

Ornamental Brass Roundel

Geometric and Biomorphic Analysis by Chris Riederer



Photo: Istanbul, Süleymaniye Mosque, 2018

This design caught my eye in 2018, it is a door handle from the Süleymaniye Mosque in Istanbul. I like the motion and subtle play of fore and background in the design. It feels like its whirling! Interestingly, this piece doesn't use any spirals. It even breaks a "rule" or two, just lovely. This material is offered in the hopes that it will be of use for interested artists, I make no claims as to the historical accuracy or relevance of the constructions presented.

Happy drawing.

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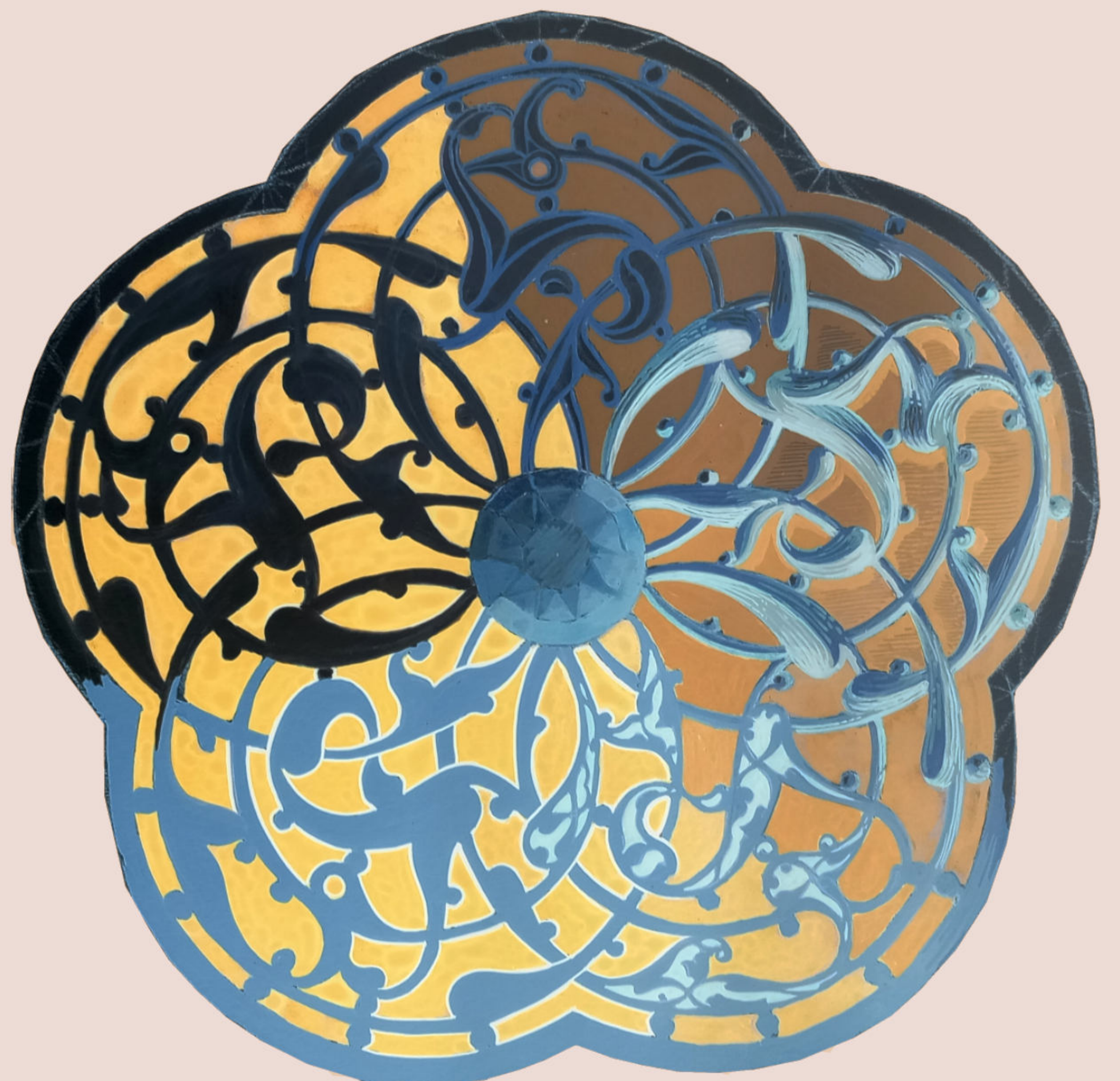
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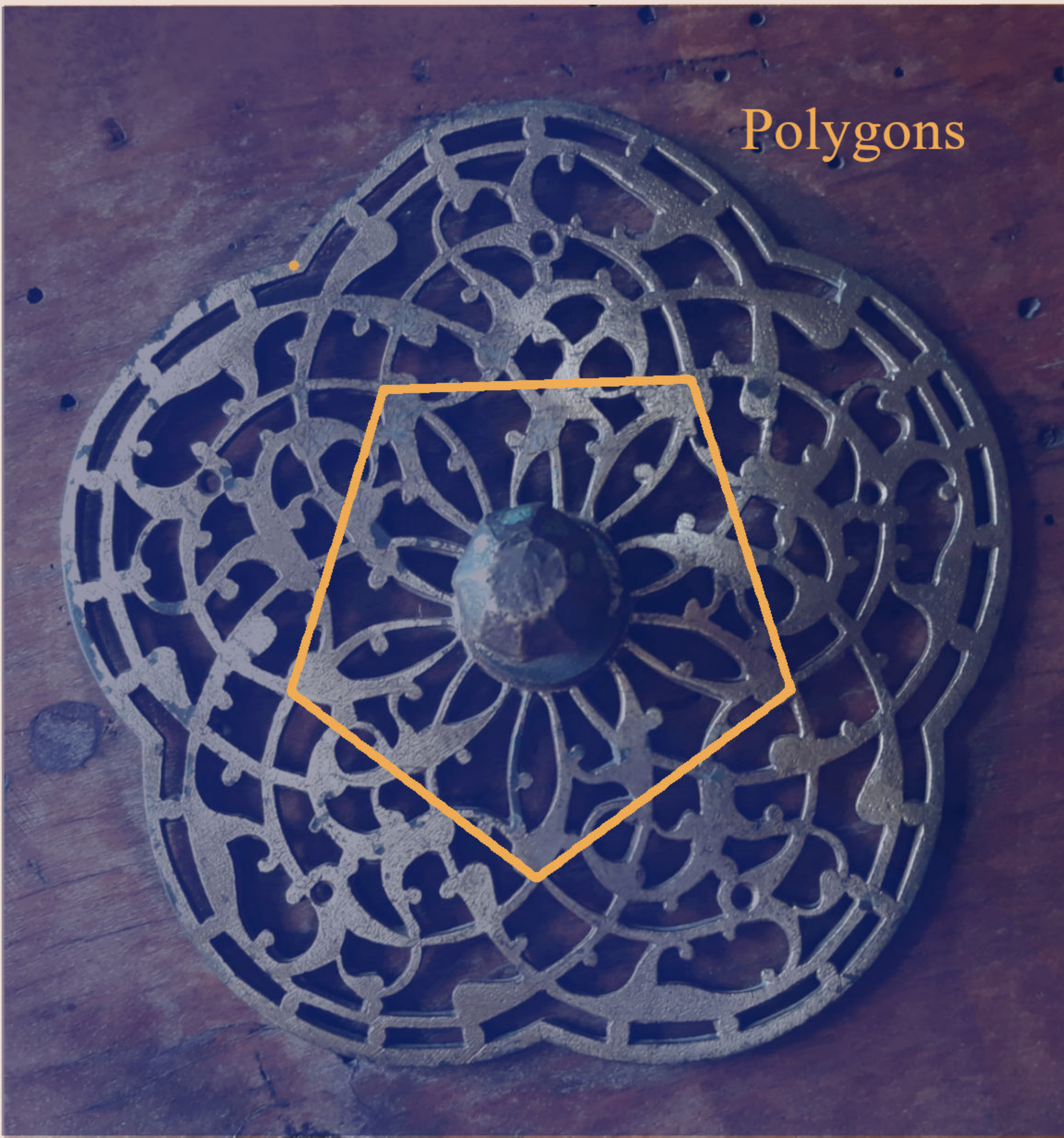
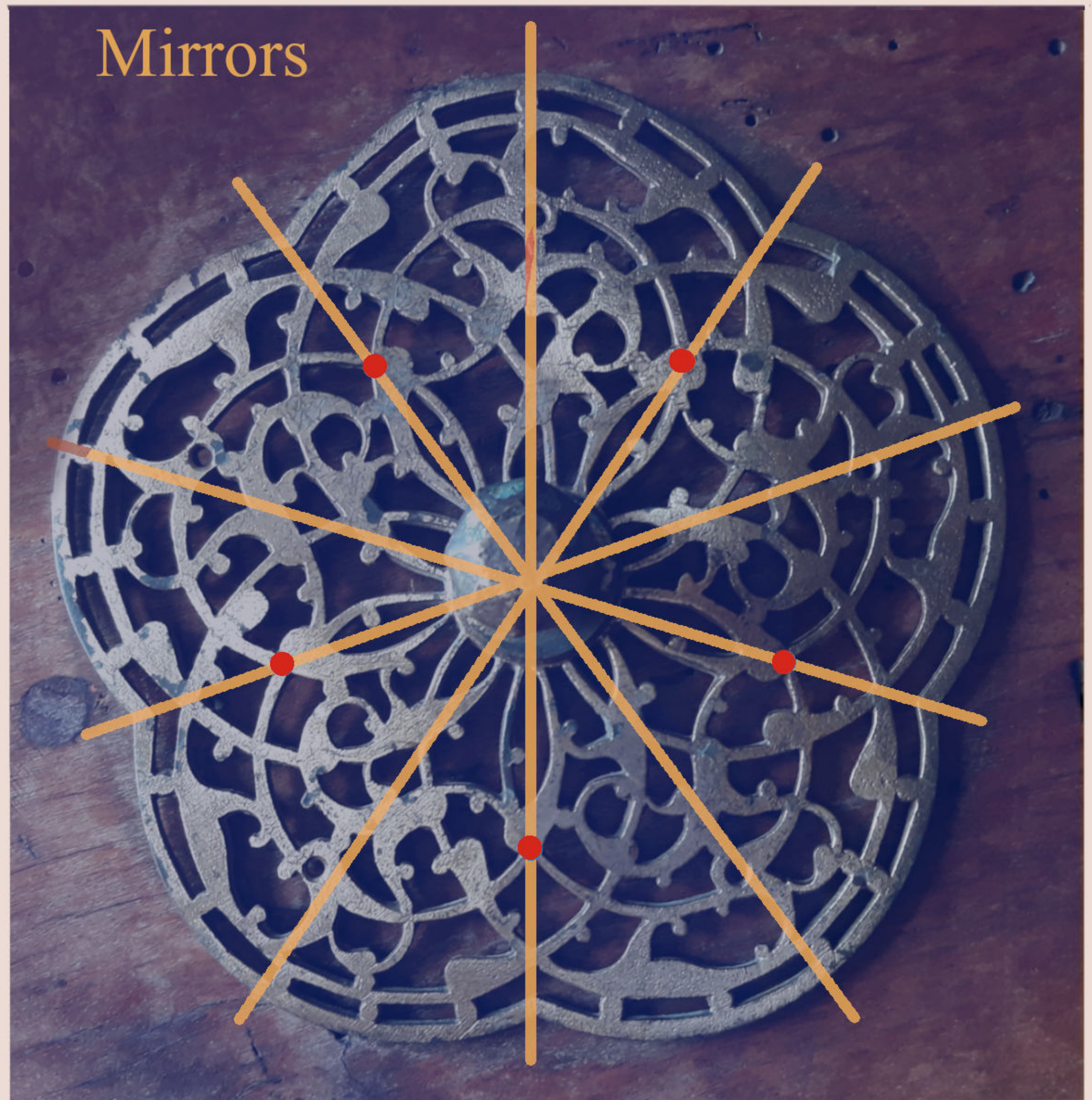
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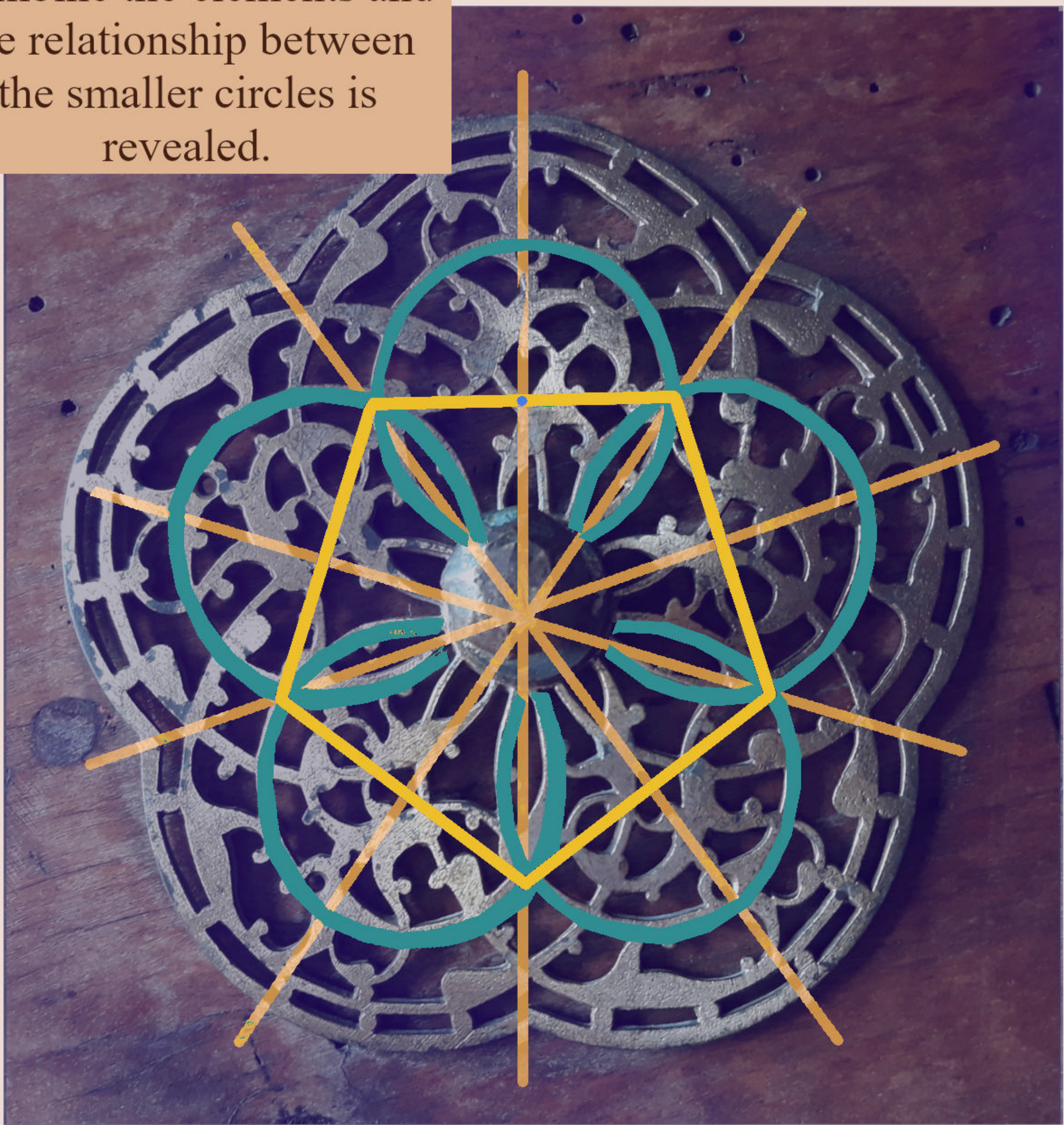
First look at the geometry

Let's observe the original design. Find the symmetry, look for mirrors, polygons, and circles. Imagine the centers of any circles, and seek out any relationships that can offer a path into the pattern. We need some anchors for the geometry.

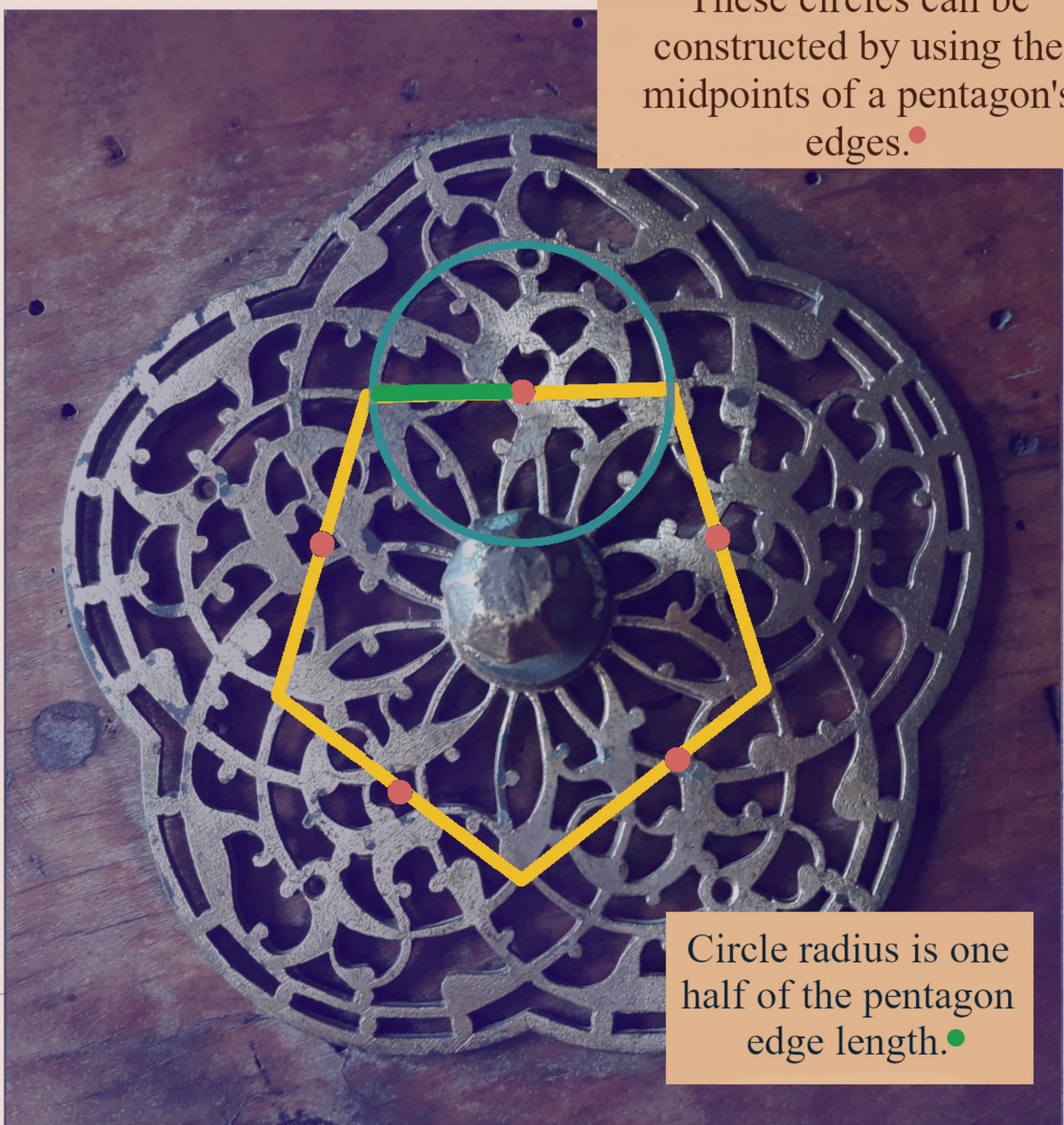


Core geometries

Combine the elements and the relationship between the smaller circles is revealed.



These circles can be constructed by using the midpoints of a pentagon's edges.

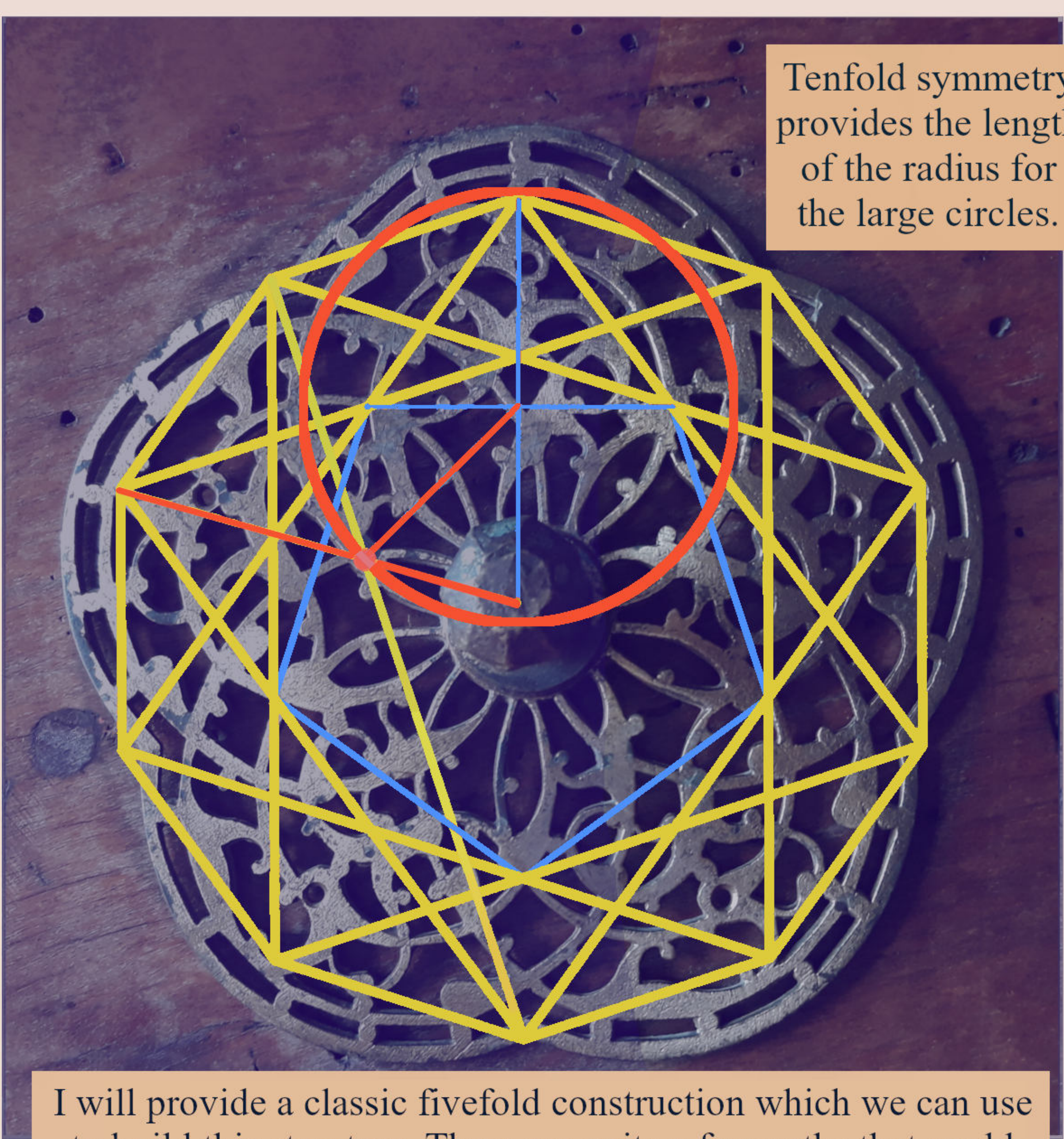


Circle radius is one half of the pentagon edge length.

Next we are looking for the radius of the larger circle.



Tenfold symmetry provides the length of the radius for the large circles.



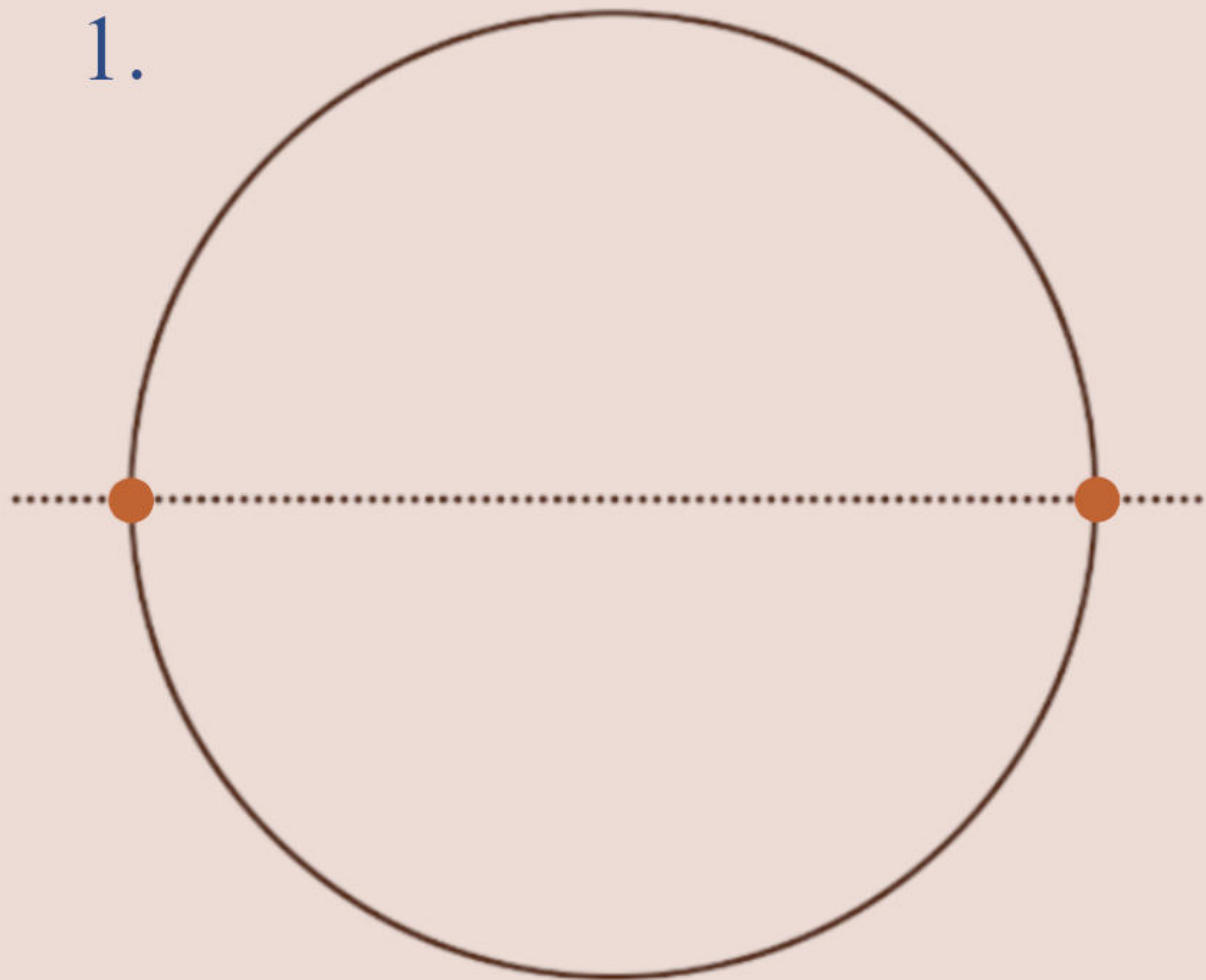
We believe the center of the larger circle is the same as the smaller circle, but need to find a geometric relationship that defines the length of the radius.

I will provide a classic fivefold construction which we can use to build this structure. There are quite a few paths that could be taken to arrive at this distance. Experienced geometers may wish to jump directly to this structure from a decagon construction or their own preferred pentagon. Go for it! And rejoin at page 8 to add the circular structures.

A classic pentagon construction

3.

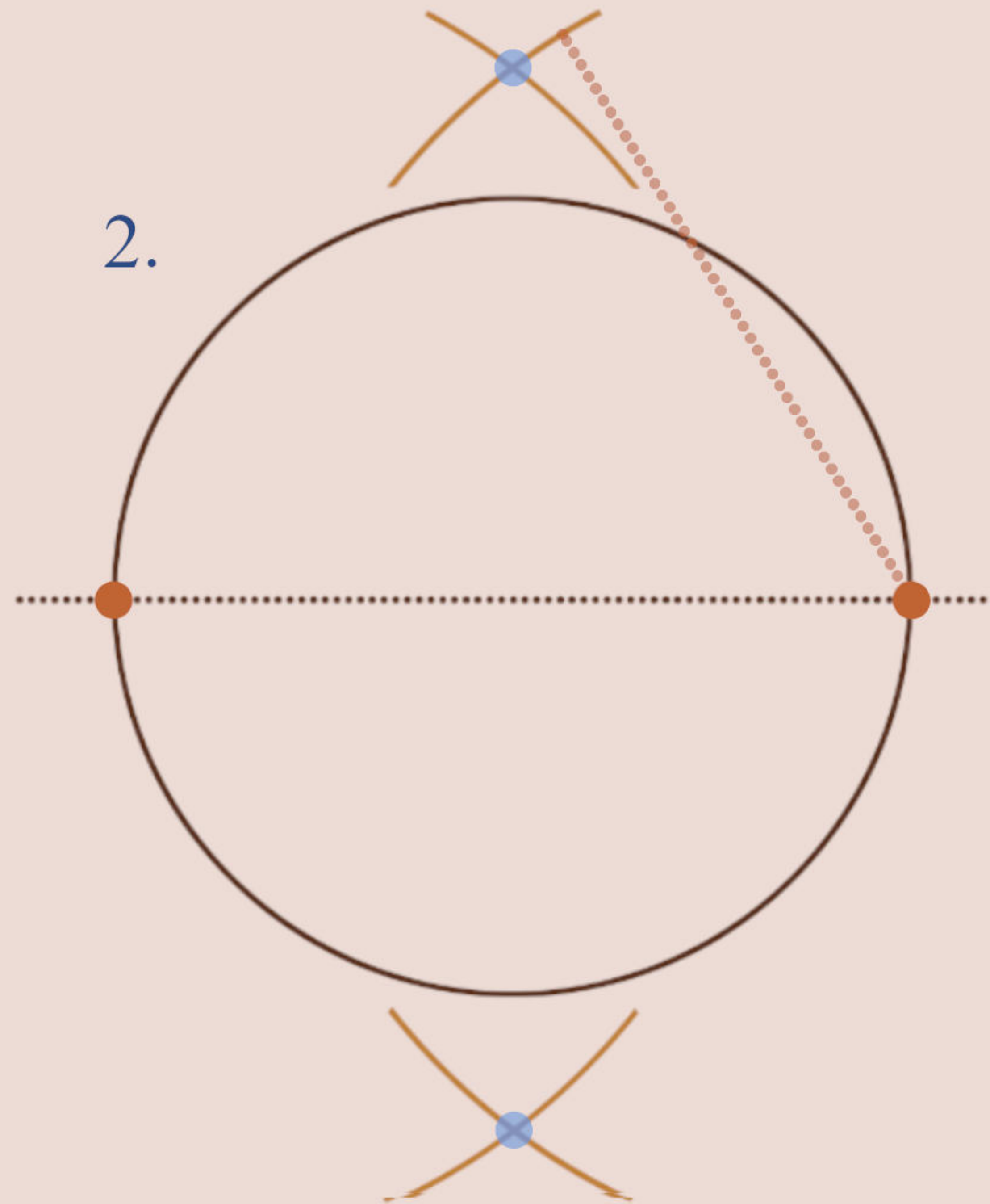
1.



