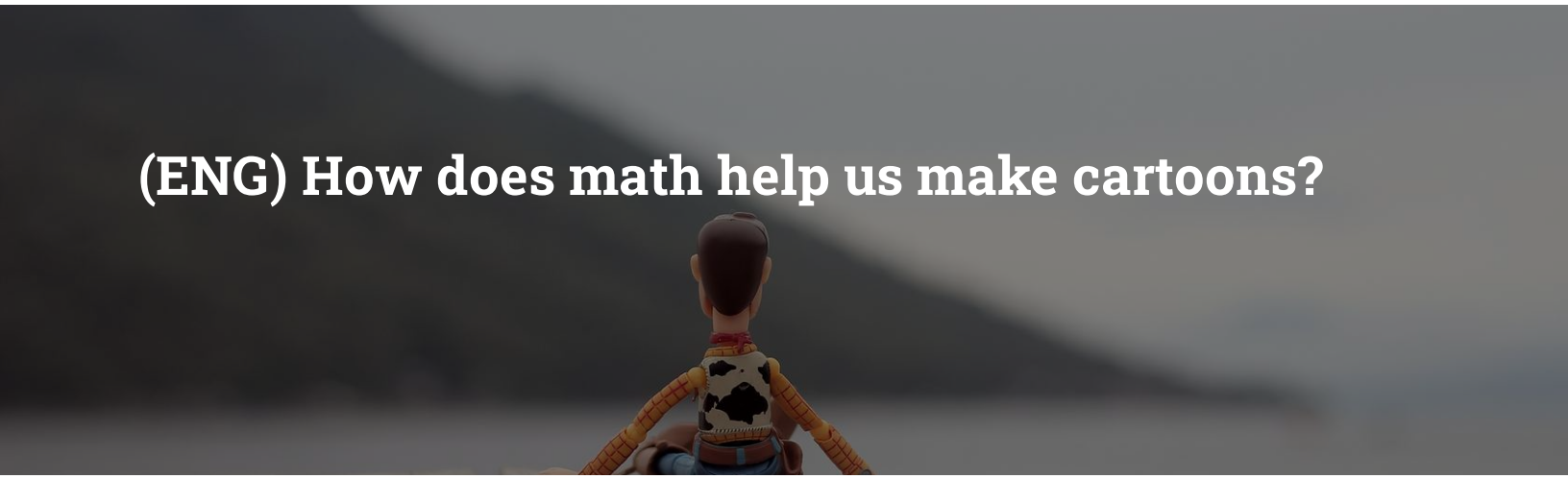


(ENG) How does math help us make cartoons?

Introduction

Step 1 - Motivational Stage

Step 2 - Investigational Stage

Step 3 - Consolidation Stage

Introduction

#In-class activity #Online activity

While drawing characters from animated films, pupils will learn about the Cartesian coordinate system. The Cartesian coordinate system is a coordinate system of two rectangular axes, first described by René Descartes. A Cartesian coordinate system is a planar coordinate system with axes x and y. For example, if we want to draw a 3D image, we add an axis perpendicular to this geometric plane and mark it with z.

The coordinate system is often used in art to computer-drawn characters for various animations. We need it to determine the exact position of certain objects in the geometric plane.

Learning Objectives

- [ ] Know the Cartesian coordinate system and its parts (axes, grid, quadrants)
- [ ] Draw points with given coordinates in the coordinate system and decipher the coordinates of already drawn points
- [ ] Gain knowledge of the coordinate system, which is used in designing an animated character in a computer program

ACTIVITY DETAILS

Activity Details

Connection of the activity with Art

One of the uses of the coordinate system in art is an animated film. Today, animated films are made by computer, so the program must receive commands about what an image looks like and where any part of it is located on the screen before the image can be moved. In this case, the coordinate system helps us.

