

The Nature of Mathematics

Mathematics in Our World

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Learning Outcomes

At the end of the chapter, the students should be able to:

1. Identify patterns in nature and regularities in the world.
2. Articulate the importance of mathematics in one's life.
3. Argue about the nature of mathematics, what it is, how it is expressed, represented, and used.
4. Express the appreciation for mathematics as a human endeavor.



Fibonacci sequence, (Vila)

$$0 + 1 = 1$$

$$0 \ 1 + 1 = 2$$

$$0 \ 1 \ 1 + 2 = 3$$

$$0 \ 1 \ 1 \ 2 + 3 = 5$$

$$0 \ 1 \ 1 \ 2 \ 3 + 5 = 8$$

$$0 \ 1 \ 1 \ 2 \ 3 \ 5 + 8 = 13$$

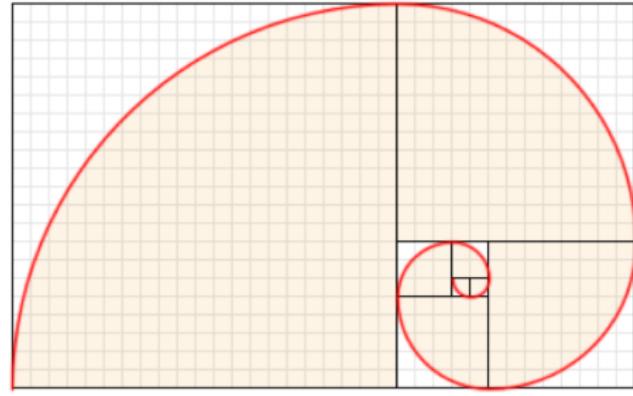
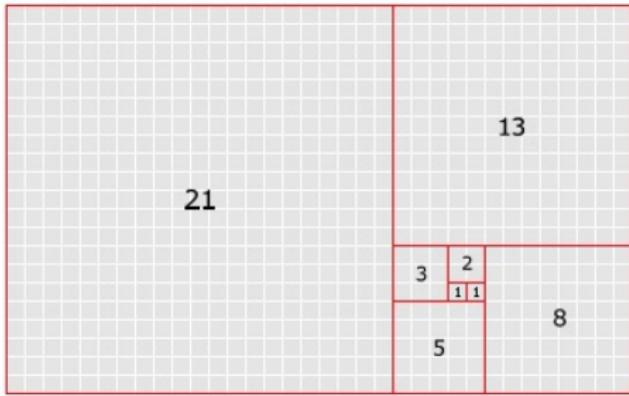
etc

0 1 1 2 3 5 8 13 21 34 55 89 144 233 377 610 987 1597

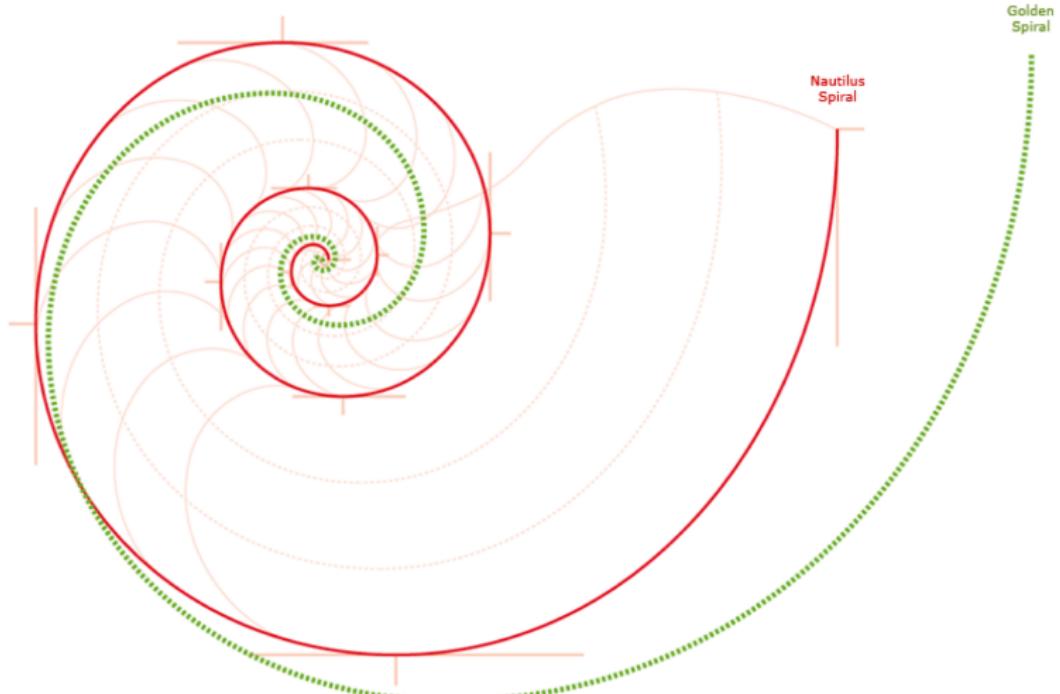
The Fibonacci sequence is "an infinite sequence of natural numbers where the first value is 0, the next is 1 and, from there, each amount is obtained by adding the previous two."



