Modern

KUSUDAMA ORIGAMI

Ekaterina Lukasheva

over

30 models in step-by-step instructions

EKATERINA LUKASHEVA

MODERN KUSUDAMA ORIGAMI

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2013: Bouquet, Celestina, Ice Cream, Jade Star, Lathyrus, Ornamentarium, Serenade, Snow Queen, Windflower.

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Photo credits

Ekaterina Kim: portrait on the cover.
Alena Rodakova: picture on page 52 (bottom).
Natalia Romanenko: picture on page 45.
Tanya Turova: pictures on page 30, page 34, page 36, page 57, page 61, page 63, page 68, page 70 and the cover.

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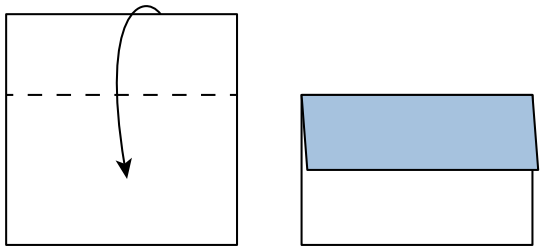
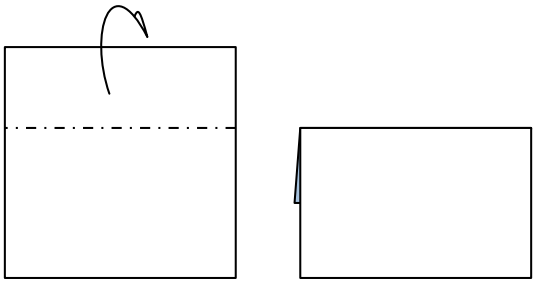
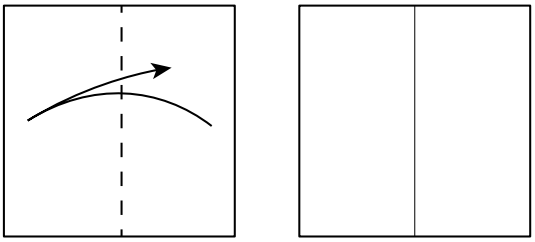
Origami symbols