Origin Circle

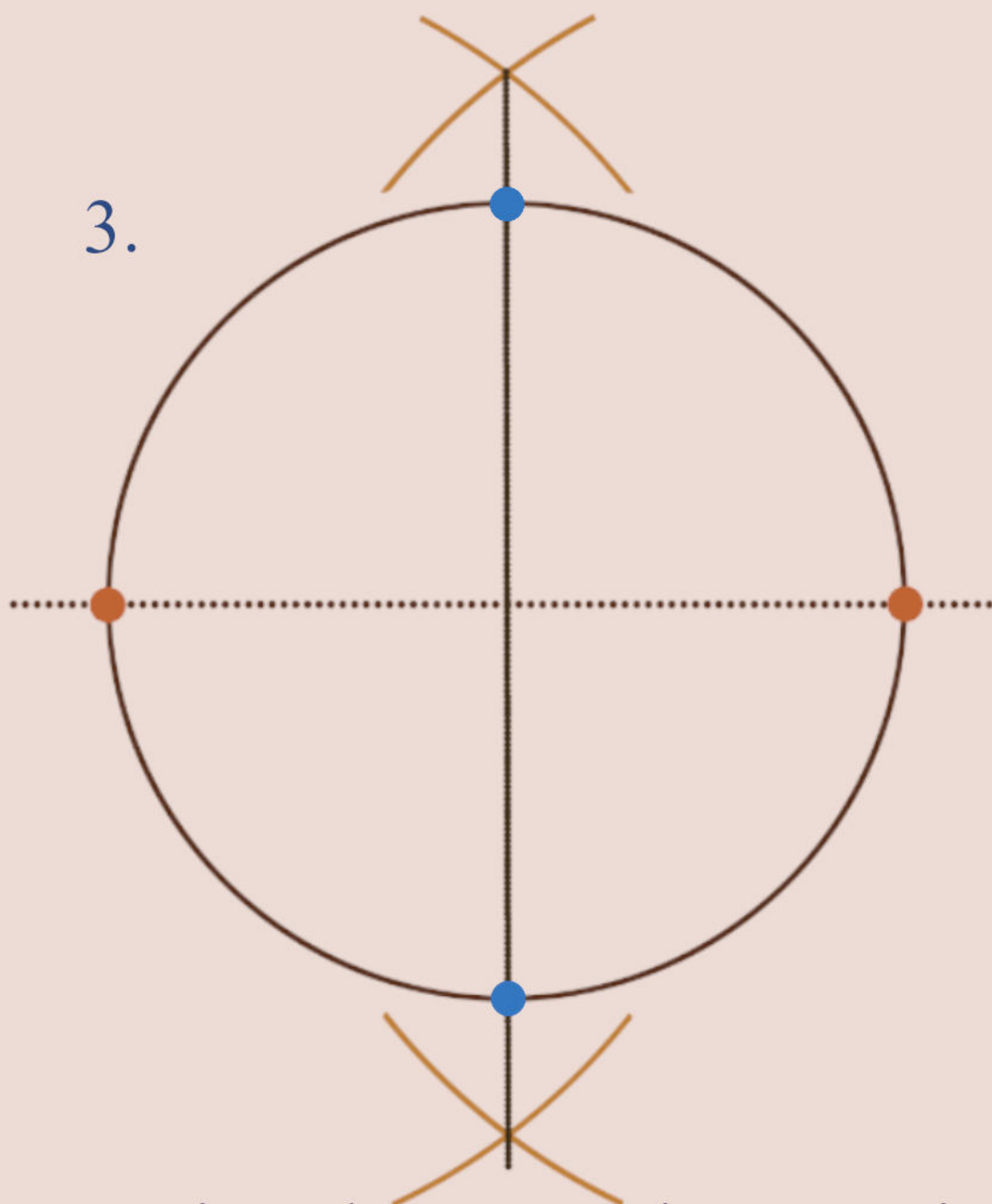
Place a circle on a horizontal line, This creates two new points where the circle and line intersect.

2.



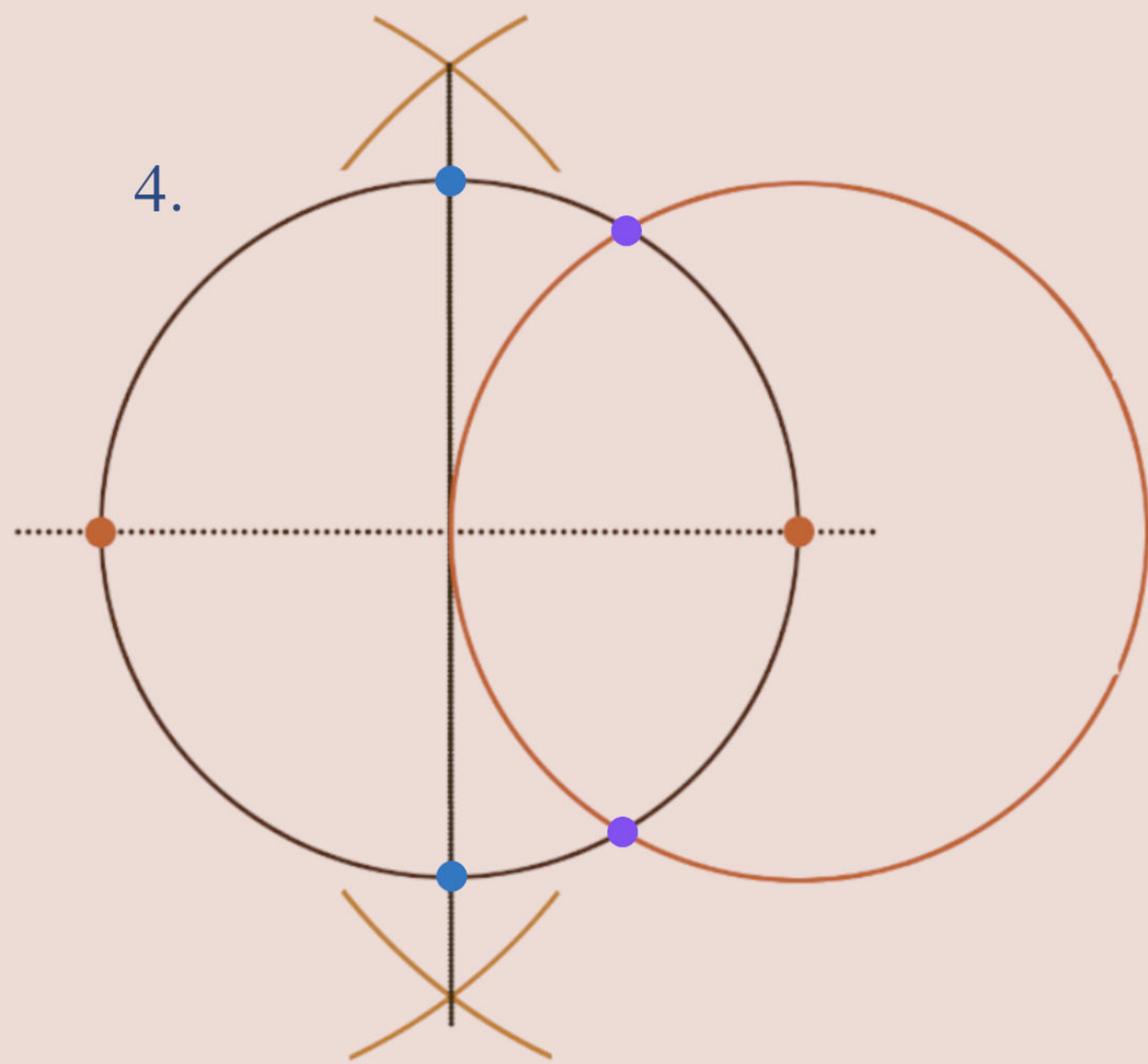
With your compass point at the intersections of the horizontal line and the origin circle, expand your compass an arbitrary amount to make new intersections *outside* the origin circle.

3.



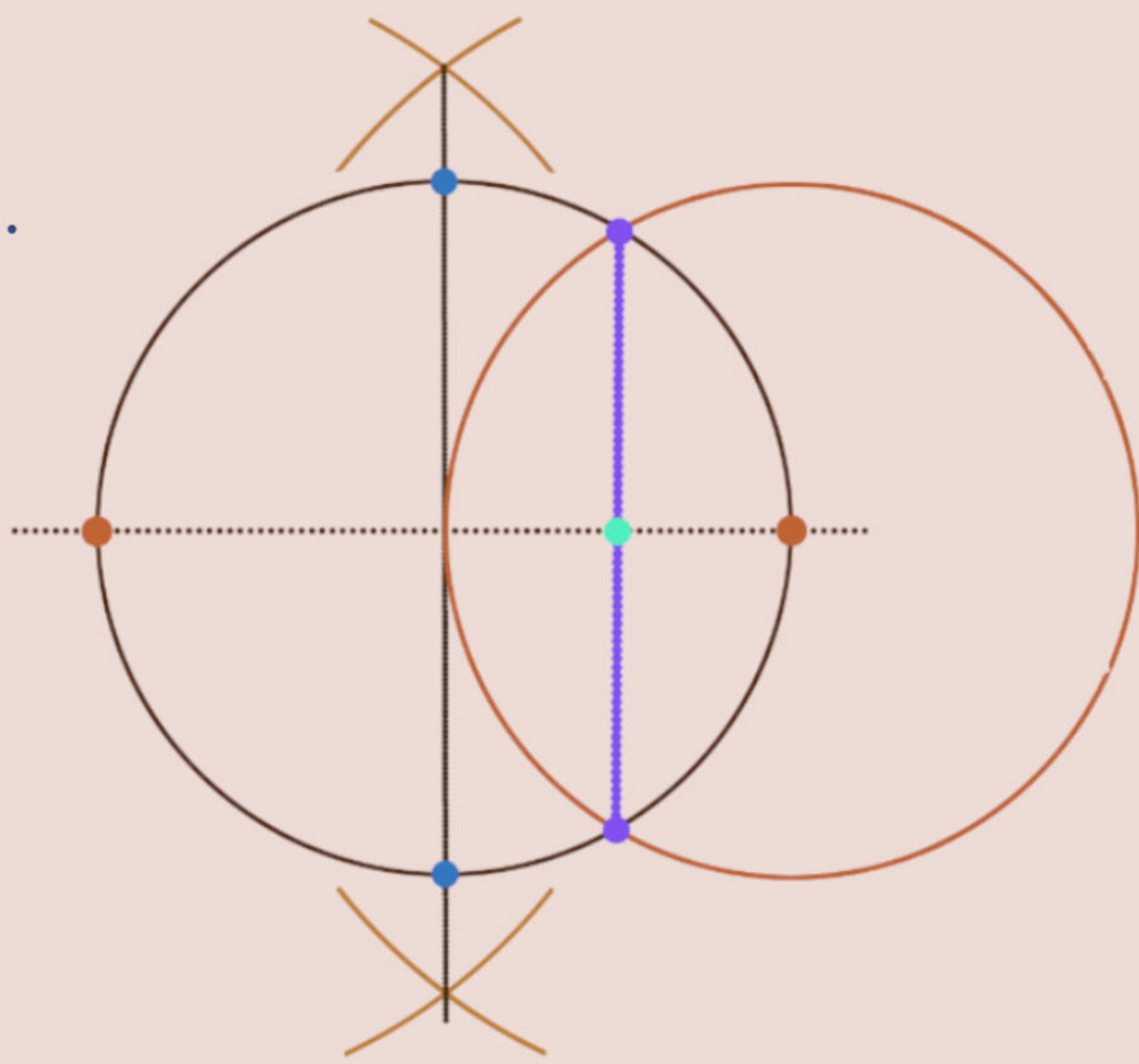
Connecting these two intersections creates a "perpendicular bisector", and divides the circle into four sections. Two new points are generated on the origin circle.

4.



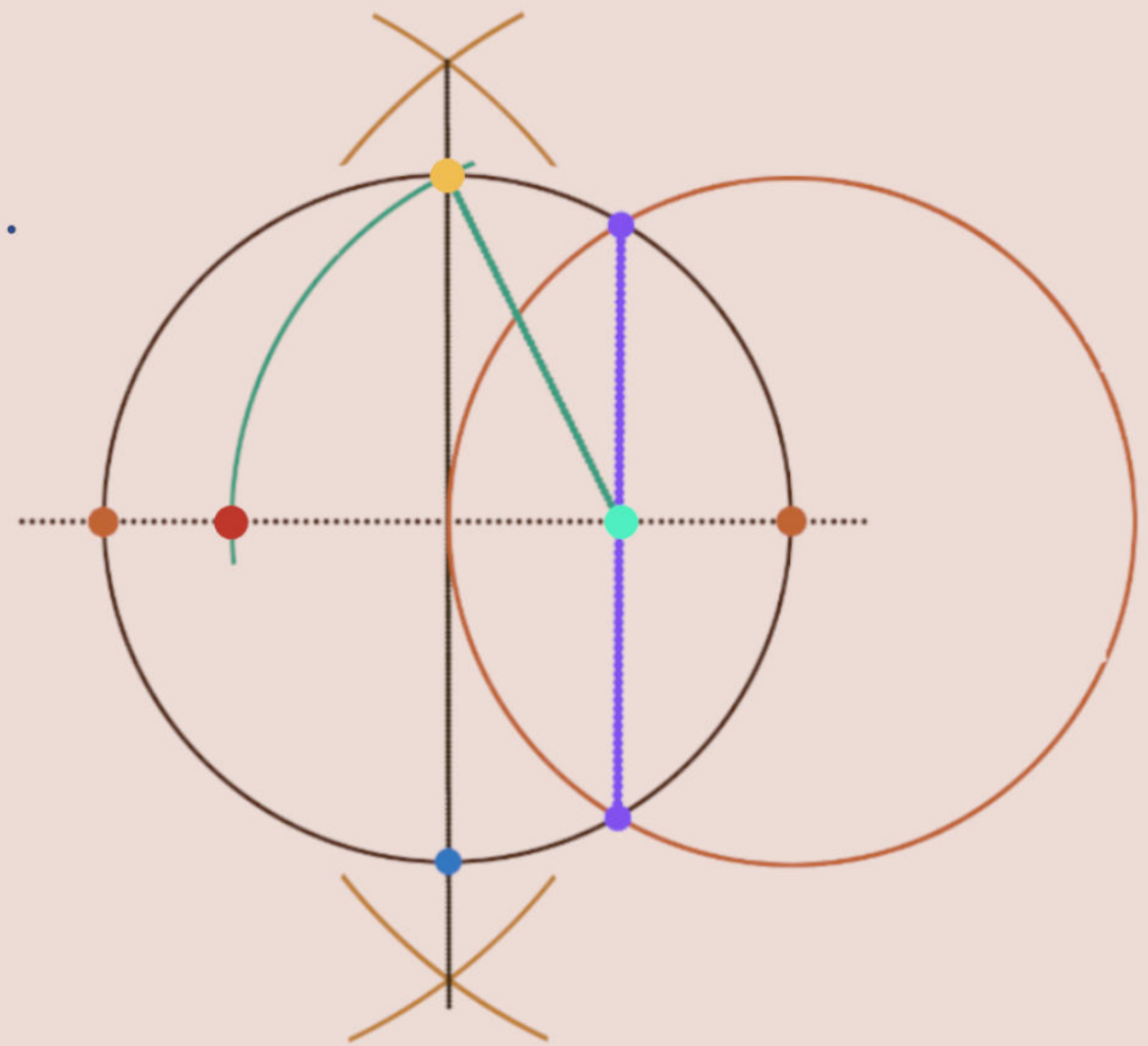
Return the compass to the original radius, and place a circle at the intersection of the origin circle and the horizontal line. Two new points are generated on the origin circle.

5.



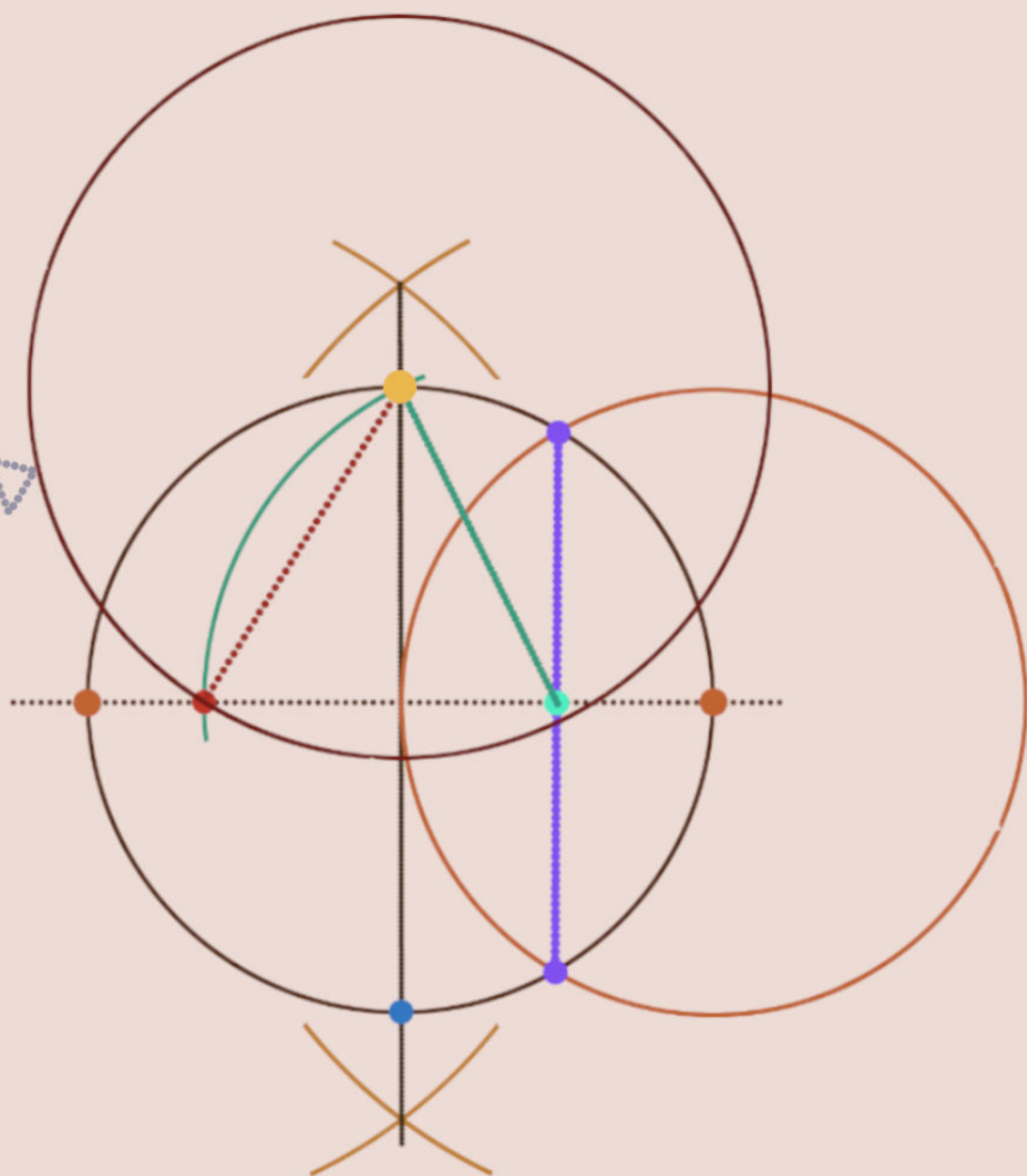
By connecting these two new points, we have found the midpoint of the radius of the origin circle.

6.



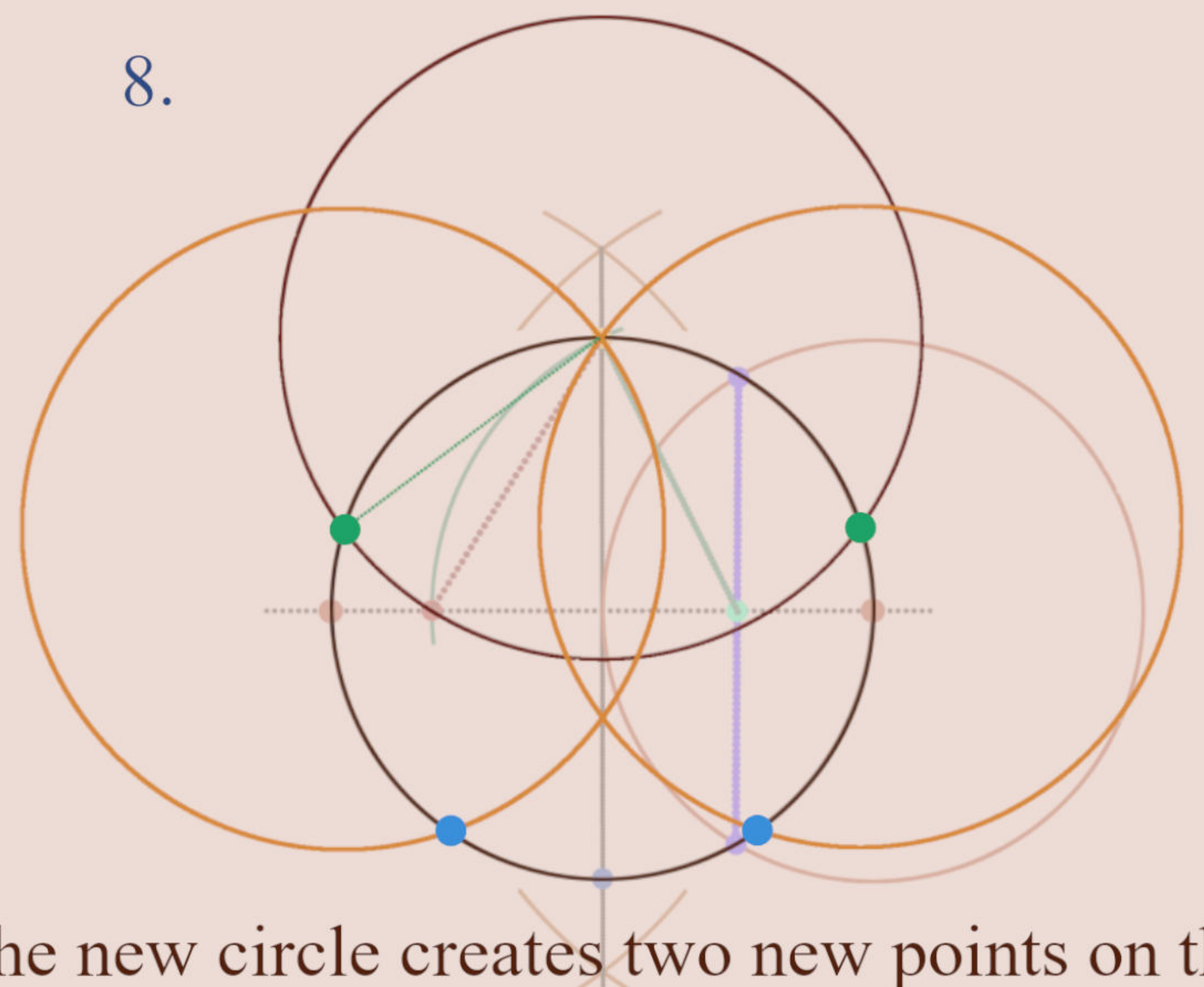
Place your compass point at the midpoint of the radius, and expand it slightly to intersect the point where the vertical line intersects the origin circle, then draw an arc that crosses the horizontal line.

7.



Place your compass point at the intersection of the vertical line and the origin circle, and expand it slightly to intersect the new point on the horizontal line. Draw the resulting circle.

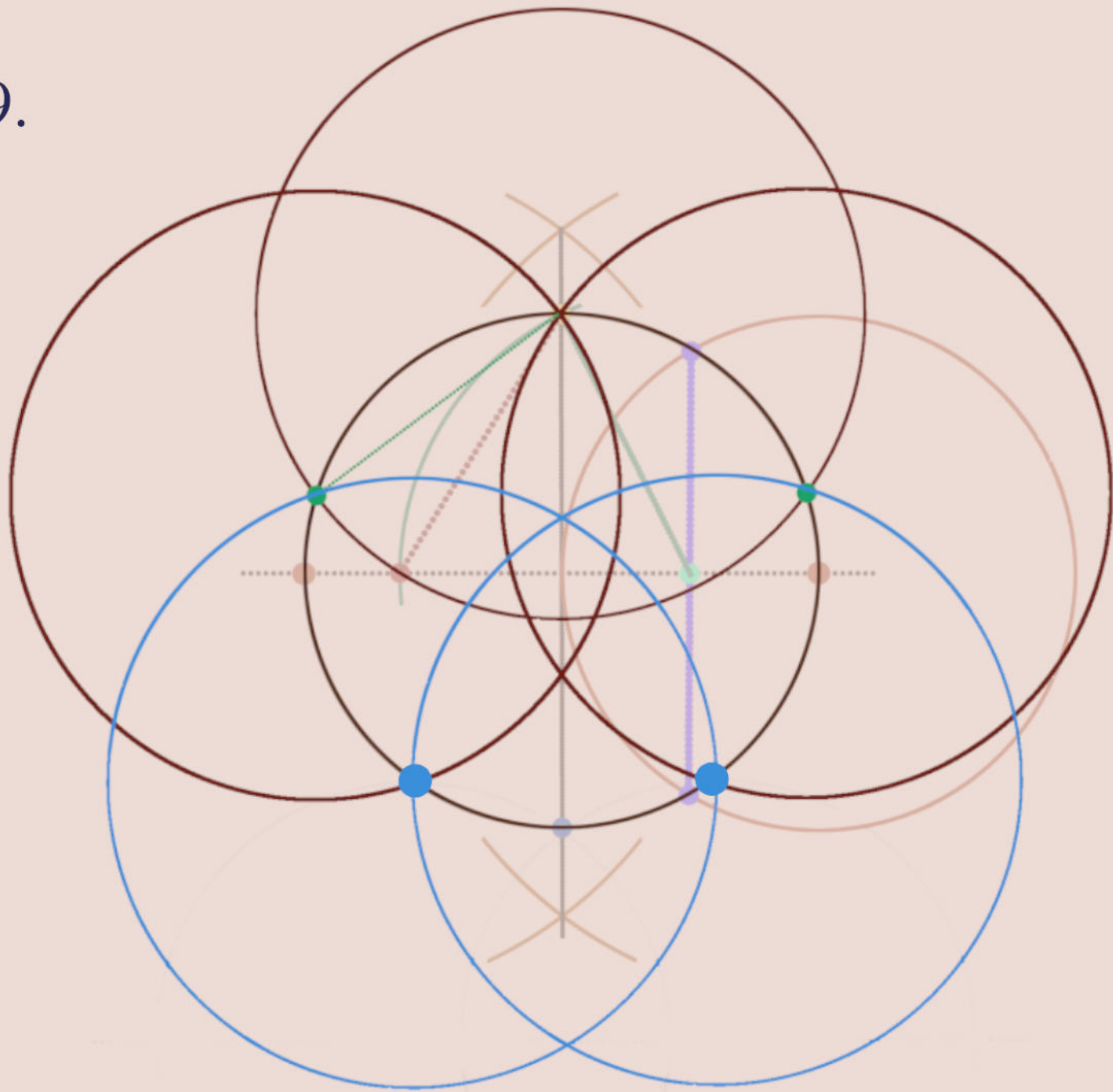
8.



The new circle creates two new points on the origin circle. Without changing your compass, place the compass point at the new intersections, and turn two more circles.

