BLUEBIRD MATH CIRCLE
Alliance of Indigenous Math Circles

Issue 29: The Game of Buzz

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

To function efficiently in today's world, you need math. The world is so technical, if you plan to work in it, a math background will let you go farther and faster.

—Mary G. Ross
In 'Ross, Mary Golda: The Cherokee Nation Remembers the First Woman Engineer for Lockheed', Indian Country News, 13 May 2008, indiancountrynews.com

NEWSFLASH

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

Monday June 6, 5-6 PM MDT online.

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

MATH PUZZLE

The number 64 is both a perfect square and a perfect cube:

$8^2 = 4^3 = 64$

What is the next number with this property?

Buzz and Buzzwhack: Two Games with Numbers

1. In the game of Buzz, players take turns counting off: 1, 2, 3…. But when a number is a multiple of 7 (that is, divisible by 7), the player must say 'buzz' instead.

   How many times does a player say 'buzz' if the game goes up to 100? To 1000? (Including 100 and 1000.)

2. The game of Buzzwhack is played exactly like the game of Buzz, with the added rule that a player must say 'whack' if the number is a multiple of 4. If the number is a multiple of both 4 and 7, The player must make both sounds.
   a. How many times does a player say 'whack' if the game goes up to 100? To 1000? (Including 100 and 1000.)
   b. How many times does a player say 'Buzzwhack' if the game goes up to 100? To 1000? (Including 100 and 1000.)

3. The game of Buzz is a good game for exactly two players, but the game of Buzzwhack is not. Why not?

Ask Bluebird

QUESTION—*Is it possible to have a certain number of points on the circle, so that when we start at a point and keep skipping the same number of points, we keep going forever, never coming back to the starting point?*–from Tatiana Shubin

BLUEBIRD SAYS—I'm not going to answer this question right now. It's pretty complicated. But here is a way to think about the situation.

1	2	3	4	5	6	**7**	8	9	10
11	12	13	**14**	15	16	17	18	19	20
21	22	23	24	25	26	27	**28**	29	30
31	32	33	34	**35**	36	37	38	39	40
41	**42**	43	44	45	46	47	48	**49**	50
51	52	53	54	55	**56**	57	58	59	60
61	62	**63**	64	65	66	67	68	69	**70**
71	72	73	74	75	76	**77**	78	79	80
81	82	83	**84**	85	86	87	88	89	90
91	92	93	94	95	96	97	**98**	99	100

Look at this chart. See how it shows multiples of 7 on a 10x10 grid?

Can you think how we can use it to help us play Buzz?

And how we can 'translate' the question above onto this chart? If we start with 7, and skip 6 numbers at a time, we get to the next red number. So we are asking if we can find a chart like this in which the first red square has no other red square under it.

If the phrase 'a chart like this' is not clear, what we are looking at is a chart with rows of ten integers each, and multiples of a fixed number (here that number is 7) colored red. So we are choosing two numbers: the number of entries in each row and the number whose multiples will be colored red.

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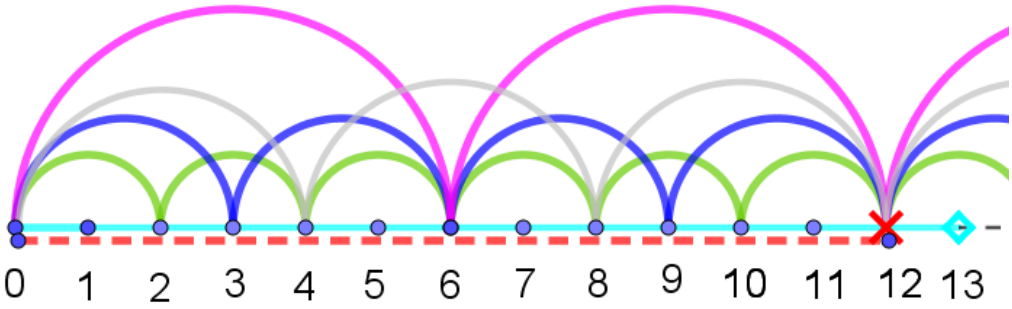
In our original problem, we are also choosing two numbers: a certain number of points on the circle, and the number of points we keep skipping.

FUN FACT OF THE FORTNIGHT

Photo: newly emerged adult cicada, by Ollllonate on Wikipedia

Cicadas are insects that stay in the ground for years, emerging to reproduce at regular intervals. It turns out to be advantageous for cicadas to have cycles which are prime numbers. One reason is that their predators also have population cycles (their populations grow and shrink at regular intervals), and the cicadas want to avoid coming out at the peak of these cycles. If, say, a cicada population has a cycle of 13 years, it will be vulnerable to predators with cycles of 1 or 13 years. But if the cicadas come out every 12 years, they will be vulnerable to predators with cycles of 1, 2, 3, 4, and 6 years.



The picture shows a swarm of cicadas (light blue) that appears after every 13 years, and another swarm (dotted red) that appears after every 12 years.

The semicircles represent predators with cycles of 2, 3, 4, and 6 years. You can see that the 12-year swarm will be hit by all of them at once when they come out, while the 13-year swarm will avoid them all at once. And this will happen to the 12-year swarm every time they come out.

(If you were to continue the diagram, the 13-year swarm would be hit by predators. Can you tell when? Can you tell when it would be hit by more than one predator at a time? It will happen very infrequently.)

There is another reason why cicadas like prime numbers: such numbers are also relatively prime. For more on these fascinating insects, see **https://youtu.be/ivQaJwFRowc**