## MiNI BLUEBIRD MATH CIRCLE Issue 4: Counting Stars

Share your problems, solutions, models, stories, and art: https://akademia.mini.pw.edu.pl/pl/ukraina The Indigenous mind is very abstract.

—Henry Fowler, Navajo

**NEWSFLASH** Join LIVE the MiNI Bluebird Math Circle to work on these activities together with friends and family. The math circle is in English and Ukrainian with live translation. Monday September 5th, 18:30-20:00 Warsaw, Poland time, online.

MATH RIDDLE Henry starts from Kayenta at noon and drives to Chinle, a distance of about 55 miles. He drives at 50 miles per hour. Dawn starts from Chinle at noon and drives, along the same road, to Kayenta. She drives at 60 miles per hour.

How far apart are they when they meet?

## Sign up at<u>https://akademia.mini.pw.edu.pl/pl/ukraina</u>

## Family Circle: Counting Stars

This is a pot by Fannie Nampeyo, a famous

8

Hopi potter.

But what if we started at 8 and went to 2, skipping a number? Then kept skipping a single number? We would get a square. But we will have left out four blue points (four vertices). If we connect these as well, we get a beautiful (vellow) star:



In this picture, we have drawn a (red) circle around the pot and put eight (blue) points around the circle. We have numbered the blue points and connected them to make a regular octagon. That is, we have started at the point number 8 (the highest number), and gone around to 1, then to 2, then to 3...., then back to 8.

This is the same pot viewed from above. It has eight copies of the 'bear claw' motif laid out in a circle.

If you know a potter, you can ask her or him how to get the pot to be a circle, and how to divide it into eight equal parts for the repeated design. Those are all interesting mathematical questions. But we will ask some other questions.

> What if we started at 8 and connected every third vertex? We get this star: 8



(We have drawn it here without the pot.) Can you see the 'two squares' star inside? And the octagon?





So we have connected the points of the octagon skipping no vertices, skipping one vertex, and skipping two vertices. If we skip three vertices, we just get the diameter from vertex 8 to vertex 4. But we leave out six other vertices. If we start with each and connect them in the same way, we get a 'skinny' star (an 'asterisk').





Counting the octagon and the asterisk as a star, we now have four kinds of stars from the Nampeyo pot. What if we start at vertex 8 and skip 4, 5, 6, or 7 vertices? What kinds of stars do we get?

Here is a pot by Anderson Peynetsa, a potter from Zuni, New Mexico:



Here is the top view. Peynetsa has put seven deer figures around a circle.



Can you make stars out of the deer? How many different stars? Are some stars 'contained' in others?

## Ask Bluebird

FUN OF FORT

QUESTION—What are polynomials and monomials? - From Ye-Shiao T.

**BLUEBIRD SAYS**—Great question! As used in elementary algebra these are not really mathematical words. The books will tell you that a monomial is a single 'term'. A 'term' is a bunch of things multiplied together. A

polynomial is the sum of many terms ('poly' = 'many' in Greek). It's the word 'sum' that is key here. So  $4x^3y^2$  is a single term (a monomial), but  $4x^3y^2 + 3xy$  is a polynomial, in this case having two terms (a 'binomial').



Is that clear? Well sorta. Take the two expressions 2(x + y) and 2x + 2y. It's not hard to see that these are equal for any values of x and y. But the first is, technically, a monomial, while the second is a polynomial. But, you might say, x and y are added in the first expression. Doesn't that make them different 'terms'? No it doesn't. When you plug numbers into this expression (evaluate the expression), the last operation you perform is multiplication. If they were separate terms, then the last operation you perform would be addition. This is the case with 2x + 2y, which is two terms.

So the difference between a monomial such as 2(x + y) and a polynomial such as 2x + 2y is only in how the expression is written.

In higher mathematics, the term polynomial is given another definition, which is more meaningful. But for elementary algebra, the terms 'monomial' and 'polynomial' are shorthand, or slang, for certain kinds of expressions.

	Let's count the number of letters in the name of each number (in English):
	'One' has 3 letters.
FACT	'Two' also has 3 letters.
THE	'Three' has 5 letters.
NIGHT	'Four' has 4 letters.
	And 4 is the only number in English that counts the number of letters in its own name. Do you know any other
	language? Are there any numbers in that language which count the number of letters in its own name?