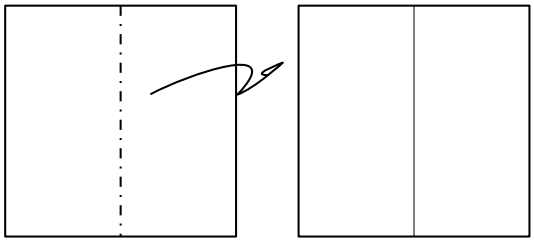
valley fold



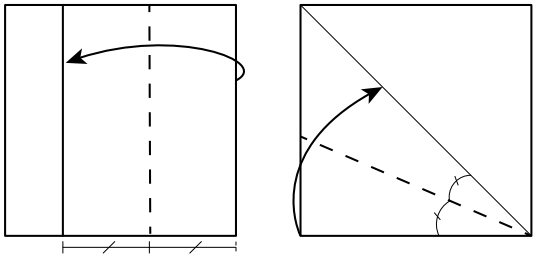
mountain fold



valley fold and unfold

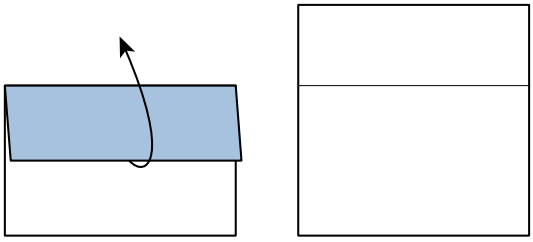


mountain fold and unfold

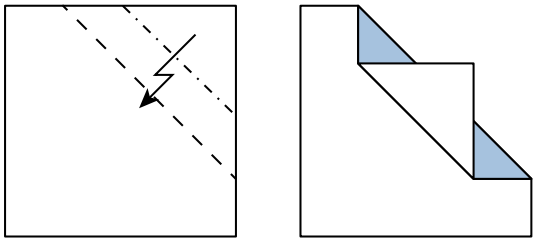


equal lengths

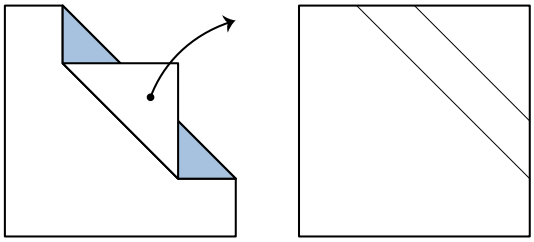
equal angles



unfold



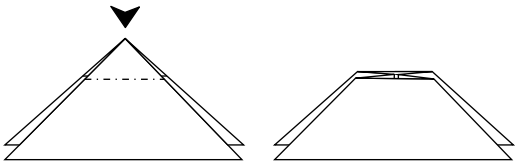
pleat fold



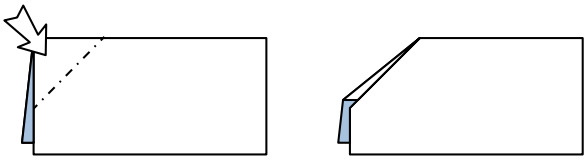
unfold/pull paper

enlarged view ahead

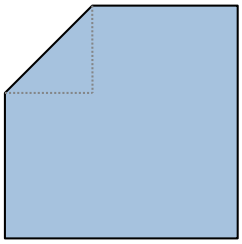
curl



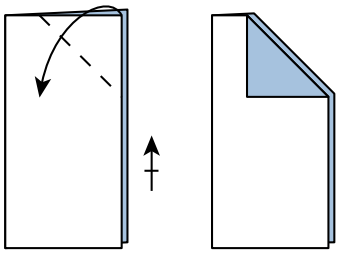
sink fold



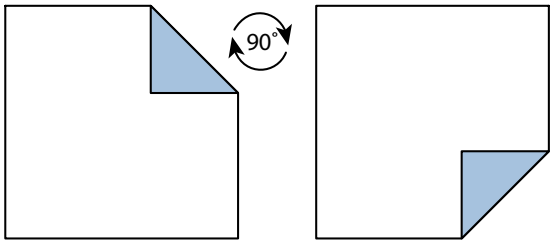
inside reverse fold



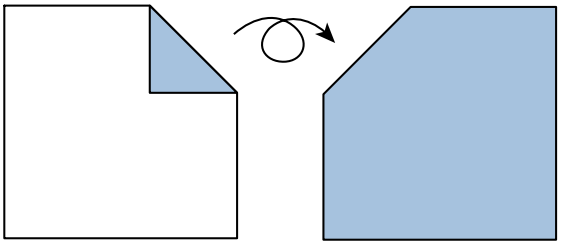
back (hidden) layer



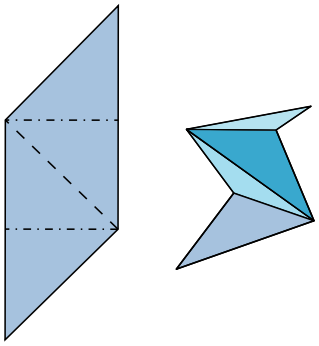
repeat on the other side



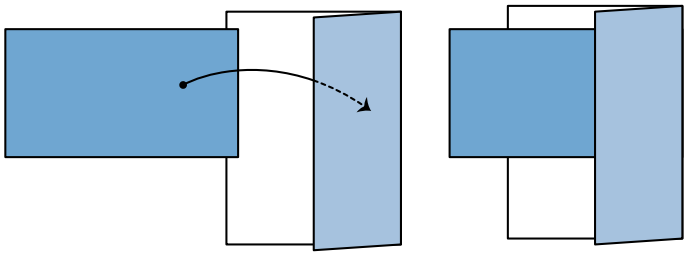
rotate 90° (or any other angle if specified)



turn paper over



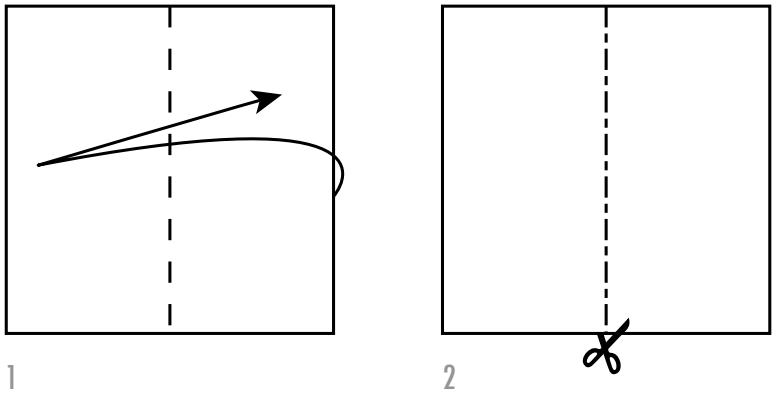
semi-fold (precrease)



put inside

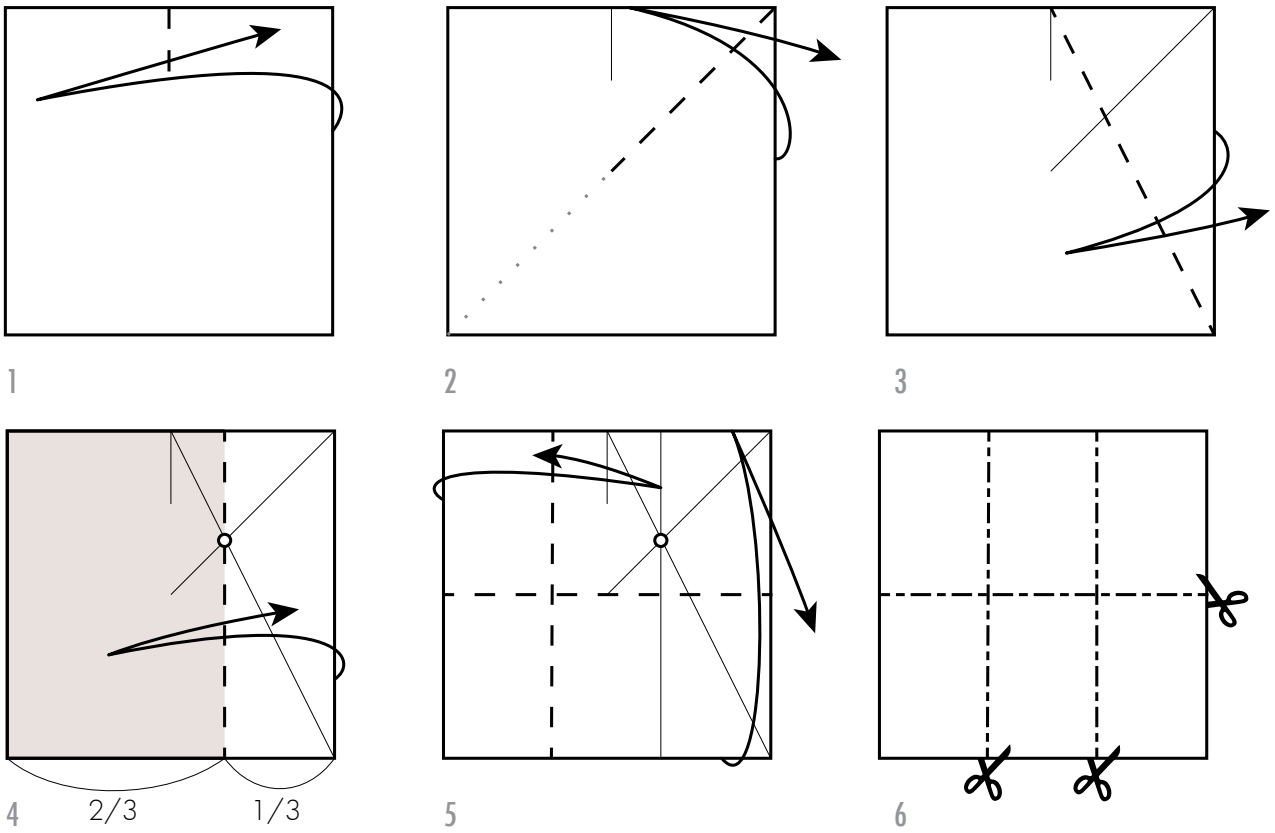
How to cut a...