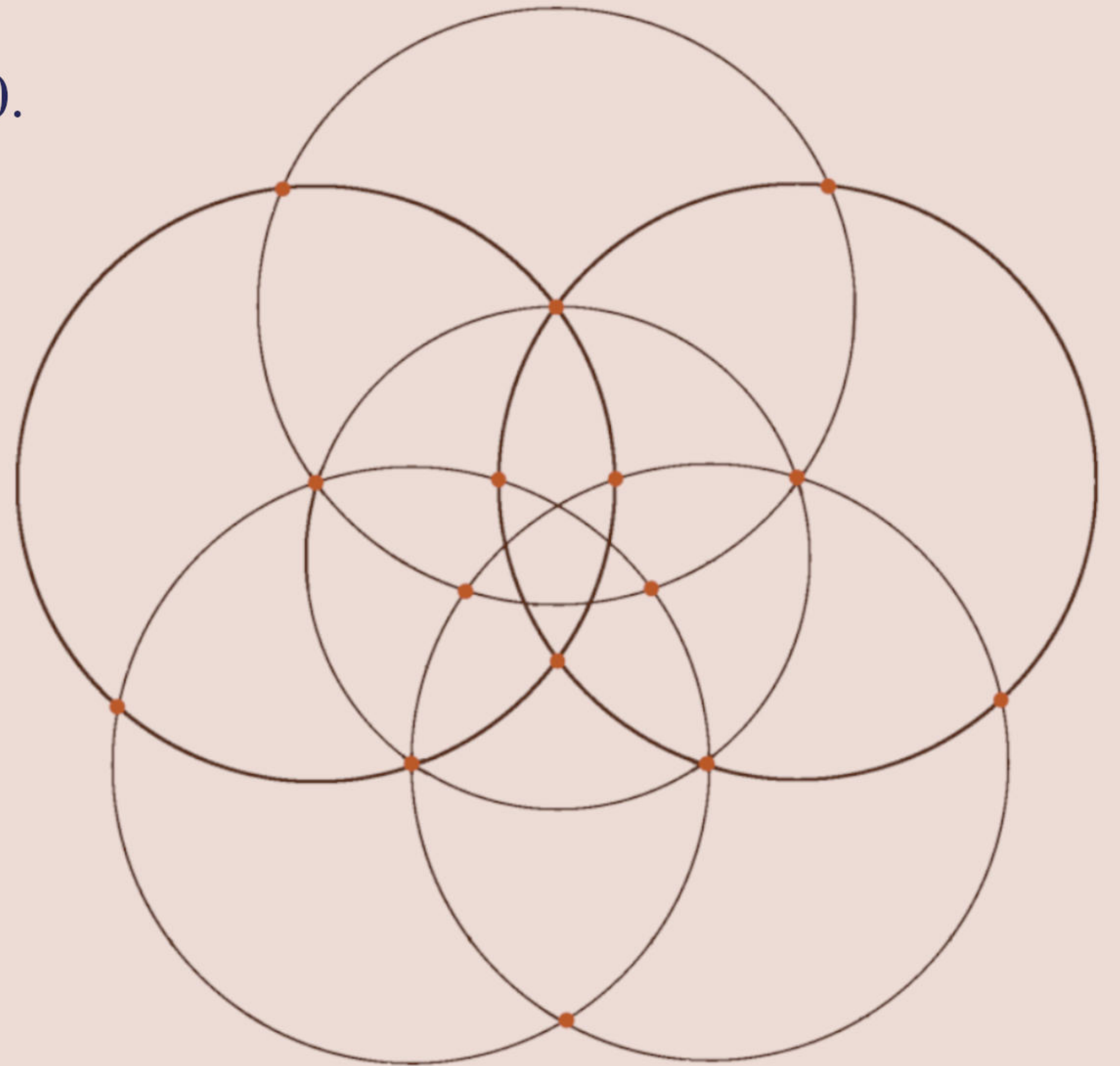
Two new points are created on the origin circle, these will be the rotation centers for the final two circles.

9.



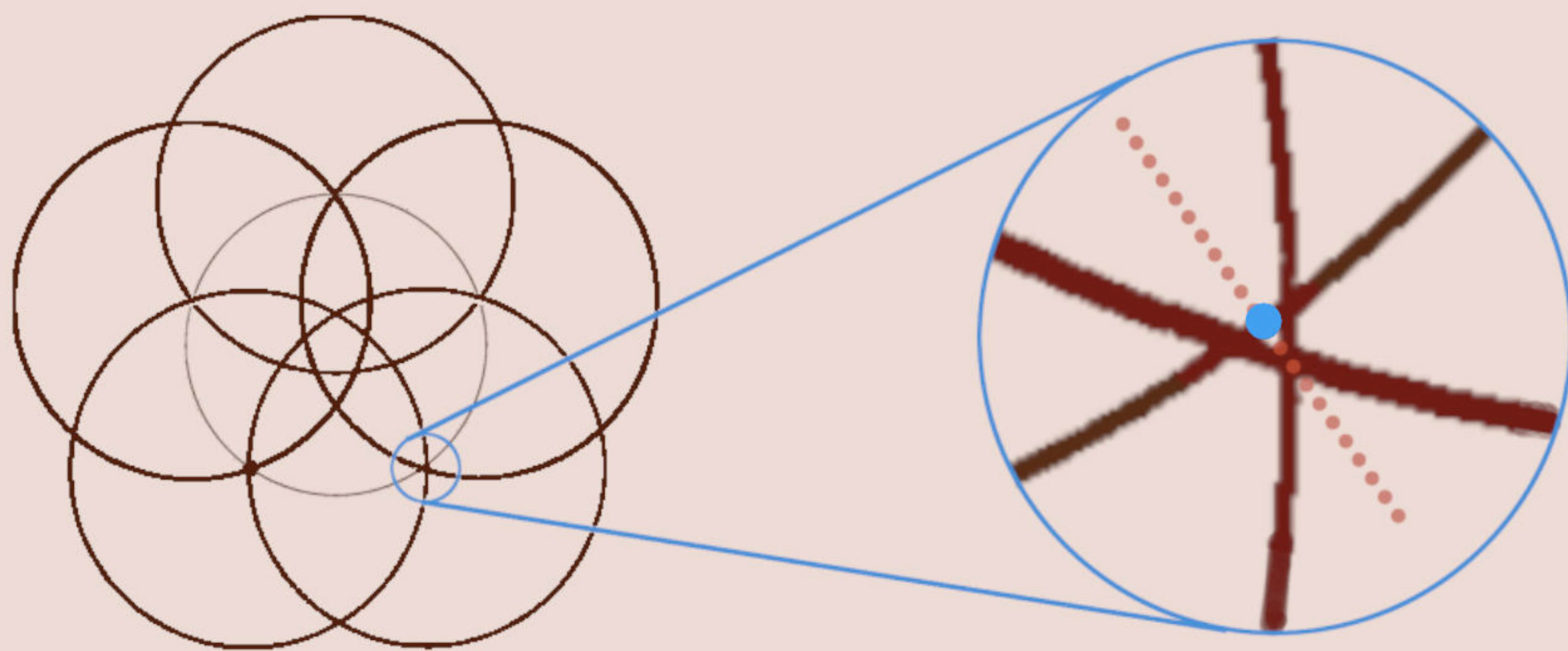
Draw the two remaining circles from the two new intersections on the origin circle to complete the fivefold flower.

10.



We now have fivefold symmetry. The origin circle has been divided into five equal sections.

It is common to find a small gap appearing at this stage.

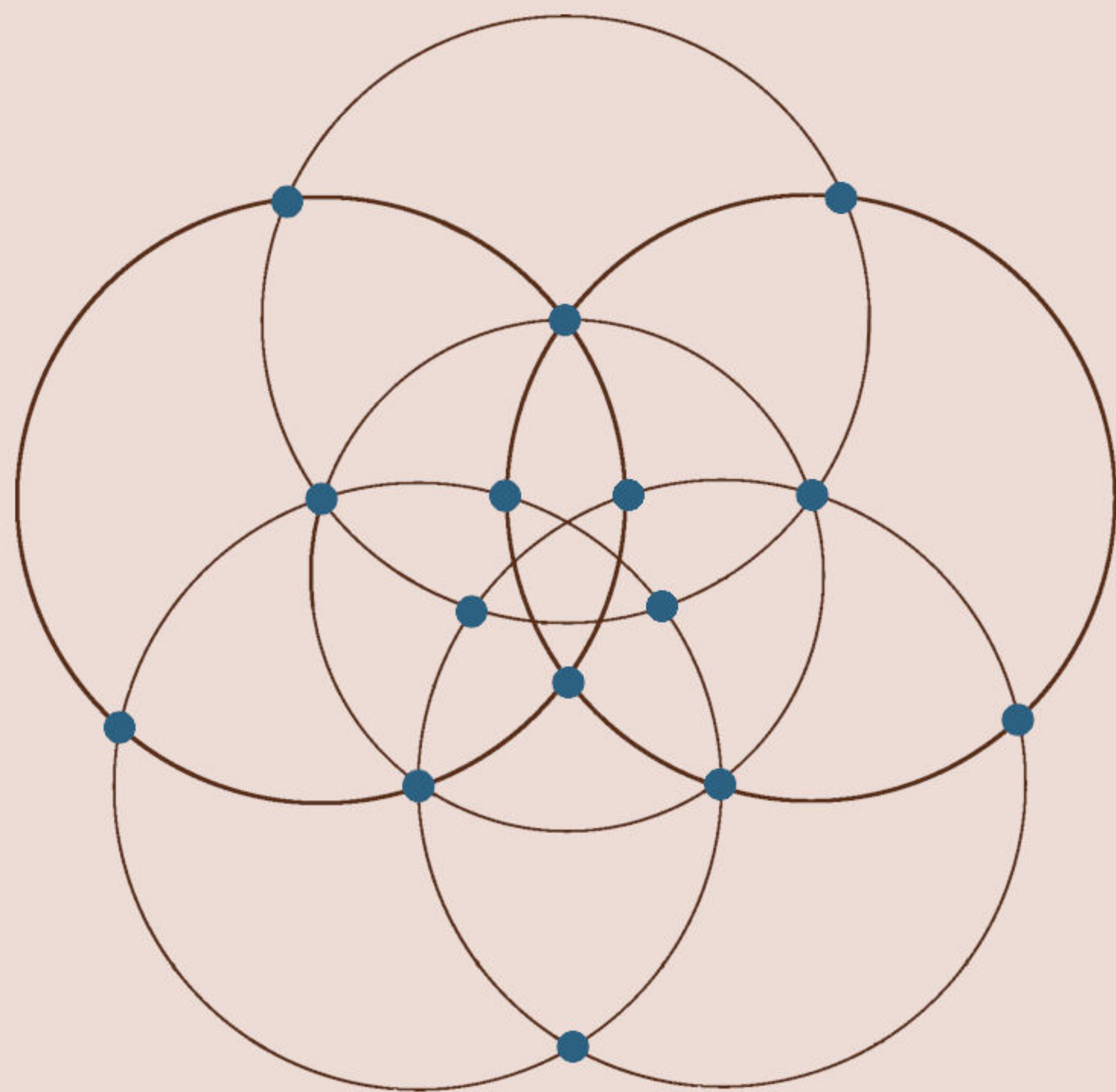


The size of this gap is a representation of the accumulated margin of error built up during the construction and is an indicator of the overall accuracy of the diagram.

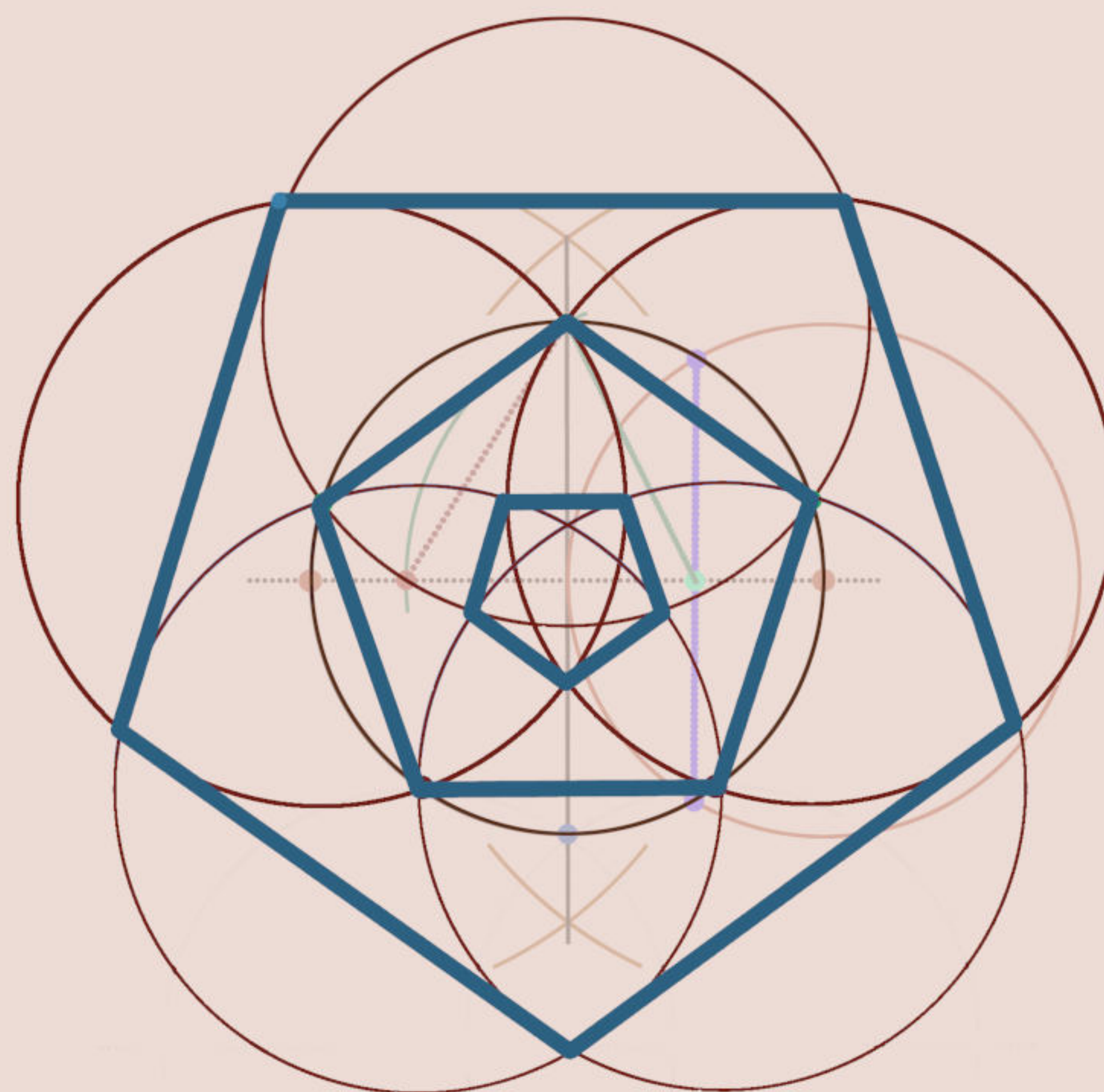
If you find a gap, here are two ways to nudge your diagram into relative correctness:

1. Split the difference. Place a new point between the two arcs. For small gaps this should resolve any issue.
2. Adjust the compass. A tiny adjustment may solve the problem. A bit of trial and error can usually dial in the correct distance. This can make for a messy drawing, but once you get it right, the diagram can be redrawn with the refined radiuses.

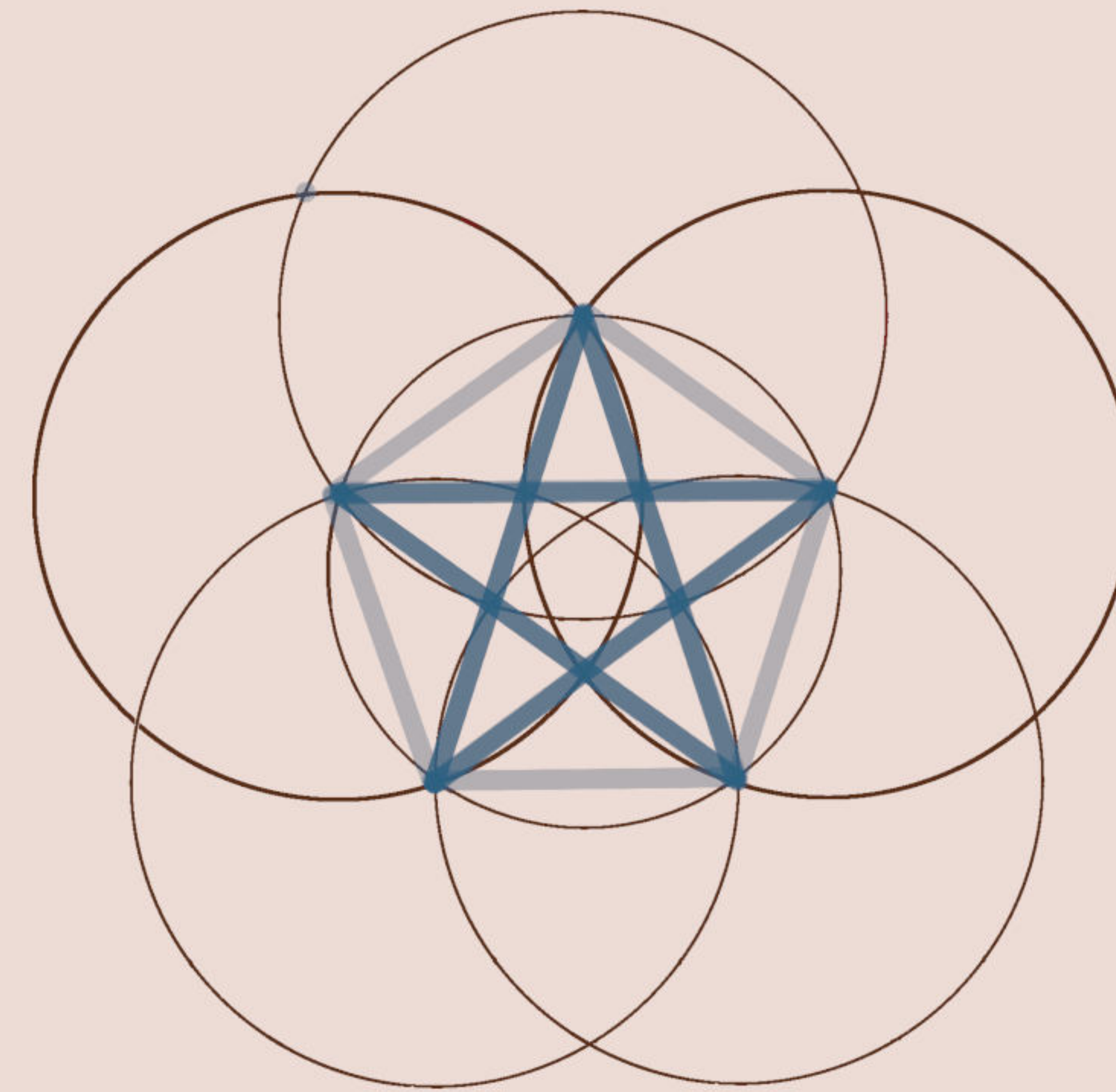
A few Pentagonal systems that exist within this construction:



Nodes arise from circle intersections

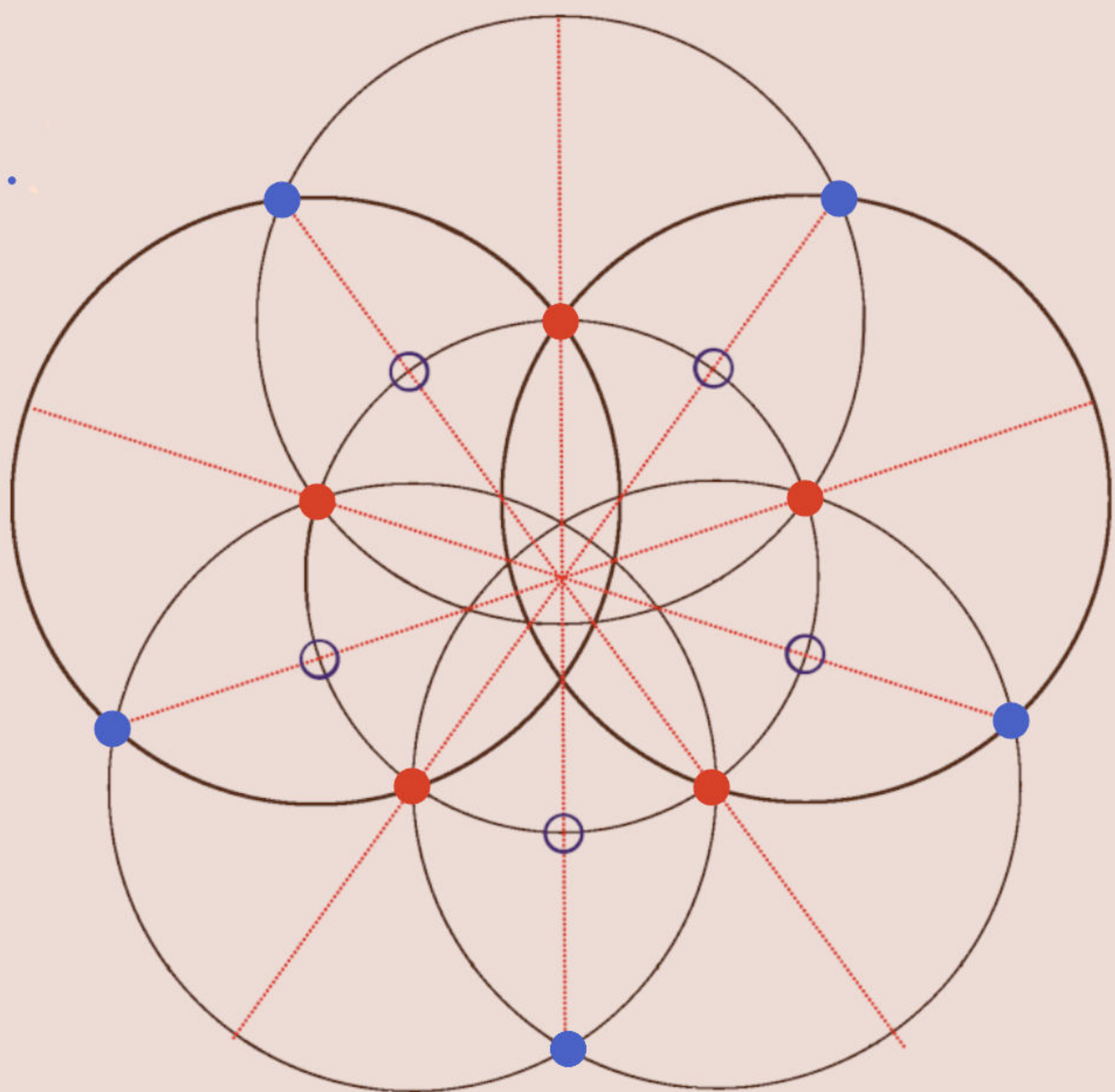


Alternating static and dynamic pentagons



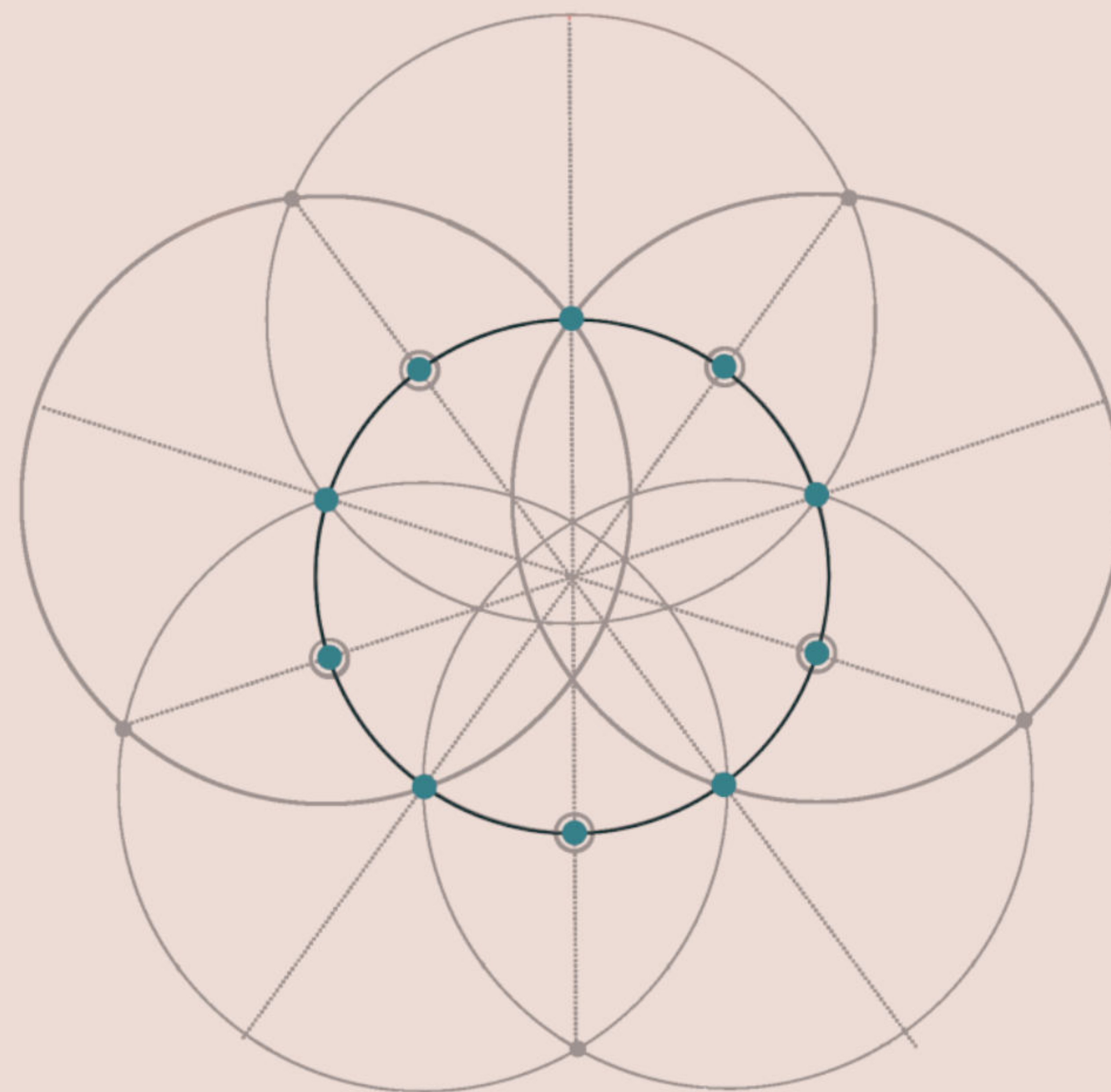
Pentagram within the origin circle

11.



Create radial lines by connecting the five points on the origin circle ●, through the center, and through the intersections of the petals. This generates the tenfold division of the origin circle.

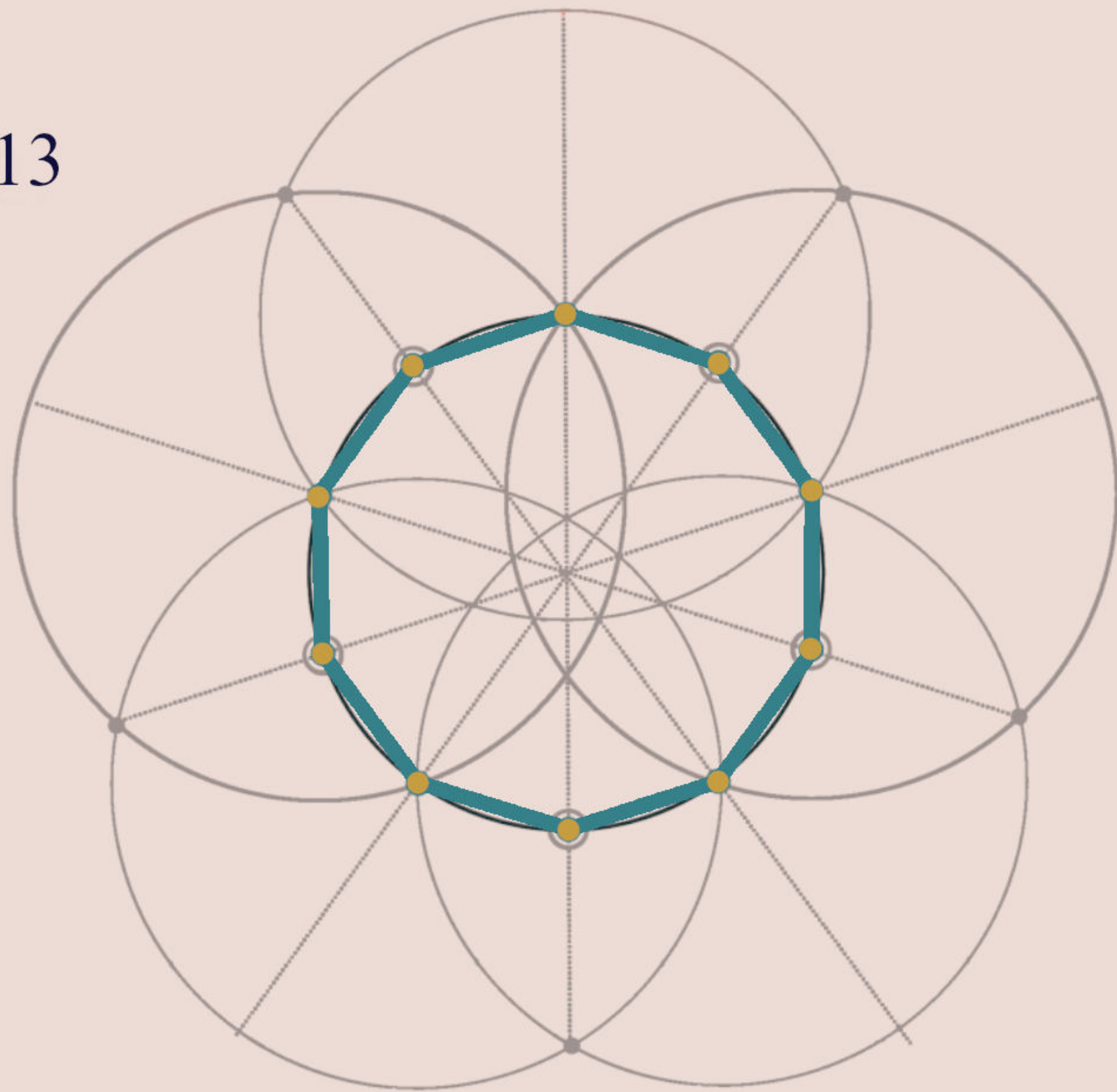
12.



