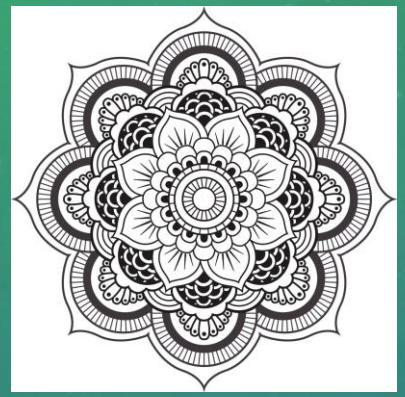
Mandalas for Math

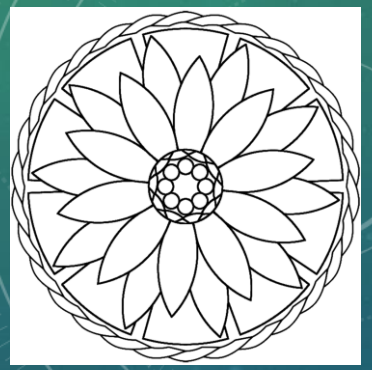
Dr. Jennifer Groman
Ashland University, Ohio
jgroman@ashland.edu

Click any key to start.

Click the -> to advance slide any time.

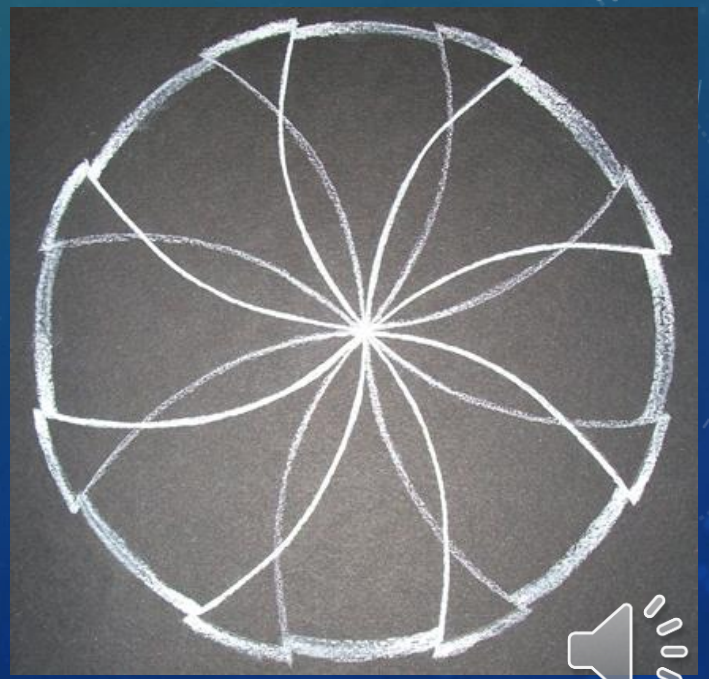
Mandala . . .



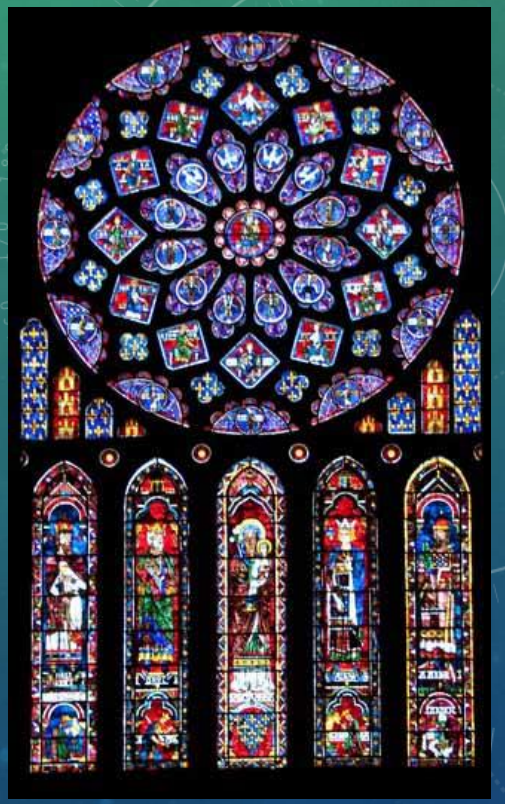


- Roughly means "circle" or "center" in Sanscrit

- Is "an integrated structure organized around a unifying center" in Tibetan Buddhism

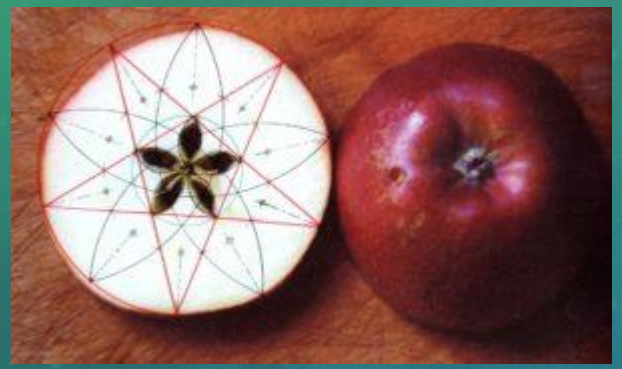


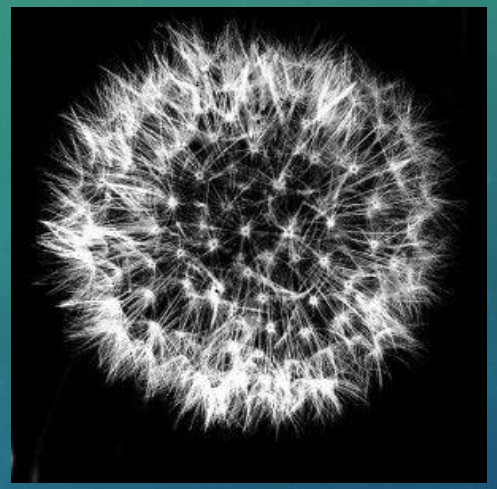
Tibetan monks create intricate mandalas out of colored sand, taking one to seven weeks in the process. When the mandala is complete, it is carefully dismantled – swept away – to demonstrate the impermanence of this life.

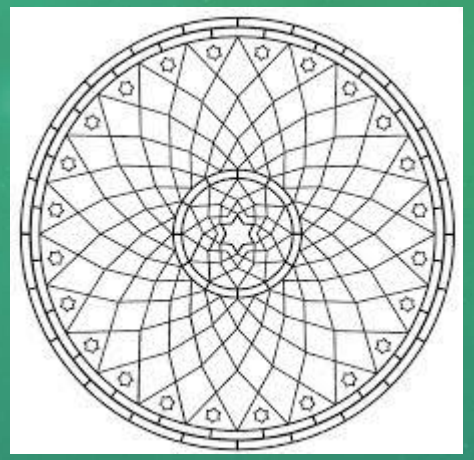


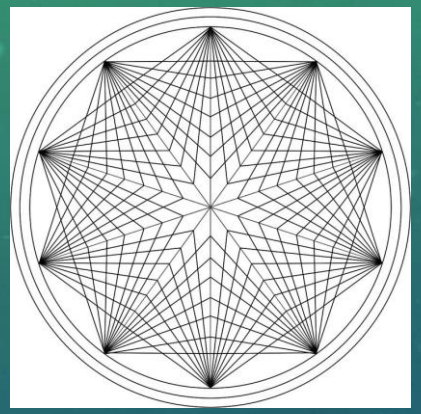
Mandalas are found in most cultures.

