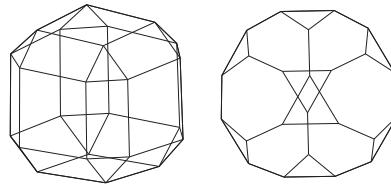


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Please keep all relevant information.
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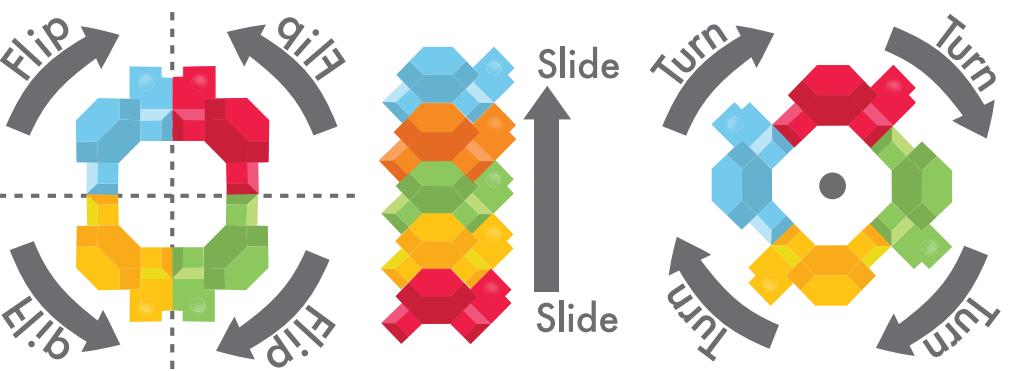
REPTANGLES™

EXPLORATION GUIDE

Table of Contents

Information
Basic Structures and Symmetries
Building Polyhedra
Creative Exploration Activities
Pattern Puzzles
Expert Puzzles

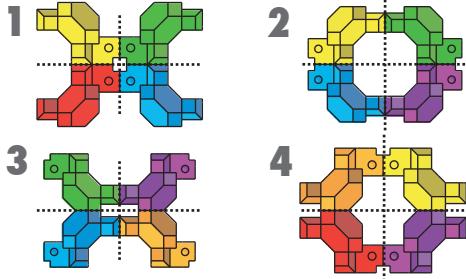
pages 1-2
pages 3-5
pages 6-10
pages 11-14
pages 15-16
pages 17-18



BASIC STRUCTURES

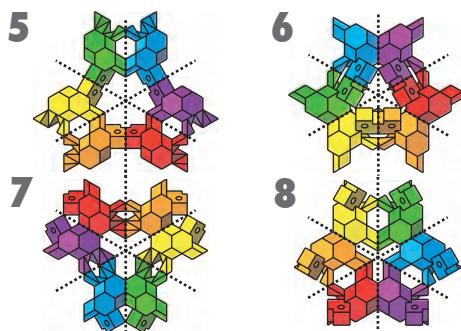
2-Fold Mirror Symmetries

Reptangles match up across 2 mirror lines.



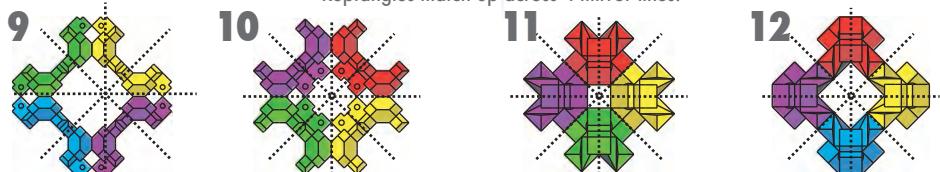
3-Fold Mirror Symmetries

Reptangles match up across 3 mirror lines.



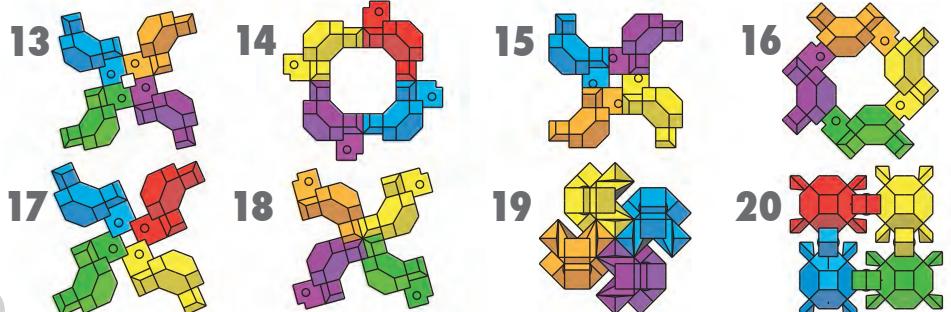
4-Fold Mirror Symmetries

Reptangles match up across 4 mirror lines.



4th Order Rotational Symmetries

Reptangles match up 4 times during one 360° rotation.



ROTATION PATTERN PUZZLES

Refer to corresponding numbers found on pages 3-4 and 7-10

Add new Reptangles to the starter structure until every Reptangle in the structure makes exactly the same connections as every other Reptangle.

Example

13

Pattern Clue

Green is touching blue's forehead with its chin

Blue is touching Green's chin with its forehead.

