallel to the x or y axis.



Picture 4: Coordinate system with grid, own photo

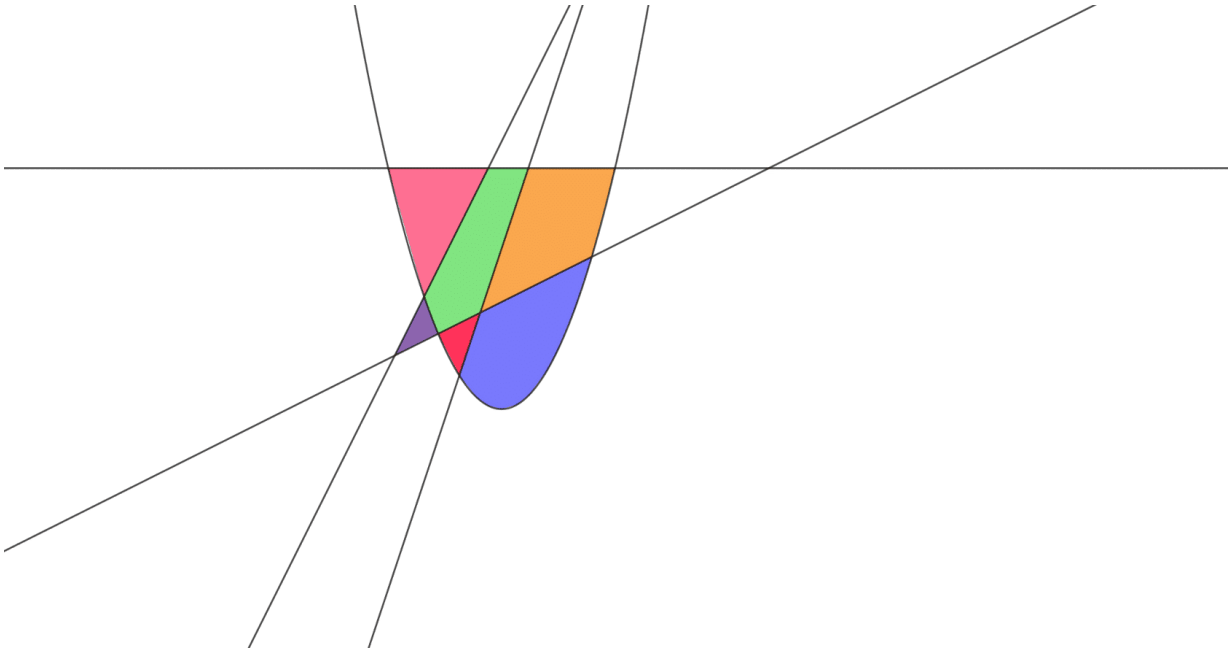
Explain:

You have probably discovered that the resulting graph is a straight line as in the first case. This is (with the features you know) very often and common.

Ask pupils:

Complete the tables and draw graphs for other functions as well. For example, if you notice that one of the graphs will not be a straight line, you should add another row in the table so that you can correctly predict the shape of the graph.

Paint the shapes you get between the intersecting parts of the graphs. If you did everything right, you should get a picture similar to the one below (in other colours, of course).



Task 3

Abstract

Explain:

We draw graphs using a table to calculate the function values for specific x coordinates. As a result, we obtain the coordinates of some points, which are then meaningfully connected in a graph. By painting the intermediate spaces, we can get exciting works of art.

Step 3 - Consolidation Stage

Ask pupils:

Task 1

Draw graphs of the following functions in one coordinate system on graph paper. For each function, make a table of values to help you draw.

$$y_1 = 2x - 1$$

$$y_2 = x^2 + 1$$

$$y_3 = 3x + 1$$

$$y_4 = 6 - 2x$$

$$y_5 = \frac{4}{x} + 3$$

$$y_6 = \frac{x}{3} - \frac{1}{2}$$

Task 2

Make up your regulations of at least five functions. Then, write the equations of functions and draw their graphs in the same coordinate system. Finally, complete and colour the picture to get the most beautiful painting possible. Tip: The more features you use, the more interesting the artwork will be!

End of the activity

EXIT