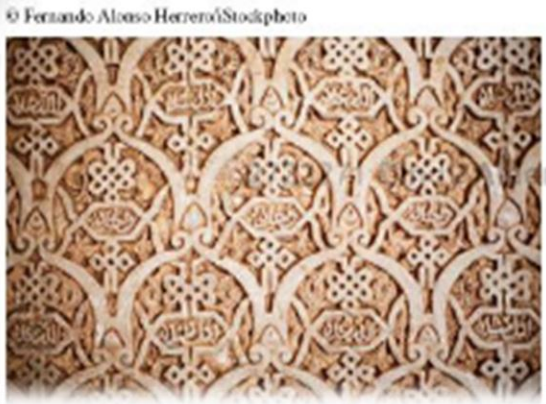
4.4 SOOTHING SYMMETRY AND SPINNING PINWHEELS

Can a Floor Be Tiled Without Any Repeating Pattern?



QUESTION OF THE DAY:

What is the most symmetric shape you can think of?

Question of the Day

What is the most symmetric shape you can think of?

Human Symmetry & Beauty

Judith Langlois

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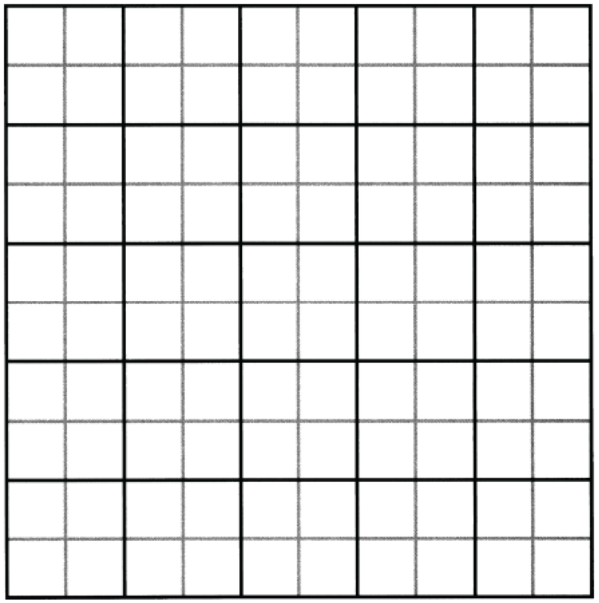
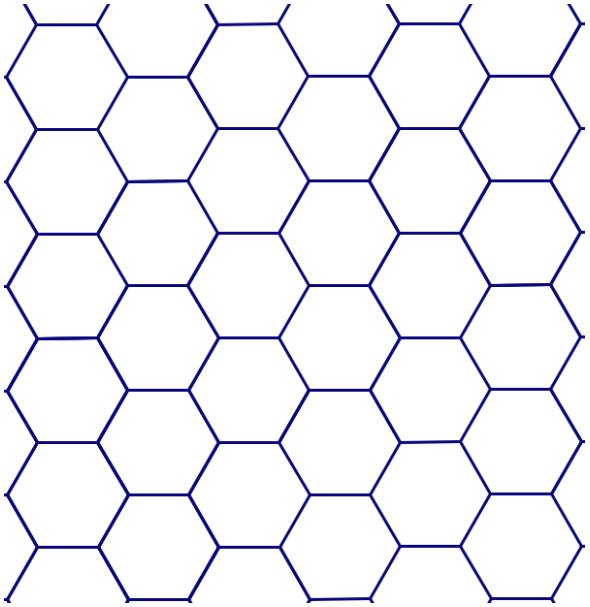
- An average computer-generated face made from 32 actual faces.

Floor Tilings

- Describe common patterns found in floor tilings:

What is Symmetry?





