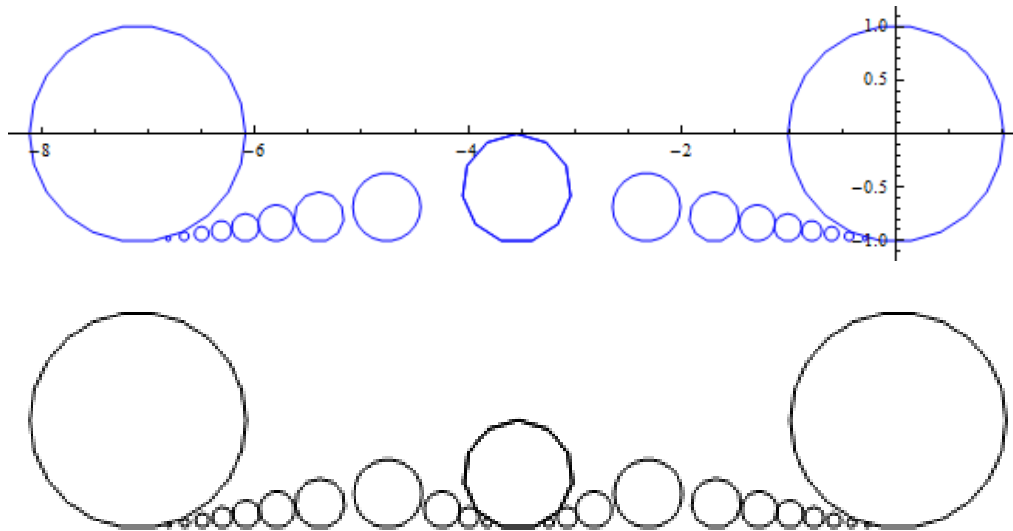


GeneticsOfPolygons.org

Summary of dynamics of the regular 22-gon: $N = 22$

This is the 5th 'twice-prime' polygon. The First Family is shown below with $N = 11$ as Mom. The second First Family is expanded to include the members of Mom's family.

Based on $N = 11$, we would expect very complex dynamics with few signs of self-similarity. There are apparently no chains of Moms or Dads past the second generation. The first generation shown below seems perfectly normal, but the web plot below reveals an assortment of semi-canonical 'volunteers'.

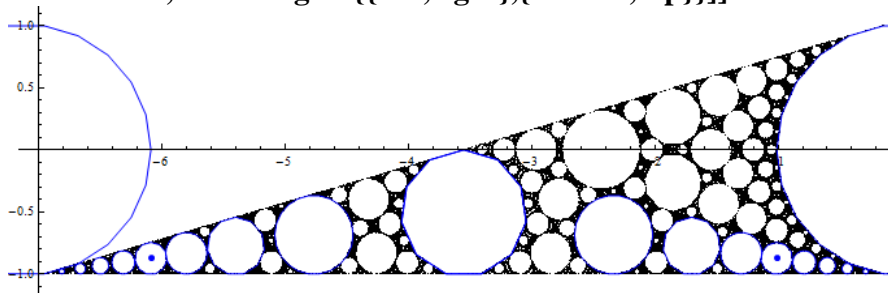


As N grows, the Digital Filter scans are a salvation. It only takes few seconds to get a depth 600 scan as shown below.

```
H0=Table[{x,1},{x,-1,.01}];
DfWeb=Flatten [Table[NestList[Df,H0[[k]],600],{k,1,Length[H0]},1];
TrWeb=DfToTr[DfWeb];
```

```
Mbox[{{{-7.162,-1.193},{-0.04782,1.16}}}; (*defines left,right, bottom, top*)
```

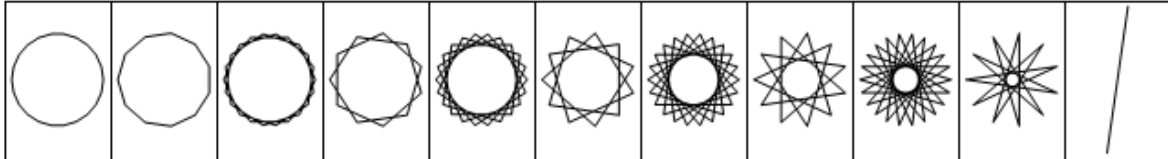
```
Show[Graphics[{AbsolutePointSize[1.0], Point[TrWeb], Blue, poly/@FirstFamily,
AbsolutePointSize[5.0],Point[{cS[5],cSL[5]}]},
Axes->True, PlotRange->{{left,right},{bottom,top}}]]
```



Projections

The two centers shown above are $cS[5]$ and $cSL[5]$. Their periods are 22 and 110. We will compare their projections below.

