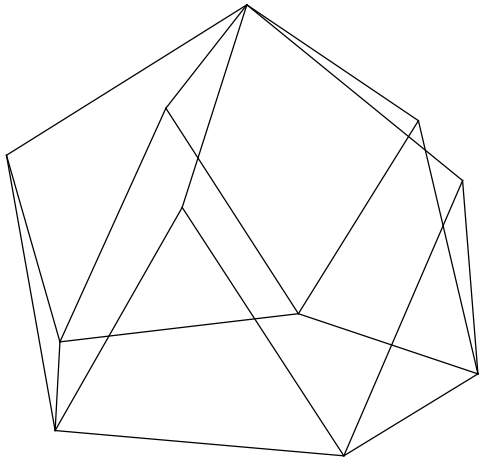
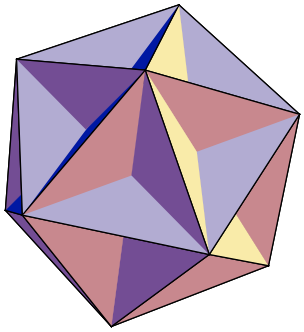
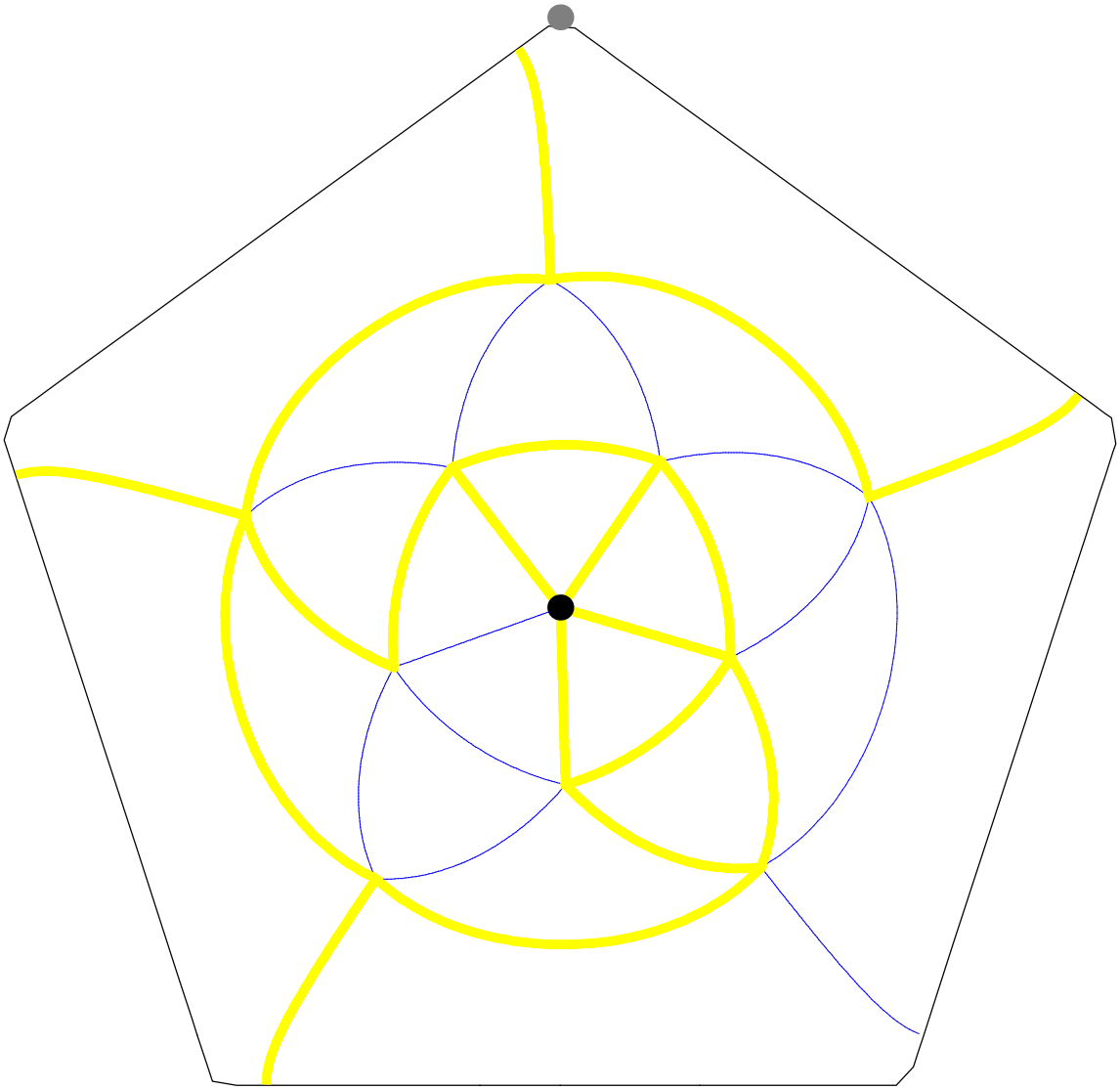
Izidor Hafner

Mazes on Uniform Polyhedra



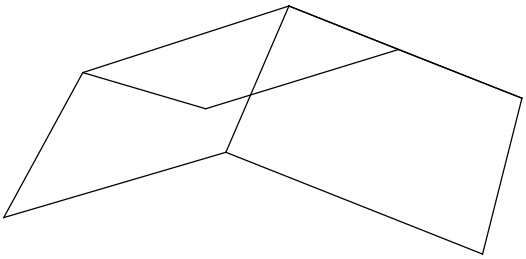


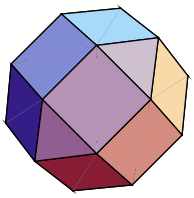


Introduction

Let as take an example. We are given a uniform polyhedron.

