2021.
KNUE-UNESCO UNITWIN
International Conference

Making Your Own Tessellation Clock

Korea National University of Education
Prof. Kwang-ho Lee

* Order of Contents

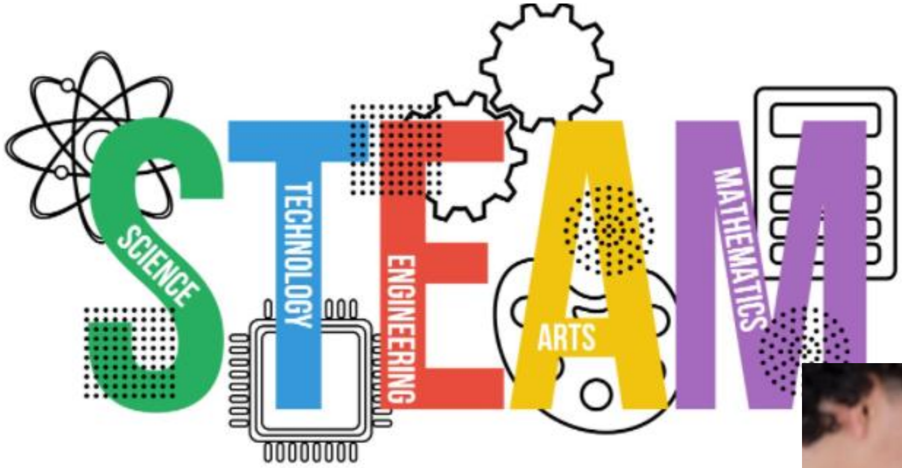
1.STEAM contents