We now have ten evenly spaced points around the origin circle. Many tenfold systems are constructable from this stage.

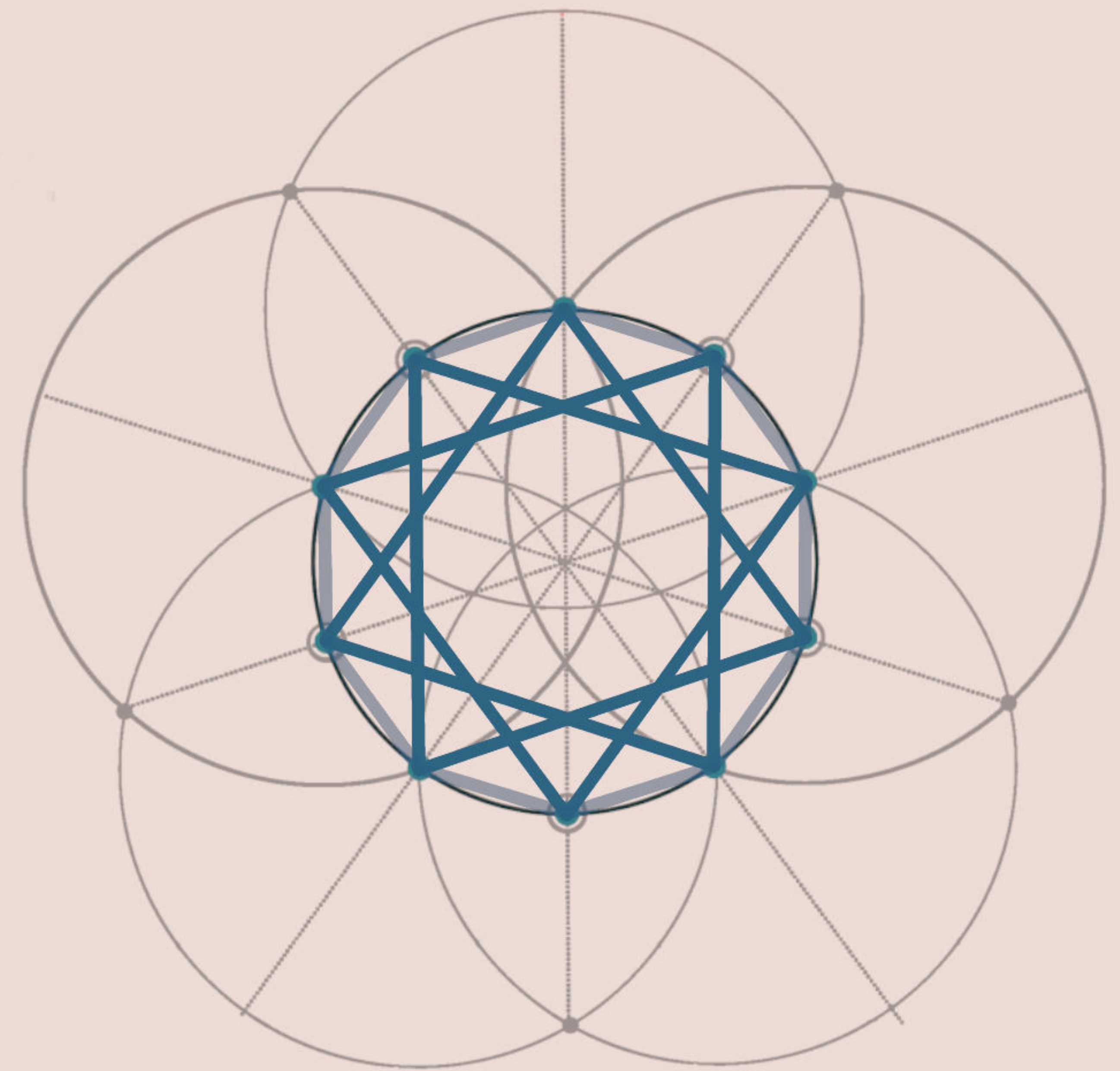
Decagon (10 sided polygon)

13

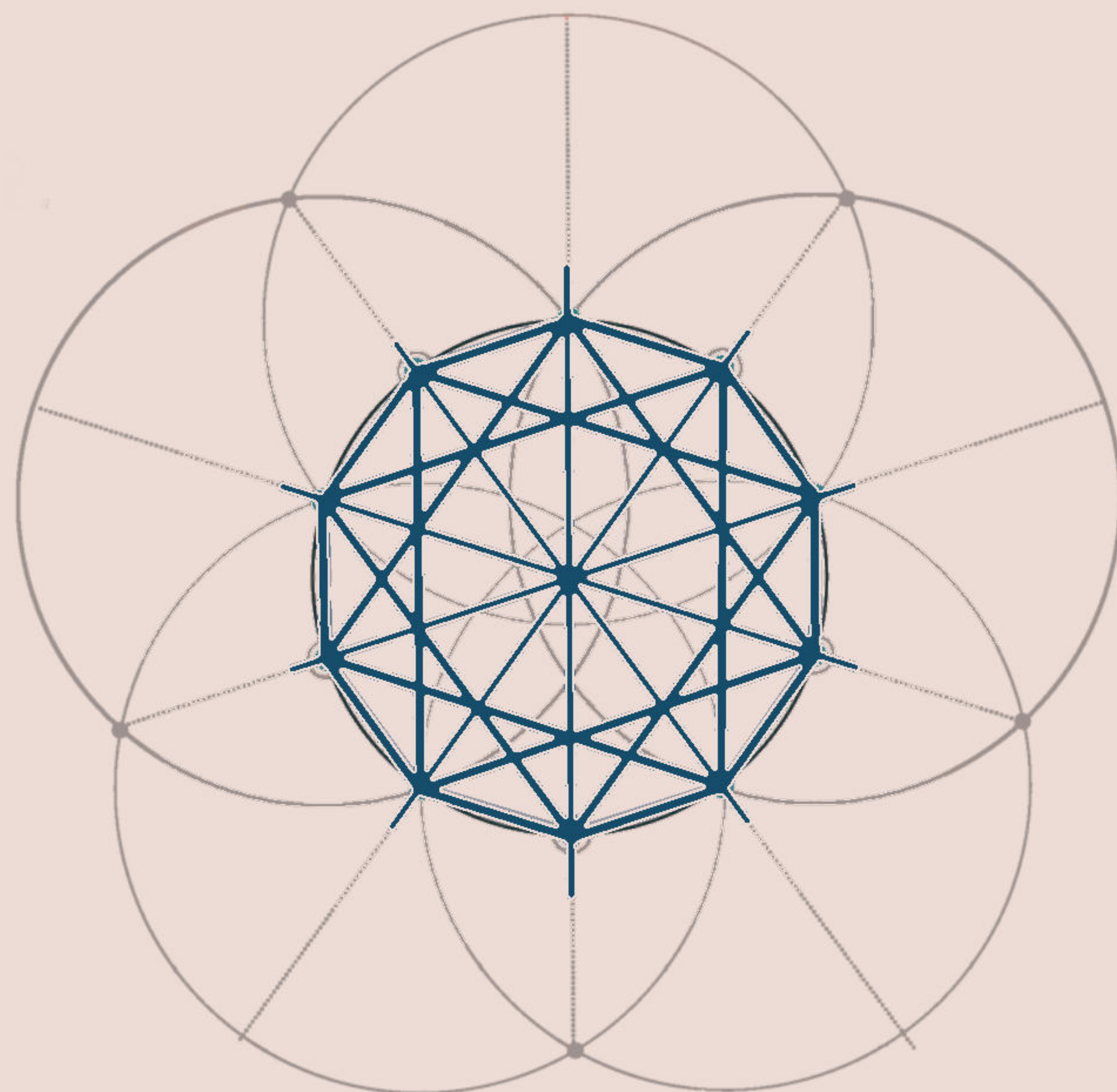


Connect adjacent points around the origin circle to create a decagon.

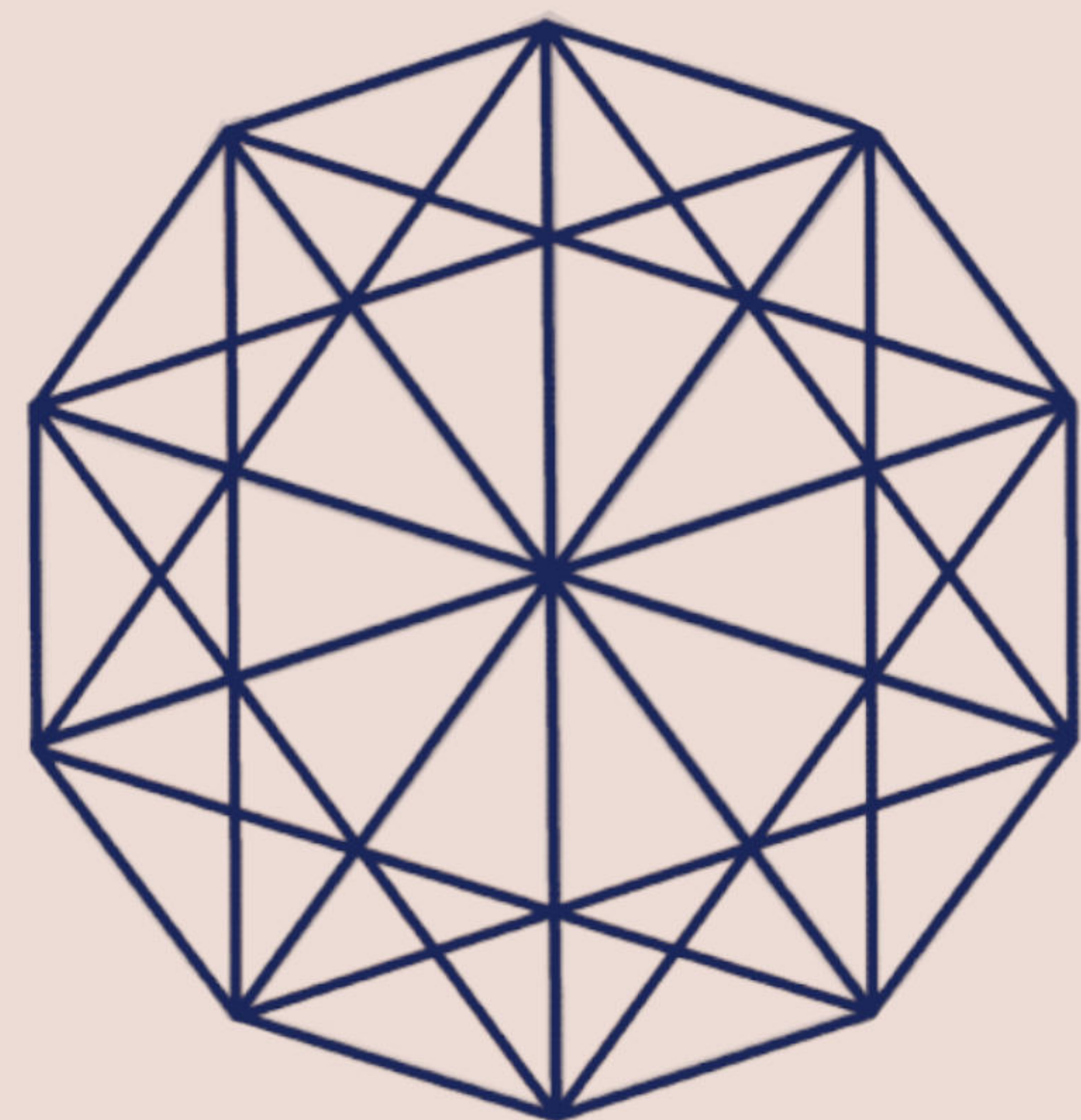
14.



Add a "skip two" star inside the decagon, by connecting every fourth point internally.



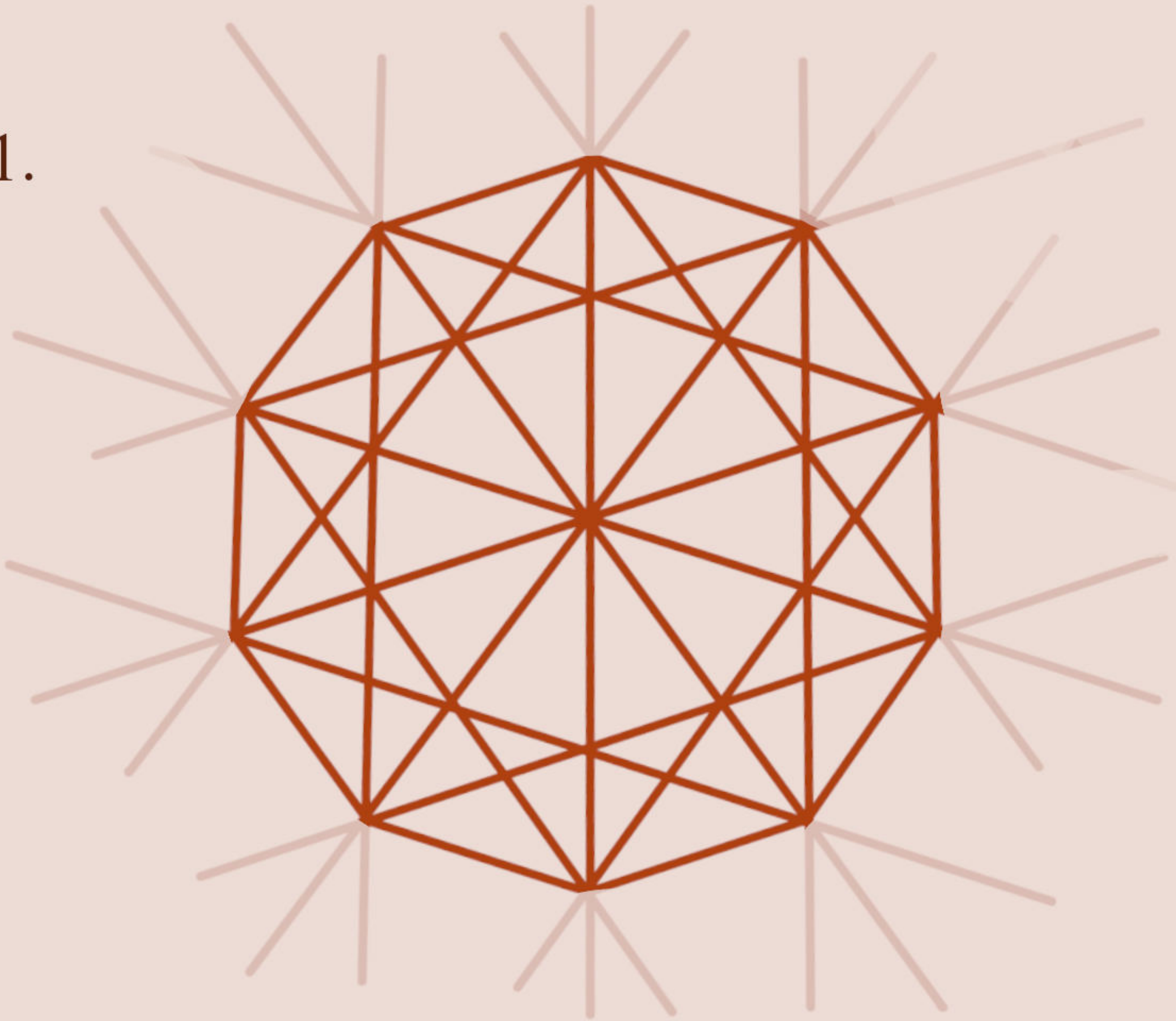
Reestablish radial lines if neccessary.



This is the structure needed for the Brass Roundel design.

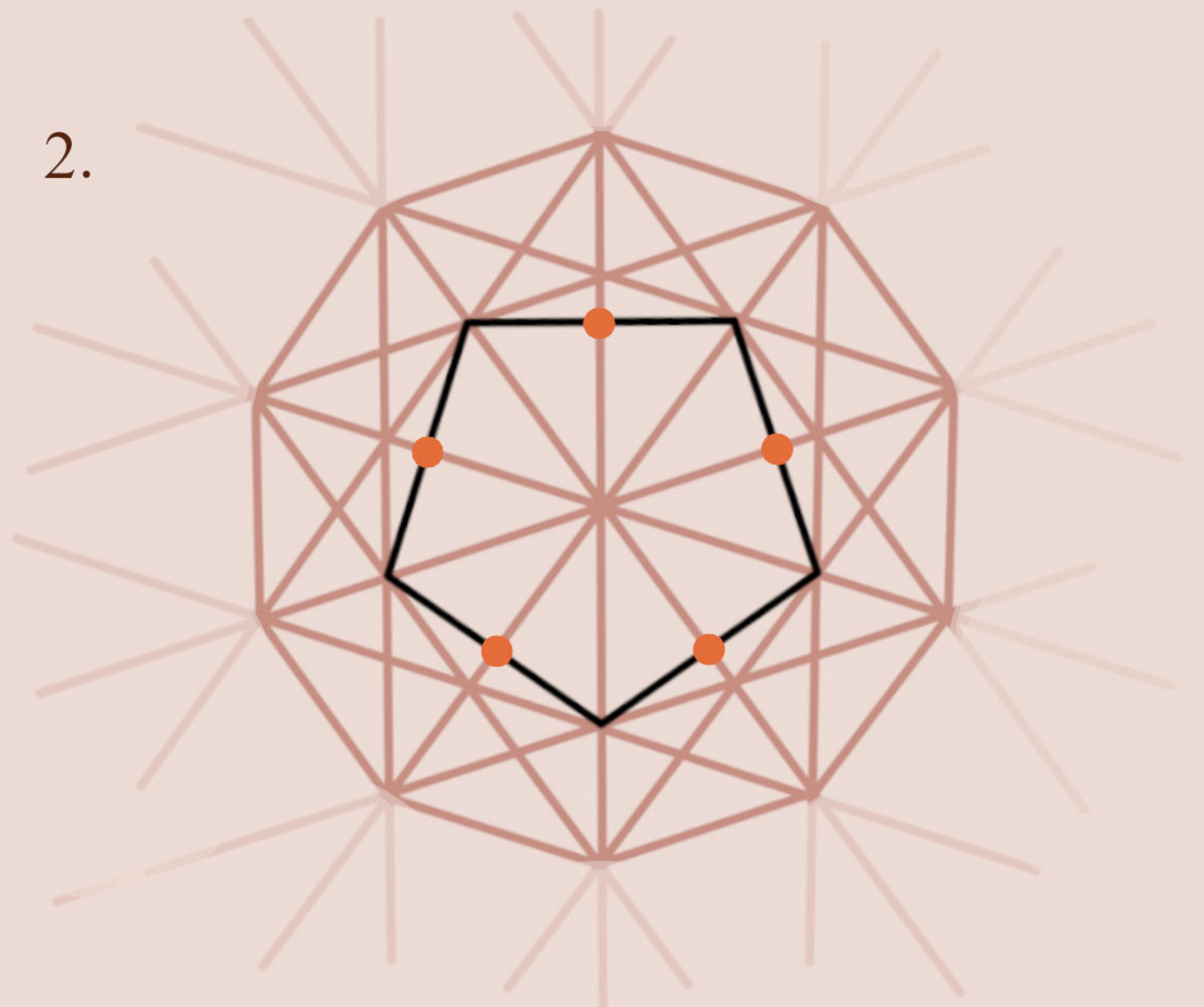
Circular structures from a decagon

1.



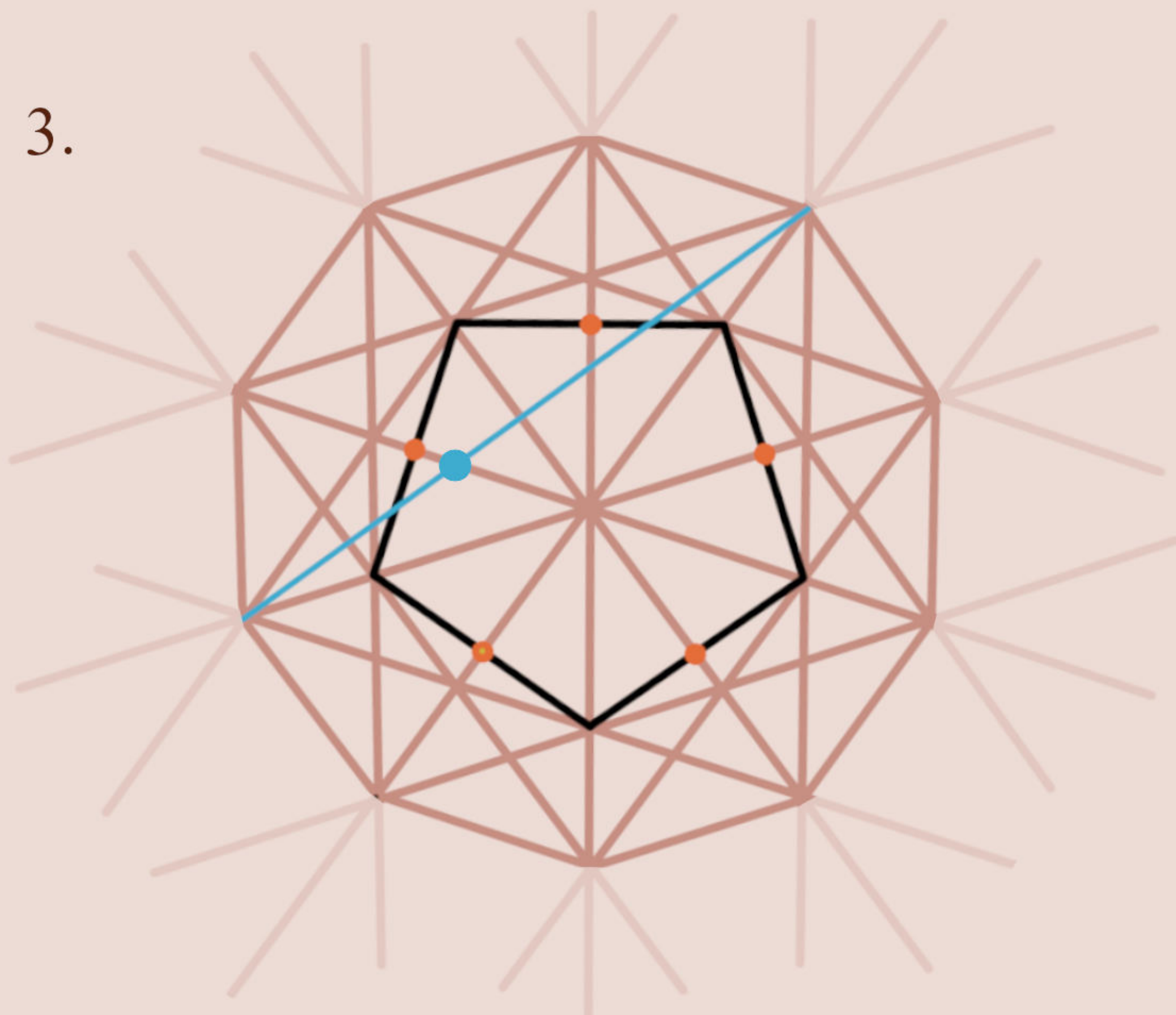
This is the core geometric structure for the design. It consists of a decagon, radial lines, and a skip two star.

2.



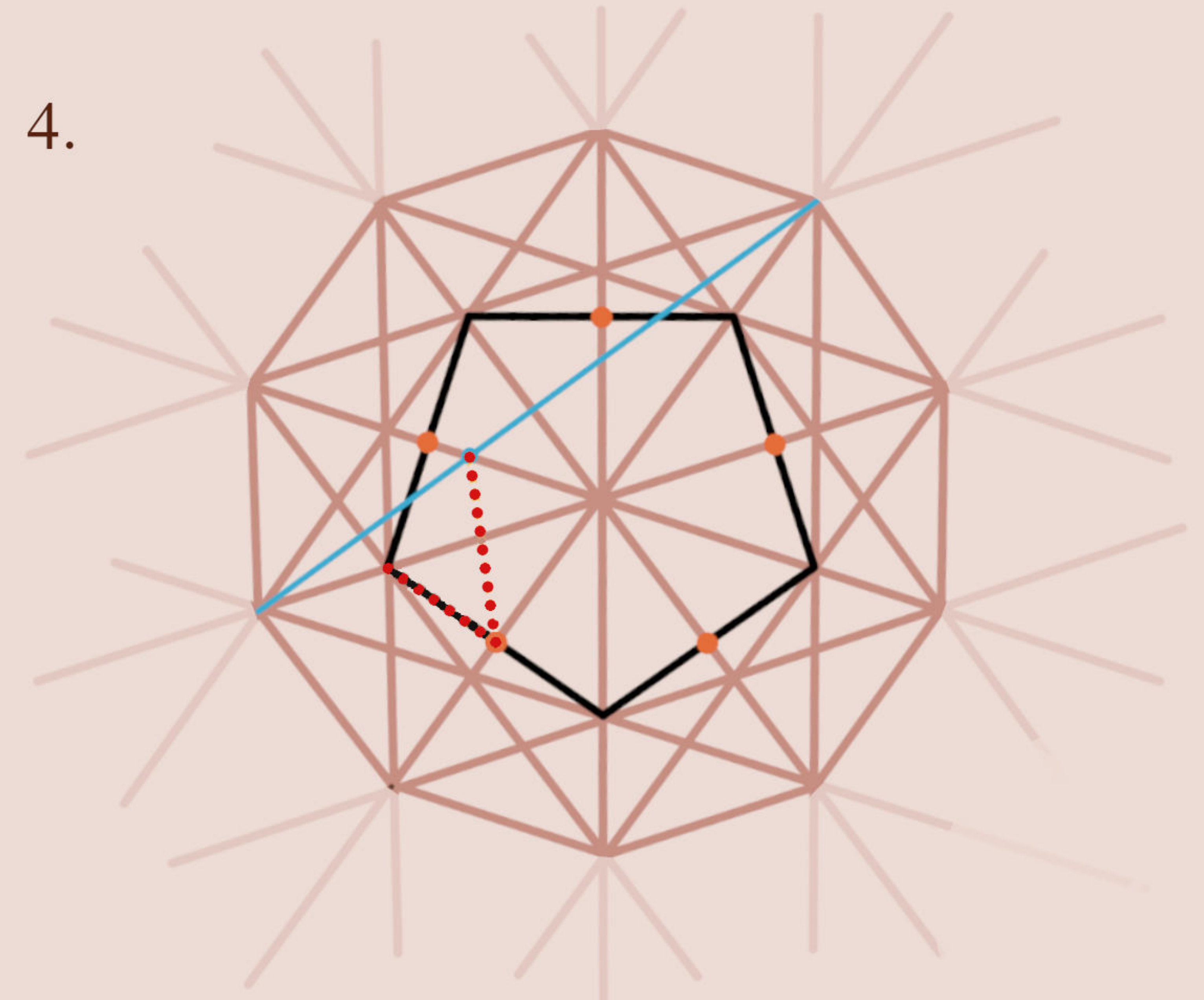
Add the inner pentagon. The radial lines cross the edges of the pentagon, creating five new intersections. These will become the rotation points for the circular strands.

3.



The blue line intersects a radial line at a point that provides the radius of the larger concentric circle.

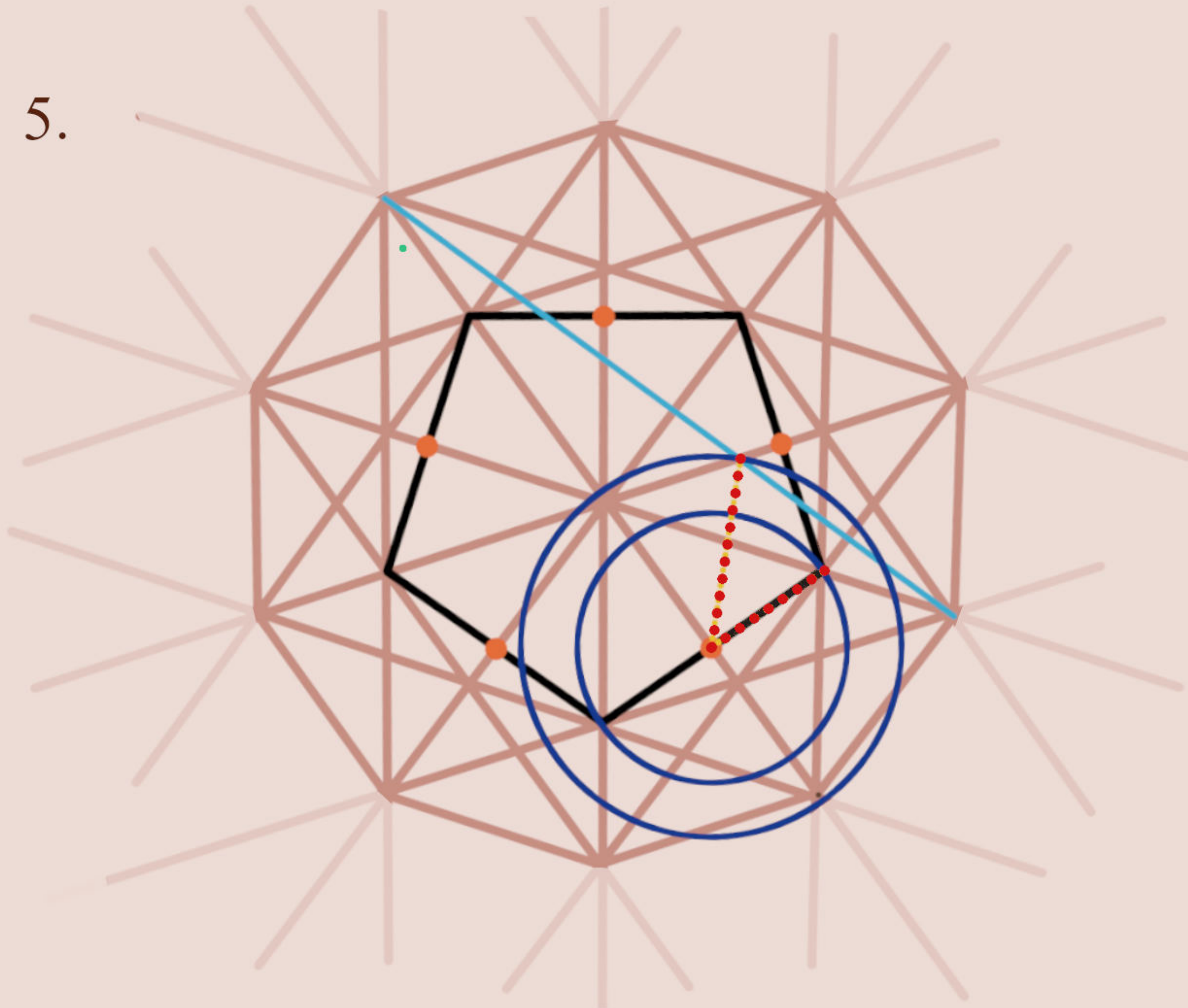
4.