`rhombicuboctahedron` {4, 3, 4, 4}

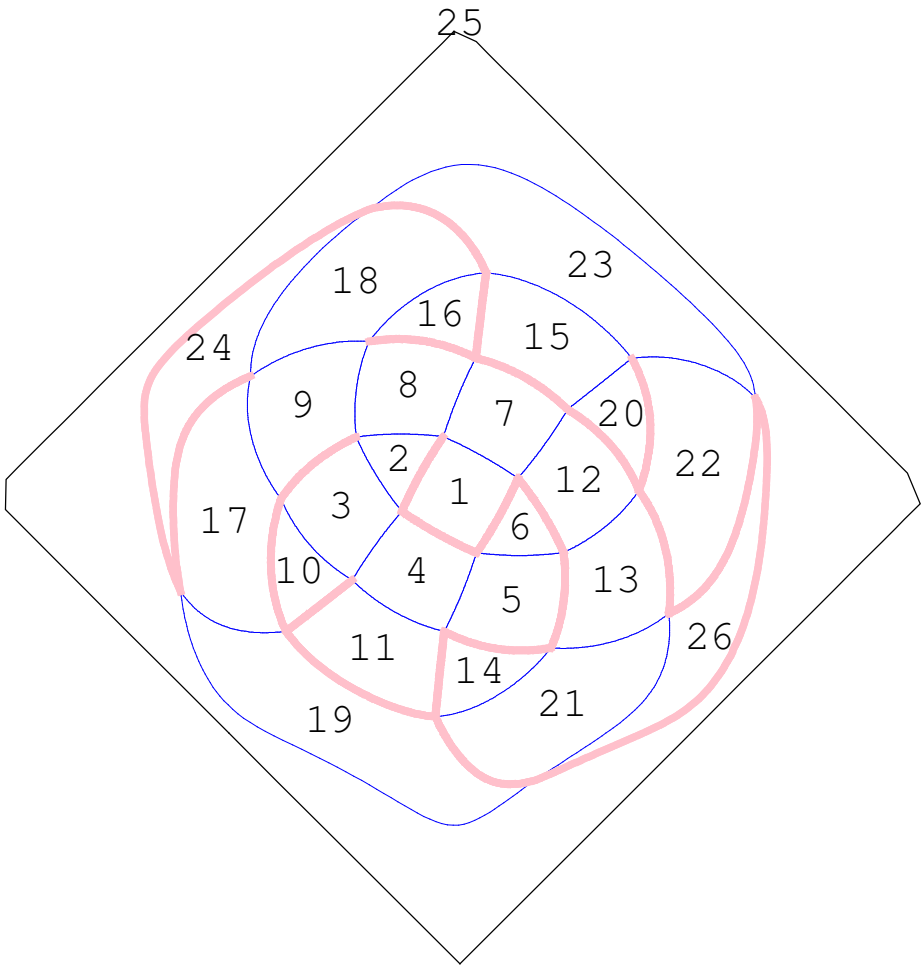


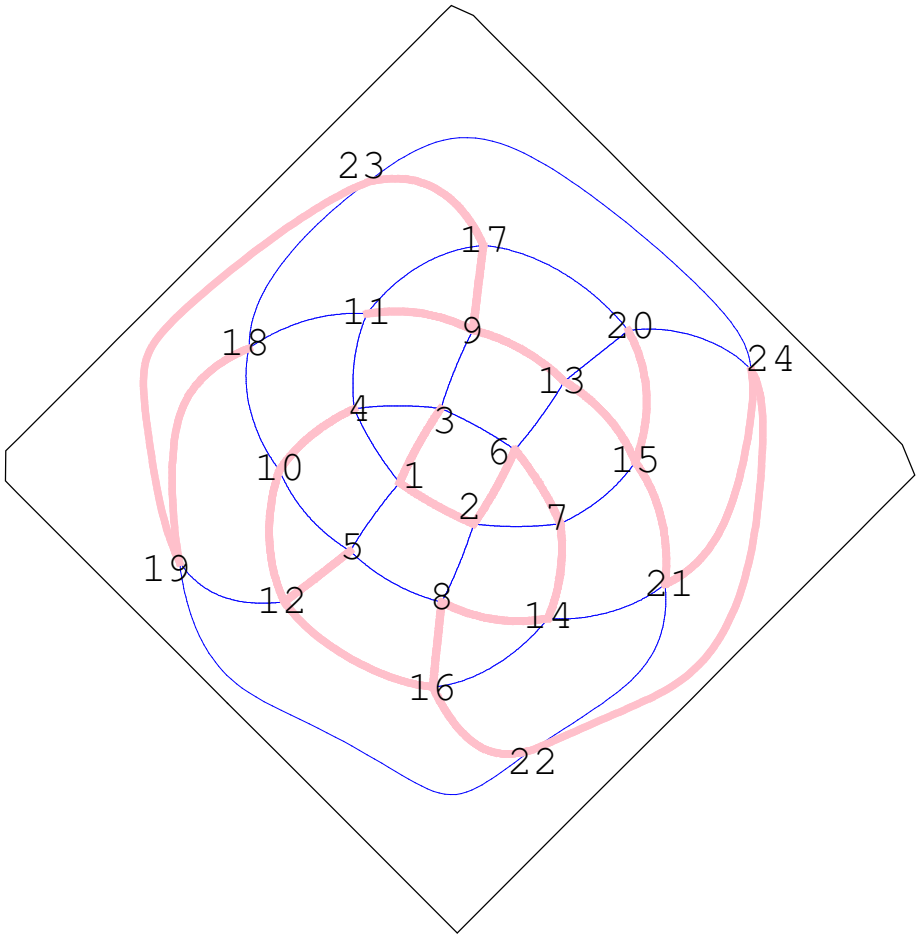


In Mathematica the polyhedron is given by a list of faces and with a list of koordinates of vertices [Roman E. Maeder, The Mathematica Programmer II, Academic Press1996]. The list of faces consists of a list of lists, where a face is represented by a list of vertices, which is given by a matrix. Let us show the first five faces:

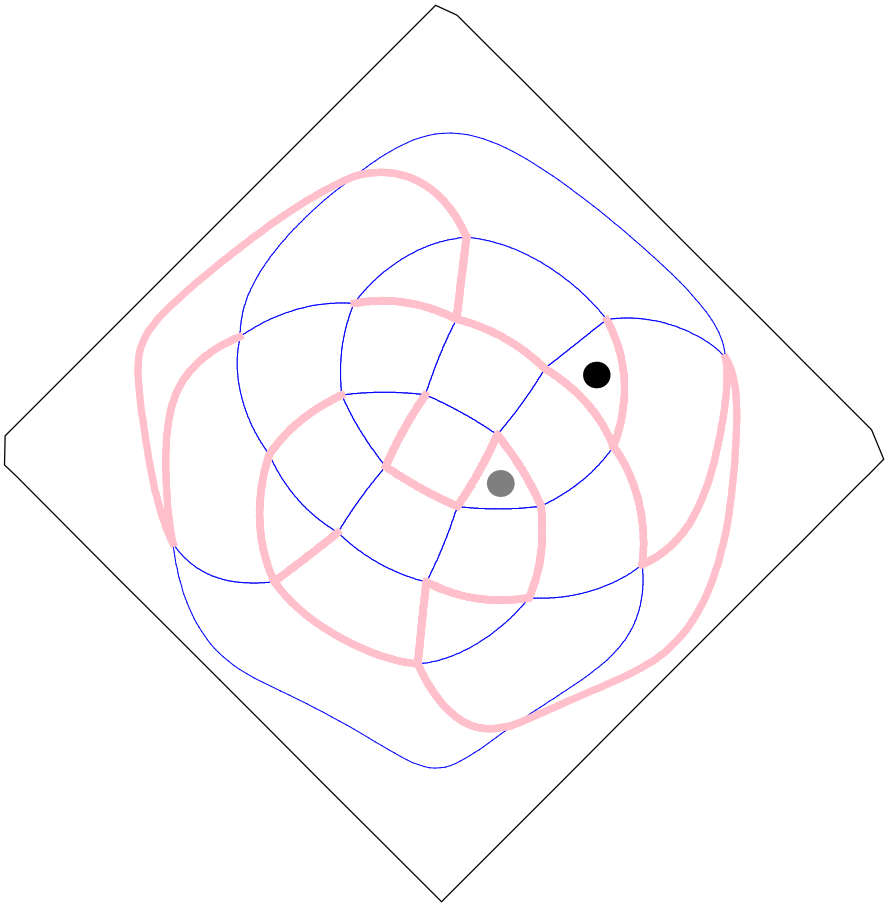
```
{{1, 2, 6, 3},
 {1, 3, 4},
 {1, 4, 10, 5},
 {1, 5, 8, 2},
 {2, 8, 14, 7}}
```

The nest two figures represent faces and vertices. The polyhedron is projected onto supescribed sphere and the sphere is projected by a cartographic projection.

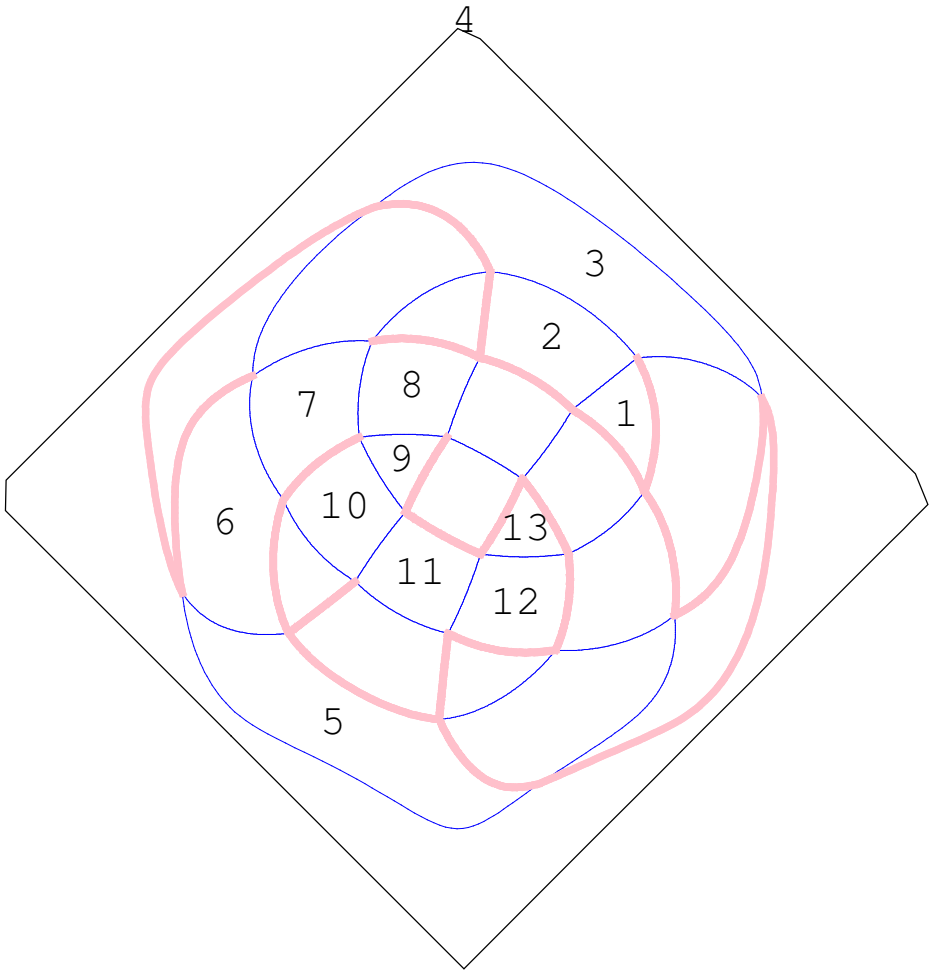




The problem is to find the path from the black dot to gray dot, where thick lines represent walls of a maze.