Link to local, national School Curriculum

Functions/ Coordinate system, coordinate axes (abscissa, ordinate), grid and coordinates of given point

Equipment required

- A computer connected to the Internet
- GeoGebra
- A sheet of paper
- A ruler
- A pen or a pencil

Duration of activity

45 minutes

Sources

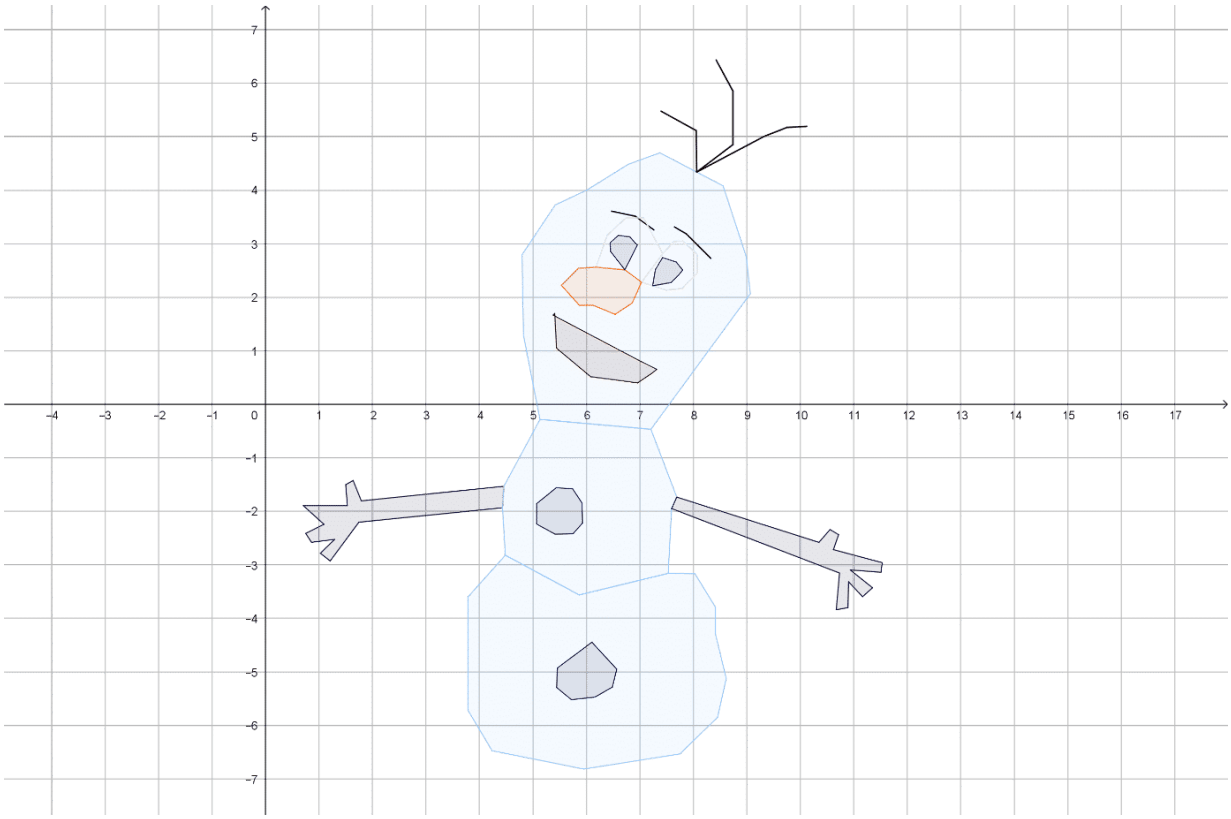
-

Step 1 - Motivational Stage

Explain:

Animationed production started to develop in the early 20th century. Imagine you want to create your animated film or a shorter animation. What do you need first? The main character, of course! First, you create a hero, and your next step is to move the hero - forward, backward, left, right or even a turn. However, for the computer to be able to move your hero, it must first know where the hero (and every bit of him/her) was at the beginning.

The coordinate system, which you will get to know during this activity, helps you with this.



