



What is 4-H? 4-H is the nation’s largest youth development organization. We reach out to kids and their families to build skills for real life.

The 4-H Pledge

I pledge my **HEAD** to clearer thinking, my **HEART** to greater loyalty, my **HANDS** to larger service, and my **HEALTH** to better living, for my club, my community, my country, and my world.

The 4-H Motto “Learn By Doing”

4-H Art & Math Project Kit Contents

Kit Introduction	Page 2
Do: Using Watercolors	Page 3
Optional Do: Make a Practice Page	Page 4
Do: Art Challenge Using Watercolors	Page 5
Do: A Guide to Color Theory & Mixing Paints	Page 6
Apply: Build a Color Mixing Chart	Page 7
Learn: A Shape Within A Shape	Page 8
Do: Build a Complex Shape	Page 9
Do: Symmetrical Cat	Page 10
Do: Symmetry Challenge	Page 11
Learn: Symmetry	Page 12
Do: Creating Your Own Patterns – Tessellations	Page 13
Learn: Tessellations	Page 14
Do: A Sequence A Spiral	Page 15
Learn: The Fibonacci Sequence	Page 16
Do: Make Your Own Patterns	Page 17
References	Page 18

About Your Kit

What Will You be Learning: Youth will mix concepts of math and art in this kit. The math concepts included are shapes, symmetry, and patterns. For art, youth will be learning basic watercolor art techniques and color theory (mixing colors).

Youth Ages: In 4-H, youth are divided into Age Groups based on common developmental characteristics. Juniors are youth 8-10 years old, Intermediates are youth 11-13 years old, and Seniors are youth 14 and above. The activities in this kit are ideal for Juniors and Intermediates but Juniors may benefit from the help of an adult.

Targeted Life Skills:

Thinking: Learning to learn, Decision-making, Problem solving, Critical thinking.

Managing: Planning/organizing, Wise use of resources.

Working: Self-Motivating.

Being: Self-Esteem, Self-Responsibility.

Time: Estimated time the activity will take is marked above the activity. Allow additional time for drying and clean-up. Activities do not need to be completed all in one sitting. Break out this kit when you have time and put it away for fun later!

Optional Supplies to Enrich Your Learning:

- Calculator
- Ruler

Cleaning supplies and instructions for cleaning are not included.

Using 4-H's "Do, Reflect, Apply" model, engage youth in learning:

DO: "Doing" is an extension of the education step. It involves hands-on activities that allow the youth to learn. Doing provides experience that supports the learning process. This is why you'll see "Do" instructions with each Activity.

REFLECT: "Reflecting" focuses on sharing and processing the activity. In this step you encourage and facilitate discussion. To maximize learning, grown-ups can ask questions provided in the Blue Reflection Boxes for great discussion. Older youth can participate in self-reflection by asking themselves the supplied question. Consider journaling your answers and revisiting them after a short time for deeper insight.

APPLY: "Applying" is the step where youth have the opportunity to think about how they can apply what they have learned to their lives and the world around them. This step asks them to think beyond their own growth.

**Based on the Art of Math Discover Club Kit by
Utah State University Extension.**

Do: Using Watercolors

 For All Ages

Gather These:

From your house –

- Small dish of Water
- Ruler (if you want one)



From your kit –

- Heavy Paper
- Pencil
- Watercolor Pallet & Brush
- Square of Parchment Paper



Need Help?

**Amy's Art Table YouTube
Watercolor Tutorial**

<https://bit.ly/3j2B3kX>

Then Do This:

1. Get your brush wet and dip it into the water color you want to use.
2. Mix your brush around in the paint. Pick up the color with your brush and put it on your parchment paper. Repeat until you have a small puddle of colored water.
3. Use your brush to move the colored water onto your heavy paper. Now you're painting!
4. To change the color of your paint try these different ways of painting
 - a. mixing in more water to your small puddle
 - b. picking up more paint from your paint pallet
 - c. wetting your brush with just water and gently wetting the paper before you start mixing and using your watercolors
 - d. layering your art by allowing your paper to dry between drawing layers

Other fun suggestions:

Draw over your paper with crayons than paint over with watercolors.

Paint with watercolors than sprinkle kosher salt over your wet paper.

Optional Do: Make a Practice Page

 Ages 11+

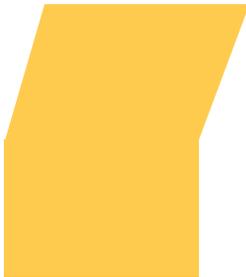
Fold Your Paper Like This

1. Hot Dog Fold (Long Edge to Long Edge) and color the edge of your fold with your pencil
2. Second Hot Dog Fold (Long Edge to Long Edge) and color the edge of your fold with your pencil
3. UNFOLD
4. Hamburger Fold (Short Edge to Short Edge) and color the edge of your fold with your pencil
5. UNFOLD

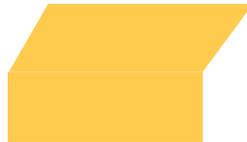
Your paper now has 8 squares.