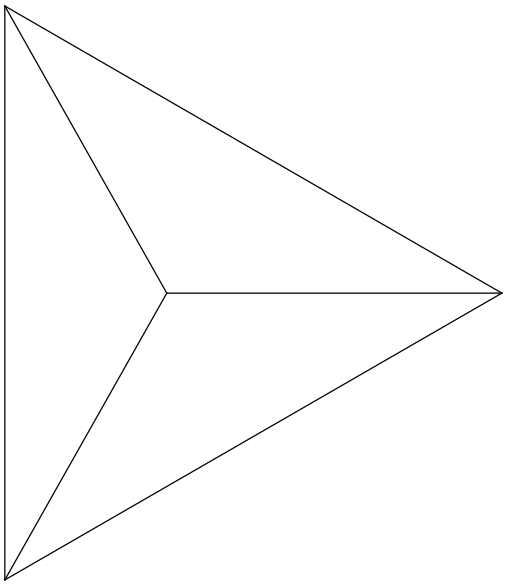
The solution is given by a list of faces passed from the black to gray dot.

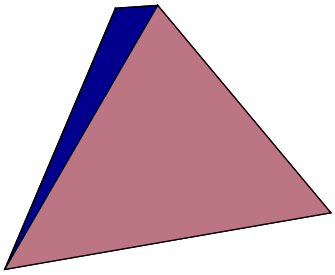


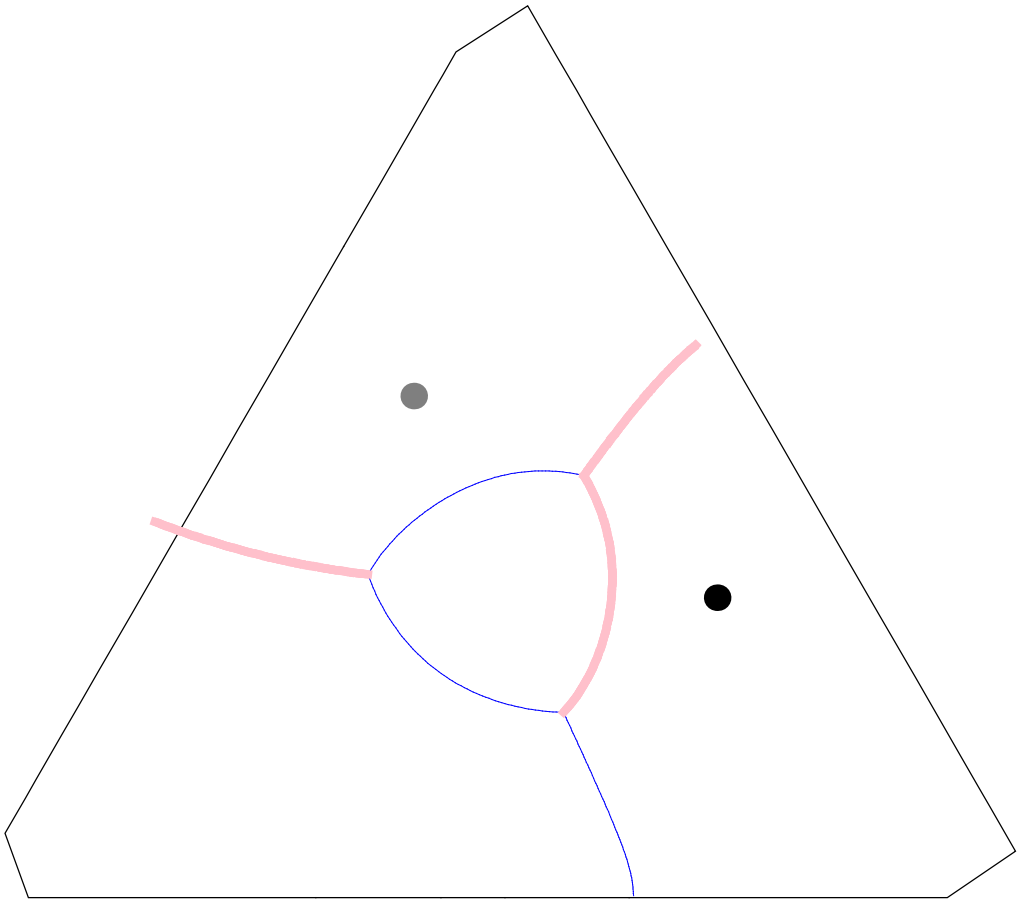
Problems

3.

