

1, 1, 2, 3, 5, 8, 13, 21, 34, 55

# Fibonacci Numbers in Nature Study Guide



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# **Fibonacci Numbers in Nature, How Amazing!**

The Fibonacci number sequence has been astonishing and baffling mathematicians, nature lovers, scientists and the curious mind for ions. This number sequence was introduced by medieval, Italian, mathematician Leonardo of Pisa in his 1202 book, *Liber Abaci* (Book of Calculation). Along with the Hindu-Arabic numerals, which we use today (0 – 9), he introduced the east Indians use of the Fibonacci sequence through a famous problem about rabbit population growth. The sequence was named after him by number theorist Edouard Lucas in the 19<sup>th</sup> century.

The number sequence is achieved by adding each of two subsequent numbers together to acquire the next number. It begins with 0 or 1, but the east Indians preferred to start with 1. It goes like this: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55 and into infinity!

This rather remarkable sequence is found all over nature, but especially in the plant kingdom. Most spirals grow by way of the Fibonacci sequence as its angles give the best sunlight exposure. Numbers of petals on flowers are many times Fibonacci numbers, such as 3 petals found on the Painted trillium, irises, and lilies, 5 found in buttercups, columbine and wild rose and 34 in plantains and pyrethrum.

The number of spirals turns, both clockwise and counterclockwise found in such familiar plants as pineapples, pinecones and sunflowers are usually Fibonacci numbers.

Come on a fascinating journey and learn about one of nature's amazing codes for growth and life!

## PowerPoint Interaction Questions – Fibonacci Numbers in Nature

**Directions:** Read through NatureGlo’s eScience PowerPoint, Fibonacci Numbers in Nature. Answer the questions below. Each question is worth 10 points each unless otherwise stated differently. Question number 7 is a two part answer, with each answer part worth 5 points each.

**Slide #3 - What are the Fibonacci Numbers?** List the Fibonacci numbers up to 10 numerals either starting with 0 or 1.

1. \_\_\_\_\_  
\_\_\_\_\_

**Slide #4 - Who Was Leonardo of Pisa?** The Fibonacci numbers were introduced to Europe through what book by Leonardo of Pisa in 1202?

2. \_\_\_\_\_

**Slide #8 Fibonacci Numbers & its Relationship with Phi – How is the Golden ratio acquired from the Fibonacci numbers?**

3. \_\_\_\_\_  
\_\_\_\_\_

## PowerPoint Interaction Questions – The Fibonacci Numbers in Nature

**Slide #12 Fibonacci Phyllotaxis** – What is the definition of phyllotaxis?

4. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Slide #13 Fibonacci Phyllotaxis – Whorled, Multijugate, Fibonacci Numbers & the Golden Angle** – The angle between successive leaves is close to Golden Angle at about how many degrees?

5. \_\_\_\_\_

**Slide #14 Fibonacci Phyllotaxis: Repeating Spirals & their Leaf Angles** –

6. In repeating spirals and their leaf angle fractions, the numerator and \_\_\_\_\_ usually consist of a Fibonacci number and its second successor.

**Slide #16 Fibonacci Numbers in Plants**. List one Fibonacci number with one flower whose number of petals usually equal that Fibonacci number. (5 points each answer)

7. Fibonacci number: \_\_\_\_\_

Flower type: \_\_\_\_\_

## PowerPoint Interaction Questions – Fibonacci Numbers in Nature

8. Slide #18 Fibonacci Numbers in the Sneezewort Plant – In the Sneezewort plant, new \_\_\_\_\_ numbers at any given stage will be a Fibonacci number.  
(5 points per answer)
9. Slide #'s 20, 21 & 22 - Fibonacci Numbers in pinecones, pineapples and sunflowers – The number of \_\_\_\_\_ turns about these plants, both clockwise and counterclockwise, are most often Fibonacci numbers.

Slide #22 What Fibonacci number did you notice at the center of the apple's horizontal cross-section?