Try different amounts of paint and water in each square to experiment. When your paper dries reflect on what techniques you liked.

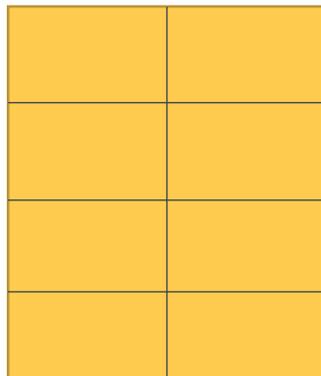
1



2



4



Learn More About Watercolors

Watercolors are different than other paints in that they are made of pigments and binders. Water carries the pigment (what you and I would call color) onto the paper. When the water evaporates (dries) the paint pigments (colors) stay on the paper.

Do: Art Challenge Using Watercolors

 For All Ages

Gather These:

From your house –

- Small dish of Water
- Ruler (if you want one)
- Pen or Pencil



From your kit –

- Heavy Paper
- Watercolor Pallet & Brush
- Square of Parchment Paper



Then Do This:

1. Make a list of the first 5 things you think of when you think of “Summer”. For example, maybe you think of green trees, flowers, sandcastles, watermelon, or popsicles.

There are no wrong answers!

2. Pick one of the items you wrote down and paint it with watercolors.
3. Share your painting using the hashtag #4HGrab&Go or by sending a photo to your local WSU Extension 4-H Office.

1.	_____
2.	_____
3.	_____
4.	_____
5.	_____



Henri-Edmond Cross (ca. 1905-1908)



Winslow Homer (1836-1910)

Expand Your Learning!

See examples of famous Watercolors from the Metropolitan Art Museum www.metmuseum.org

Apply the watercolor techniques you practiced earlier and learn about Color Theory

Gather These:

From your house –

- Small dish of Water

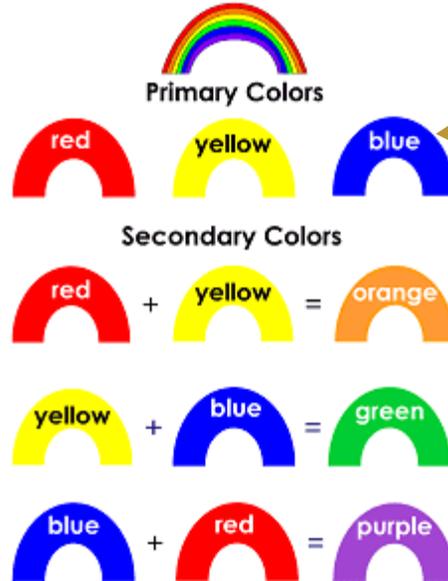


From your kit –

- Heavy Paper
- Watercolor Pallet & Brush
- Square of Parchment Paper



“
Colour are the smiles of nature.
-James Henry Leigh Hunt ”



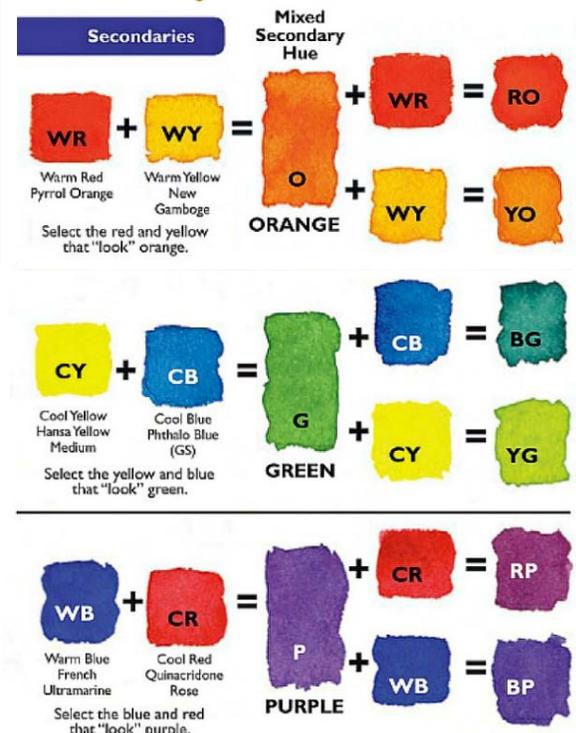
These are the Primary Colors. Do you see them in your paint pallet?