`tetrahedron` {3, 3, 3}

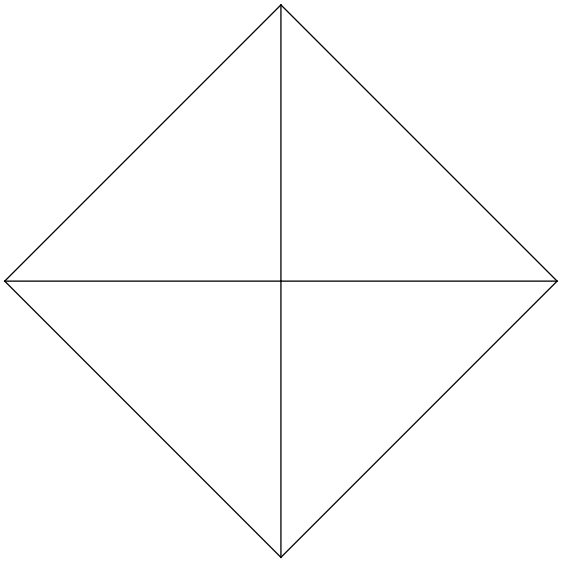


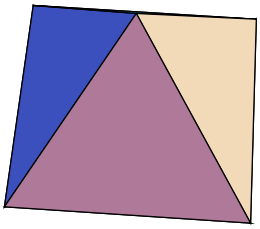


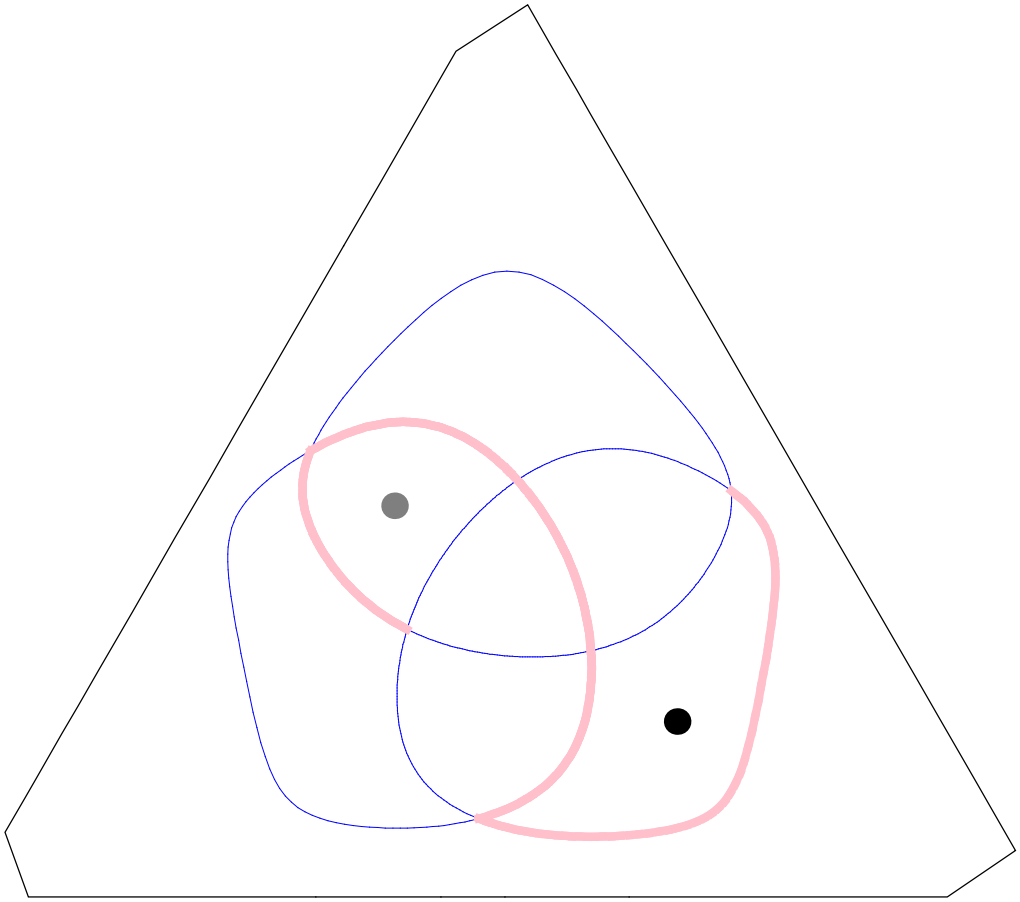


4.