Picture 1: A snowman, own photo made with GeoGebra

Everyday life problem

Explain:

We want to draw a snowman. Then, we would like to make a simplified version in a computer program so that the position of all its parts will be precisely determined.

Ask pupils:

How are we going to achieve this.

Consolidation of already known content

Ask pupils:

Draw a number line, mark the starting point and the unit, and draw some integers on it.

Step 2 - Investigational Stage

STUDENTS' TASKS

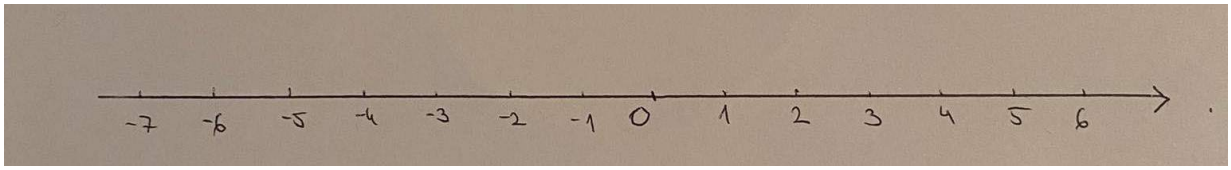
1

Task 1

Explain:

We will first look at a similar story on paper. Choose a point that is approximately in the middle of your sheet. This point is the coordinate origin and has the same value as line 0. You can draw a number line through this

point.



Picture 2: Number line, own photo

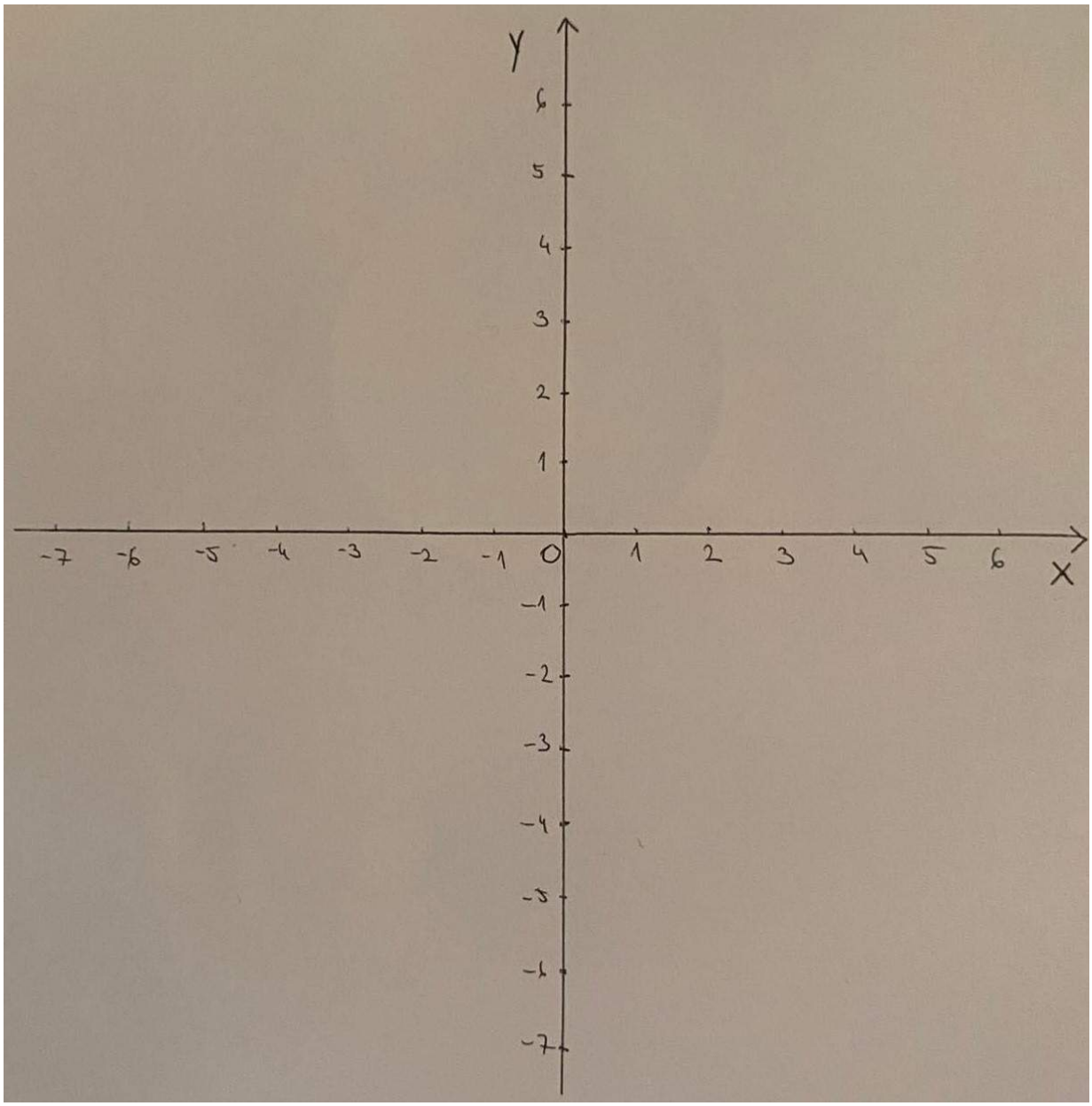
You've probably discovered that you can only present one dimension this way, which is not enough for our initial assignment. So we need another coordinate axis to obtain another dimension.

