# Math Circle – Culmination Project

LA Math Circle | Advanced Group

May 18, 2014

You will be working in groups of 2-3 to prepare a 10-15 minute presentation to deliver to the class on Sunday, June 1, on an exciting, interesting mathematical topic. The topic may be one from this list (only one group per topic, please), or a topic of your own choosing, per instructor approval.

You are welcome to use any format that you'd like – Powerpoints, videos, songs (as long as we can understand you), skits, game shows, etc. Make sure to involve the audience – your goal is to teach us something without putting us to sleep!

When you go about creating your presentation, make sure to include the following:

- **Introduce us** to your topic. What is it about?
- **Teach us the "math"** of your topic. While you're doing this, pretend you're explaining your topic to your taxi driver. *Do* use a few "big words" and some "math" but make sure to define and explain clearly so we can all follow you.
- Tell us how it might apply **in the "real world."** Why should we care about this topic?
- Please prepare a quarter-page or half-page **handout** on your topic, which will be distributed to the class when you present. It might contain a few main ideas, define your "big words," have a puzzle, etc. The only **requirement** is that it is informative in some way **and** contains at least one problem for the audience to consider. Your problem can be conceptual or quantitative, and don't be afraid to challenge us. Please email your handout to Jeff at lewis.jeffrey.m@gmail.com no later than Friday night, May 30; we'll do the printing.

(If you choose to handwrite parts of your handout, just scan it in and email it.)

- You must use **at least one visual aid** (chalkboard, Powerpoint, props, etc.) If you can find an example of your topic in the building, on a nearby tree, etc, lead us there and show us!

- Whether you choose from one of our topics or pick your own, you **must do research or investigation.** The purpose of this project is not to pick a topic you already know about and tell us about it. It is for you to learn something new and show us what you have learned! If you are given a handout for your topic, its purpose is to inspire you, but you are expected to do further research.

- It is much better to pick **one** aspect of your topic and cover it in **depth** than to give us a whirlwind overview of your entire topic. Do not feel that you need to cover every aspect of your topic, but rather find something that is interesting **to you** about it and follow through with it.

Here are the topics we have come up with. If you have an idea of your own, please run it by us for approval.

1. Parabolic reflectors (p. 22-23).

2. Cycloids (p. 6-8).

3. The mathematics of basketball (especially shooting baskets!), baseball, or another sport of your choice.

4. Pick one of your favorite card games (Texas Hold 'Em, Big Two, etc... not go fish, please) and explain the mathematics of it. You'll likely want to reference probability and combinatorics, among other topics.

5. The Monty Hall problem.

6. The basic mathematics of investment and finance. Teach us something we'll need to know in the real world!

7. History and beauty of pi (p. 18-19). Archimides' approach, Buffon's Needle Problem, etc.

8. The Fibonacci sequence (p. 28-29). I am especially interested in the places that the Fibonacci sequence is said to appear, such as nature/plants.

9. Puzzles and paradoxes of topology. Examples include the Trinity of Rings (p. 31), the Mobius strip, Klein bottle, etc (p. 44-46, 61). This would be a great topic to make props for!

10. Fractals (p. 78-79).

11. Mathematics of the billiard table. (p. 42, but you can go into other aspects as well)

12. The evolution of mathematical symbols. Why do we use the symbols we do, and what are some past representations of these symbols? (p. 52-54)

13. The mathematics of traffic, pedestrians, and other city-related dynamics. Can you come up with an effective road and sidewalk conceptualization for a hypothetical or real city based on your findings?

14. The "classic" way to make a geometrical construction is using a ruler and compass. But it's not the only way. What kinds of geometric constructions can you make by folding a piece of paper (and no other tools)? (p. 48-50)

15. Hexagons in nature (snowflakes, honeycomb, etc.)

16. Why is the sky blue? (This topic involves some scientific concepts in addition to math, but is definitely doable.)
    On a related note, why are sunsets red/pink?
    Key words/hints: Rayleigh scattering, light wavelengths

17. The golden rectangle (p. 102-106)

18. Paradoxes in mathematics, for example, Zeno's Paradox (p. 116-117), but you are encouraged to discuss others!

19. Tessellations (p. 120-121), and their applications in architecture, soccer balls, and other things.

20. The mathematics of music (p. 142-145)