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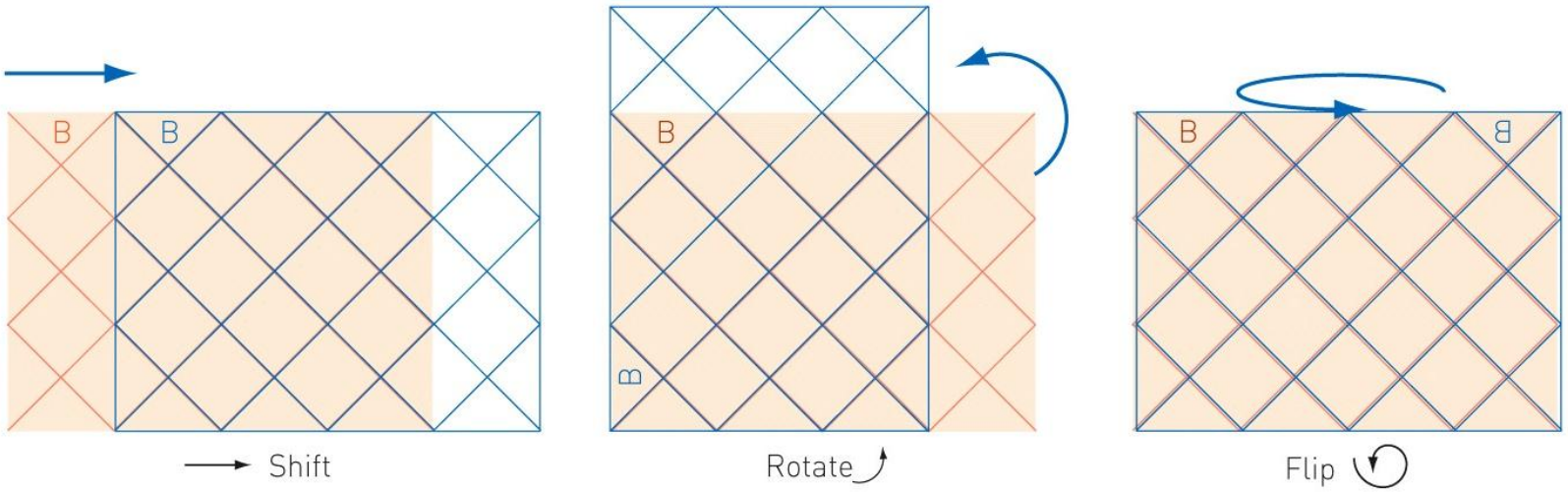
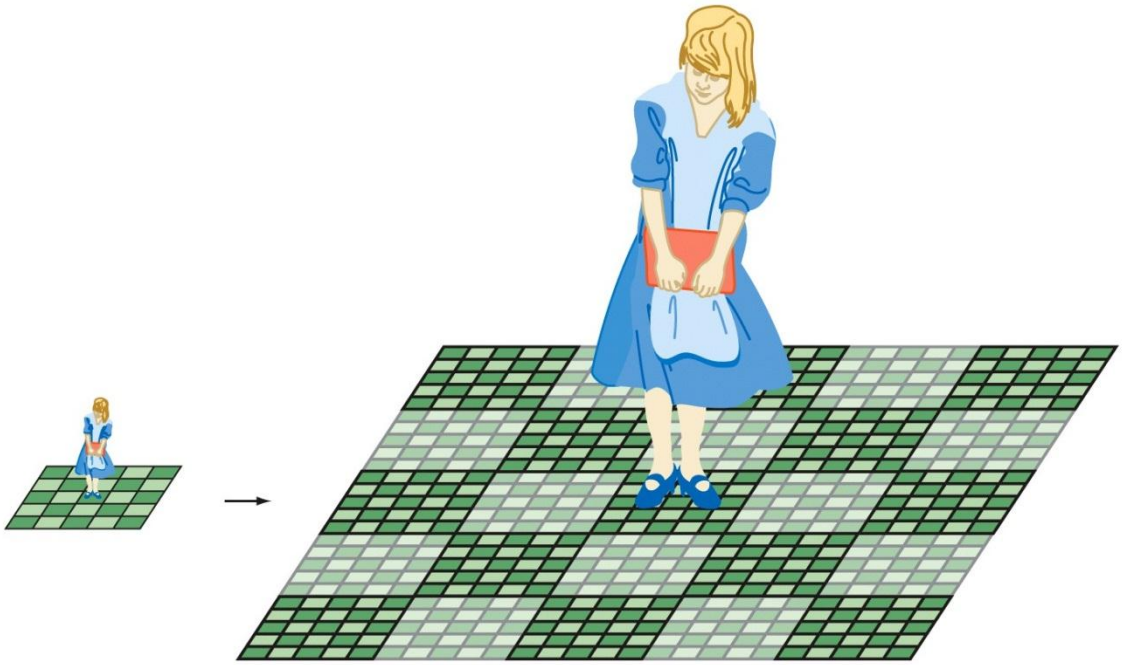
What is Rigid Symmetry?