10. \_\_\_\_\_

# The Fibonacci Numbers in Nature Journal Entry

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Directions: Fill in the information below. You can use the Fibonacci Numbers in Nature resource page to assist you here: <http://hascmathart.weebly.com/fibonacci-numbers-in-nature.html>

## Sketch

### 1). General Description

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### 2). Size

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### 3). Color

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### 4). Patterns

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### 5). Related numbers and geometric shapes

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# Mathematician/MathArtist Journal Entry

Your Name:

Today's Date:

Mathematician/MathArtist:

Directions: Select a mathematician or a "MathArtist" (one who used or uses mathematics in their artwork). Follow the guidelines below.

## Sketch and or Photos

	<p>1). Life Work</p> <ul style="list-style-type: none"><li>•</li><li>•</li></ul> <p>2). Related numbers and geometric shapes</p> <ul style="list-style-type: none"><li>•</li><li>•</li></ul> <p>3). Other mathematical relationships</p> <ul style="list-style-type: none"><li>•</li><li>•</li></ul>
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# The Fibonacci Numbers in Nature Web Resources

Learn more by visiting Natureglo's eScience Virtual Library at the links below.

Fibonacci -

<http://hascmathart.weebly.com/mathartist-fibonacci.html>

Fibonacci Numbers in Nature:

<http://hascmathart.weebly.com/fibonacci-numbers-in-nature.html>

## Project and Activity Ideas

Students can do a research project using the resources from the headings, **Web Resources, Projects and Activities, Live & HYBRID course Videos and Informative Videos** listed on the resource page. A scoring rubric is on the following page for parents who choose to grade any student research project(s) work.

## Natureglo's eScience Student Project Rubric:

**Usage: PowerPoints, posters & other written research projects**

Category	<b>Criteria</b>				Points
	<b>4 Exemplary</b>	<b>3 Accomplished</b>	<b>2 Developing</b>	<b>1 Beginner</b>	
<b>Accurate Research/ Information Gathering &amp; Citation</b>	All taken from several sources & cited in work	Most taken from sources & cited	Some taken from sources and cited	Little or none taken from sources and or not cited	
<b>Content</b>	Great number of interesting facts around topic	Many interesting or too many facts	Some important facts	Few or no facts	
<b>Graphics/ Sound/ Animation</b>	High quality; enhance understanding on every page. All borrowed graphics with source cited.	Many enhance understanding on most pages; most borrowed graphics cited.	Some enhance understanding; some cited	Zero, unrelated, very few or poor quality graphics and/or none cited	
<b>Organization &amp; Attractiveness</b>	Well organized and very attractive; demonstrates creative & logical sequencing and sentence structure	Mostly well organized and attractive; demonstrates logical sequencing and sentence structure	Somewhat organized and attractive, but some illogical sequencing and sentence structure	Unattractive and or weakly organized or disorganized	
<b>Grammar and Mechanics</b>	All correct	1 – 5 errors	5 – 10 errors	Frequent errors	
<b>Divide total points from 20 for grade.</b>			<b>Total Points/Grade:</b>		

# PowerPoint Interaction Quiz: Fibonacci Numbers in Nature

**Directions:** After completing the review questions and studying them, answer the questions below. Each question is worth 10 points each unless otherwise stated differently. There are a few two part questions, that are 5 points each.

**Slide #3 - What are the Fibonacci Numbers?** List the Fibonacci numbers up to 10 numerals either starting with 0 or 1.

1. \_\_\_\_\_  
\_\_\_\_\_

**Slide #4 - Who Was Leonardo of Pisa?** The Fibonacci numbers were introduced to Europe through what book by Leonardo of Pisa in 1202?

2. \_\_\_\_\_

**Slide #8 Fibonacci Numbers & its Relationship with Phi – How is the Golden ratio acquired from the Fibonacci numbers?**

3. \_\_\_\_\_  
\_\_\_\_\_

## PowerPoint Interaction Quiz – The Fibonacci Numbers in Nature

**Slide #12 Fibonacci Phyllotaxis** – What is the definition of phyllotaxis?

4. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Slide #13 Fibonacci Phyllotaxis – Whorled, Multijugate, Fibonacci Numbers & the Golden Angle** – The angle between successive leaves is close to Golden Angle at about how many degrees?

5. \_\_\_\_\_

**Slide #14 Fibonacci Phyllotaxis: Repeating Spirals & their Leaf Angles** –

6. In repeating spirals and their leaf angle fractions, the numerator and \_\_\_\_\_ usually consist of a Fibonacci number and its second successor.