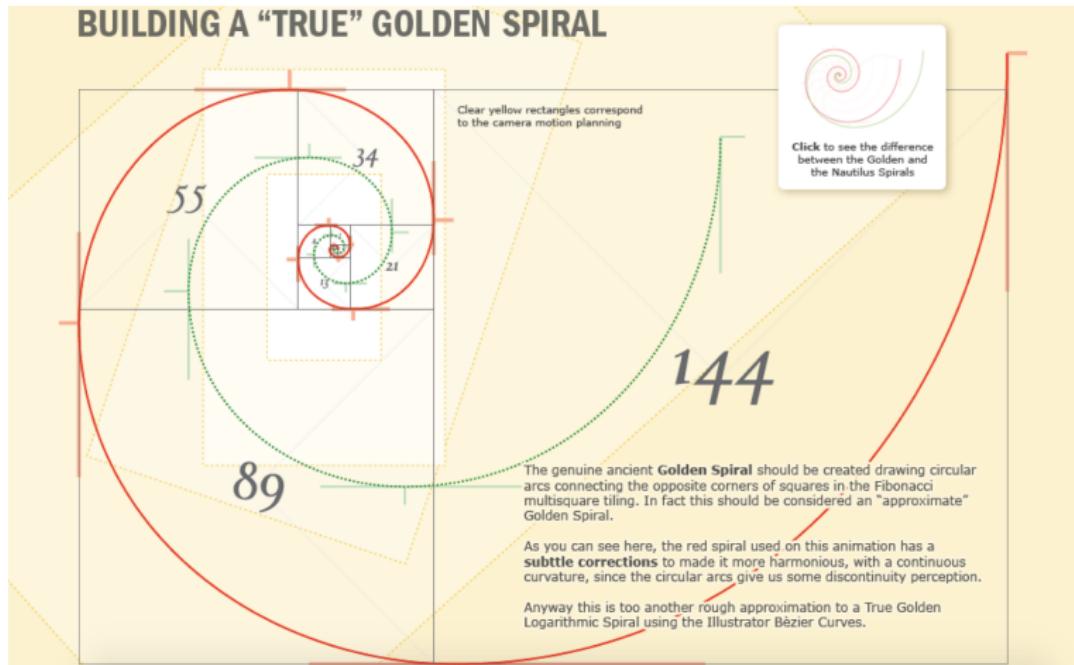
Fibonacci Spiral (Vila)



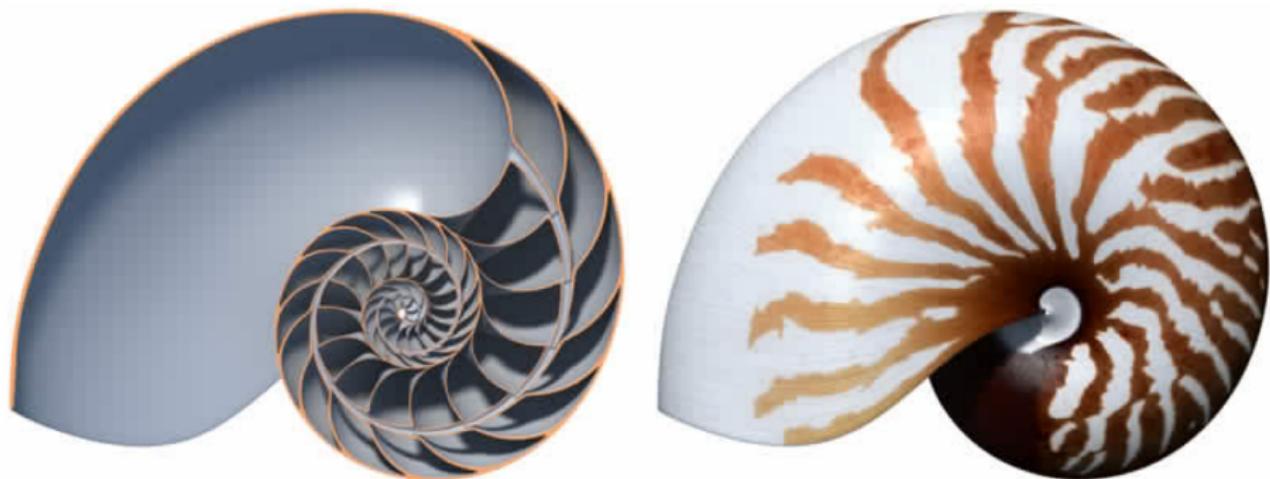
Nautilus Spiral (Vila)



Golden Spiral (Vila)



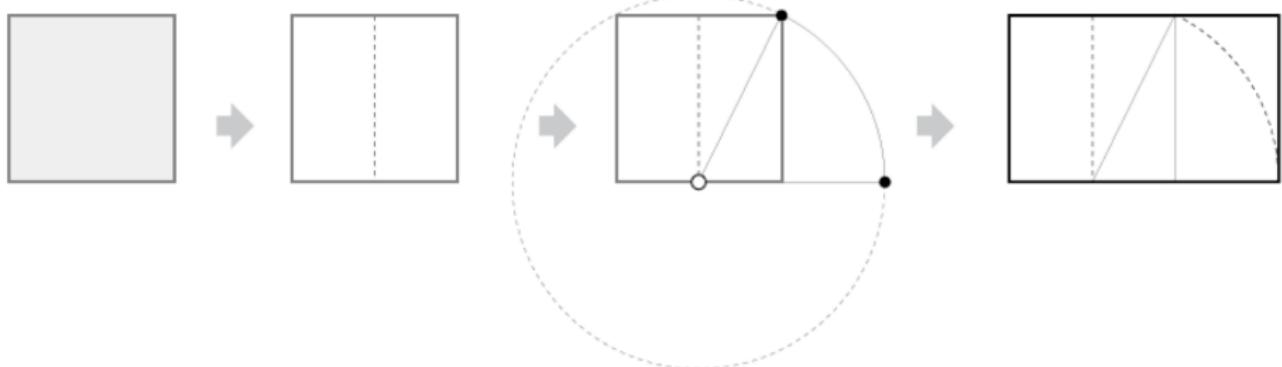
Nautilus Shell (Vila)



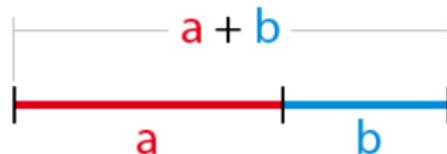
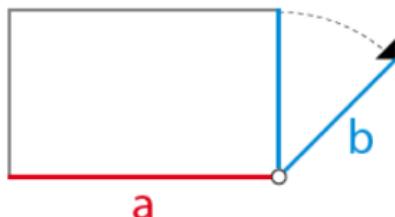
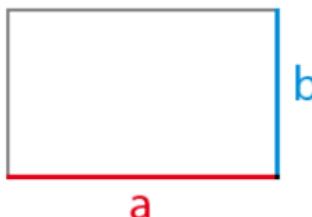
nautilus shell is neither a fibonacci spiral nor a golden spiral



Golden Rectangle (Vila)



