Chapel Hill Math Circle

Chapel Hill Math Circle
Session 12 – March 15, 2025:
Pi Day – Playing with Circles
Beginners' Group (grades 1-3), 10:30-11:30a

Mr. Barman –
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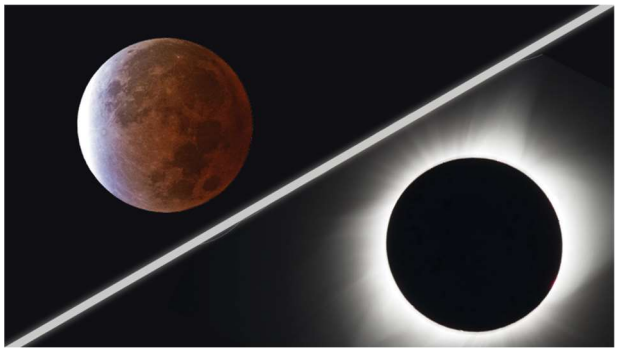


Supplies needed per student: 1-2 white paper plates, at least 6-8" in diameter (alternatively several circles drawn on paper), straightedge (like a ruler), as well as paper and pencil

Welcome to Math Circle session 12. March14 of each year is called "Pi Day". We will talk a bit about what this means and do some fun exploring with circle.

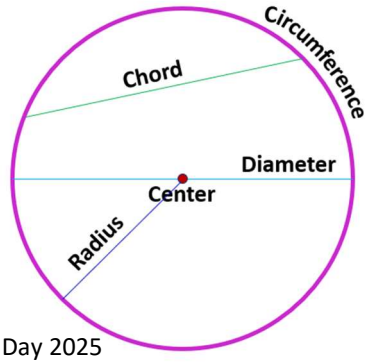
Did you see the total lunar eclipse early on Friday morning? It was beautiful to see and not too cold outside. The picture above[1] shows both a lunar and a total solar eclipse. What cool circles!

If you have been coming to my math circle for a while, we celebrated Pi Day on March 16, 2024 (also session 12 but for 2023-4) with learning to use a compass and straight edge to find the center of a circle, draw a circle through 3 points, draw a circle given its diameter ("belt"), and finding the line called the tangent that just touches a circle at a specific point[2]. Today we will play with circles and discuss how you could measure inside and around them.

What is a circle anyway?

How do you define "circle"? How do you measure a circle?

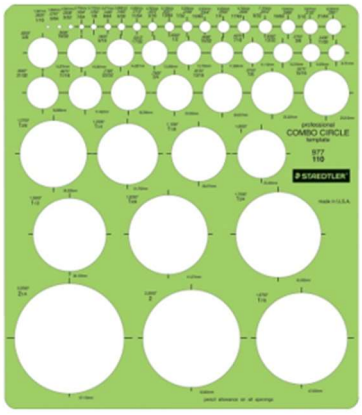
Let's define some parts of a circle such as chord, diameter, and radius.



[1] from Boston's Museum of Science, mos.org/discover/pulsar/when-is-next-eclipse, accessed Pi Day 2025
[2] You can find this handout free to download at tinyurl.com/mathInstPiDayConstructions.

Make some circle art!

If you want to explore circles, you might enjoy having a quality compass and maybe even a circle template[3]. Take a few minutes to explore and make some circle art[4].



Let's measure some circles!

In a separate handout I have a cool activity to measure circles. Let's try it!

Have fun

Happy Pi Day! Keep on playing with circles. See you next time.

Have Fun!
Mr. Barman

[3] The simple compass image is from geyerinstructional.com/ball-bearing-compass.html, accessed Nov. 29, 2022. In her fourth grade, I purchased for my daughter a Staedtler Comfort 552; the image here is from staedtler.com/intl/en/products/technical-drawing-instruments/compasses/mars-comfort-552-quick-setting-compass-552-02, accessed Jan. 24, 2022. The template is from amazon.com/Staedtler-Combo-Circle-Template-977/dp/B000KIBQ46, accessed Feb. 20, 2023.

[4] I'm including some lovely art that my Stanford Math Circle students made in early March 2025. 2nd grader Jayden made the many circles all together and 1st grader Karan made the solar system.