- *Rigid symmetry* of a pattern in the plane is



What is Symmetry of Scale?

- A pattern in the plane has *a symmetry of scale* or is *scalable* if



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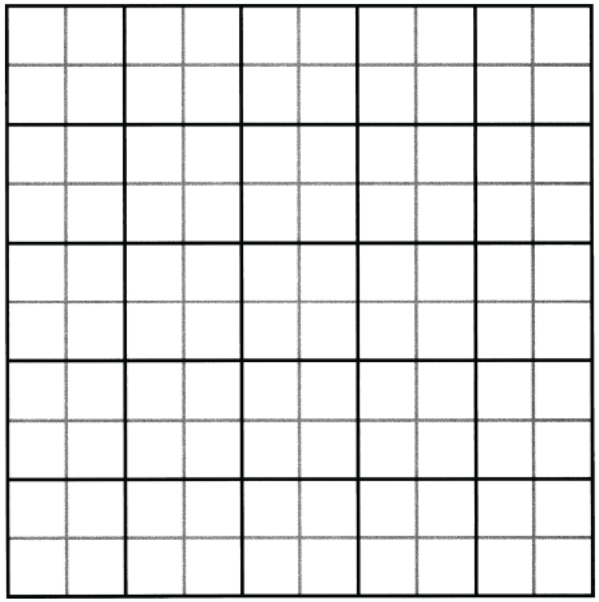
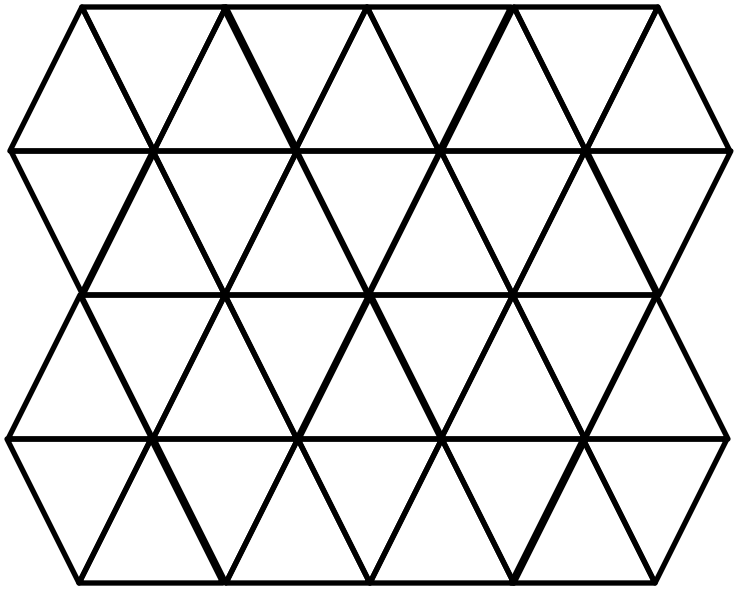
Symmetry of Scale

- If you can take a tile and surround it with copies of itself to create a super-tile of the same shape, then you have a method to tile the plane.
- When you use this method, you automatically get symmetry of scale.