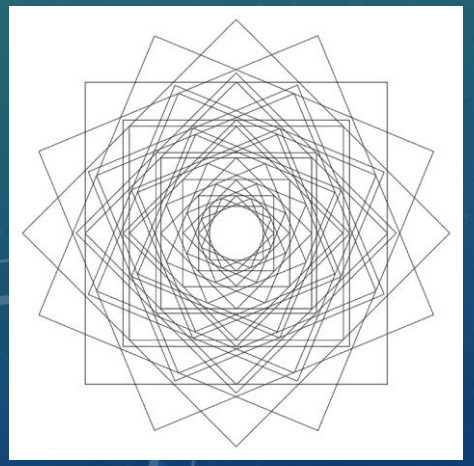
Mandalas are found in nature









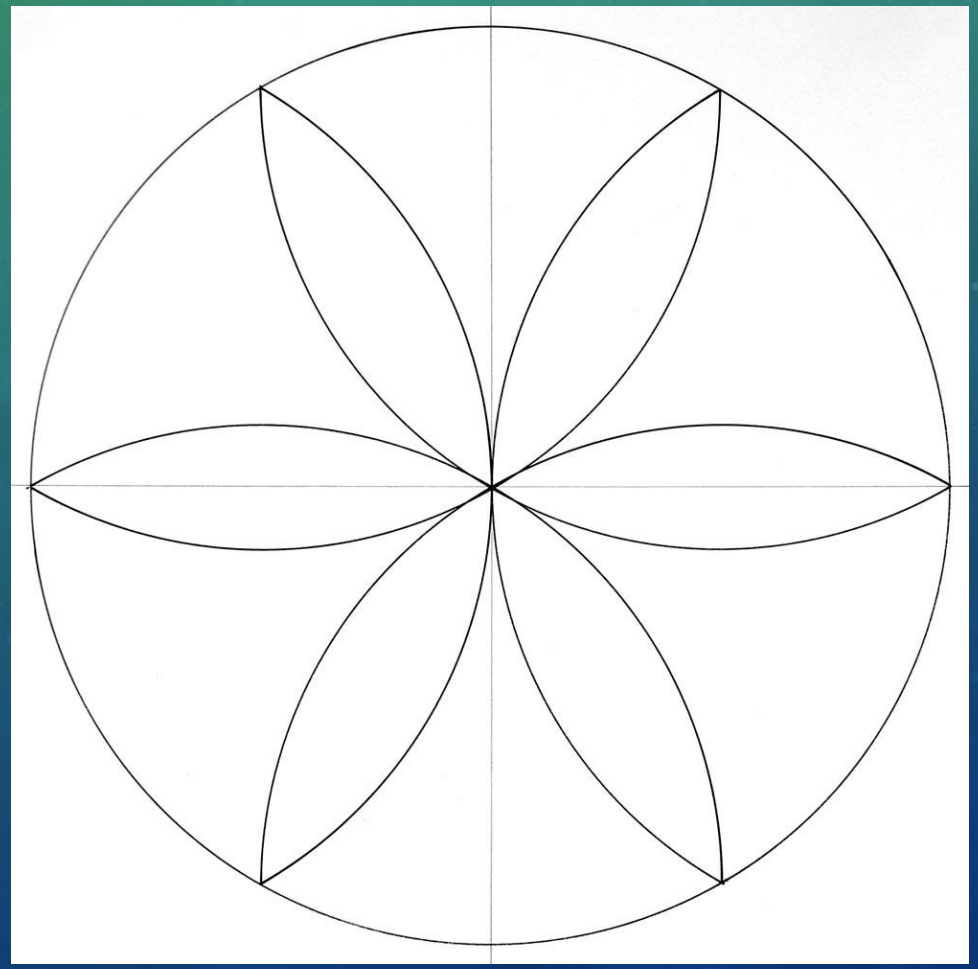


The other group is working with meditative mandalas. But you are here because of a love for mathematics.

Symmetry, elegance, and precision are all exemplified in the intricate patterns of the mandala.

Those of us who love math understand and revel in the beautiful geometry of these images.

Let's start by making a simple 6 petal mandala.



But first . . .

Vocabulary

Circle Perimeter Angles Radius

Diameter Circumference Pattern

Radial Symmetry Fractal Sector

Quadrant Sextant Octant Congruence

Similarity Arc

Skills

Using a compass to:

*bisect an angle

*draw lines of symmetry

*determine equal sector (wedge) sections of a circle with 3 or more sectors

*draw regular polygons of 3 or more sides within the circle

Side Effects May Include

Common Core Standards

Math Standard 3: Uses basic and advanced procedures while performing the processes of computation.
Math standard 4: Understands and applies basic and advanced properties of the concepts of measurement.
Math Standard 5: Understands and applies basic and advanced properties of the concepts of geometry

Ohio Common Core Standards in Mathematics

G.7.2.: Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

Whew.

Let's Begin

You need:
Blank Paper
Compass
Straightedge
Pencil

Start with a circle.

Draw a circle on your paper using your compass.

Mark the center.

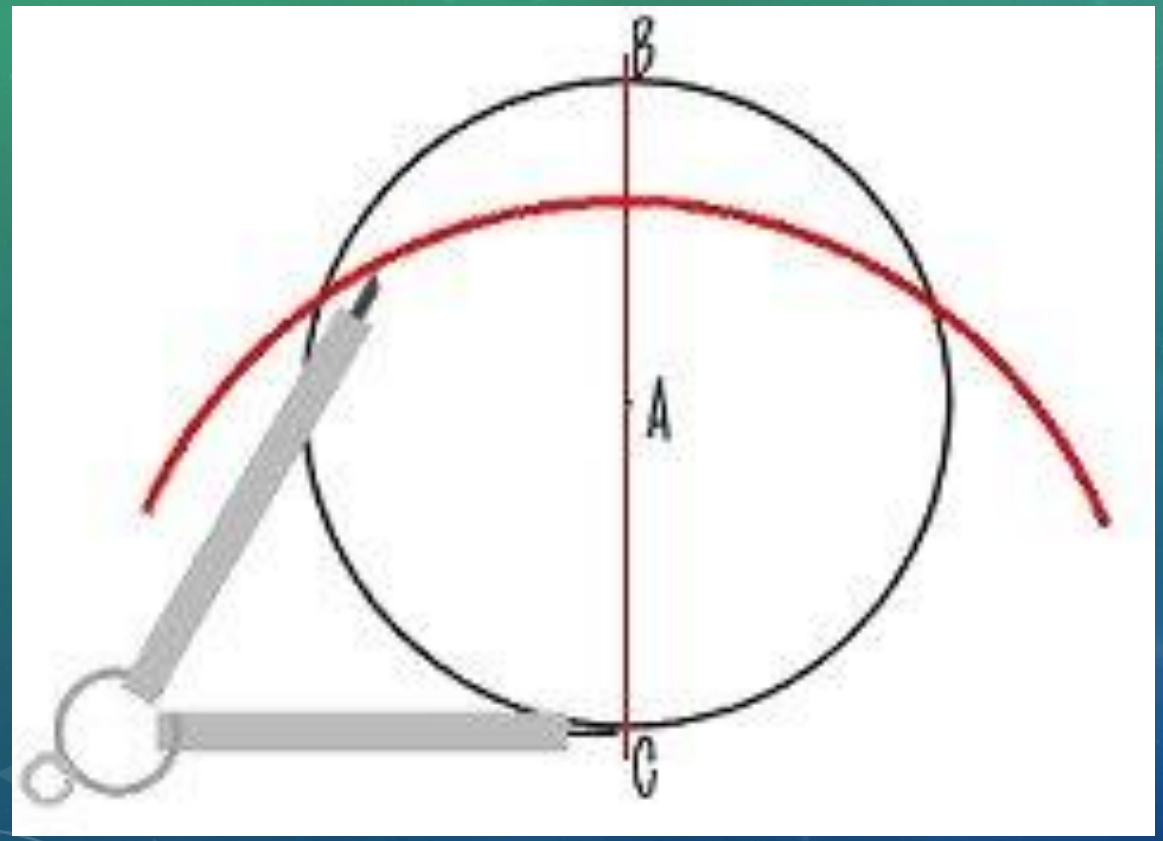
Draw a line representing the diameter of the circle, starting from the bottom of the circle to the top.