Golden Ratio (Vila)



$$\frac{a}{b} = \frac{a+b}{a} = \varphi \text{ (Phi)} = 1.61803399\dots$$



Relationship between Fibonacci sequence and Golden Ratio (Vila)

$$1/1 = 1$$

$$2/1 = 2$$

$$3/2 = 1.5$$

$$5/3 = 1.666666666666$$

$$8/5 = 1.6$$

$$13/8 = 1.625$$

$$21/13 = 1.61538461538$$

$$34/21 = 1.61904761905$$

$$55/34 = 1.61764705882$$

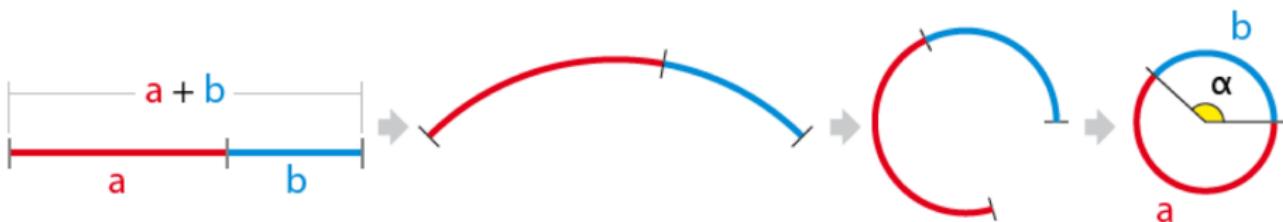
$$89/55 = 1.61818181818$$

—

Phi = 1.6180339887...



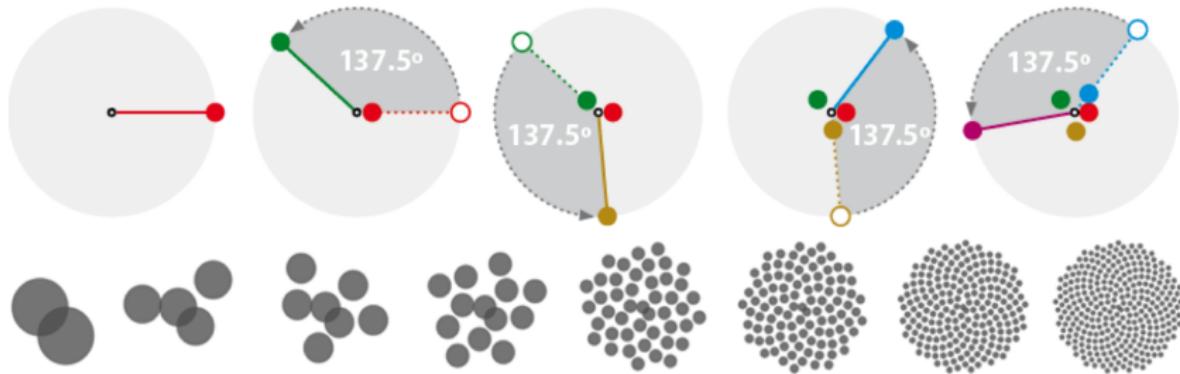
Golden Angle (Vila)



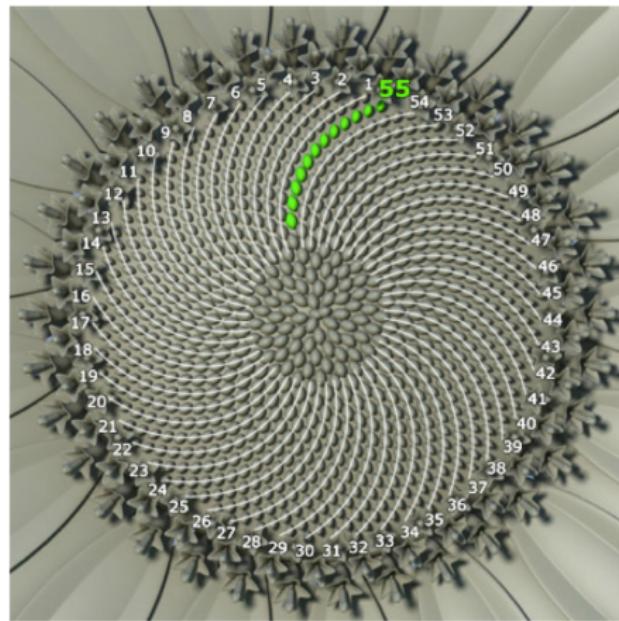
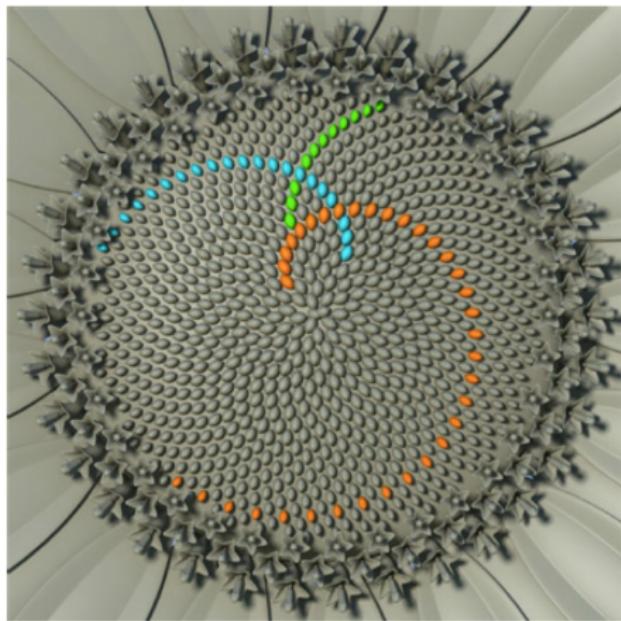
$$\frac{a}{b} = \frac{a+b}{a} = \varphi \text{ (Phi)} = 1.61803399\dots \Rightarrow \alpha = 137.507764^\circ \dots \sim 137.5^\circ$$



Arrangement of sunflower seeds (Vila)



Fibonacci numbers and the spiral patterns of sunflower seeds (Vila)

