

SCENARIO		
<b>Title</b>	Perpendicular lines and parallel lines.	
<b>Summary</b>	<p>Representation of perpendicular and parallel lines  Viewing boards with such simple ones  Attempts to use a ruler and a set square when drawing  searching for straight (parallel) sections in a child's environment, e.g. parallel sections as elements of objects in the classroom, outside the window, etc. It is worth placing sticks, pencils or crayons on the bench in such a way that they are models of perpendicular or parallel sections. In one of two lessons you can use your own city, district and village plan. The child learns to use the plan, gets to know the area. An educative exercise is to search the map of perpendicular and parallel streets, as well as search for perpendicular (parallel) streets to the indicated street. The child may use the instruments to justify perpendicularity or parallelism of the streets.  Work with the scratch program</p>	
<b>Author/s</b>	Renata Jasińska, Alicja Radziwon	Date: 01/12/2019

Didactic objectives	
<p>Lesson aims Student:  recognizes straight or perpendicular sections and straight or parallel sections;  indicates perpendicular and parallel streets on the city plan;  draws perpendicular lines and parallel lines with a ruler and set square;  draws perpendicular and parallel lines on a squared paper;  uses the characters T and    to describe perpendicular lines and parallel lines;  indicates and draws a segment being the distance of a point from a straight line.</p>	
Physics <input type="checkbox"/> Mathematics <input checked="" type="checkbox"/> Information <input type="checkbox"/> Technology <input type="checkbox"/> Robotics <input type="checkbox"/> Programming <input type="checkbox"/>	
Education Level:                    10-12years <input checked="" type="checkbox"/> 12-14years <input type="checkbox"/>	
Problem Statement	
<p>How to draw a parallel and perpendicular straight with a ruler?  How to draw a segment being the distance of a point from a straight line?</p>	
BOM (Bill Of Materials needed)	
Computer workstations	
Activity description	
<p>Familiarization with the topic of classes  2. Presentation of perpendicular and parallel lines on boards.  3. Search for straight (parallel) sections in a child's environment.</p>	

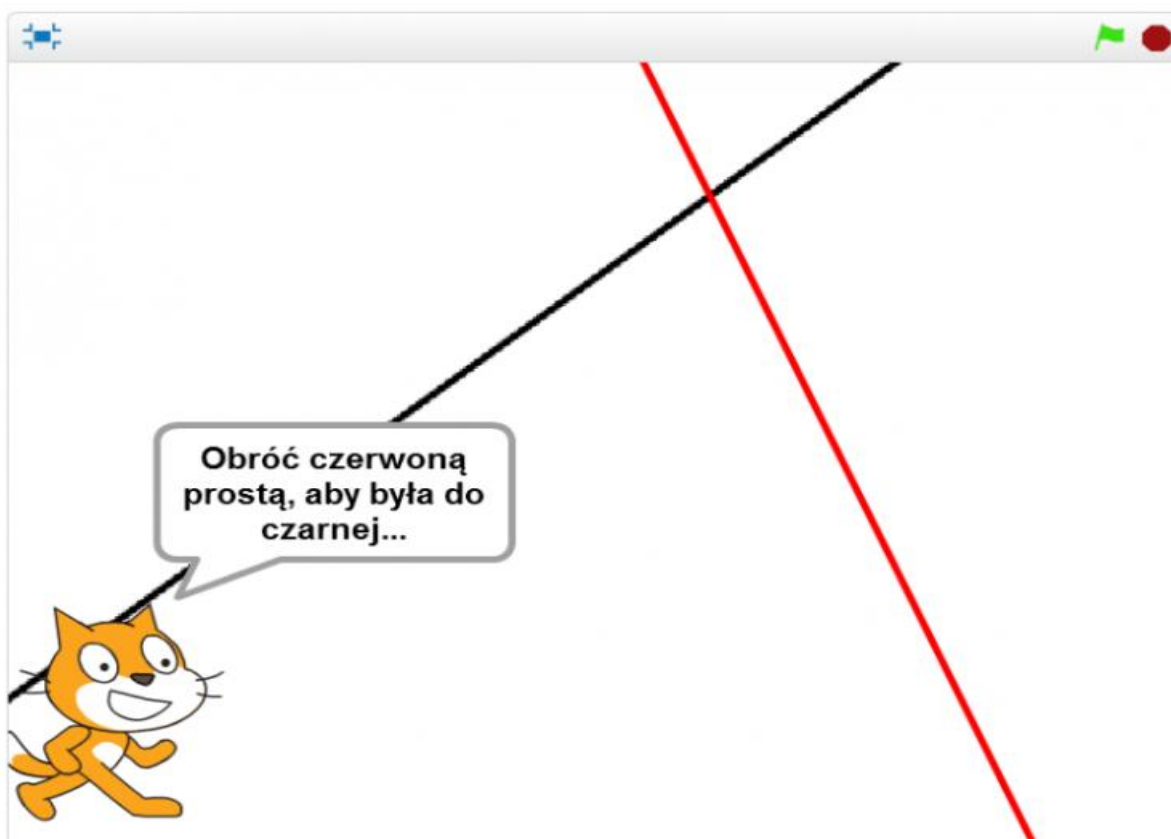
4. Search for perpendicular straight sections of the child's environment.
5. Drawing with a straight ruler and set square perpendicular and parallel.
6. Practical exercises with arranging sticks, pencils, crayons - perpendicular and parallel sections.
7. Practical exercises with city plan - marking perpendicular and parallel streets.
8. Work with the scratch program - perpendicular and parallel lines –