1:2 rectangle (half square)



1 2

2:3 rectangle

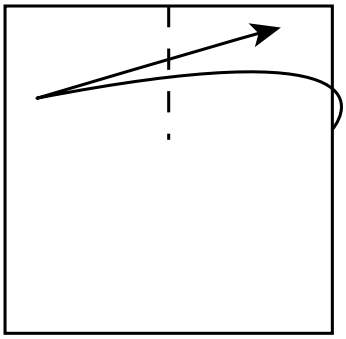


1 2 3

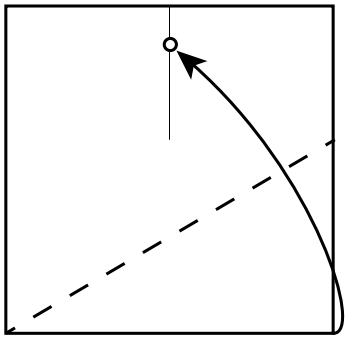
4 5 6

At step 4, the gray part is equal to 2/3 of the square's length, and the white part equal to 1/3. If you want a large 2:3 rectangle, cut the white part away at this step and use the the remaining gray area. If you wish to have smaller 2:3 rectangles, continue to steps 5-6.

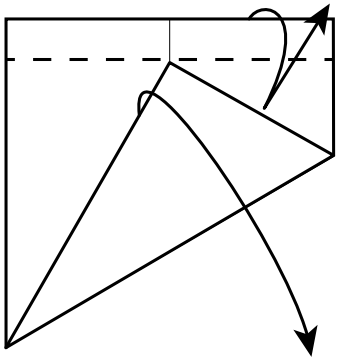
2:√3 rectangle



1



2



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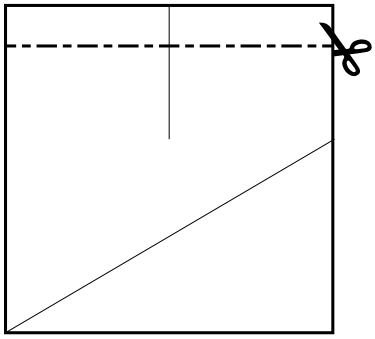
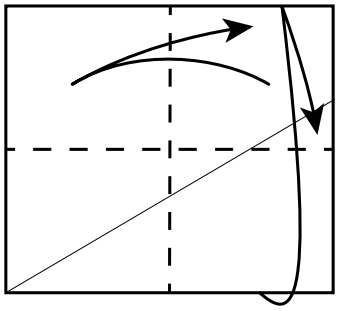
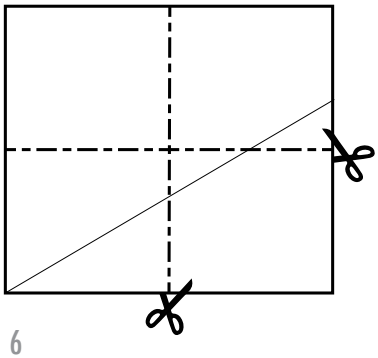


4



5



6

At 4th step you get the needed 2:√3 rectangle. If you wish to have smaller rectangles, continue to steps 5-6.

Modular origami

Origami is the art of paper folding. Traditional origami uses a single, uncut sheet of paper, whereas modular origami uses multiple sheets joined together to create a singular form. This method offers great flexibility in shapes you can achieve while keeping the single unit relatively simple. So if you dislike 100+ step origami diagrams still wanting the resulting piece to look intricate, modular origami is for you.

The figures created through modular origami are usually highly symmetric, because they are made from multiple equivalent units, or modules. The origami modules usually have special locks to allow unit-to-unit connection without using any adhesive. This feature of modular origami brings it closer to construction sets: you are just making the pieces of the construction set yourself prior to the assembly process.

There are several names for modular origami throughout the world. In the west it's referred to as modular origami, but in Eastern Europe and South America, the Japanese word "kusudama" is is commonly used for ball-like modular origami figures. In Japan, the word "kusudama" originally meant "medicine ball", possibly referring to a ball made from flowers and used for incense.

About the author

My name is Ekaterina Lukasheva, but my friends call me Kate. I became acquainted with modular origami as a teenager; it quickly became my passion and has been ever since. As I grew up, I continually developed my modular origami skills, and at some point, I started creating my own designs. It is very interesting, since I compose the puzzles that I can then assemble into beautiful spheres. When I create a new origami model, I try to either make it look different from the existing models or make its modular locks different. In this book, I gathered models with locks that may seem unusual or challenging to you, but once you get the hang of them, you're sure to like them!

My first book Kusudama Origami was published in 2014 by Dover publishing. Besides that I usually publish my diagrams in various origami journals throughout the world. I have the website www.kusudama.me with numerous kusudama pictures, as well as a few free diagrams and videos.

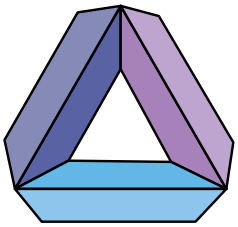
I was born in 1986 in Moscow, Russia. Since early childhood I adored architecture and design art books and catalogs, as well as "entertaining math" books. I tried several hobbies throughout my life like construction sets, drawing, oil-painting, photography, modelling and... origami. The latter possesses me at the moment. For me it's the best culmination of mathematics, art and design. I gain inspiration from various 3-dimensional objects like flowers, cacti, architecture objects and stellated polyhedrons.