GraphicsGrid[Table[Graphics[poly[Wc[[k]]]],{k,1,HalfN}],Frame->All]



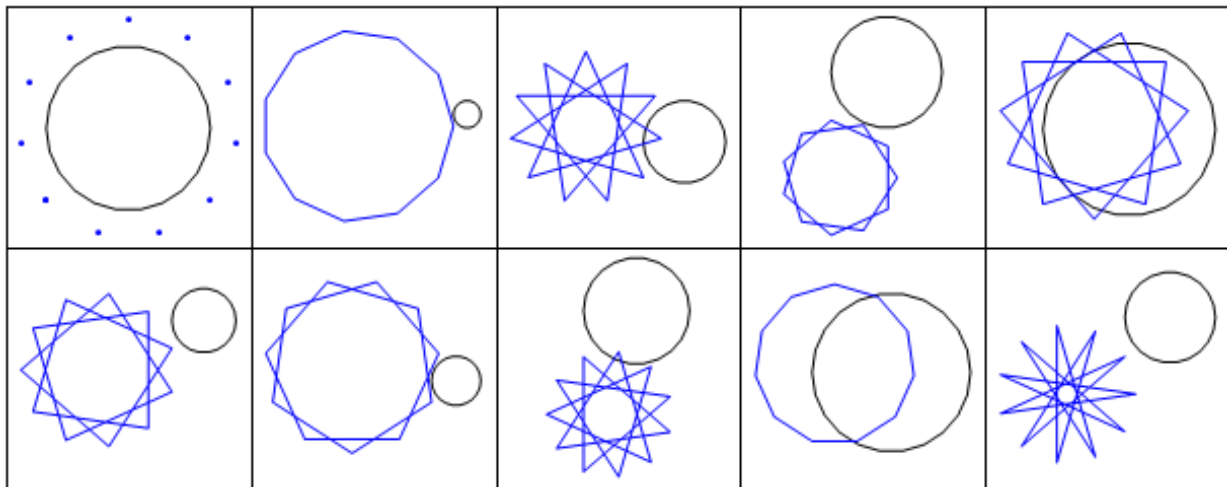
Example 1: $q_1 = cS[5] \approx \{-1.0102832265380362040, -0.875415399060728982425\}$

Ind = IND[q1,50]; k = 12; (*k is one more than half of the period to close the plot*)

Px=Table[Graphics[{poly[Mom],Blue,Line[PIM[q1,k,j]]}],{j,1,HalfN}];

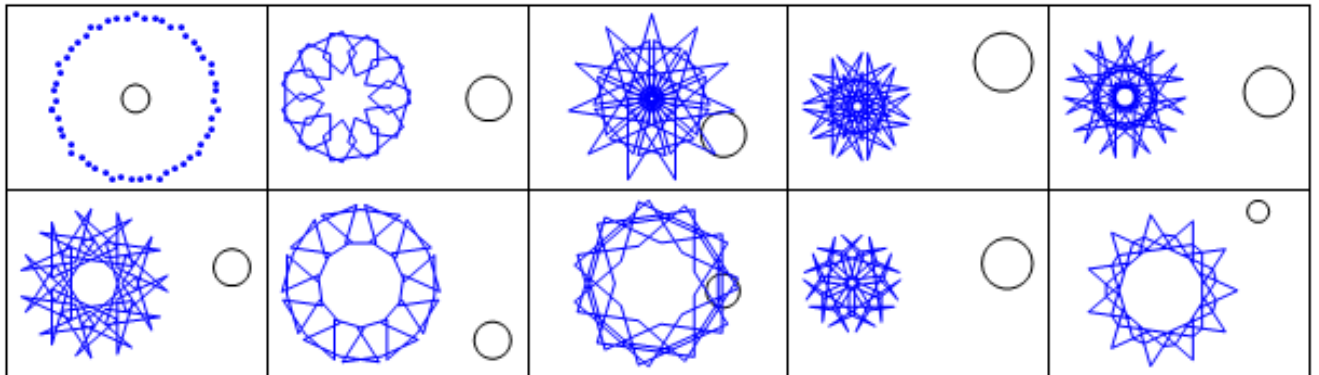
Px[[1]]=Graphics[{poly[Mom],AbsolutePointSize[3.0],Blue,Point[PIM[q1,k,1]]};
 (*plot the P1 projection with points instead of lines*)