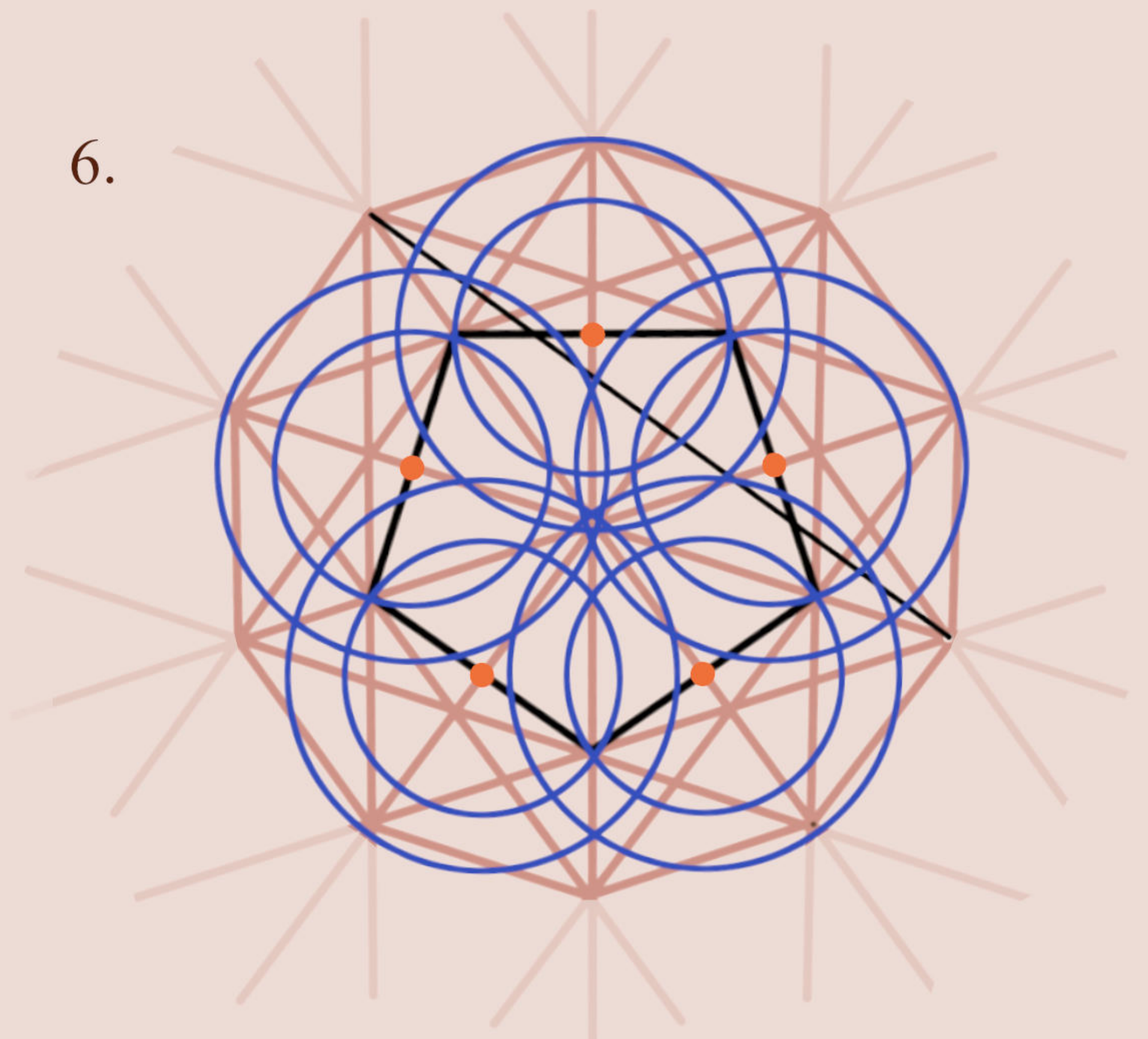
The red dotted lines describe the radii of the two circular strands.

Circular structures cont.

5.

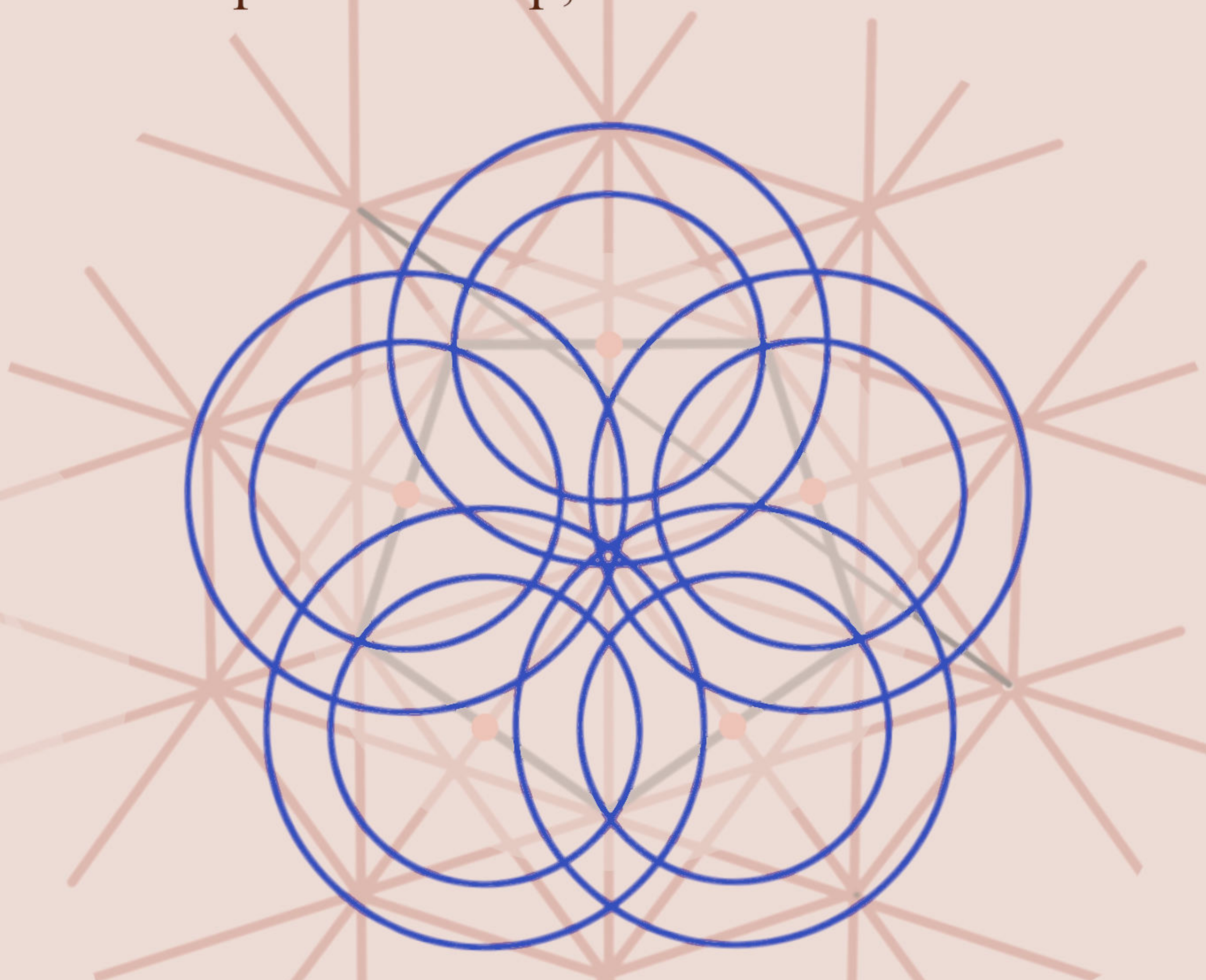


6.



With your compass point at the orange intersections, expand the compass to the lengths described in the previous step, and turn the circles.

Repeat at each orange point to place all the concentric circles.

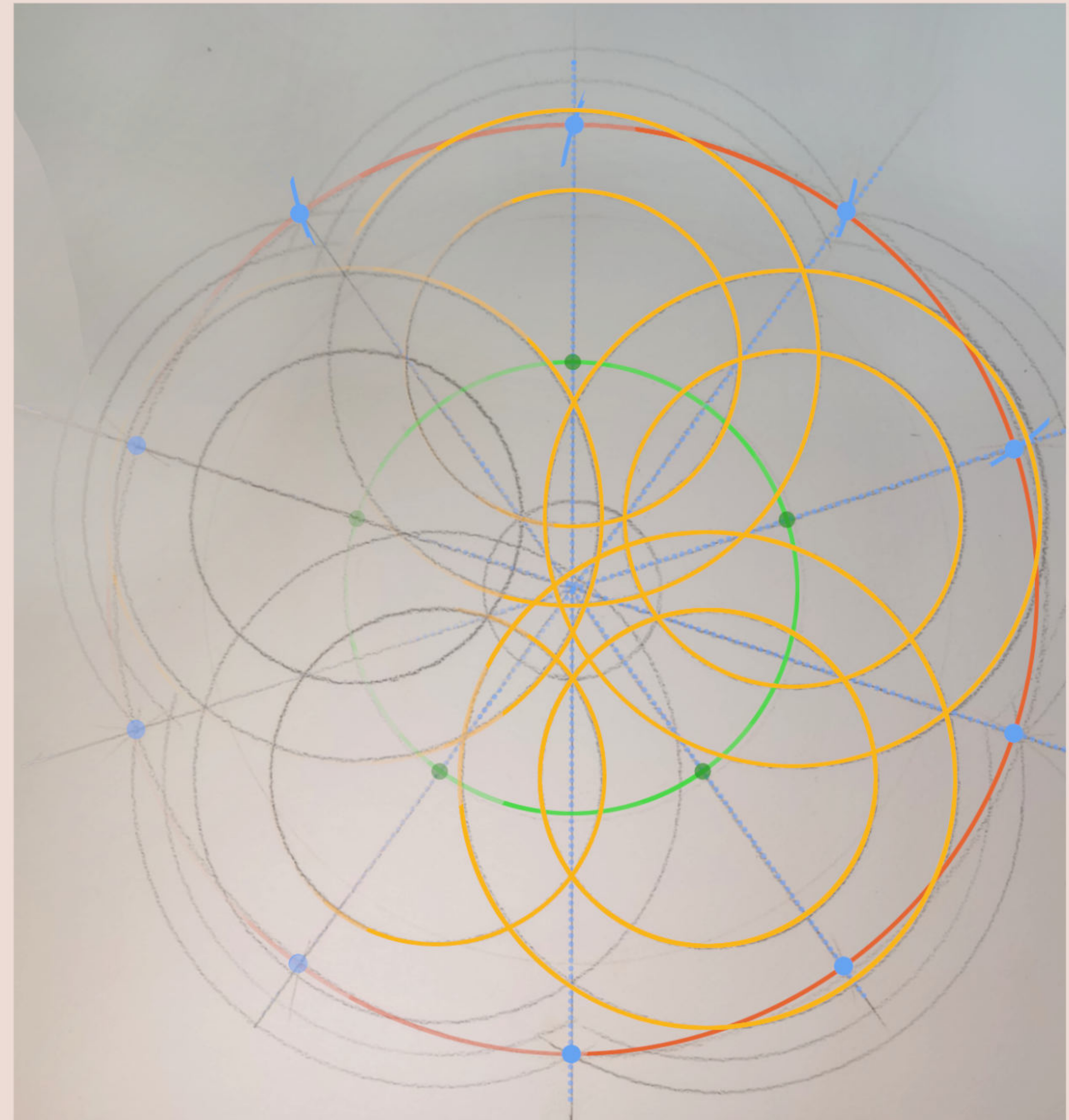
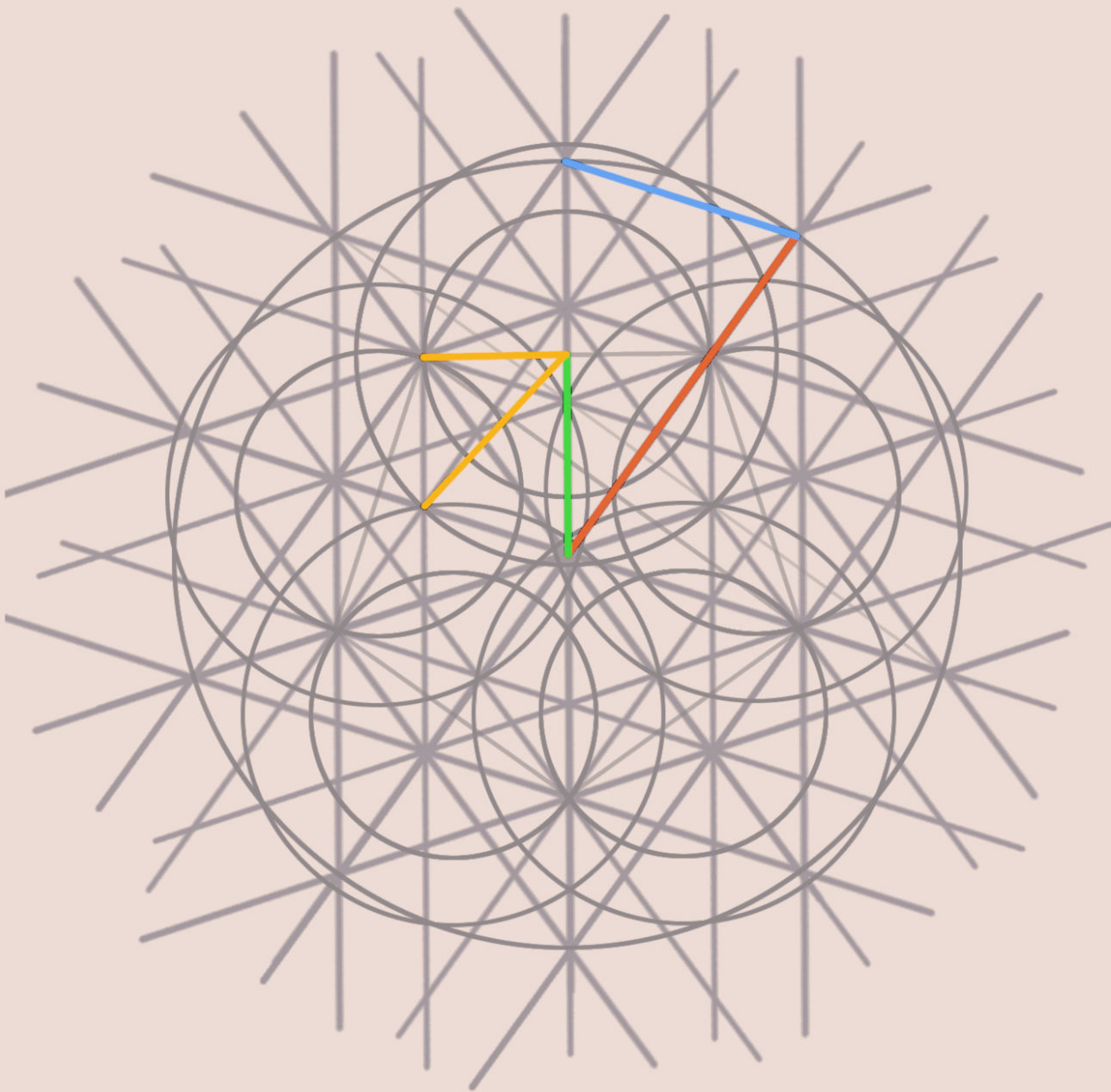


These concentric circles describe the primary strands of the biomorphic design.



Cleaning up the diagram

Your drawing may be a bit chaotic or busy at this stage. Now that we have the circular structures, we don't need so much information, and can lift measurements from the construction to draw a simplified diagram.



Information we need:

1. The origin circle radius. ●
2. The 10-fold division of the circle. ●
3. The distance from the center to the rotation points of the final circles. ●
4. The radius of both concentric circles. ●

Step 1. Re-establish origin circle

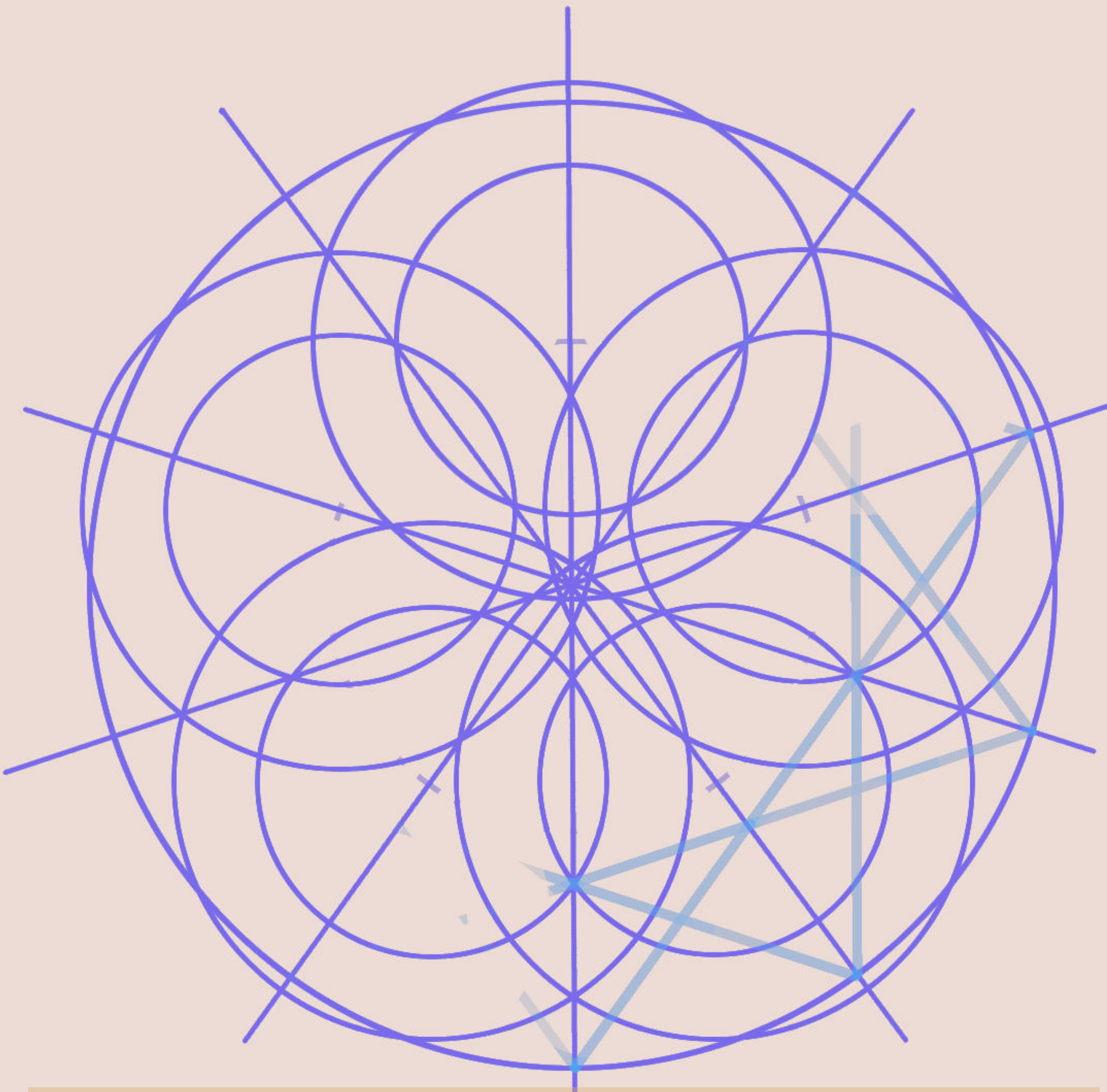
Step 2. Set compass to 10-fold division and walk the compass around, marking 10 points.

Step 3. Connect points through center for radial lines.

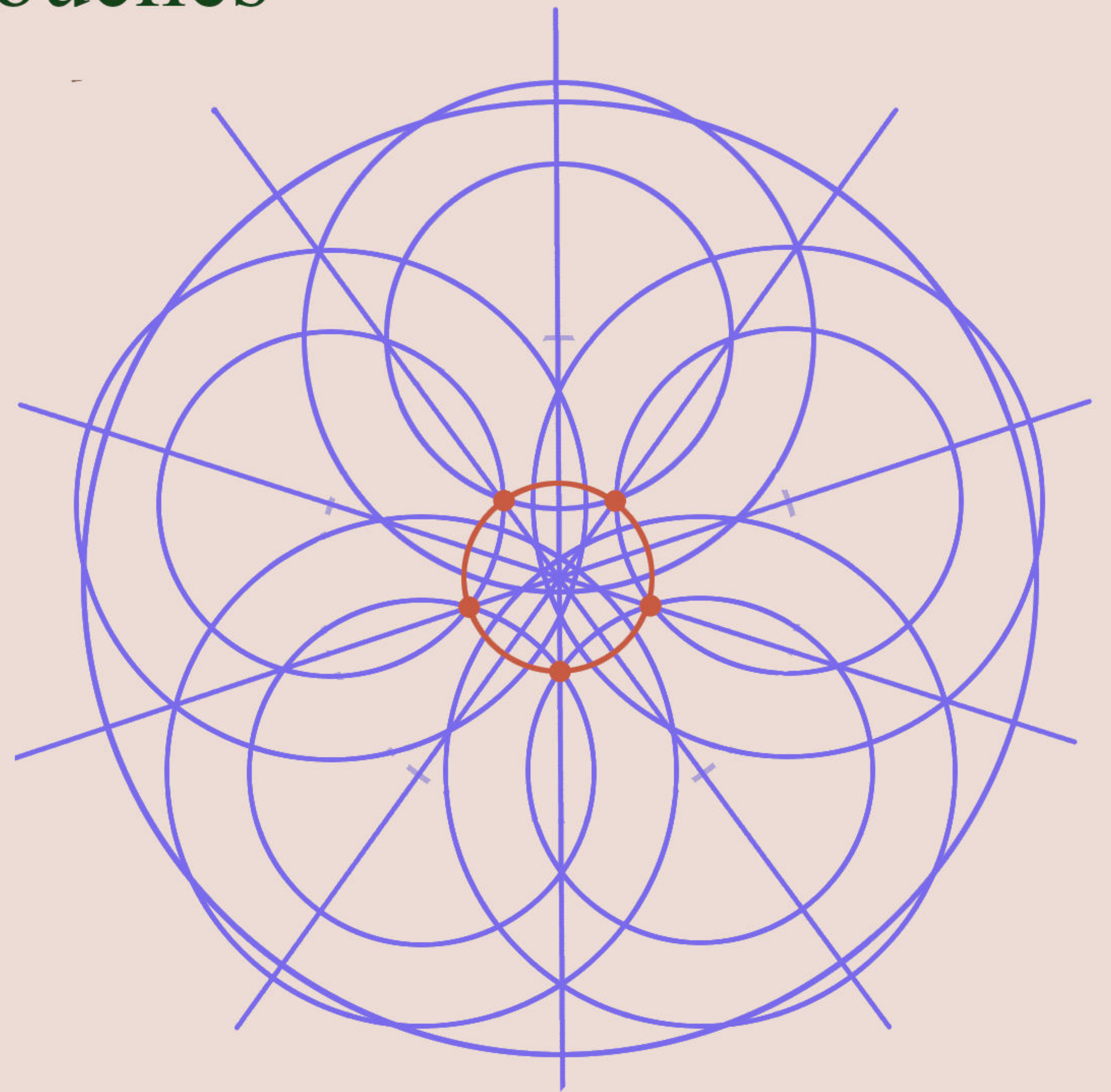
Step 4. Set compass to the green distance and draw the circle. 5 rotation points are created where the circle crosses the radial lines.

Step 5. Use the yellow distances to turn the five sets of concentric circles from the green rotation points.

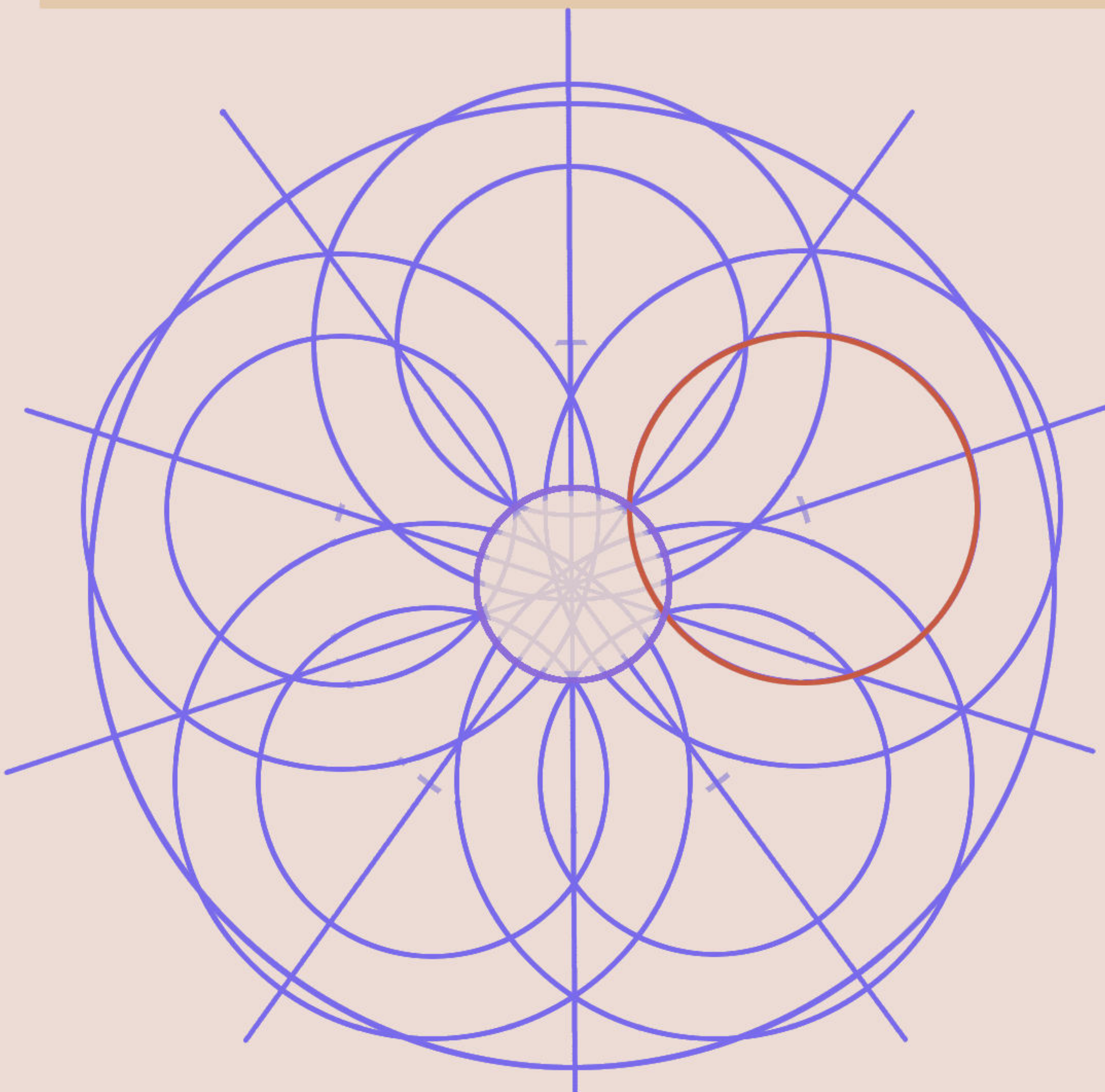
Finishing touches



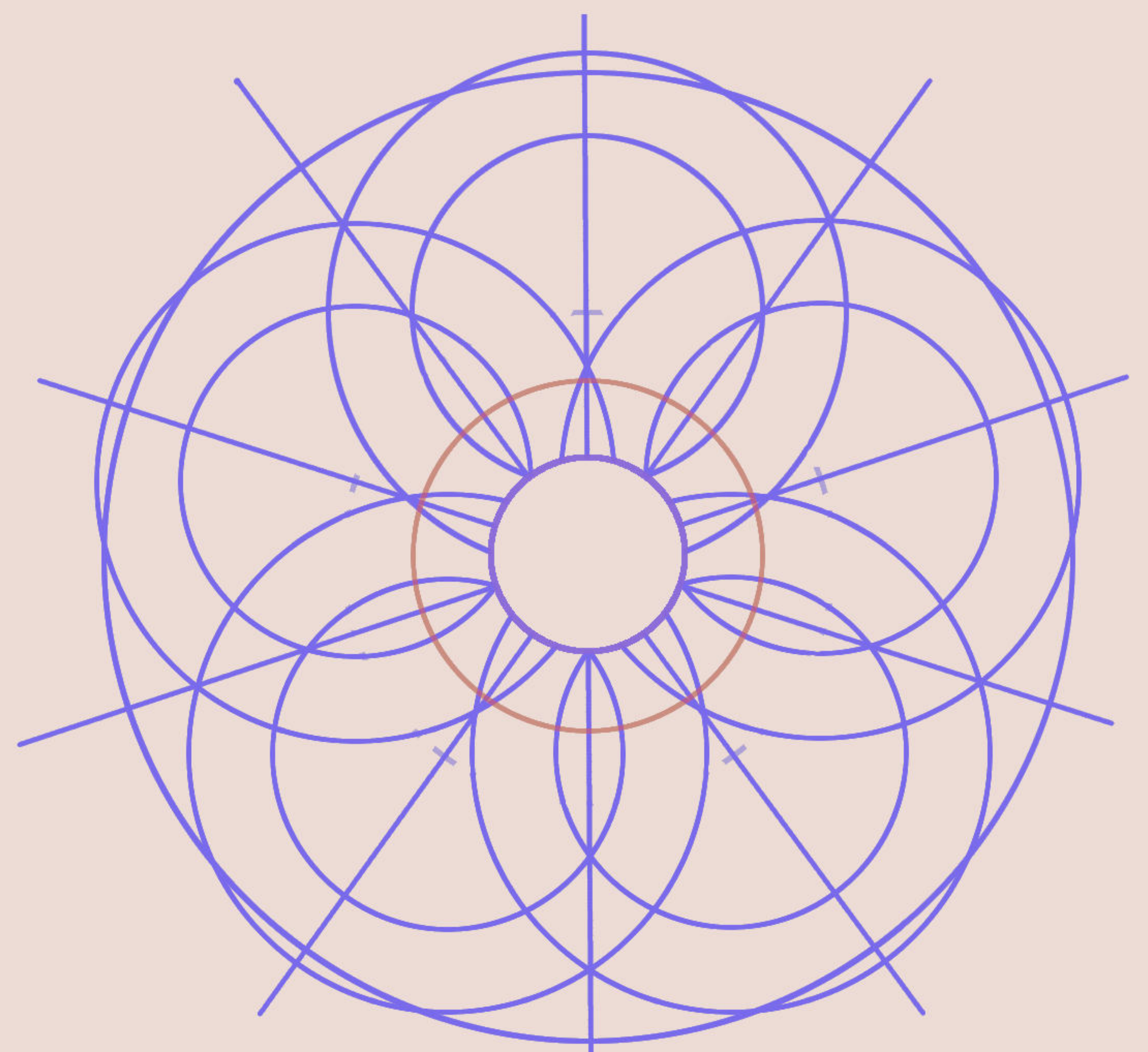
Faintly reestablishing the star can provide extra information, but can be skipped.



