(ENG) The importance of graphs in works of art

Introduction

Step 1 - Motivational Stage

Step 2 - Investigational Stage

Step 3 - Consolidation Stage

Introduction

#In-class activity #Online activity

A graph and chart have different meanings in mathematics. There is also a particular branch of mathematics called graph theory. This studies graphs as sets of points and the connections between them. The word chart can also be used to display data. In this activity, we will focus more on reading graphs of functions.

Pupils will learn to read individual data from the graph through the activities. Ultimately, they will also be able to analyze the graph as a whole.

Learning Objectives

- [ ] Learn the basics of reading different graphs; they understand the information from them.
- [ ] Analyse and comment on various graphs and charts

ACTIVITY DETAILS

Activity Details

Connection of the activity with Art

Graphs can be used to present data from various areas of everyday life. Additionally, graphs are also used in art. Significantly fascinating is the artist and scientist Jill Pelto, who uses graphs in her works. One of the first who dealt with graphs and charts was William Playfair. He was a scotish economist and engineer, who served Great Britain as a secret agent in its war with France. He represented his data with line, pie and bar charts.

Link to local, national School Curriculum

Functions/Read graphs

Equipment required

- A computer connected to the internet
- a pen
- a sheet of paper

Duration of activity

45 minutes

Sources

-

Step 1 - Motivational Stage

Explain to pupils:

In mathematics, we often use graphs when we want to display some data. We can display data much more transparently with graphs, but this only makes sense if the recipient has the necessary knowledge to read graphs.

Jill Pelto is an artist who presents scientific research and data in her works. She particularly likes to include important environmental topics such as sea level rise, melting glaciers and increasing the use of renewable energy sources. She also presents this data in her works of art with the help of graphs.

Check out some of her work: https://www.jillpelto.com/gallery.

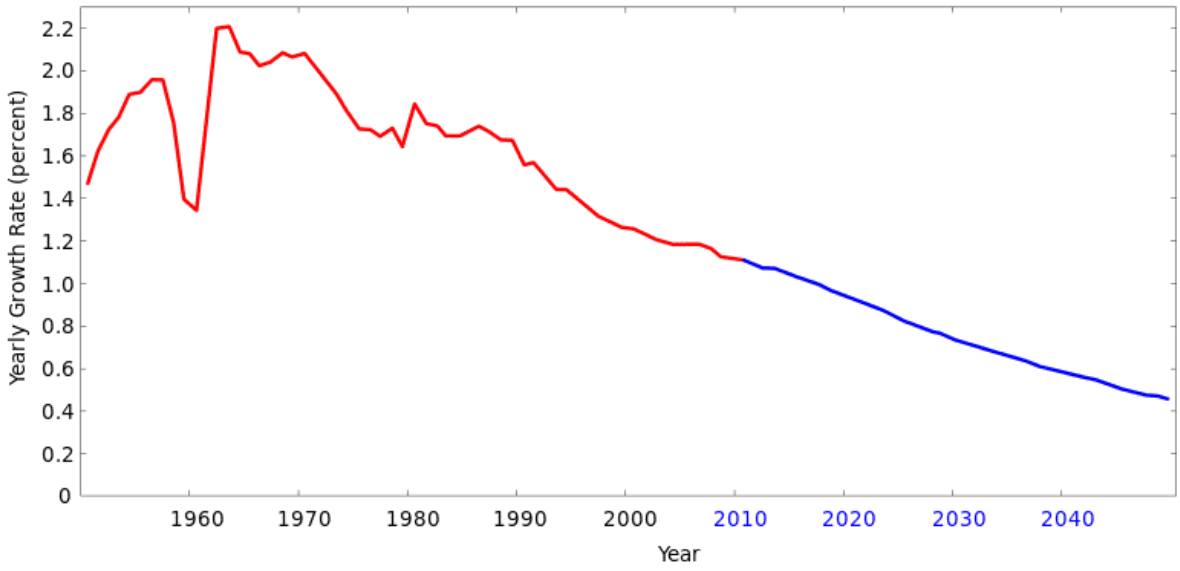
Everyday life problem

Explain to pupils:

Mathematicians and others use graphs, which show the dependence functions of two variables, where one is dependent, and the other is independent. Examples of such graphs from everyday life are the number of inhabitants over the years, the price of gasoline in recent months, the population of various animal species over time, the rise in average temperature in recent years, and many others.

Ask pupils:

"What can you tell from the graph below?"



