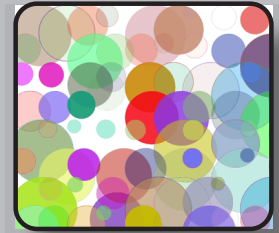


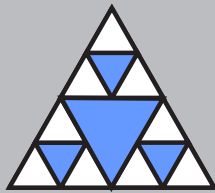
Apollonian fractals.



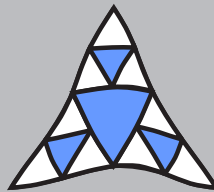
Apollonius was a Greek mathematician who lived over 2000 years ago.



Earlier we worked on fractals of equilateral triangles.

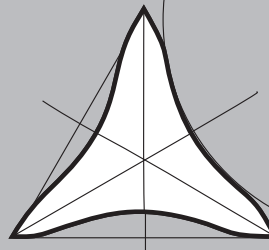
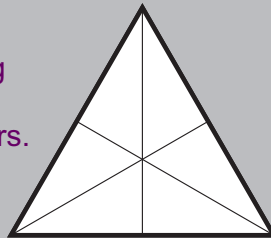


This page is about distorting these triangles



In this way it is possible to connect triangle geometry with circle geometry.

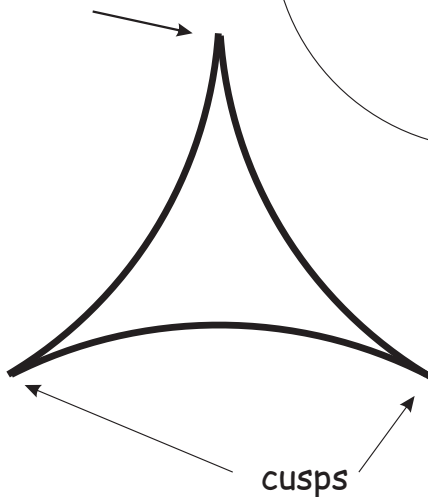
This is done by pushing in the triangle's sides with circle-shaped pushers.



Push the circle in this direction so that it distorts the side of the triangle.



