

Name: _____

Fibonacci Sequence and Fractal Spirals

1. First, we're going to figure out the Fibonacci sequence. Fill out the blanks below:

0 + 1 = _____

1 + _____ = _____

_____ + _____ = _____

_____ + _____ = _____

_____ + _____ = _____

_____ + _____ = _____

_____ + _____ = _____

_____ + _____ = _____

2. List each number after the equal sign: 1 1 2 ____ ____ ____ ____ ____ ____

3. Now, square each number: 1 1 4 ____ _____ _____ _____ _____

4. Add two adjacent numbers from the list above together.
1 + 1 = ____ 1 + 4 = ____ 4 + ____ = ____ ____ + ____ = ____

What pattern do you see? Circle those numbers where you've seen them before!

5. How about when you add the squared numbers (from #3) sequentially?
1 1 4 ____ _____ _____

1 + 1 + 4 = ____ then add the next number in the sequence to that

____ + ____ = _____ + _____ = _____ + _____ = _____

6. List the numbers from above after each equal sign (=): _____ _____ _____ _____

Fibonacci Sequence and Fractal Spirals

7. How is each number listed in #6 expressed as a multiplication of numbers in the Fibonacci sequence, listed after #2?

your first number _____ = _____ x _____ your second number _____ = _____ x _____

your third number _____= _____ x _____ your fourth number _____= _____ x _____

Another fun and mind-blowing fact…

8. Going back to the original Fibonacci sequence, divide the larger number by the previous smaller number and let's see what we get. The original sequence (#2) is:

1 1 2 ____ ____ ____ ____ ____ ____ ____

and so on…

1 ÷ 1 = ____ 2 ÷ 1 = ____ ____ ÷ 2 = _____ ____ ÷ ____ = _____ ____ ÷ ____ = _____

_____ ÷ _____ = _____ _____ ÷ _____ = _____ _____ ÷ _____ = _____ _____ ÷ _____ = _____

Golden ratio = 1.618033…

9. Let's do some graphing to see more about how this works!

a. What is the first number of the Fibonacci sequence? _____
On the graph paper at the end of this handout, there is square that is 1 x 1.

b. What's the second number of the Fibonacci sequence? _____
Right above the square you just drew, draw another 1 x 1 square.

c. What's the second number in the Fibonacci sequence? _____
Directly to the left of the two existing squares, draw in a 2 x 2 square.

d. What's the next number in the Fibonacci sequence? _____
Right below your existing squares, draw a _____ x _____ square.

e. What's the next number in the Fibonacci sequence? _____
To the right of all that you've drawn, draw a _____ x _____ square.

f. What's the next number in the Fibonacci sequence? _____
Above all that you've drawn, draw a _____ x _____ square.

g. What's the next number? _____
To the left of all that you've drawn, draw a _____ x _____ square.

h. What's the next number? _____
Below all that you've drawn, draw a _____ x _____ square.

… To the right of that would be the next square, but we've run out of room.

10. Now let's see how we can make a pattern out of these squares.

In the original square, draw a line from the bottom left to the top right.
On the next 1 x 1 square, continue that line across your square, from the bottom right to the top left.
Cross the 2 x 2 square from the top right to bottom left.
Cross the 3 x 3 square from the top left to bottom right.
Cross the 5 x 5 square from bottom left to top right.
Cross the 8 x 8 square from bottom right to top left.
Continue the line across the 13 x 13 square and the 21 x 21 square, wrapping up with a line that would go through the 34 x 34 square.

11. What pattern do you get?

12. Where do we find spirals naturally?

13. Count the number of things that make up a spiral on a pineapple or a pine cone or the number of petals on a flower or number of spirals on a froccoli or seeds of a sunflower.

They all occur in Fibonacci numbers! Nature is full of mathematical patterns! Amazing, huh? See what other cool patterns you can figure out in nature.

Fibonacci Sequence and Fractal Spirals