Notes for Parents

Measuring circles and irrational numbers

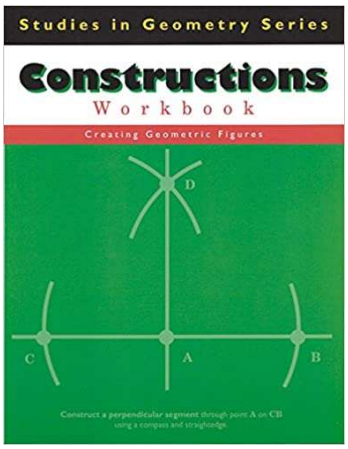
It's a natural inclination of humans to categorize, summarize, and *measure*. 1st and 2nd graders may have heard of Pi but without a bit more math may not be able to fully appreciate this important irrational number. By the way, Pi isn't the "most irrational" number at all; it is close to 22/7 and "almost" rational. There's a great Numberphile video[5] that you might want to show to your child which shows that Phi, the golden ratio, is the "most irrational" number.

I did an activity similar to the measuring one with my daughter in homeschool at around 1st or 2nd grade and led her to the discovery that the circumference of every circle is about three times that of its diameter. I hope that the children in math circle will find this as well.

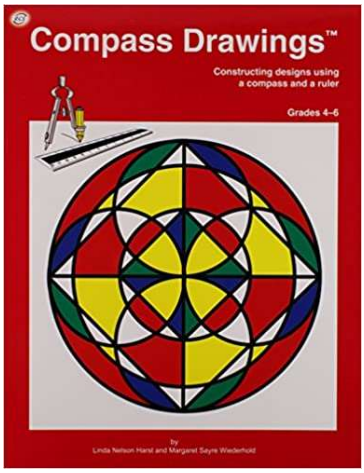
History and value of circles

In our hour together we won't get to talk much about the history or uses of circles but I'll try to have a short conversation. Transportation is an obvious and very important use of circles and the invention of the wheel is of paramount value. If you wish you can chat with your child about other uses of the circle – in coins, manhole covers (did you know that square manholes can have the cover fall in but circular ones can't), our eyes, telescopes, petri dishes, and much more. Discussing form and function can be quite incisive and interesting.

Constructions



Constructions are a topic that isn't covered very much in school nowadays. As you may know, the idea of constructions is to be able to make something, like a kind of number (a constructible number) or a shape like an equilateral triangle, using just a compass and a straight edge (not a ruler where there are measurements). The Greeks loved constructions and came up with quite a few.



There's a number of books and online references where you can direct your curious child to try many constructions. Two books that I used with my daughter in homeschool are Tammy P. Leonard's *Constructions: Creating Geometric* Figures which I found on amazon[6] for about $11, and *Compass Drawings: Construction Designs using a Compass and a Ruler* by L. Harst and M. Weiderhold (which now seems to be out of print at least on amazon). You might enjoy the rich page on constructible

[5] youtube.com/watch?v=sj8Sg8qnjOg
[6] amazon.com/gp/product/1930820437, accessed Feb. 20, 2023

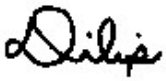
numbers at science4all[7].

Here are a few good websites about constructions:

- The Berkeley Math Circle has published a nice and readable 2-page handout on constructions and history of math[8].
- A good reference on constructions is on the Math is Fun website[9].
- Math.net has a straightforward page[10] with clear directions that your children can try to copy line segments, copy an angle, find midpoints of a line and middles of circles, and more constructions.
- MathBitsNotebook has a nice page of constructions[11] as well.
- Math Open Reference has a page with many animated constructions that also have printouts[12] with instructions.

Thanks for coming to Chapel Hill Math Circle. See you in two weeks.

Till next time!



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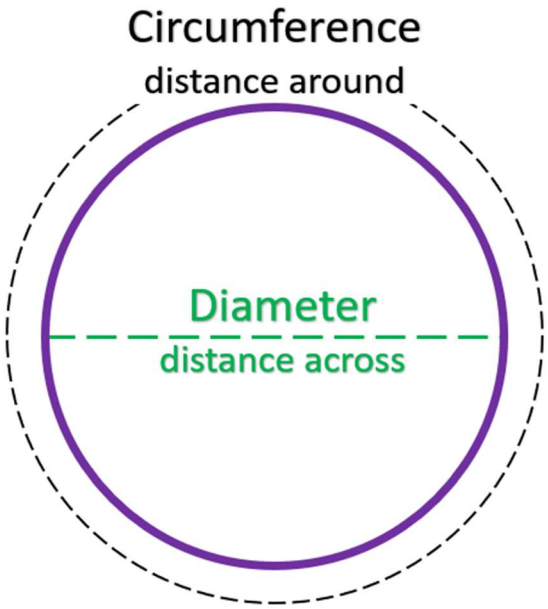
[7] science4all.org/article/numbers-and-constructibility
[8] mathcircle.berkeley.edu/sites/default/files/archivedocs/2014_2015/lectures/1415lecturespdf/Beg%20-%202014.09.30%20(Session%202,%20Handout).pdf
[9] mathsisfun.com/geometry/constructions.html
[10] math.net/geometric-construction
[11] mathbitsnotebook.com/Geometry/Constructions/CCoutline.html
[12] mathopenref.com/tocs/constructionstoc.html