Picture 1: World population growth rate 1950–2050

Ask pupils:

Review what you have learned about the coordinate system and graphing using the table.

Step 2 - Investigational Stage

STUDENTS' TASKS

1

Task 1

Ask pupils:

"What do you notice when you look at the graph in Picture 1?"

Explain:

When we see the graph, we can quickly notice that we also have new labels on the graph, and the axes are no longer named x and y. So how are the axes labelled?

Instead, we have years on the abscissa and annual growth rate (percentage) on the ordinate. Other than that, the graph is constructed similarly to the graphs we have drawn, only the shape of the graph is somewhat unusual. We will determine what this means and which data can be read from the graph below.

2

Task 2

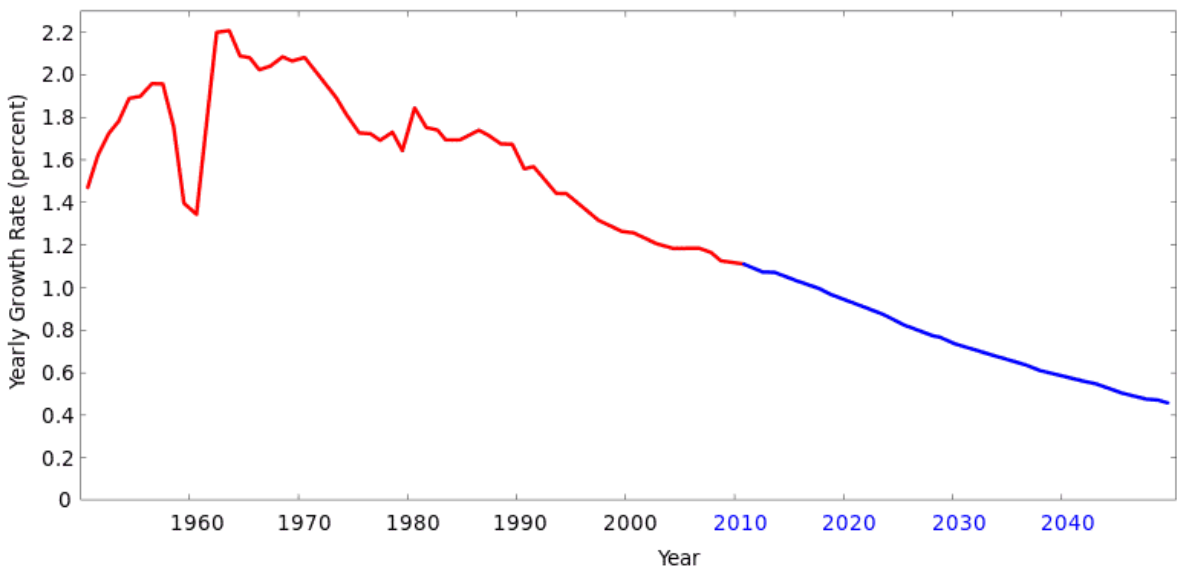
Read graphs

Explain:

The most important step we have already taken is determining which axis represents which variable. IN this case, we discovered that the independent variable is time, which is given in years, and the dependent variable is population growth, which is given in percentages. Since we have seen that the graph is also made for future years, we can conclude that the red part of the graph is from already known data, while the blue part is a prediction for coming years.

Ask pupils:

"Is that correct? We can already read from the graphs the coordinates of the points. So what was the percentage of population growth in 1980?"



Picture 2: World population growth rate 1950–2050

Explain:

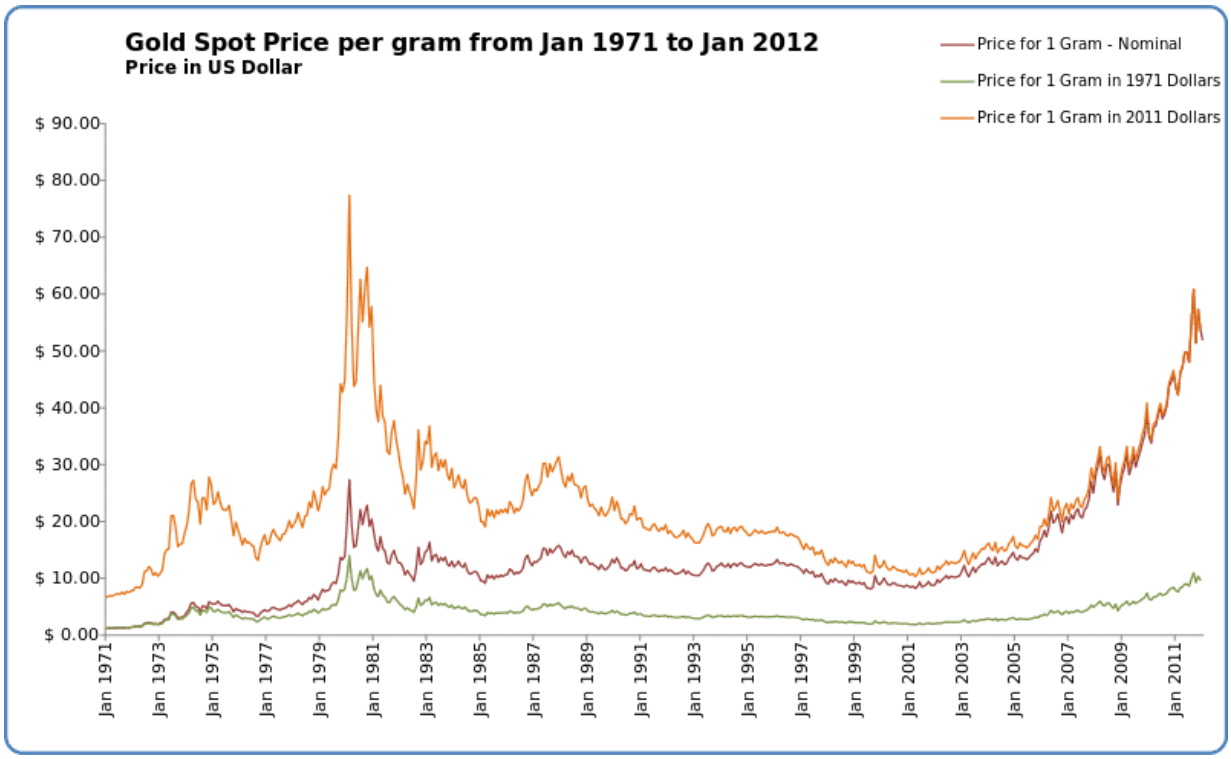
What do we need to do? First, we help ourselves with the network. If the network is not drawn, we must draw the rectangles ourselves. Print the graph in Picture 1 to do this part of the activity more accurately. Next, draw a rectangle on the abscissa axis through the year 1980. Find the point where this perpendicular line intersects the graph, and draw a perpendicular line on the ordinate axis. Where the perpendicular line intersects the ordinate, read the data. It tells you that the population growth in 1980 was 1.8%.

In addition to individual points, the graph can also be treated more holistically. For example, we are often interested in which parts of the graph of the function increase, in which parts it falls and where it is constant. If the graph is only increasing or decreasing over the entire range, it is said to be monotonic.

A graph is said to increase if one variable increases, which also affects the other variable to increase. If one variable increases and the other decreases, the graph descends.

Let's analyze our graph: At the beginning of the data recording, the number of inhabitants increased, except from 1960 to 1962, when population growth decreased significantly. It then grew enormously until 1965, when it began to decline. The development number's graph of inhabitants as a function of time is mainly decreasing from 1965 onwards, except for some years. The highest growth was around 1967 (about 2.2%). Based on the given predictions, the graph is about to decline; however, we cannot determine the lowest point yet.

One graph can present several sets of data. Therefore, it also includes a legend, which is mandatory, and tells us which colour corresponds to a particular data. An example of such a graph can be seen in Picture 3.



Picture 3: Gold Spot Price per Gram from Jan 1971 to Jan 2012

Ask pupils:

Similarly, try to analyze this graph as well: write down the minimum and maximum values for the selected data set and the falling and rising areas. The gold spot price refers to the price at which gold may be bought and sold right now, as opposed to a date in the past. With this we can also try to predict its price in the future.

3

Task 3

Ask pupils:

"So what can we tell from the graph?"