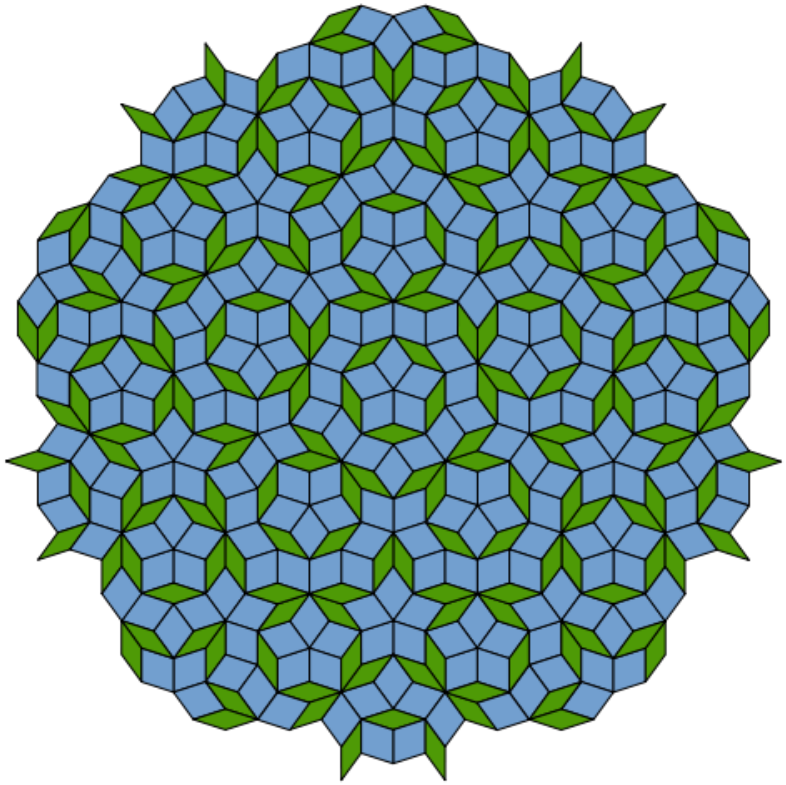
A Strange Question

- Suppose we have a pattern that is so regular that it has symmetry of scale. Must that pattern also have rigid symmetry?





Penrose Patterns



- http://www.youtube.com/watch?v=yK4P17Lsp2A
- http://www.youtube.com/watch?v=Pyg0f27kKXw

Quilted with Math

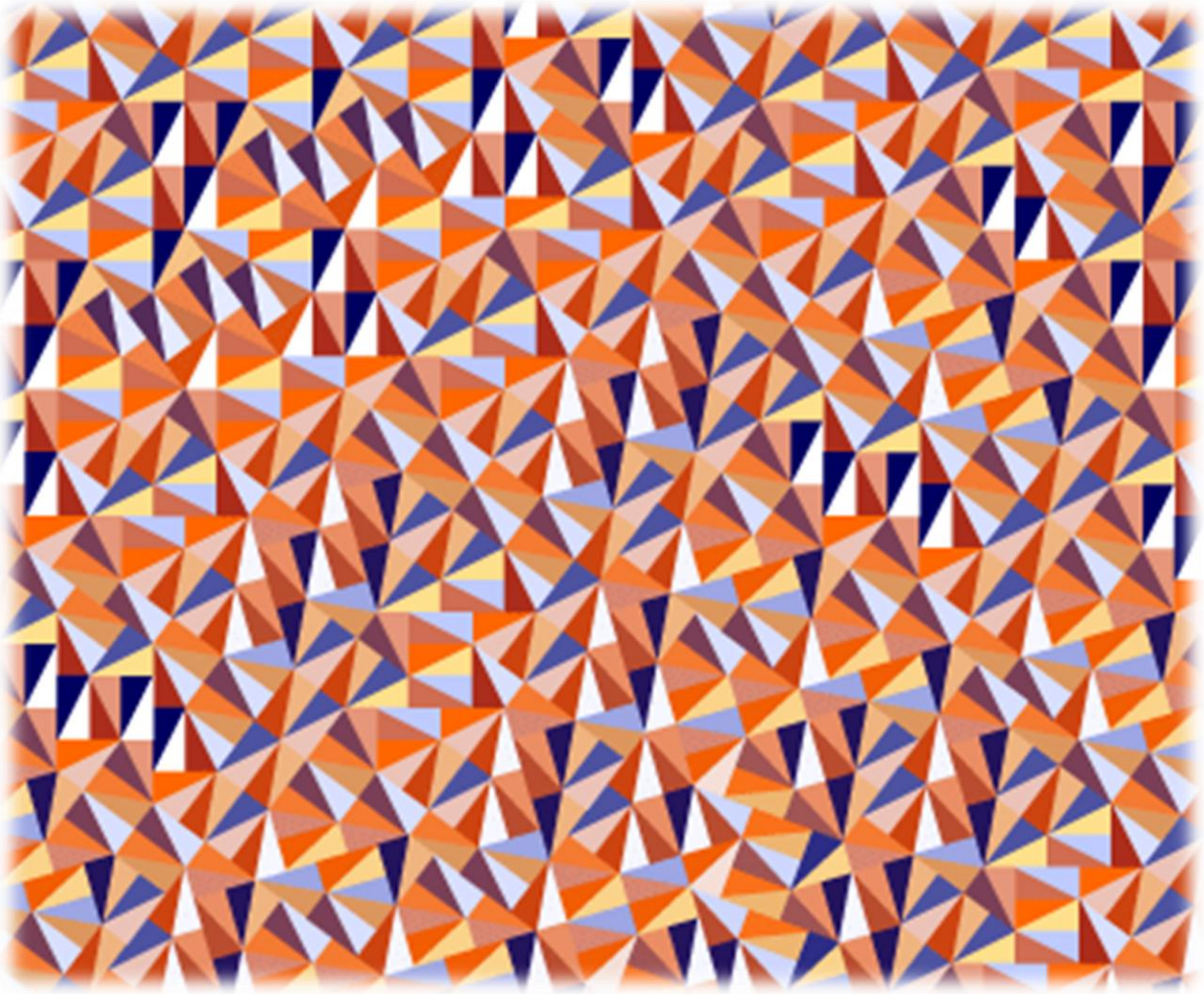
- When Rodger Penrose's wife brought home some Kleenex toilet paper made by the British division of the Kimberly-Clark Corporation that appeared to be quilted with the same pattern Penrose had developed and patented back in the 1970s, he was a little less than pleased.