### Sample script and the appearance of the scene

"Straight perpendicular and parallel straight" is a project in which there are 2 sprites:

- Guide cat, which gives instructions and commands and assesses the correctness of the task
- straight - a line that appears in two places on the stage at different angles. One of them doesn't move (it's a stamp) and the other one is rotated by the player.

The cat will decide whether to set the lines parallel or perpendicular. We leave the background white for better readability.



Let's start with the preparation of sprites. The cat appeared automatically, and we draw a straight line ourselves (by clicking the brush next to the inscription "New sprite"). Remember to click the line icon, not the pencil. After drawing the line, we duplicate it to have 2 costumes that look identical, differing only in colors (e.g. the first black and the second red). To make our lines reach from edge to edge, it's worth setting the size to e.g. 150% at the beginning. Since we have prepared sprites, we have to put them somewhere. The cat can be in any corner, and straight: stationary will be hooked e.g. at (-100.0) and movable at (100.0). So after starting the program, we should clear the stage, set our sprite in the selected place, set a random direction and remember it ( $k$  = the direction of the black line), make a stamp, jump to the second place.

```

kiedy kliknięto
ustaw rozmiar na 150 %
wyczyść
zmień kostium na kostium1
idź do x: -100 y: 0
ustaw k na losuj od 0 do 179
ustaw kierunek na k
stempluj
zmień kostium na kostium2
idź do x: 100 y: 0