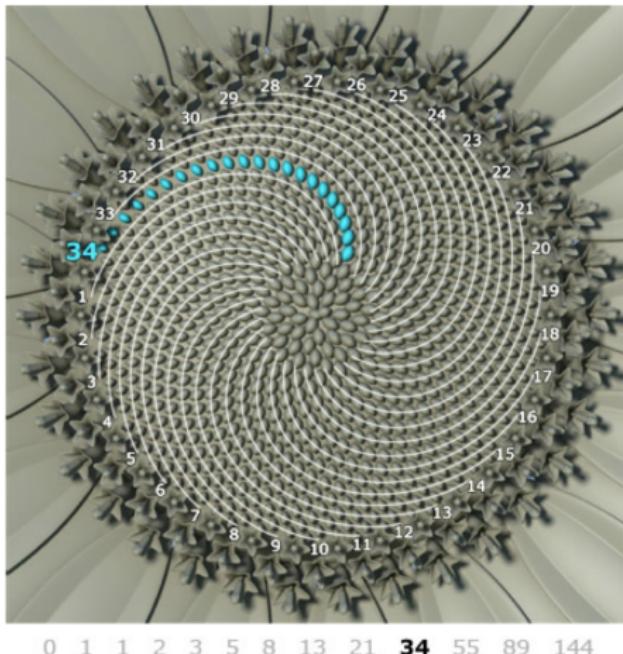


0 1 1 2 3 5 8 13 21 34 **55** 89 144

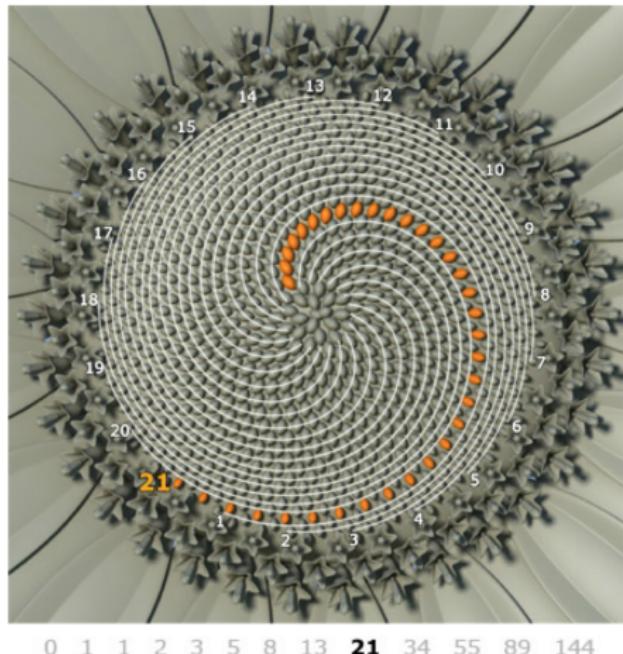


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Fibonacci numbers and the spiral patterns of sunflower seeds (Vila)