Mathematician sues maker of Kleenex

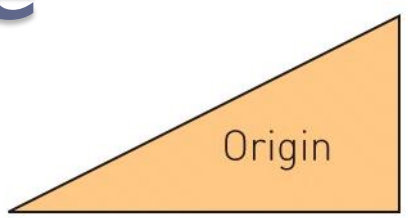
LONDON — One of Britain's most distinguished mathematicians is suing Kimberly-Clark, claiming the company is using his copyright design on its Kleenex quilted toilet paper. The suit brought by Sir Roger Penrose, a professor of mathematics at Oxford University, alleges that the company is using a pattern that has the same overall appearance as "the Penrose Pattern." Penrose devised the complex design in the 1970s. Penrose is best known for his work with Stephen Hawking of Cambridge University on relativity, black holes and the question of whether time has a beginning.

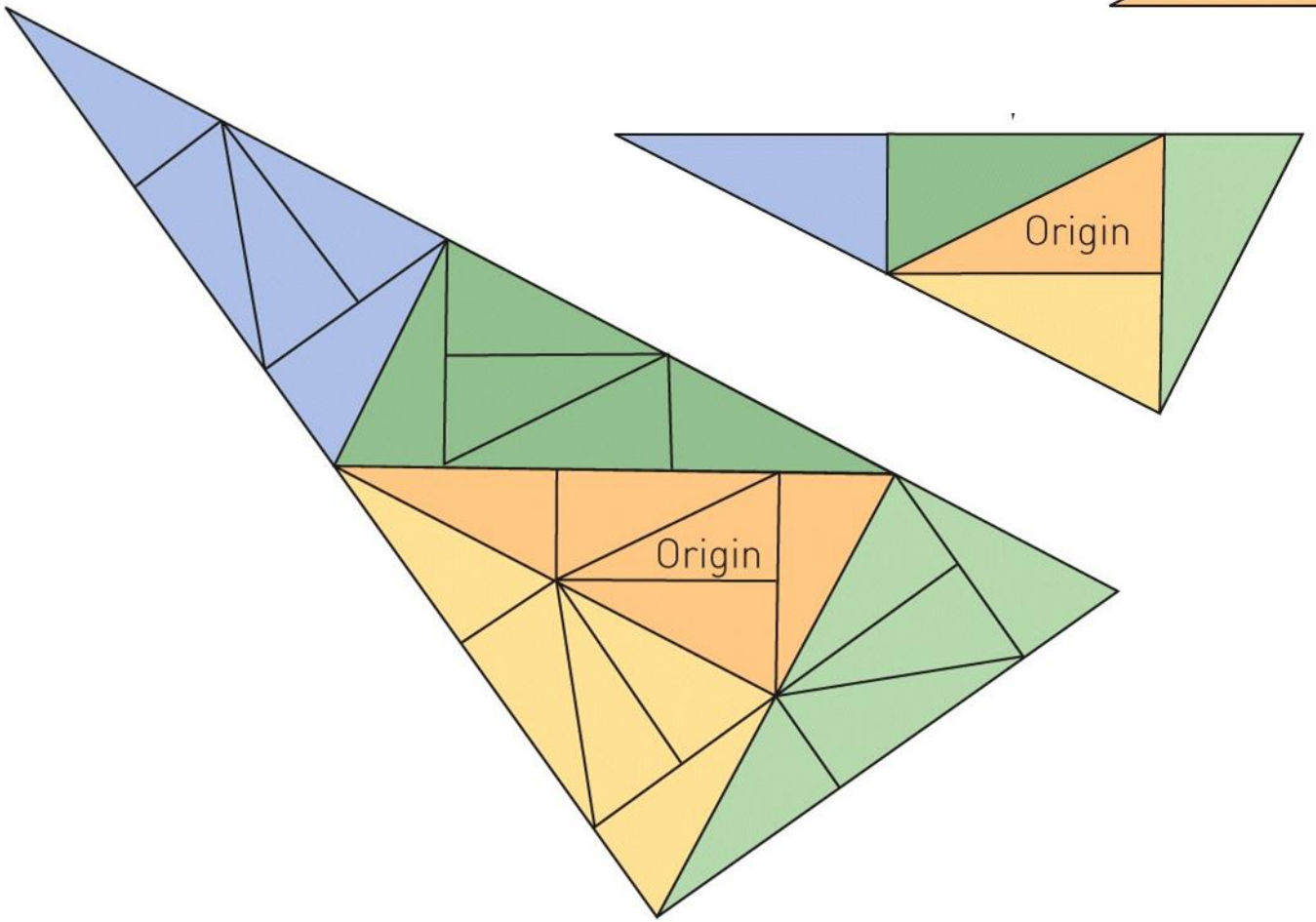
- The company explained that the quilted aperiodic pattern made it so that the toilet paper sat evenly on the roll.

