Charter

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Other Math Club Charter and Student Success

Purpose

The purpose of this document is to describe in detail the Tyee Other Math Club proposed for the duration of the 2016-2017 school year. This club is open to all Tyee students with emphasis on participation by sixth graders. Tyee also offers a competitive math club and an online math games math club.

Charter

The club concerns the mathematics that one might find in a book by Martin Gardner: Mathematics that is interesting, challenging and rewarding to think about with minimal preparatory background. In the same breath the club is intended to help students build their mathematical context map wherein problems, proofs and concepts fit together into a larger picture like a jigsaw puzzle. And in the same breath (it was a very big breath) the club is about having fun with your friends.

The club is based on the pleasure of doing mathematics; it is not oriented towards competition. It will encourage self-expression and student presentation of reason-based arguments.

To emphasize the point above: Club meetings will emphasize fun and friendship. As part of this we expect to engage in mock debates and bad acting. We will use simple scripts such as those found when you click the **Dialogs** button at this website. Other activities will require physical motion, for example simulating a solar system or a guitar string.

The club charter will include some whimsical elements:

- The Other Math Club will regularly change its name.
- .emit ni sdrawkcab sevom bulc siht emit ni sdrawrof evom yam stneduts elihW
    - .sgniteem bulc ta esnes erom ekam lliw sihT
- Club members must not be the person from Porlock (see below)

The club acknowledges and embraces the idea that mathematics is a creative process. We strive to respect that process and hence will practice appropriate decorum. This is the 'person from Porlock' rule. A famous poet was writing down a long poem from memory when he was interrupted by a visitor from the town of Porlock. The interruption caused him to forget the remainder of the poem; which is unfortunate.

The student comes to the Other Math Club prepared to do mathematics. Should an attending student have other priorities on a given meeting day -- for example homework -- that student is expected to focus on those other priorities with the Porlock rule in mind.

Student Success

A successful outcome from participating in the Other Math Club will have three components. First the student will have a broader view of the nature and value of mathematics. Second the student will improve their skills in solving complex problems. These skills including arguing a reasoned perspective, developing and trusting their intuition, and building strategies for overcoming 'being stuck'. Third the student will gain a sense of mathematics as a creative activity with relevance to other parts of their lives.

Everything Below Here Is Stuff You Can Safely Ignore

It is notes and details from the process of working out how the club will work. If you are really interested in the guts of this club by all means: Read on (and join in the fun; I can be reached at rob 5 at uw dot edu). But everything above here is really all the basics.

Club Elements

The Other Math Club is about the student and is based upon these elements:

1. Club meetings: Fun with friends, Dialogs, Bad Acting, Team Projects, Action, New Ideas
2. You the student sitting in a quiet place with a blank piece of paper and a pencil
3. Web-based components: This website, the computing website, Khan Academy perhaps
4. Away from the club meeting: Fellow students, teachers, librarians, books, libraries, family

Meeting

Agenda for first / second

Meetings will be very busy. Be prepared to run very fast just to avoid going backwards. Progress forwards will be up to you after Other Math Club is over. See the Problems page to look for things that might be fun to explore.

Here is the agenda for the first meeting on September 19:

- Last word
- Activity: Parole
- Background: Logic and Reason and Abstraction
- Questions: Name, favorite flavor of math and/or ice cream, how loud can you yell, do what here?
- Announcements: Monday night is the Parent Info (2202, 7 pm) + handout + backwards in time
- Story Time: Number Theory
- Activity: String
- Background: String to infinity
- Dialog: Zeno Says Relax
- Background: Infinity 2
- Dialog: Argument clinic
- Dialog: Monty Hall
- Teams activity: Hand out team cards, 5 minutes discussion
- First word

Prep Notes

Do

More work on Problems
Write: hill of abstraction, lg font OMC
Ping on snacks

Bring

Monty Hall? (optional)
Puzzles bats and mammoths
Guitar
First Handout x 30 copies
Consent Form x 30 copies
Contact Form per Nelson
Parole Dialog
Zeno Dialog

Argument Clinic Dialog
Monty Hall Dialog
Agenda
String finder (optional)
Team Cards: As many as are ready

Problem Selection

Math puzzle books like those of Martin Gardner are both good and bad. They are good because they are wonderful; because they present truly beautiful ideas and patterns and problems. The down side is that they are not connected in some way to a plan. A math class is an example of a plan: It has a starting point and an end and a lot of connected ideas along the way.