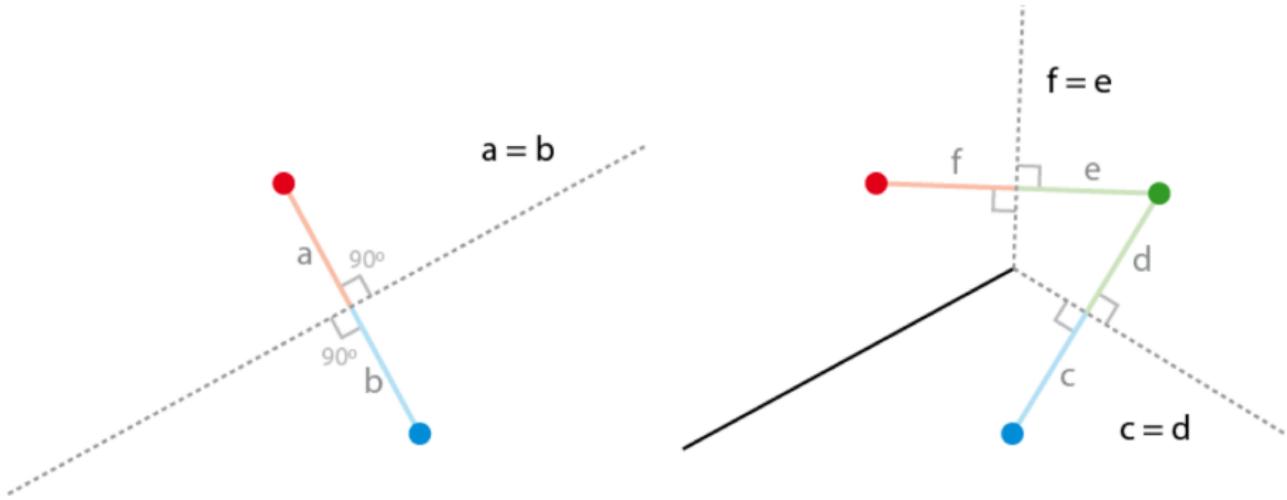
0 1 1 2 3 5 8 13 21 **34** 55 89 144



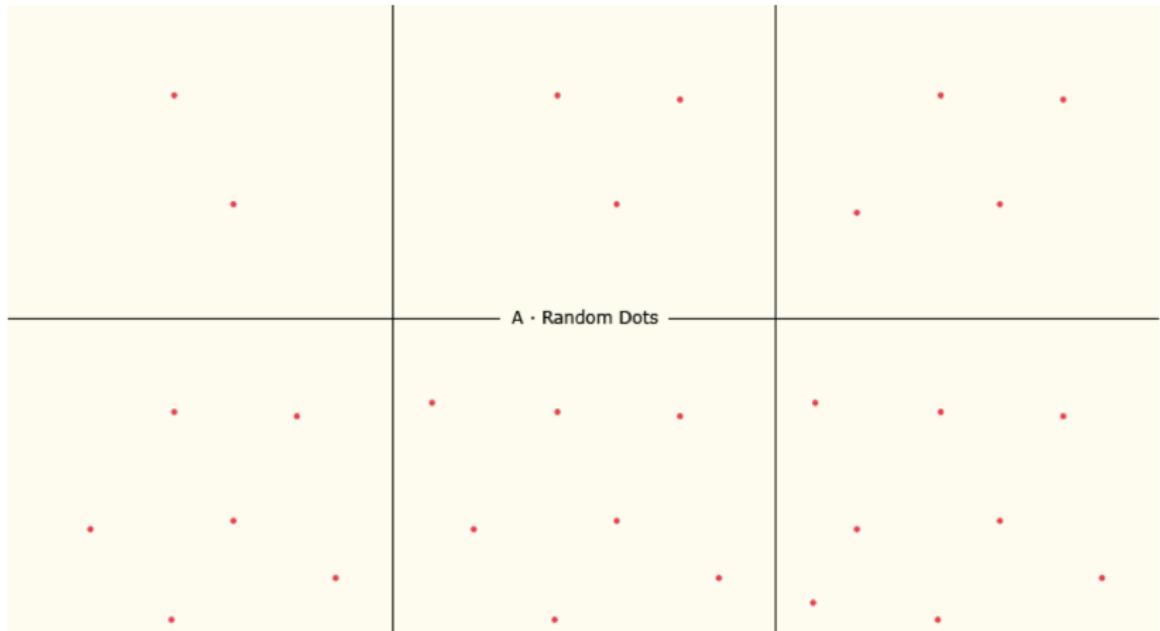
0 1 1 2 3 5 8 13 **21** 34 55 89 144



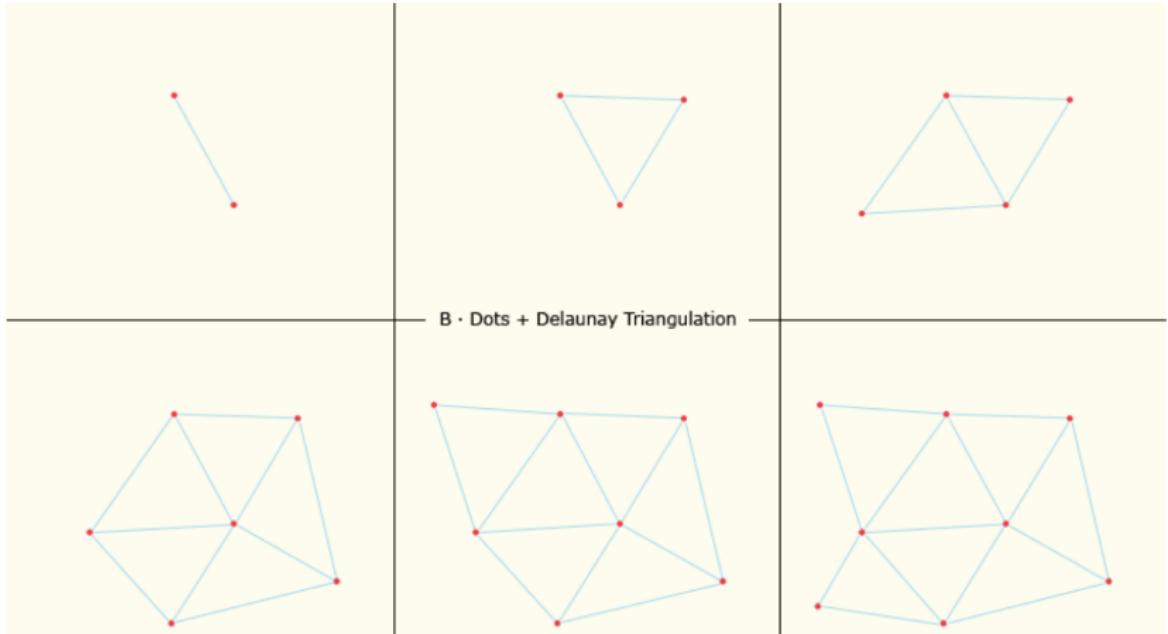
Voronoi Tessellation (Vila)



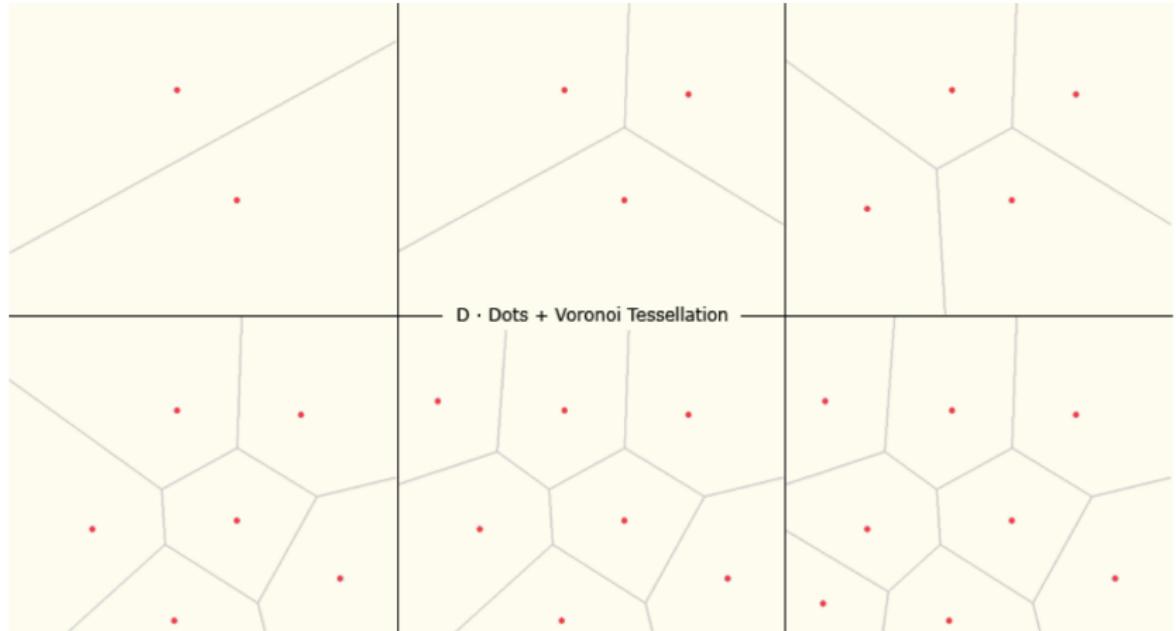
Delaunay Triangulation (Vila)