2

Task 2

Explain:

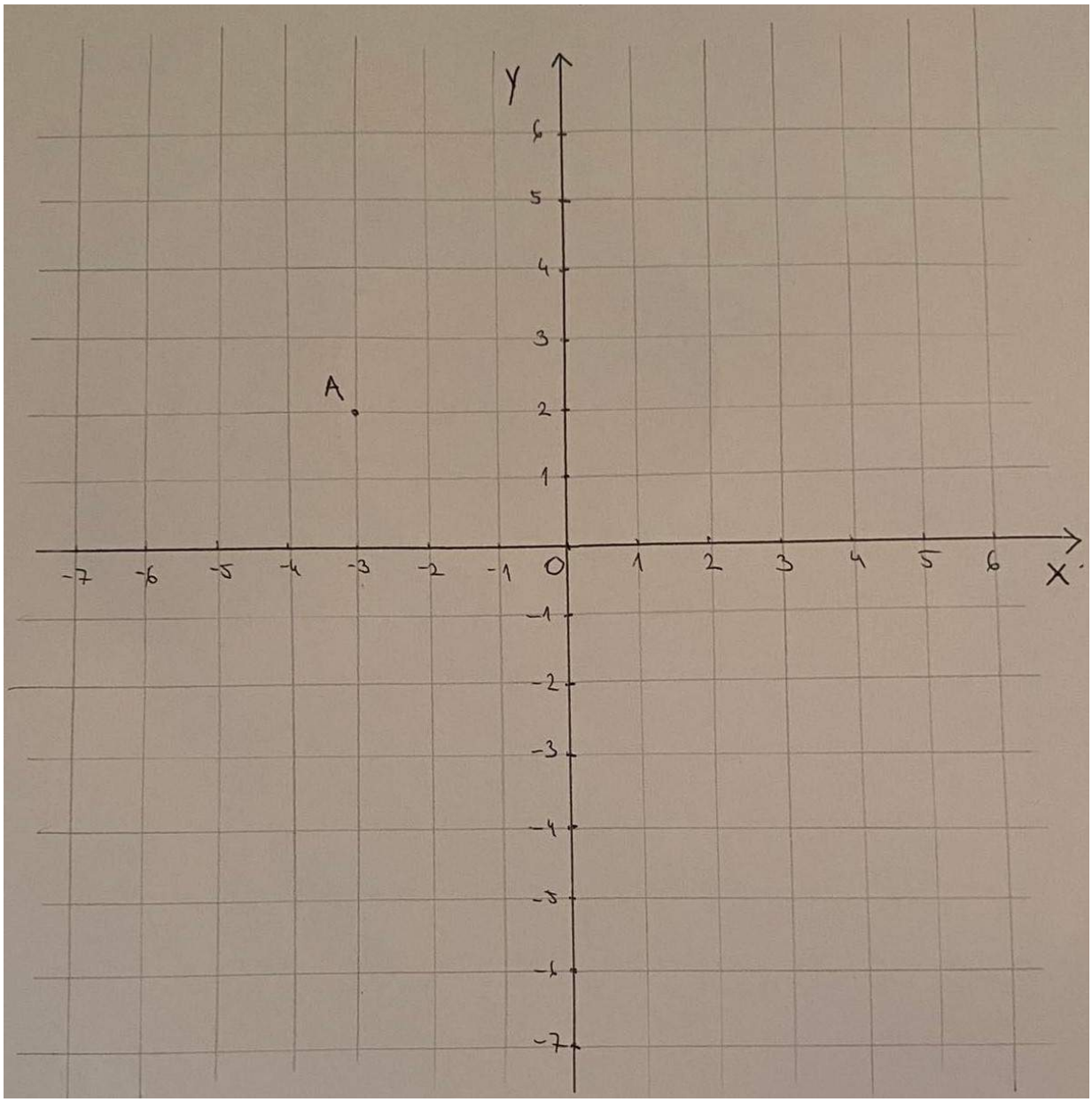
Draw another line on a sheet of paper that will intersect the horizontal axis at a right angle at the coordinate origin. By a known agreement, we orient this axis upwards – so the value increases. Additionally, you can now mark a unit and some integers on this line.