Solution

Now everybody's forehead is touching somebody else's chin, and everybody's chin is touching somebody else's forehead.

18

19

4 Reptangles Required

14

15

16

17

20

3 Reptangles Required

21

22

23

24

25

8 Required

26

24 Reptangles Required

74

75

77

12 Reptangles Required

80

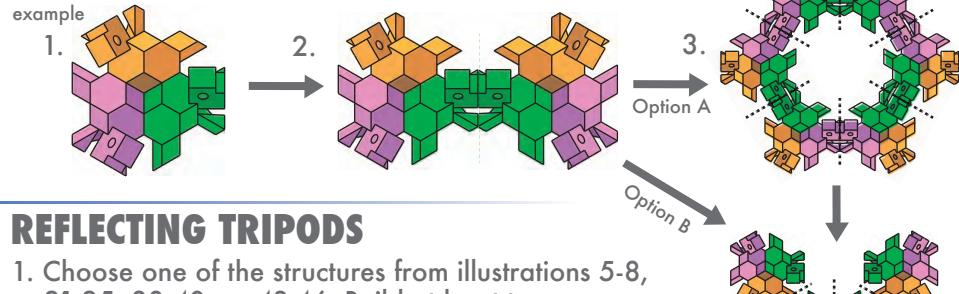
81

82

78

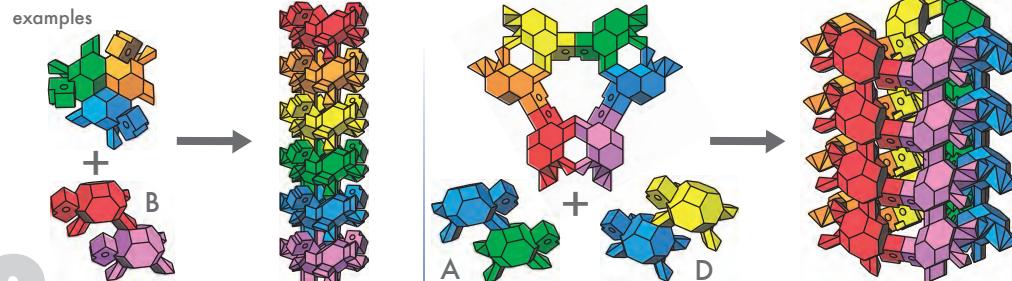
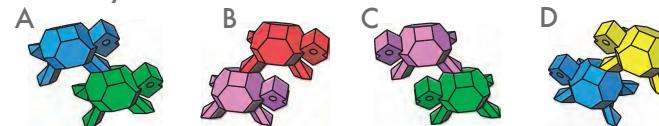
REFLECTING TRIPODS

1. Build a tripod structure from page 4 (illustrations 21-25). Set your tripod on a flat surface so it can be viewed from the top.
2. Find a way to reflect the tripod by connecting 3 new Reptangles.
3. Continue reflecting one or more tripods at a time.
As you see a pattern develop, continue building.



REFLECTING TRIPODS

1. Choose one of the structures from illustrations 5-8, 21-25, 38-40, or 43-46. Build at least two.
2. Use one or more of these four connections to stack your structures and create tubes.

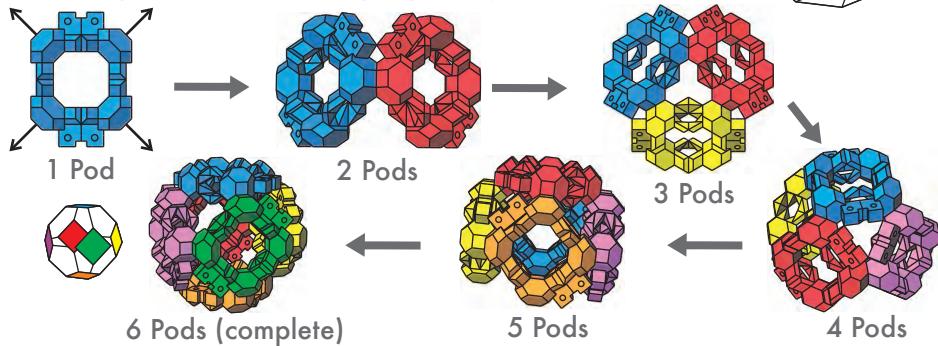


BUILDING POLYHEDRA

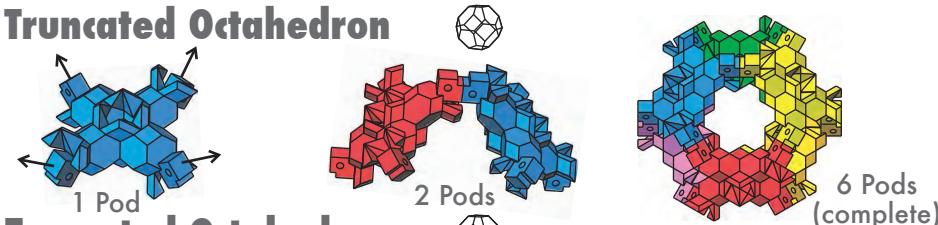
Build polyhedra with identical "pods" by repeating the same connections over and over.