GraphicsGrid[{{Px[[1]],Px[[2]],Px[[3]],Px[[4]], Px[[5]]},{Px[[6]],Px[[7]], Px[[8]], Px[[9]], Px[[10]]}],Frame->All] (*2 groups of 5*)



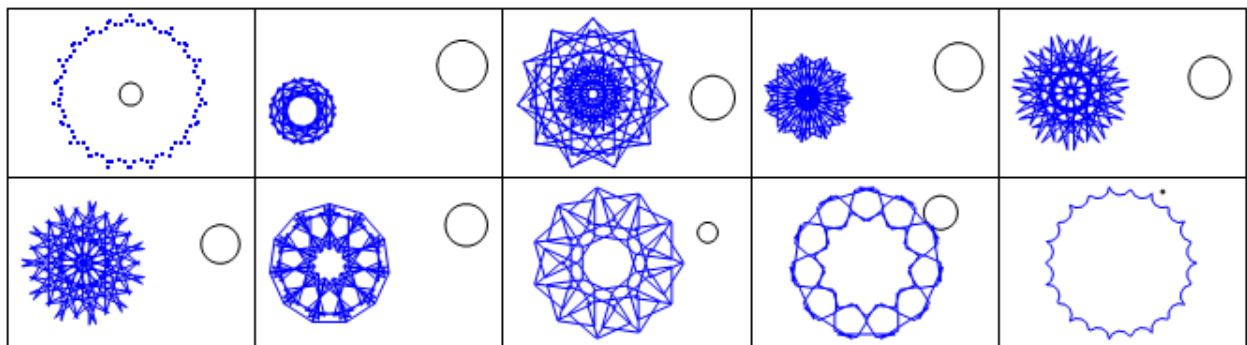
The period 22 canonical projections above are easy to predict given the remappings, but the corresponding outer ring projections shown below are much more interesting. Back in $N = 11$ these two points are part of the same orbit.

Example2: $q_1 = \text{cSL}[5] \approx \{-6.088647839230410447, -0.875415399060728982425\}$
 Period 110 so $k = 56$;

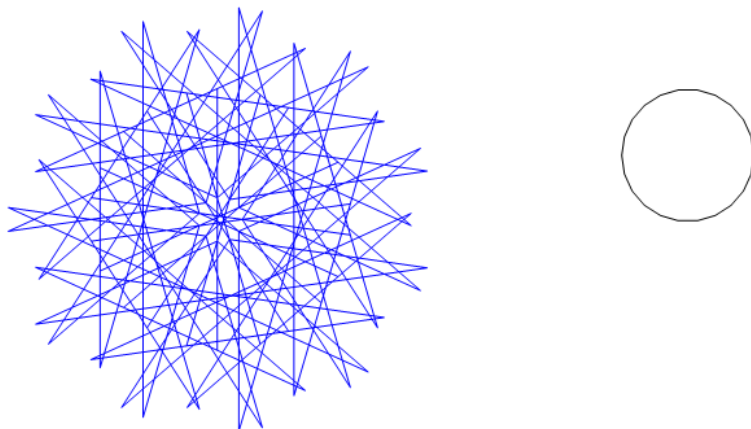


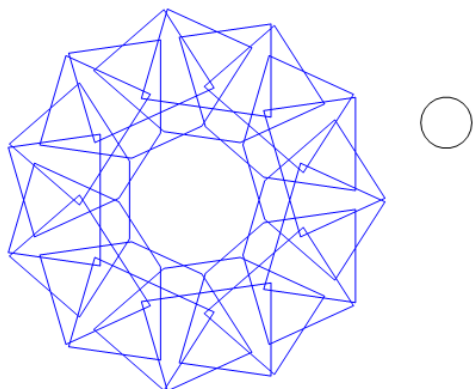
Example 3; $q_1 = \text{cMom1} = \text{cSL}[1] \approx \{-6.811374477778500, -0.9793278021758950199\}$

Period 198 so $k = 100$

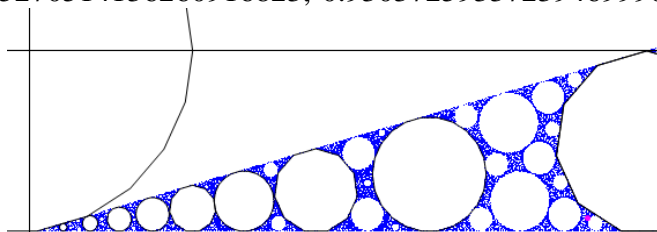


Below is are enlargements of P6 and P8 (which are plotted by simply typing $Px[[6]]$ and $Px[[8]]$)





