BLUEBIRD MATH CIRCLE
Alliance of Indigenous Math Circles

Issue 22: Symmetry in Navajo Rugs

Share your problems, solutions, models, stories, and art:
https://aimathcircles.org/Bluebird

Together, the threads in a Navajo rug communicate more than function, warmth or beauty. They represent culture, geography and a way of life.

—Ron Garnanez,
weaver and artist

NEWSFLASH

Join LIVE Bluebird Math Circle to work on these activities together with friends and family.

Monday February 28, 5-6 PM MST online.

Sign up at https://aimathcircles.org/Bluebird

MATH PUZZLE

Can you guess what the missing figures are in the sequence of figures below?

Finding Symmetry in Navajo Rugs

Below are five Navajo rugs. Each has some sort of symmetry. See if you can describe the symmetries before reading on. (A symmetry is a way in which one part of a figure looks like another part of the same figure.)

#1 Burntwater rug by Louise Yazzie
#2 Changing Woman (Asdza'a' na'dleehe') rug, unknown artist, circa 1920
#3 Tree of Life rug by Marie Begay
#4 Revival rug by Rean Begay
#5 Pictorial rug by Master Weaver G.H.

Three Kinds of Symmetry

We will be talking about three kinds of symmetry. The first is vertical line symmetry. The letters A and H have these symmetries: the left half of each letter looks like its right half: A H

1. Can you find other letters with vertical line symmetry?

The letters B and C have horizontal line symmetry: B C

2. What other letters have horizontal line symmetry?

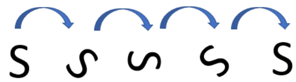
The letter X has both horizontal and vertical line symmetry: X

 For classrooms, math circles, and family mathematics

3. Which other letters have both horizontal and vertical line symmetry?
4. Some of the rugs above also have these symmetries. Can you tell which rugs have which symmetries?

The letter X also has another kind of symmetry. If you rotate ('spin') it around its center point by 180 degrees, it still looks the same.

The letter S has this kind of symmetry:



5. What other letters have this sort of rotational symmetry by 180 degrees?
6. Which rugs in the diagram above have this kind of rotational symmetry?
7. Can you find a letter, or a rug, or a design, which has both horizontal and vertical line symmetry, but does NOT have rotational symmetry by 180 degrees?
8. If you haven't solved the math puzzle in the yellow space above, go back and look again after reading this newsletter. See if you have any new ideas.

Ask Bluebird

QUESTION—*How can the Fibonacci numbers be found in Pascal's Triangle?–from Tammy Jones*

BLUEBIRD SAYS—*They're right here, along certain diagonals.*

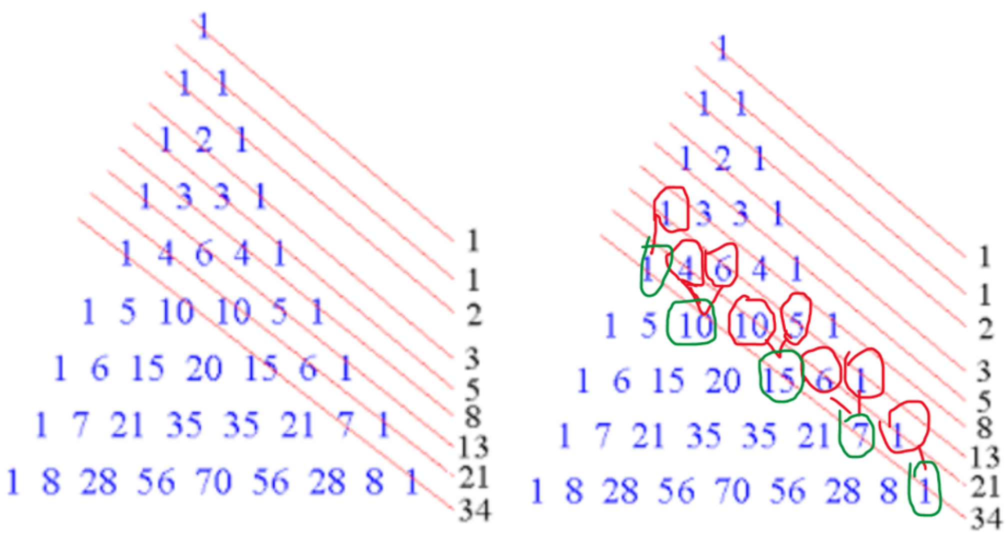


Diagram on the left: "Pascal's Triangle and Its Relationship to the Fibonacci Sequence" by MapleSoft.com

A formal proof would be by induction. But it's not hard to see informally why this is true. Each Fibonacci number is the sum of the two that it follows. And if you look at any one diagonal, you will see that the sum of its elements is just the sum of the elements of the previous two diagonals. This is shown above for the diagonal that adds up to 34.

FUN FACT OF THE FORTNIGHT

Planets follow roughly elliptical orbits around the sun. But their speed along the orbit is not constant. They are slower when they are further from the sun and the gravitational attraction is weaker. They speed up as they get closer to the sun.

Johannes Kepler (1571-1630) figured out that as they move, they sweep out equal areas in equal times.

Illustration by RJHall for Wikimedia