Do This:

- 1) Get your brush wet and pick up a small amount of your first Primary color (Red, Yellow, or Blue). Create a small pile of usable paint on your wax paper or a nonporous surface like an old plate.
 - 2) Clean your brush with water and pick up your second Primary color (Red, Yellow, or Blue). **Make two separate piles of paint on your wax paper.**
- Color
1

Color
2
- 3) Slowly mix the two colors.
 - 4) If the combination of your colors isn't creating the secondary color (Orange, Green, or Purple) you desire you could try:
 - a. Adding **more** of one or both Primary Colors
 - b. Adding a small amount of black paint to **darken**
 - c. Adding more water to **lighten**

These are Secondary Hues if you want to try adding more of a primary color to make making more shades of colors.



Expand your learning!

Visit the Smithsonian website and learn about the Science of Color. library.si.edu

Do you know why you can see colors? askabiologist/asi.edu/explore/seeing-color

Apply Color Theory to Build a Color Mixing Chart

Gather These:

From your house –

- Small dish of Water
- Ruler (optional)



From your kit –

- Heavy Paper
- Watercolor Pallet & Brush
- Square of Parchment Paper

Need Help?

Watch the Mr. Otter Art Studio Tutorial
<https://bit.ly/3kNK0ih>

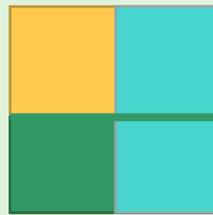


Do This: Build a Color Mixing Chart

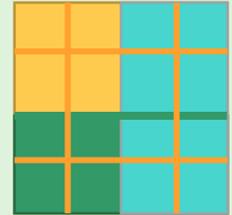
Step 1.

- Draw a large square on your paper.
- Divide it in half.
- Divide it in half the other way.

1



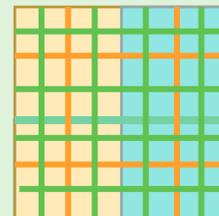
2



Step 2

- Divide the sections in half.

3



Step 3

- Divide the sections in half again.
- You now have an 8 x 8 grid with 64 squares!
- Label each column (columns run top to bottom) with a color from your paint pallet from left to right Red, Green, Blue, Yellow, Orange, Violet, Black, Brown.
- Label each row (rows run left to right) with a color from your paint pallet from the top to the bottom Red, Green, Blue, Yellow, Orange, Violet, Black, Brown.

CHECK YOUR WORK: The top right square on your grid should be labeled Red, Red.

Do This: Begin Mixing Paints

Each square will be a combine of the Column (running top to bottom) color and the Row (running left to right) color. The color you want the most of is the Row (running left to right) color.

- For the first row pick up a little red and a little more red (square 1). Pick Up Red and a little green (square 2). Pick up red and a little blue (square 3). Continue down the row.
- In the second row pick up green and a little red (square 9). Pick up green and a little green (square 10). Pick up green and a little blue (square 11). Continue down the row.
- Repeat this process until each square is filled.

This is a great reference tool for what color combinations you can create when you are painting and want a specific color.

You will also be practicing using your brush.

Learn: A Shape Within a Shape

 Ages 11+

Let's talk about shapes. Off the top of your head, what are some basic shapes?

Today we are mainly looking at triangles and squares.



A triangle has three sides and a square has four, but there are many other shapes out there with many different numbers of sides. We call a shape that has many sides (more than four) a polygon. How many sides does a stop sign have? [Answer: 8] Is it a polygon? [Answer: Yes, because it has many sides]. These many-sided shapes are everywhere, but they aren't as different as they seem. In reality, they are simply just large shapes that have smaller shapes inside them.

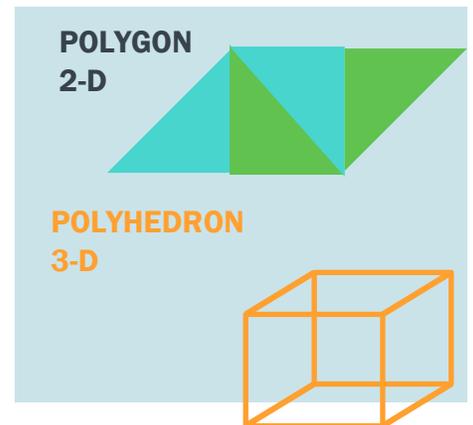
That means we can use basic shapes to create complex shapes. For example, a triangle is a pretty simple shape, but when we put two triangles together, we can build a square.



When you combine two triangles with a square, you can build a trapezoid



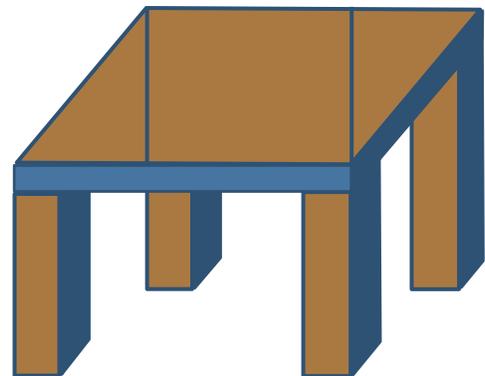
or if you flip one of the triangles upside down, you can build a parallelogram.