68 Truncated Octahedron

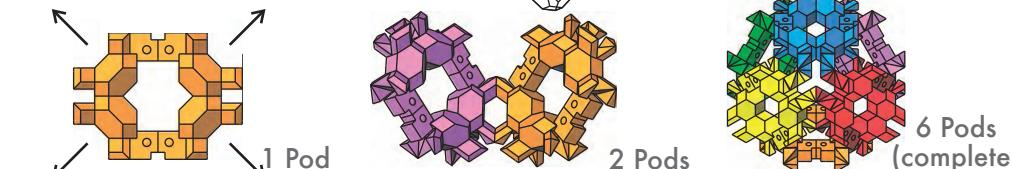
Connect each pod to four others by repeating these connections.



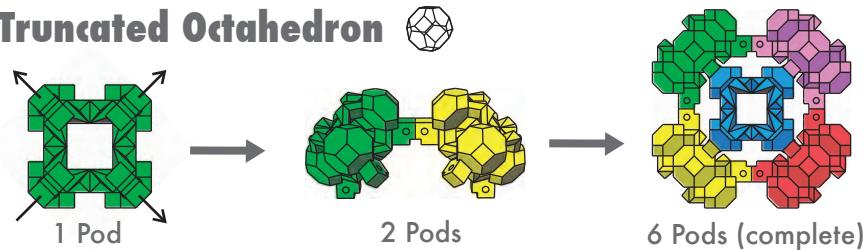
69 Truncated Octahedron



70 Truncated Octahedron



71 Truncated Octahedron



72 Truncated Octahedron



73 Truncated Octahedron

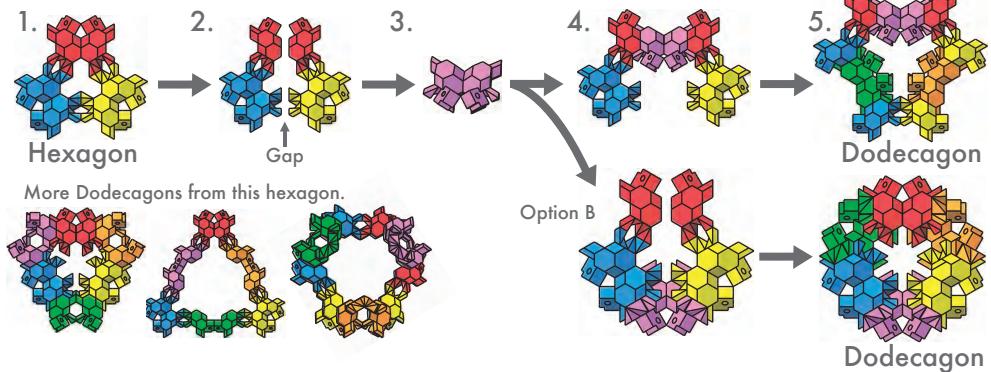


74 Truncated Octahedron



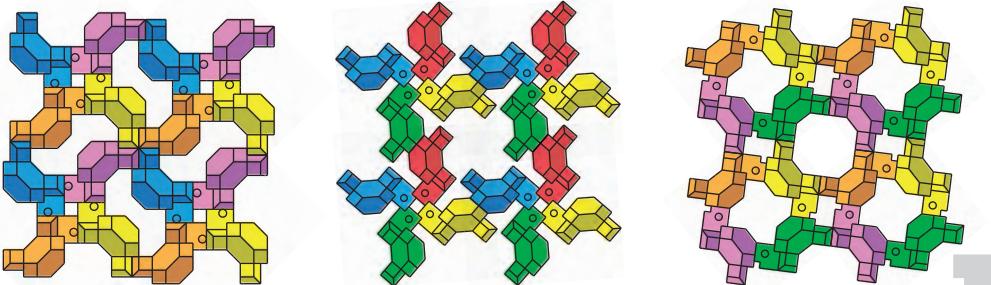
HEXAGONS TO DODECAGONS

1. Build a hexagon from page 3 (illustrations 5-8). Place the hexagon on a flat surface so it can be viewed from the top.
2. Split the hexagon into mirror image halves. This will create two gaps.
3. Create a new Reptangle pair with reflective symmetry. (There are 7 different ways to build a mirror pair of two Reptangles.)
4. Find a way to bridge either of the two gaps in your structure by using your Reptangle mirror pair.



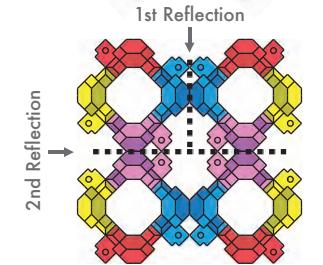
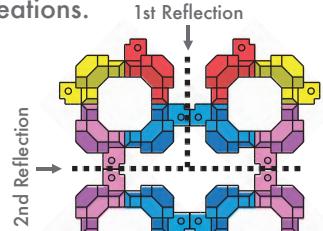
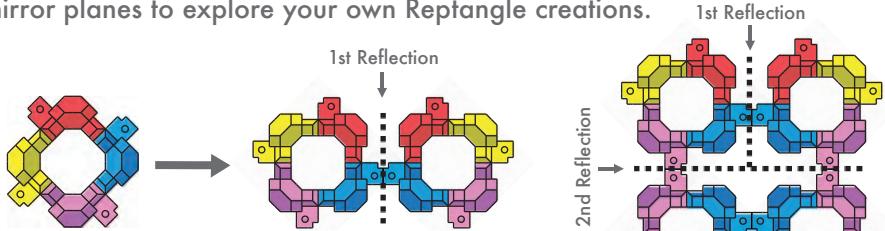
HEXAGONS TO DODECAGONS

Choose a "rectangular" structure from page 3 and add different "translations."