`octahedron` {3, 3, 3, 3}

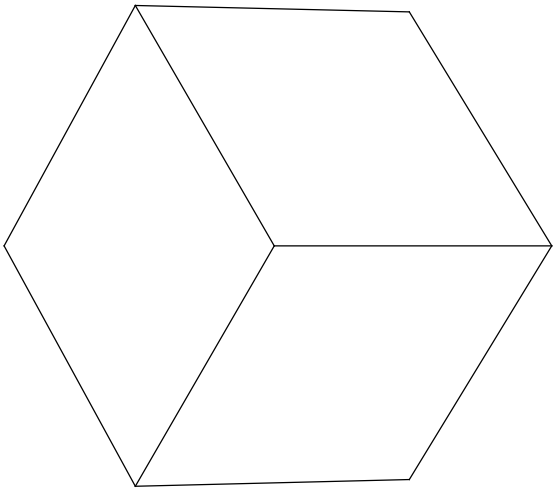


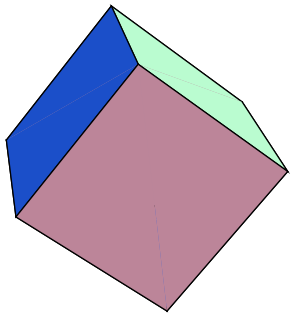


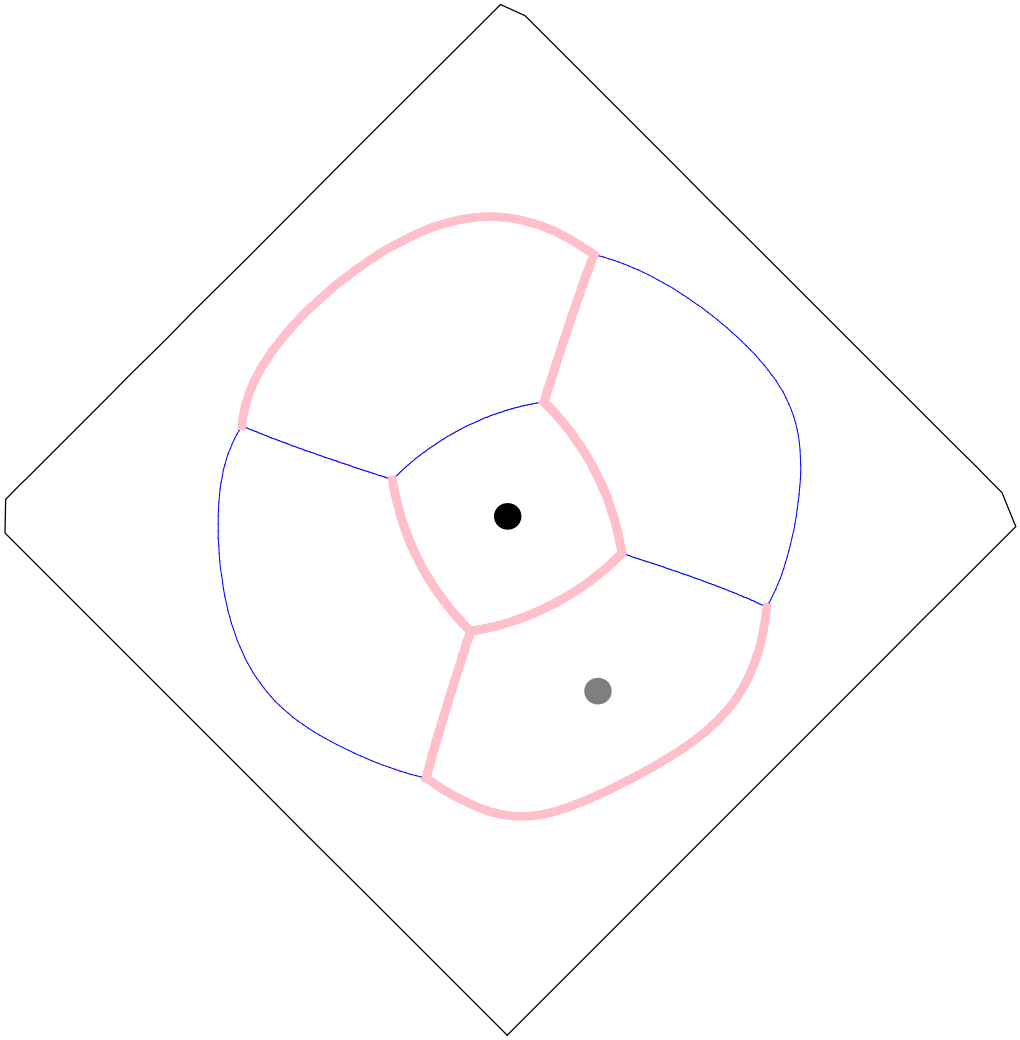


5.

`cube` {4, 4, 4}

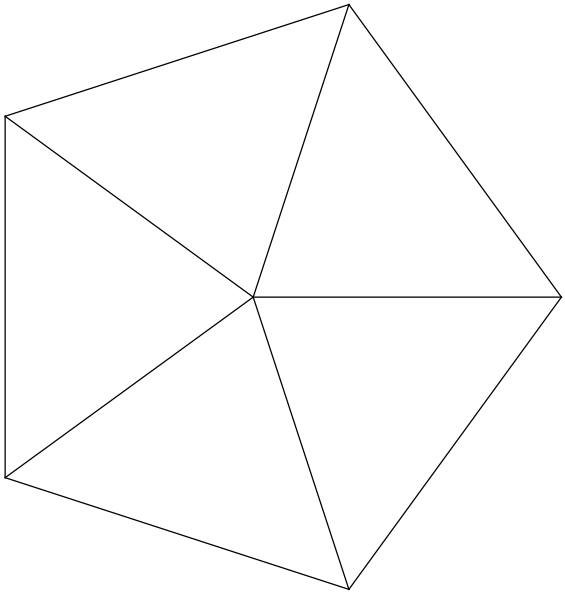


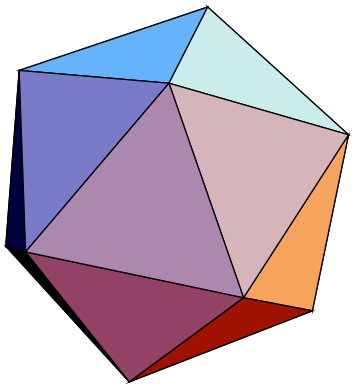


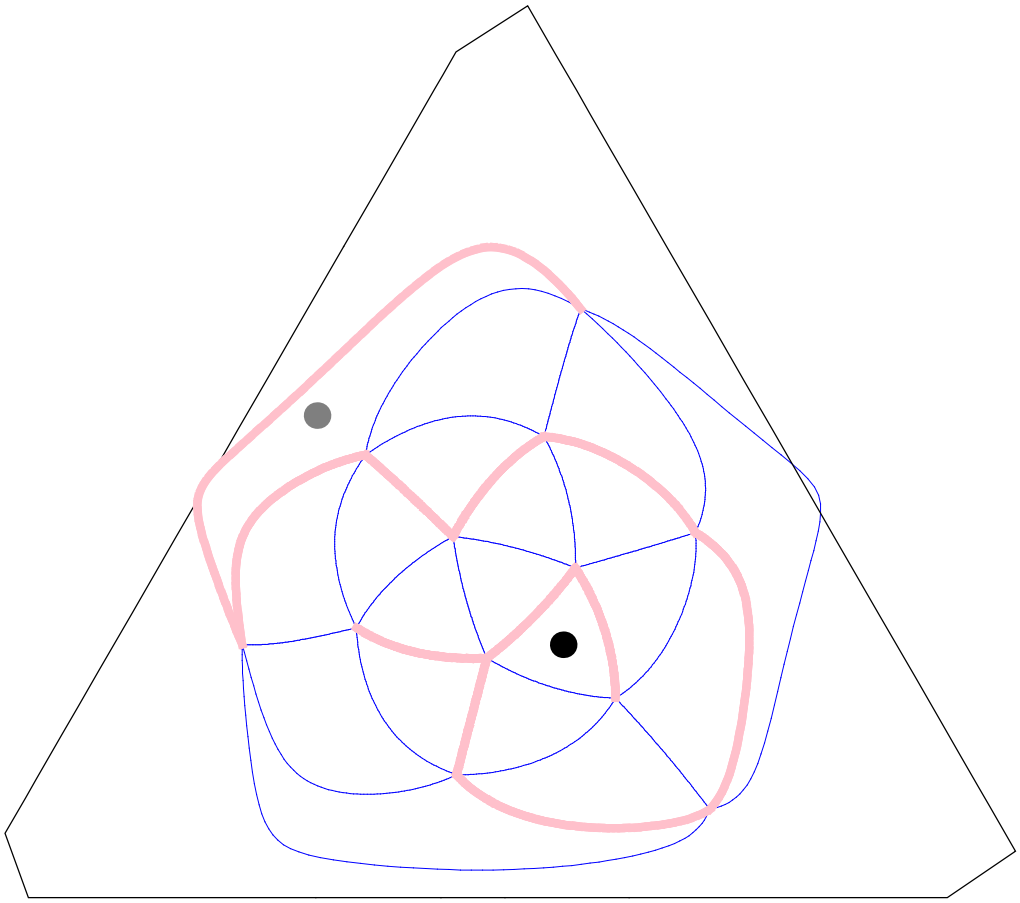


6.