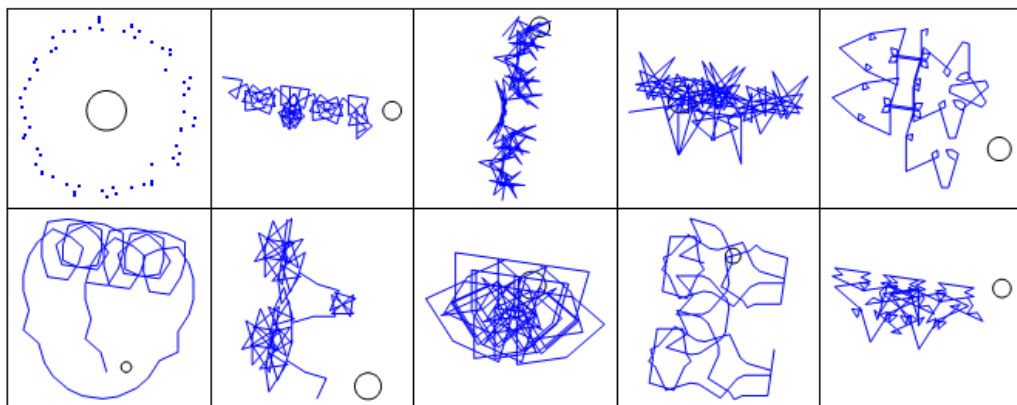
Example 4: An inner star point from $N = 11$: $q1 = \{-0.647039927393410515924548192, -0.823058559556705316896021741\}$ from the region around $S1$ on the edge of Mom . The corresponding point in $N = 22$ is $q1 = \text{TranslationTransform}[cMom][q1 * rMom] = \{-3.879673365270514136260916823, -0.930372593372394699903398151\}$ It is shown below



```
Ind = IND[q1,50000];
Px=Table[Graphics[{poly[Mom],Blue,Line[PIM[q1,k,j]]},{j,1,HalfN}];Px[[1]]=Graphics[
poly[Mom],AbsolutePointSize[2.0],Blue,Point[PIM[q1,k,1]]];
```

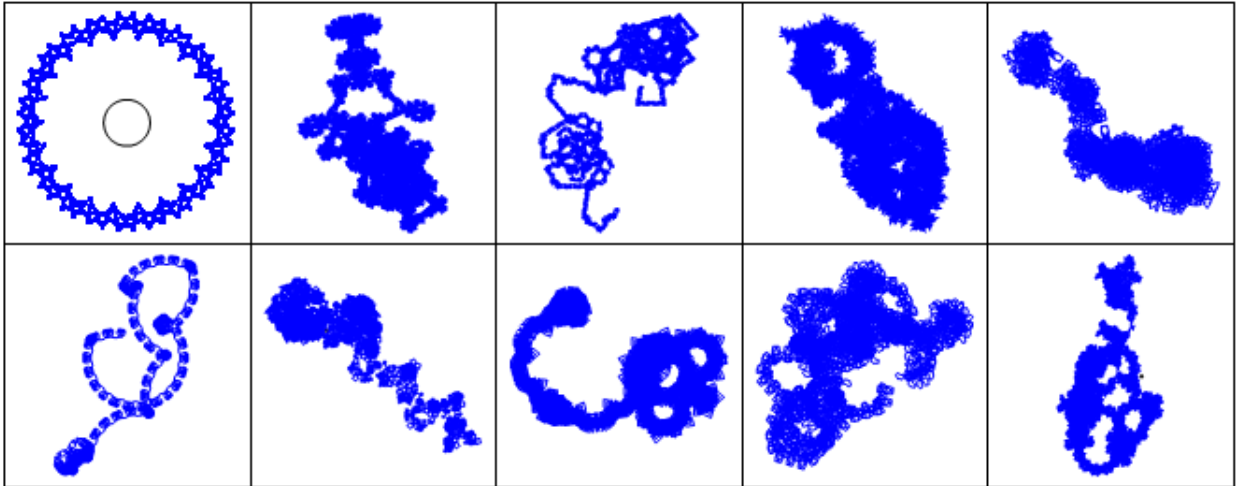
```
k = 100;
```

```
GraphicsGrid[{{Px[[1]],Px[[2]],Px[[3]],Px[[4]], Px[[5]]},{Px[[6]],Px[[7]], Px[[8]], Px[[9]],
Px[[10]]}},Frame->All]
```

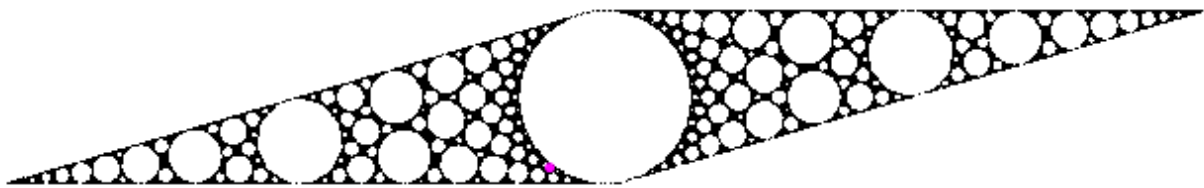


This is no longer an inner star point and the projections have more 'embellishments' than the $N = 11$ versions.