While I graduated as a specialist in applied math and programming and completed my PhD on differential equations, I don't feel any of these things are needed to make and enjoy beautiful origami. ;)

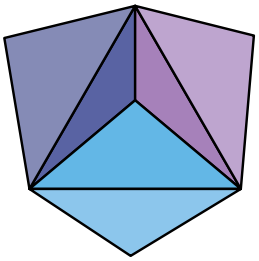
Modular assembly

The units presented in this book can be assembled in various ways. The assembly methods for modular origami spheres are based on the structure of Platonic[1] and Archimedean[2] solids. Each unit corresponds to an edge of the solid. The detailed assembly of these solids is outlined below.

There are two types of units in this book: 'edge' units and 'solid' units. The former act and look like real edges of the solids when you assemble the modules. But indeed the 'solid' units act in the same way: the only difference is that the final shape becomes solid, and the holes between the units turn to the pyramids.

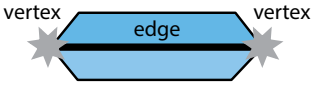


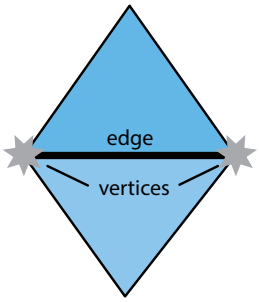
edge units



solid units

It means that the same assembly methods can be used for the both 'types' of the units. The following image illustrates the correspondence between units and the underlying solids.





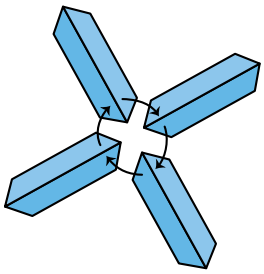
The methods below will illustrate the assembly methods for the edge units. But the same assembly schemas apply to the solid units as well. The assembly schemas are given symbolically, each arrow represents the unit's particular connection method.

1 Platonic solid is a regular convex polyhedron composed of identical regular polygons meeting in identical vertices.

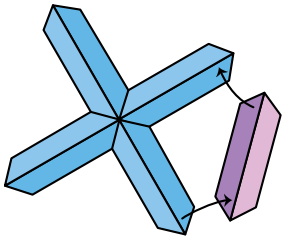
2 Archimedean solid is a highly symmetric, semi-regular convex polyhedron composed of two or more types of regular polygons meeting in identical vertices. They are distinct from the Platonic solids, which are composed of only one type of polygon meeting in identical vertices.

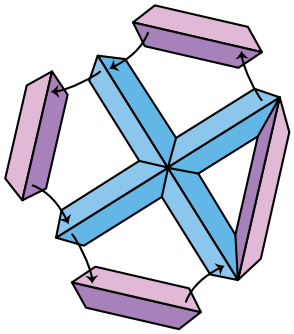
Octahedron 12A method

A regular octahedron is a Platonic solid composed of 8 equilateral triangles, 4 of which meet at each vertex. Since an octahedron is formed with 12 edges, you will need 12 units to complete a modular octahedron figure.

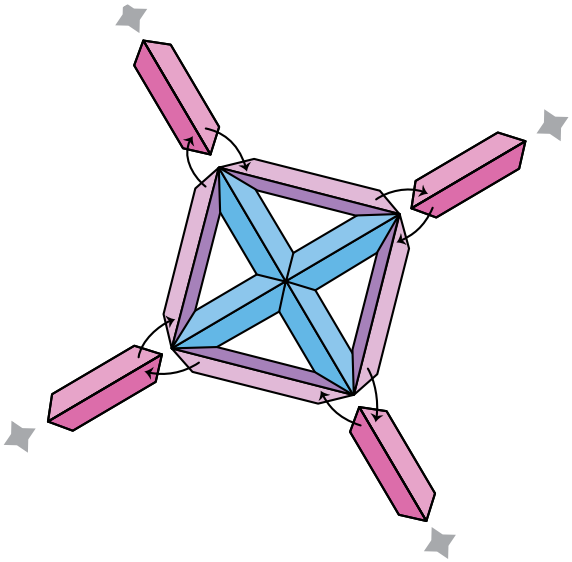


connect 4 units so that they meet at a single point



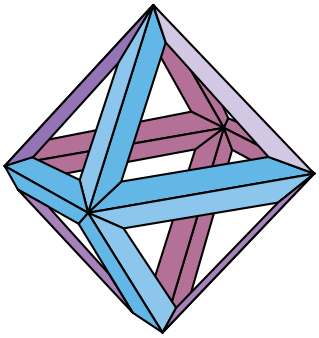


continue adding the units so that every 3 units form a triangular hole (triangular pyramid in case of solid units)

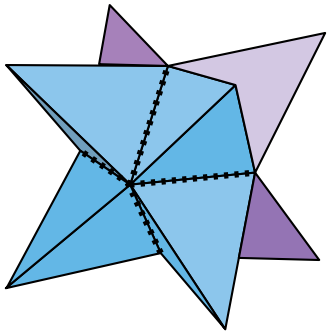


add 4 more units so that 4 units meet at a single point each time

connect the sides marked with the stars in the illustration to one point behind, completing the octahedron



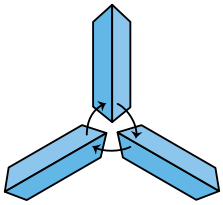
complete octahedron



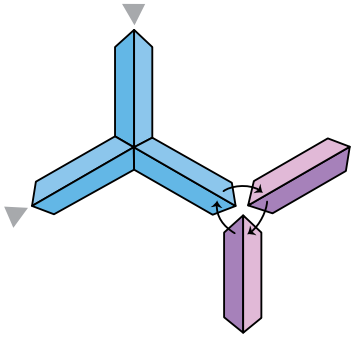
solid version of octahedron: dotted lines show the underlying octahedron

Cube 12B method

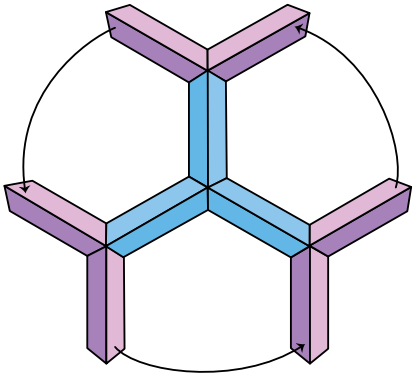
A regular cube is a Platonic solid composed of 6 square faces, with 3 edges meeting at each vertex. Since a cube is formed with 12 edges, you will need 12 units to complete a modular cube figure.



