BLUEBIRD MATH CIRCLE
Alliance of Indigenous Math Circles

Issue 9

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

So long as mists envelop you, be still; be still until the sunlight pours through and dispels the mists—as it surely will. Then act with courage.

—Chief White Eagle, Ponca

NEWSFLASH

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

Monday July 26th, 5-6 PM MDT online.

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

MATH RIDDLE

Customer: How much is 1?
Salesman: 30 cents
Customer: I'd like 14, please.
Salesman: That will be 60 cents.
Customer: Oops, I really need 114.
Salesman: No problem, 90 cents.

What is the customer buying?

Family Circle: Handshakes and Combinations

After months of knowing each other only over Zoom, 5 friends finally meet in person and intend to each shake hands with one another. **How many handshakes will take place?**

Experiment with your solution to this problem, and pay attention to what your first instinct is. Is it to try with a smaller group of people? Is it to draw a diagram? Is it to act it out with your family members? Is it something else entirely? The neat thing is that any of these are a great way to approach this puzzle!

Photos: Two Nansemond Tribe members holding hands at a dance ceremony in Chesapeake, VA; replacing a handshake last year

Once we have figured it out for the case of 5 people, can you figure out for 10 people? What about 100? Well, the answer is yes, but the question is how we can do so easily without having to draw one hundred stick figures on paper. Let's try to build upwards by finding a pattern, starting with just 2 friends and working our way up.

Aha, these numbers have a nice pattern to them, don't they? Can we now use this pattern to predict the number of handshakes among 100 friends? Not only that, but this sequence has quite a cool geometrical representation, giving it the name of **triangular numbers**.

Let's try another approach. What if we think of this as a simple multiplication problem, since we know how many handshakes each friend has to make? That is, each of the 5 friends has to shake hands with 4 other people: $5 \times 4 = 20$. Try it this way, and… We run into a problem. Has math broken? See if you can figure out why the result here doesn't match the one we got before!

Returning to our 5 friends, they now want to have group hugs in every possible group of 3. **How many different group hugs can they make?** Since it's a small group, let's write out each possibility and see what we get. Weird… Where did we see this result before? Is it a coincidence? Let's see if there's an explanation.

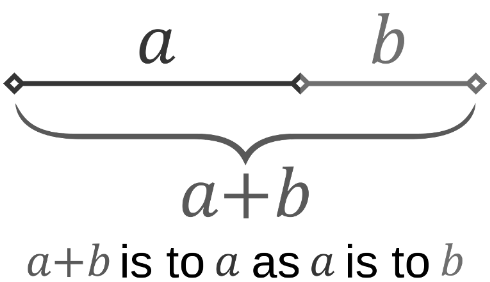
All of these questions come from the topic of **combinatorics**, which explores methods of counting different possibilities.

Ask Bluebird

QUESTION—The golden ratio seems to appear everywhere in the natural world. Is this golden ratio found in other cultures throughout the earth? - *From Dirk Chapito*

BLUEBIRD SAYS—This is quite an interesting question that lets us look into the history of mathematics across the world! For those who haven't heard of it, you can think of the **golden ratio (ϕ, read 'phi')** like this: imagine a line segment, and you want to find the point on the line that makes the ratio of the longer piece to the shorter one equal to the ratio of the whole segment to the length of the longer piece. The golden ratio is the one that makes this equality true, and its value is **approximately 1.618**.

Over 2500 years ago, the Greek mathematician and sculptor Phidias used the golden ratio in his work (and then had the number 'phi' named after him). About 1100 years ago, Abu Kamil, the Egyptian mathematician credited with first using irrational numbers in equations, used the golden ratio in novel geometric calculations. The golden ratio was known to Native American cultures, as well. The Ancestral Pueblo peoples incorporated the golden ratio into the layout of their sites dating about 900 years back. Modern archaeological studies show Pueblo and Greek building dimensions with ratios close to 1.618, though we have no ancient texts explaining how that came to be. About 500 years ago, Leonardo da Vinci of Italy called it the "divine proportion." The name "golden ratio" was first used in the 1800s by German mathematician Martin Ohm.



FUN FACT OF THE FORTNIGHT

How many people do you think we need to gather in a room so that there is **more than a 50% chance that two of them will share a birthday**? With 365 days in the year, it feels like there need to be quite a lot of people there for this to be true. However, the surprising result is that **23 people is enough** for it to be more likely than not that two people will share a birthday!

This occurs thanks to combinatorics, which shows us that the **number of possible pairs it is possible to make** among 23 people is very large, and we only need one of those pairs to match in their birthday. This is called **the birthday paradox.**

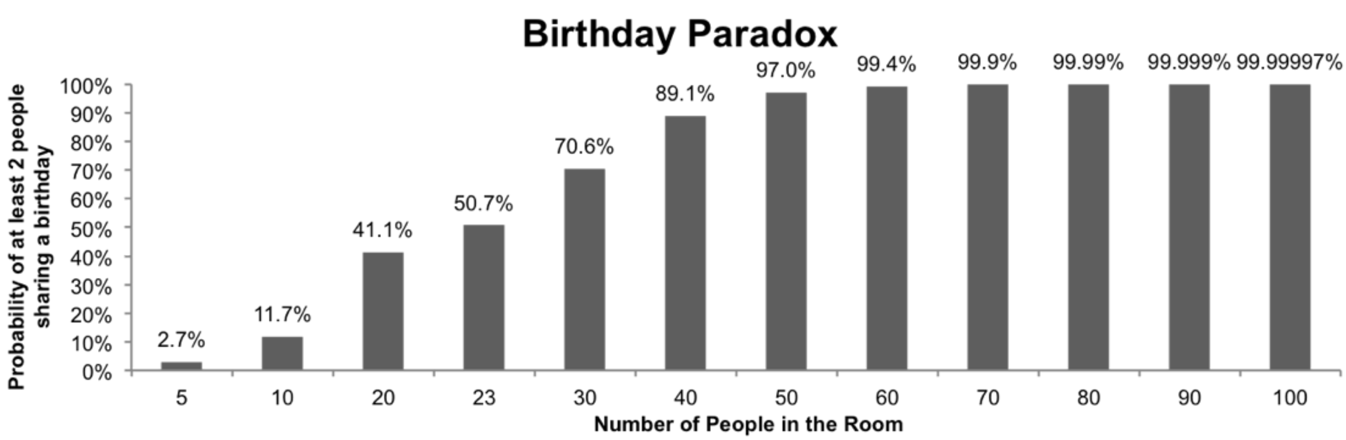


Image: Newfound Research

