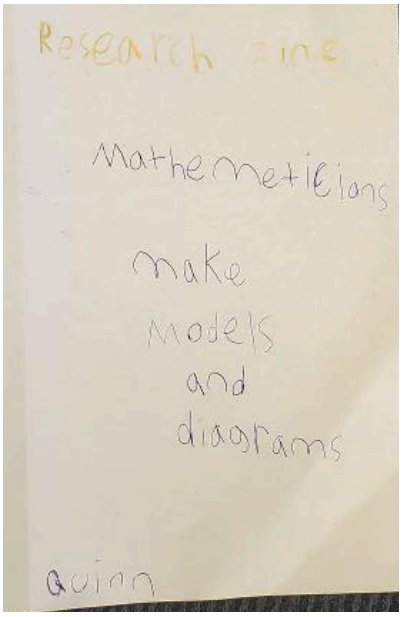
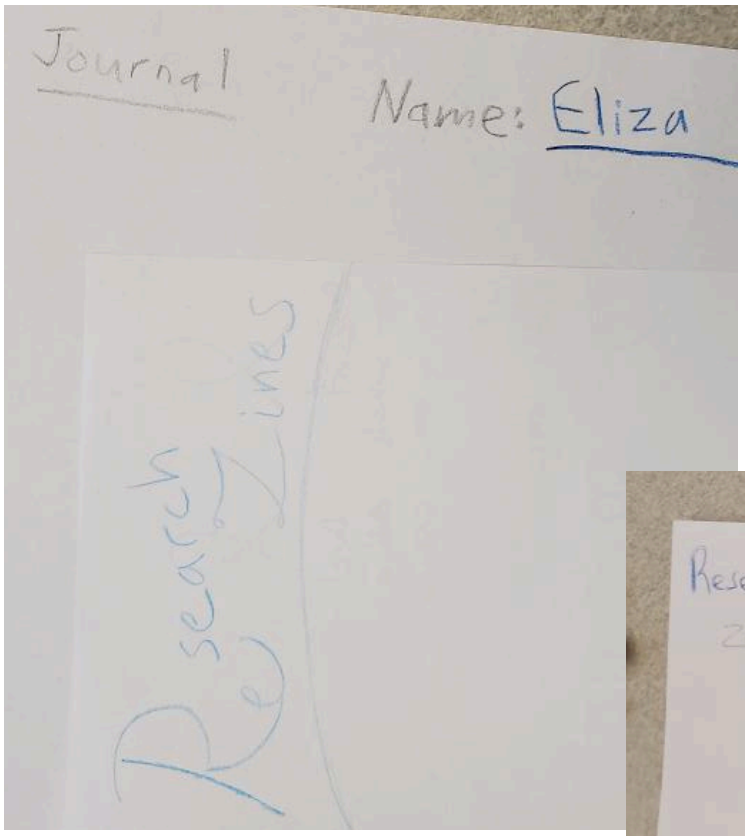
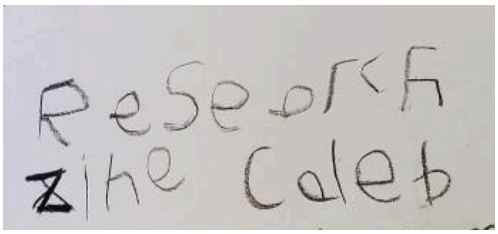
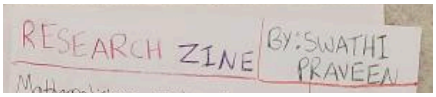
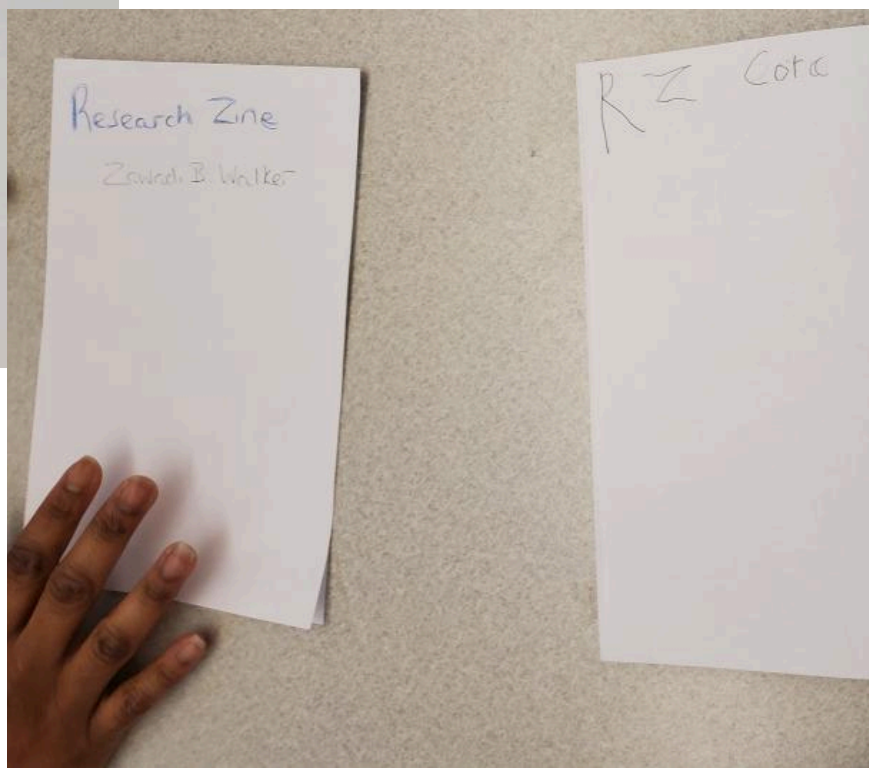


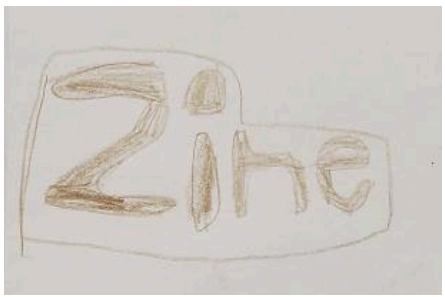
This Knot Is Not a Knot: Our Research Zine