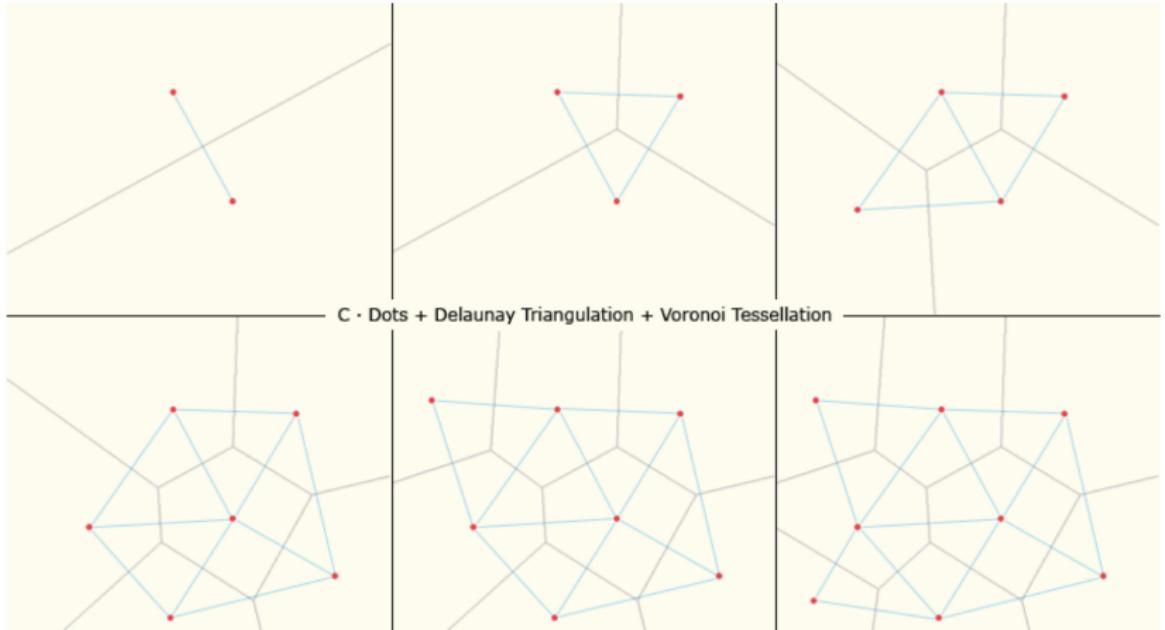
Delaunay Triangulation (Vila)



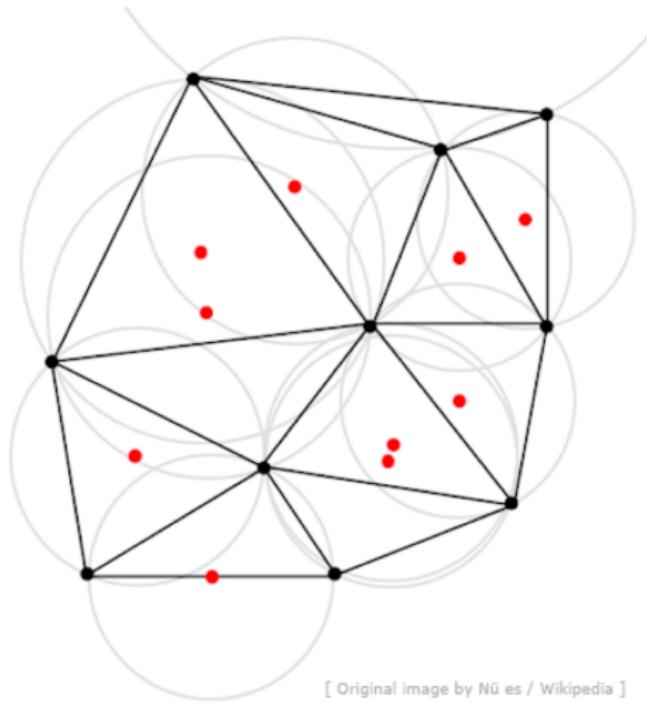
Delaunay Triangulation (Vila)



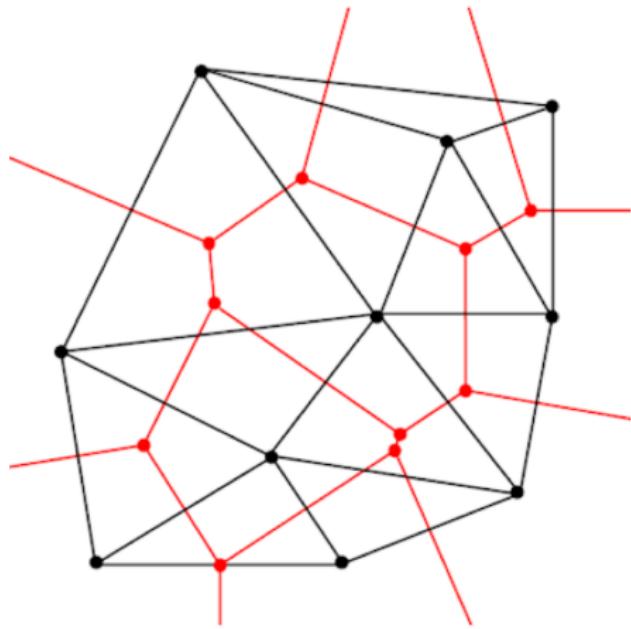
Delaunay Triangulation (Vila)



Delaunay Condition (Vila)



[Original image by Nü es / Wikipedia]

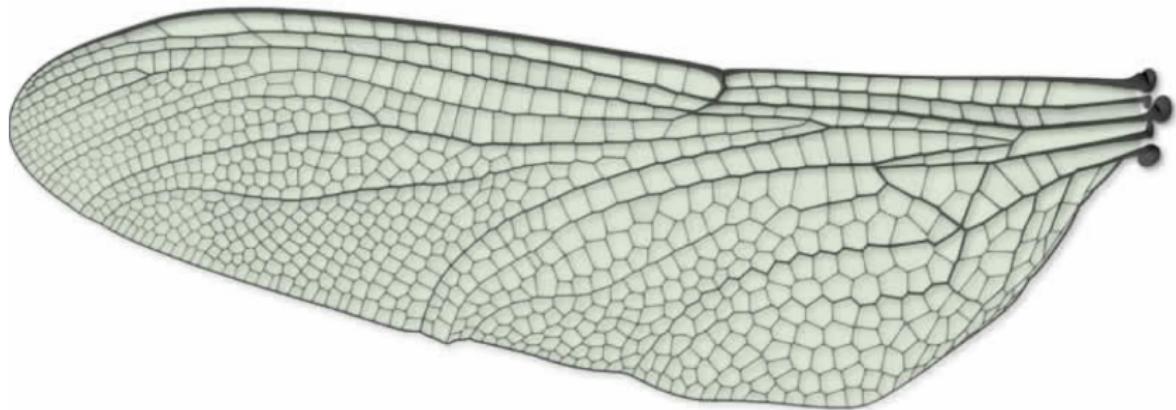


[Original image by Nü es / Wikipedia]