Picture 3: Coordinate system, 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

An ordered pair of numbers x, y presents the position of a point in the coordinate system, where x and y are any real numbers. Furthermore, x shows the displacement from the coordinate origin to the point on the x axis and y shows the displacement on the y axis. The coordinates of the point A from the picture above are written as A(-3, 2).

Let us now test this knowledge in the case of the snowman. Open the GeoGebra program first.

You can already see the drawn coordinate system when you open the program. In the top line, you have various commands with which you can draw different geometric elements in the coordinate system. Instructions accompany each command on what you need to specify for the selected element to be drawn.

Almost every command requires you to specify at least one point of your geometric element. You can define points by clicking on the desired location or giving its coordinates. Use more commands, such as polygon and line segment, to make a snowman. You can also change the colours of drawn objects.

3

Task 3

Abstract

Explain:

The Cartesian coordinate system consists of two mutually perpendicular axes. Mark the horizontal axis with x. This is called the abscissa axis. The vertical axis y is the ordinate axis. The point where the axes intersect is called the coordinate origin. The coordinates of each point are presented as an ordered pair of real numbers x, y. Furthermore, x shows the displacement from the coordinate origin to the point on the x axis, and y shows the displacement on the y axis. In art, however, the coordinate system comes in handy if we want to create an animation or even an animated film.

Step 3 - Consolidation Stage

Ask pupils:

Task 1

Draw a coordinate system on a piece of paper. Draw points in the system:

A (22.5, 10)	G (15, -1.32)	M (-0.81, 0.84)	S (12, 8)
B (29, 5.74)	H (13, -8.65)	N (-8, -1.36)	T (12.4, 6)

C (34, -1.36)	I (11, -1.32)	O (-3, 5.74)	U (13.6, 6)
D (26, 1)	J (6, 0)	P (3.5, 10)	V (14, 8)
E (24, -1.32)	K (2, -1.32)	Q (6, 6.67)	W (15, 5)
F (20, 0)	L (0, 1)	R (11, 5)	X (20, 6.67)

Connect the points in alphabetical order and colour the resulting polygon.

Task 2

In GeoGebra, try to create the main character of your favourite animated film. To complete this task, apply the knowledge of the coordinate system.

End of the activity

EXIT