If you combine basic shapes together, you can create more complex shapes of all kinds and sizes. In 2-D, we create **polygons**. In 3-D, we do the same but call them **polyhedrons** instead.

Why combine shapes? We put different shapes together all the time to fit our daily needs. Look around you. These include tables, chairs, playgrounds, houses. Every 2-D and 3-D object is made of a combination of shapes.

How many shapes do you see?



Do: Build a Complex Shape

Gather These:

From your kit –



- Your choice of one of the Papers with pattern



- Colored Pencils

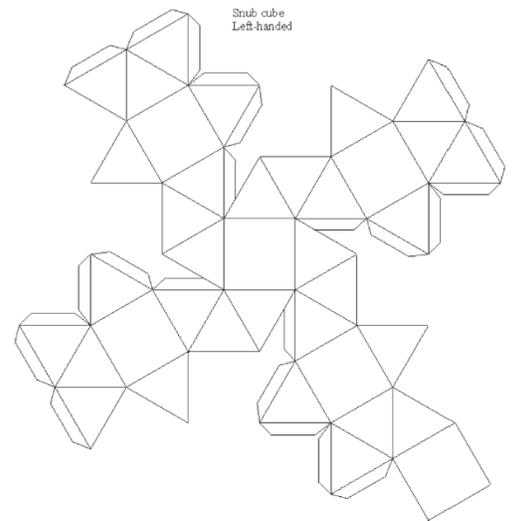
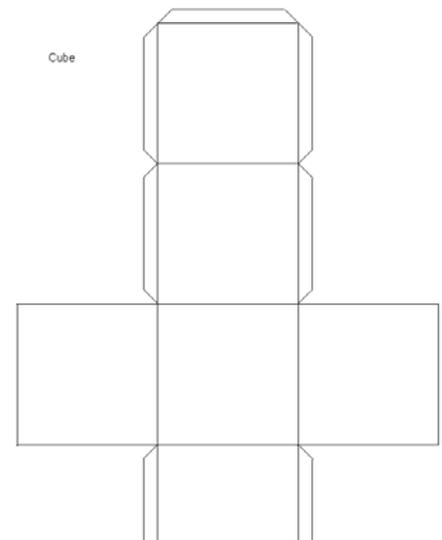
- Scissors

- Glue Stick



Do This:

1. Find the shape patterns included in this kit that you wish to build.
2. (Optional) Use colored pencils or your watercolors, or your other coloring materials to give your soon-to-be polyhedron some color.
3. Cut along the outside of the shape.
4. Fold at creases (you may need to fold it all the way into the shape to see what should be pasted to what).
5. Put glue on the tabs and paste your shape together until it becomes a full polyhedron.



Reflect:

Where do you see complex shapes around you?

When you started folding your shape together did it matter what order you folded in?

Expand your learning!

Borrow a book on origami from your local Library or find an online template and fold to your heart's content! For added fun count the different shapes that make up each polyhedron you create. Try to beat your personal best.

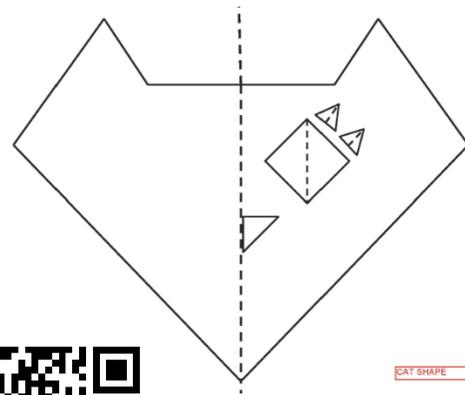


This Photo by Unknown Author is licensed under CC

Gather These:

From your kit –

- Cat Shape
- Colored Paper
- Colored Pencils
- Scissors
- Glue Stick

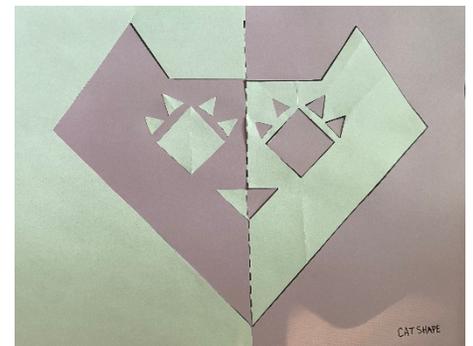


Need Help?
Watch our Tutorial
<https://youtu.be/b8DzBblHsyl>

Do This:

1. Fold the cat shape in half along the dotted line, creating a line of *symmetry*.
2. Cut along the outside of the cat (along the solid black line). Set the outer edges aside, do not throw it away.
3. Keep your cat folded in half. Cut out the triangle nose, again cutting along the solid black line. Set the nose aside.
4. Fold the cat shape along the dotted line for the cat's diamond eye (creating a line of symmetry) and cut out the eye by cutting along the solid black line. Set the eye aside.
5. Follow the same steps (in step 4) for the triangle eyelashes. Folding along the dotted lines and cutting the solid black lines. Set the eyelashes aside.
6. Unfold your shape and see the symmetry you've created. Is everything symmetrical? [If done correctly, then yes].
7. Now cut the cat shape in half, down the line of symmetry (dotted line).
8. Cut the outer edge you set aside in half along the line of symmetry (dotted line).
9. Paste one of the halves of the outer edges to the left or right side of your **colored paper**.
10. Take the left side of the outer edge and paste on the left side of your colored paper. Take the right side of the cat face and match it up to the opposite side of your outer edges, pasting that to the right side of your colored paper creating a full cat face again.
11. Find the nose that you set aside. Cut the nose in half along the dotted line. Inside the outer edge half (the left side of your colored paper), match the half of nose to the cut out side of the nose on the cat face.
12. Find the diamond eye that you cut out and set aside. Paste on the left side of your colored paper so it will be symmetrical to the cut out for the eye on the cat face.
13. For the eyelashes, you can choose whether to make them symmetrical or not. If you want them to be symmetrical, paste them like a mirror object to the ones on the other side. If not, paste them somewhere else (like maybe below the eye instead of on top of the eye).

Final Symmetrical Cat 



Do: Symmetry Challenge

 For All Ages

Gather These from your Kit:

- Blank Paper
- Colored Pencils
- Scissors
- Glue Stick
- Image of Choice
- Pencil



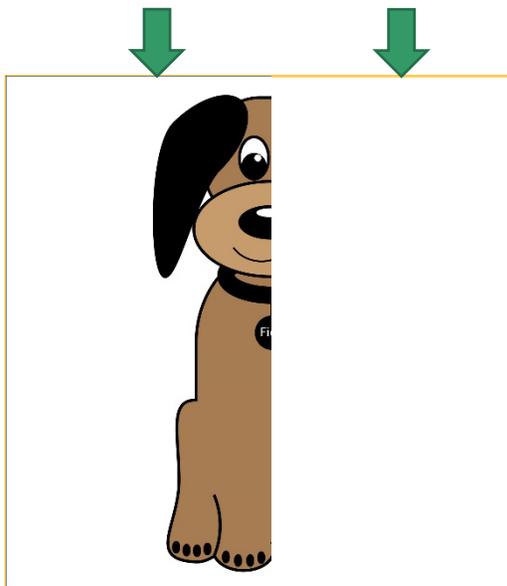
Need Help?

Watch the Mr. Otter Art Studio Tutorial
<https://bit.ly/3kNK0ih>

Do This:

1. You will need to choose one of the provided images for this activity.
2. Take your chosen image and fold it in half. Carefully cut along the fold.
3. Paste the half sheet onto your piece of blank paper.
4. On the blank side, try to draw in the other half of the face/object to match the pre-drawn side.

Try drawing the outline of the other side of this photo for practice.



Expand Your Learning!

On your next walk around your yard or neighborhood look for examples of symmetry and draw or write down what you see. Look at buildings, houses, stores, trees, flowers, animals, and people.



An object that has symmetry can be divided into two pieces.
 Learn more on the next page.

Learn: Symmetry

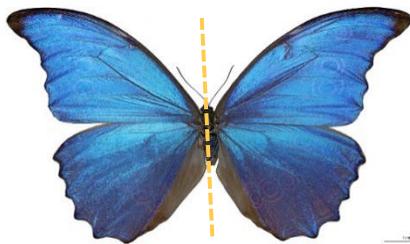
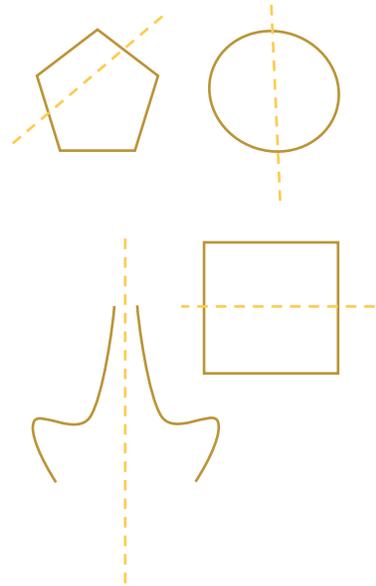
 For All Ages



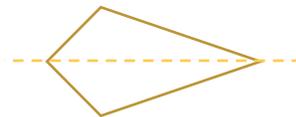
Here's another way to think of symmetry: If you were to draw a line from top to bottom through the very center point of a circle, would both sides look exactly the same? If yes, then that's symmetry. Can you do the same thing with a square? That's some more symmetry. Many objects in nature have symmetry.