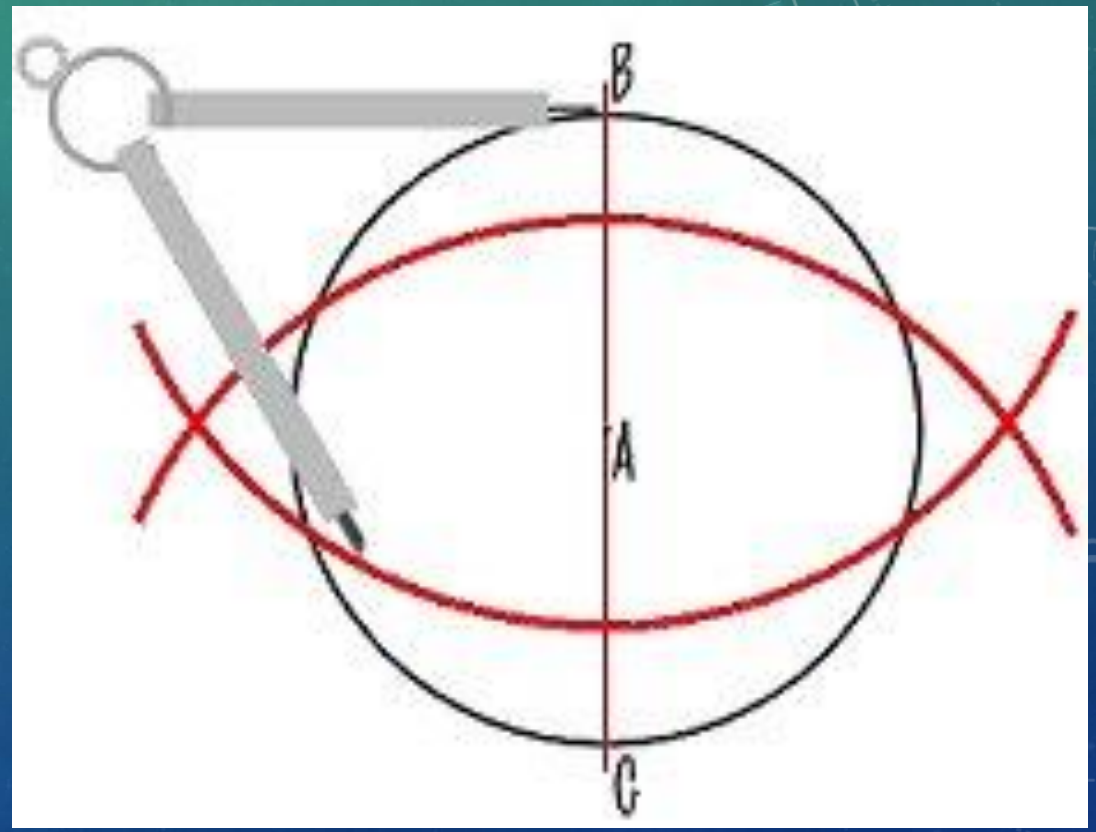
Using your compass divide the circle into four equal parts.

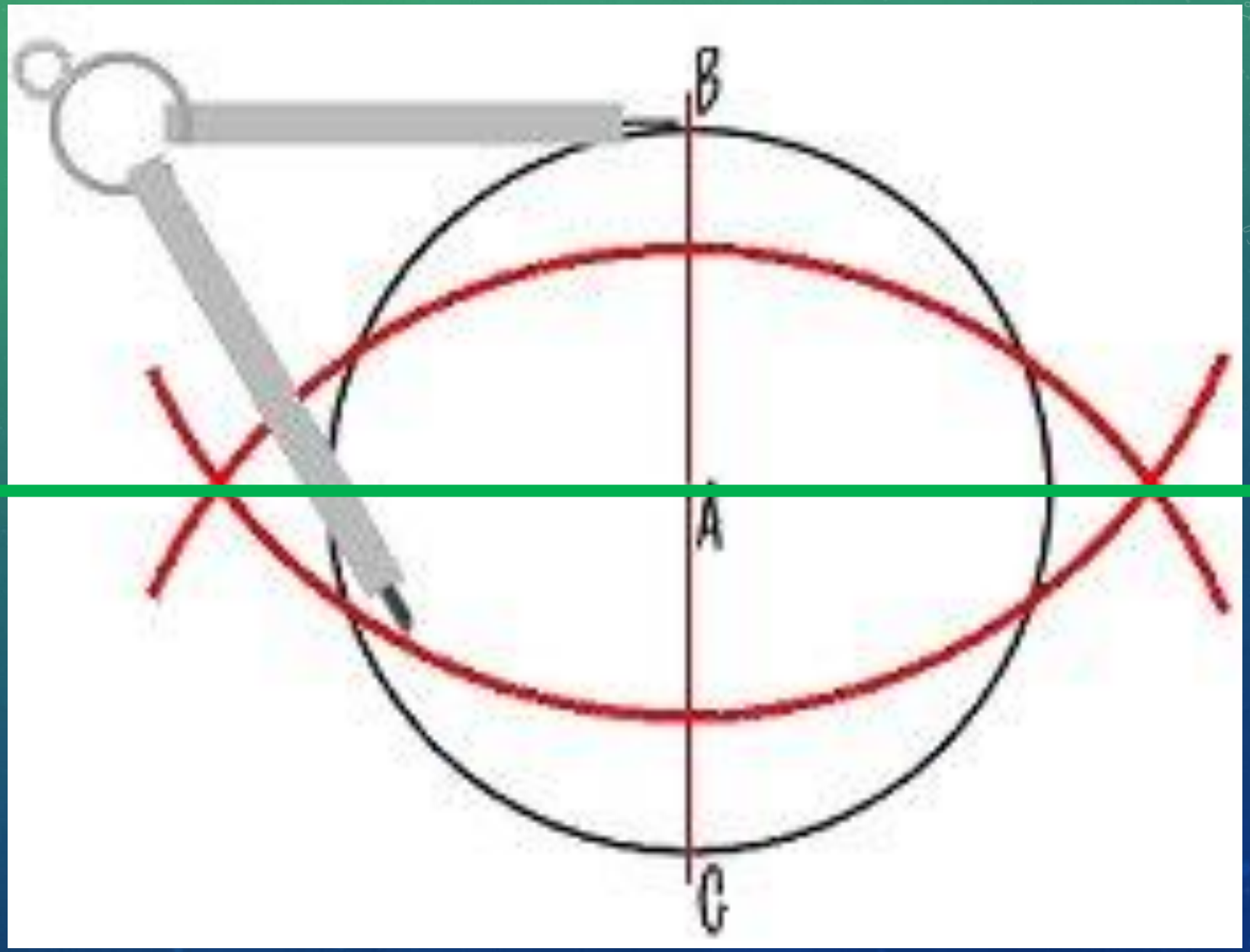
How will you do that?

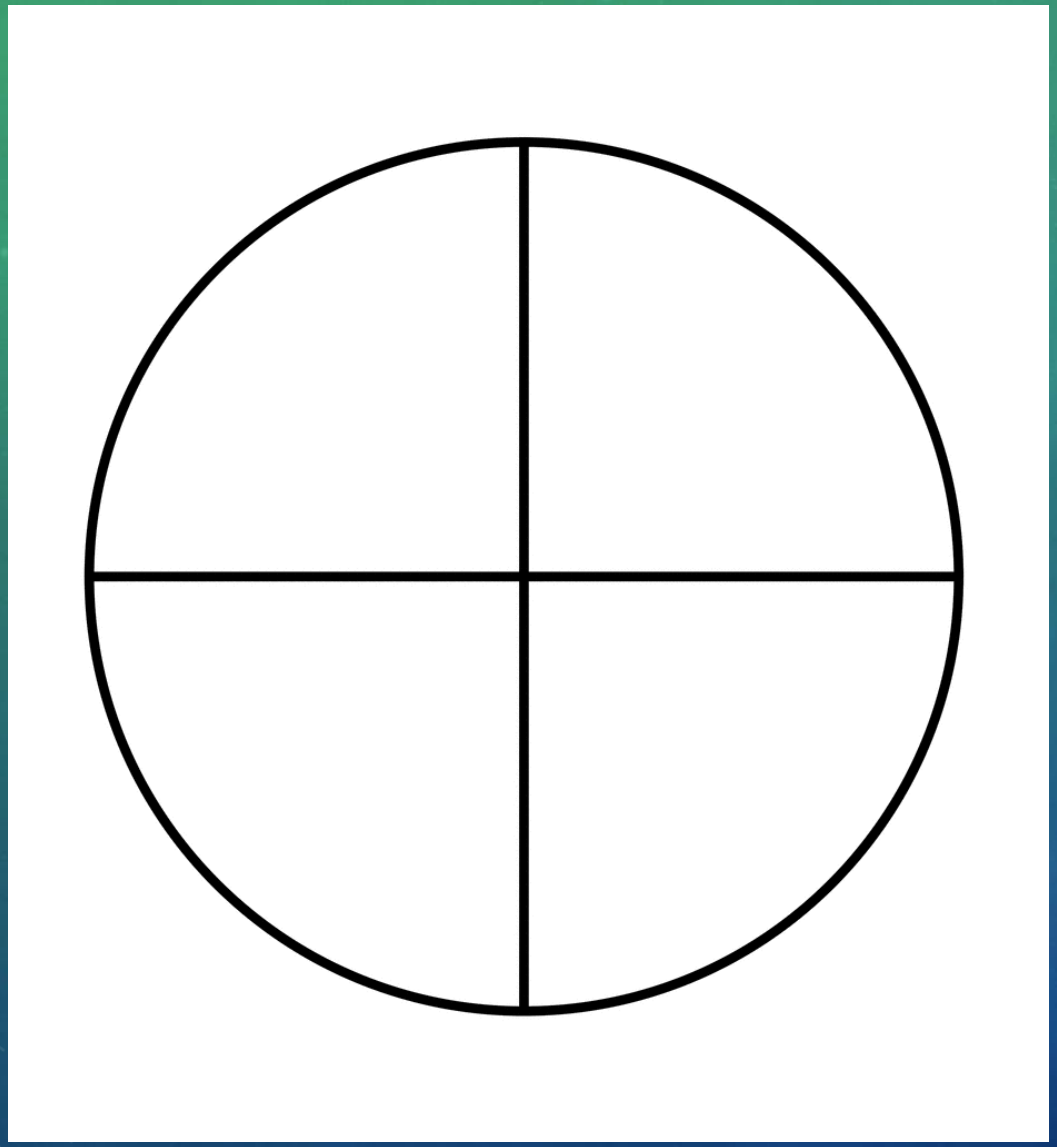
Talk to your neighbor about how to solve this problem.