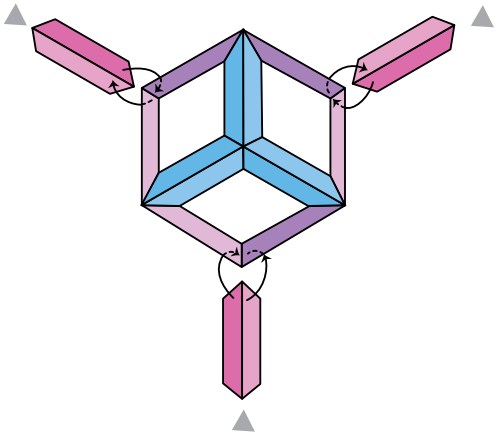
connect 3 units so that they meet at a single point



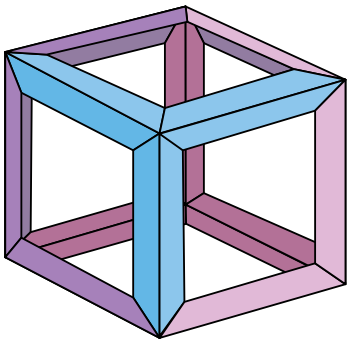
add units to the loose sides of the edges so that 3 units meet at a single point each time



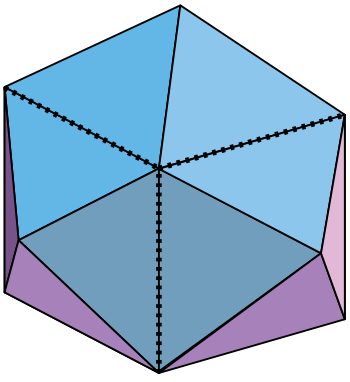
connect loose units as shown



add the remaining units so that 3 units meet at a single vertex, connect the sides of the units marked with triangles to a single point behind



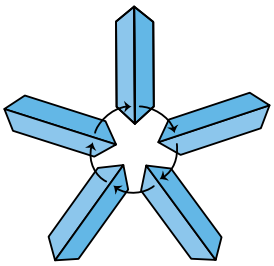
complete cube



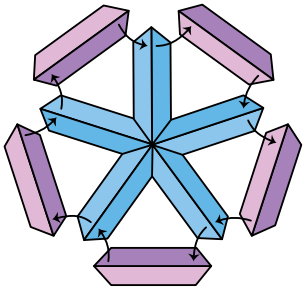
solid version of the complete cube: dotted line shows the underlying cube

Icosahedron 30A method

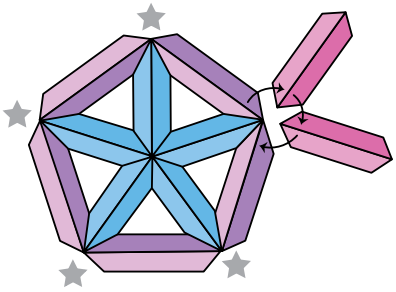
An icosahedron is a polyhedron composed of 20 triangular faces, with 5 of those meeting at each vertex. Since an icosahedron is formed with 30 edges, you will need 30 units to complete a modular icosahedron figure.



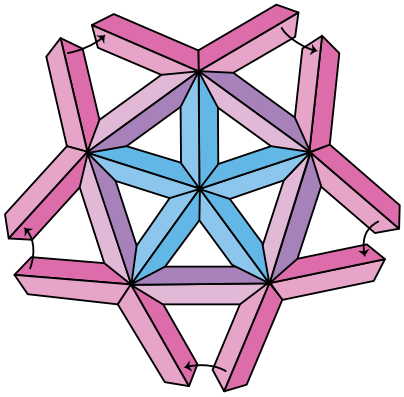
connect 5 units so that they meet at a single point



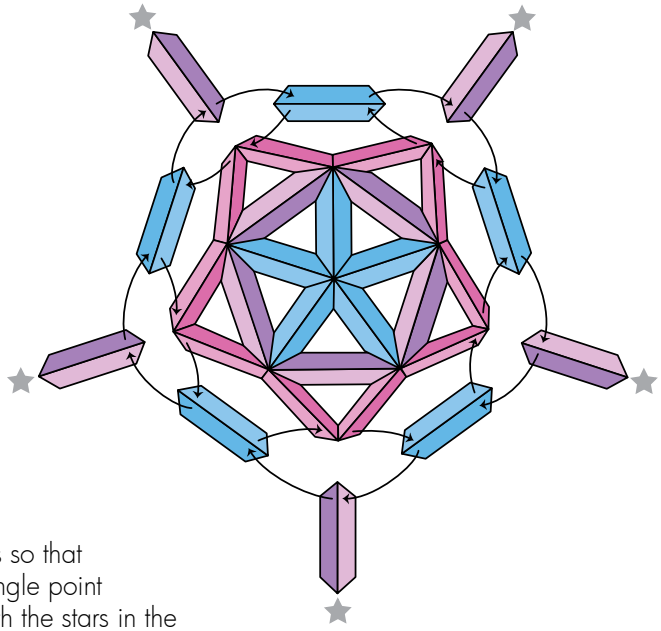
add 5 more units to form 5 triangles



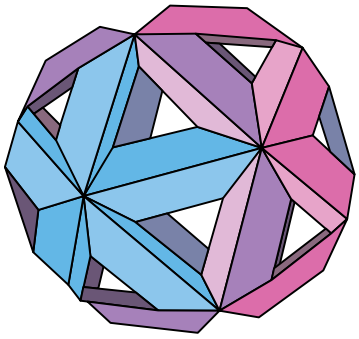
connect 2 additional units to every unfinished vertex, so that 5 units meet at a single vertex each time