`icosahedron` {3, 3, 3, 3, 3}

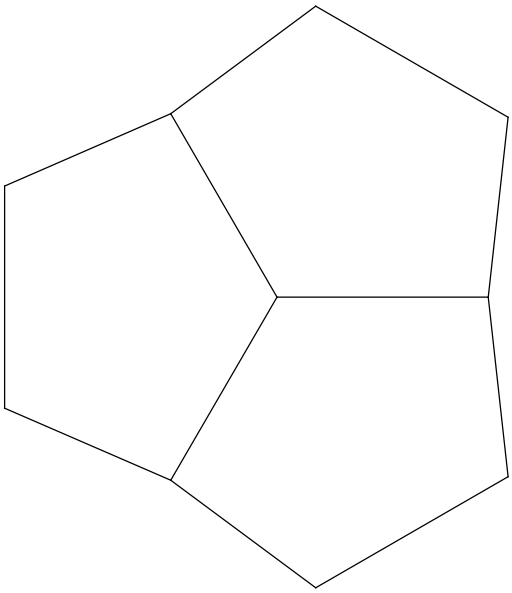


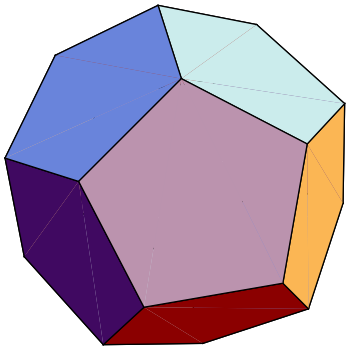


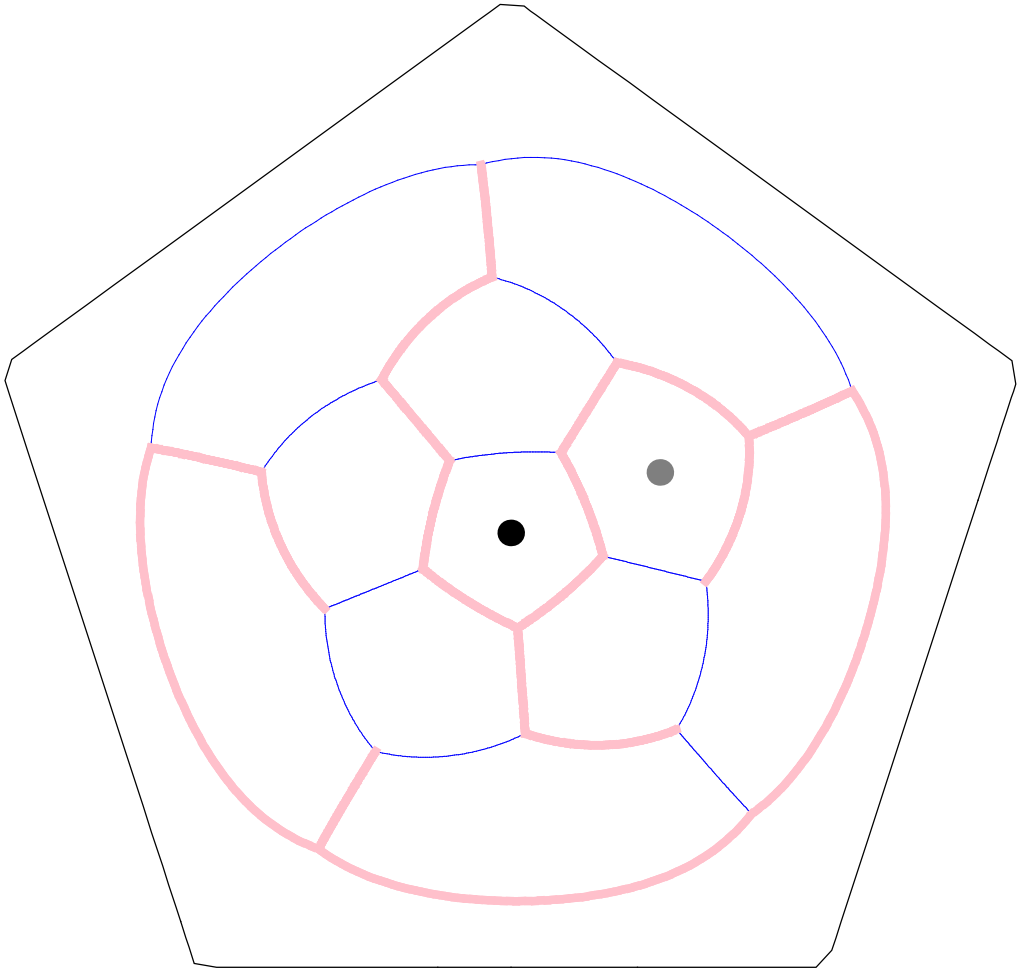


7.