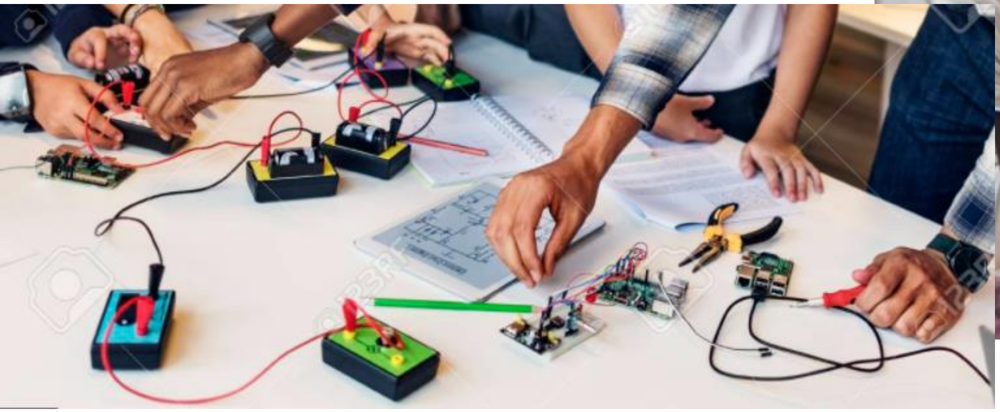
2. Tessellation

3. Making Clock

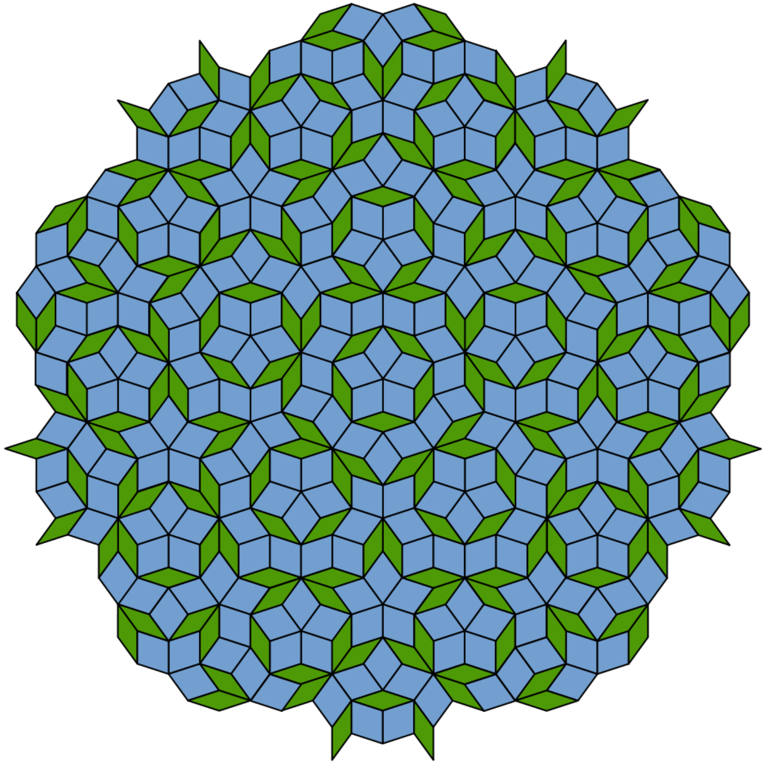
4. **Conclusion**

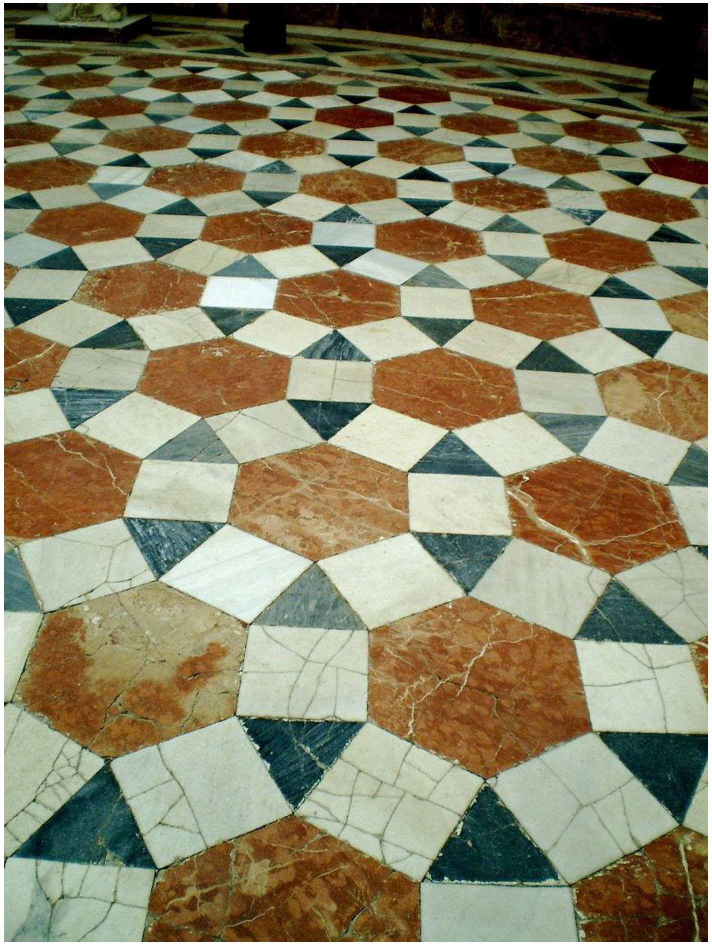
Introduction



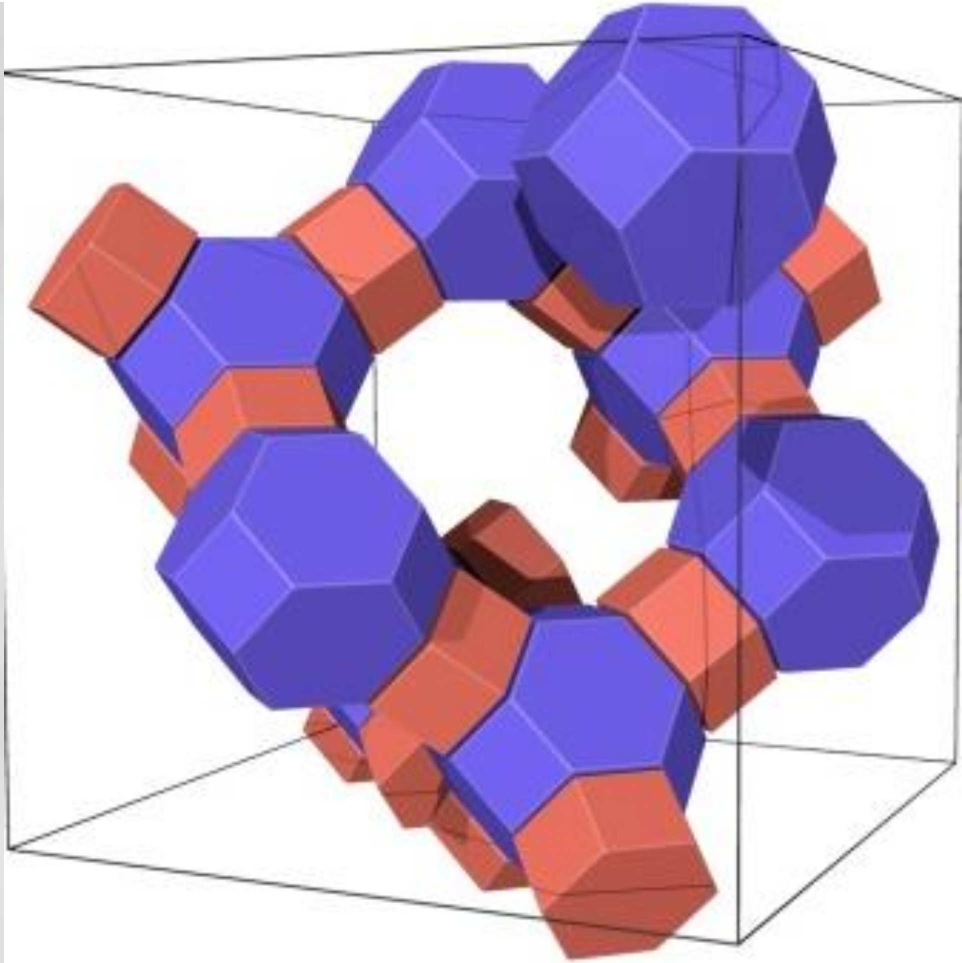


What is a Tessellation?