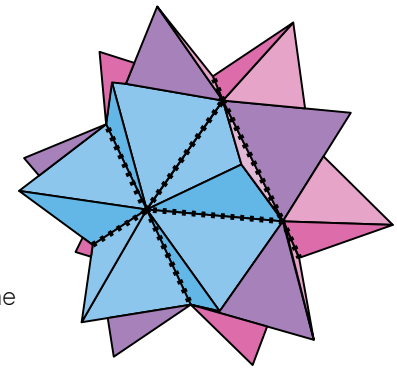


connect the loose sides of the units so that they form 5 triangles



add units to the non-finished vertices so that 5 units meet at a single point
the units marked with the stars in the picture should meet at a single point



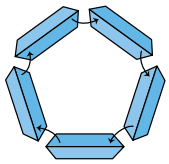


complete icosahedron (left) and the solid version of icosahedron (right)

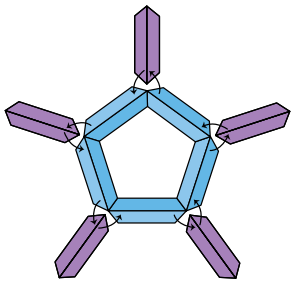
the size of the holes as well as the sharpness of the spikes may vary from unit to unit

Dodecahedron 30B method

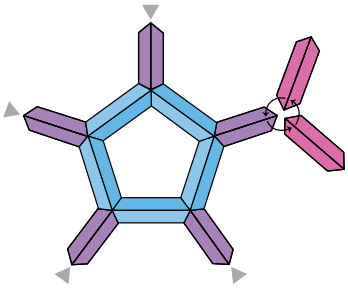
A dodecahedron is a Platonic solid composed of 12 pentagonal faces, with 3 of those meeting at each vertex. Since a dodecahedron is formed with 30 edges, you will need 30 units to complete a modular dodecahedron figure. The assembly scheme described below may not be the most comfortable; while it illustrates the algorithm, the actual sequence of the assembly may be slightly different.



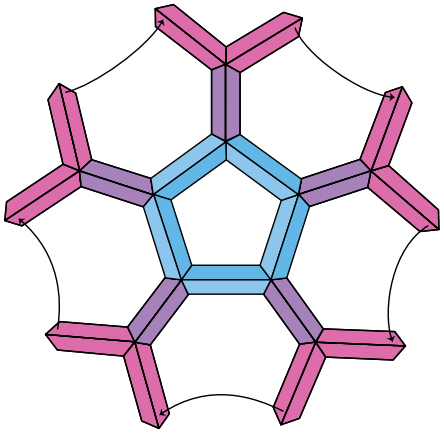
connect 5 units so that they form a ring



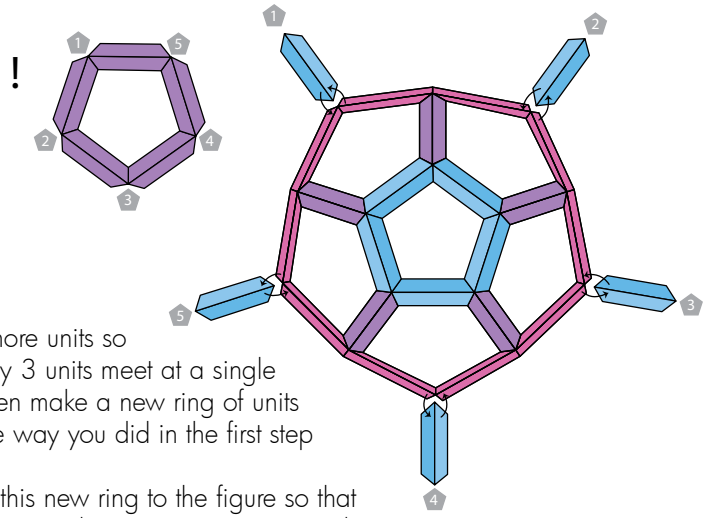
connect 5 more units so that every three units meet at a single vertex as shown



add 2 units to every loose side of the unit so that 3 units meet at every point



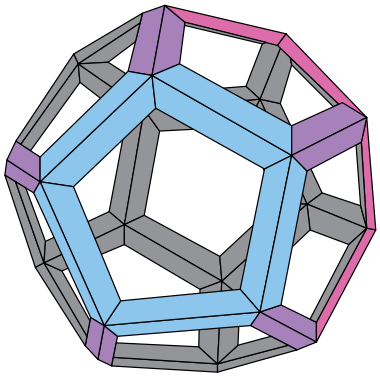
connect the loose edges so that you get 5 pentagonal rings around the central one

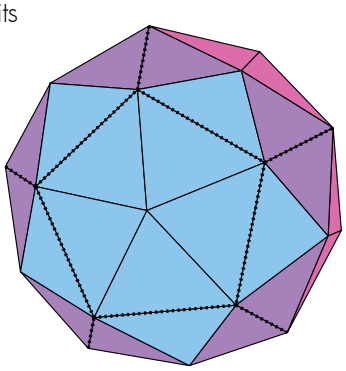


add 5 more units so that every 3 units meet at a single point, then make a new ring of units the same way you did in the first step

connect this new ring to the figure so that the numbers in the gray pentagons match up

this picture is to illustrate the structure only, as it is more comfortable to add the last 5 units one by one