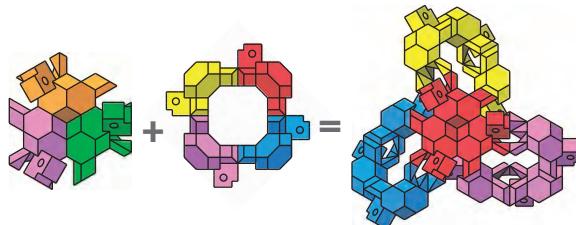
REFLECTING RECTANGLES

Build "rectangular" structures from page 3, then reflect the groups on different mirror planes to explore your own Reptangle creations.

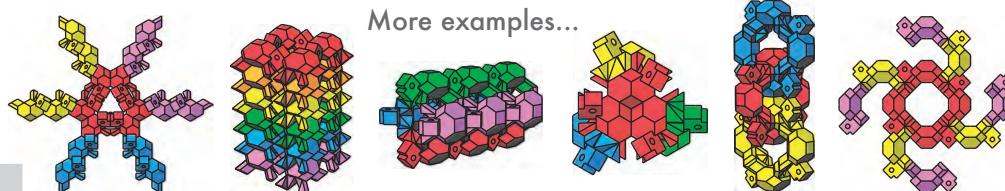


COMBINATIONS

Pick out two or more structures. Combine the symmetries of the two and create a new structure.



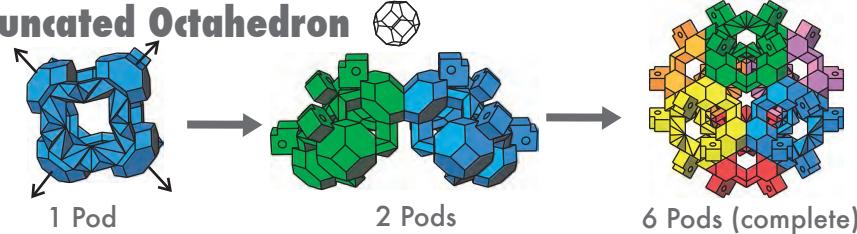
Another way to "Flip" the same structure by choosing different mirror planes.



75 Truncated Octahedron

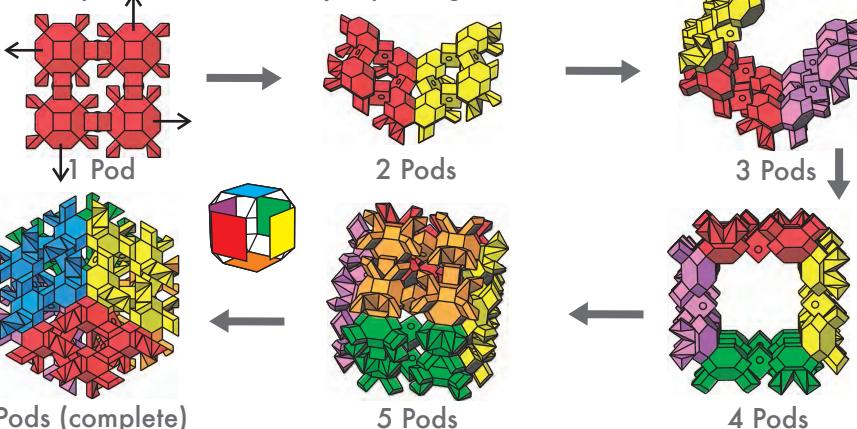


76 Truncated Octahedron



77 Lesser Rhombicuboctahedron

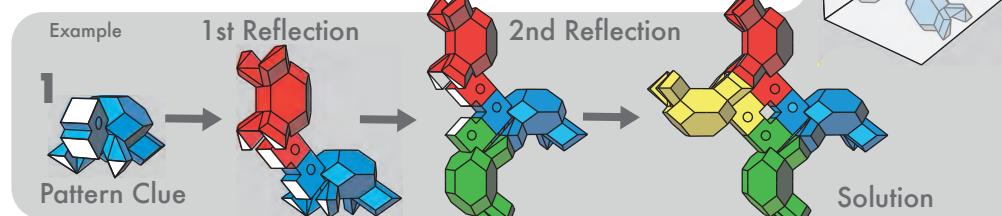
Connect each pod to four others by repeating this connection.



REFLECTION PATTERN PUZZLES

Refer to corresponding numbers found on pages 3-10

Reflect Reptangles by connecting new Reptangles to the white surfaces. Continue until every Reptangle is reflected in this way. (Hint: Imagine that the white surfaces are touching mirrors.)