Think of a butterfly. If you were to imagine a line straight down the center of a butterfly and fold it in half, you would find symmetry. That imaginary line is called the line of symmetry. We represent it by a dashed line. On either side of that dashed line, you should have a mirror image. Mathematicians love discovering these sorts of natural symmetries of shapes because it helps to map out the patterns of objects we see every day.

What has *more* symmetry, a circle or a square? [The correct answer is a circle, because a square only has 4 symmetries and a circle has an infinite number of symmetries]. No matter how many times you turn that circle, its position will not appear to change. However, you know that a square has been rotated when someone turns it except for when it is turned 90, 180, 270, and 360 degrees. It appears to change in all the other rotations in between.



[This Photo](#) by Unknown Author is licensed under [CC BY-SA](#)



Need Help Understanding Symmetry?
Watch this video from FreeSchool
<https://bit.ly/30oyy51>



Reflect



- What kind of shapes can you create that have symmetry?
- How did folding the object help to see the symmetry?
- Can you find symmetry without folding?

Apply

- Why might artists choose to use symmetry (e.g. drawing)?
- What other objects in your day-to-day life have symmetry?
- When might it be a good idea to create something with symmetry?



Do: Creating Your Own Pattern – Tessellations

 Ages 11+

What is a tessellation? A tessellation is a pattern that sort of looks like a puzzle. It is created by taking a shape and moving it (without rotating it) using **translation symmetry**.

Gather These from your Kit:

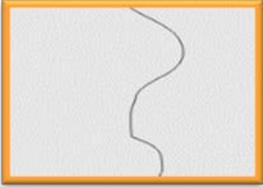
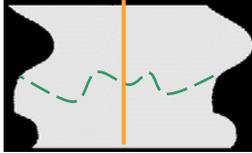
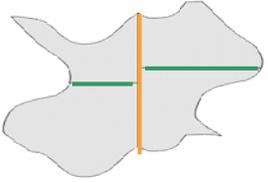
- Heavy Paper 
- Index Card
- Scissors 
- Pencil
- Colored Pencils or Watercolor Supplies 

Need Help?

Watch a video walking you through this activity step by step.
<https://youtu.be/bp0Wjufo4Ng>



Do This:

1. Start with cutting your index card into a square. **Draw a wavy line from the top of your index card to the bottom.** Try not to make the line too complicated and make sure you can cut along the line (no sharp corners). 
2. Cut along your line and then tape the index card back together with the flat sides touching. 
3. **Draw another line that connects the two cut edges.**
4. Cut along the **line you just drew** and then swap the sides and tape your new pattern together.
5. Take your heavy paper and trace your created pattern piece. Once you have your pattern started move your piece over until an edge lines up with the previous tracing. Keep repeating until your entire paper is covered by the pattern. Now you have a full tessellation! 

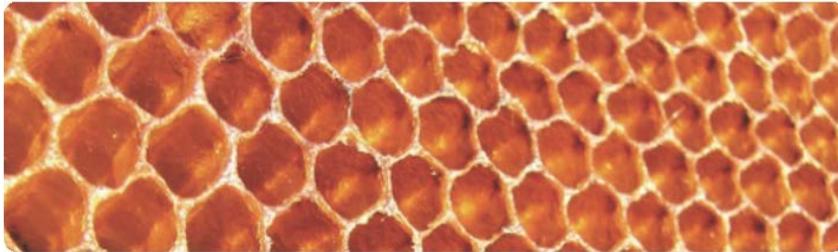


Now make your tessellation a true work of art by adding color!



Learn: Tessellations

What is a tessellation? A tessellation is a pattern that sort of looks like a puzzle. It is created by taking a shape and moving it (without rotating it) using **translation symmetry**. **Translation Symmetry** is when an object has done a movement, a shift, or a slide in a specific direction without the object rotating. It is important to note that this shape touches all of the other translated versions of that shape. There are plenty of tessellations that exist all around us; the most common one that occurs in nature is a beehive, which has a bunch of hexagons translated up, down, left and right. If you Google “tessellation,” you are bound to find a whole bunch of interesting patterns created using this symmetry technique.



(Kids Revolution 2012)



Expand Your Learning: Learn more about Translation Symmetry by watching this video bit.ly/3bsAKNe

Reflect

- How many shapes do you know how to make?
- What kind of shapes do you use every day?
- Why are basic shapes, polygons, and polyhedrons important?

Apply

- What tessellations are in the world around you?
- How do artists use shapes?
- What shapes do you use or need every day?

What is the Fibonacci sequence? Quite simply, the Fibonacci sequence is a list of numbers that form a naturally occurring pattern. How does it work? You start with the first two numbers, 0 and 1. Then you add them together to get the next number. So, $0 + 1 = 1$. Now your sequence is 0, 1, 1. Then you look at the last two numbers and add them together. So, $1 + 1 = 2$. Let's do this together one more time. The last two numbers were 1 and 2 so now we add $1 + 2 = 3$. Now your sequence is 0, 1, 1, 2, 3. See the pattern? Now that you have the first four numbers in the Fibonacci sequence (0,1,1,2), find the next ten and add them to the sequence. The correct answer is at the bottom of the page.