The Other Math Club is not a class so it takes on the idea of selecting problems based on context value. And two other criteria:

Imagination and intuition engaged?
Context: Does the problem connect?
Payoff: Is the solution rewarding and worth the effort?

For club meetings, also: How can we make a problem kinesthetic? If the problem concerns a wolf and a sheep and a cabbage crossing a river with a girl who has a small canoe: That's a keeper.

Not Knowing

Imagine you have a cart with its wheels stuck in the mud: Often the best way forward is to pull the cart backwards a bit and giving it a running shove. These statements are very welcome ways of backing up the cart:

> ***I don't know.***
> ***Huh?***
> ***I'm sorry… I wasn't listening.***

Why are these powerful? They may be the only way forward when we are stuck. We don't have time to get embarrassed or worry about not getting it. The club is vanishing forward into the past after all!

Topics

1. Non-mainstream
    a. Graph theory and combinatorics
    b. Probability
    c. Geometry and spatial reasoning
    d. Physically motivated problems (proteins)
    e. Games
    f. Logic and proof
2. Computation
    a. From idea to articulation to algorithm to code
    b. Playing with code to explore ideas (Jupyter notebook)
3. Beyond-topic objectives
    a. Is a given problem solvable/fair?
    b. Is computation applicable?
    c. Exhaustion or elegance?
    d. Fallacies and fair practice in debate
    e. How do we learn to choose problems? Solve problems?
    f. How do we learn to teach others? Compose? Explore?

Culture

The Other Math Club takes as its mathematical inspiration the work of Martin Gardner and the community of mathematicians he was inspired by (and whom he inspired). This includes two books by Lewis Carroll: Alice's Adventures in Wonderland and Through the Looking Glass. (You may notice this influence in the club charter statement that the Other Math Club moves backwards through time.) One of Martin Gardner's many books is called The Annotated Alice which takes up the challenge of explaining the mathematical elements found in these books.

In sum there is more to mathematics than arithmetic and algebra and geometry and calculus. These are the subjects of our curriculum and they are much like a road through the vast countryside of mathematics. Away from that road there is much more to explore and happily Gardner and his colleagues have given us maps.

There is another element of this picture I would like to share as well. We (those of us in middle school) are at a time in our lives where we are learning to focus and concentrate for extended periods of time on bigger more difficult assignments. Some respond with 'I can't wait until I am done so I can take a break.' Others -- and these other people are very strange -- say 'I can't wait until I am done so I can get back to mathematics.' Personally I can't wait to finish writing up these web pages so that I can get back to mathematics.

Skills

Because the club is open to all students we will need to discover how to match students to fitting activities, puzzles and problems. Also coordinate skill level; for example: Distributive law for multiplication? Work with abstract symbols? The Other Math Club is intended for sixth grade students and up. Topics will be *assumed* to be familiar even though *they are not necessarily familiar*; therefore a word of explanation.

As an example: Suppose that a problem involves multiplying $(a + b) \cdot (a + b)$. This is not necessarily second nature to all students but it is a basic element of algebra. We make it safe to say 'I don't know how to do that' and we will use a digression method to discuss it. This will proceed from both an abstract and a numerical perspective to arrive at the relevant result. The result will be something we can refer to in the course of pursuing the problem; but we will also follow up with the students. We don't want anyone left confused by the material.

We will not have the time to drill on skills by repetition or other means. Students can build such things into their context web for future use; and this will simply be improvisational 'figure it out as we go'. Making time and bringing enthusiasm to work on mathematics independently -- skills and problems and projects -- is central to the student's success.

Some References

The following books provide source material for the initial outline of the Other Math Club. Some are fairly advanced (Proofs from the Book) and others concern as much cultural aspects of mathematics pedagogy.

The Best Writing on Mathematics 2014, 2015 (Pitici)

Penrose Tiles to Trapdoor Ciphers (Gardner)

Journey Through Genius (Dunham)

Introduction to Graph Theory (Trudeau)

Proofs From The Book (Aigner, Ziegler)

A Pathway Into Number Theory (Burn)

The Book Of Numbers (Conway)

What is the Name of this Book (Smullyan)