Draw these lines lightly and erase them when you're done.






B
A
C

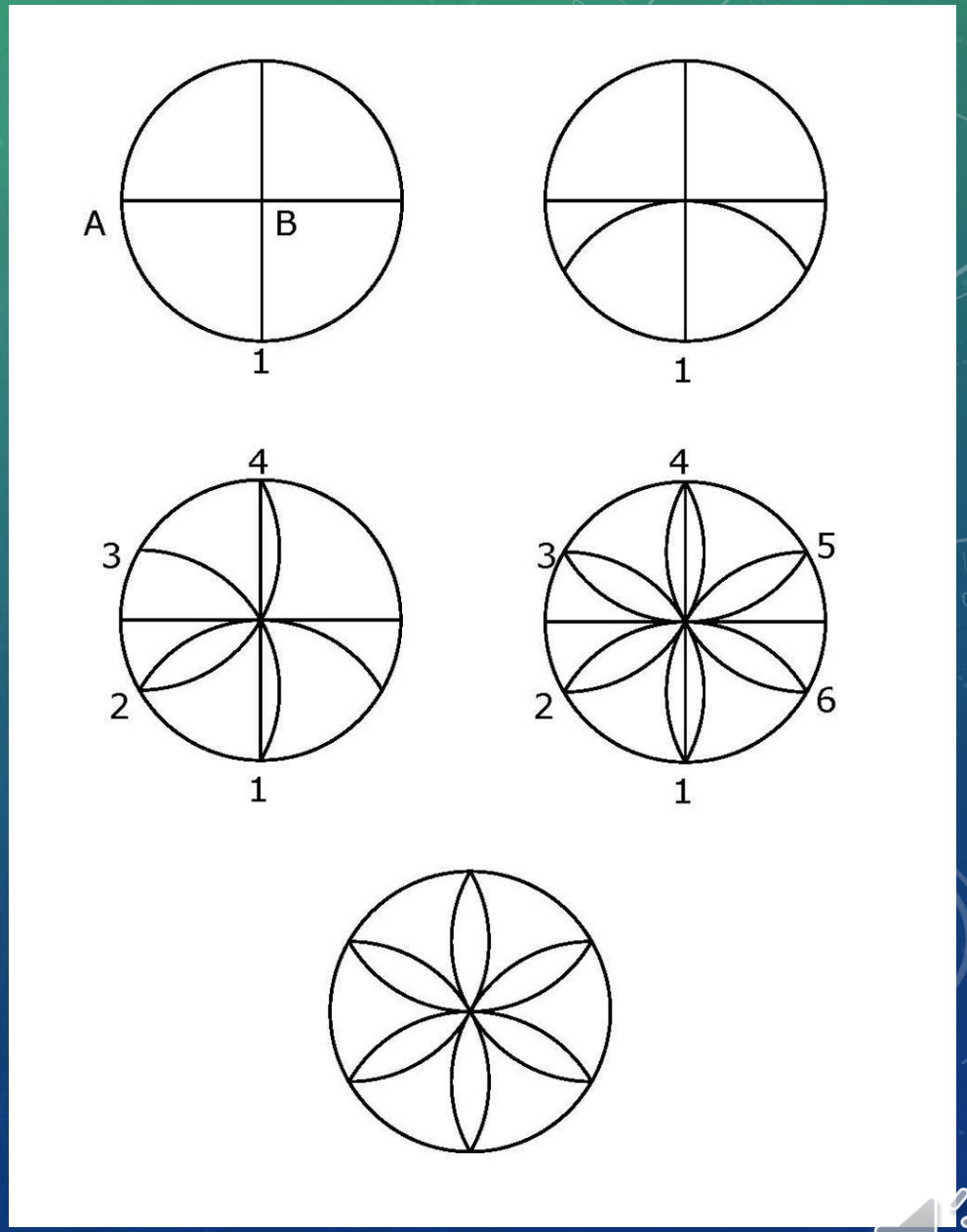


Erase your guide-lines so you have this.

We'll use this circle to make an elegant 6 petal flower mandala.

Set your compass width to the circle's radius (A to B).

1. Put your compass on the 1 and make an arc from one side of the circle to the other.
2. Put your compass on the point that your arc crossed the circle (2) and draw a similar arc from that point
3. Put your compass on the next point (3) and draw a similar arc.
4. And so on.
5. And so on

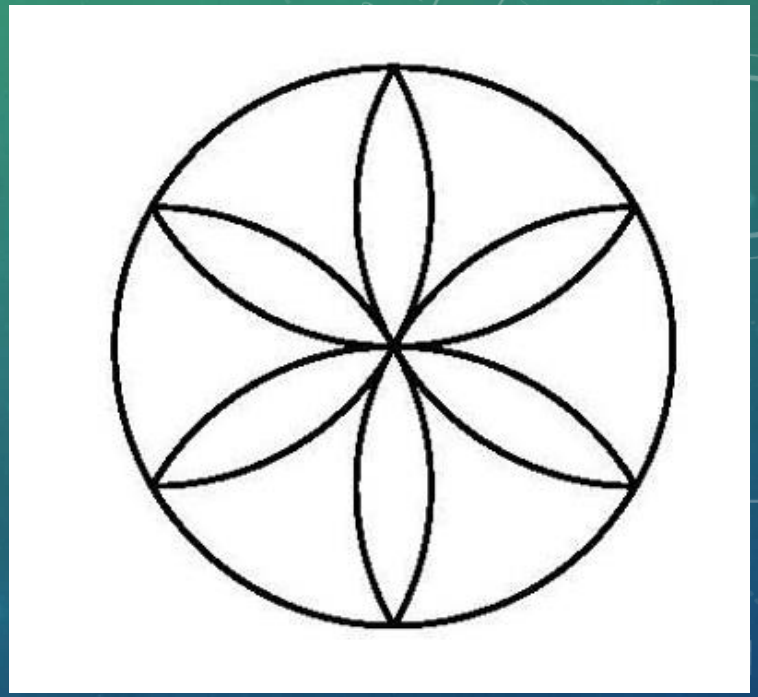


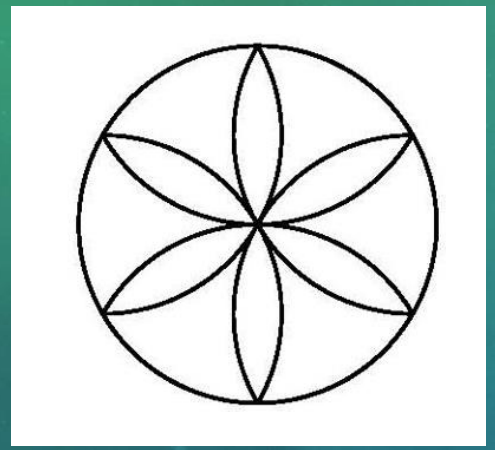
Pretty!