Now Draw the Sequence!

Gather These from your Kit:



- Graphing Paper

- Pencil



- (Optional) Colored Pencils



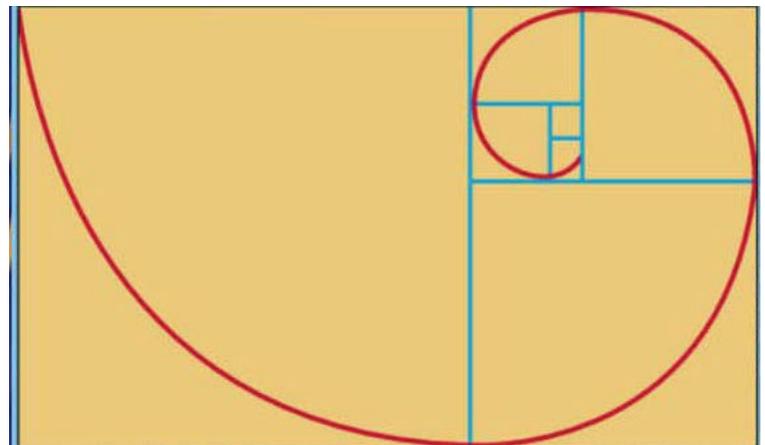
Need Help?

Watch a video walking you through this activity step by step.

bit.ly/3hZY2wx

Do This:

1. In the center of your graphing paper, trace a one by one square. Next to that outlined square, trace another one by one square (should be touching). This takes care of the first three numbers of Fibonacci's sequence (0, 1, and 1).
2. The next number in the Sequence is 2 ($1+1=2$). Next, trace a two by two square that shares the **bottom edge** of the previous two squares.
3. To the **right** of these, trace a three by three square ($1+2=3$).
4. On the **top** of your previous squares, trace a five by five square ($2+3=5$).
5. Continue creating squares in a counterclockwise direction according to the Fibonacci sequence until your graphing paper can't hold anymore squares.
6. **Finally, create your spiral by connecting the points of your squares at a diagonal. Starting with the one by one square in the middle, draw a half circle in the first one toward the second. Then continue at the point the last square ended, drawing another half circle from that point to the two by two. Continue until the spiral is connected through all of the traced squares.**



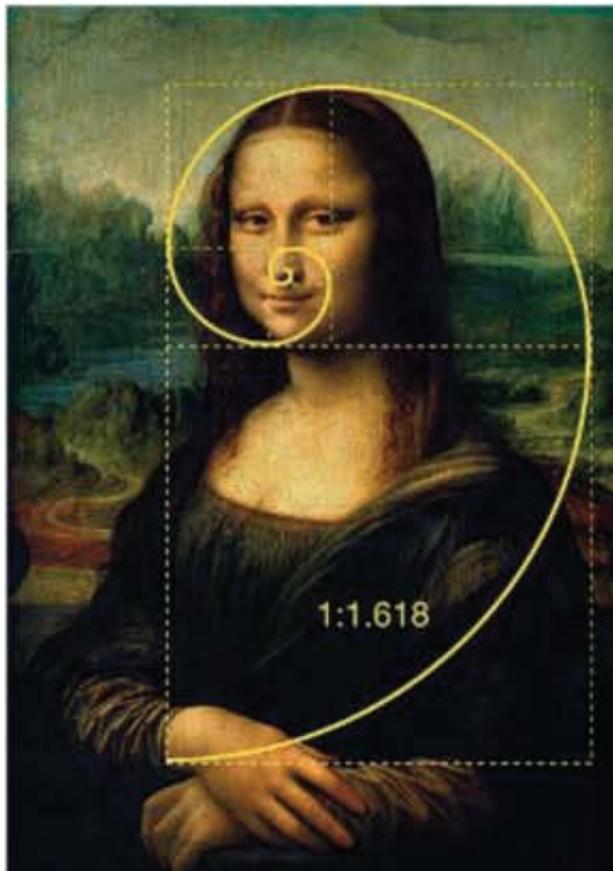
Learn: The Fibonacci Sequence

 Ages 11+

Fibo-what? In the 13th century, Signore Leonardo Pisano Bogollo created a special sequence of numbers named after his nickname, “Fibonacci,” which roughly translates to “son of Bonacci” (Knott 1996). Thus, we have a beautiful mathematical way to help make sense of the patterns in this world: the Fibonacci sequence. The first 10 numbers are 0, 1, 1, 2, 3, 5, 8, 13, 21, 34.