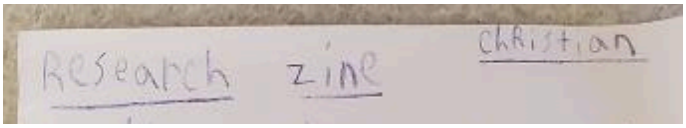


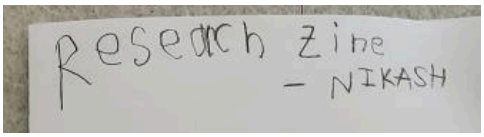


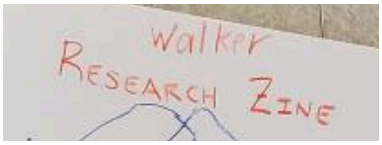


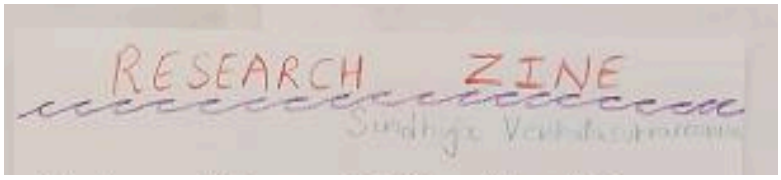


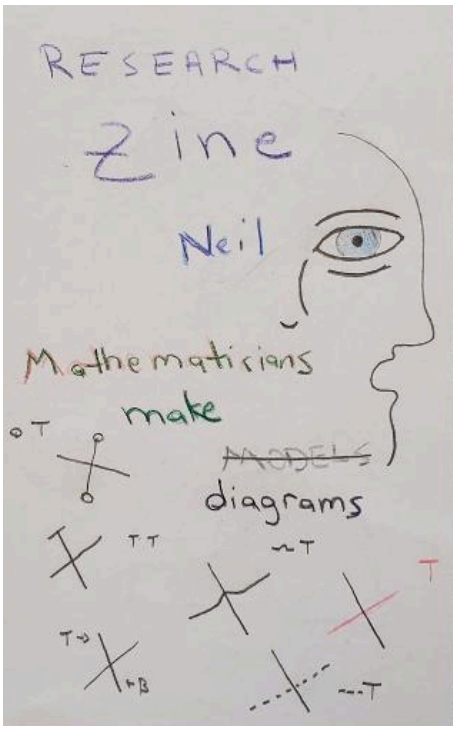


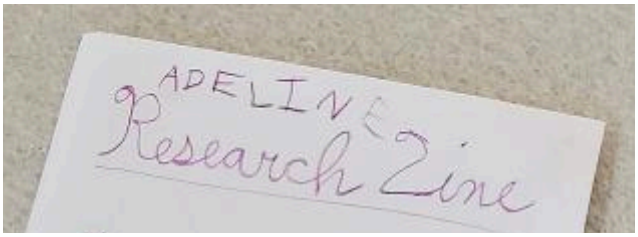


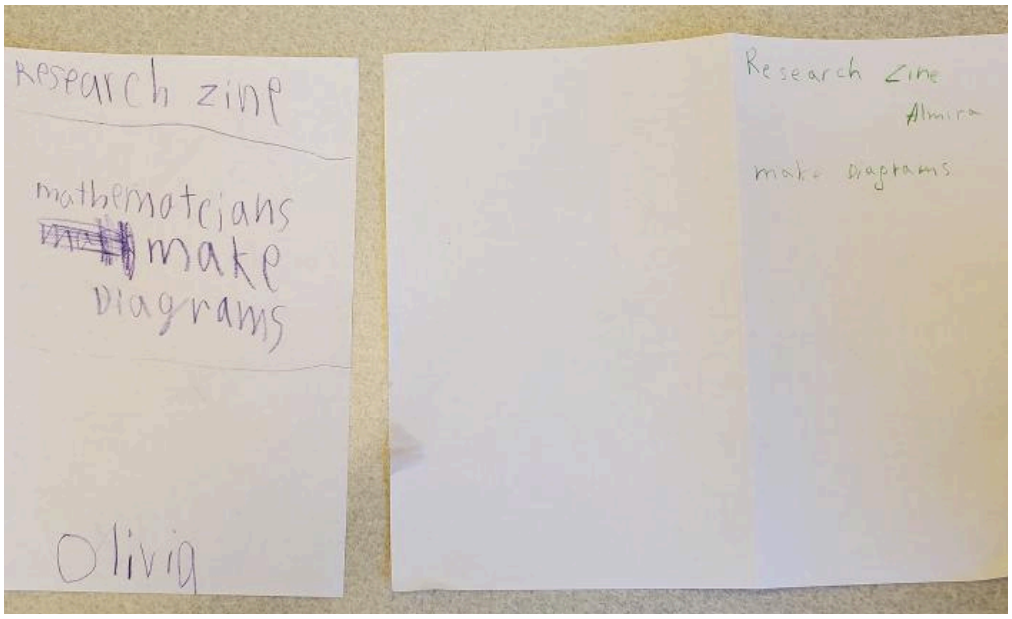


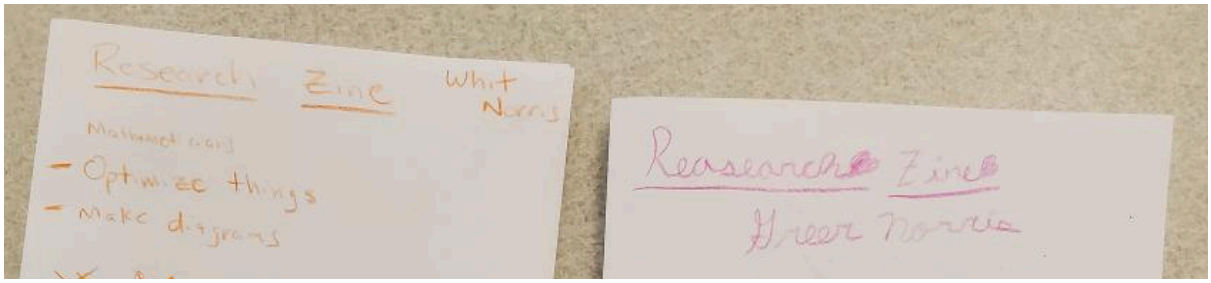






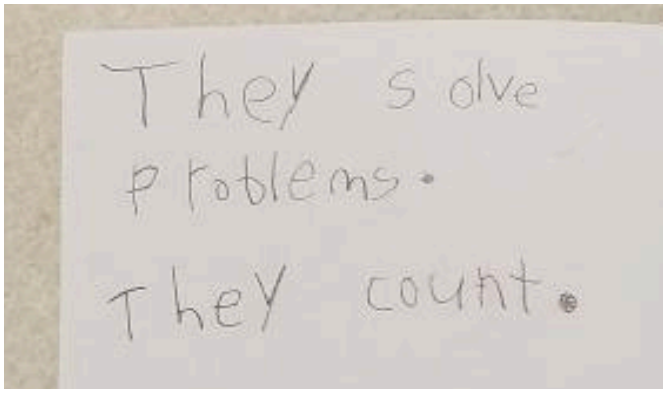


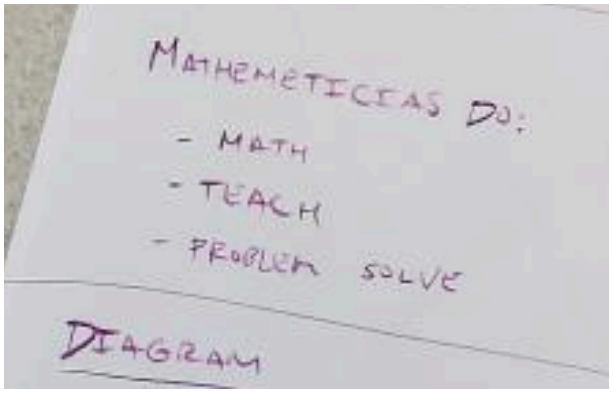


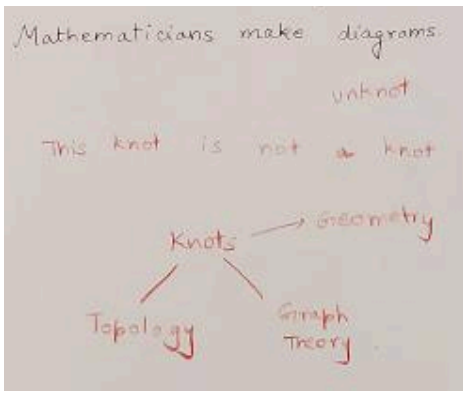


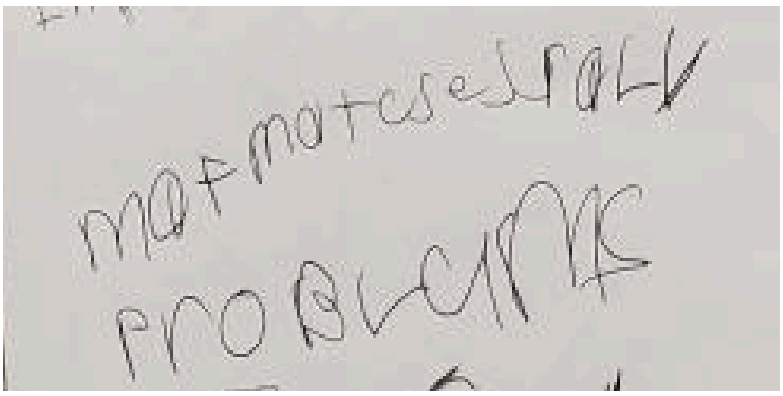
What do mathematicians do?

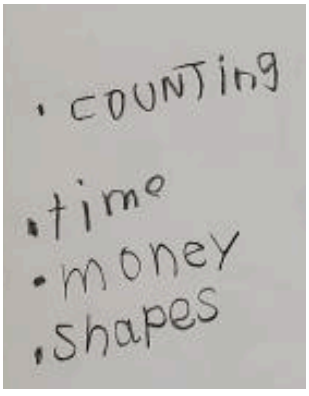
Think for a minute about what mathematicians do.

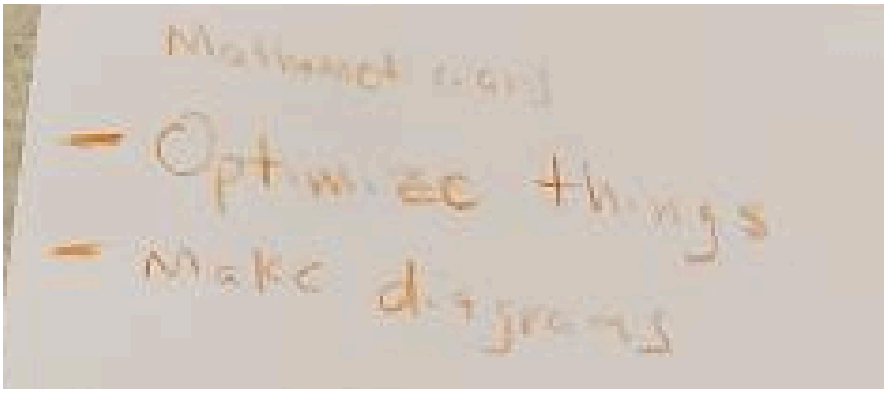


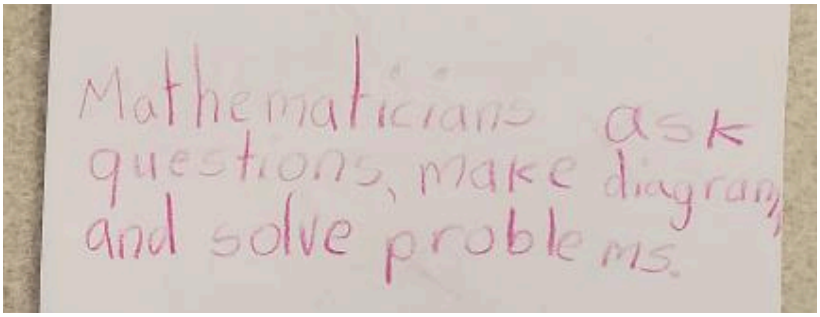












Among other things, mathematicians invent and make models and diagrams.

Same but Different: Models and Diagrams

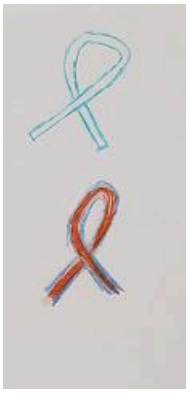
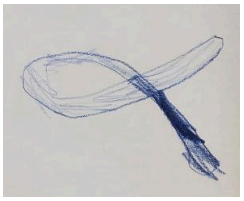
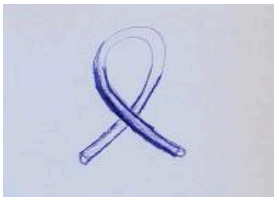
How are this model and this diagram the same? What is different?

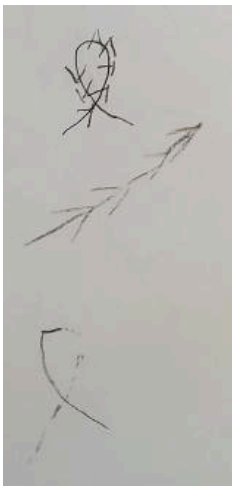
In geometry, we pay a lot of attention to shape. For example, one of the wire's ends points up, but both ends in the diagram point down. Let's move into topology, where we care less about shape and more about insides, outsides, loops, and overlaps.

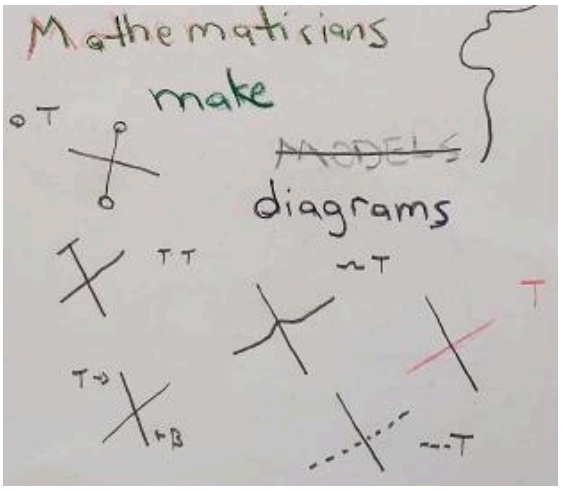
This is not a very useful diagram for topology. It doesn't show which of the two crossing lines is on top of the other!

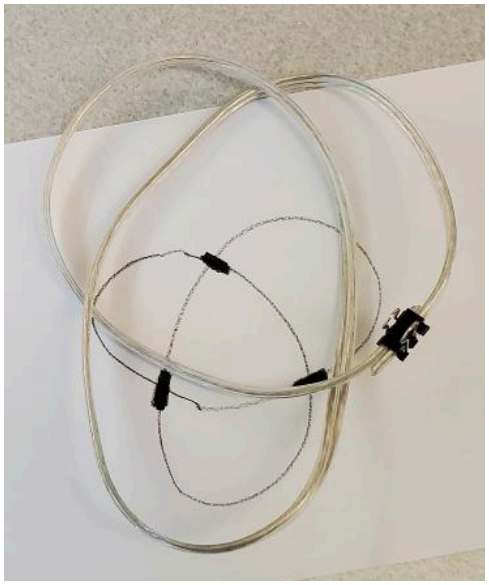
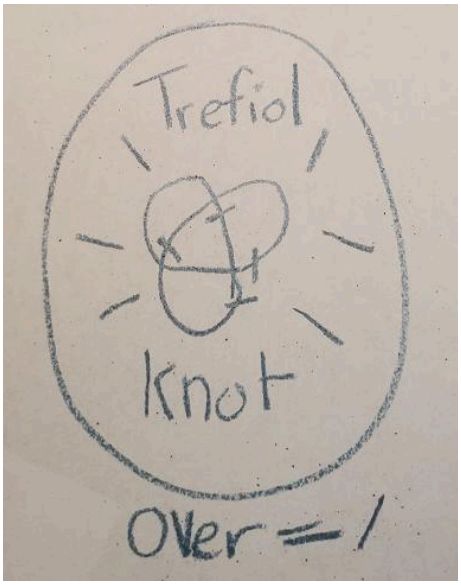
Knotation:
Your Own Notation for Knot Diagrams

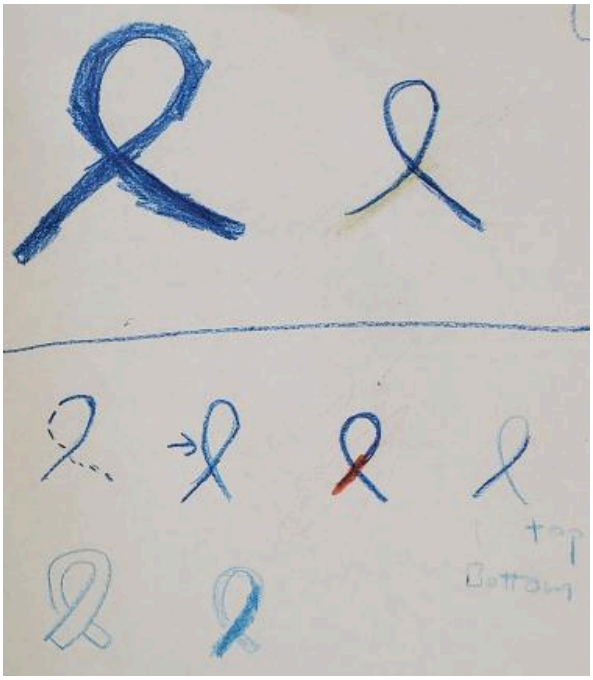
Let's make better diagrams! How can we show which of the crossing lines is on top? Think about it and invent your own ways.