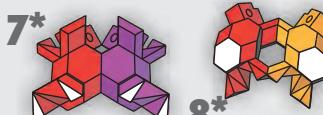
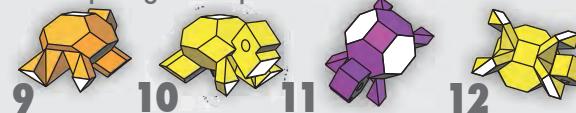
4 Reptangles Required



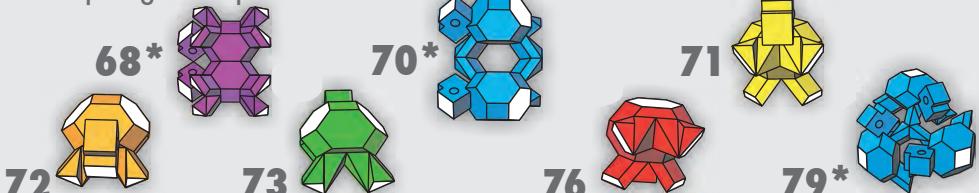
4 Reptangles Required



4-8 Reptangles Required

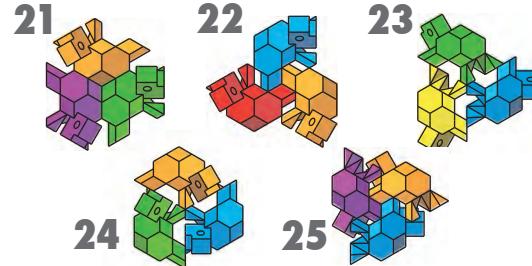


24 Reptangles Required

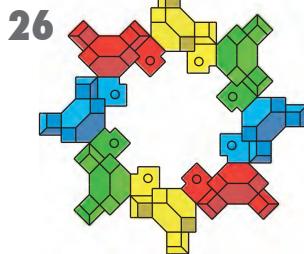


*If the puzzle diagram shows a pair or group of Reptangles, reflect the entire group.

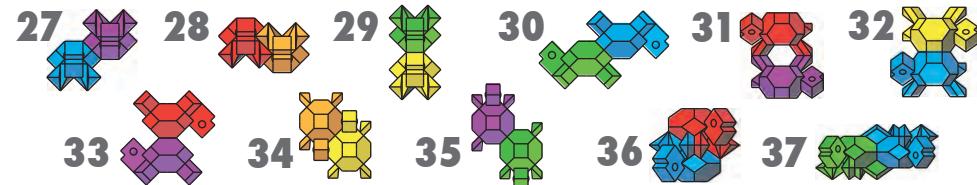
3rd Order Rotational Symmetries
Reptangles match up 3 times during one 360° rotation.



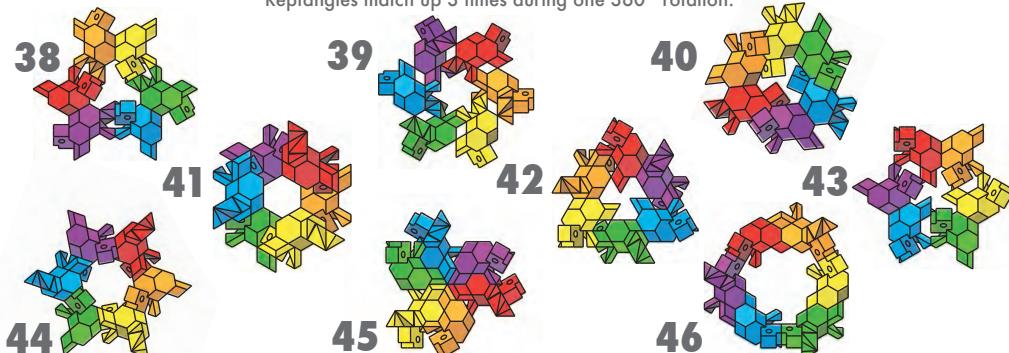
8th Order Rotational Symmetries
Reptangles match up 8 times during one 360° rotation.



2nd Order Rotational Symmetries
Reptangles match up twice during one 360° rotation.



3rd Order Rotational Symmetries
Reptangles match up 3 times during one 360° rotation.



EXPERT PUZZLES

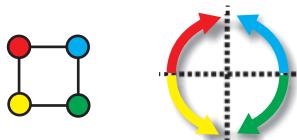
Very difficult!



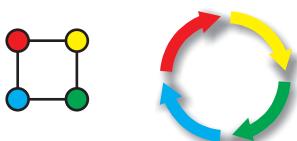
The Puzzle: Imagine that someone just handed you three Reptangles and said "I bet you can't connect these to make an equilateral triangle." That's the essence of these puzzles. No hints - just a tough challenge. You can struggle with them or use them to stump your friends.