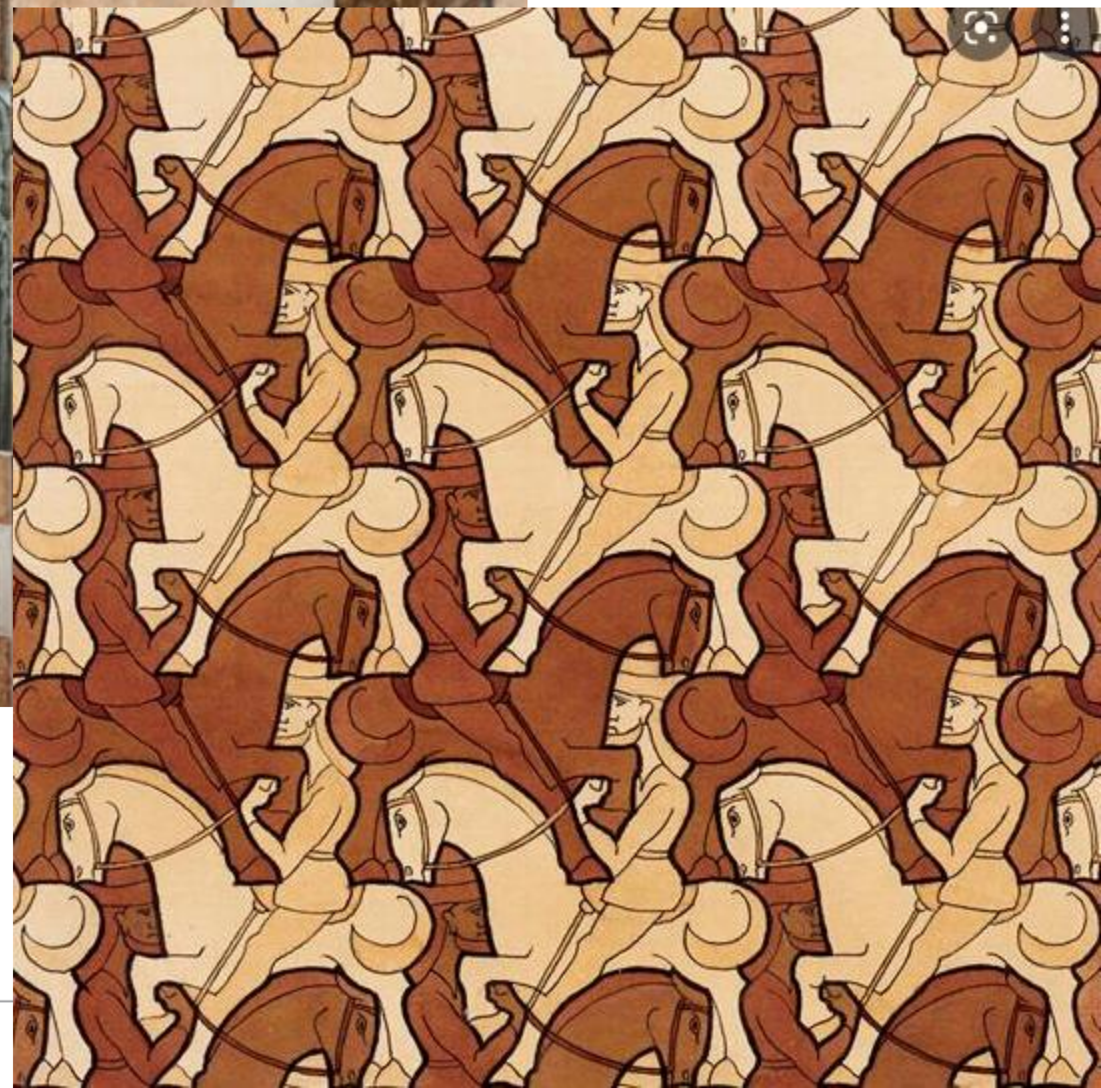




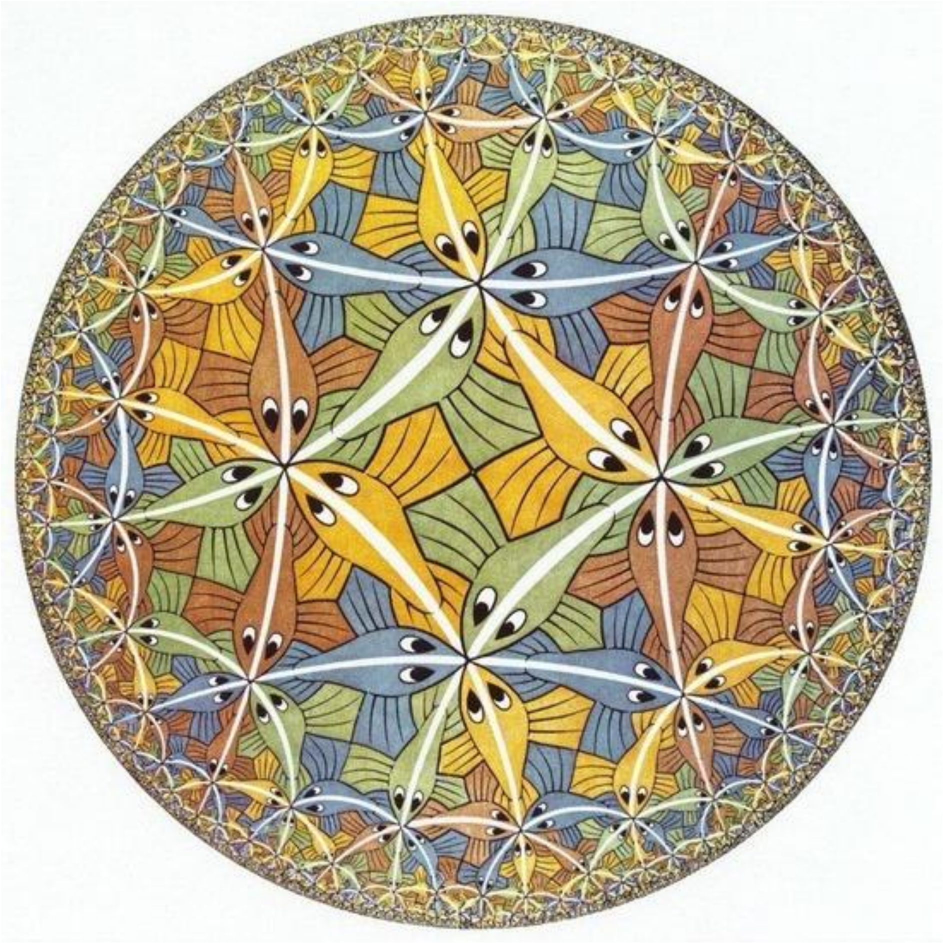
History of Tessellation

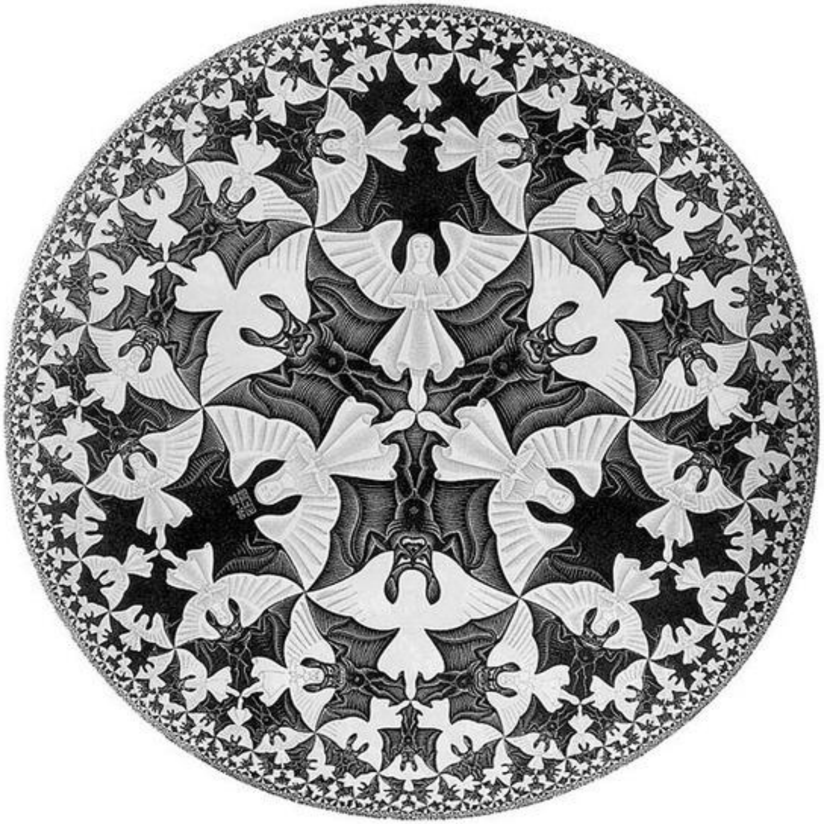


Application of Tessellation

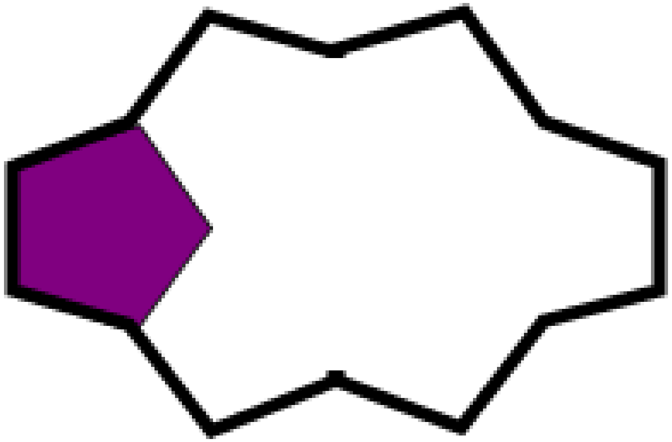


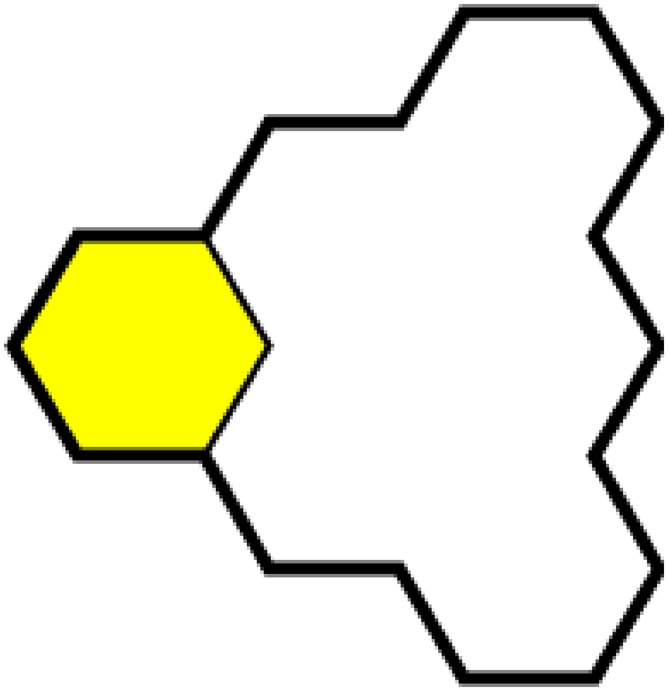