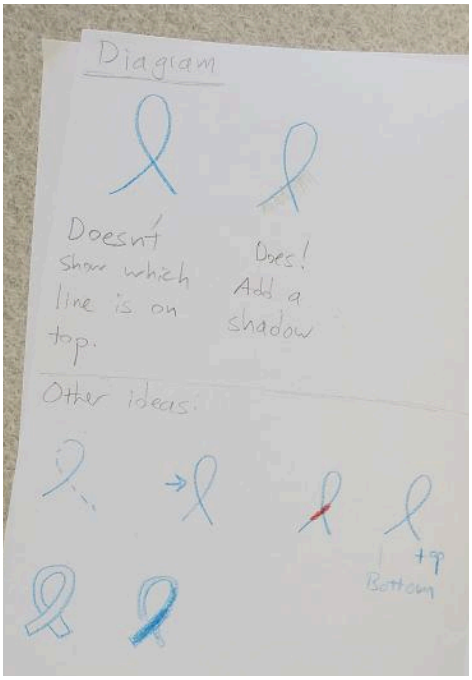





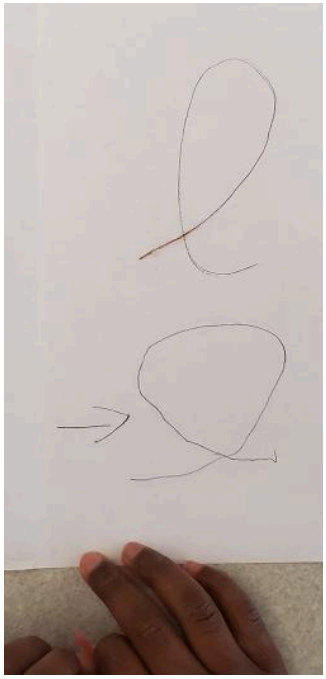


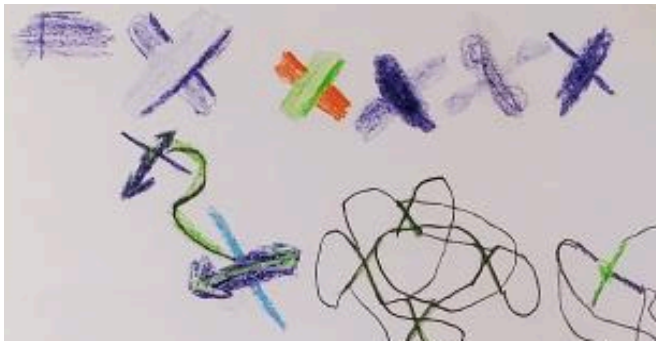



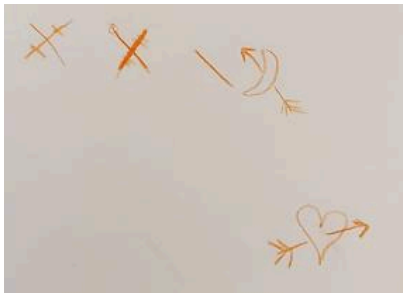



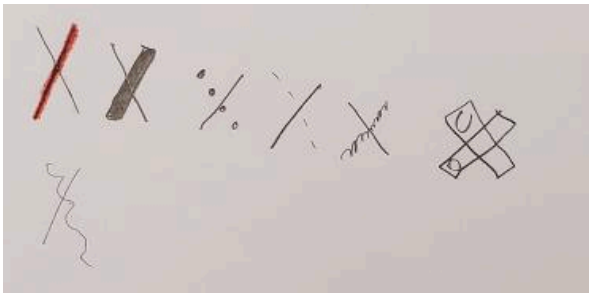


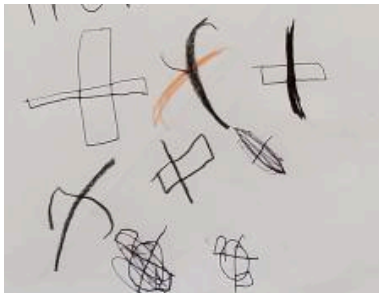


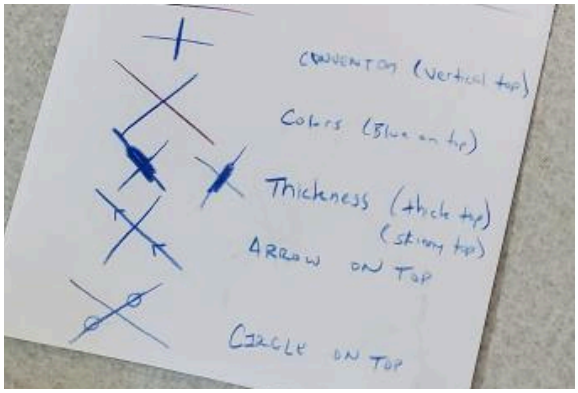


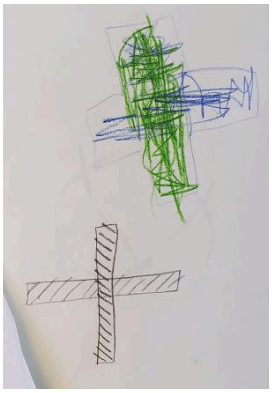


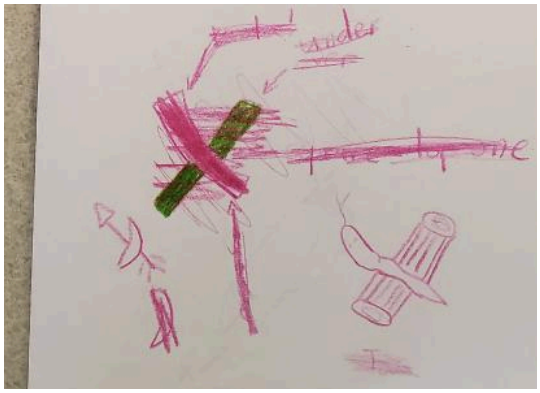












This Knot Is Not a Knot: Puzzles with Diagrams of Knots

By Jennifer Mann at https://mathcircles.org/activity/puzzles-bands-knots/

What is a knot?

Determine which of the following are mathematical knots.

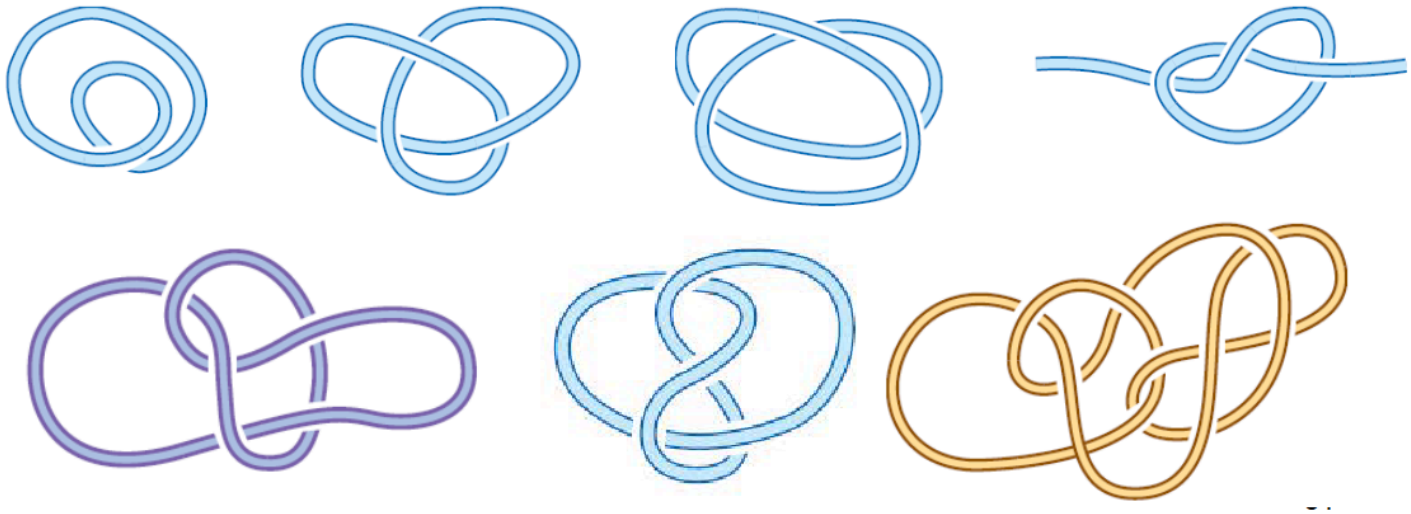


Image adapted from The Heart of Mathematics: An Invitation to Effective Thinking, 4th Edition by Edward B. Burger and Michael Starbird

What helps you see if a tangle is a mathematical knot, or a simple loop (an unknot)?