```

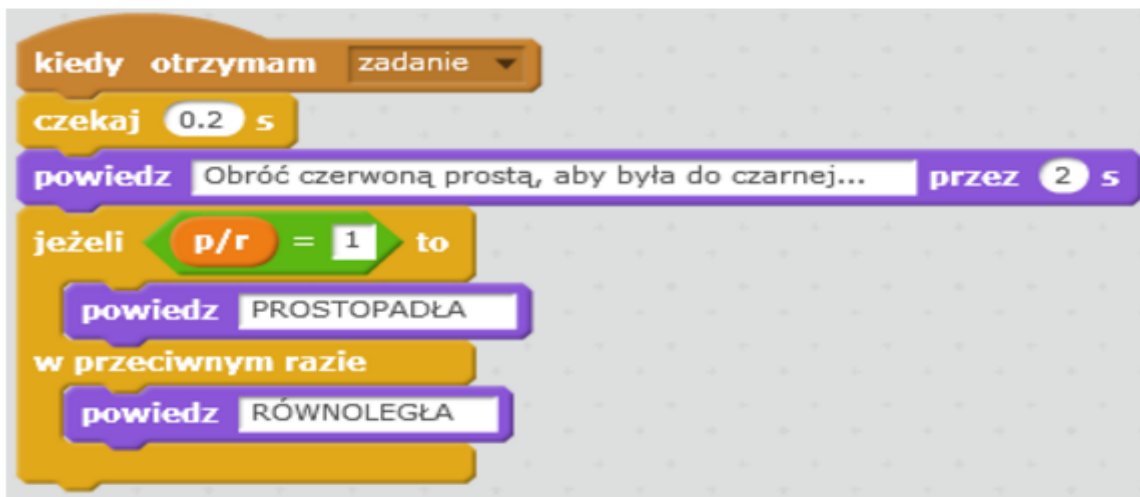
It is worth considering with what accuracy (jump) we will rotate the straight line. If we rotated it 90 degrees, the task would be very simple; if it were 1 degree - it would be very difficult to see if the lines are perpendicular or whether there is an angle of 89 or 91 degrees between them. Therefore, it is worth choosing experimentally. Let's assume it will be 15 degrees. If we would like to change the direction of the red line at the beginning (for difficulty), we must rotate it by a random multiple of our jump (15). What limits to draw? If we do not want them to be parallel, we must add to this direction an angle greater than zero, but less than 180, so we are interested in multiples of 15 greater than 0 and less than 