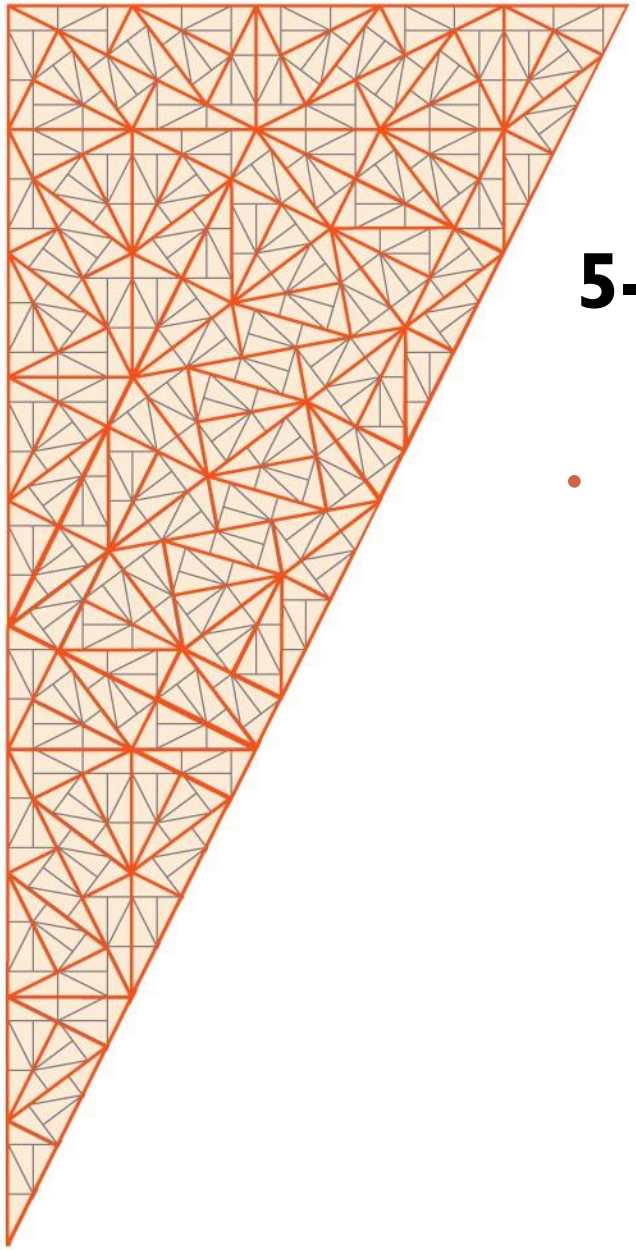
The Pinwheel Pattern



Construction of The Pinwheel Pattern







5-unit Pinwheel Triangles

- How many triangles make up this super-super-super tile?