**Slide #16 Fibonacci Numbers in Plants**. List one Fibonacci number with one flower whose number of petals usually equal that Fibonacci number. (5 points each answer)

7. Fibonacci number: \_\_\_\_\_

Flower type: \_\_\_\_\_

## PowerPoint Interaction Quiz – Fibonacci Numbers in Nature

8. Slide #18 Fibonacci Numbers in the Sneezewort Plant – In the Sneezewort plant, new \_\_\_\_\_ numbers at any given stage will be a Fibonacci number.  
(5 points per answer)
9. Slide #'s 20, 21 & 22 - Fibonacci Numbers in pinecones, pineapples and sunflowers – The number of \_\_\_\_\_ turns about these plants, both clockwise and counterclockwise, are most often Fibonacci numbers.

Slide #22 What Fibonacci number did you notice at the center of the apple's horizontal cross-section?

10. \_\_\_\_\_

# PowerPoint Interaction Quiz: Fibonacci Numbers in Nature Answer Key

**Directions:** After completing the review questions and studying them, answer the questions below. Each question is worth 10 points each unless otherwise stated differently. There are a few two part questions, that are 5 points each.

**Slide #3 - What are the Fibonacci Numbers?** List the Fibonacci numbers up to 10 numerals either starting with 0 or 1.

**1. 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, or 1, 1, 2, 3, 5, 8, 13, 21, 34, 55**

**Slide #4 - Who Was Leonardo of Pisa?** The Fibonacci numbers were introduced to Europe through what book by Leonardo of Pisa in 1202?

**2. Liber Abaci**

**Slide #8 Fibonacci Numbers & its Relationship with Phi** – How is the Golden ratio acquired from the Fibonacci numbers?

**3. By dividing a Fibonacci number by the number before it**

## PowerPoint Interaction Quiz – The Fibonacci Numbers in Nature Answer Key

**Slide #12 Fibonacci Phyllotaxis – What is the definition of phyllotaxis?**

**4. plant leaf arrangements on a stem**

**Slide #13 Fibonacci Phyllotaxis – Whorled, Multijugate, Fibonacci Numbers & the Golden Angle – The angle between successive leaves is close to Golden Angle at about how many degrees?**

**5. 137.5**

**Slide #14 Fibonacci Phyllotaxis: Repeating Spirals & their Leaf Angles –**

**6. In repeating spirals and their leaf angle fractions, the numerator and **denominator** usually consist of a Fibonacci number and its second successor.**



## PowerPoint Interaction Quiz – The Fibonacci Numbers in Nature Answer Key

**Slide #16 Fibonacci Numbers in Plants. List one Fibonacci number with one flower whose number of petals usually equal that Fibonacci number. (5 points each answer)**

**Student answers will vary but should include any one of the following numbers along with at least one plant name of whose petal numbers are typically that Fibonacci number.**

- **3 - iris, lily, trillium**
- **5 - buttercup, columbine (aquilegia), larkspur, pinks, wild rose**
- **Cultivated buttercups bred into multi-petal forms**
- **8 – delphiniums, some daisy cultivars**
- **13 - corn marigold, cineraria, daisies (some) ragwort**
- **21 - aster, black-eyed susan, chicory**
- **34 - plantain, pyrethrum**
- **55, 89 - Asteraceae family, michaelmas daisies, roses**
- **Some species precise about number of petals such as wild buttercups; others with varying petal numbers; average being Fibonacci numbers**

## PowerPoint Interaction Quiz – Fibonacci Numbers in Nature Answer Key

8. Slide #18 Fibonacci Numbers in the Sneezewort Plant – In the Sneezewort plant, new **growth shoot** numbers at any given stage will be a Fibonacci number.  
(5 points per answer)
9. Slide #'s 20, 21 & 22 - Fibonacci Numbers in pinecones, pineapples and sunflowers – The number of **spiral** turns about these plants, both clockwise and counterclockwise, are most often Fibonacci numbers.

Slide #22 What Fibonacci number did you notice at the center of the apple's horizontal cross-section?

1. **5 or 5-pointed star (for the shape and number of "petal-like" spokes in the middle of the apple)**