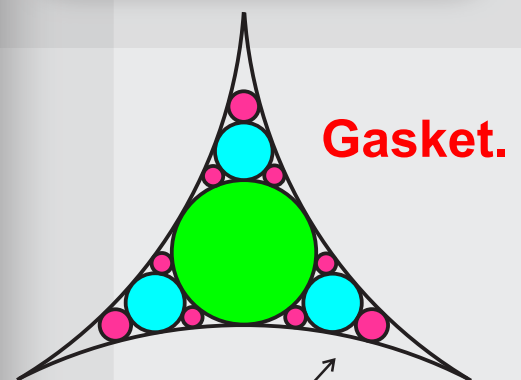
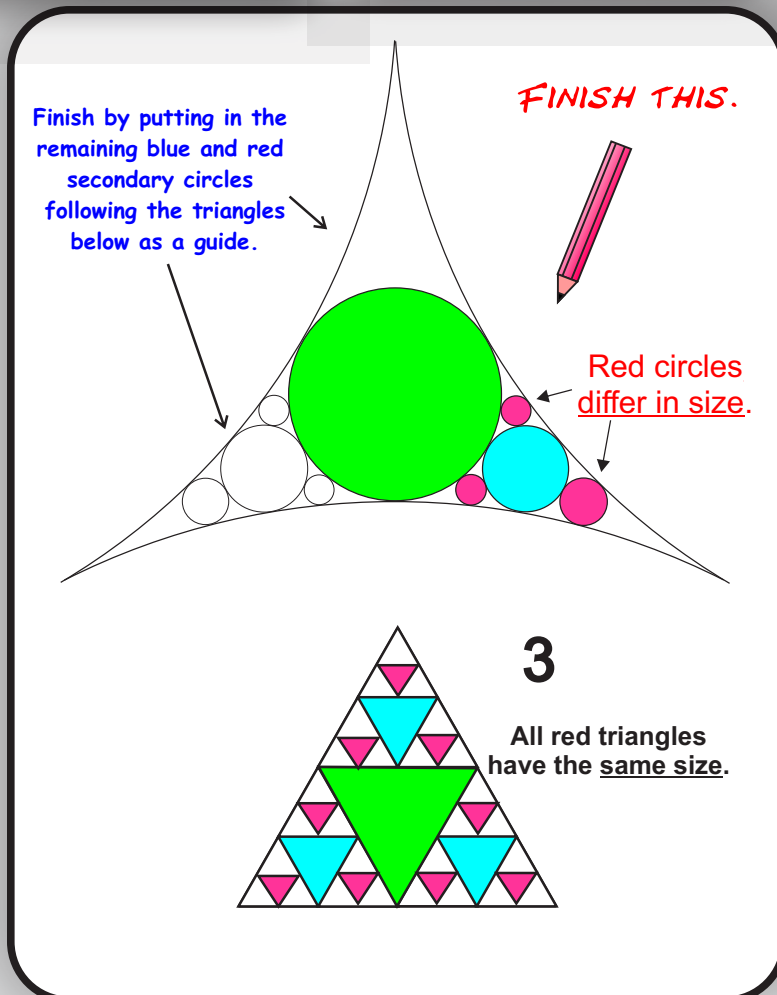
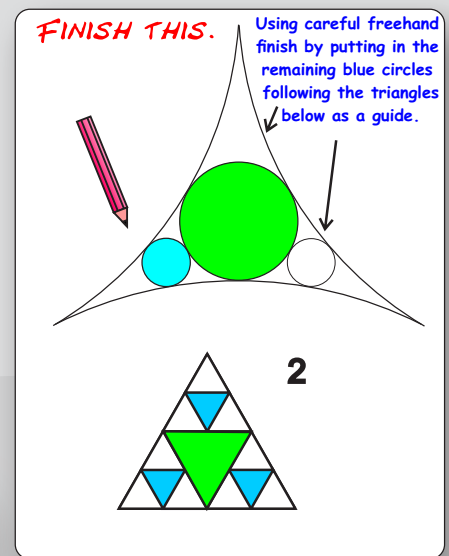
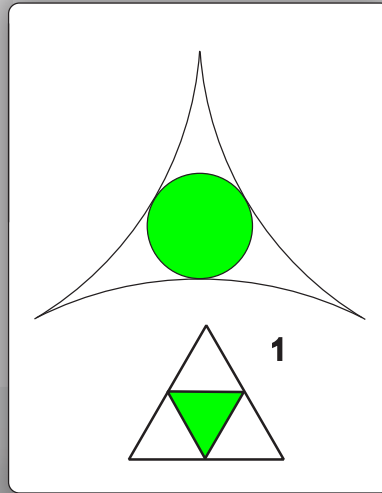
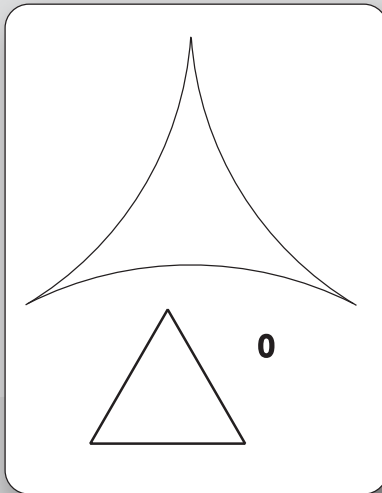
The resulting figure, which can be used to make sets of fractals, has three cusps.



cusps

Follow the four steps below which show how obtaining results in the curved figure is the same as making fractals in the triangular figure. Straight lines of the triangle fractal become curved. However, note that the figures are referred to as "gaskets" and that they are strongly related to the larger formal family of fractals.

Gaskets



Why do you think all blue circles are the same size but the red circles come in two sizes? (see next page).



You need to notice that in stage 3 the sets of circles in red are not identical in size. This contrasts with the triangle version in which the third sets are identical in size.

HAPPY FAMILIES.