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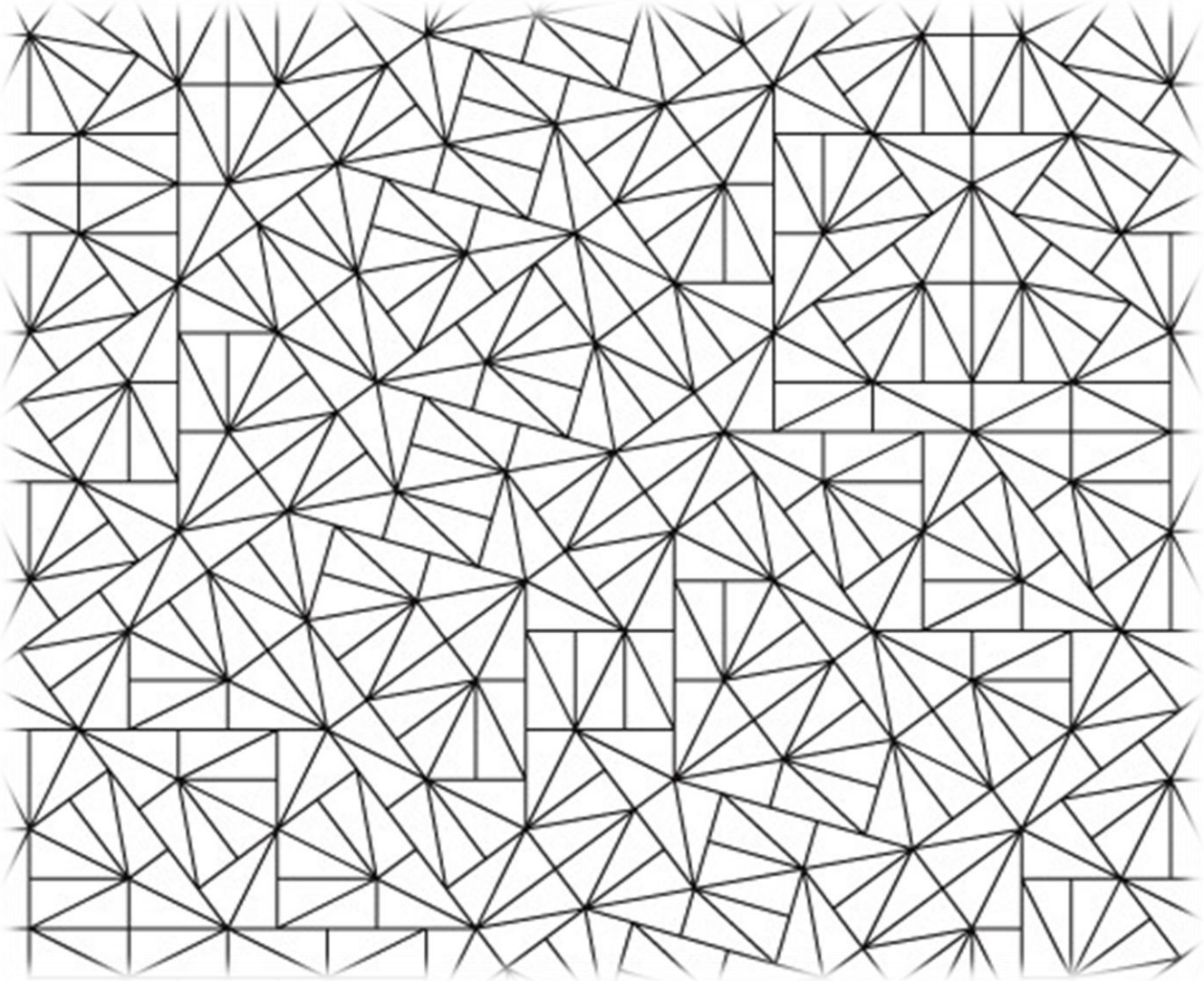
A 625-unit Pinwheel Triangle showing 5-unit and 25-unit components.

