

## **MINI BLUEBIRD MATH CIRCLE**

## Issue 15: Stars, Turtles, and Growth with Angela Hall

Share your problems, solutions, models, stories, and art: https://akademia.mini.pw.edu.pl/pl/ukraina My people will sleep for one hundred years, but when they awake, it will be the artists who give them their spirit back.

> —Louis Riel, Historic Leader of the Métis People

#### NEWSFLASH

Join LIVE Bluebird Math Circle to work on these activities together with friends and family. Monday, February 26, 18:30-20:00 Warsaw, Poland time, online. Sign up https://akademia.mini.pw.edu.pl/pl/ukraina



#### MATH COYOTE CORNER

What do you call it when an artist and a mathematician get into an argument?

**Orthogonal visions!** 

### Meet Angela Hall



Angela Hall, Aski ka na kwa ha mo wa tam (She Who Sings with The Earth), is a member of the Métis Nation of Alberta and of Cree and Nakota Sioux ancestry. Angela lives in Stony Plain, Alberta, and is a teacher with more than 30 years of experience, artist, poet, and mother. Angela discovered her gifts of art later in life. Inspired by the empowerment she experienced through creating her artwork, Angela completed several graduate courses in Art Therapy.



The painting on the left, called The Stories We Tell, is

featured at <u>https://www.youcubed.org/resource/indigenous-maths-art/</u>. Angela Hall shared the following about it: "We are star people lowered by Grandmother spider to Earth's School. Hence, Turtle Island, or Northern America, is on a cycle of learning and

Indigenous expression. This painting describes how we come from the stars to weave stories among the earth of spiritual exploration and growth." Learn more at <a href="https://www.aguenusart.com/">https://www.aguenusart.com/</a>

# Family Circle: Stars, Turtles, and Rates

**Same but Different: The Turtles** Mathematics is about similarities in different things and differences in similar things. It takes many people to work out the math of how complex things are same but different. Let us play with the first four turtles in Angela Hall's painting. You can focus on shape, structure, size, or anything else you notice for this modeling game.

- 1. Quietly look at the four turtles for a minute.
- 2. Think: "The four turtles are all the same because..." Write down several similarities.
- 3. Choose one turtle. You can choose one you like, or one that stands out, or a random one.
- **4.** Think: "My turtle is different from all the others because..." Write down several differences.

5. Share similarities and differences with a partner and then with more math friends. Exactly the Same: The Star Rays You probably noticed that the star in the center of the painting is made of identical shapes. That symmetrical structure appears in many Indigenous designs, such as the gorgeous Lakota star blankets or Navajo hogan houses built along the cardinal directions. Let us model that structure with paper.

1. Quietly look at the star for a minute. Notice the repeating shapes.



- 2. Draw a big circle in the middle of your paper and mark its center.
- 3. Fold your paper through the center of your circle. Don't worry about the edges of the paper; they won't be in your way.

You can now draw half the star, You can also fold the circle through its The more you fold, the easier your work: center again, and only then draw and the less of the star you need to draw and cut it out through both layers of paper, and unfold. cut out a smaller fraction of the star. cut out!





How many times do you need to fold your circle through the center to make the 8-pointed star with a single straight cut?



4. Experiment with different folds. Are your stars more precise and symmetric with more or fewer folds?

**Grow Your Turtles** You probably noticed that the circles that make turtle shells in the painting grow larger from one turtle to the next. How? Here's a way to model paper turtles that looks pleasing to many people.

- 1. Measure out a small radius and draw a circle (a turtle shell). Fold your circle in half through the center, then again into a quarter. Draw turtle parts on your quarter-shell, then cut out your design and unfold.
- 2. Talk with your math circle partners and choose a rate for your team. Multiply your radius by that rate, and draw a circle with that new radius. Make a turtle out of that circle, as before.
- 3. Keep multiplying your previous radius by the same rate to grow your turtles. If you calculate several radiuses in your sequence, several people could make turtles at the same time. Figure out a way to calculate the radius of any turtle in your sequence, such as Turtle #100.
- 4. Choose your rate of growth wisely! If your turtles grow too fast, you'll run out of paper. If they grow too slowly, the design will look boring. Some rates will even shrink your turtles!

The method above is called exponential growth. Come up with your own rule for growing a beautiful sequence of turtles, and name your rule. Experiment with exponential growth or your own rules: <u>https://www.geogebra.org/geometry/ywyngavf</u>

# Ask Bluebird

**QUESTION**—Is it true that Leonardo da Vinci demonstrated his epic art skills by drawing perfect circles freehand? From Anonymous.

BLUEBIRD SAYS—That's probably a legend, not because da Vinci couldn't do that, but because artists and crafters all around the world have a lot of tricks for making good circles by hand. Ask around or search the web to learn how!





Paintings by Angela Hall:

FUN FACT OF THE FORTNIGHT How does Angela Hall paint the complex sense of growth that she envisions in her mind? She estimates, measures her shapes, or builds geometric constructions. Math researchers often analyze art and collaborate with artists. Give that a try! Explore these paintings rich with mathematics that stem from Indigenous imagery.





With Métis dot art, you could estimate growth rates by counting the number of dots making each curve or area. This method is similar to numerical integration.



Rainbow Crow Creation Story; The Grandfathers; Lowered from the Stars, at BearClawGallery.com

Teacher guide: https://aimathcircles.org/wp-content/uploads/2023/12/Bluebird-MC-Issue-58-Teacher-Guide.pdf