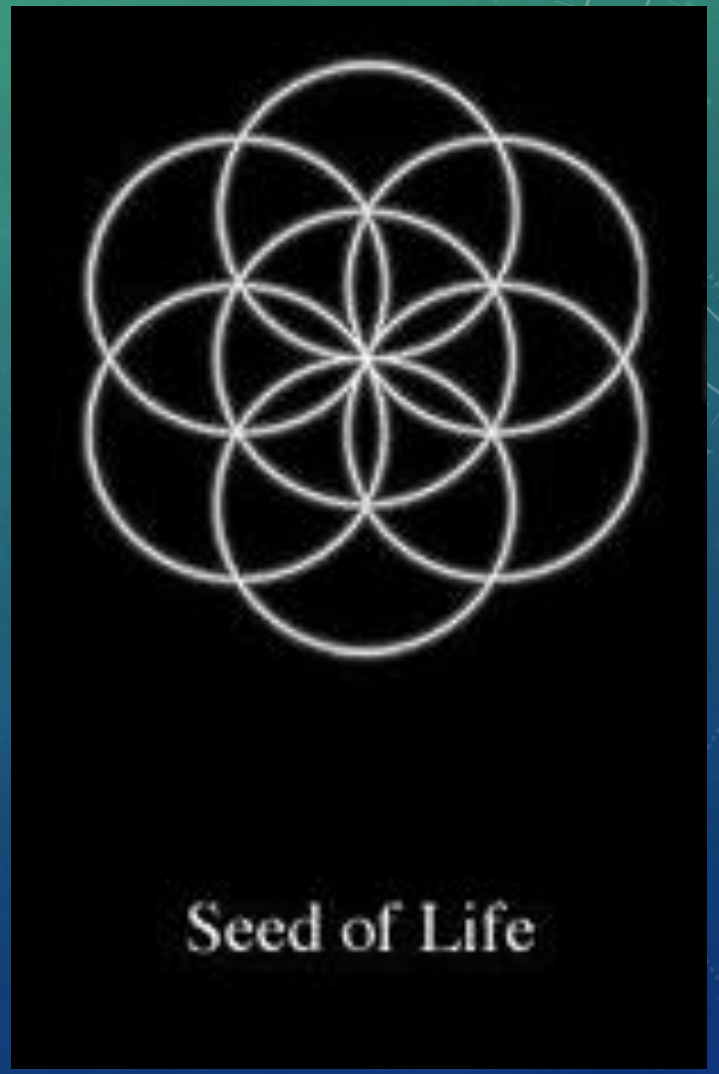
Now . . .

Challenge:

Find a way to make this a symmetrical 12-petaled flower.

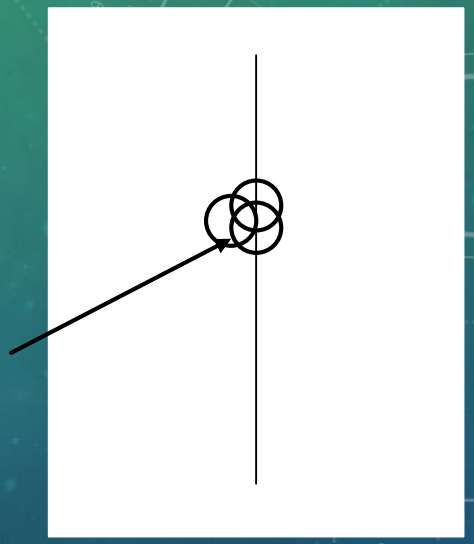


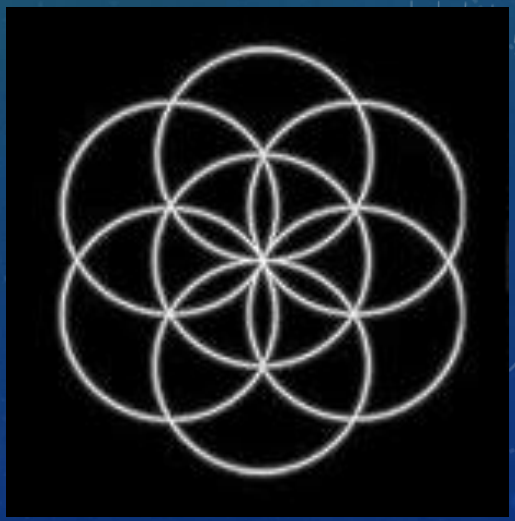



Seed of Life

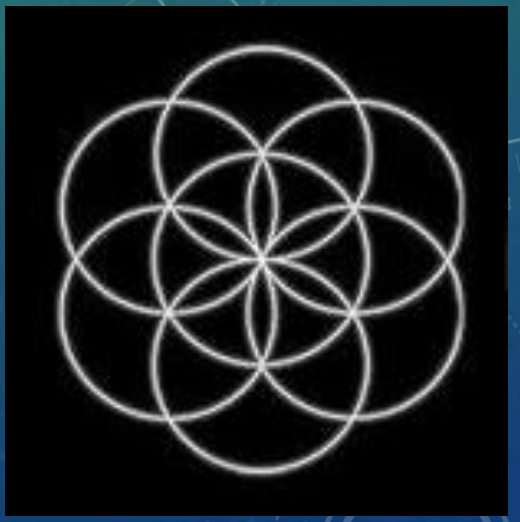
The seed of life

- Take a blank sheet of paper.
- Divide the paper roughly in half by drawing a vertical line on the paper.
- With your compass width an inch only, roughly at the center of the line draw a circle. Keep the compass at one inch throughout.
- Using the vertex where the circle crosses the vertical line as the center, draw a circle.
- Putting your compass point at the vertex where *that* circle crosses the original circle, draw another circle.
- Can you see how you might continue the pattern you used for the 6-petal mandala? Do it!





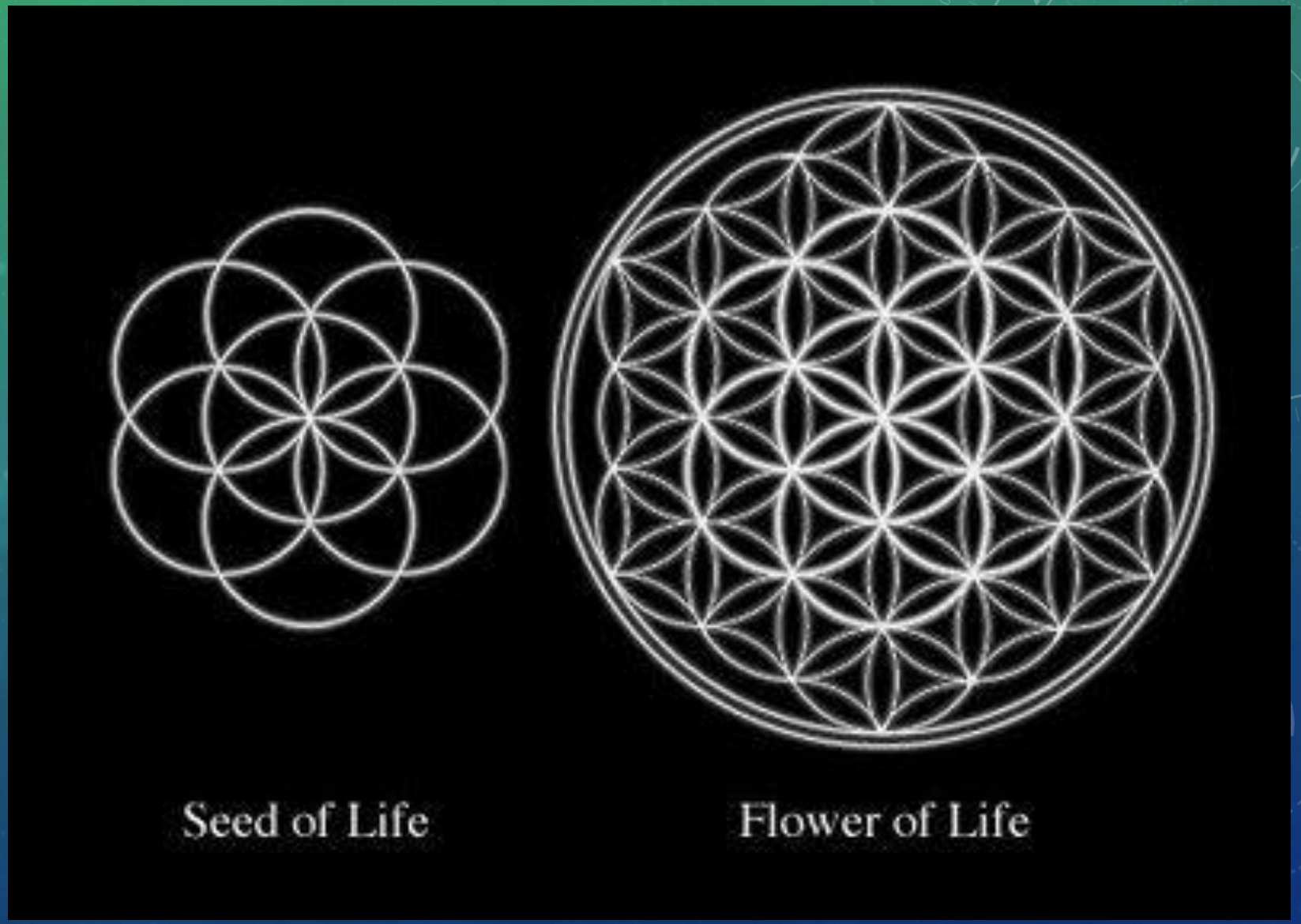
The seed of life



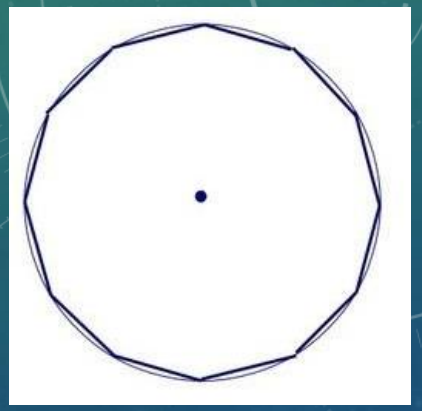
Cool, huh? (see the six petal flower in the center?)