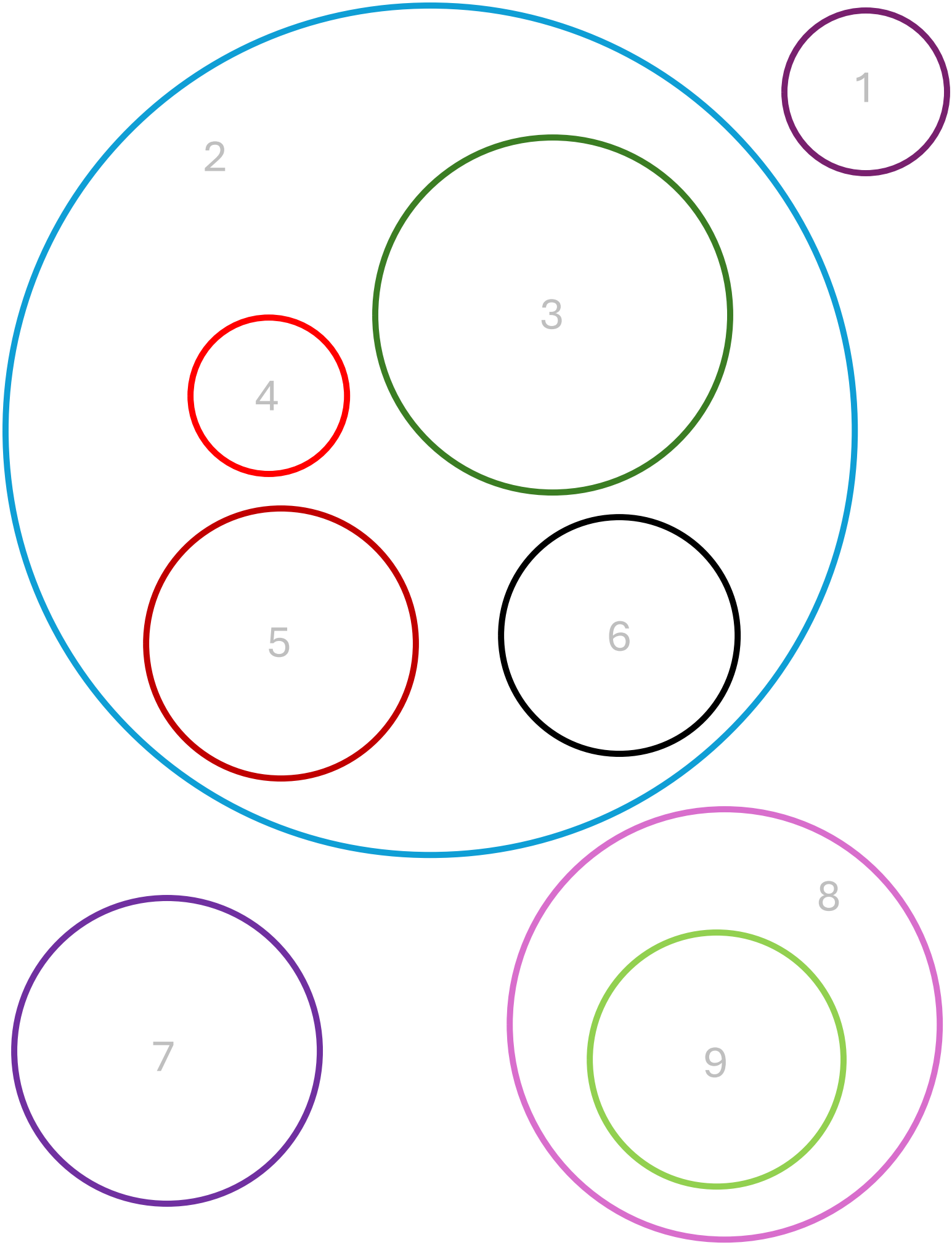
Mathematics Institute of the Triangle

Happy Pi Day! Pi Day is March 14 (3/14) and sometimes July 22 (7/22). Pi is a Greek letter written as π and it is a little bit more than 3. Let's explore it a bit.