2nd Order Rotational
11 Solutions, page 4



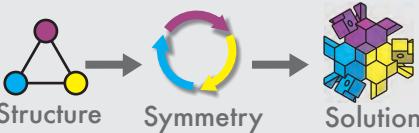
2-Fold Reflective
7 solutions, some on page 3



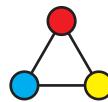
4th Order Rotational
11 solutions, some on page 3

● = 1 Reptangle / = Connection

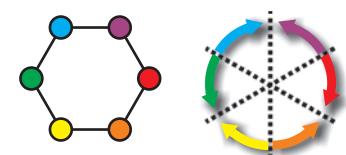
Example



Structure Symmetry Solution

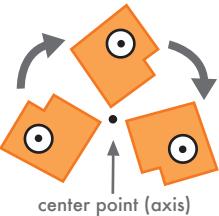


3rd Order Rotational
5 solutions, page 4



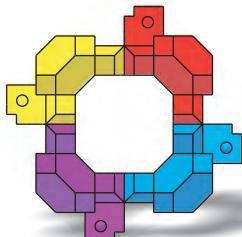
3-Fold Reflective
4 solutions, page 3

3. ROTATIONS (turns)



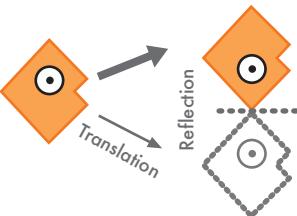
center point (axis)

Reptangles with rotational symmetry "match up" when you turn them around a center point (axis)

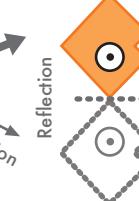


Rotational Symmetry
4th Order 90° turns

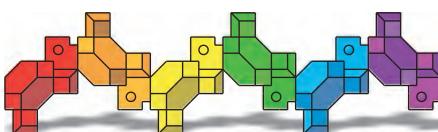
4. GLIDE REFLECTIONS (slide+flip)



Translation

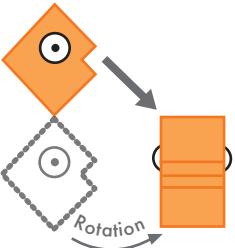


Reptangles with glide reflective symmetry "match up" when you translate (slide) and reflect (flip) them.



Glide Reflective Symmetry

5. GLIDE ROTATIONS (slide+turn)



Rotation

Reptangles with rotation symmetry "match up" when you translate (slide) and rotate (turn) them.

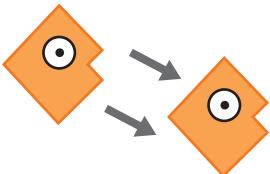


Glide Rotational Symmetry

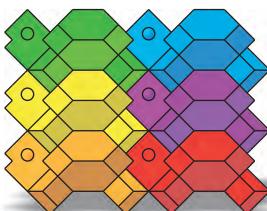
THE BASIC MOVES

When you build with Reptangles™, each new turtle added represents a geometric transformation of the Reptangle that came before it. Think of a transformation as a specific way of "moving" a Reptangle. In this booklet, we refer to 5 types of transformations.

1. TRANSLATIONS (slides)

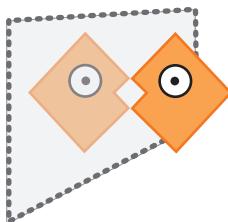


Reptangles with translational symmetry "match up" when you slide them. A translation does not change the way a Reptangle is pointing.

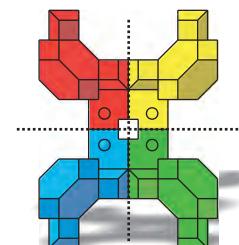


Translational Symmetry

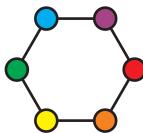
2. REFLECTIONS (flips)



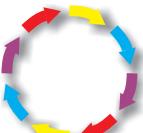
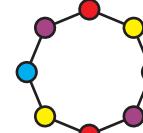
Reptangles with reflective symmetry "match up" when you flip across mirror lines or mirror planes (dotted lines).



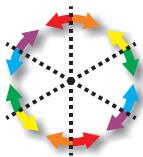
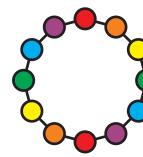
Reflective Symmetry
2-fold



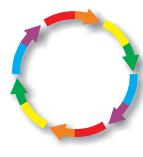
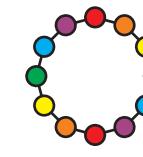
3rd Order Rotational
9 known solutions, page 4



8th Order Rotational
1 solution, page 4

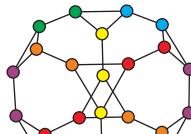


3-Fold Reflective
Many solutions, some on page 12

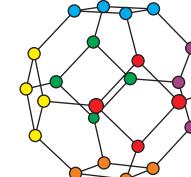


6th Order Rotational
1 known solution, page 4

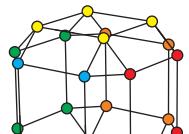
POLYHEDRAL STRUCTURES (Various Symmetries)



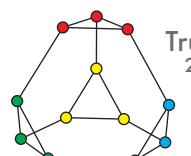
Truncated Cube
1 known solution, page 9



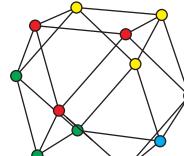
Truncated Octahedron
9 known solutions, page 5-8