Types of Tessellation





Regular Tessellation





Regular Tessellation

Possible regular polygons for Regular tessellation

Why are there only 3 regular tessellations?

Proof)

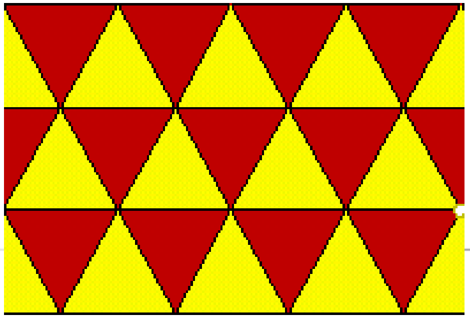
If a point is surrounded by k regular n-polygons

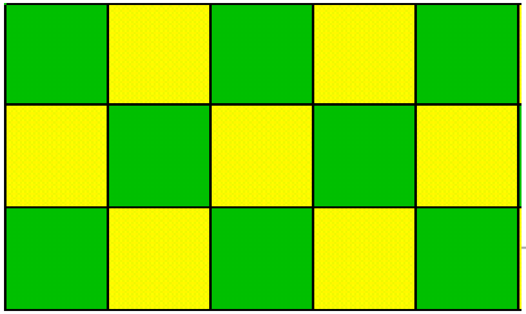
An interior angle of Regular n-polygon is $\frac{(n-2)\pi}{n}$

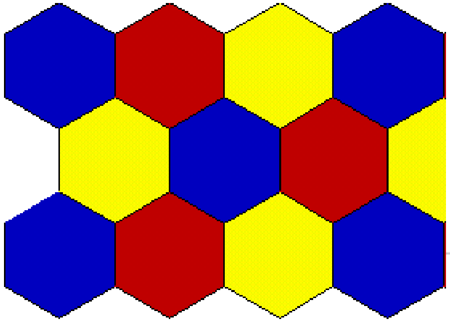
$$\frac{(n-2)\pi}{n} \times k = 2\pi \ (n \geq 3, k \geq 3, n, k \in N)$$