12. If we want to avoid perpendicularity, then the rotation angle must be in the range  $(-90, 90)$ , i.e. we are interested in multiples from -5 to 5. How to decide whether we will set the lines perpendicular or parallel? At the beginning let's introduce a variable (p / r) that will randomize the value from 2 numbers: if we draw 1, then we will set perpendicular, and 2 - parallel.

```

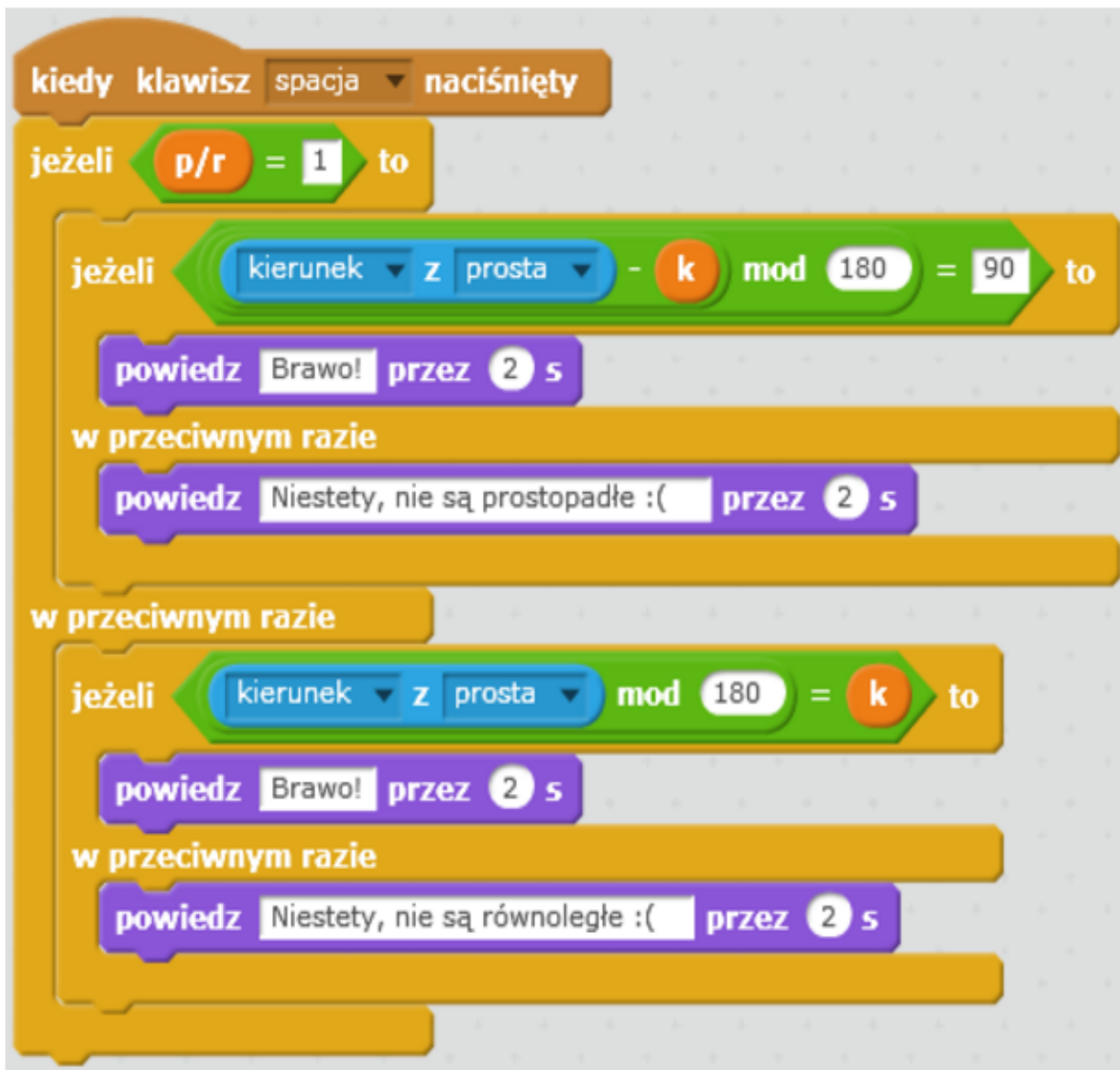
kiedy kliknięto
ustaw rozmiar na 150 %
ustaw p/r na losuj od 1 do 2
wyczyść
zmień kostium na kostium1
idź do x: -100 y: 0
ustaw k na losuj od 0 do 179
ustaw kierunek na k
stempluj
zmień kostium na kostium2
idź do x: 100 y: 0
jeżeli p/r = 1 to
ustaw kierunek na k + 15 * losuj od -5 do 5
w przeciwnym razie
ustaw kierunek na k + 15 * losuj od 1 do 11