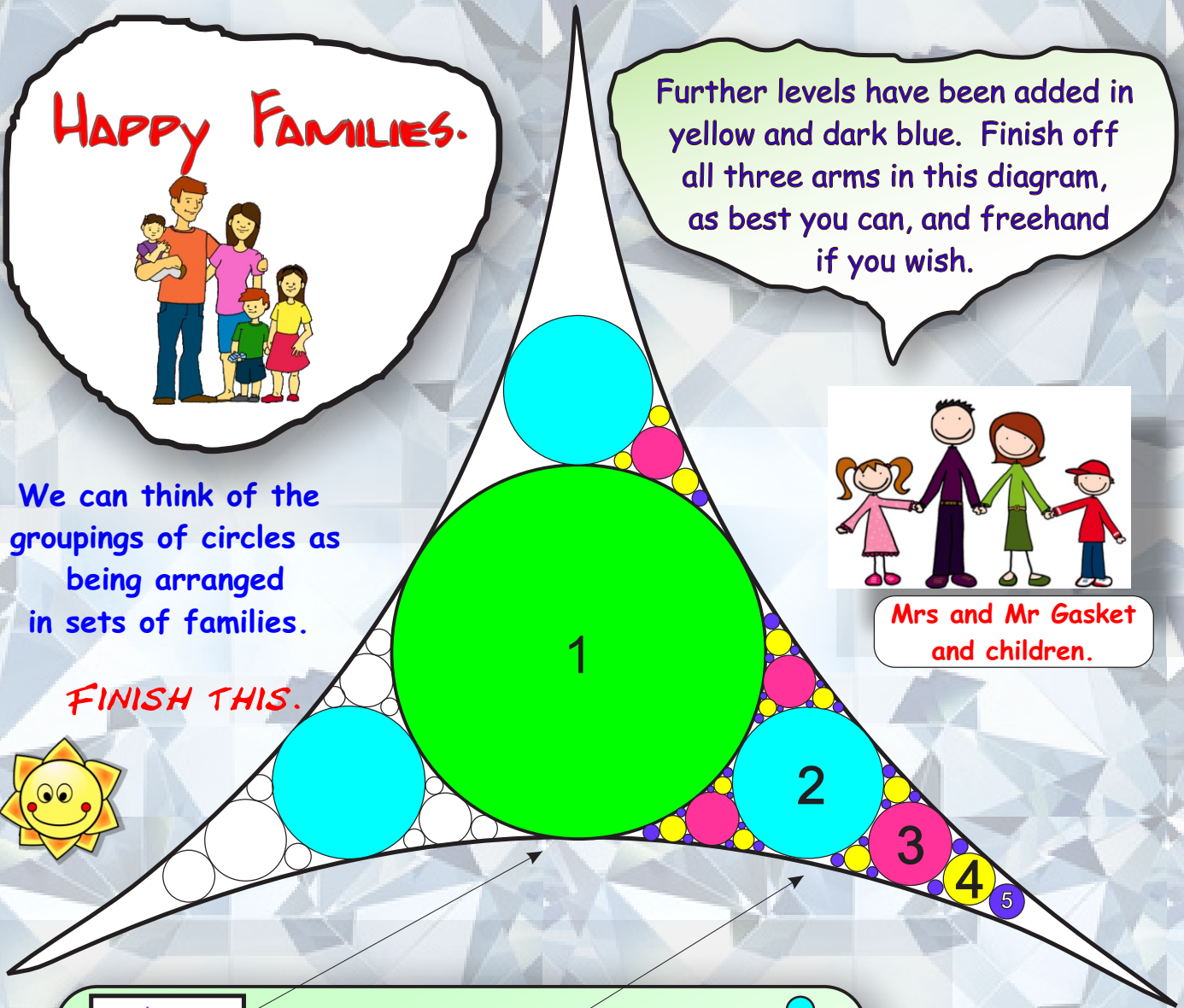
Further levels have been added in yellow and dark blue. Finish off all three arms in this diagram, as best you can, and freehand if you wish.

We can think of the groupings of circles as being arranged in sets of families.

FINISH THIS.

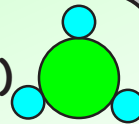


Mrs and Mr Gasket and children.



At the start:

Mrs Green at 1 has three children (blue)



Then in this numbered cusp only:

Mrs Blue at 2 has three children (red)



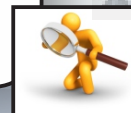
Mrs Red at 3 has three children (yellow)



Mrs Yellow at 4 has three children (dark blue)



Mrs Dark Blue at 5 has no children, yet!



- Q1: for this cusp only, how many great grandchildren does Mrs Green have?
 Q2: for this cusp only, how many grandchildren does Mrs Red at 3 have?
 Q3: for this cusp only, how many grandchildren of any parentage are there ?
 Q4: for the full figure of three cusps, what is the total population?