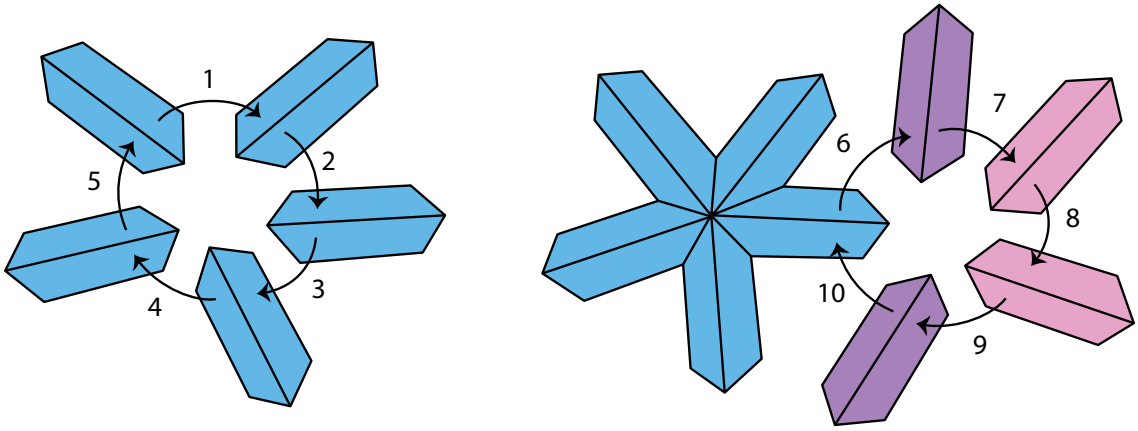


complete dodecahedron (left) and the solid version of dodecahedron (right)

the size of the holes as well as the sharpness of the spikes may vary from unit to unit

Assembly hint

Almost all of the models in this book (except Apricot, Compass, Malachite and Windflower stars) share a similar connection system which can look unstable at first glance. However, if you join the pieces as shown below, they will connect more stable, and assembly process will be more comfortable. The diagram below illustrates the modified assembly sequence for the icosahedron (30A method), but the same idea may be applied to any sphere you assemble. The concept behind this method is to try and finish the vertices of the polyhedron first. Thus, when you assemble an icosahedron, finish the vertices where five edges are connected. Since a "star" of five units is enclosed it becomes stable (steps 1-5 in the picture). Instead of closing the adjacent triangles, you should then assemble the next "star" (steps 6-10). Continue to assemble the model by finishing the vertices, proceeding in this fashion until the model is finished. As you go, keep in mind that the holes between the units should be triangular.



Tips and tricks

- Try to choose papers of the same type and weight for a single model. If you mix papers with different properties in a single model it may not only look inconsistent but may also lack symmetry.
- Try folding a test unit from lager piece of paper before starting the entire modular. It may give you a hint as to what paper size would be most comfortable for you, as well as how the color or pattern of the paper will appear when folded into a particular module.
- If you are not sure how to perform a particular step, refer to the next step in the diagram, as the illustration should give you a hint of the resulting shape.
- If you would like to use sticky notes for folding , you can apply some corn-starch directly on the adhesive, making it less sticky and more ideal for folding.
- Be as accurate as possible when making every single unit. The more precise you are, the better the final model will look. Some modular locks only function when your folding is very precise.

For precise and sharper creases use a folder or a wooden stick. You may find a special origami folder or use some clay modelling tools you can find in any art supply store.

A pincer or tweezers can be very handy during the assembly process or for curling the petals. Use it when you need to tuck the small flaps into pockets.

Paper and craft knives can be used for cutting paper.

A letter opener can be very useful for cutting paper when you travel; you can take it even on board!

PVA glue

Clips can be helpful to temporarily fasten the units for stability during the assembly.

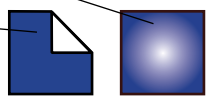
The models in the book do not generally require glue for assembly, but if you are a novice to modular origami you may need some. If you want your kusudama have a better chance of staying together when handled by guests, children or gently batted by animals, add a bit or glue during assembly or to a complete model. Stick glue is better during assembly, while PVA glue (white liquid glue) can be used to fasten more permanently the complete model. Add a drop of PVA glue to the point where units meet to fasten the point. This glue becomes nearly invisible when dry, but be sure to test it on a scrap of your selected paper before adding to the kusudama.

Near the model name for each diagram in this book, you will find some symbols and other indicators with suggestions to help guide you in your paper selection, as well as the difficulty level and assembly possibilities for a particular model.

suggests the use of origami-specific gradient paper

difficulty level out of 5

suggests the use of paper with different colors on each side



☆☆

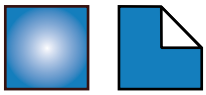
30A, 12A

recommended assembly method and number of units (see pages 12-15)

7x7 cm square

recommended paper size (novices may want to use larger paper, whereas experienced folders could go even smaller)

MODEL NAME



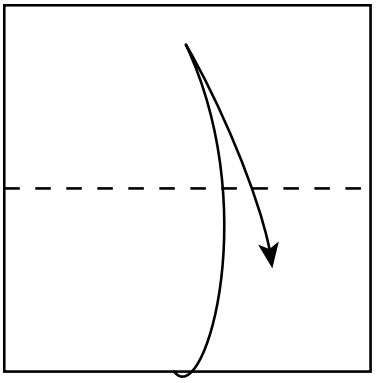
☆
5-8 units

5x5 cm square

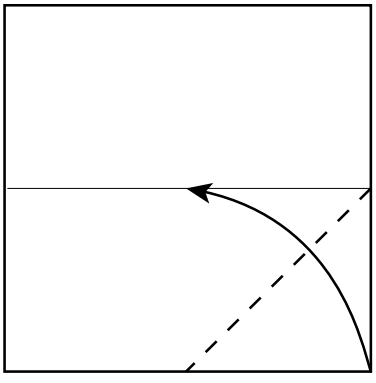
WINDFLOWER

STARS

This star is a perfect starter; it is easy to make and spectacular when finished. You may use these stars for many decorative purposes: glue them to the gift card or make a little brooch. You can make this star out of 5 or more units. I recommend making it from 5 to 10 units. The more units you add the fluffier your star will get. Use pincers to curl the loose flaps at the end of the assembly process.