Turn the inner circle that describes the central handle.



Set the compass to the radius of the smaller concentric circle.



Lightly scribe the circle with the compass point in the center. This circle will help place nodules and anchor motifs.

Biomorphic elements

Let's observe the original design.

Notice shapes and their interactions with motifs.

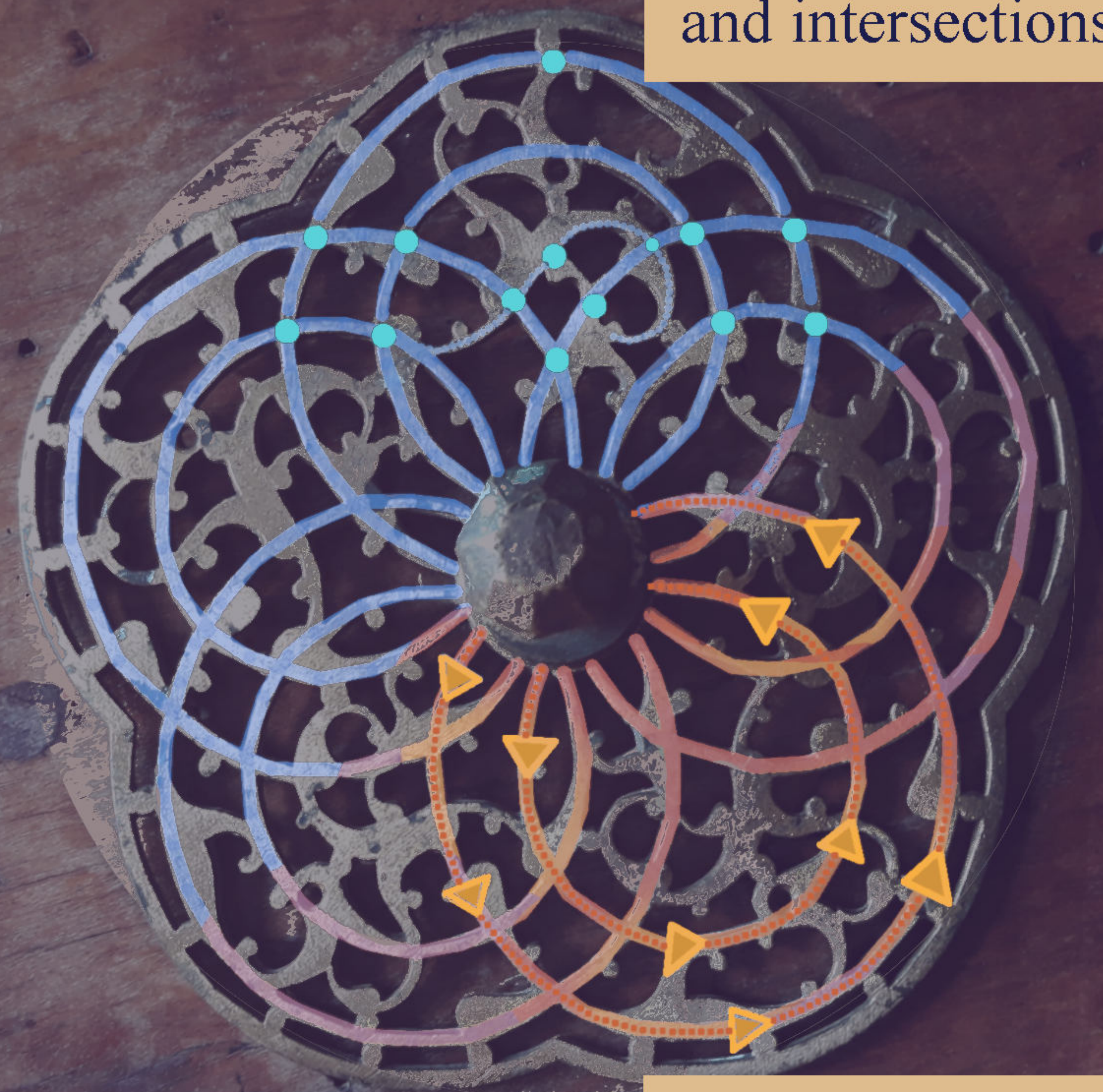


Other big shapes.

Shapes in the negative space.



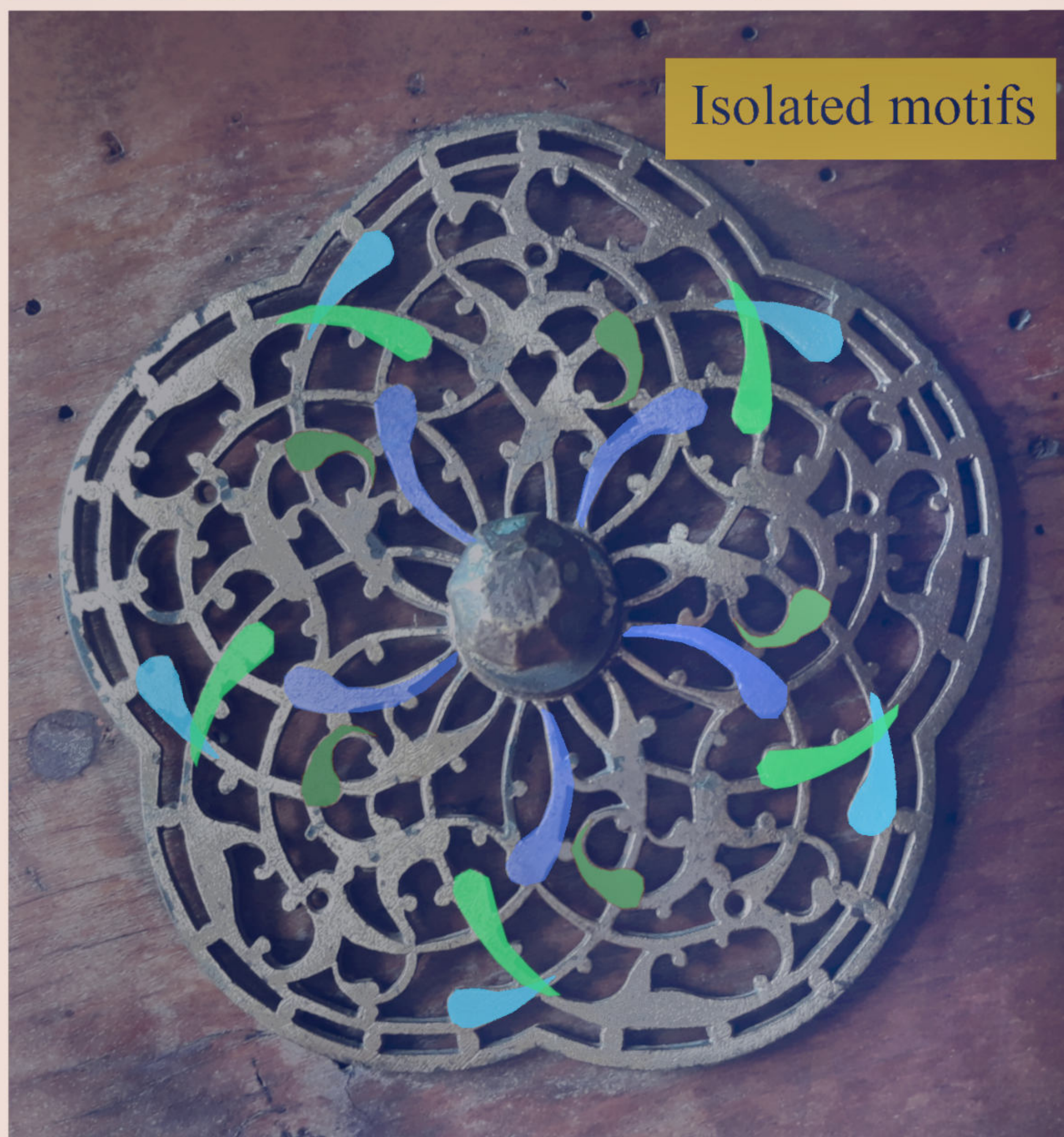
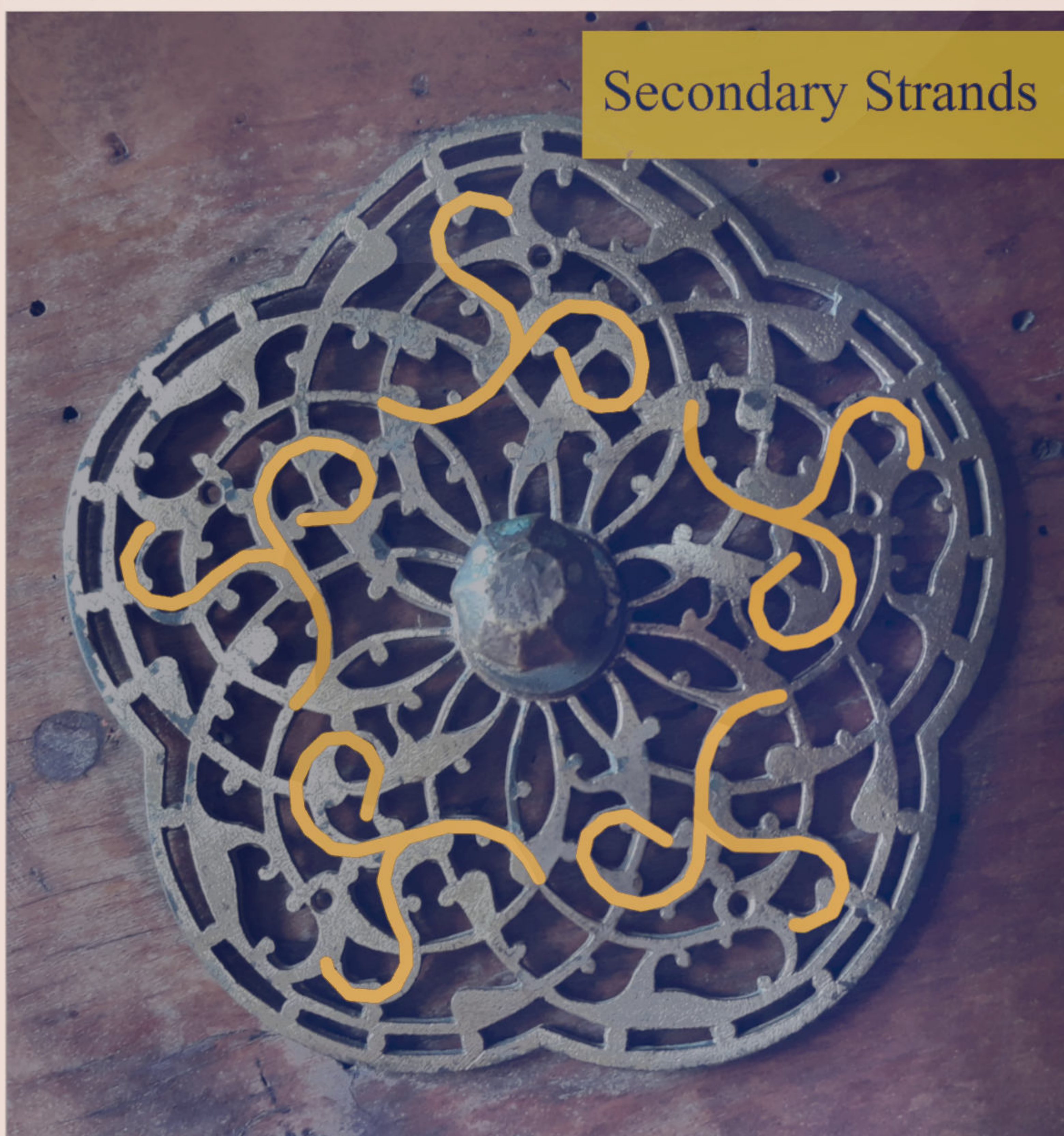
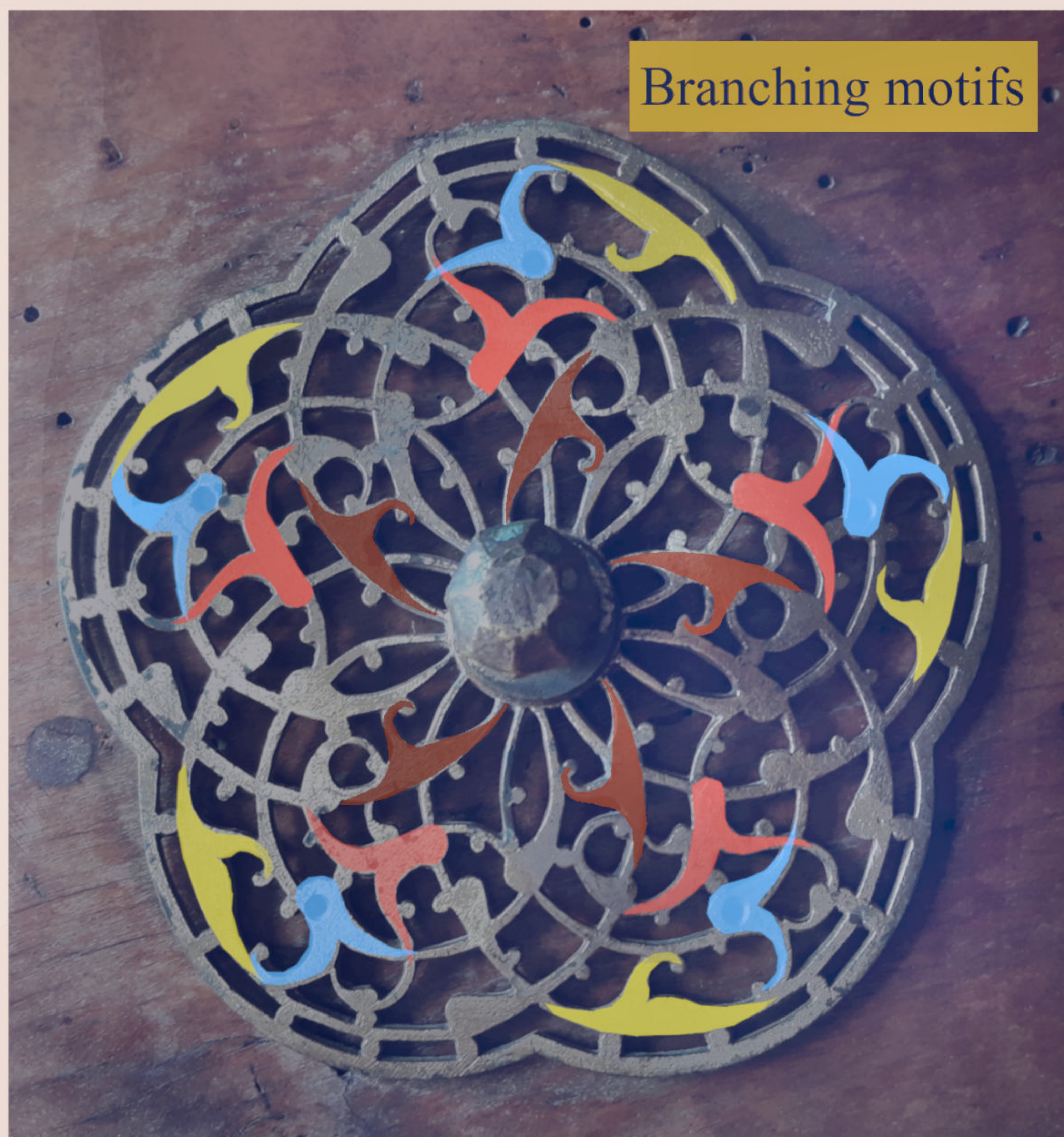
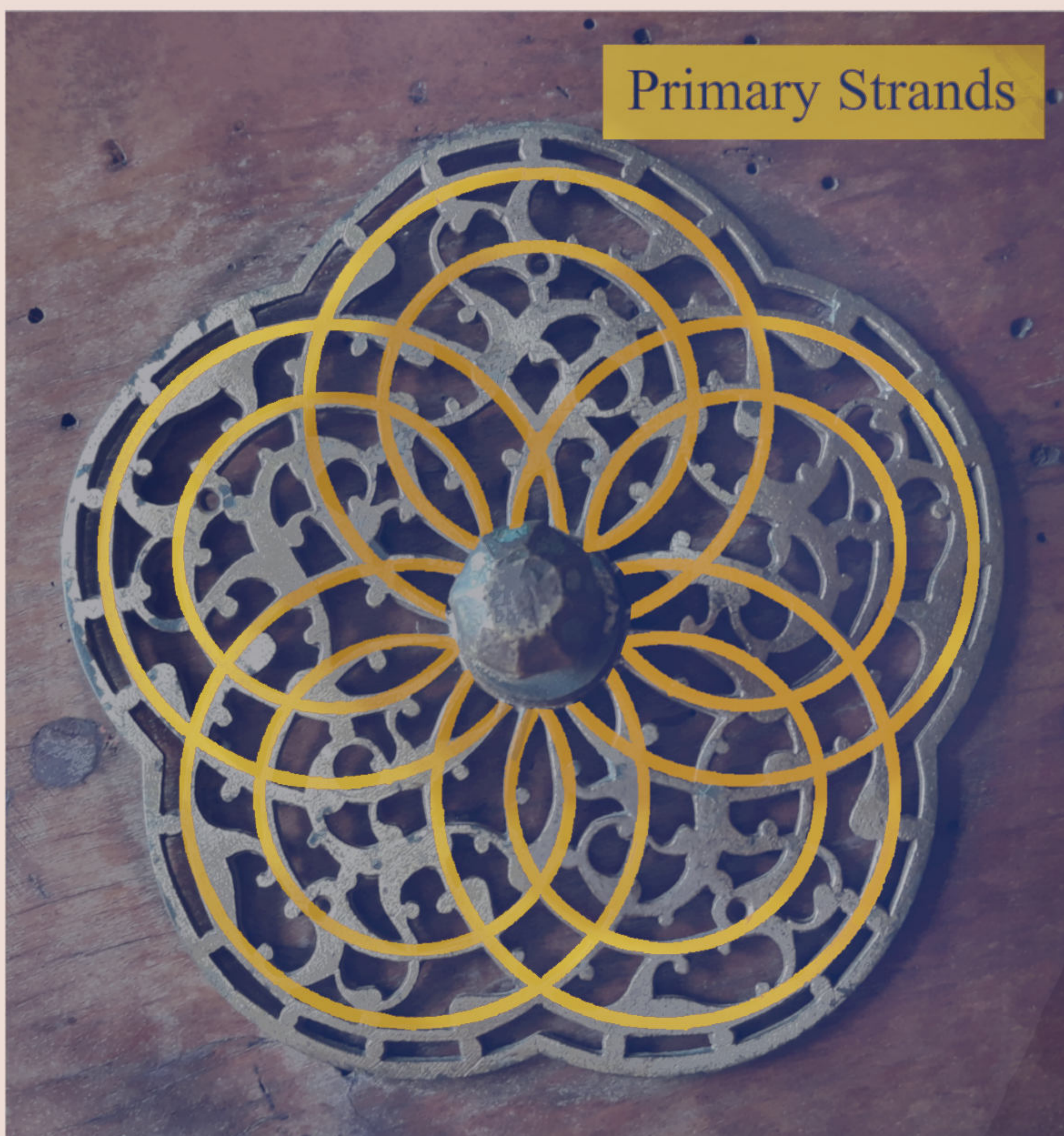
Important strands and intersections



Direction of flow.

Motifs and strands

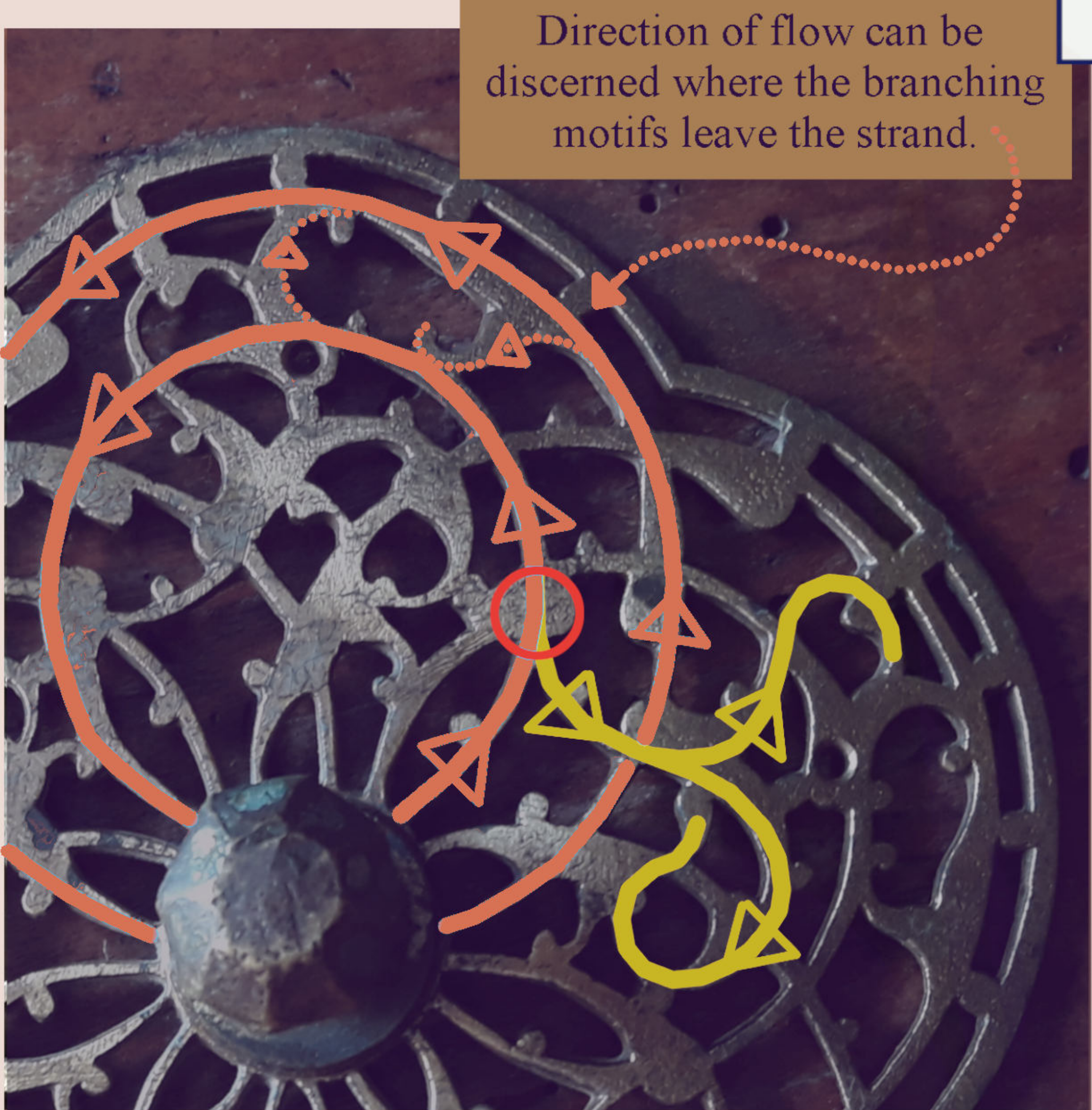
Look for motifs, how do they relate to each other, and to the strand?



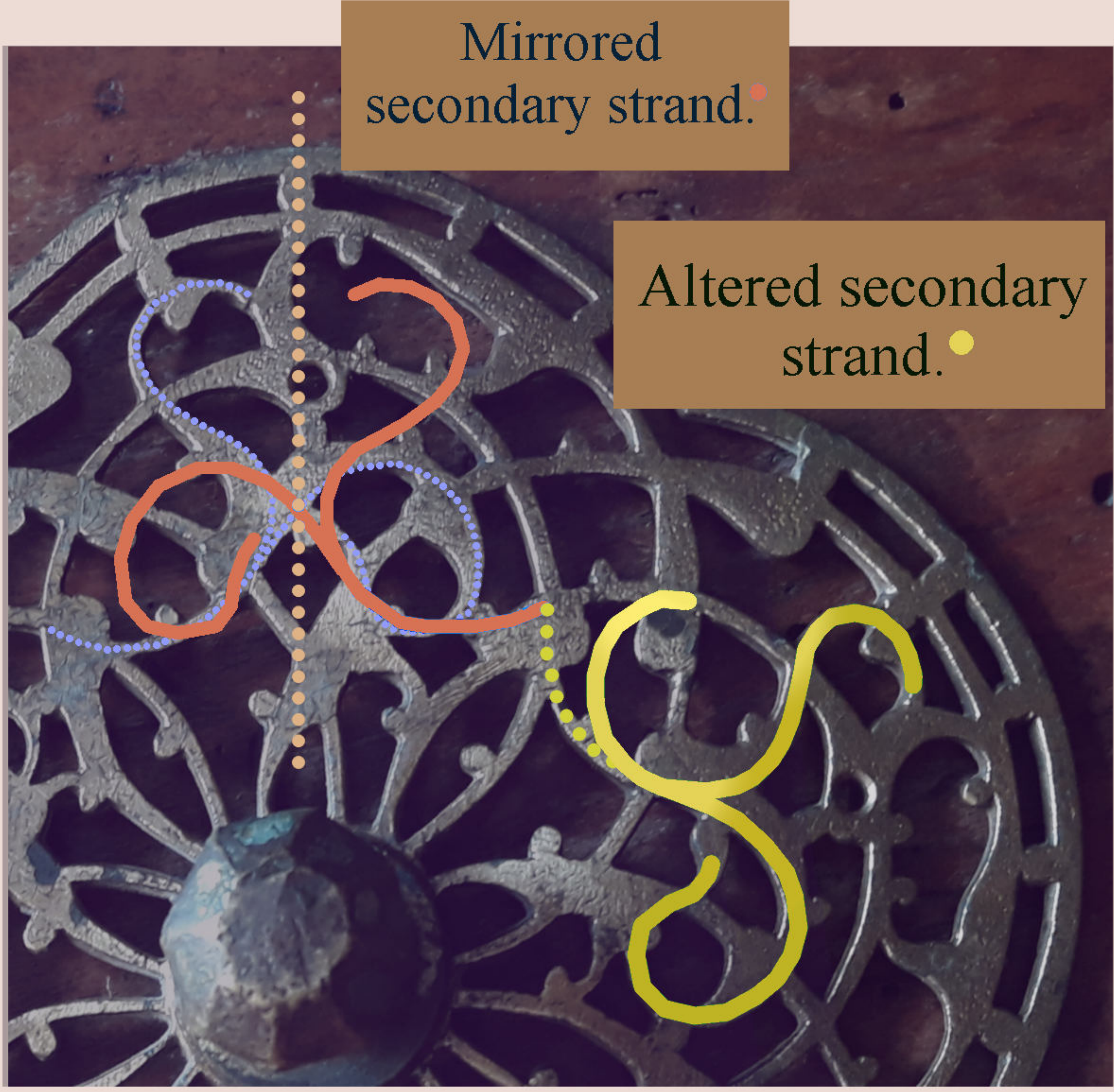


There are 8 distinct motifs used in this design. They are all of the Rumi group, and appear in two types, branching and non-branching. The branching motifs are all of similar size, while the non-branching motifs appear in two different sizes.

You may notice that the secondary strand does not flow in the same direction as the primary circular strand. This is usually avoided as it can cause issues with the design and interrupt the visual flow. In this case it works fine, in my opinion. If you wish to modify the design to flow continuously, this can be achieved by mirroring the secondary strand (will cause a cascade of changes), or changing the origin of the secondary strand.