$$(n-2)k = 2n, \qquad nk - 2n - 3k = 0, or\ (n-2)(k-2) = 4$$

$$n = 3, 4, 6$$

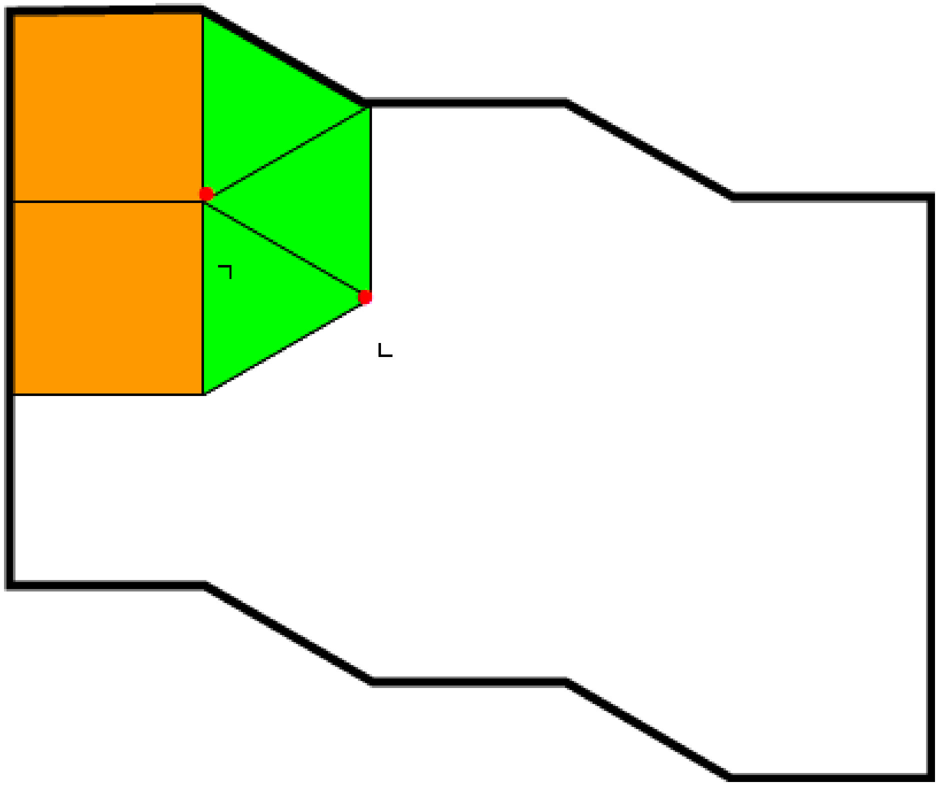






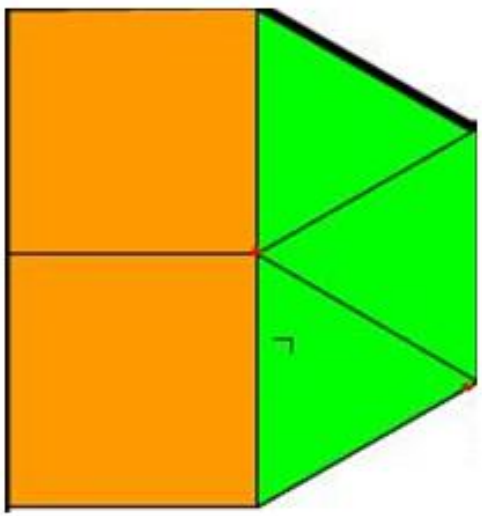
Archimedean Tessellation

Find combinations of regular polygons that fill 360 degrees



Archimedean Tessellation

Naming Tessellations



Type and number of regular polygons gathered at vertex ㄱ
→3 equilateral triangles, 2 squares,
Record the smallest number to appear first
→From an equilateral tringle