```

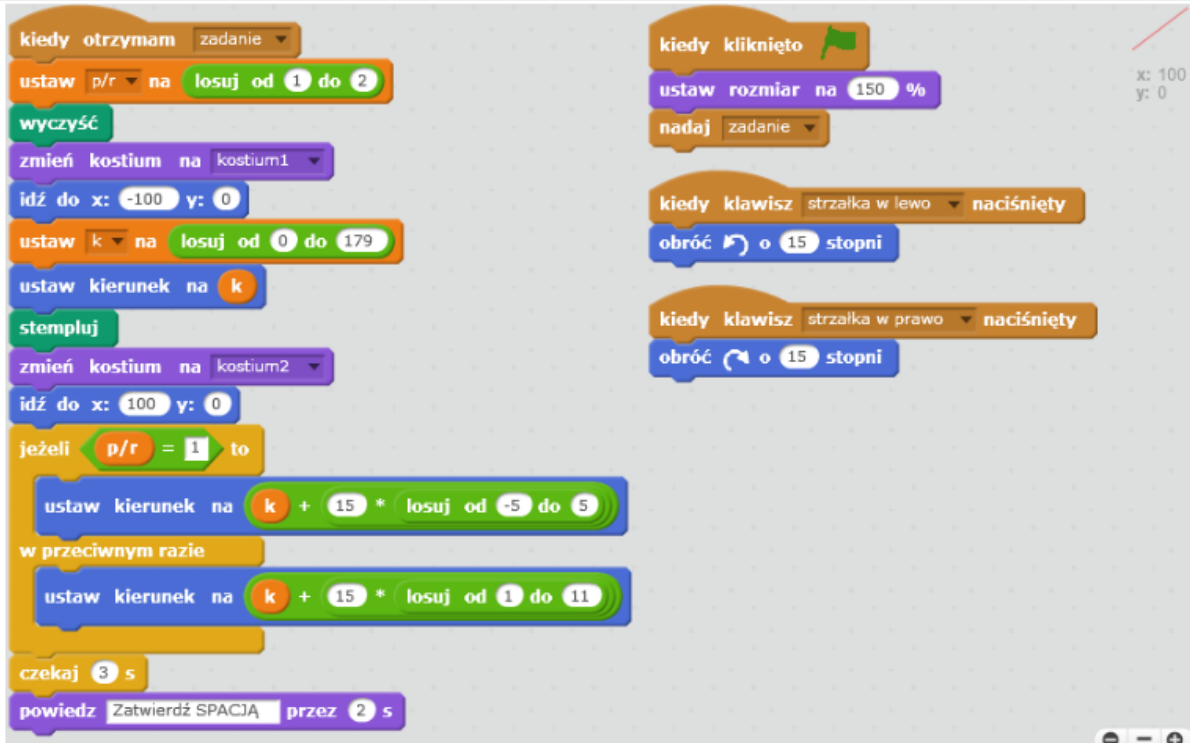
The red line can be rotated using the keyboard: right arrow - turn 15 degrees to the right (clockwise), left arrow - opposite. So that we know what task awaits us, this can be communicated to us by a Cat. He, in turn, will learn that he is to say something by means of a message. So after setting the simple ones, they should send a message such as "task". When the Cat receives it, he will say "Turn the red straight so that it is black ..." and after a while it will add depending on the value of the variable "p / r" - "RECTANGULAR" or "PARALLEL"



Now we will need time to set the straight line. A signal for the computer to complete the task will be pressing space. Then the Cat will assess the correctness of the task. How? The direction of the black line is in the range  $\langle 0.179 \rangle$  and the red -  $\langle -179.180 \rangle$ . So the lines will be parallel if they have the same direction or if the red one is 180 degrees smaller and perpendicular if the difference in directions is  $\pm 90$  or  $\pm 270$ . We can save these conditions in various ways. The simplest seems to be the use of the remainder of division - modulo. It is worth noting that in the case of parallelism after dividing by 180, e.g. from the angle -110 we get the remainder 70, and in the case of perpendicularity all numbers:  $\pm 90, \pm 270 \bmod 180 = 90$ . Hence the way of checking could look like this:

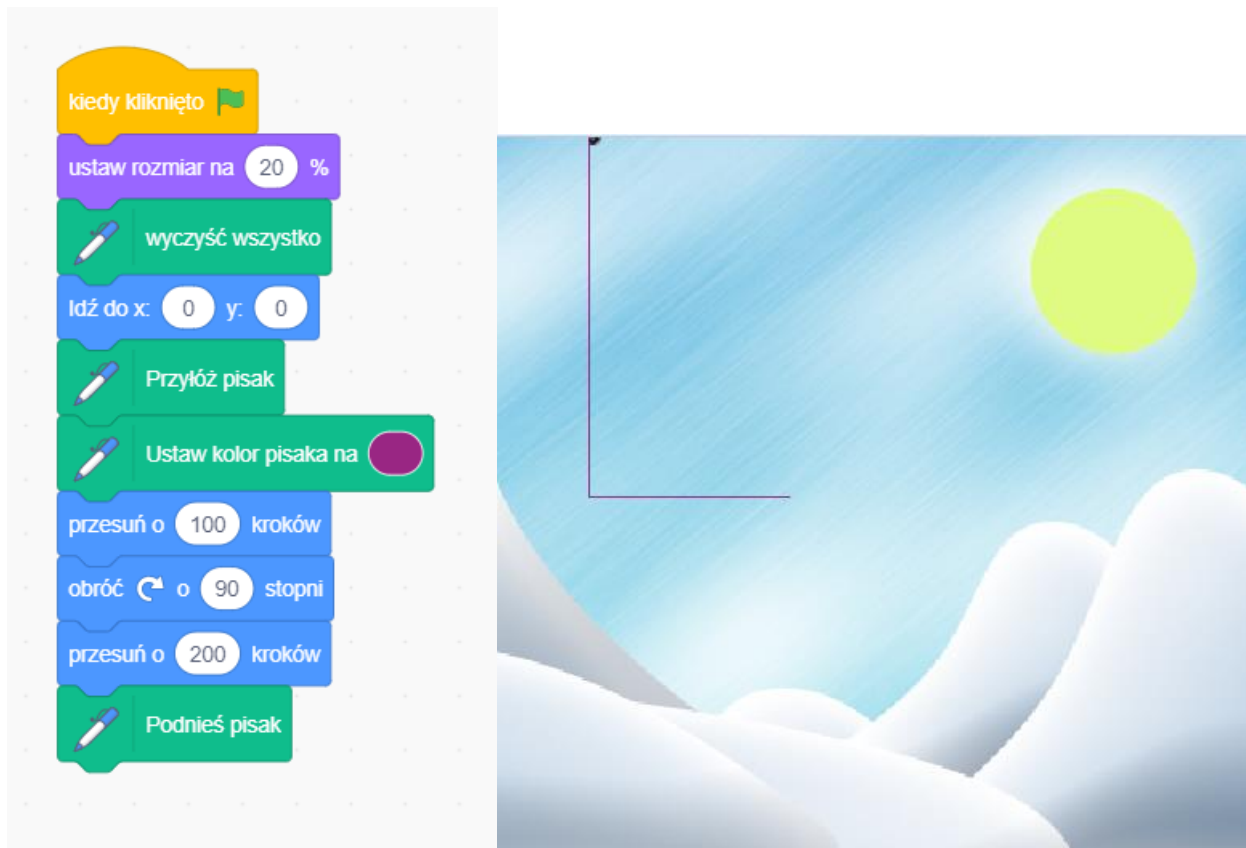


To prevent the program from terminating at this point, you can force a subsequent start with the message "task" after evaluation. However, this message should also cause a new simple setting. Therefore, you must also modify the Simple sprite script, which will eventually look like this:

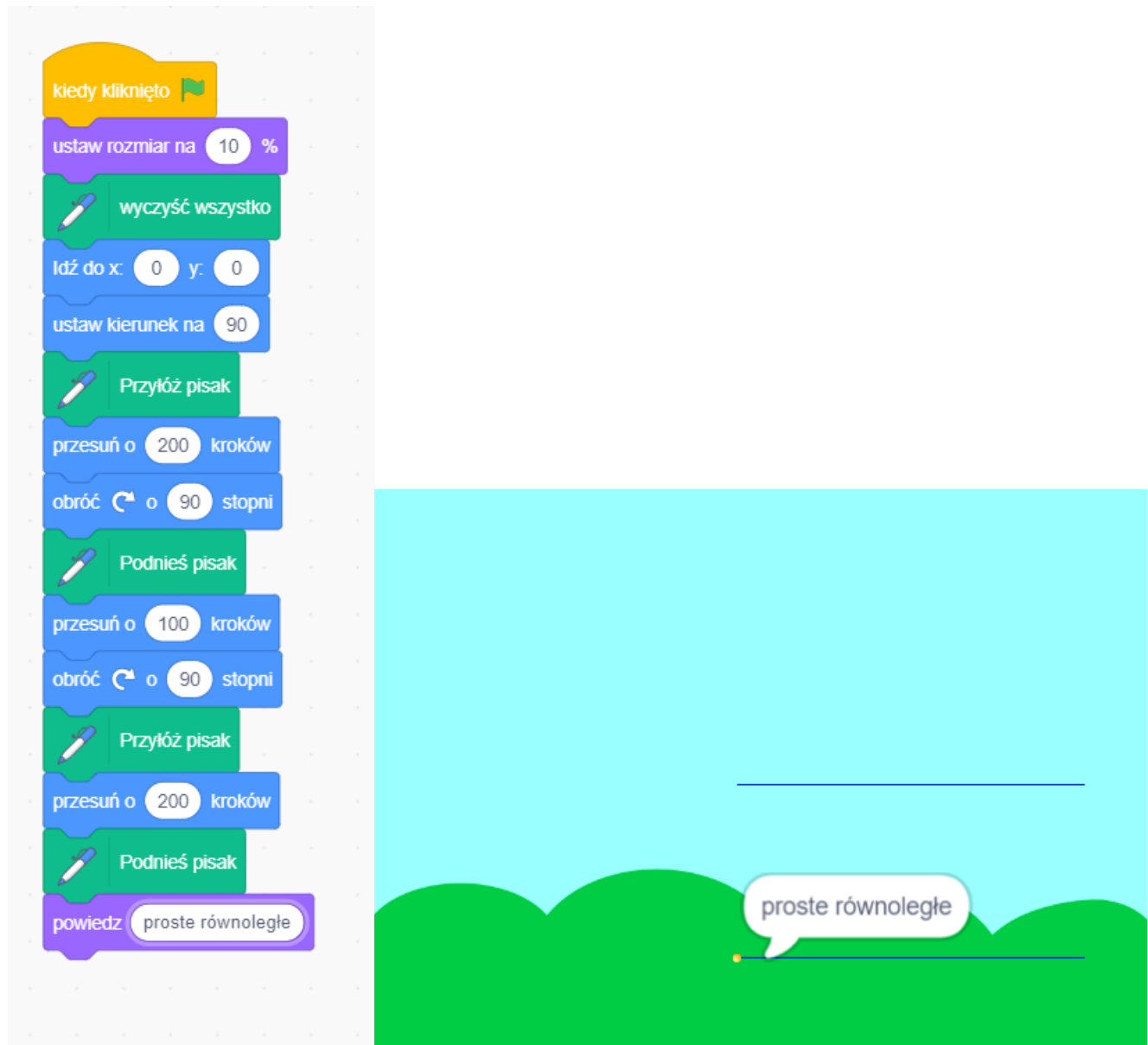


Summary  
 Or a very simple script

### Perpendicular lines



## Simple paralel



The image shows a Scratch script on the left and a stage on the right. The script consists of the following blocks:

- When clicked (yellow)
- Set size to 10% (purple)
- Erase everything (green)
- Go to x: 0 y: 0 (blue)
- Set direction to 90 (blue)
- Bring pen down (green)
- Move 200 steps (blue)
- Turn 90 degrees (blue)
- Bring pen up (green)
- Move 100 steps (blue)
- Turn 90 degrees (blue)
- Bring pen down (green)
- Move 200 steps (blue)
- Bring pen up (green)
- Say "proste równoległe" for 2 seconds (purple)

The stage shows a light blue sky and green hills. Two horizontal blue lines are drawn, one above the other, representing parallel lines. A speech bubble containing the text "proste równoległe" is positioned near the bottom line.

### Resources

Charts showing the arrangement of perpendicular and parallel lines  
Plates with an effect that we want to receive (stairs, spirals, mazes).

Rulers, squares, pencils, sticks, crayons.

### Students' Evaluation

Grade for involvement, active participation in classes - written grade.

### Bibliography

Mistrzowiekodowania.pl

Available mathematics school textbooks, workbooks, task sets. Just those with whom the class works

### **Scalability**

We can program so that stairs and spirals are created.

### **More information**

We can program so that stairs, spirals from sections of a certain length or from a specified number of sections are created.

### **More information**

The task can be differentiated by working in the scratch program from checking and calculating circuits, by stacking ready-made blocks for writing the program yourself.