But what is the Fibonacci sequence? Quite simply, the Fibonacci sequence is a list of numbers that form a naturally occurring pattern. That’s right, this order of numbers exists in nature. For example, you can find them in pinecones, conch shells, and flowers, to name a few.

In nature the Fibonacci sequence appears as a spiral, beginning quite small, and getting larger and larger as it turns. Look at the example photo of a shell on the right. This spiral is created by placing squares of equal base and height (in order of Fibonacci’s sequence) close to one another.



Where else can you find a spiral like this?

Since this sequence is all about natural patterns, many artists use the sequence (and others like it) to create art without even knowing that they are using it. Remember Leonardo Da Vinci’s famous painting, the Mona Lisa? Her body is aligned according to the Fibonacci sequence, sitting quite comfortably in a spiral exactly like the one you just created.

Expand Your Learning!

To learn more about the Fibonacci Sequence look up “The Golden Ratio”.

Do: Make Your Own Patterns

 Ages 11+

The Fibonacci sequence does not apply to everything, but it is a great example of how it is possible to find patterns in the world around you. Once you find a pattern, it is also possible to describe the “rule” of the pattern by describing how you get from one part to the next. **The “rule” of a pattern is simply a description of how it works.** Let’s use Fibonacci’s sequence as an example. 0, 1, 1, 2, 3, 5, 8... The rule for this pattern was looking back at the last two numbers and adding them together. Patterns of objects in our world have rules like this that mathematicians try to find in order to explain and recreate those patterns. Thus, we can use addition, subtraction, multiplication, and division to describe what’s going on in the world around us.

Let’s try a different example. 1, 5, 21, 85, 341, 1365... What rule will give us this sequence of numbers? [Answer: 4 times the number plus 1]. And just like that, we have found the **rule** for a pattern.

To Gather:

- Pencil
- Paper

To Do:

Make up your own pattern. Remember, you can use one or more operations (don’t use division if you’re not ready for fractions). When you’ve created one, share it with someone and see if they can guess your pattern’s rule.

Reflect

1. What is a pattern?
2. Who was Fibonacci and what was his connection to patterns?
3. In what ways do you see patterns naturally occur in the world around you?
4. What kind of man-made patterns can be found in the world around us?

Apply

1. How are patterns related to art? How can artists use them to their advantage?
2. What is it about a spiral that is visually appealing?
3. Why do you think patterns (such as the Fibonacci sequence) are so important to mathematics?

Expand Your Learning!

M.C. Escher was a famous graphic artist. You can view an online gallery of his work at mcescher.com. Look for how he used patterns in his work.

SHARE : Post on Social Media using the Hashtags #4HGrab&Go and #4HGrowsHere You can also tag your County 4-H Page.

JOANN



SHARE YOUR 4-H CRAFT CREATIONS
#JOANNLOVES4H

Want to purchase additional craft supplies? You can save 15% every day with every purchase as a 4-H Rewards Member with JOANNS www.joann.com/4-h/

References

The 4-H Youth Development Program utilizes current best practices and research-based techniques for teaching youth new skills. This page gives credit to the experts and agencies from whom we got materials or concepts for this kit.

A Simple Method For Creating Tessellations From Rectangles. (n.d.). Retrieved August 17, 2020, from <http://sofia.nmsu.edu/~pmorandi/math112f00/EscherRectangle.html>

Belmonte, C. & Pappas, C. (n.d.) Painting by Number, Scientia Review. Retrieved from <http://www.scientiareview.org/pdfs/208.pdf>

Cross, H. (1905). Landscape with Starts [Digital image]. Retrieved August 21, 2020, from https://www.metmuseum.org/art/collection/search/459189?&pkgids=613&ft=* &offset=0&rpp=20&ps=3

DeRosier, C. (2016, January 01). Tessellation Art. Retrieved August 17, 2020, from <https://www.cindyderosier.com/2016/01/tessellation-art.html>

Short, S. (2020). Susie Short: Working with a Split Primary Color Palette. Retrieved August 18, 2020, from <http://danielsmith.com/blogs/susie-short-working-with-a-split-primary-color-palette/>

Winslow Homer (American, 1836–1910). *Flower Garden and Bungalow, Bermuda* (detail), 1899. Watercolor and graphite on off-white wove paper, 13 15/16 x 20 15/16 in. (35.4 x 53.2 cm). The Metropolitan Museum of Art, New York, Amelia B. Lazarus Fund, 1910 (10.228.10)

For the full curriculum visit utah4h.org/discover/



4-H 

WASHINGTON STATE UNIVERSITY
EXTENSION

WSU Extension programs, employment, and volunteer service are available to all without discrimination. Concerns regarding potential discrimination may be reported through your local Extension office or directly to the WSU Office for Equal Opportunity, web: oeo.wsu.edu, email: oeo@wsu.edu, phone: 509-335-8288