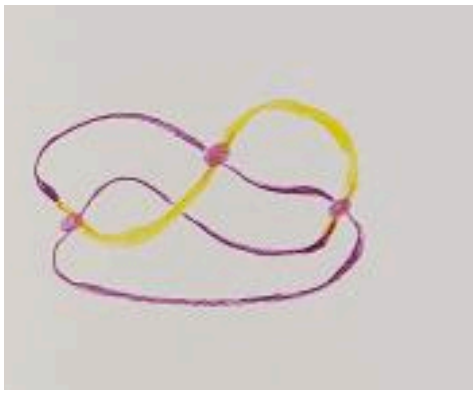
Your Knots or Unknots: Knot Diagrams

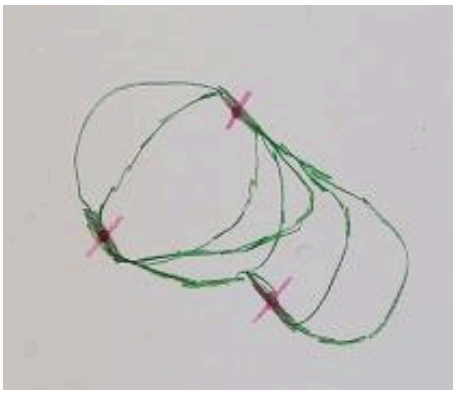
Draw three dots (you can try with more later). At each dot, draw small crossing lines, choose which goes on top, and mark it. Create a diagram by these rules:

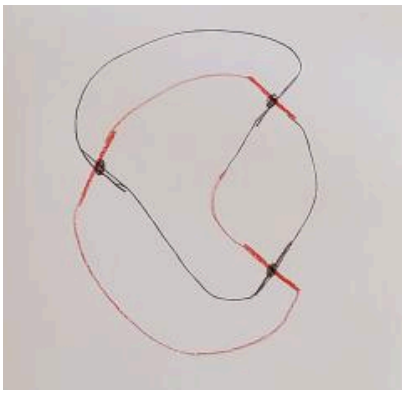
1. Connect lines end to end only, not in the middle of lines.
2. Don't connect any end to itself, only to another end. It's okay if they are neighbors!
3. Use each end only once, as if it gets all used up after one connection.
4. Keep connecting the ends until there are no free ends left.
5. If you made extra crossings, choose which line goes on top and mark it.

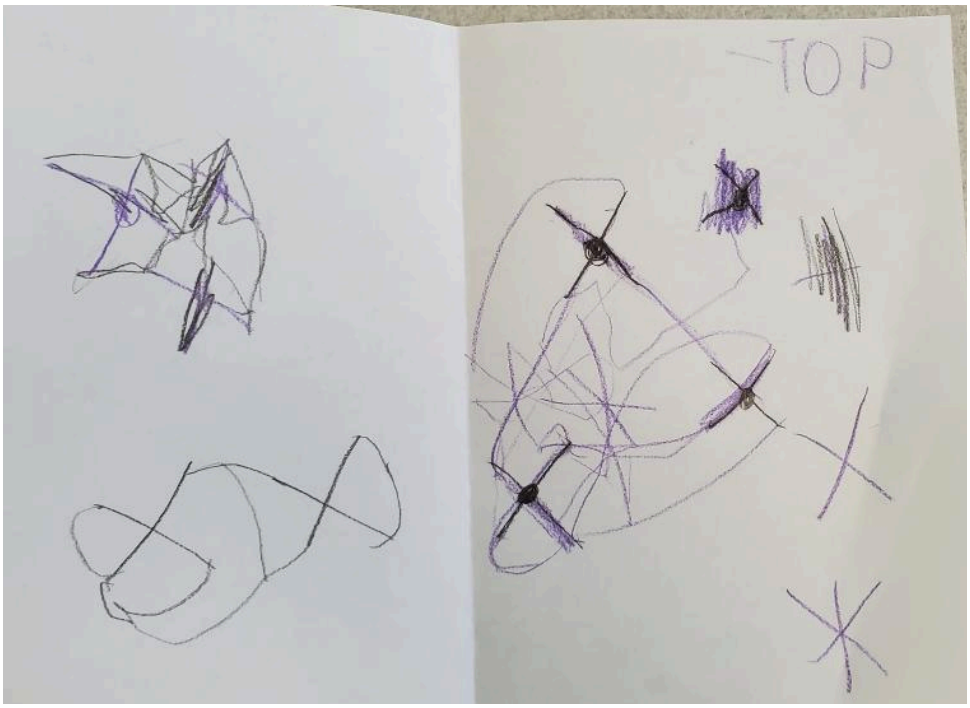
Some of our diagrams follow the rules, and some are experiments outside of the rules. You can find out which is which.

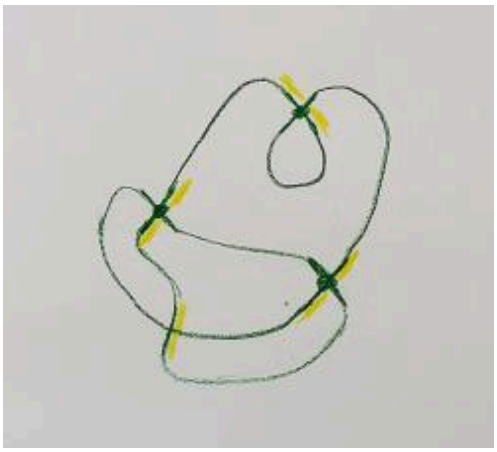
Try to determine which of these diagrams are mathematical knots. You can also model these diagrams with wire or yarn.