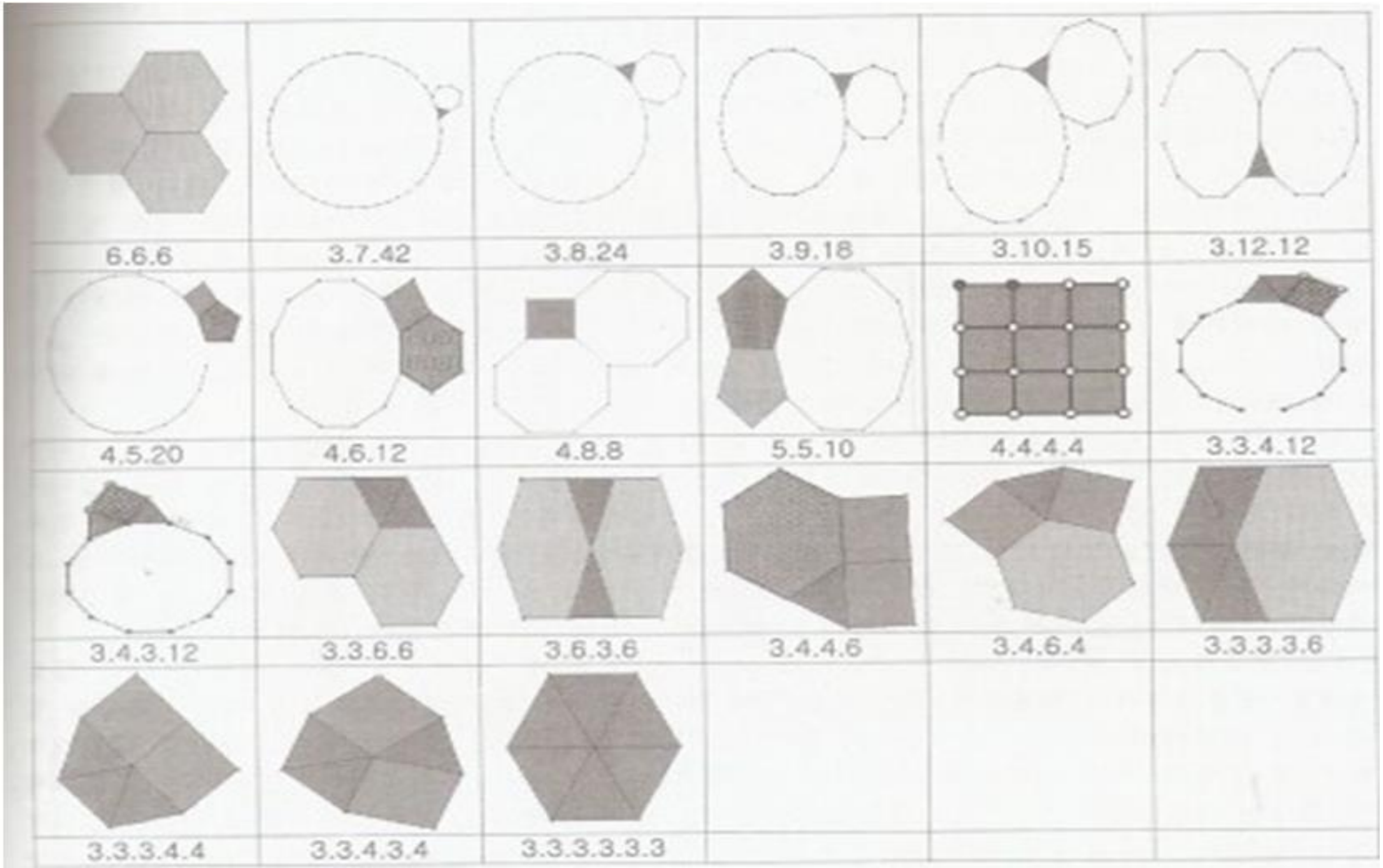
→3.3.3.4.4.

Archimedean Tessellation

Finding Archimedean Tessellations(AT)

Regular Polygon	Sum of interior angles	An interior angle
Equilateral Triangle	180	60
Square	360	90
Regular Pentagon	540	108
Regular Hexagon	720	120
Regular Heptagon	900	128.5
Regular Octagon	1080	135
:	:	:
Regular n-polygon	(n-2)X180	(n-2)X180÷n

Archimedean Tessellation



Archimedean Tessellation

Determining arrays that allow AT

Proof]

$1)k = 3$

Assume that (a, b, c) is possible AT.

$\left(\frac{a-2}{a} + \frac{b-2}{b} + \frac{c-2}{c}\right)\pi = 2\pi$ must be satisfied.

Therefore

$$1 - \frac{2}{a} + 1 - \frac{2}{b} + 1 - \frac{2}{c} = 2,$$

$$\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = \frac{1}{2} \quad \text{----- (1)}$$

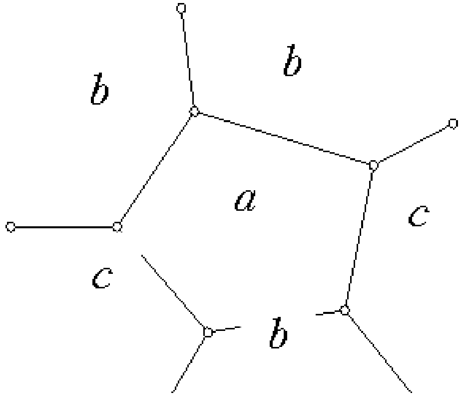
$$3 \leq a \leq b \leq c.$$

(3,7,42), (3,9,18), (3,10,15), (3,12,12), (4,5,20), (4,6,12), (4,8,8), (5,5,10), (6,6,6).

