BLUEBIRD MATH CIRCLE
Alliance of Indigenous Math Circles

Issue 8

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

If we wonder often, the gift of knowledge will come.

—An Arapaho proverb

NEWSFLASH

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

Monday July 12, 5-6 PM MDT online.

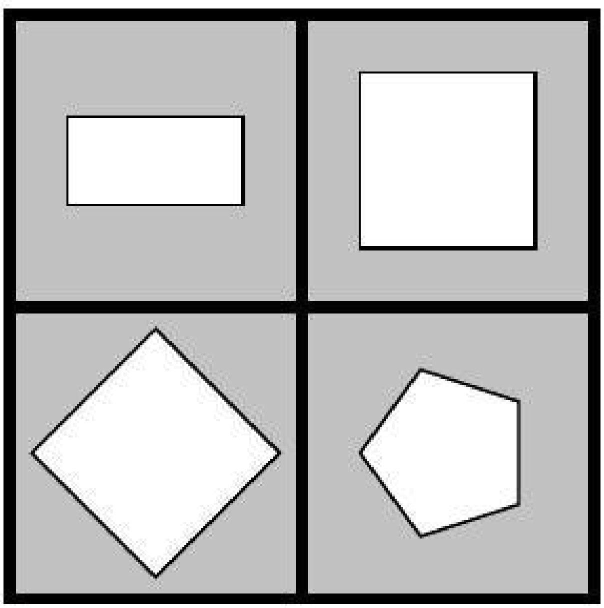
Sign up at **https://aimathcircles.org/Bluebird**

MATH PUZZLE

What comes once in a minute, twice in a moment and never in a thousand years?

How am I different?

1. Think about each of the four shapes in the grid on the left below. For each shape, find one thing that makes that shape different from the other three. The grid on the right shows *Four Seasons*, a set of four drums made by Brandon Gabriel and Melinda Bige, Indigenous artists from the Kwantlen First Nation, and displayed in Surrey, British Columbia. For each drum, think of one thing that makes it different from the others. It can be interesting to think about the symmetry of the designs.



2. Think about each of the four numbers in the grid on the left below: 9, 16, 25, and 43. For each number, find one thing that makes that number different from the other three. For instance, the number 9 has one digit, while all the others have two. How about the number 16? Can you find a property that distinguishes that number from the others? How about 25? 43?

9	16
25	43

17	26
44	65

Now what about the four numbers on the right: 17, 26, 44, 65?

Family Fun: No-Three-in-a-Row

Here's a game which you can play on your own or with another person. To begin, write the numbers 1 – 9 over a set of boxes like this:

1	2	3	4	5	6	7	8	9

Players take turns in which they choose a number and write it in the box below. After three turns, we could be left with this:

1	2	3	4	5	6	7	8	9
1		3				7		

A player loses the game when they enter a number that forms a sequence of three-in-a-row. Suppose that four turns have been played and that it's now your turn. For example, look at the following situation:

1	2	3	4	5	6	7	8	9
	2	3			6	7		

If you choose "4", you will lose because 2-3-4 form a sequence of three-in-a-row. The only winning move you can make is to choose "9." Then your opponent will lose on their next turn.

Take some time to play the game and keep track of how many moves are played before someone loses. What is the largest number of moves that can be played before someone loses? Can you explain why this is the case? Suppose we play with the numbers 1 to 99. What would be the largest number of moves that can be played without someone losing?

Suppose that you play using only the numbers 1 to 5 and that you are the first player to make a move. Can you find a strategy that guarantees that you will win?

How about if we play with 1 to 6? Can you find a winning strategy for either player?

You can make the game more complicated (and more interesting!) by including skip-counting in the rules. Now the loser is the first player to add a number that makes three-in-a-row while skip-counting by any number. For instance, forming 2-4-6 will cause you to lose since that makes three-in-a-row while skip-counting by 2s. In the same way, forming 3-6-9 will also cause you to lose. If we play this modified game with the numbers 1 to 11, what is the largest number of moves that can be played before someone is guaranteed to lose? If we play this modified game with the numbers from 1 to 210, no one knows the answer to this question.

Ask Bluebird

QUESTION—*What is π?* From Ye-Shiao T., Tuba City Boarding School

BLUEBIRD SAYS—***Take any circle and measure its circumference (distance around the boundary) and radius (distance from the center to boundary). Then divide the circumference by two times the radius; you will always end up with the number we denote by π.*** *This fact was known to many ancient peoples such as Babylonians, Egyptians, Indians, Chinese, and Greeks, although it wasn't until the 1700s that the symbol π was used for this number. Number π appears in countless other areas of mathematics, including geometry, probability, quantum physics, and more.*

One particularly surprising appearance of π is in number theory: if you take every natural number - 1, 2, 3, …, square the numbers thus getting 1, 4, 9, …, take their reciprocals - $\frac{1}{1}, \frac{1}{4}, \frac{1}{9}, \ldots$*, and add them all up:* $\frac{1}{1}+\frac{1}{4}+\frac{1}{9}+\ldots$*, then the result will be exactly* $\pi^2/6$ *(which is approximately 1.644934).*

FUN FACT OF THE FORTNIGHT

A standard deck of playing cards contains 52 cards, and each card contains a number (1 through 13) and a suit (heart, diamond, spade, or club). How many different ways can you arrange these cards? The answer is approximately 10^{68} (a 1 followed by 68 zeros), which is beyond astronomical; for reference, astronomers believe that the universe is approximately 10^{18} seconds old, and that there are approximately 10^{23} stars in the entire universe.

Suppose you open a brand new pack of cards. How many times do you need to shuffle until the deck is random? At least 7, if you use riffle-shuffling (split the deck into two, and interleave the two halves). If you riffle-shuffle fewer than 7 times, then it is mathematically impossible to end up with some arrangements of cards, and even some magic tricks depend on a deck of cards that is not sufficiently shuffled.