1



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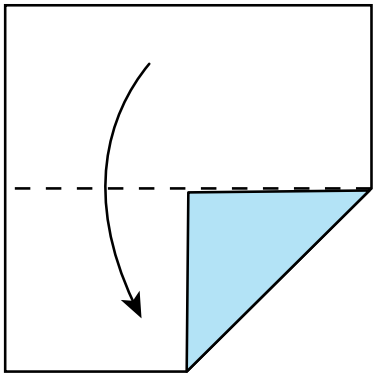

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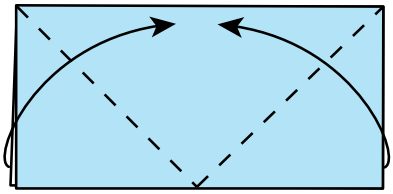

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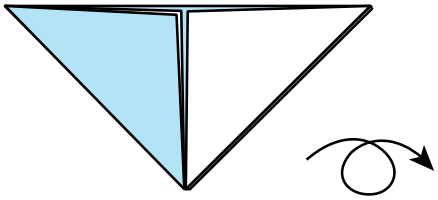

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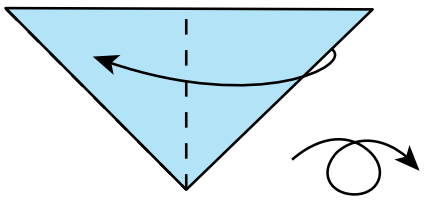
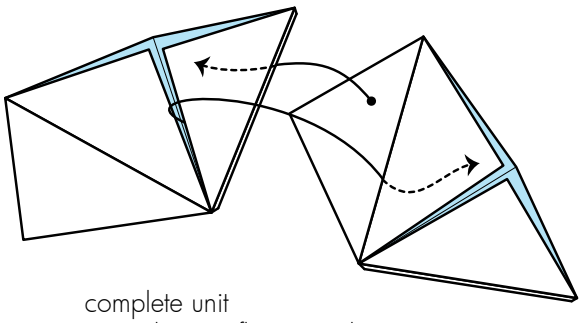
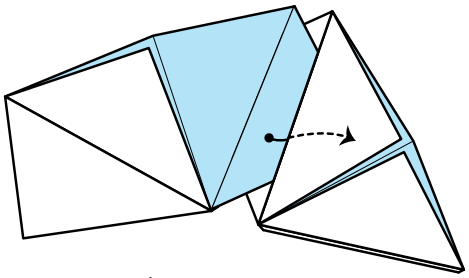


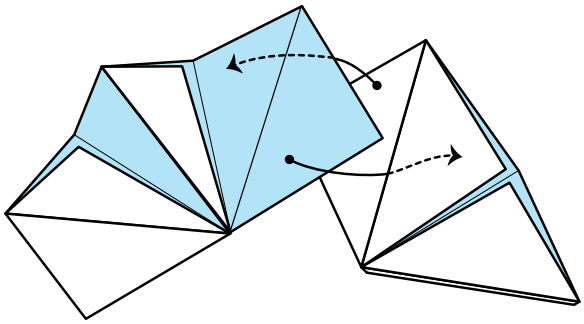
6 semi-fold



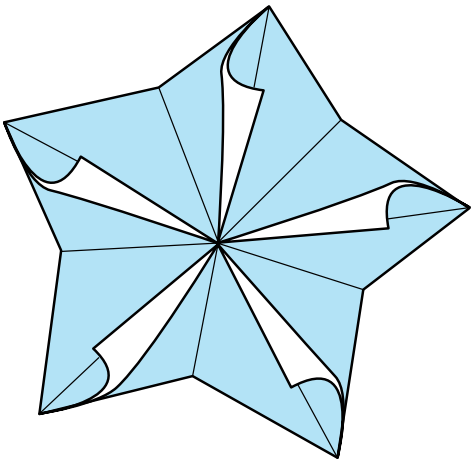
complete unit
insert the two flaps into the
two pockets simultaneously



in progress



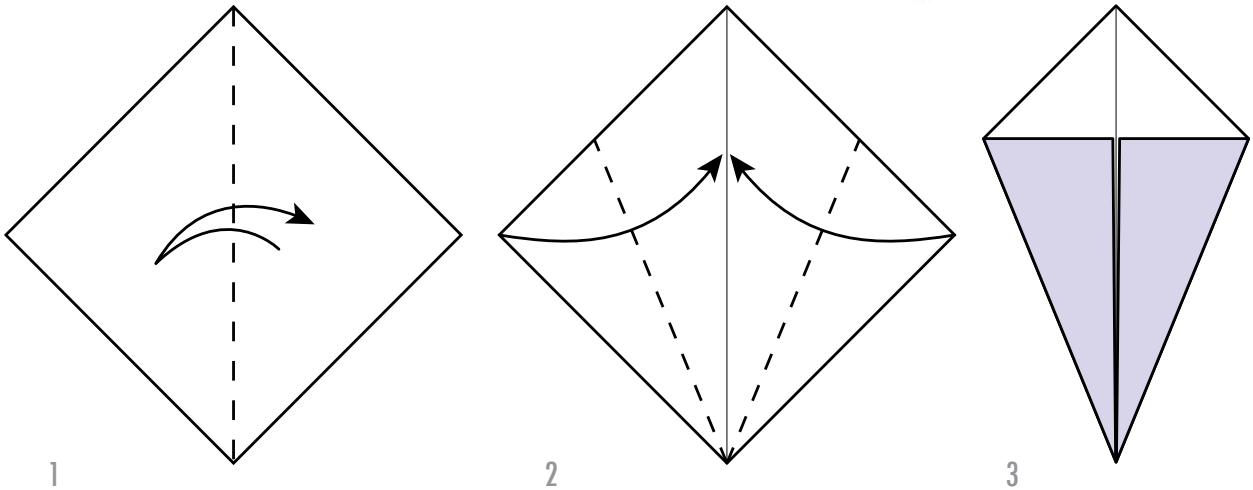
continue adding units
you can make a star with 5 or more units
when you stop adding units, connect the
free sides to create a star



☆
5-8 units

5x5 cm square

FLOWERET



1 2 3

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Contact: art@kusudama.me