- You could draw a circle on the next sets of vertices to expand your design, and the next, exponentially, of course, until your Seed of Life is the size of a football field.

You can see how the Seed of Life becomes the Flower of Life, another mandala form.



But let's make a couple of mandalas using twelve points on the circle



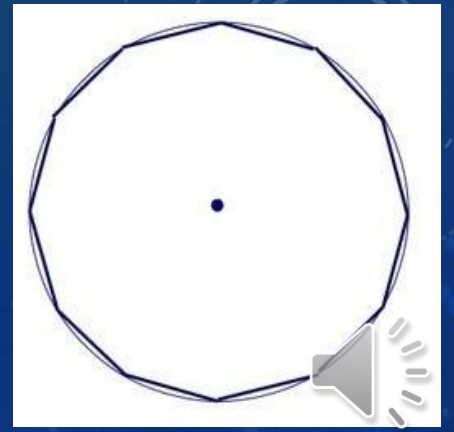
*This next activity works with any number of points on the circle.

*You might have students determine the angle measurement on 12 points/sectors, or 11 sectors, or 8, or 20, before going ahead to make the mandala.

- Take the template page that has four circles on it.
- 12 points around the circle are marked.

12 point mandalas

- If you were students, I might ask: If we connected each point to the next point – what would that polygon be called?
  - Yep! A dodecagon. Smarty pants.
- Now, lightly number all the points clockwise starting at any point. 1-12.



Dodecagon Star Mandalas

- On one dodecagon, use your straightedge to connect every other point (1 to 3, 2 to 4, 3 to 5) to create a wide star.
- On your next dodecagon, connect every third point, skipping two points between connections (1 to 4, 2 to 5, 3 to 6, etc). You have a different star.
- On another dodecagon, connect every fourth point, skipping three points between connections (1 to 5, 2 to 6, 3 to 7, etc..). An even differenter star.
- You could keep trying this pattern to see what happens but instead . . .

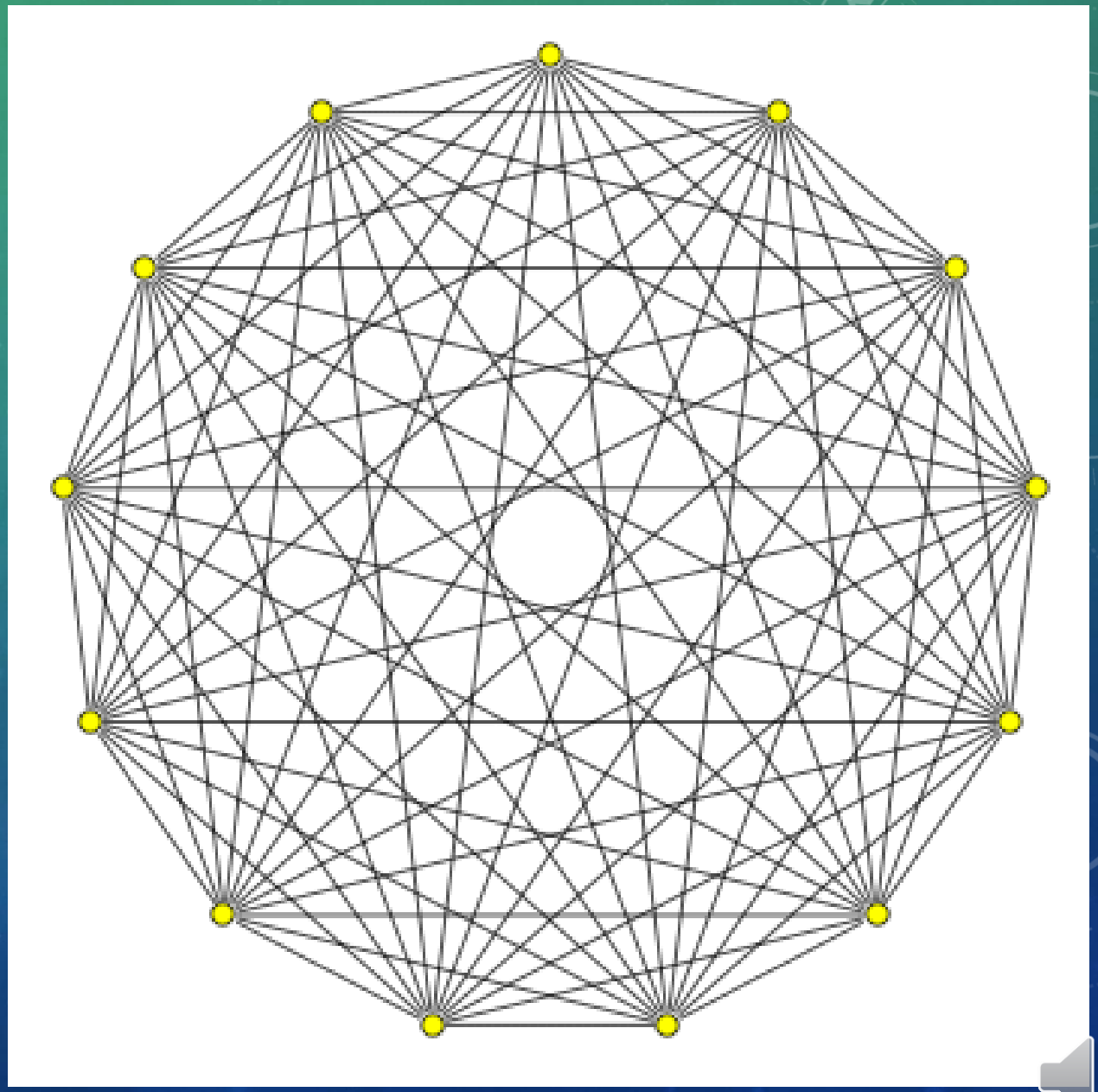
1. On your fourth dodecagon, start at point 1. Use your straightedge to draw a line from 1 to 2. From 1 to 3. From 1 to 4. From 1 to 5.

2. You get the picture. Continue.

3. Now start at point 2. Draw a line from 2 to 3. From 2 to 4. And so on.

4. Finish around the circle.

Cool, huh?



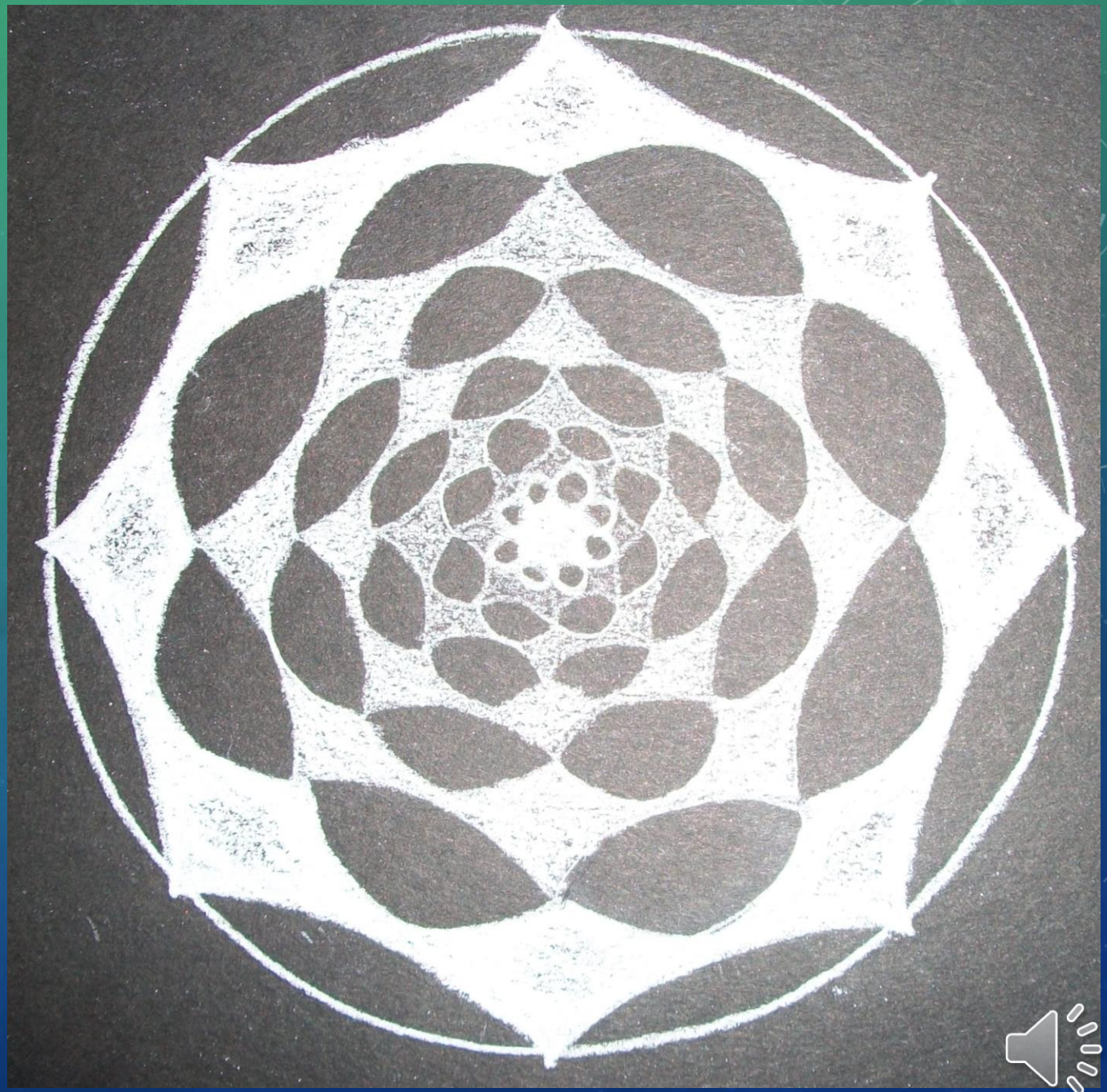
Ready to try your own?

