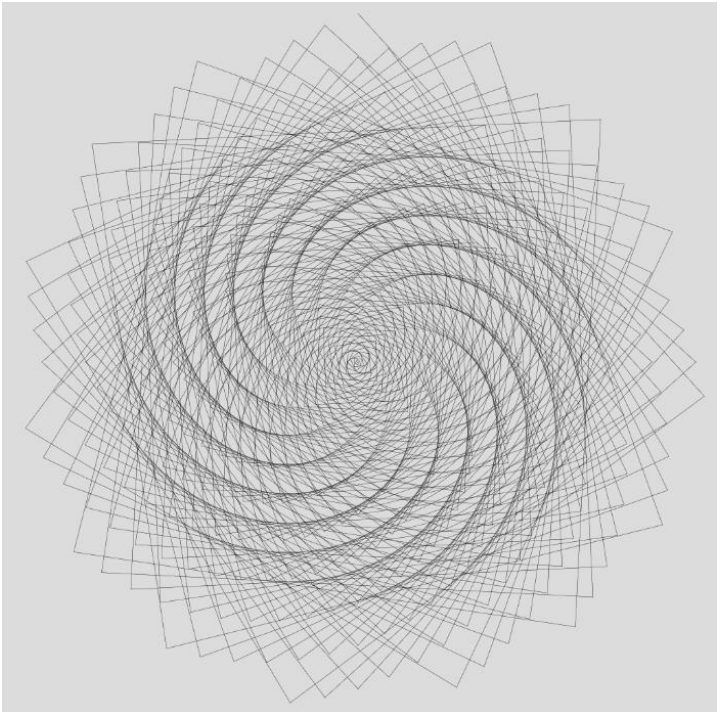
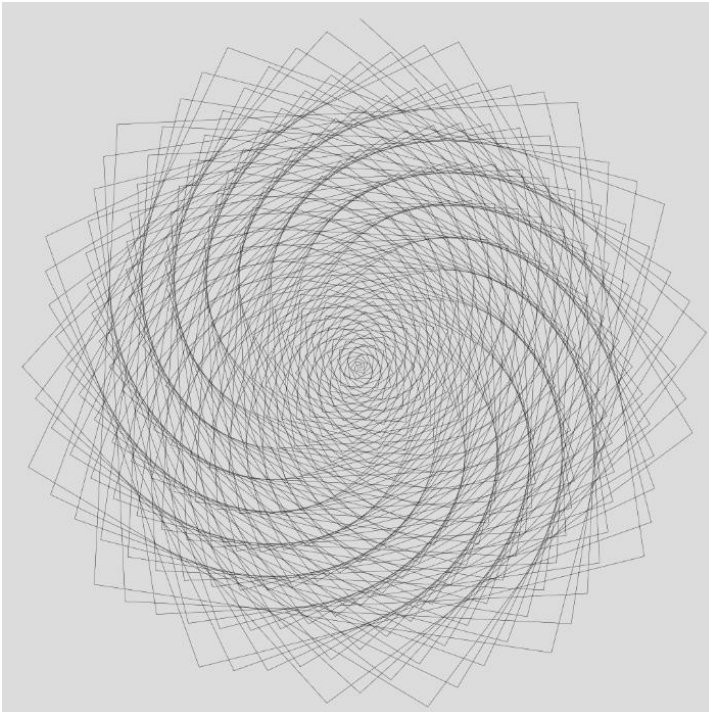
