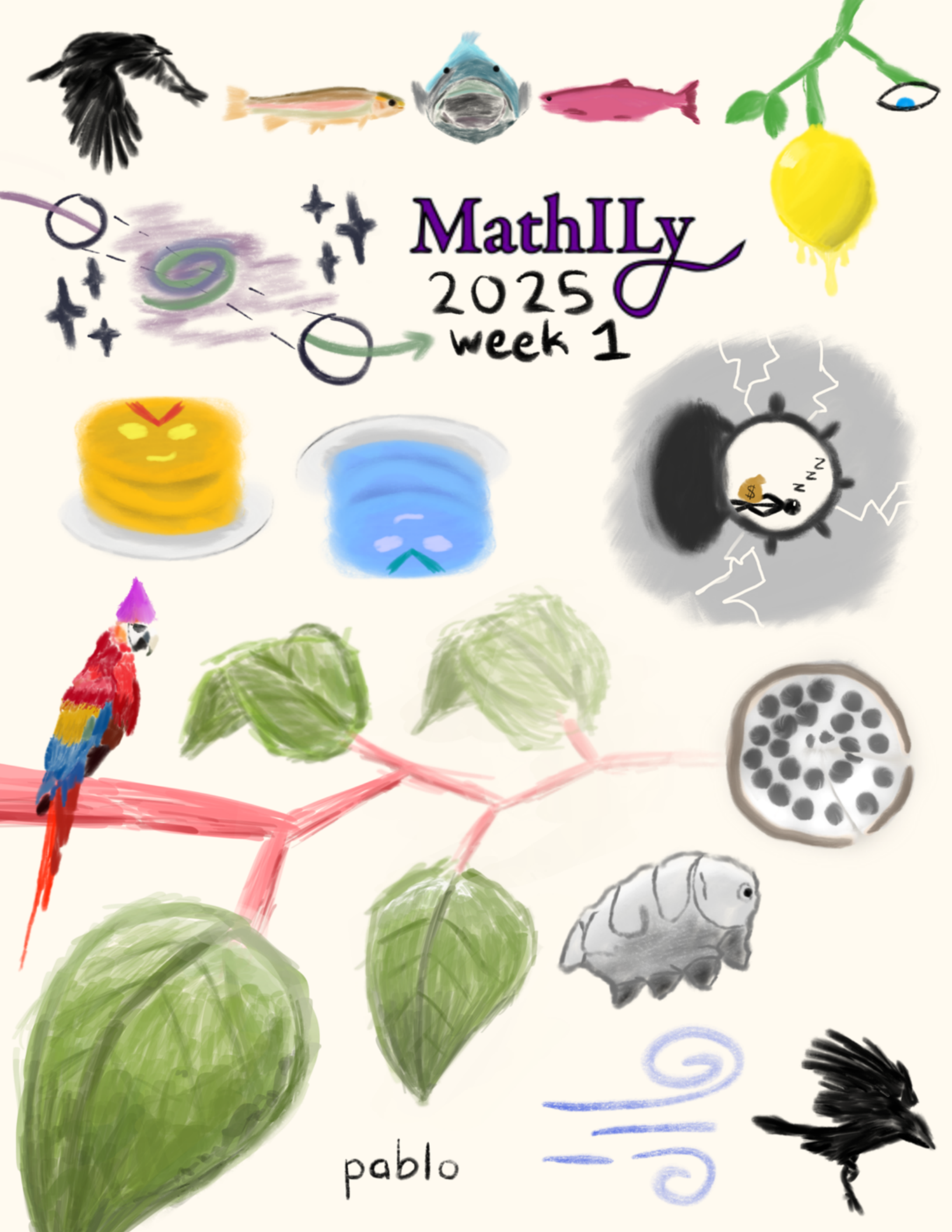
MathILy
2025
week 1
pablo

the MathILy Record of Mathematics (RoM)

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Welcome...

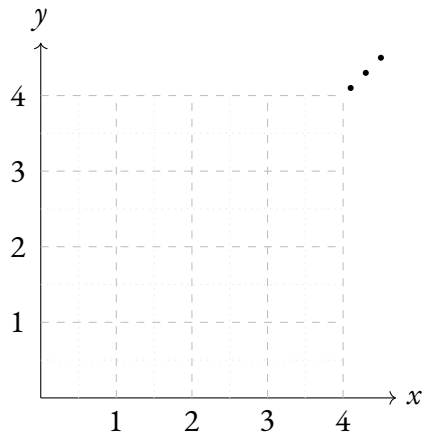
to the 1st issue of the Record of Mathematics, MathILy 2025. Despite excitement and anxiety, we embarked on our first root journey. sarah-marie's root discussed divas that plan to move to Nebraska while experiencing an odyssey with diverse salmon. Every morning, Hannah's root made breakfasts made with butter, syrups, and squeezed lemons. We cannot forget the unbounded creativity for all the oxen from Brian's root that had space pirates traversing stars. Each root brought original yet non-plusing discussions which will continue for the next few weeks. During our daily gathering, we invited our first guest speaker, Sahana, who fascinated us with Euclidean metrics.

Read more in Root Classes!

In this issue...

3.1 I am Average at Chess BY Brandon Furman

On Monday, Brian showed us his infinite chessboard. Annoyingly, he only drew a small part of his chessboard:



Brian starts with queens on every square on the main diagonal $y = x$. Brian's question is, "Which queens can he remove to ensure the entire board is still threatened?" First, Darsh showed we needed to keep queens on the squares (k, k) for either every even k, or every odd k. Then, Matti showed we couldn't remove three queens who's coordinates form an arithmetic sequence of three. Soon, we were choosing the first few queen coordinates we would remove. We chose the following numbers:

$$0, 1, 3, 4, 9, 10, 12, 13, 27...$$

Someone shouted "Aha! These are the NuwoTs from the EAR!" (NuwoTs are Numbers without Twos in base three) We spent the rest of the Daily Gather discovering that our algorithm for finding these numbers actually selects the NuwoTs, and that the set of all NuwoTs form a valid set of queen removals. Neat!

3.2 Sumthing's Different BY Leo Tsai

On Tuesday, Hannah started the Daily Gather by introducing some rules to make numbers in a fancy way:

- Add ± powers of 2.
- Use as few terms as possible.

As an example, the shortest way to write 14 is $14 = 16 - 2$.

We explored this idea for a while and made conjectures. One of our conjectures was that every natural number n can be written uniquely as a sum of ± powers of 2, such that none of the powers of 2 are consecutive or equal. We also claimed that this is the shortest possible way to write n.

To find this sum, we could start with any sum of powers of 2, and make replacements as such:

- Replace $2^k + 2^k$ with 2^{k+1}
- Replace $2^k - 2^k$ with 0
- Replace $2^{k+1} - 2^k$ with 2^k