- You're probably ready to try out your own ideas and patterns.
- Or you could go back to earlier mandalas and either add lines, shapes and patterns to them, or color them.

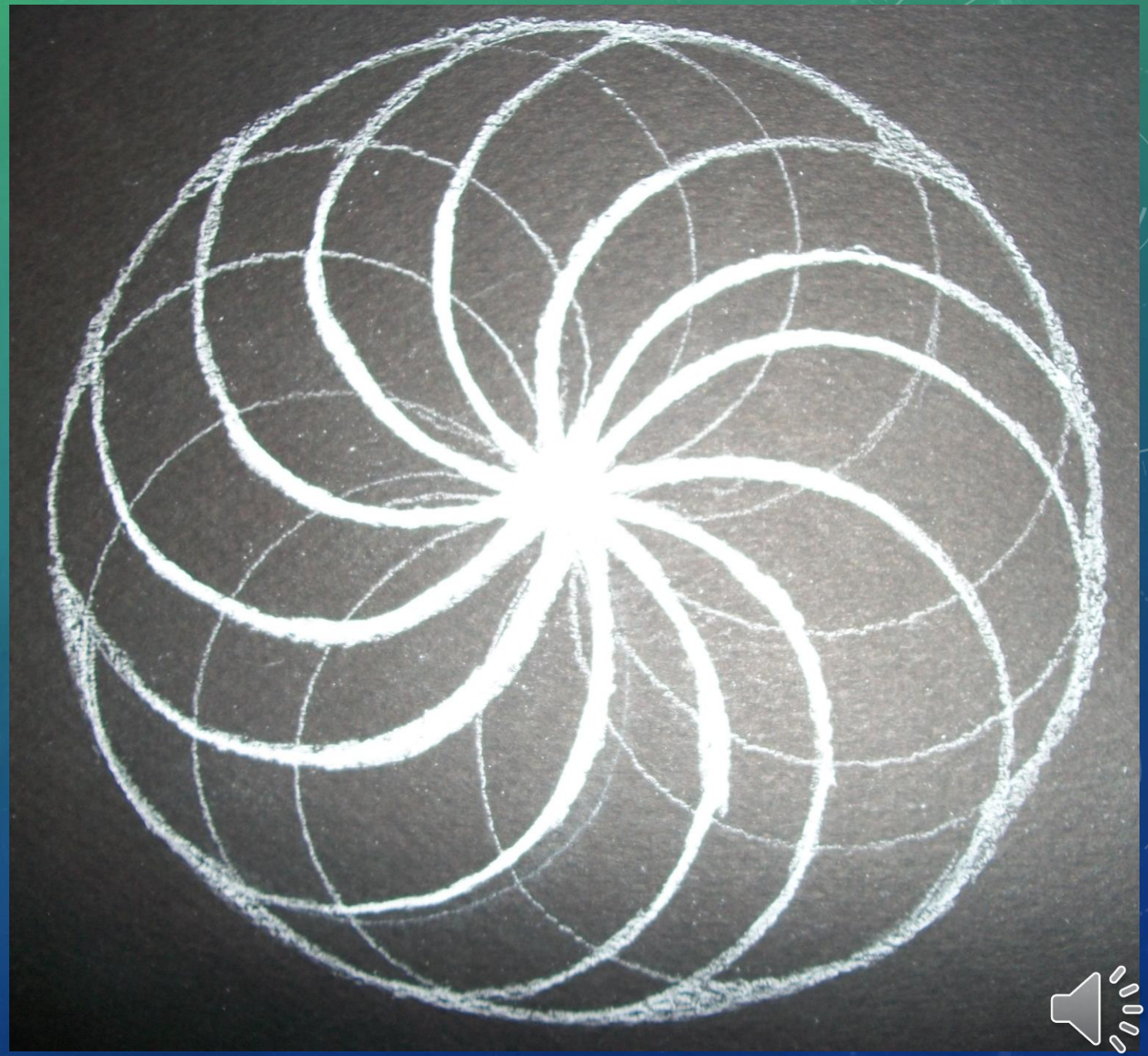
Every once in a while, look around at the variety of stars, designs, and variations in everyone's mandalas.

Amazing.