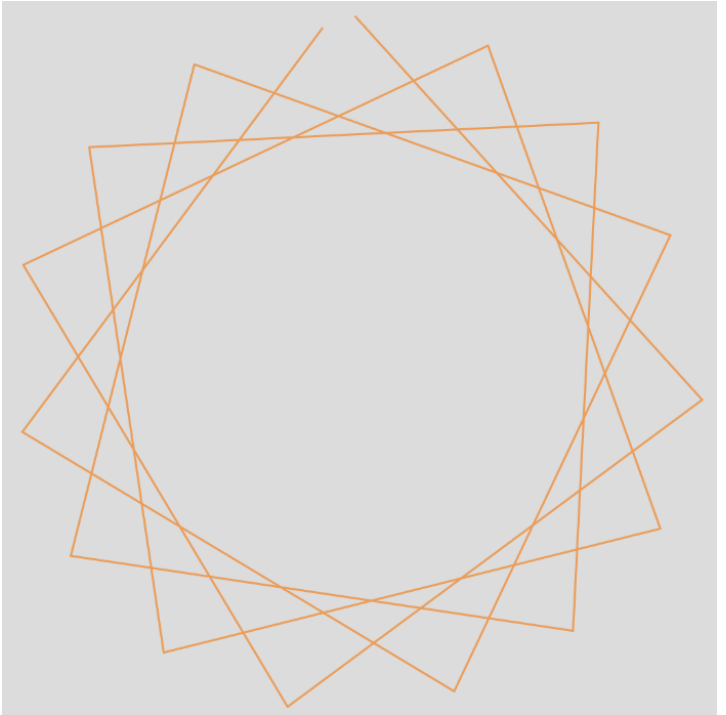
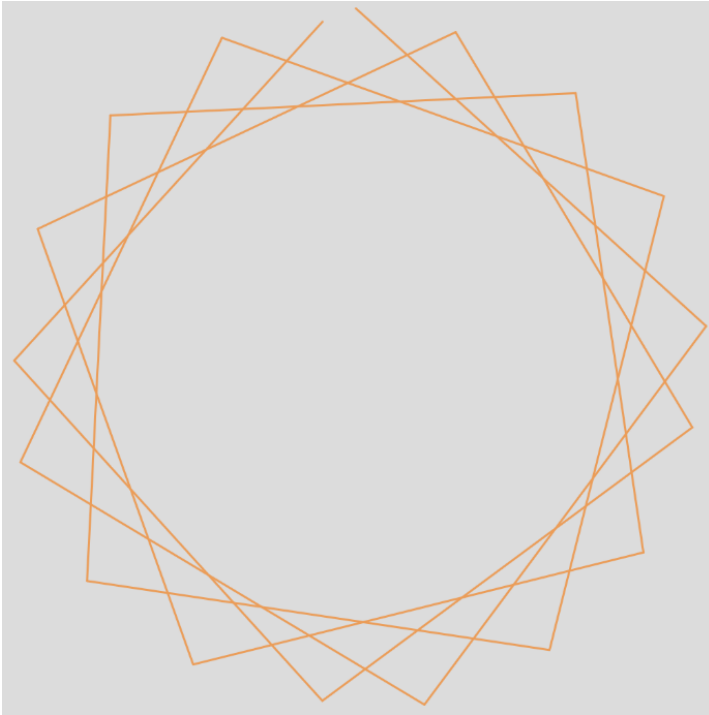