A 625-unit Pinwheel Triangle showing 5-unit, 25-unit, and 125-unit components.

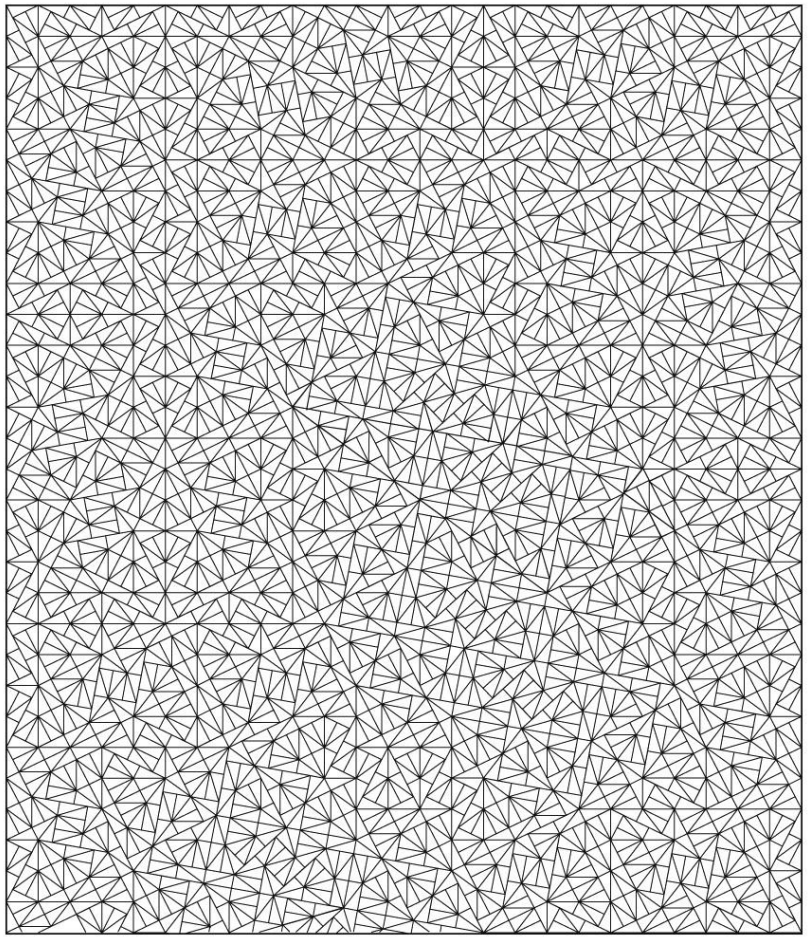
The Pinwheel Pattern



The Pinwheel Pattern

- Uniqueness of Scaling:

- Rigid Symmetry:



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Homework

- Read 4.4 Soothing Symmetry and Spinning Pinwheels pgs. 249-269.
- Mindscapes 4.4 #2, 6, 8, 10, 12, 16
- The Mαth βook Presentation

Resources

- http://tilings.math.uni-bielefeld.de/substitution_rules/pinwheel