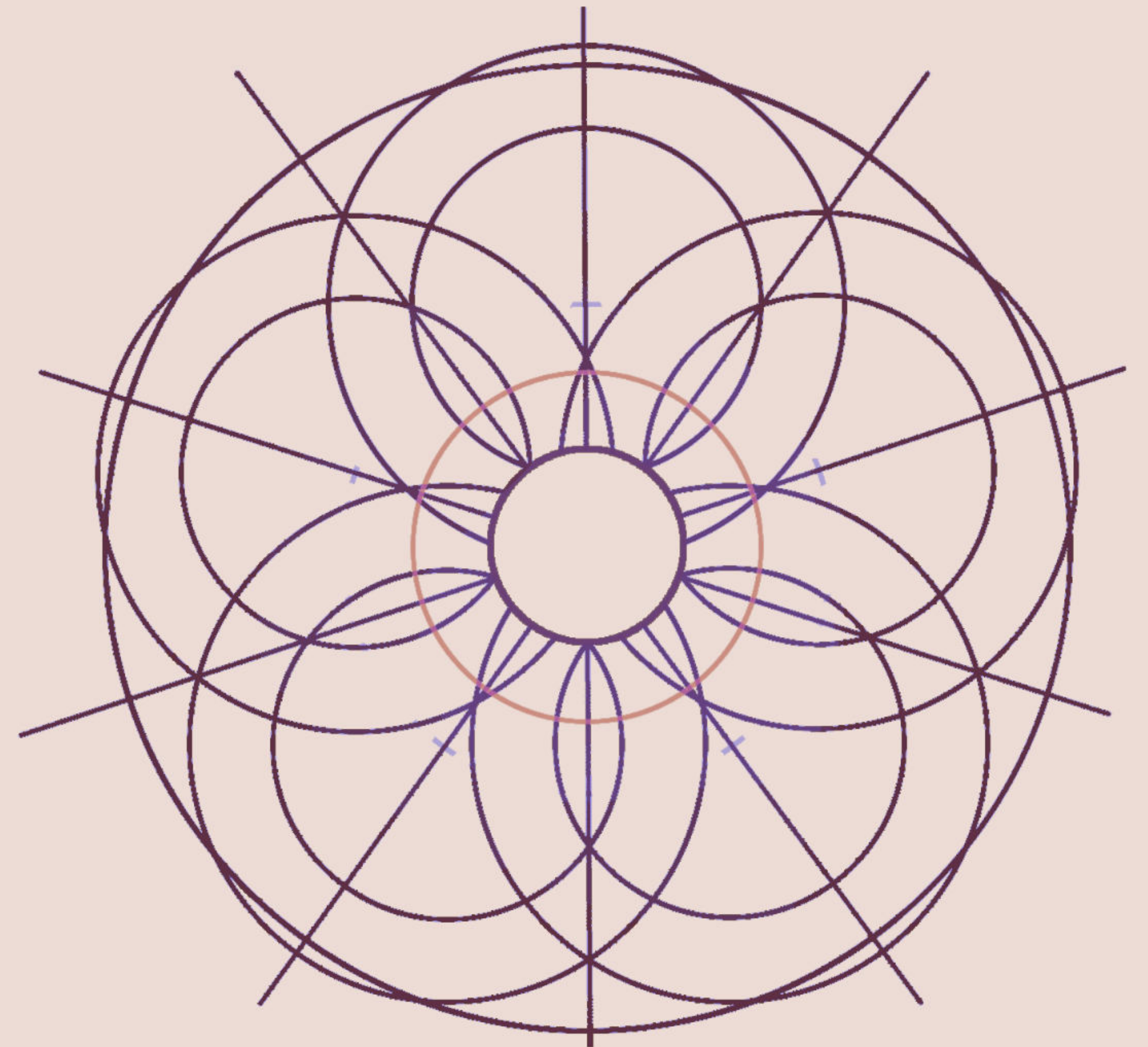


Direction of flow can be discerned where the branching motifs leave the strand.



Mirrored secondary strand.

Altered secondary strand.



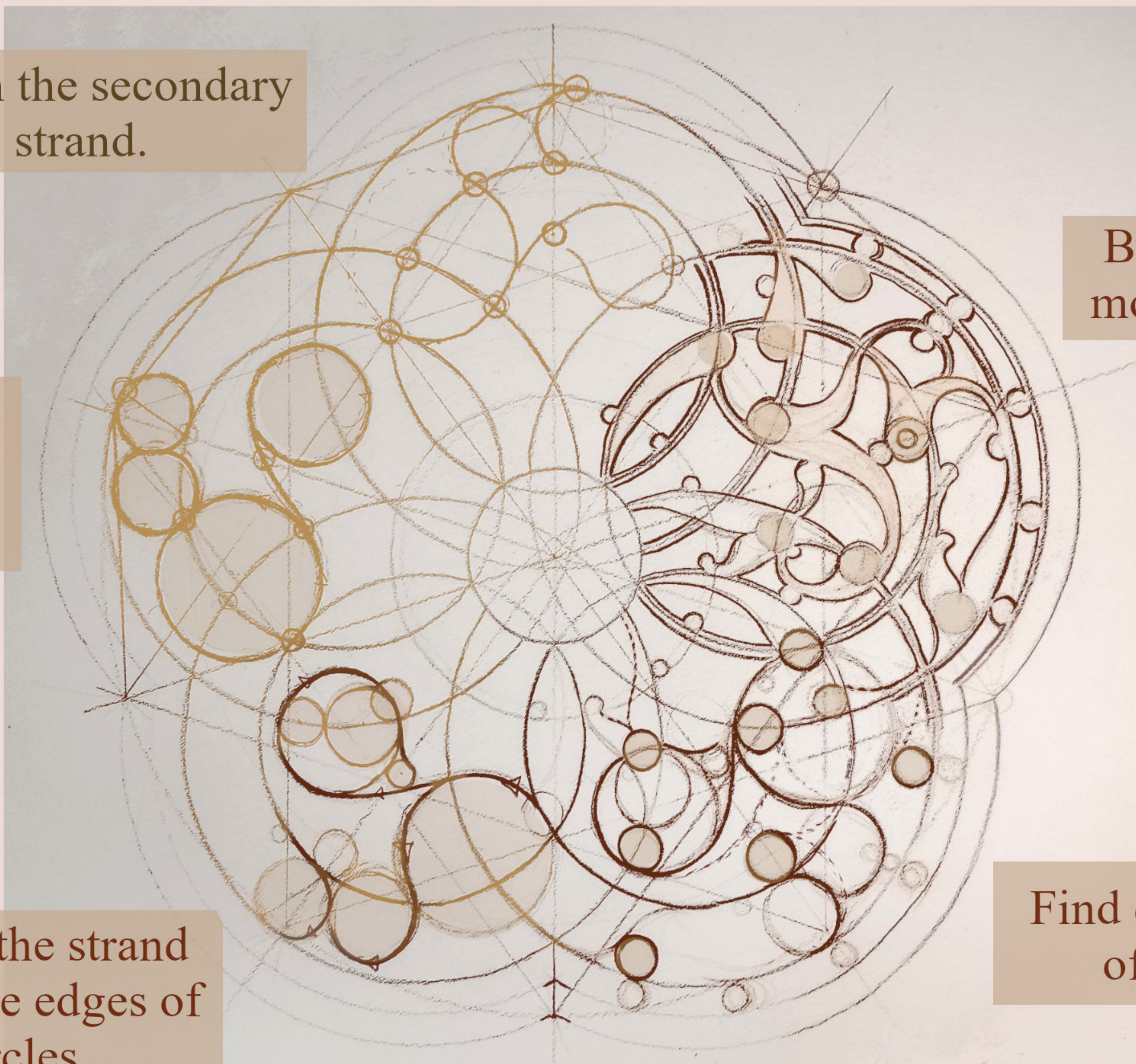
Sketch the secondary strand.

Build and refine motifs in context.

Conceptualize the strand as circles.

Refine the strand along the edges of circles.

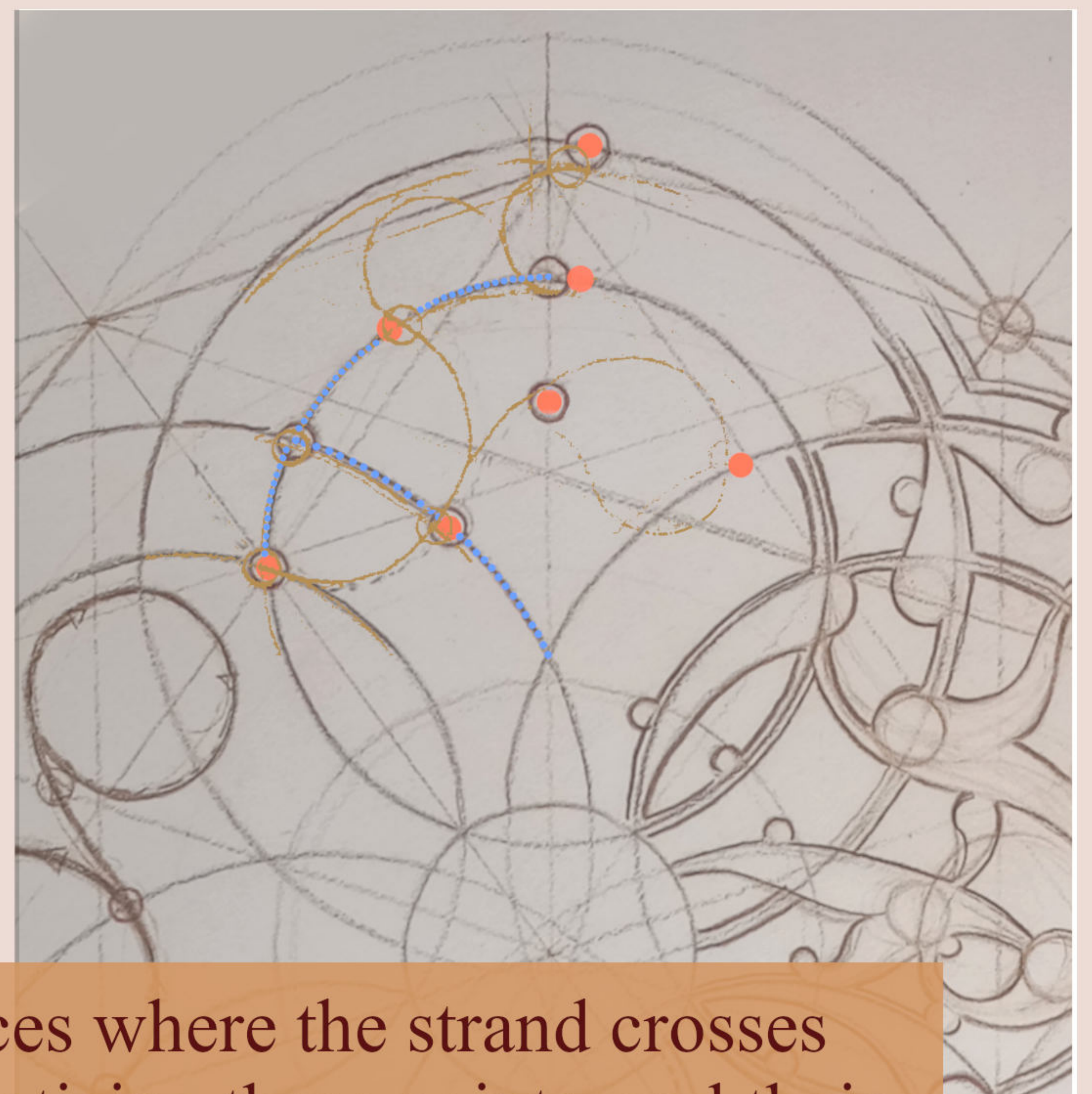
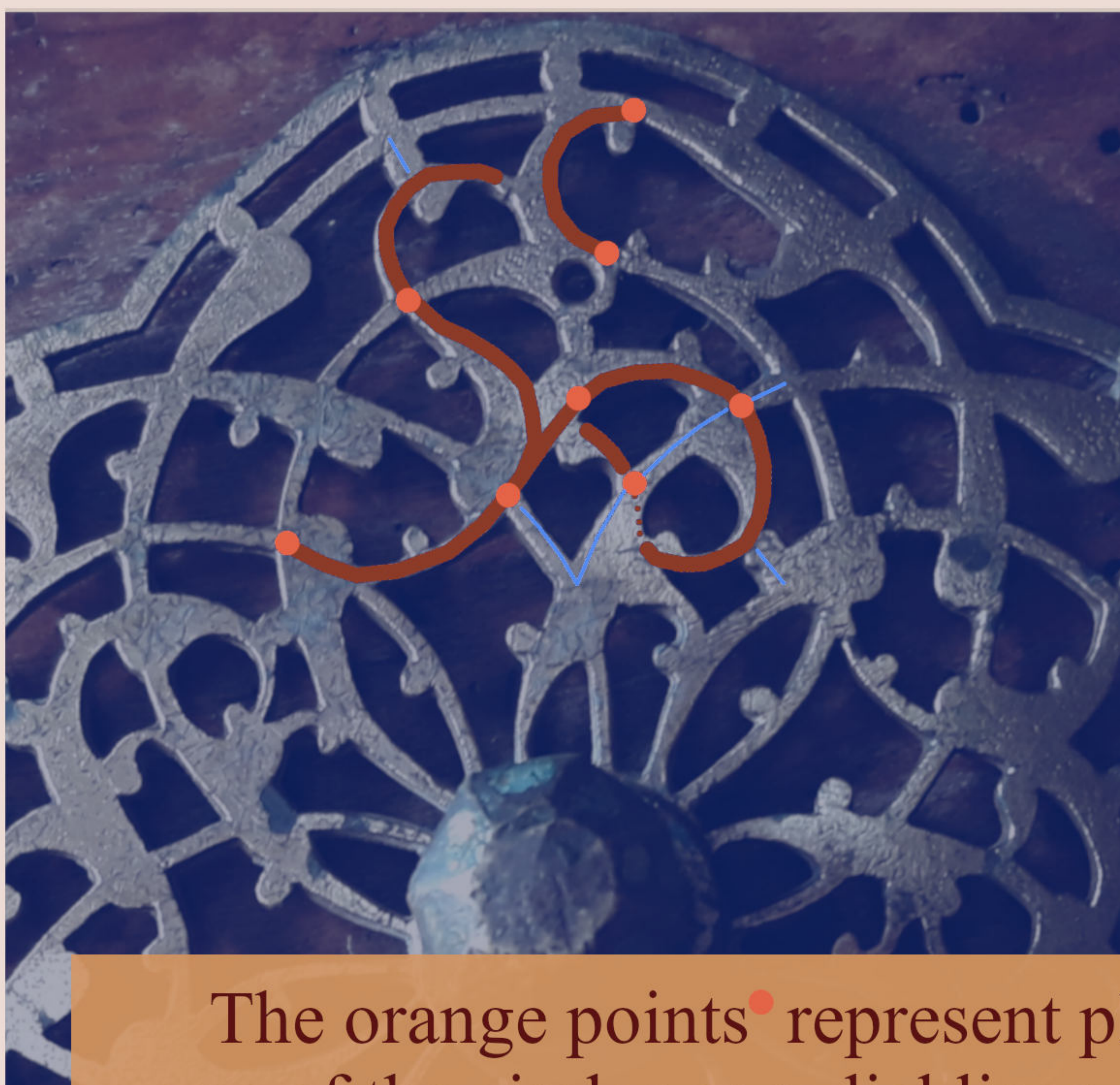
Find defining circles of the motifs.



Sketching the Secondary Strand

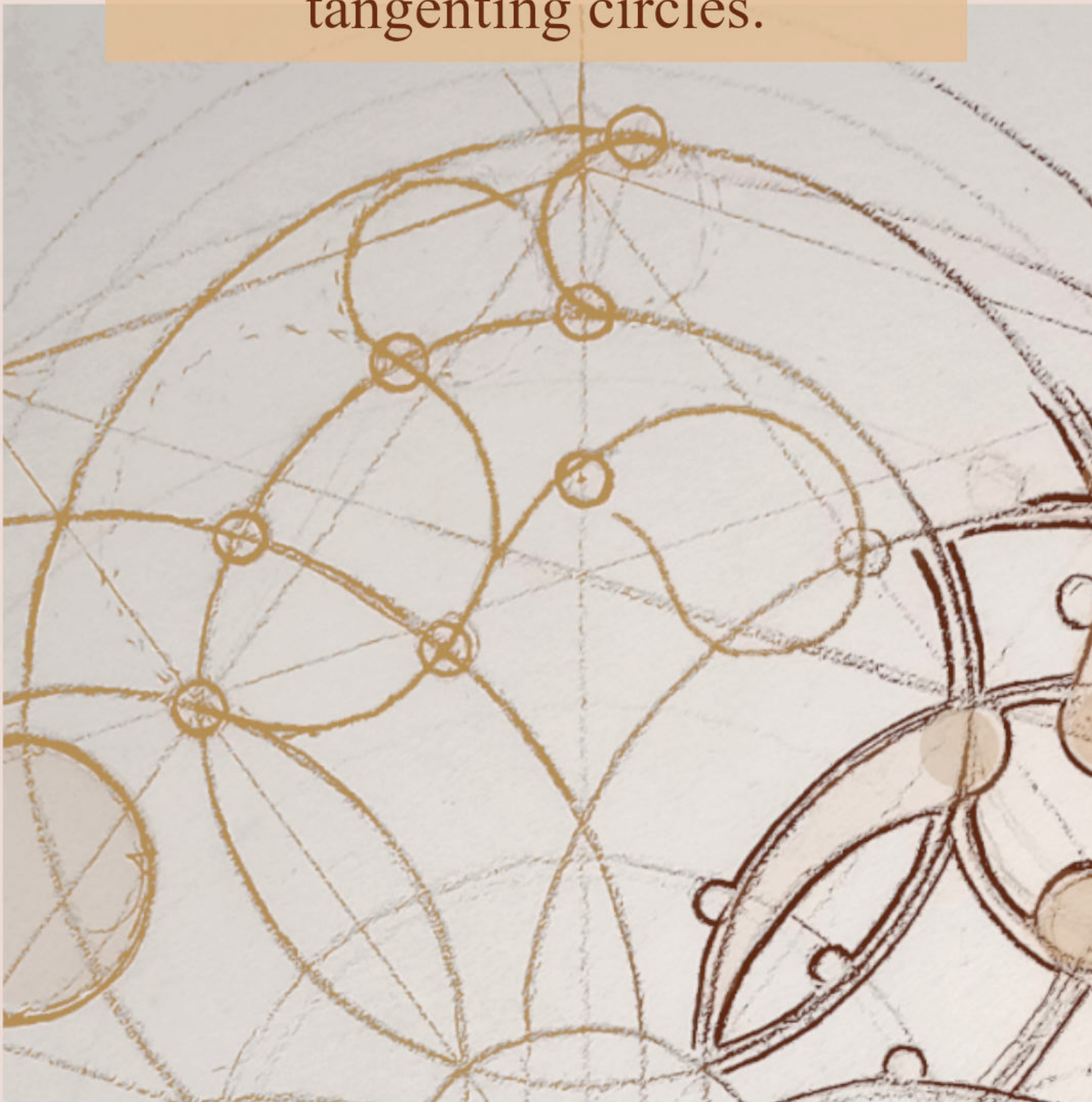


This is the strand we are looking for.

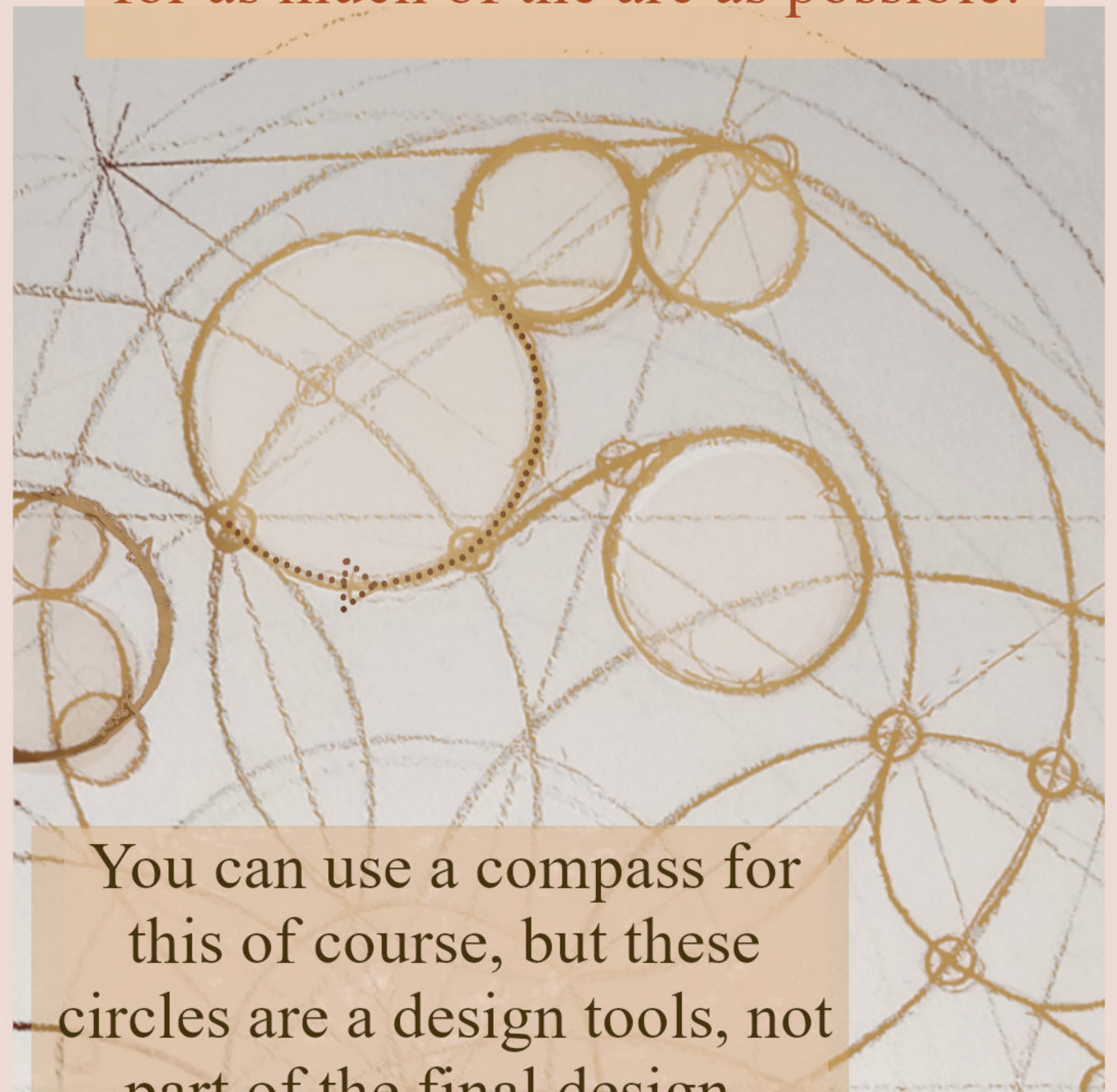


The orange points represent places where the strand crosses one of the circles or radial lines. Noticing these points, and their relative distance from known intersections can break up the strand into pieces and help refine the placement.

With the rough strand drawn, it can be helpful to think about the strand as a path, flowing around the edges of a set of linked or tangencing circles.

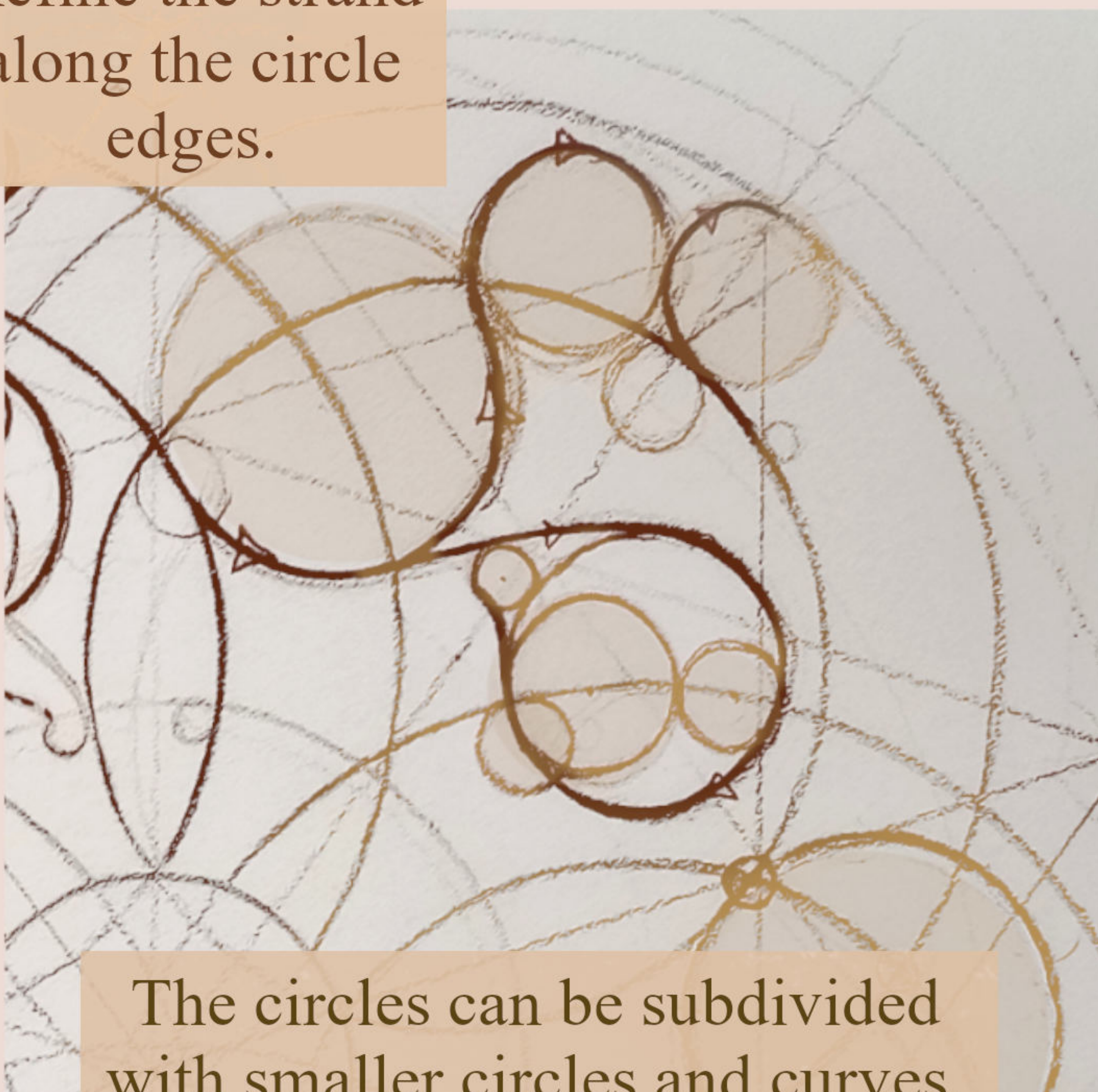


Lightly sketch in the circles that border the strand. Try to find the circles that run along the strand for as much of the arc as possible.



You can use a compass for this of course, but these circles are a design tools, not part of the final design.

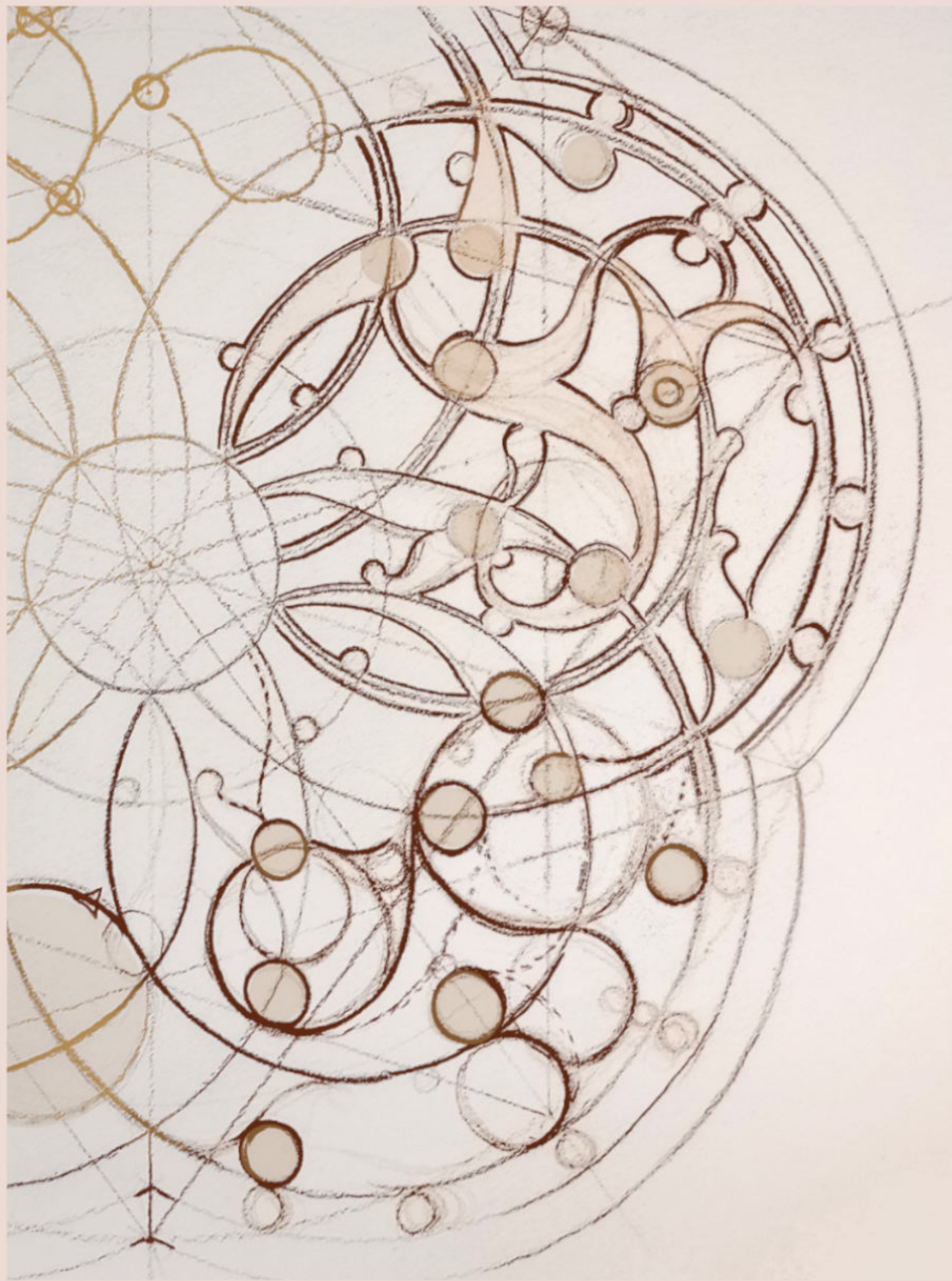
Refine the strand along the circle edges.



