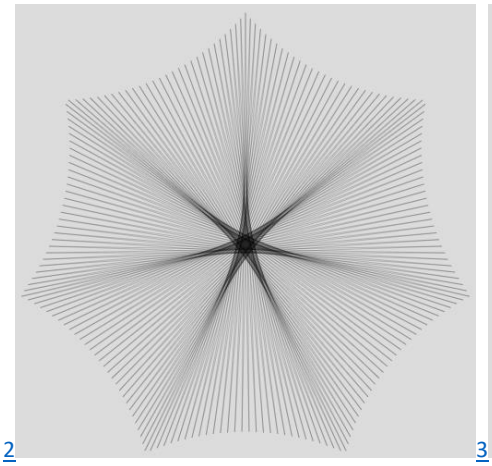
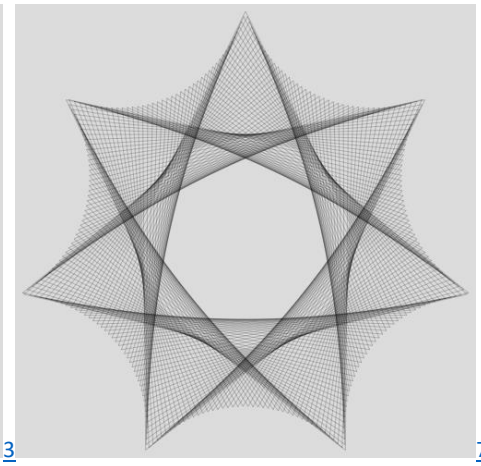
Generalized Stars: Exploring 1-off Images using 7-point Stars (and more)

The rule proposed in the divisible stars explainer was that if you start with a quivering ***G***-gon and move ***S*** = ***G·J*** in the opposite direction of ***n*** = ***P*** = ***G·J*** $\pm$ 1 to ***S*** = ***G·J*** $\mp$ 1 you end up with a divisible 2***G*** star (such as a 6,2 star when ***G*** = 3). Such stars are even … so if you find odd quivering stars a different rule must apply. One adjustment is to increase the difference between ***n*** and ***S*** so that a 9,3 star is possible by adjusting ***S*** (or ***n*** = ***P***) so that the difference is 3. Such stars are by their very nature, divisible in the sense that the point and jump values have a common divisor. Can this be generalized to non-divisible stars such as when the number of points in the star is prime?

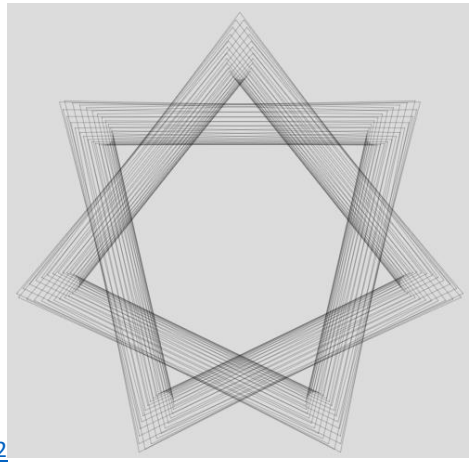
The images below provide a generalization on this idea by focusing on 7-point stars. Four images have ***J*** = 100 and are of the following form: ***S*** = 100·***k***-1, ***n*** = ***P*** = 100·(7-***k***)+1 for ***k*** = 2, 3, 4, and 5. Virtually identical images result if we reverse the - and + signs (***S*** = 100·***k***+1, ***n*** = ***P*** = 100·(7-***k***)-1). At right are 210-line 7,2 and 7,3 quivering stars for reference.



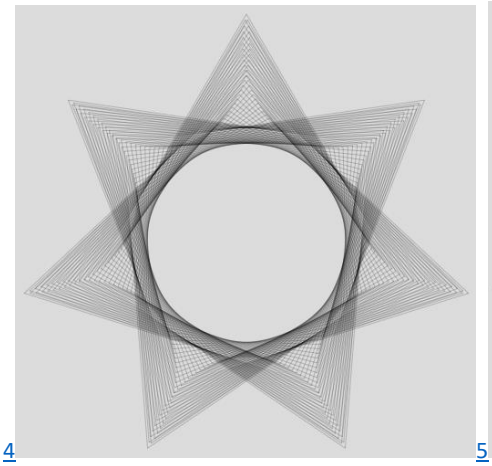
2



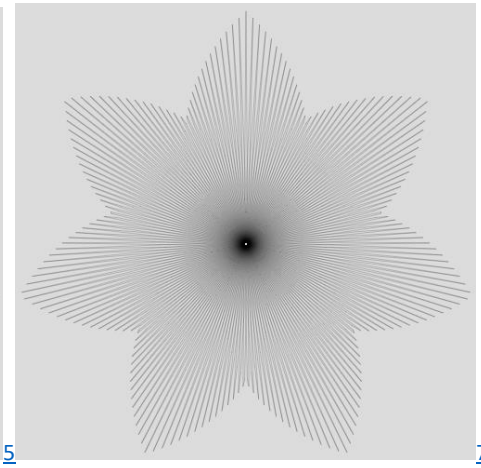
3



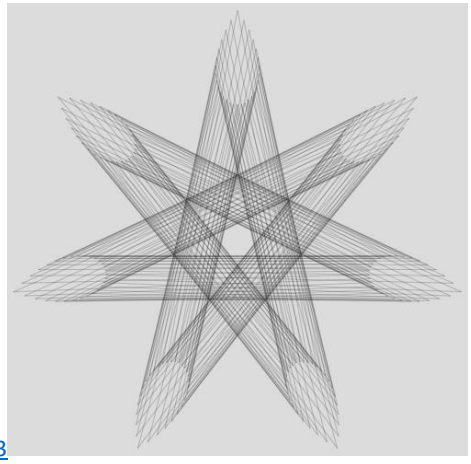
7,2



4



5



7,3

The number of lines in each image in the first two columns is ***S*** (199, 299, 399, and 499). Two other values are possible but were omitted because they are less interesting: 1 shows a 99-line outline of a smoothly pulled in 7-gon; and 6 shows a 599-line outline that is virtually indistinguishable from a circle. Both right column quivering stars have 210 lines.

There are point curves in each image: The curves between points are especially easy to see if you use *Fixed Count Lines Drawing* mode. Each image has a smallest step at *Drawn Lines* = ***k***. ***k*** = 2 looks very much like a porcupine image. ***k*** = 3 is a shape-shifting triangle and k = 4 is a shape-shifting quadrangle. Interestingly, ***k*** = 5 looks like a porcupine image (and is discussed in its own explainer). Both quivering stars are smallest step at *Drawn Lines* = 7. The line curves are especially visible in the 299-line middle top image. (One way to know for sure that what you are looking at is a line curve is to click *Toggle Subdivisions* on. Any curve visible inside the 60K to 120K ***n·S*** magenta points donut hole MUST BE line created.)

A generalization. Suppose you want a star with ***G*** points. Set ***J*** to a nice round number (I used 100 above). If ***n*** + ***S*** = ***G·J*** and ***n*** = ***P***, then the resulting star will have ***G*** points (however, in all likelihood, it will not be smallest step image).

An exercise. Set ***J*** = 100. Choose 200 < ***C*** < 500 with last digit 1, 3, 7, or 9 and set ***n*** = ***P*** = ***C***. Compare three ***S***: ***S*** = 700-***C***; ***S*** = 800-***C***; ***S*** = 1000-***C.*** Watch how each is drawn in *Fixed Count Lines Drawing* mode. Propose ***S*** if you want a 12-gram.