

Bringing joy to a diverse math audience

DEMOCRATIZING THE JOY OF MATH

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Today's goal

**Take an idea + share an idea
for joyful math teaching +
keep the conversation going**

<https://forms.gle/n9rRrddCoYNbS2CUA>

**Sign up for a buddy system to
communicate about your math program**



Talk roadmap

Technical skills



COMPUTATIONAL FLUENCY

Same grade but years apart



BASIC ALGEBRA

No skills to very comfortable



GEOMETRY

Rudimentary to advanced

Motivation + confidence



MOTIVATION

Some will try any math, others very reluctant



OVERCONFIDENCE

One student's overconfidence can stifle discussions



UNDERCONFIDENCE

Students might not try due to lack of confidence

Speed



FASTER/SLOWER

Need to build in solutions for both groups

Other variables



PREFERRED TOPICS

Interests vary widely



LANGUAGE SKILLS

Large range of vocabulary, reading and writing



LEARNING DIFFERENCES

Very different student needs







COLLABORATION

Huge range of ability and willingness to work with others

Goals of a joyful math class



-  **1** Make every student feel welcome and able to participate and contribute
-  **2** Allow every student to experience the joy of discovery
-  **3** Have students utilize their strengths and be recognized for them
-  **4** Give students a chance to work on new-to-them skills

**Long term: have students believe that
a) math is enjoyable, and b) they can do hard math**

Technical skill range

- At the same grade level, students are often years apart
- Being comfortable with all 4 operations is not a given for older elementary students
- In middle school level, there is a range from 0 to 100% in terms of algebraic skills and basic geometry



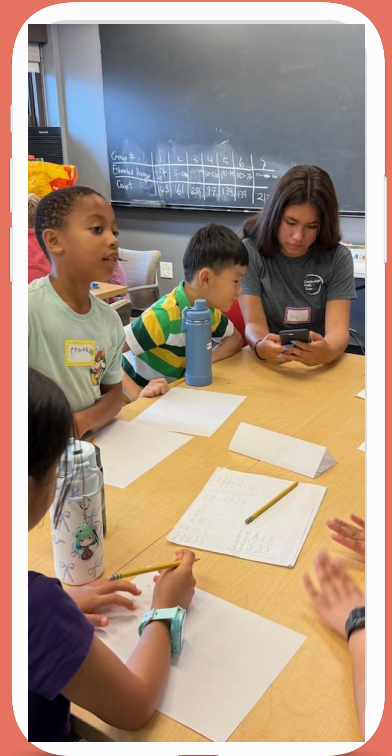
Motivation + Confidence

- Some students are ready to do hard math, others are afraid.
- Confidence determines whether a student...
 - Attempts the problem
 - Makes progress on the problem
 - Participates in discussions



Speed of learning

- Students at the same grade have a huge range of speed of problem solving.
- It's discouraging to have a classmate state the answer when you are just getting started.
- It's also discouraging to have to wait for the bulk of math class.



Technical skill range SOLUTIONS

- **Study areas of math where the playing field is more level** - things where speed of computation is largely irrelevant, and where there is limited background knowledge required.
- **Have additional classes where students get to work on the technical skills**, in a fun and creative way.
- When there's freedom of curriculum, some **great topics include: combinatorics, graph theory, statistics, logic, mathematical games, math modeling.**
- When possible, in an enrichment setting: **avoid topics/formats requiring fast computation with large numbers, or extensive knowledge of more advanced algebra and geometry.**
- [Once students gain confidence and skills needed to tackle these other topics, there's no need to avoid them.]



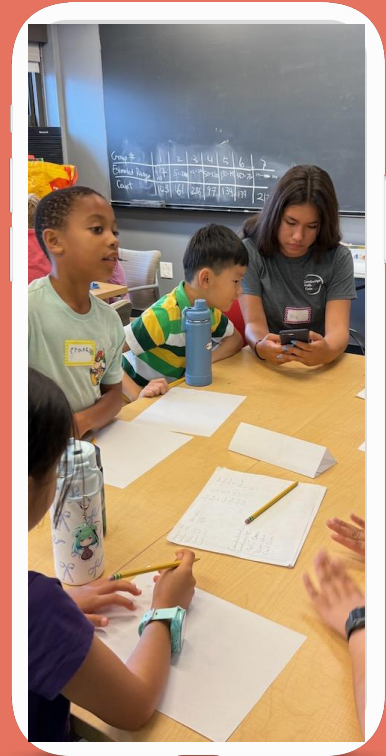
Motivation + Confidence SOLUTIONS

- **Make the start of the class welcoming and fun**, e.g. by having colorful building blocks and welcoming teachers at every group's table, and a fun ice-breaker or warm-up, to get students talking.
- **Have an exciting launch to the main math lesson** - a mystery to be solved, a connection to history or to a real-world problem faced by the students outside the classroom.
- **At the end of class, have a choice** - kids who find the day's lesson exhausting can switch to a lighter activity, such as games, while others can choose to continue to work on harder problems.
- **Tailor problem difficulty so that problems are challenging but doable**
- **Provide emotional and math support as needed** from the teachers
- **Pair students up** to give a confidence boost