The circles can be subdivided with smaller circles and curves. Any motifs generated within them will be intrinsically linked with the curve of the strand.

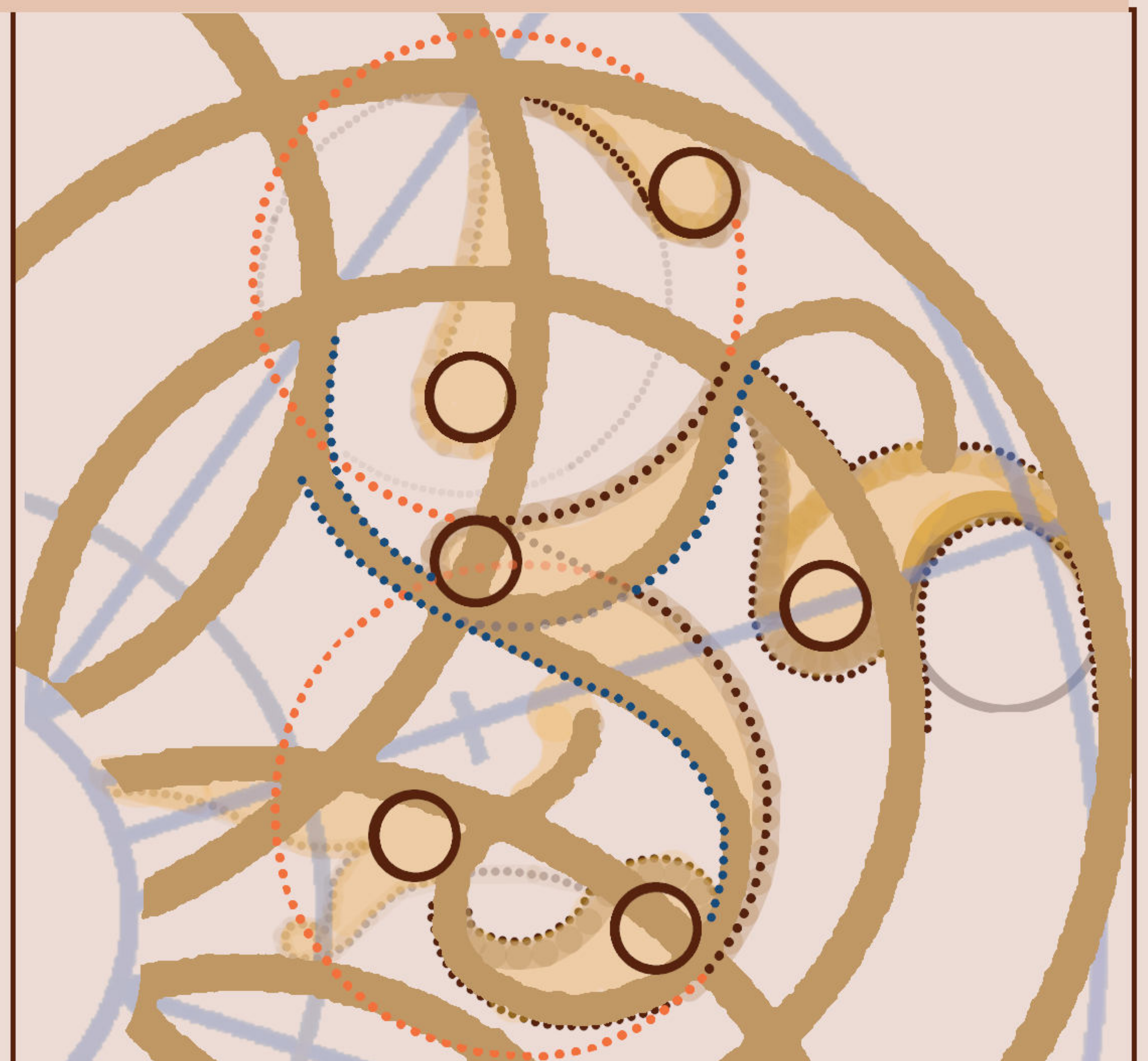
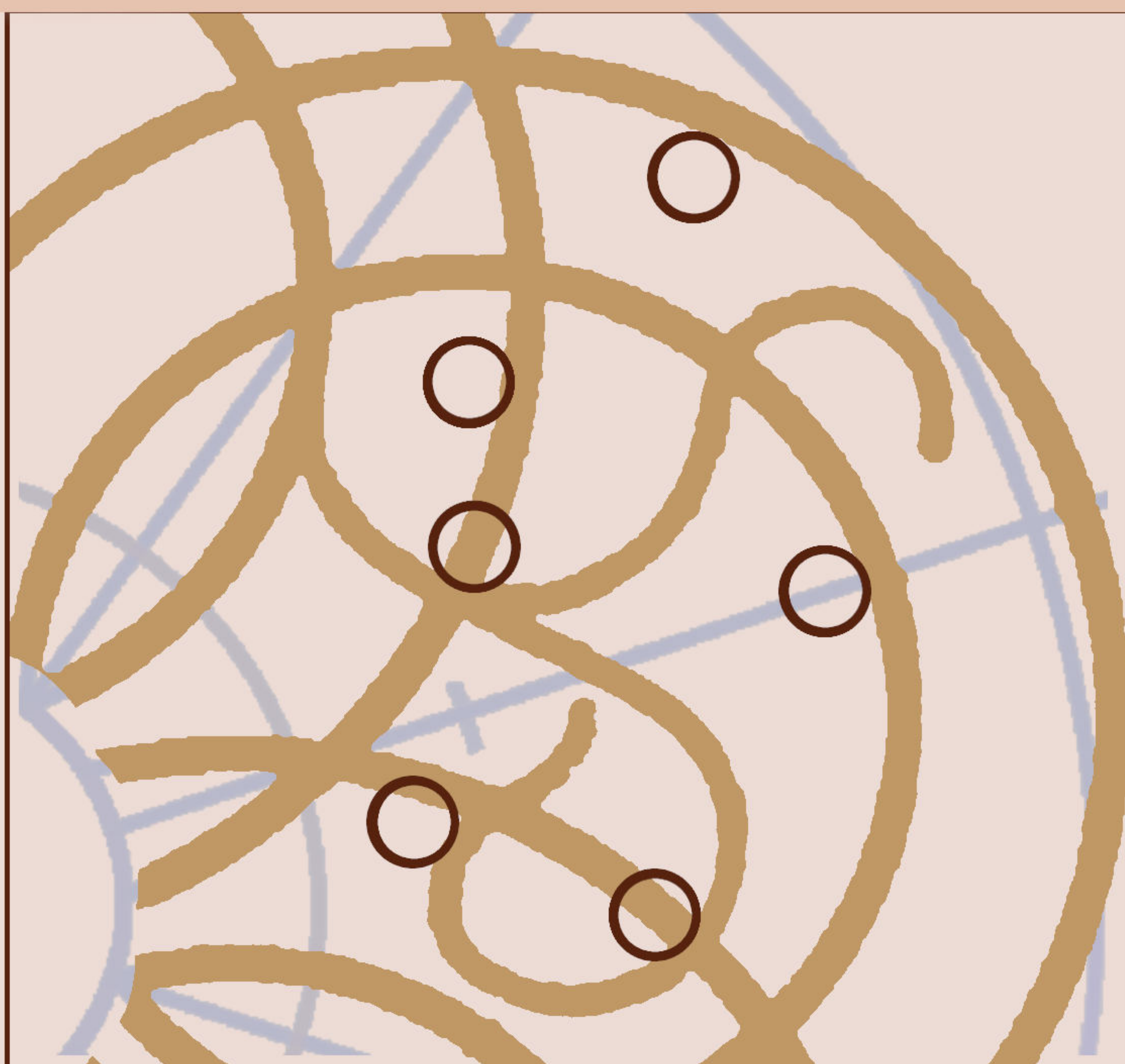


With a refined strand and a circular system, we need to find the circles *within* each motif, that interact with the strands and circles.

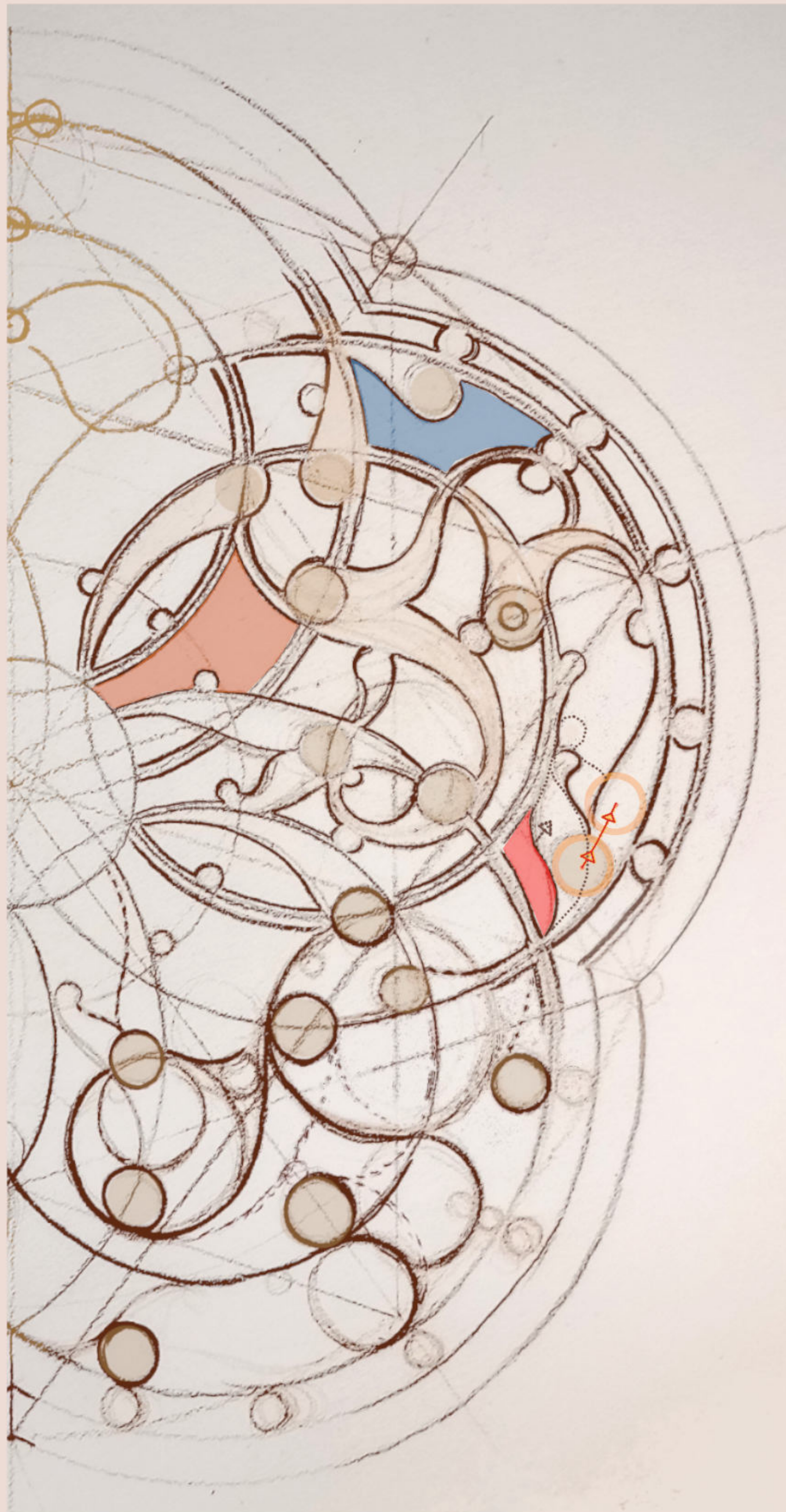


Each motif is anchored to the strand by noticing and sketching the largest circle that can fit *inside* the motif while touching the strand. The size and position of the circle will define the character of the motif. Small circles will yield narrow, spindly motifs, while larger circles will create wide and chunky motifs.

The profiles of the motifs can be completed with circular arcs of various sizes. They can be drawn by hand, by rejoining the circle and the strand. If each new curve is part of some larger or smaller circle, the finishing curves should relate nicely with the curves of the strands.



Refining motifs with negative space



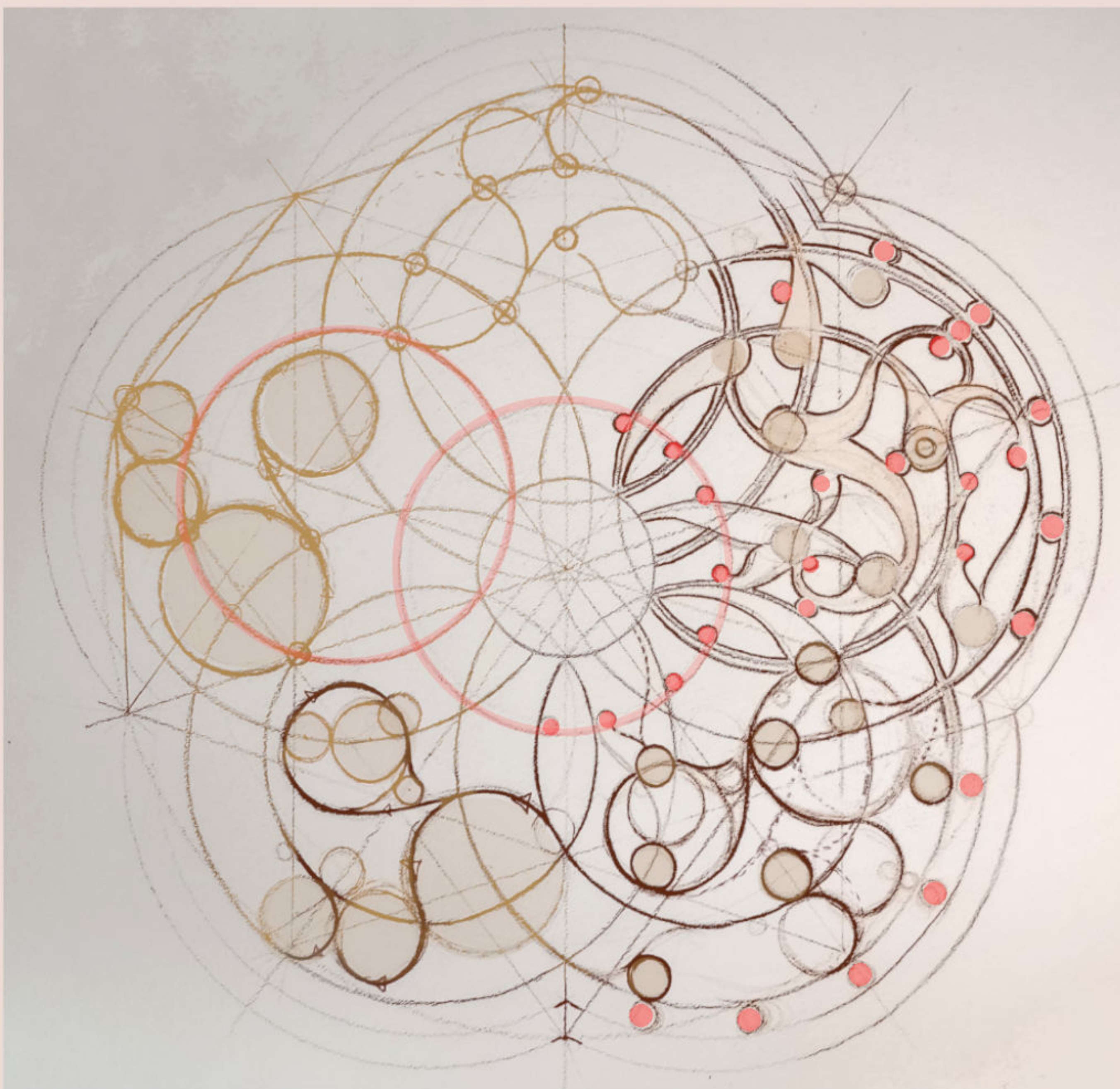
Noticing the specific character of the shapes within the negative space in the piece can help us to notice areas that need adjustment.

In my drawing on the left, the blue and peach areas are pretty close to the original, but the red areas are clearly very different. My drawing crowds the motif against the strands and creates a negative space shape that is too small. We can adjust the motif by moving the defining circle along the strand until it more closely matches the original.

Nodules

The smallest design elements in this piece are little circular bumps that are attached to the strands and motifs. They serve both a practical and aesthetic purpose. The "nodules" connect the strands and motifs to each other, providing structural support for a delicate piece. They also add a design element that is substantially smaller than the rest of the motifs.

The variety of scale within the design offers the eye many different anchors and points of interest when observing the piece. The nodules serve to break up the shapes in the negative space, adding an organic, chaotic element into what is a very clean, geometric design.



Note that most of the nodules are placed in response to the strands and motifs, connecting them for strength or breaking up the negative space. There is however, a lovely little group of 15 nodules around the center of the design that respond directly to the geometry of the piece.

This circular group of nodules has the same radius as the smaller of our concentric circle strands. By utilizing a radius that is already within the composition to control the placement of this element, the designer ensured that even the most organic part of the design is grounded in a harmonious proportional relationship.

Rendering and finishing

There are an infinite number of paths to take when finishing a design. I won't guide your hand closely here, but will offer a few examples of different styles and techniques I explored while studying this piece.

Blue and White



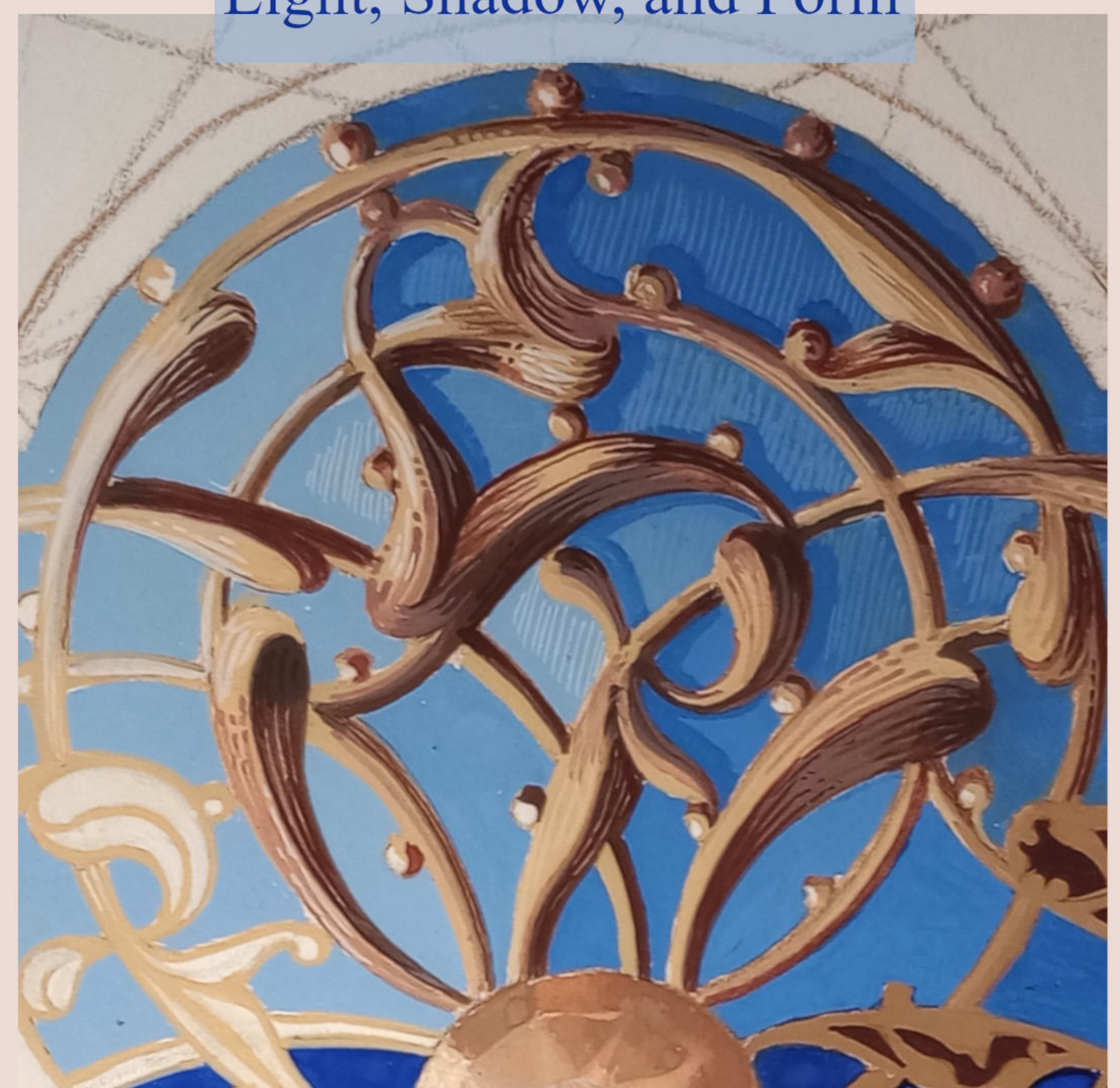
Simple Outline



Fractal Motifs

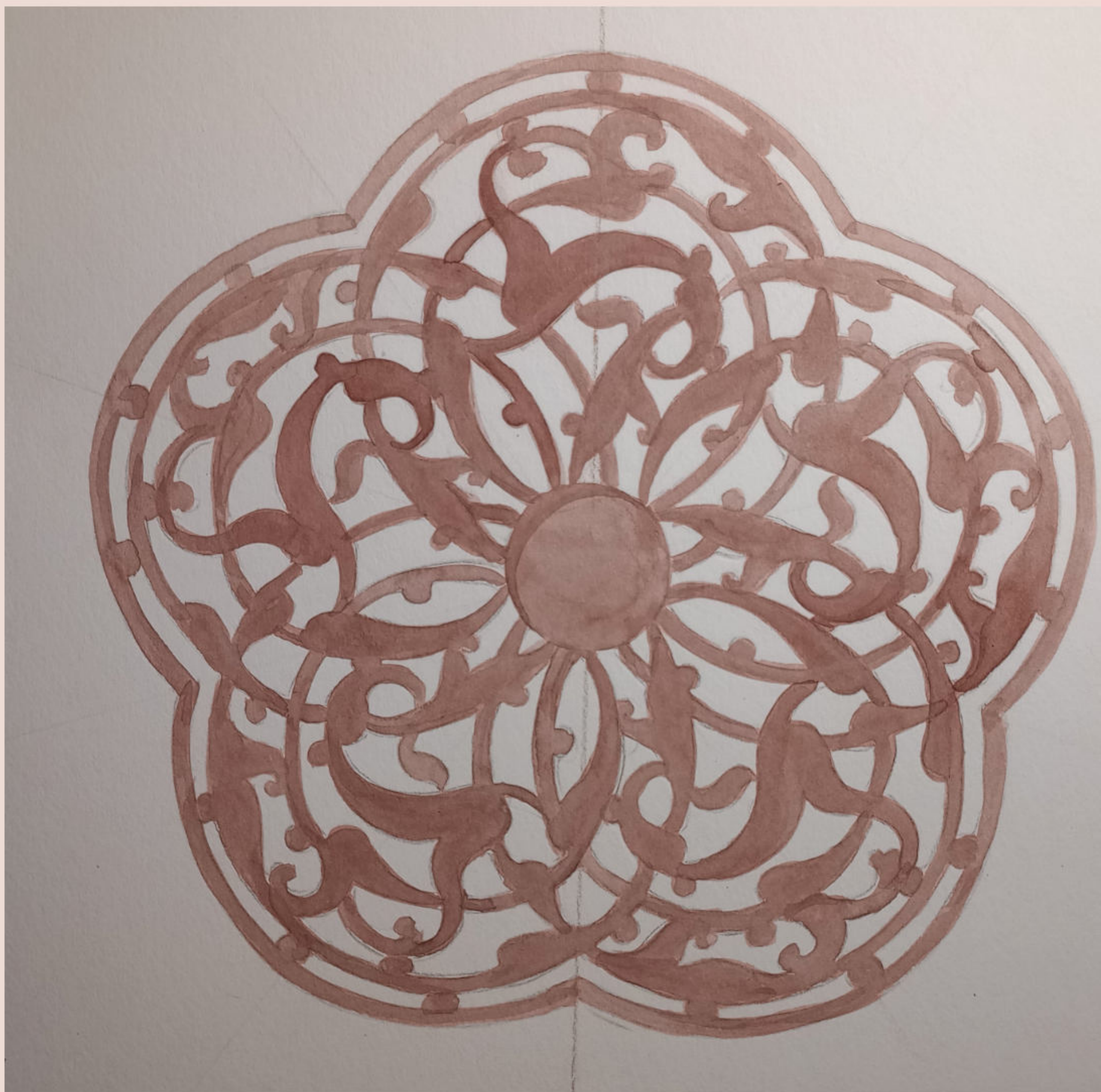
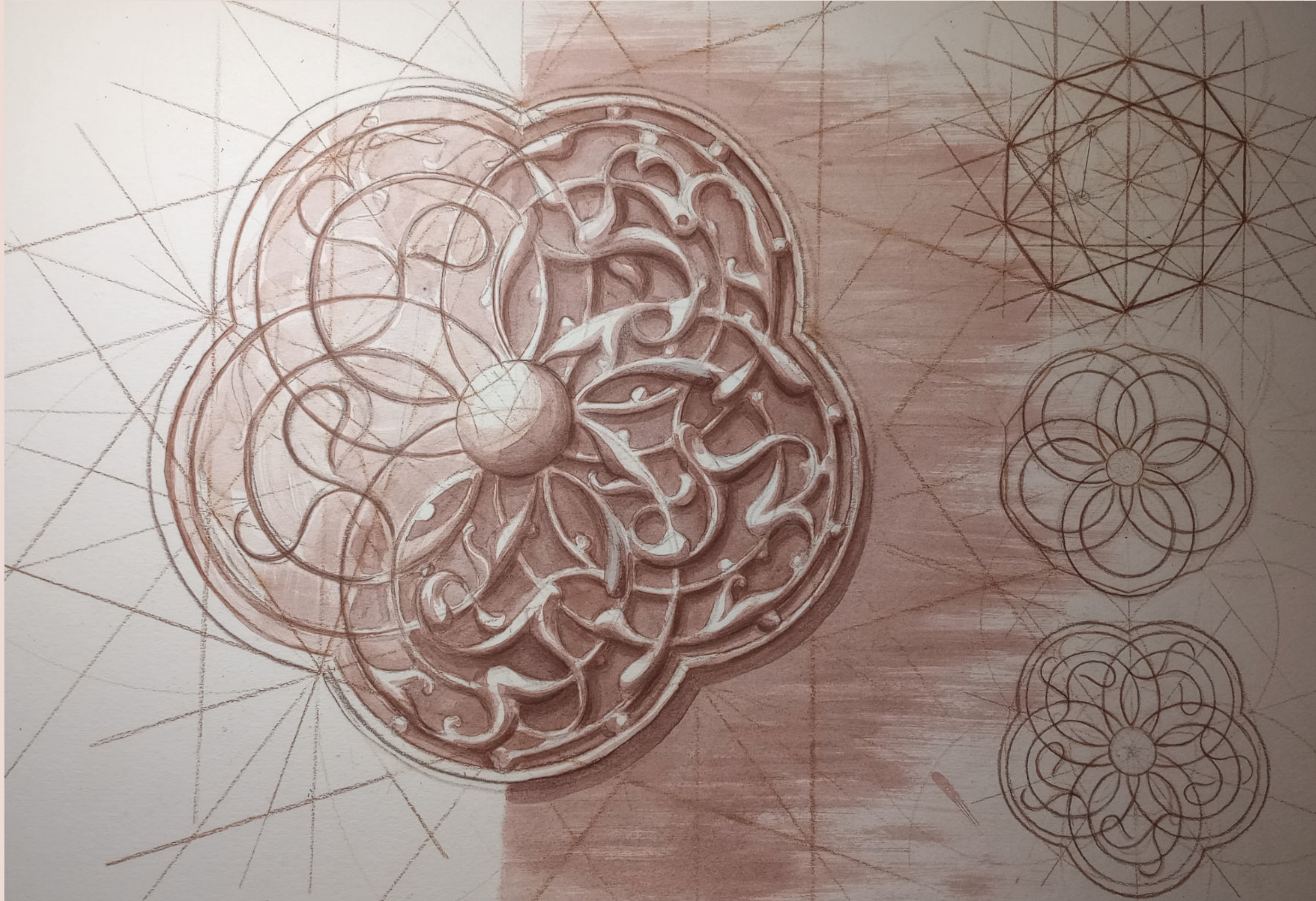


Light, Shadow, and Form



Inkwashes

A few examples of renders with transparent washes of ink.



If you made it this far... THANK YOU! I hope you found this material useful in your artistic meanderings. Please feel free to reach out with pictures of your beautiful art, comments, or if you noticed any glaring inaccuracies or typos.