Swirls Created using Difference between Squares

Below are two versions of $n = 64$, $r = 256$ spirals, The left with $J = 15$ with the first 17 lines shown, DL = 17, and the right with $J = 17$ and DL = 15. Both end one vertex to the left of the top at the vertex 63 radius: Counter-clockwise swirls result with final images shown beneath the first DL lines.

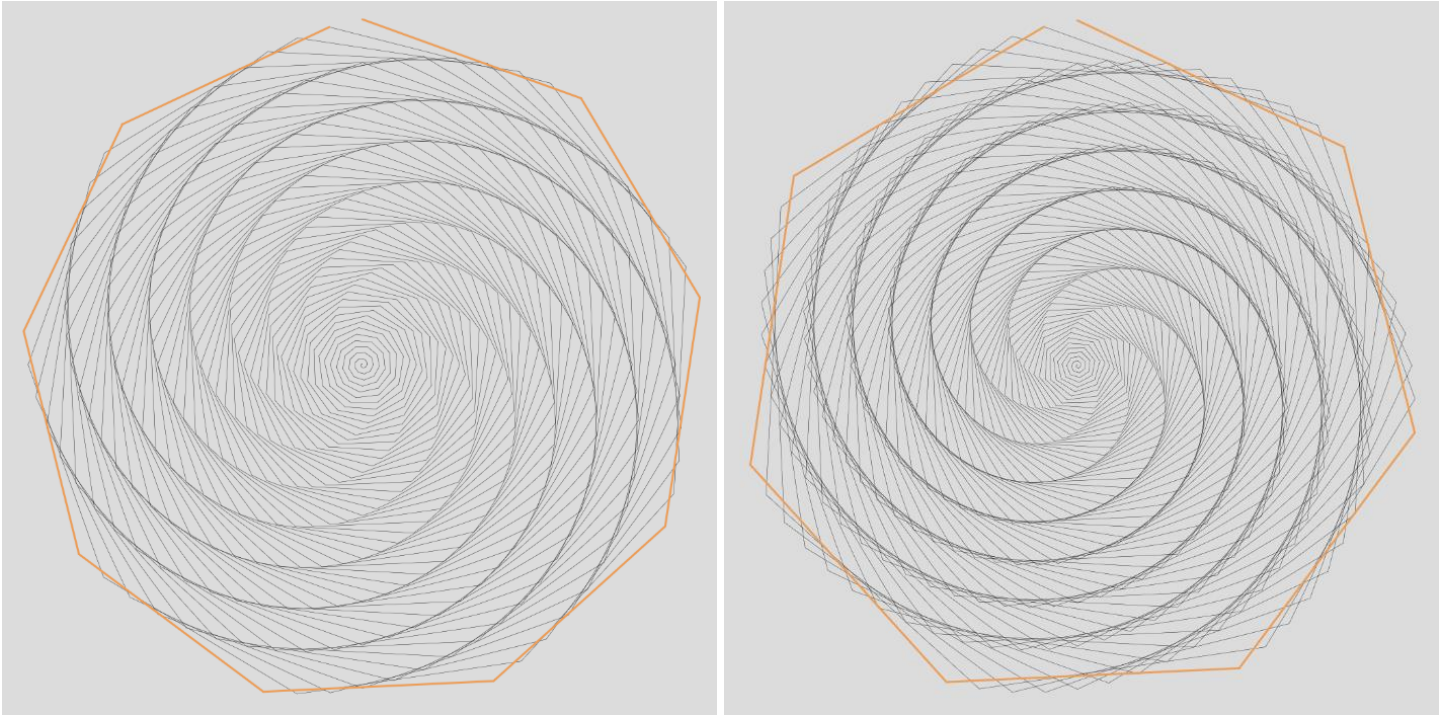


Notice that the bottom image on the left has 17 swirls but the one on the right has 15. *You do not need to count them, you simply note that in this instance, both top images are like [cracked-open](#) stars, the left is 17,4 the right 15,4.*

These images “work” because of difference between squares, used in a different context in [E8.5.2](#) and [E21.3](#). In this context, $15 \cdot 17 = 255 = 16^2 - 1^2$, and 255 vertex jumps is 1 vertex shy of four times around (four *strands* as discussed in E12.5) $255 = 4 \cdot 64 - 1$, at vertex 63.

A difference between squares primer. Given two numbers a and b with $a > b$, let $C = (a+b)/2$ is the center, $k = (a-b)/2$ is the average difference from the center, then the *difference between squares* formula is: $a \cdot b = (C+k) \cdot (C-k) = C^2 - k^2$. In the context of these numbers, $a = C+k = 17$, $b = C-k = 15$, with $C = 16$ and $k = 1$.

A second difference between squares pair is shown below, based on the same n and r . The left has 9 swirls to the center given $J=7$, the right has 7 swirls to the center given $J=9$. The left is a cracked-open 9-gon, and the right a cracked open 7-gon. In difference between means terms, $C = 8$ and $k = 1$. Both are counterclockwise because $7 \cdot 9 = 63 = 64 - 1$.



Below, provides one final difference between squares pair, based on the same n and r . The left is a 13-gon based on $J=5$ and DL=13. The right is a pentagon based on $J=13$ and DL=5. Both are *overly-closed* because $5 \cdot 13 = 65 = 81 - 16 = 64 + 1$, given $C = 9$ and $k = 4$, and therefore both produce *clockwise* swirls to the center.