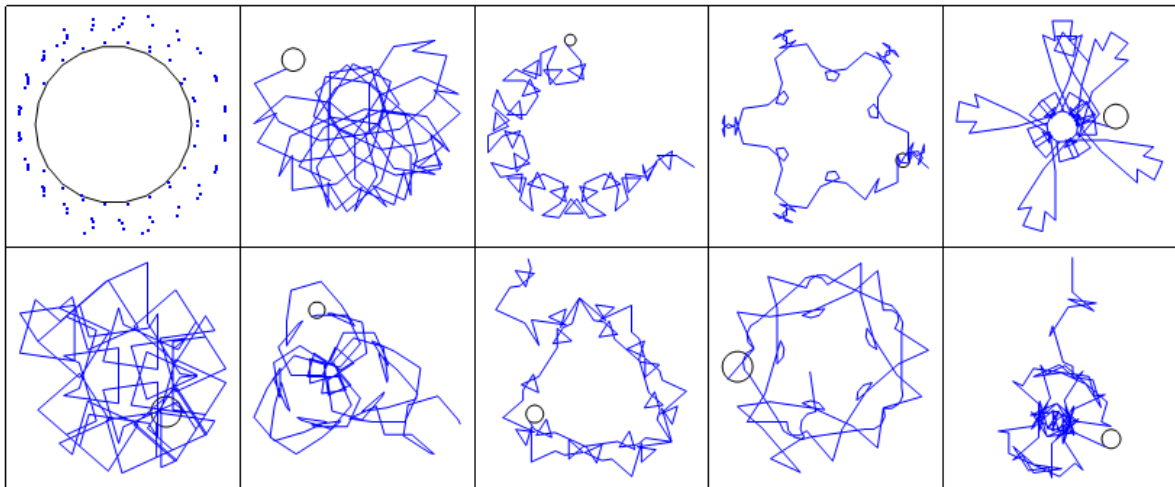
$k = 20000$;



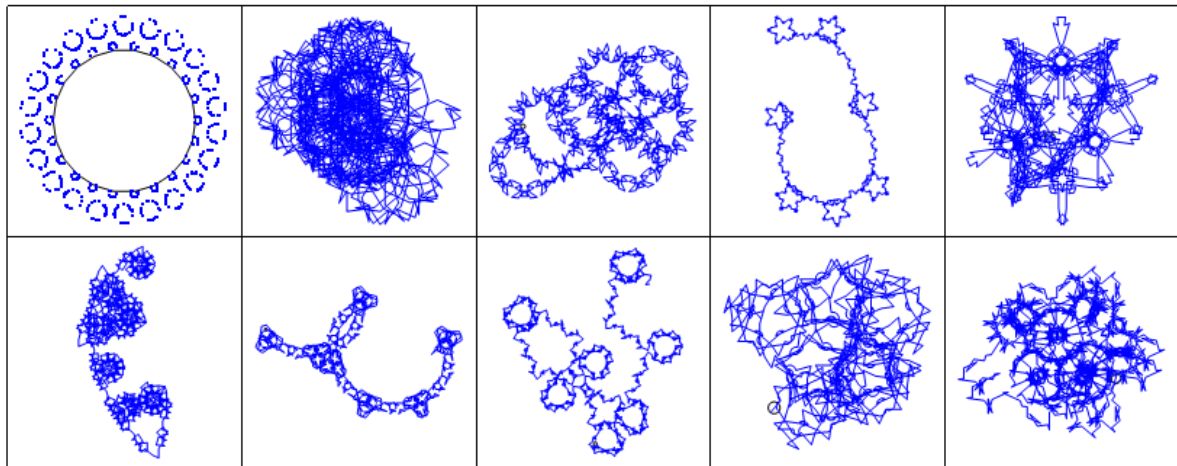
Example 5: An inner star point. The original q_1 point from Example 4 above. It is shown below



$k = 100$; Note the arrows



k = 1000;



Below are the first 450 points in the P4 projection.