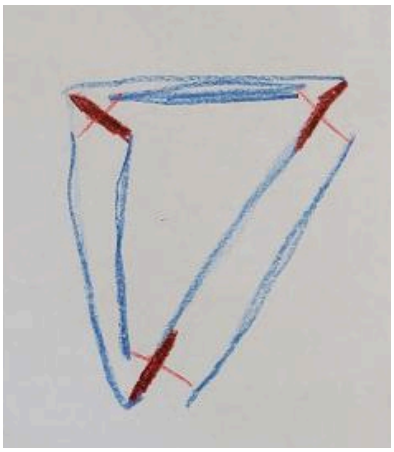


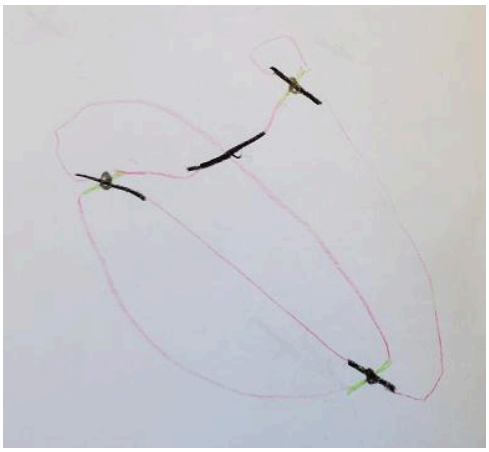


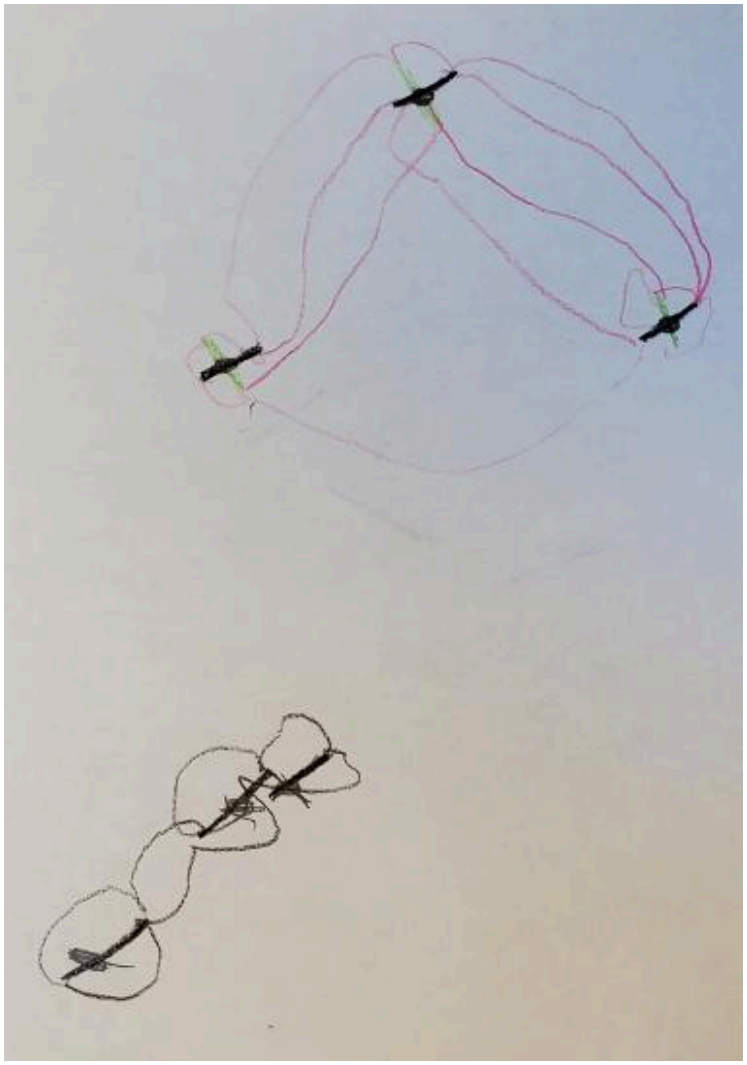


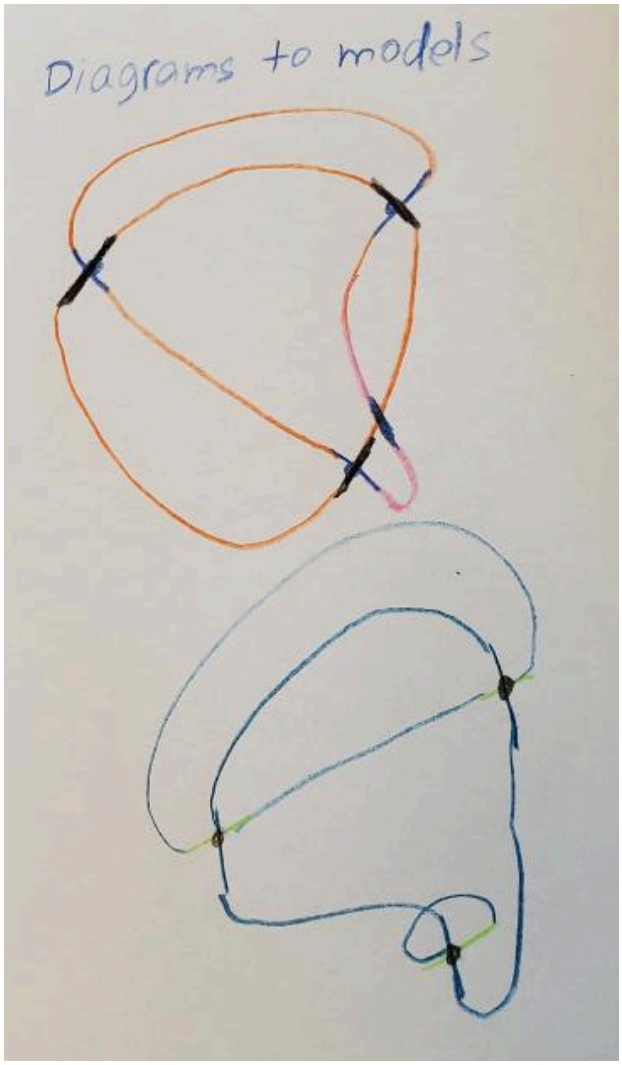


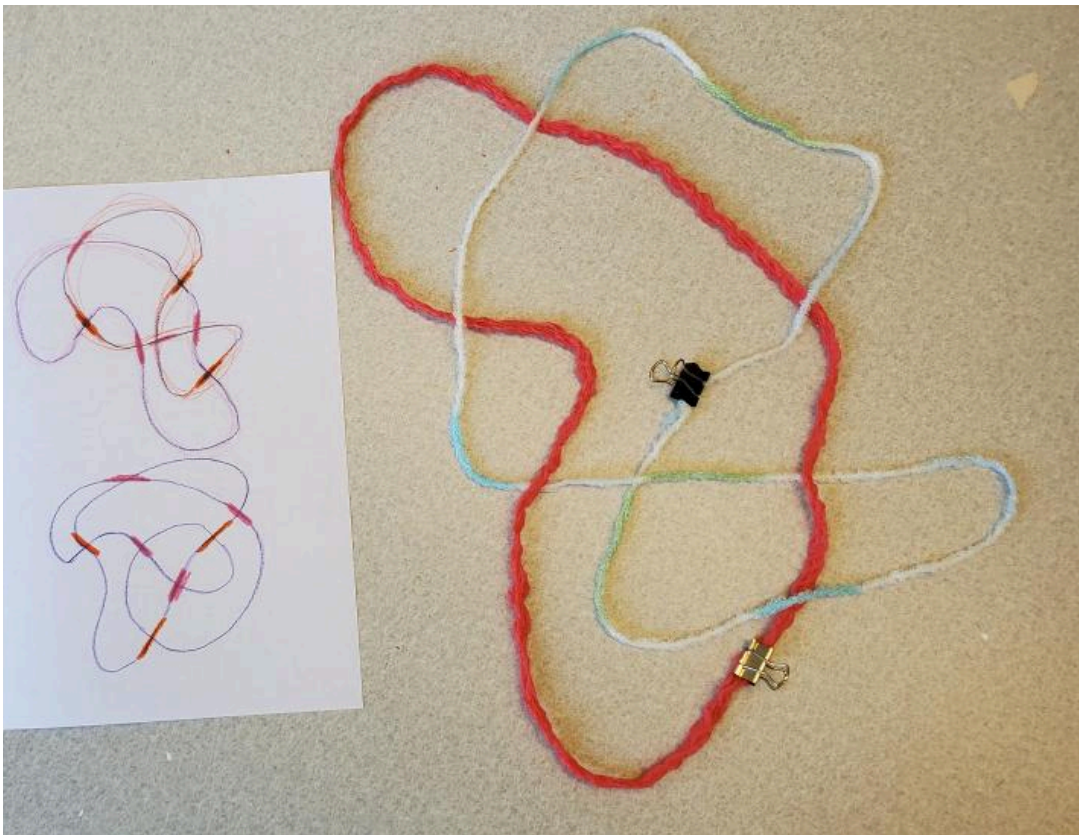


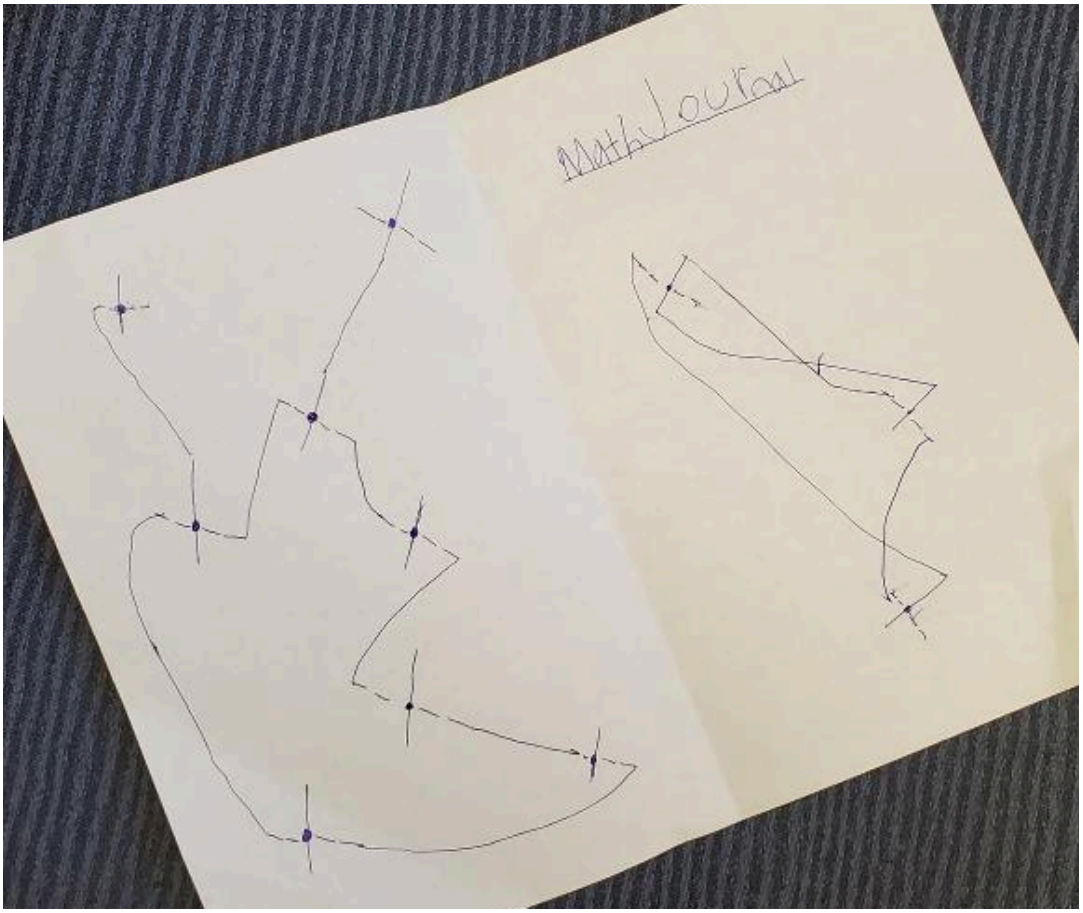


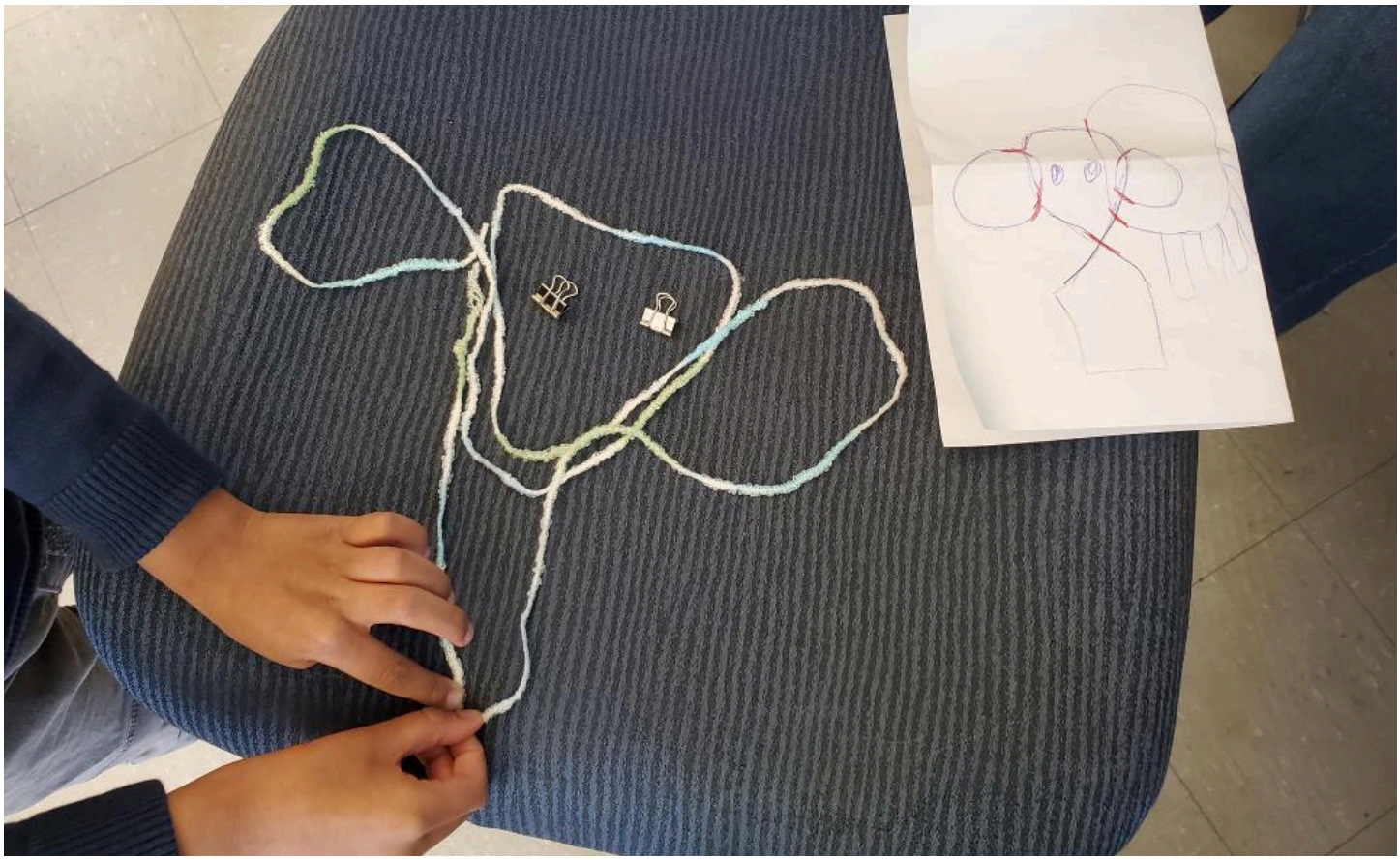


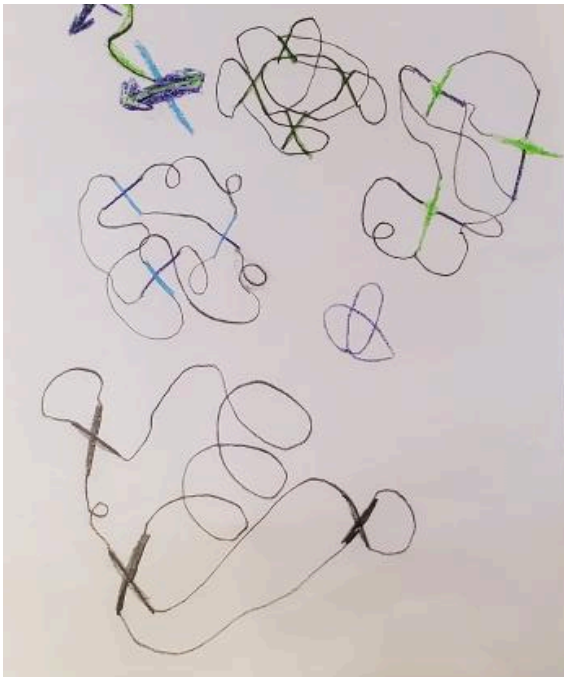


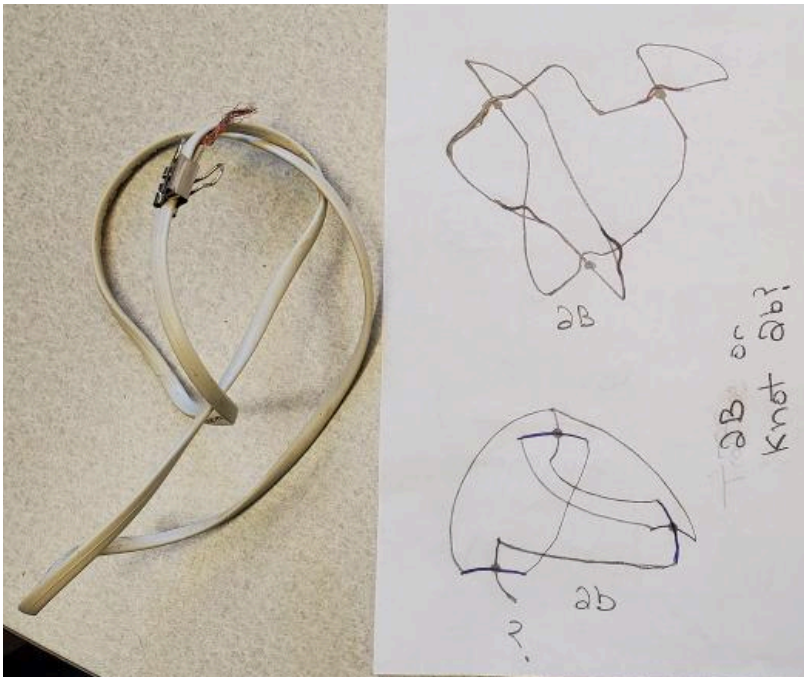


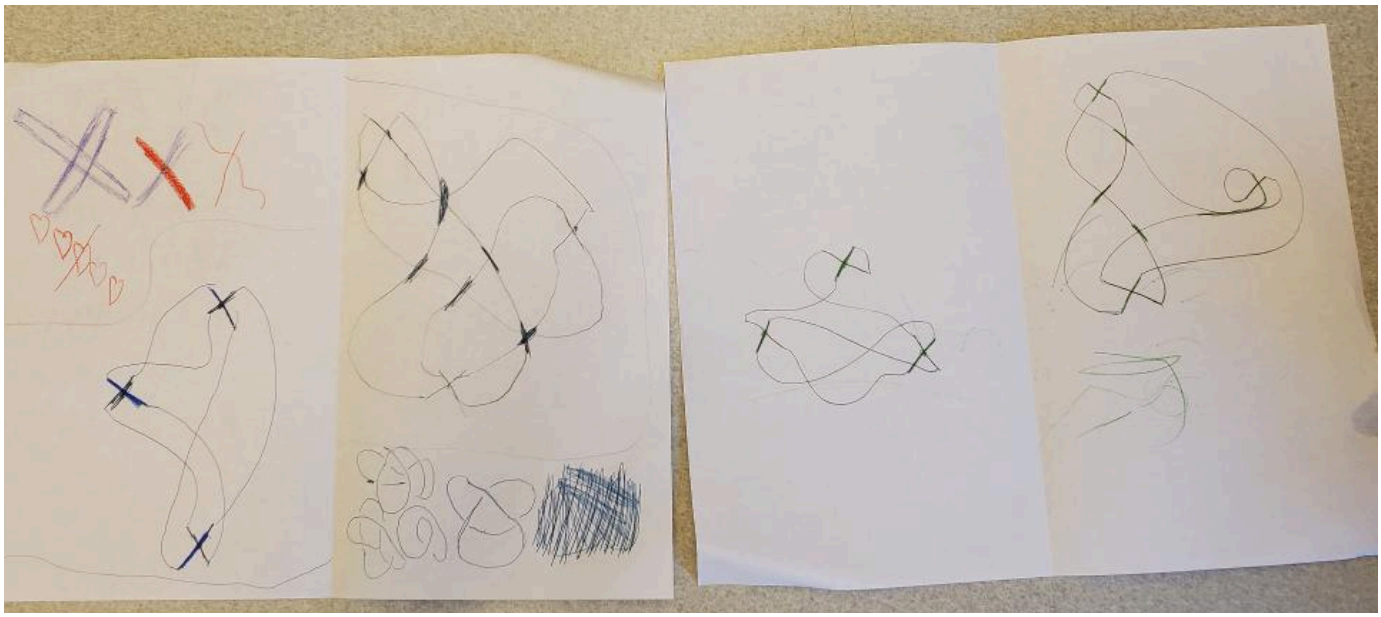


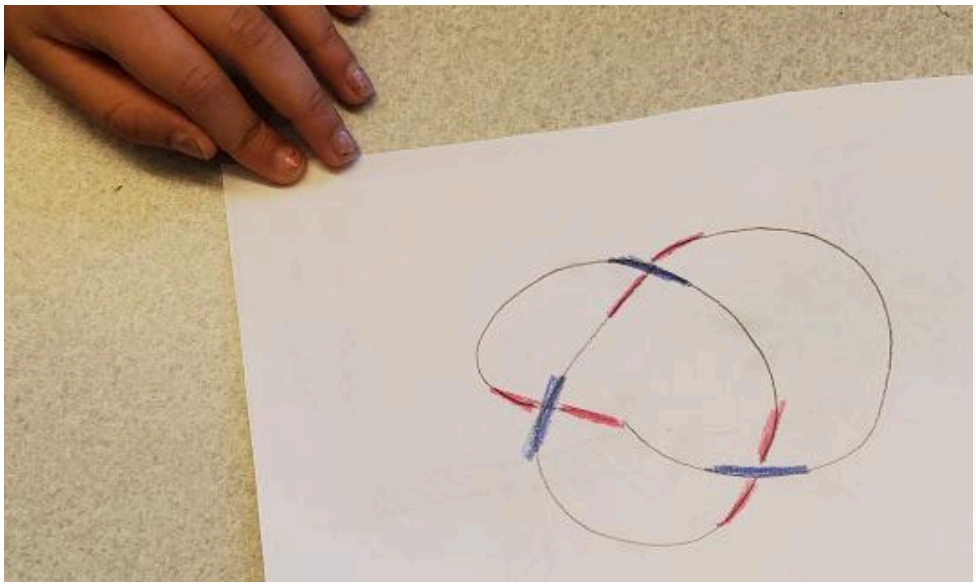


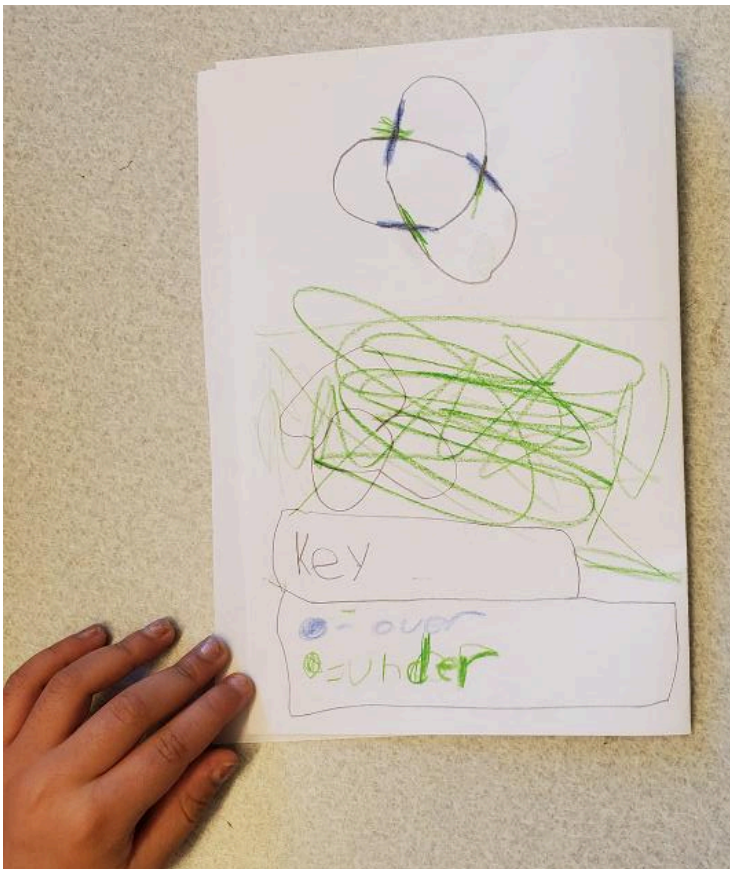


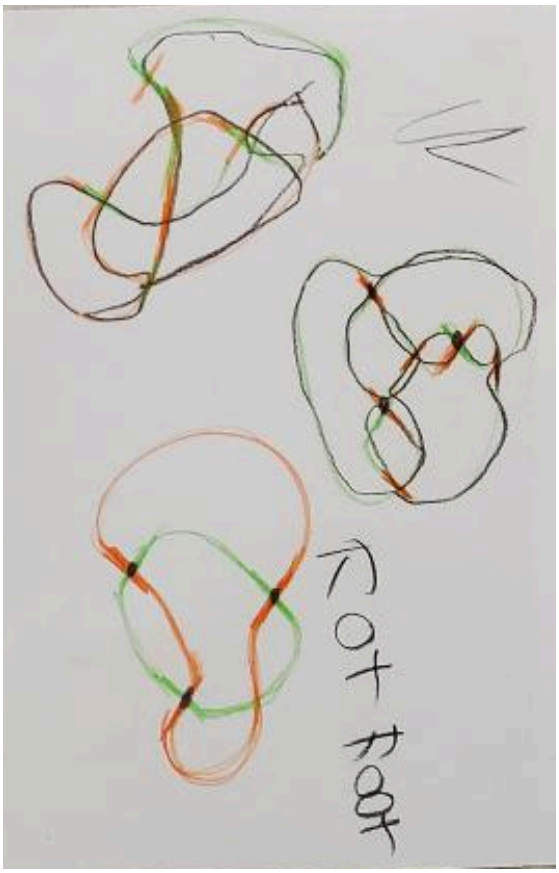


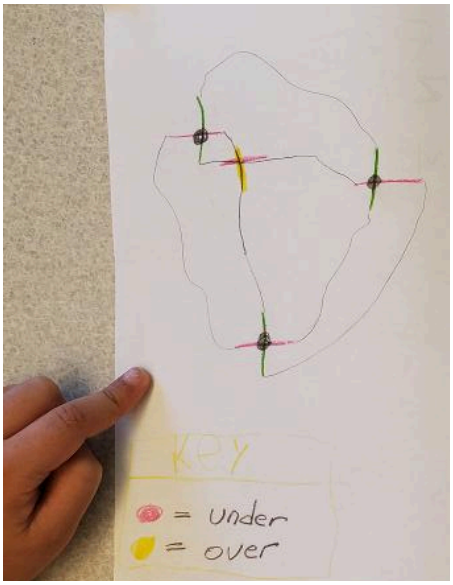


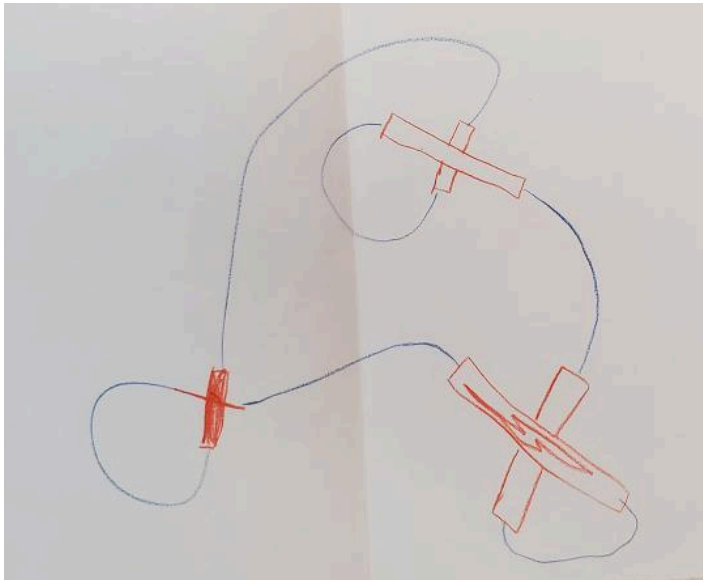