Explain:

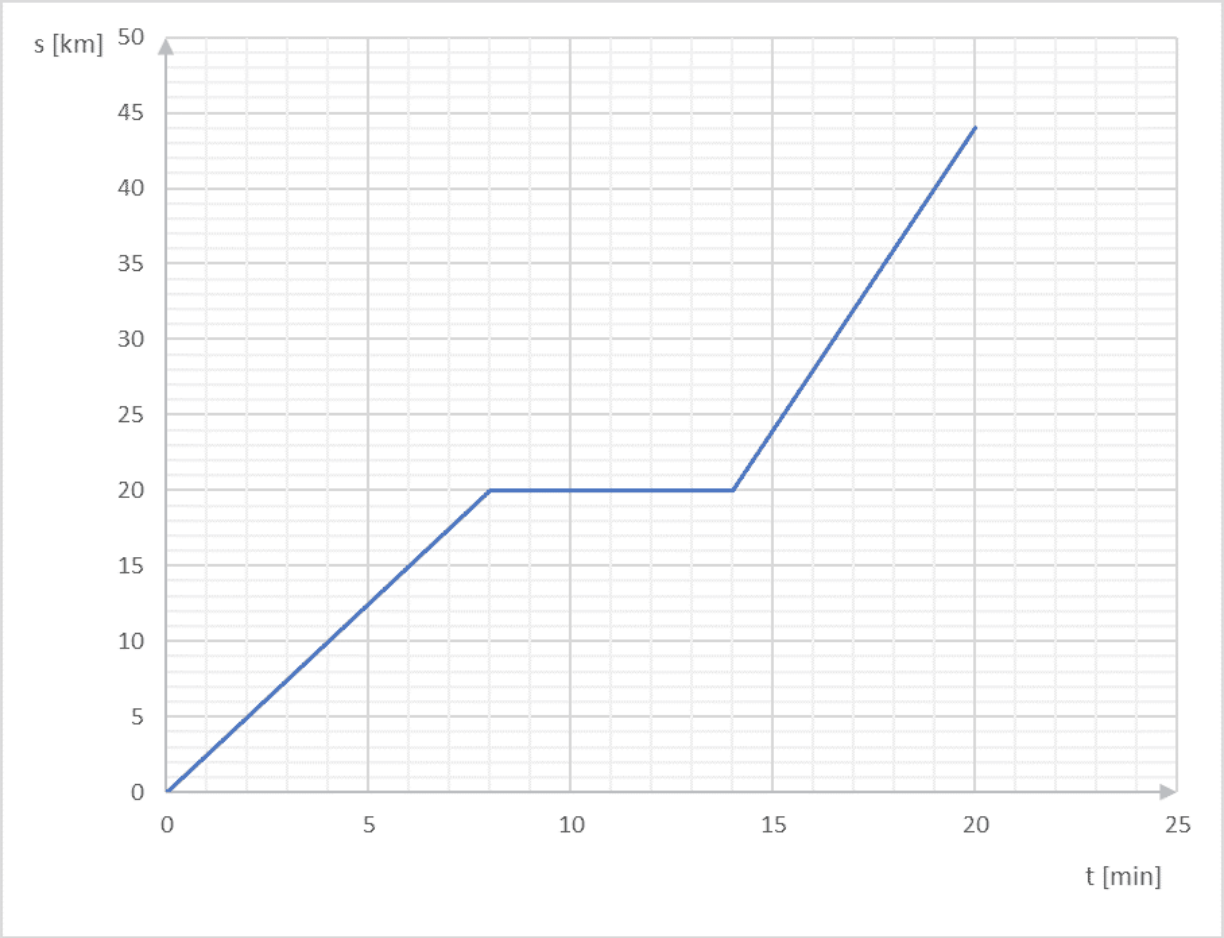
First, we look at the dependence of the two quantities the graph shows, which are dependent and independent. If we are only interested in one piece of data, we can understand it as the coordinates of a point, but we can observe the graph as a whole.

It is essential to look at which parts of the graph are decreasing and increasing; from this, we can understand the relation between the quantities and how they change.

Step 3 - Consolidation Stage

Explain:

Graphs are also ubiquitous in physics. For example, we use them in movement, where we often illustrate the dependence of path, speed or acceleration on time. The picture shows a graph showing the dependence of the path (s) on time (t).



Picture 4: Graph of path versus time, own photo made with Excel

Ask pupils to answer the following questions:

"How long did we observe the movement of the body?

How far did the body travel in the first six minutes?"

Try to understand the speed data from the graph. For example, velocity tells us how far a body has travelled in a unit of time.

"Did the body have the same speed throughout the observation?

During which time interval did the body move the fastest?

Has the body ever rested? What is your conclusion based on?"

Choose any work by Jill Pelto, find a graph and try to analyze it. Note: Since graphs do not have axes marked, you will have to be more original in reading the graph.

End of the activity

EXIT