- On the next page is a variety of circles. We will be measuring them, as best we can.
- One thing we will measure is the distance around each circle. That is called the circle's "circumference" from Latin "circum" meaning "around" and "ferre" meaning "to carry".
- We will also measure the distance across each circle, or its "diameter". This word comes from ancient Greek "dia" for "across or through" and "metron" for "measure". Imagine that each circle has a belt that goes across the widest part of the circle – that is its diameter.
- See if you can find any patterns by putting your measurements in the table here.
- How will we measure? You can use a cloth measure or a flexible ruler. I have provided on a separate page a "ruler" that is marked with "units". You can cut out this ruler and use it to measure.



Circle	Diameter	Circumference
Circle 1		
Circle 2		
Circle 3		
Circle 4		
Circle 5		
Circle 6		
Circle 7		
Circle 8		
Circle 9		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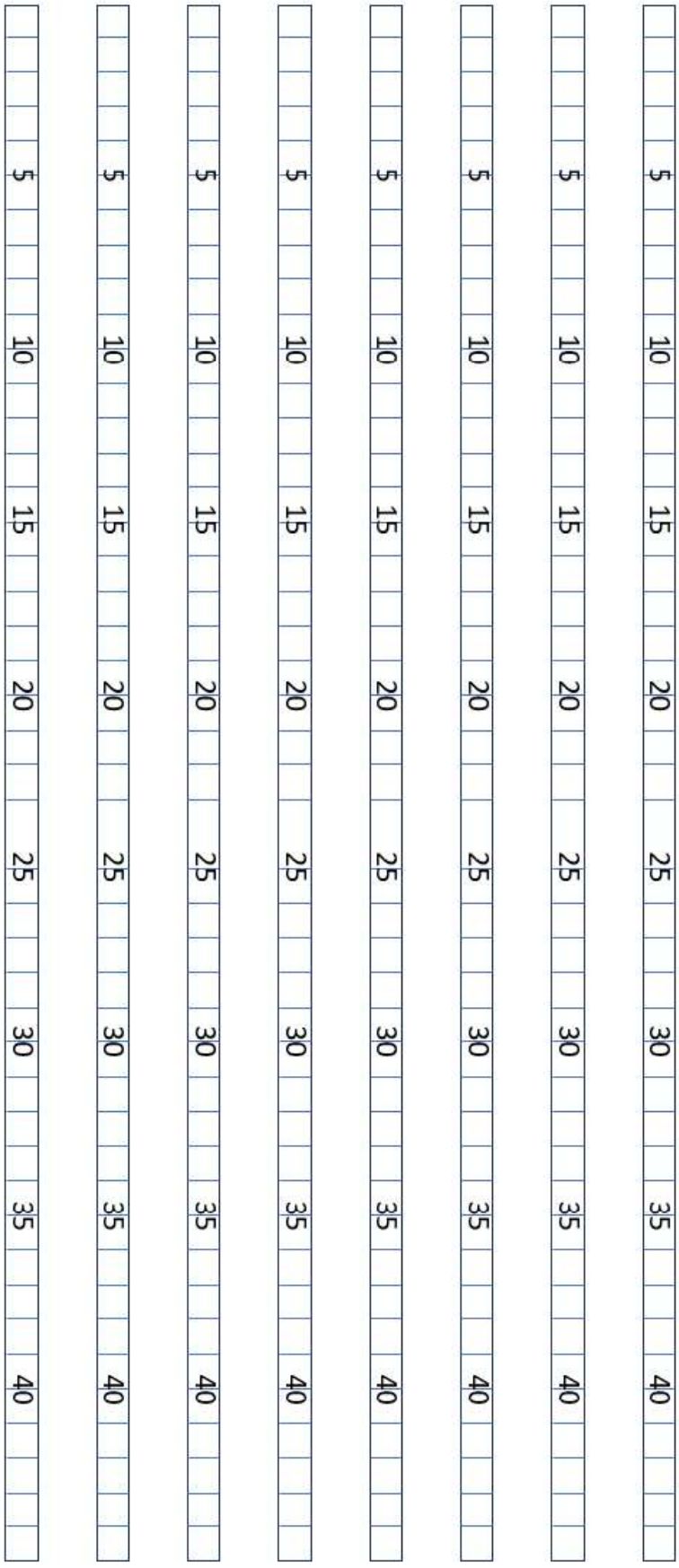
I have made 8 copies of a ruler so in case your ruler gets damaged you can cut out another one.