Lesser Rhombicuboctahedron
1 known solution, page 8



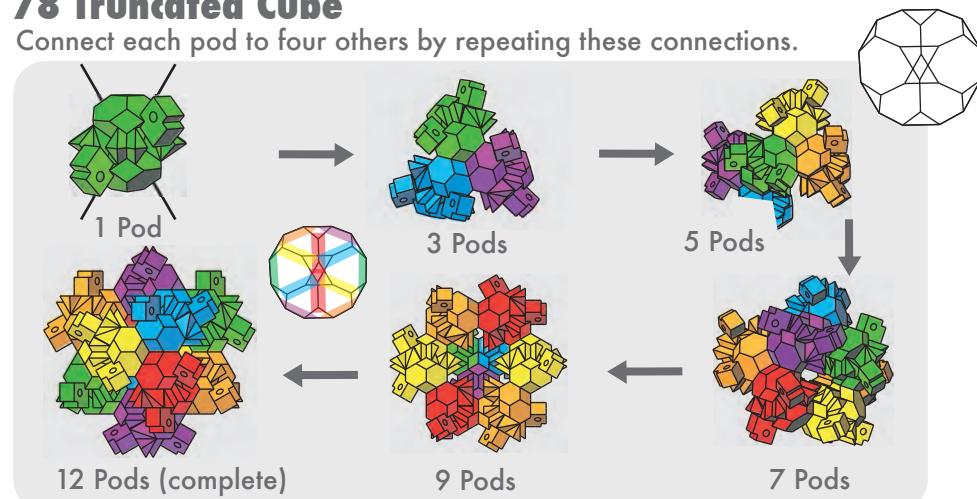
Truncated Tetrahedron
2 known solutions, page 10



Cubooctahedron
1 known solution, page 10

78 Truncated Cube

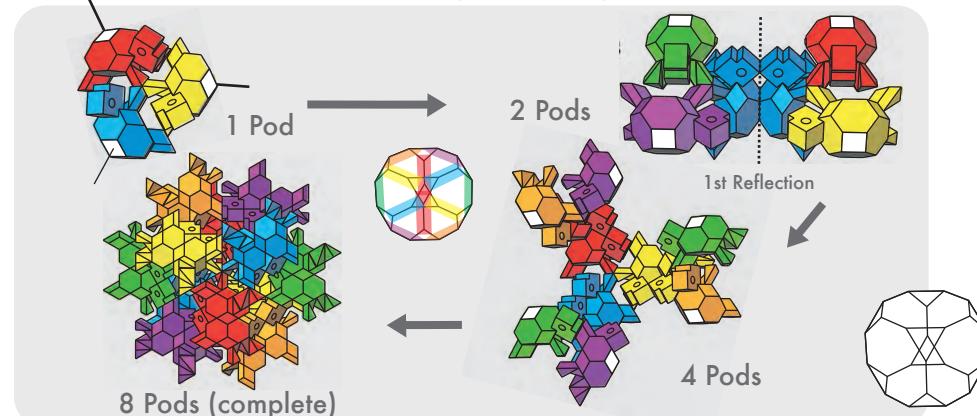
Connect each pod to four others by repeating these connections.



79 Truncated Cube

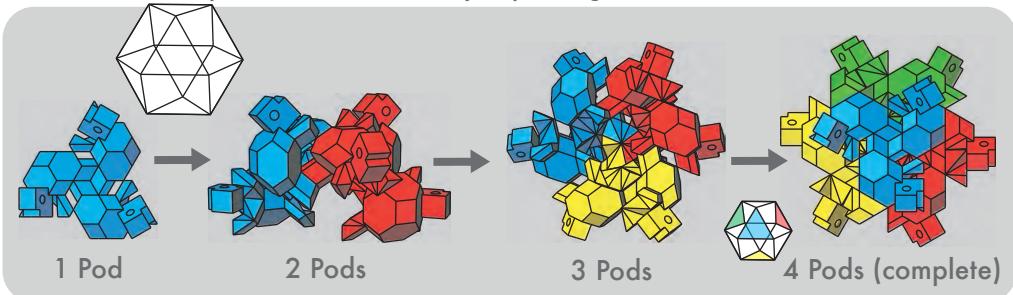
Connect each pod to three others.

Connect these white surfaces, thereby reflecting pods.



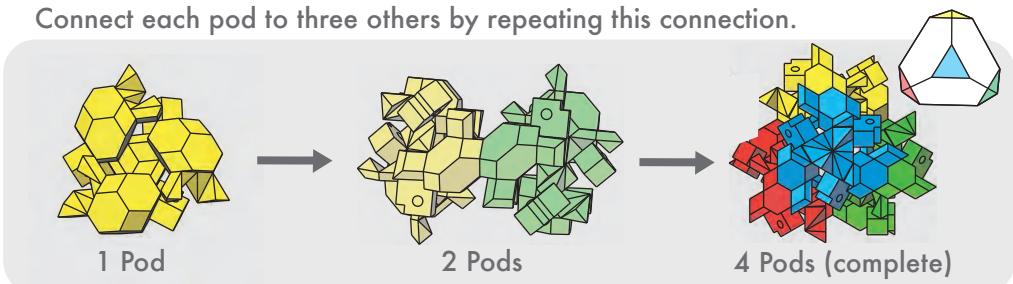
80 Cubooctahedron

Connect each pod to three others by repeating this connection.