Archimedean Tessellation

Determining arrays that allow AT

Proof]
Assume a is odd,
the combination surrounding a-polygon (b,c,b,c, …,b,c,b).
all must have the same arrangement, so $b = c$.
(3,7,42), (3,8,24), (3,9,18), (3,10,15), (4,5,20), (5,5,10)
cannot be AT
(6,6,6)is not because all figures are the same
(3,12,12), (4,6,12), (4,8,8) are AT

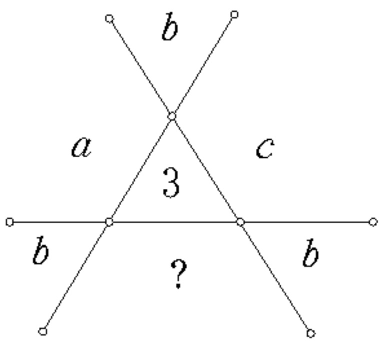


Archimedean Tessellation

Determining arrays that allow AT

Proof]
when $k = 4$

$$\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{d}=1$$
$$3 \leq a \leq b \leq c \leq d$$



Possible combinations (3,3,4,12), (3,3,6,6), (3,4,4,6), (4,4,4,4).
(4,4,4,4)is not AT
(3,3,4,12), (3,4,3,12),(3,3,6,6), (3,6,3,6), (3,4,4,6),(3,4,6,4)
Let's (3,a,b,c) can be AT.
$a = c$ must be satisfied.
So (3,6,3,6), (3,4,6,4) are AT

Archimedean Tessellation

Determining arrays that allow AT

Proof]

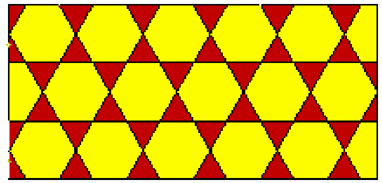
when $k = 5$

$$\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{d}+\frac{1}{e}=\frac{3}{2}$$
$$3 \leq a \leq b \leq c \leq d \leq e$$

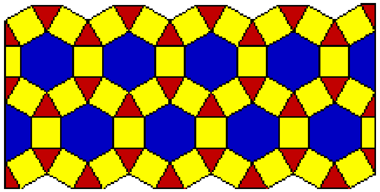
(3,3,3,3,6), (3,3,3,4,4), (3,3,4,3,4)

Archimedean Tessellation

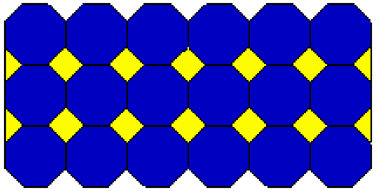
8 are the AT.



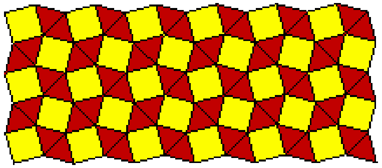
(3,6,3,6)



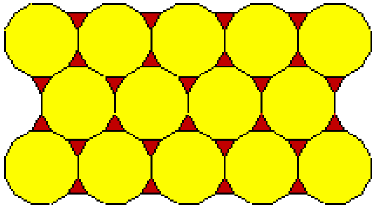
(3,4,6,4)



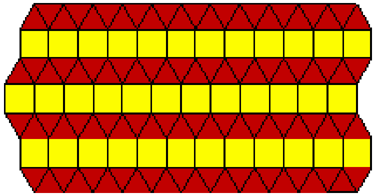
(4,8,8)



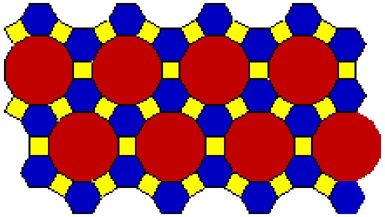
(3,3,4,3,4)



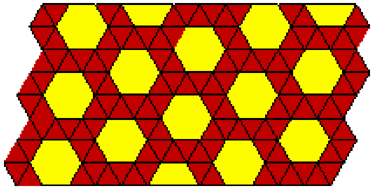
(3,12,12)



(3,3,3,4,4)



(4,6,12)



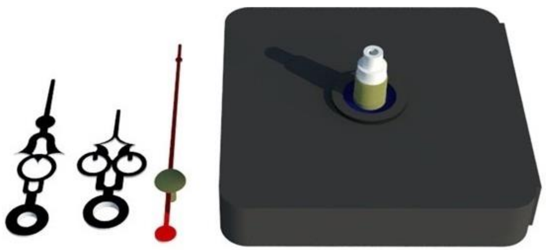
(3,3,3,3,6)

Archimedean Tessellation

Making your own clock using AT

Materials

1. Clock kit, Numbers, Woodrock
2. Color papers with and equilateral triangle, square, regular pentagon, regular hexagon, regular octagon, regular dodecagon with same sides.
3. Driver, Spanner, Glue, battery





Archimedean Tessellation

Making your own clock using AT

The order

1. Planning a design with AT
2. Create a clock face according to your design
3. Decorate with clock hands and numbers
4. Advertise your design
5. Appreciating the work

Conclusion

- → Attract the interest before delivering the content of formal geometry
- → Enable learners to develop their own discoverability and exploration ability
- → An important transformation concept was used
  number of vertices and sides of a polygon, size of interior angles, congruence,
  symmetry-(important concept in mathematics and science)
- → Make a work of art
- → Help to enhance the creativity of the learners

Thank you for attention