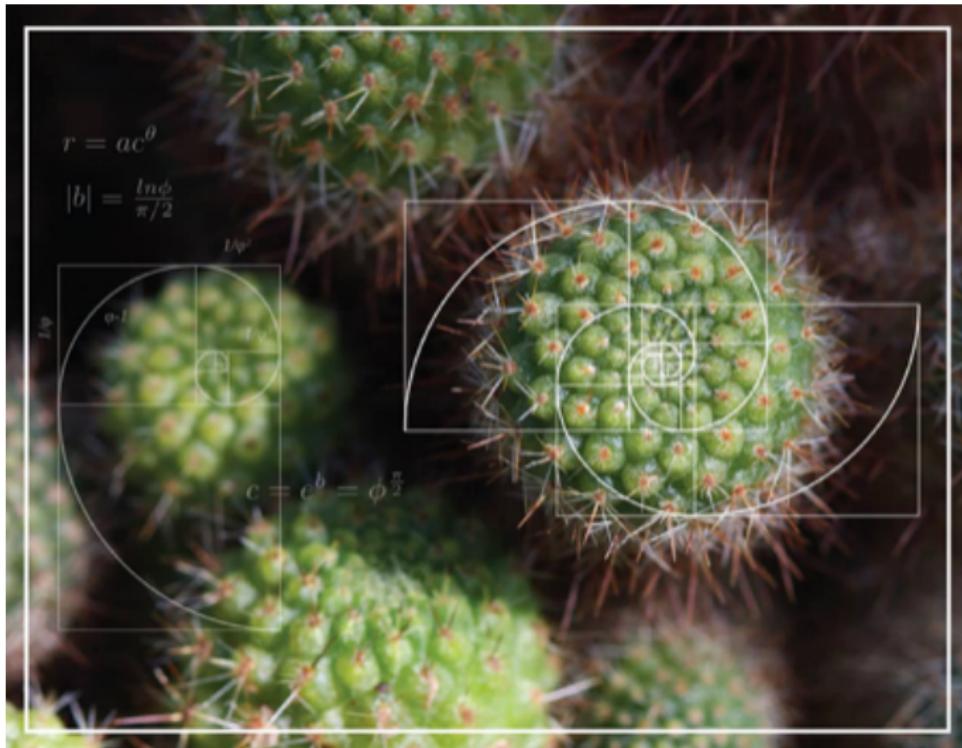


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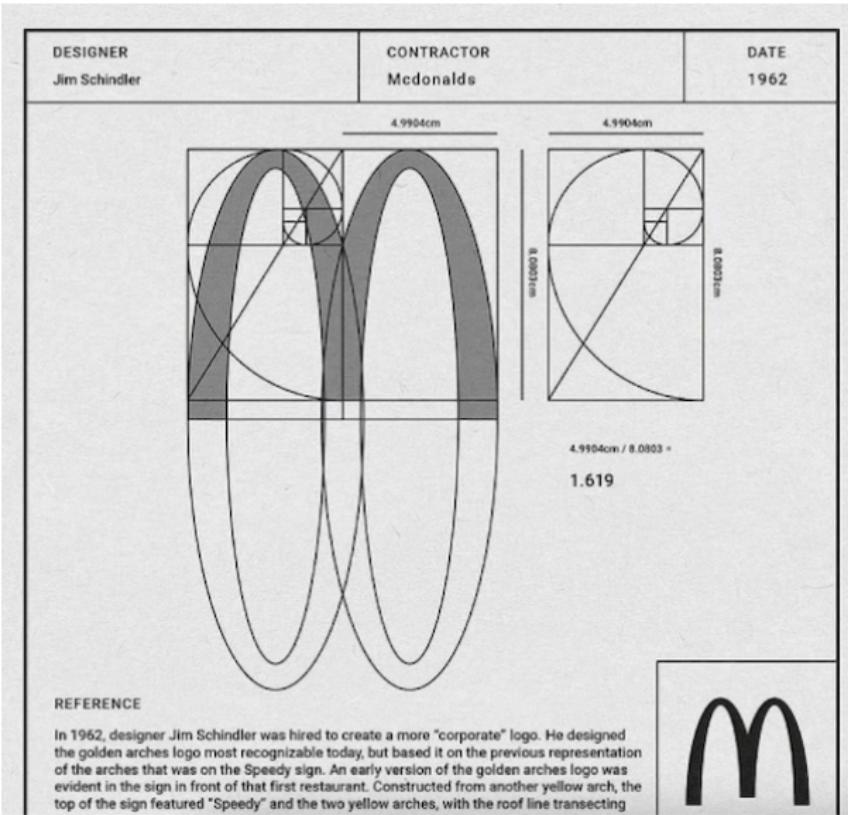
Dragonfly Wing (Vila)



