Activity

- Fibonacci Spiral -

Educational Goals

- Introduce the Fibonacci numbers and the Fibonacci spiral
- Observe the presence of mathematics in nature
- Develop the mathematical culture

Key Features of the Targeted Competency

- To mobilize and apply concepts and processes appropriate to the given situation (C2)
- To define the elements of the mathematical situation (C2)

Concepts Used

- Arithmetic (addition)
- Measures of lengths (conventional units)
- Comparing and constructing plane figures (squares, rectangles, circles)

Materials

- “Fibonacci Spiral” Geogebra application (available on the Internet via this link: https://www.geogebra.org/m/XnUkTse6)
- Pencils
- Ruler
- Compass
- Blank sheet (suggested size of 8 ½ by 14)
- Pictures in the appendix

Targeted Academic Level

Elem Cycle Three

Targeted Competency

C2

Mathematical Fields Concerned

Suggested Teaching Formulas

Time Required

Approximately 30 minutes

Suggested Process

Step 1: Introduction (5 minutes)

To introduce the activity, present to the students objects or images of nature and make them observe the spirals. You will find in the appendix two pictures of flowers and examples of spirals countdowns on these same pictures.

We recommend that you bring objects in class or that you use your own pictures. For example, you can use a sunflower, a strawberry, a pineapple or a pine cone. It is on the pine cone that the spirals will be the most obvious (there is an example in the appendix). Ask the students to count the spirals that start from the centre of the flower or the stem of the fruit, both clockwise and counterclockwise. They must note the results, because you will come back to them later. The expected result is that the number of spirals will be a Fibonacci number, but we advise you to not mention it to the students right away.

Step 2: Creation (15 minutes)

In this section of the activity, the students will discover the Fibonacci spiral and experiment its creation. Use a sheet of paper oriented on the “landscape” side and start approximately in the middle of the sheet, drawing side by side two squares that have 1 cm sides. Under these two squares and juxtaposed to them, add a square which side is 2 cm. Next, on the left, add a square which side is 3 cm. It must be adjacent to the previous squares (so, we are using the 2 cm and 1 cm sides to make a 3 cm side). Continue by drawing a square, which side is 5 cm, above the squares already drawn, then always drawing squares that use the previous squares’ sides as their sides, going clockwise.
Ask the students to write the length of the squares’ sides and tell them that they are Fibonacci numbers.

An example of the drawing described here can be found in the “Fibonacci Spiral” Geogebra document. By moving the cursor[1] up to the value 6, we can see the progression of the drawing and the link with the numbers of the Fibonacci sequence.

Step 3: Assimilation (10 minutes)

Explain how to build the Fibonacci sequence: each Fibonacci number is the result of the addition of the two previous numbers. In the drawing made in step 2, adding together the sides of two squares gives the side of the next square. So, the squares all have Fibonacci numbers as their side measurement.

So the students can properly see the Fibonacci sequence, write with them the first terms: 1, 1, 2, 3, 5, 8, 13, 21,…

Fibonacci numbers can be found, among others, in nature. Take back the numbers noted during step 1 and observe them. We notice that they are Fibonacci numbers!

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[1] The cursor is at the bottom of the Geogebra page. It is shaped like a dot that we can move along a line. By moving that dot, we change the value of “a” and that progressively forms the drawing.

Another interesting characteristic of the Fibonacci sequence is that it allows to draw perfect spirals.

To form a perfect spiral, take back the drawing of step 2 and ask the students to join the squares' corners with arcs of circle to form the Fibonacci spiral. In the Geogebra document, we can observe the drawing of this spiral by moving the cursor from 6 to 13.

Short on Time?

Here are some suggestions for an "express" presentation:

→ Simply present in class the Fibonacci sequence and the drawing of the spiral associated to it by using the Geogebra application.

→ Give the students the mission to bring a pine cone picked in nature for next class. During the next class, take a few minutes to count the spirals and notice the link with the numbers of the Fibonacci sequence. The spirals are more obvious and easier to count on objects like pine cones than on pictures of flowers.

APPENDIX

Flower A without spirals

Flower A with spirals (clockwise)

Flower B without spirals

Flower B with spirals (clockwise)

Flower B with spirals (counterclockwise)

Pine cone with spirals in both directions