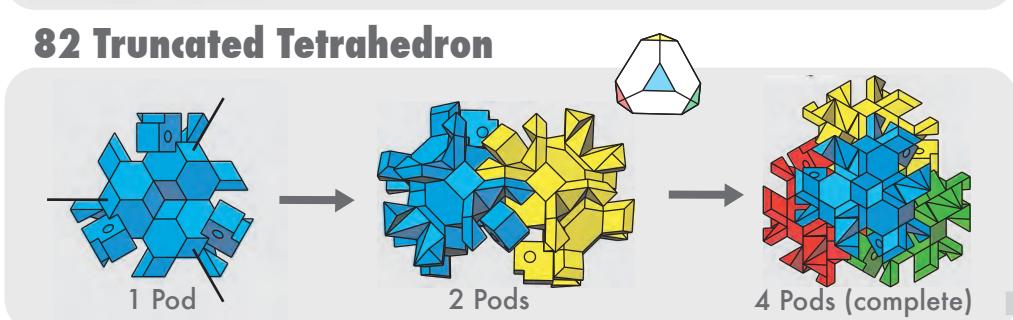


81 Truncated Tetrahedron

Connect each pod to three others by repeating this connection.



82 Truncated Tetrahedron



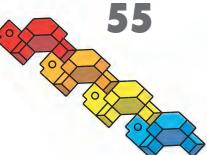
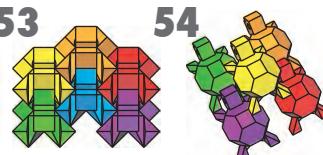
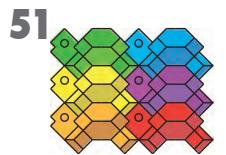
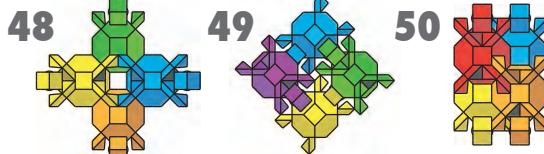
6th Order Rotational Symmetries

Reptangles match up 6 times during one 360° rotation.

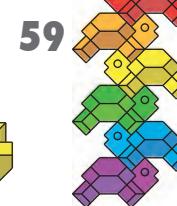
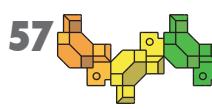


2nd Order Rotational Symmetries

Reptangles match up twice during one 360° rotation.



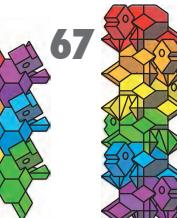
Translational Symmetries (slides)



Glide Reflection Symmetries (slide+flip)

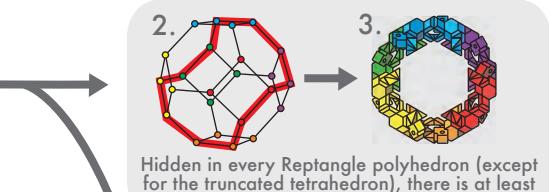
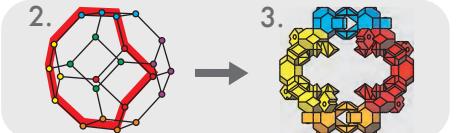
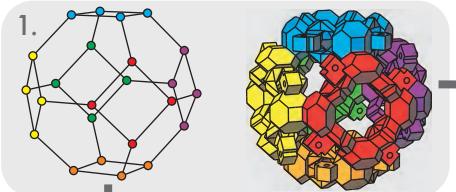
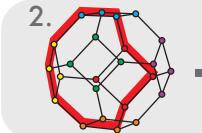
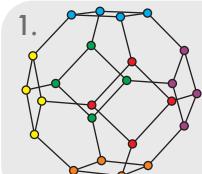


Glide Rotation Symmetries (slide+turn)

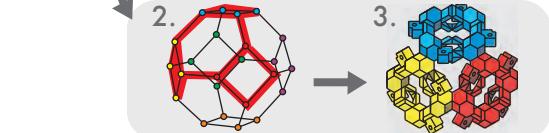


DISSECTING POLYHEDRA

1. Build any polyhedron from illustrations 68-82.
2. Look for symmetric designs within your polyhedron (see red outlines).
3. Remove those structures or build from scratch.



Hidden in every Reptangle polyhedron (except for the truncated tetrahedron), there is at least one symmetric, equatorial ring, like this one.

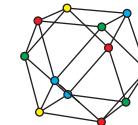
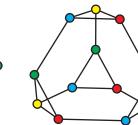
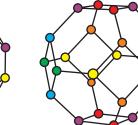
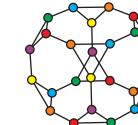
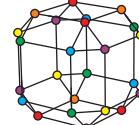


COLOR PATTERN CHALLENGES

Challenge 1 Arrange the Reptangles in any polyhedron from illustrations 68-82 so that no similar colors touch. For illustrations 80-82, limit yourself to only four colors.

Challenge 2 Arrange the Reptangles in any polyhedron illustrations 68-82 so that all similar colors are contiguous. Use all six colors. For illustrations 68-77, find a new way to do this.

Challenge 1



Challenge 2