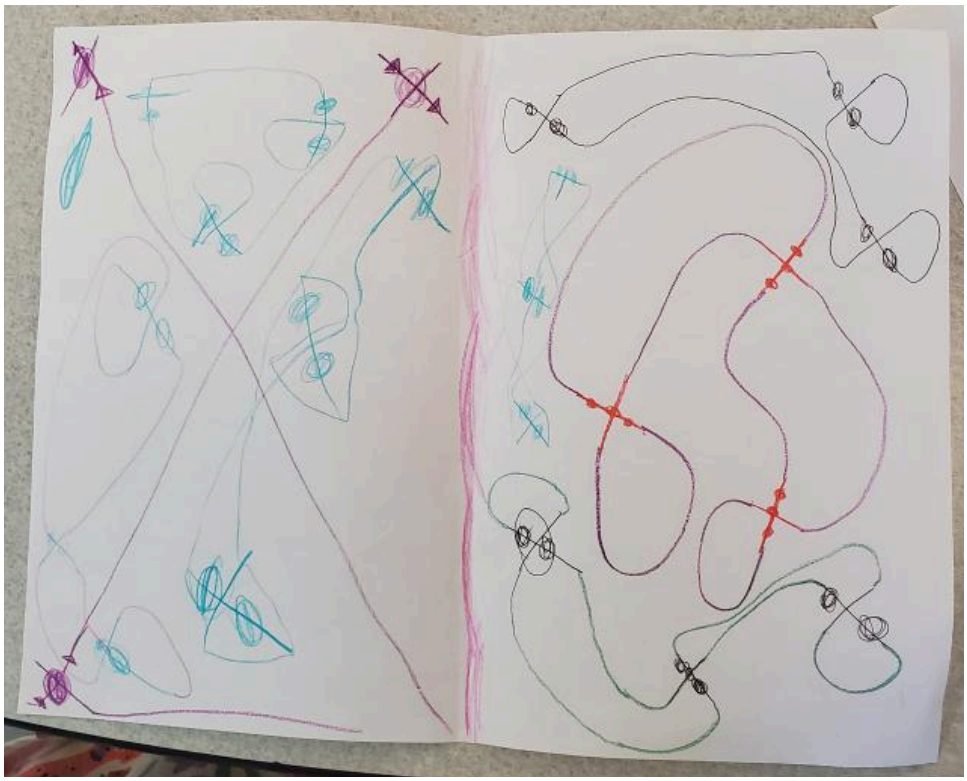


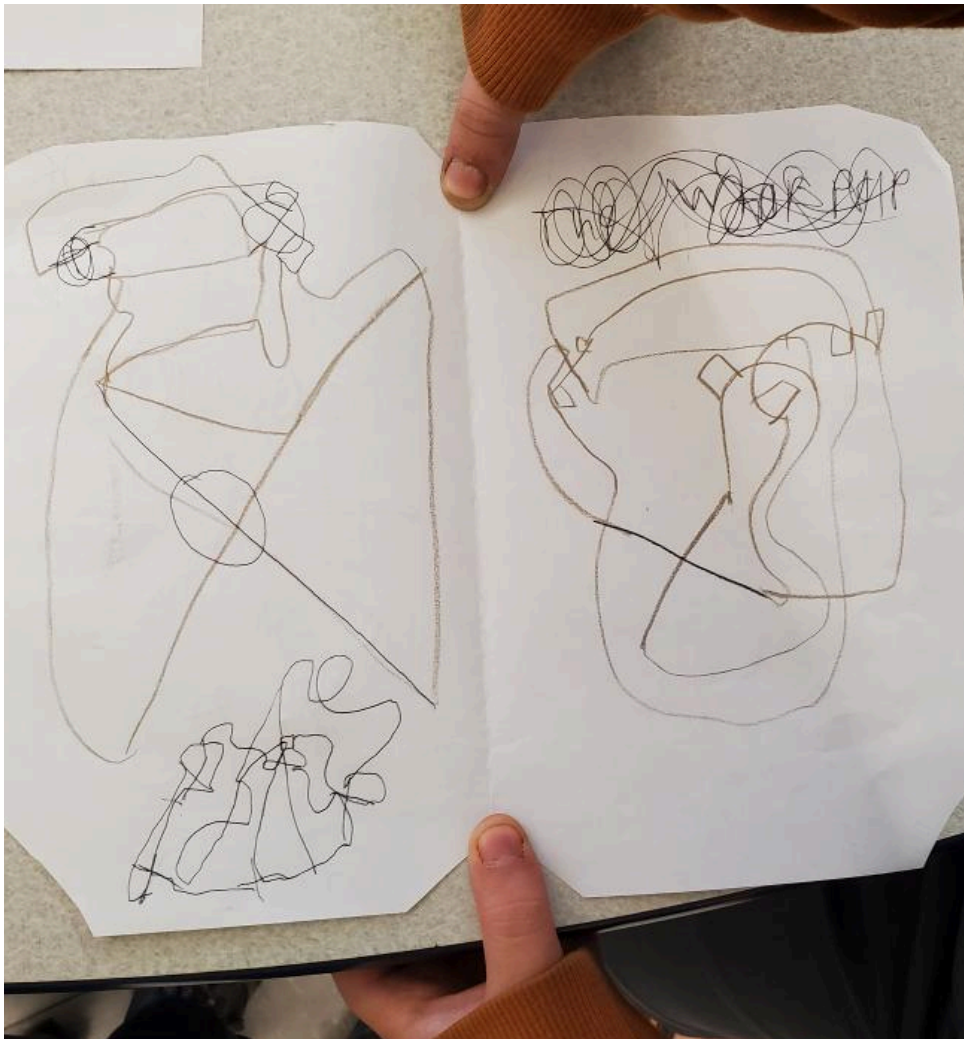


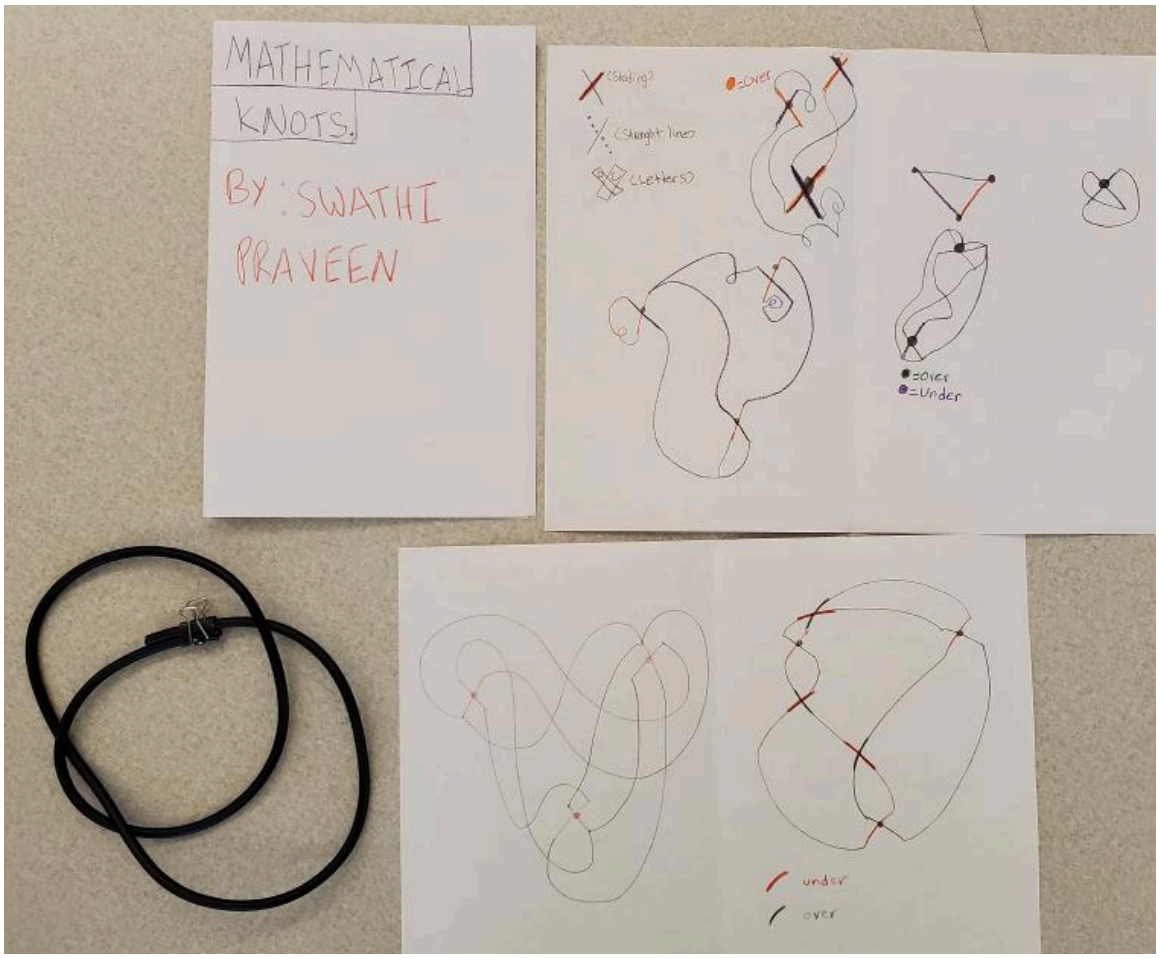




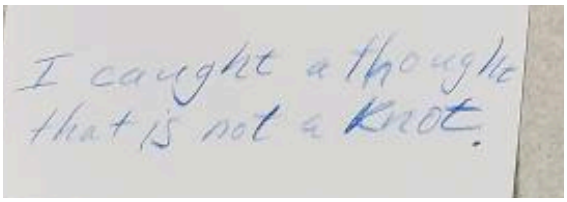


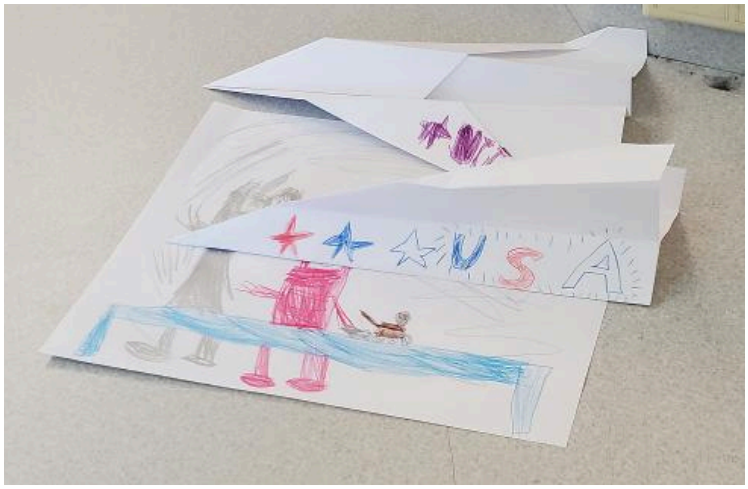


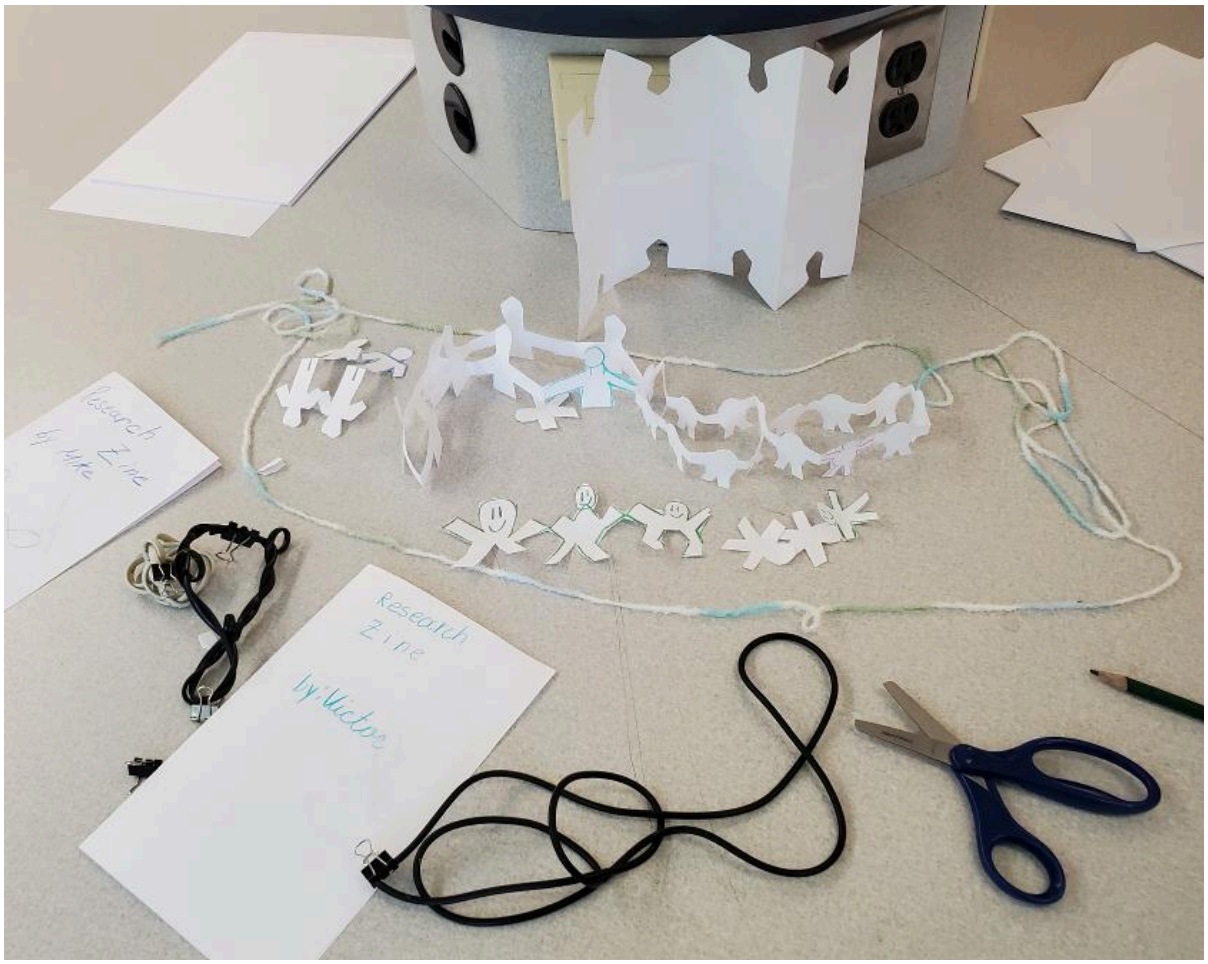


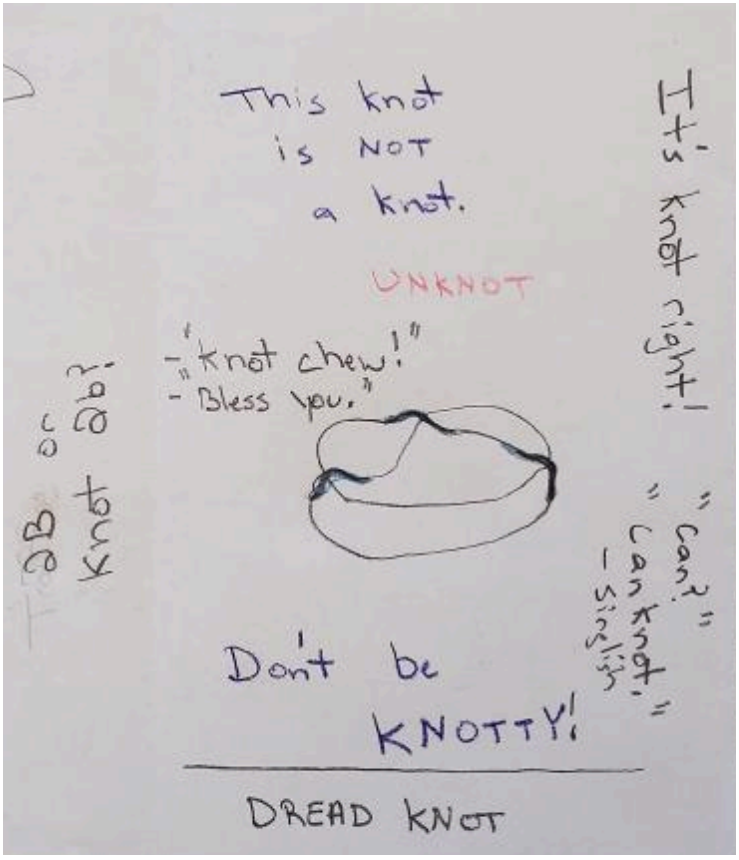


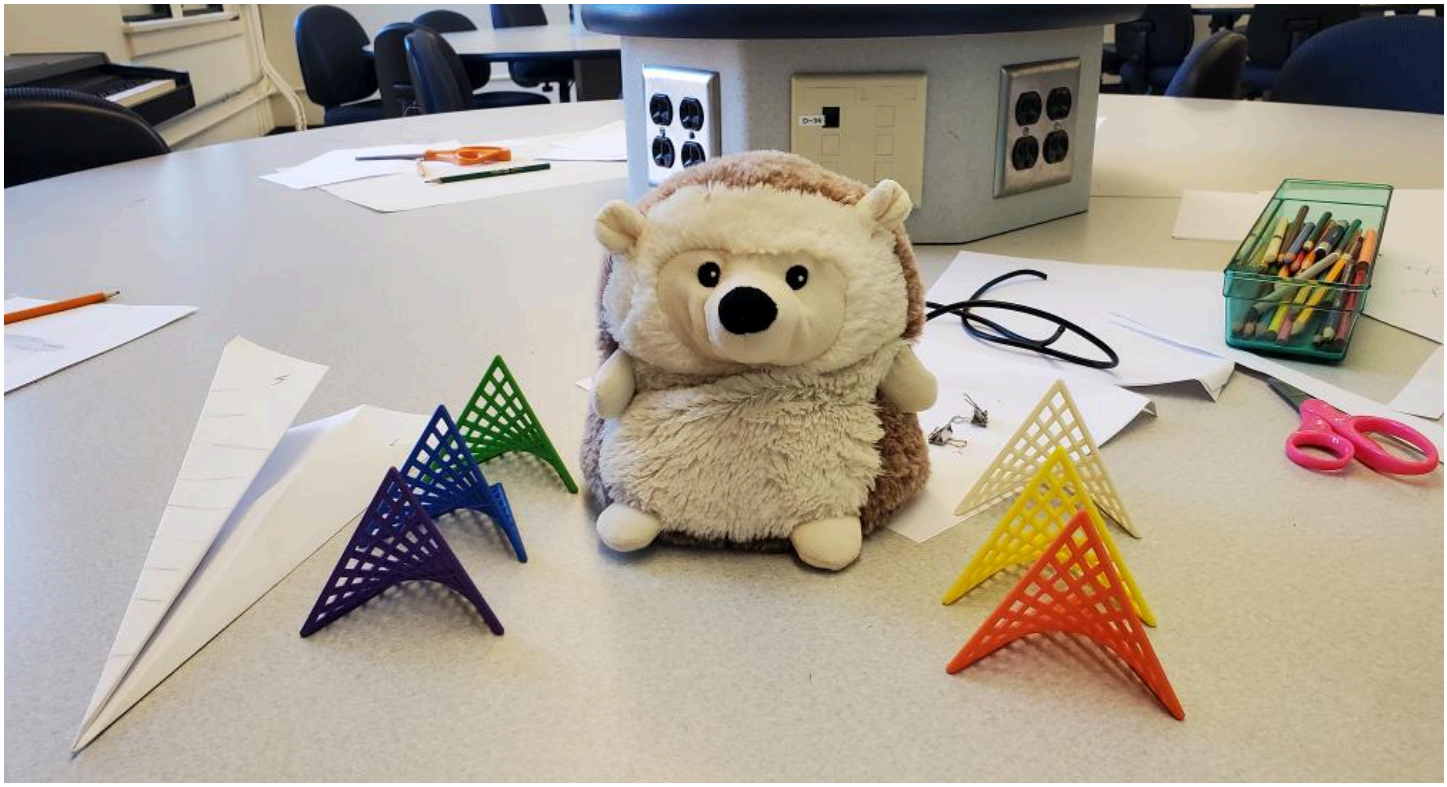
Puns and Extras











Facilitator Guide

Pathways

#51 Geometry
#54 General Topology
#57 Manifolds

Family Math Circle is an informal learning space where participants make all mathematics accessible to everyone in kind ways. Pathways name our math inspirations using Mathematics Subject Classification. Mathematicians around the world label their work with library codes from MSC, https://msc2020.org/ Let us help students feel happy familiarity with each subject area!

What will everyone make?

Design your own notation for intersections of lines in knots. Use your notation to make diagrams of knots and unknots. Make models of knots. Make puns with the word "knot." Show your creations to friends and family.

Gear check

Paper, colored pencils, yarn, tape, and scissors. Optional: recycled wire (phone, charger) cut into approximately yard-long pieces, and binder clips to hold the wire's ends together.

Math friends and links

Math circles about knots https://mathcircles.org/activities/?_search=knot
Knot games https://naturalmath.com/2012/08/knot-theory-for-young-kids/
Well-curated collection of knots https://en.wikipedia.org/wiki/Knot_theory
A Creative Commons comic book featuring knots
https://mathemalchemy.org/a-comic-book-adventure-in-math-and-art/

Words with math friends

Tell friends and family all about your math creations. Use these terms +"math" to find images, videos, and articles on the web.

- Crossing lines (crossings), closed loop
- Knot, unknot, equivalent knots
- Knot diagram, knot theory

Send questions, comments, photos, or your own knot ideas to reach.out@naturalmath.com
We answer every email!