Golden Spiral in Nature



Golden Spiral in Some Famous Logos

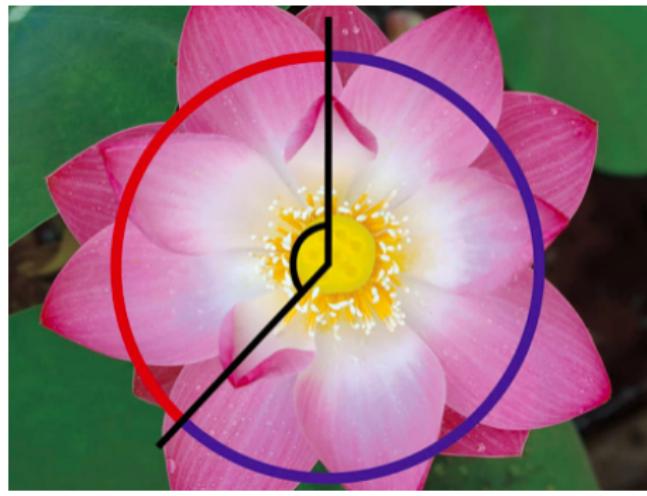
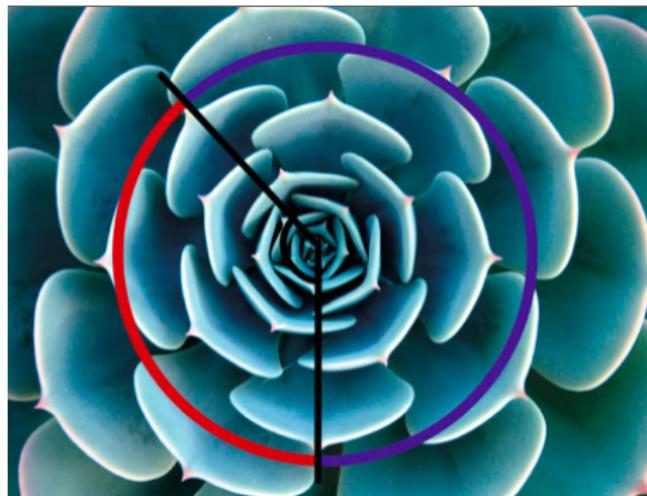


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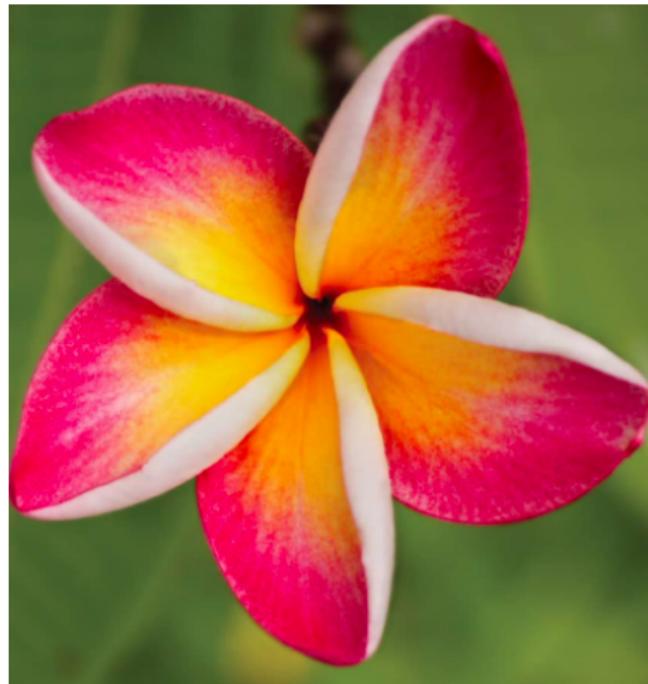
Fibonacci Numbers in Nature



Golden Angle in Nature



The Beauty of Five

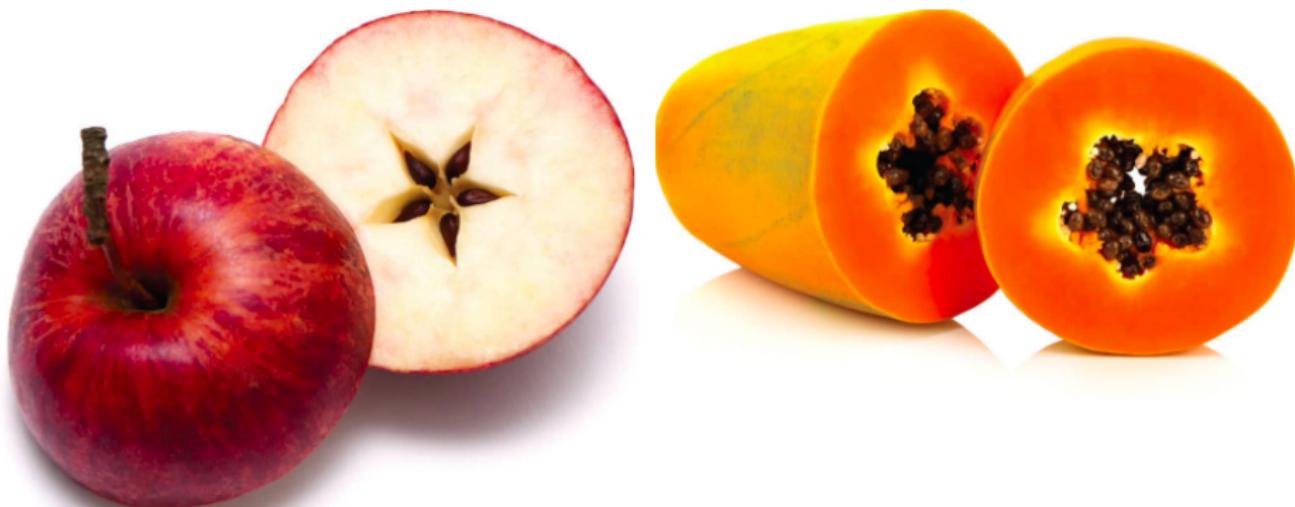


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The Beauty of Five



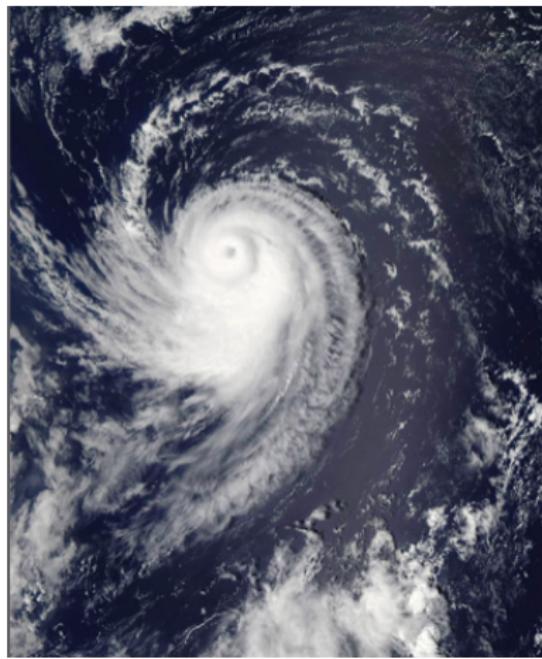
The Beauty of Five



Spirals in Nature



Spirals in Nature



Spirals in Architecture



References

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