Speed of learning SOLUTIONS

- **Grouping students by both level of knowledge and speed of learning**, as much as possible
- **Having extra challenge problems for faster students** to work on while waiting for others to catch up
- **Putting more problems on handouts than most students can solve**, in case some students work extra fast
- Low floor, high ceiling



Next steps - what will you do?

Partner program - accountability, mutual support and advice from other programs/departments:

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Q&A

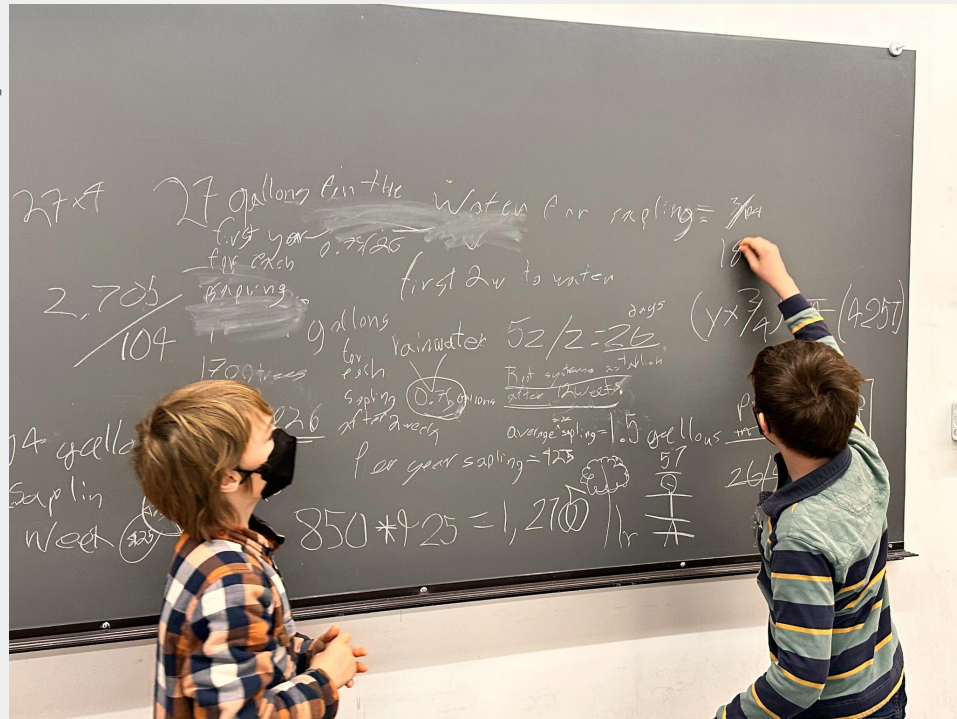
Any questions?

Email nataliya@cambridgemathcircle.org

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Thank You!

Appendix

Great variety of level of interest for any given topic

Some students gravitate to more computational topics, others love anything with logic, still others love geometry, some prefer hands-on activities and others paper and pencil ones...

Great variety of level of interest for any given topic SOLUTIONS

- Don't stay with any single topic for more than 3 classes in a row
- Intersperse competition weeks, when different topics arise
- Introduce hands-on activities occasionally
- Accommodate students when they need to do an alternative activity

A wide range of language knowledge

- Some students are new to English, some are well-versed in day-to-day English but not more rare words, and others have large vocabularies

A wide range of language knowledge SOLUTIONS

- Ask for volunteers to define words that are likely to be new to many students
- Have students record definitions for new (to them) terms
- Include pictures explaining the setting (has the bonus of getting all kids more engaged)

Working with students with learning differences

Many students find it hard to sit still, especially in an afterschool/weekend setting

Some students have reading disabilities

Some students find it hard to interact with others

Working with students with learning differences SOLUTIONS

- Build movement into classes
- Ask for a volunteer to read, so students who don't yet read are able to hear the problems
- Pick groups carefully when needed to accommodate students with communication issues