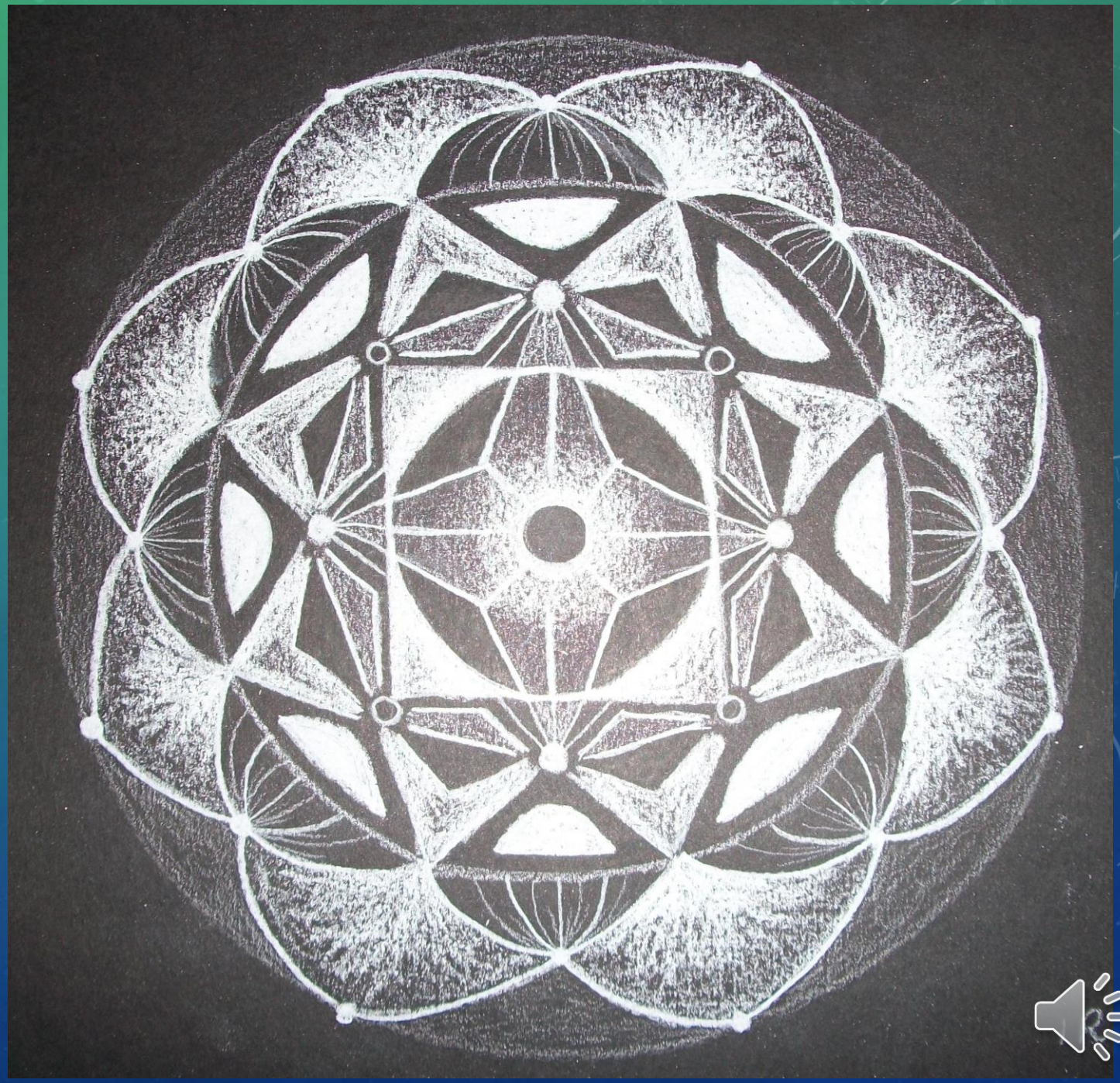
3 minutes



2 minutes



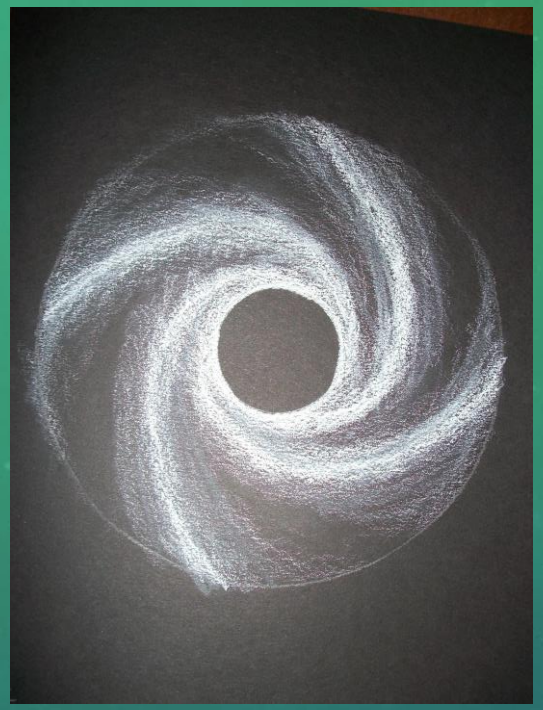
1 minute



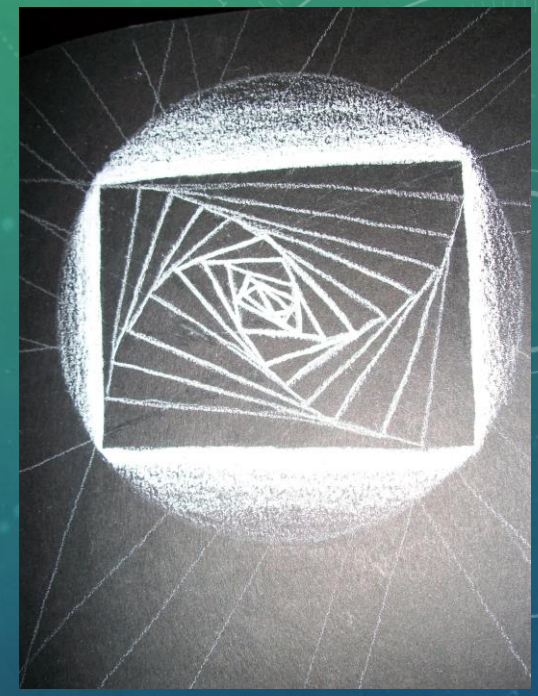
Time's Up!

Now let's talk

- Choose one question, talk to someone nearby:
  - What are your first impressions?
  - Talk about the creativity in this activity.
  - How might you use this?
  - What ideas do you have for differentiating this activity to make it more challenging?



Thank you for trying this Mandala for Math activity.

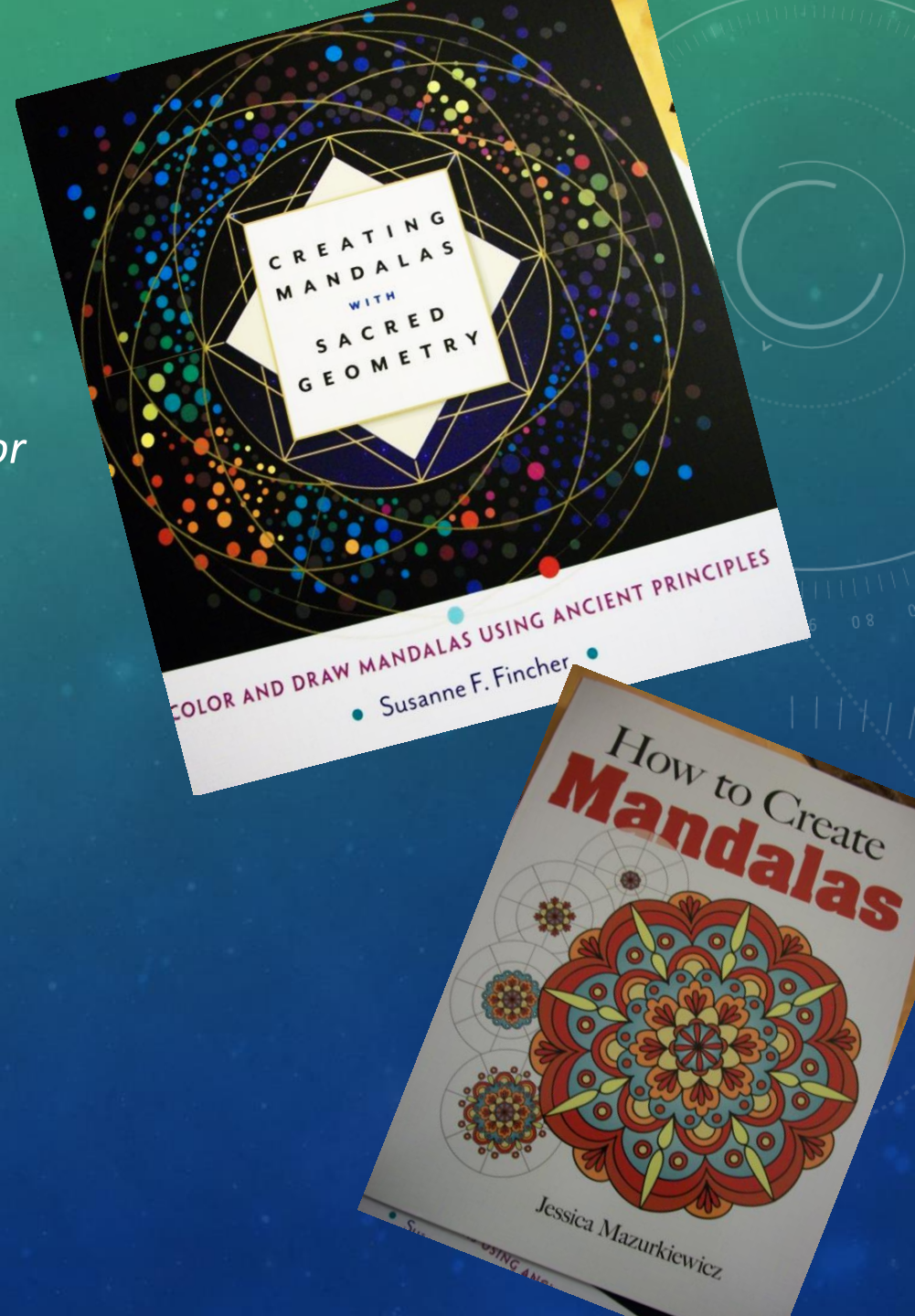


Leave a 3x5 card with your name and email with me and I will send you the PowerPoints for both Mandala activities.

You can help prepare for the next group by putting the tools you used back in the box.

The following books were useful in creating this activity

Fincher, S.F. (2017). *Creating Mandalas with Sacred Geometry: Color and Draw Mandalas Using Ancient Principles.* Boulder, CO: Shambala.

Mazurkiewicz, J. (2013). *How to Create Mandalas.* Mineola, NY: Dover Publications, Inc.

All mandalas on black paper created by Jennifer Groman.
Other mandalas and geometric drawings from Fincher (2017) and Mazurkiewicz (2013) and online.