`dodecahedron` {5, 5, 5}

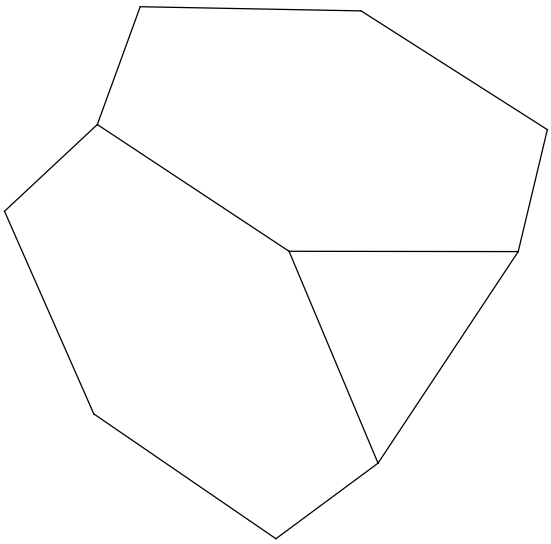


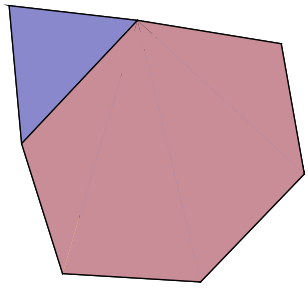


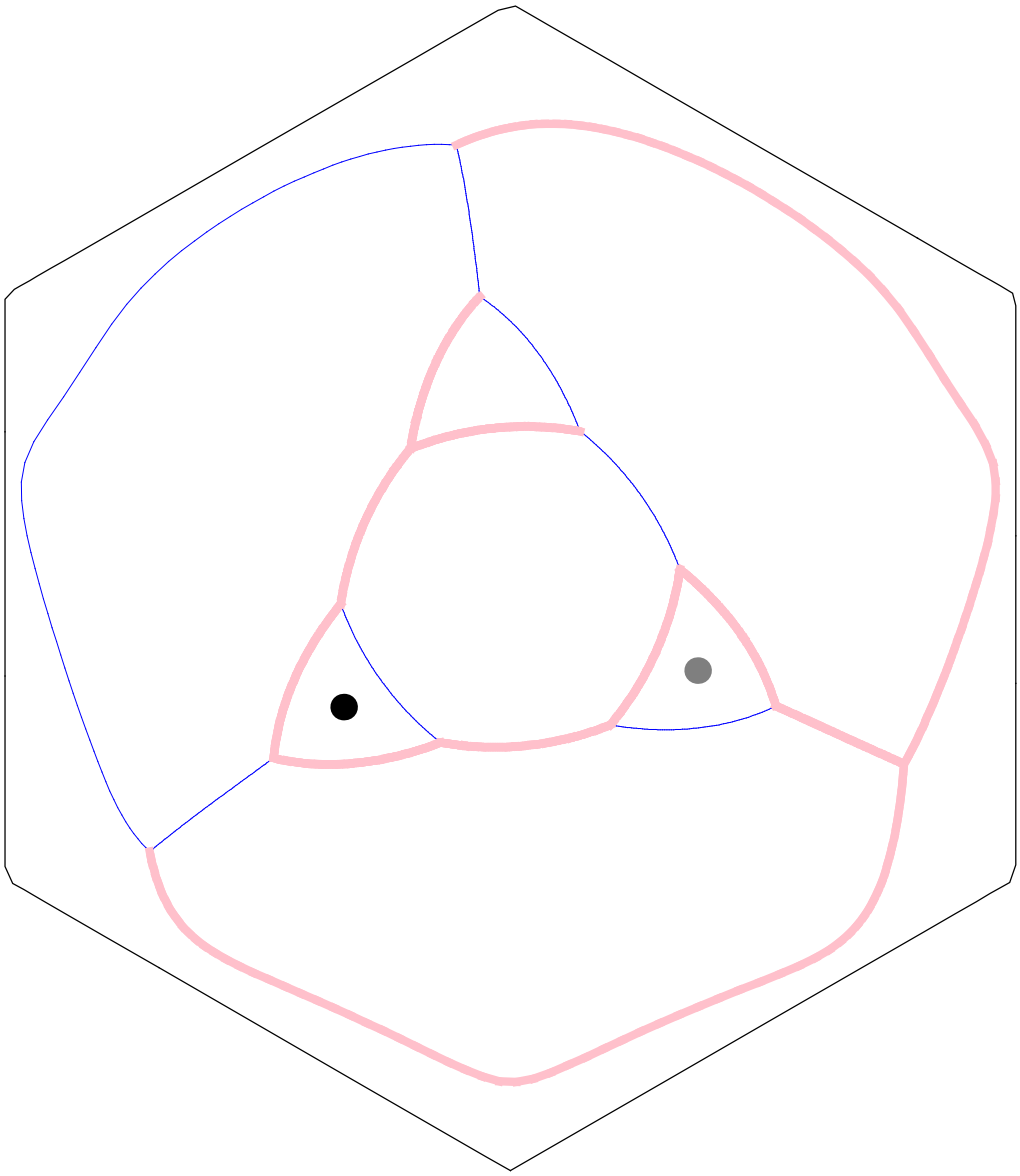


8.

`truncated tetrahedron` {6, 6, 3}

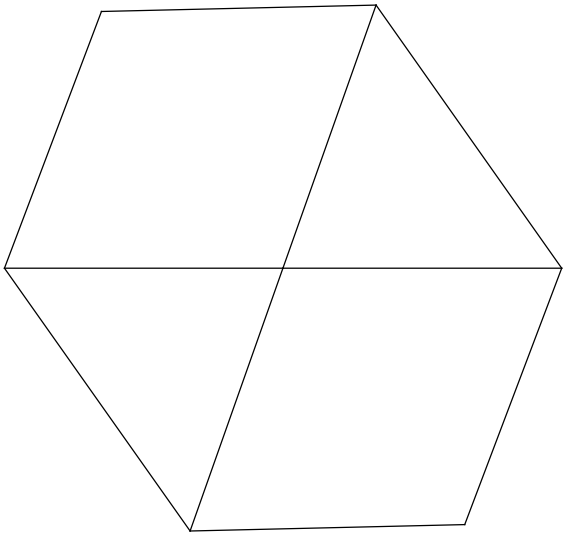


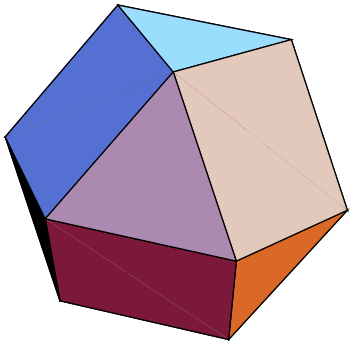


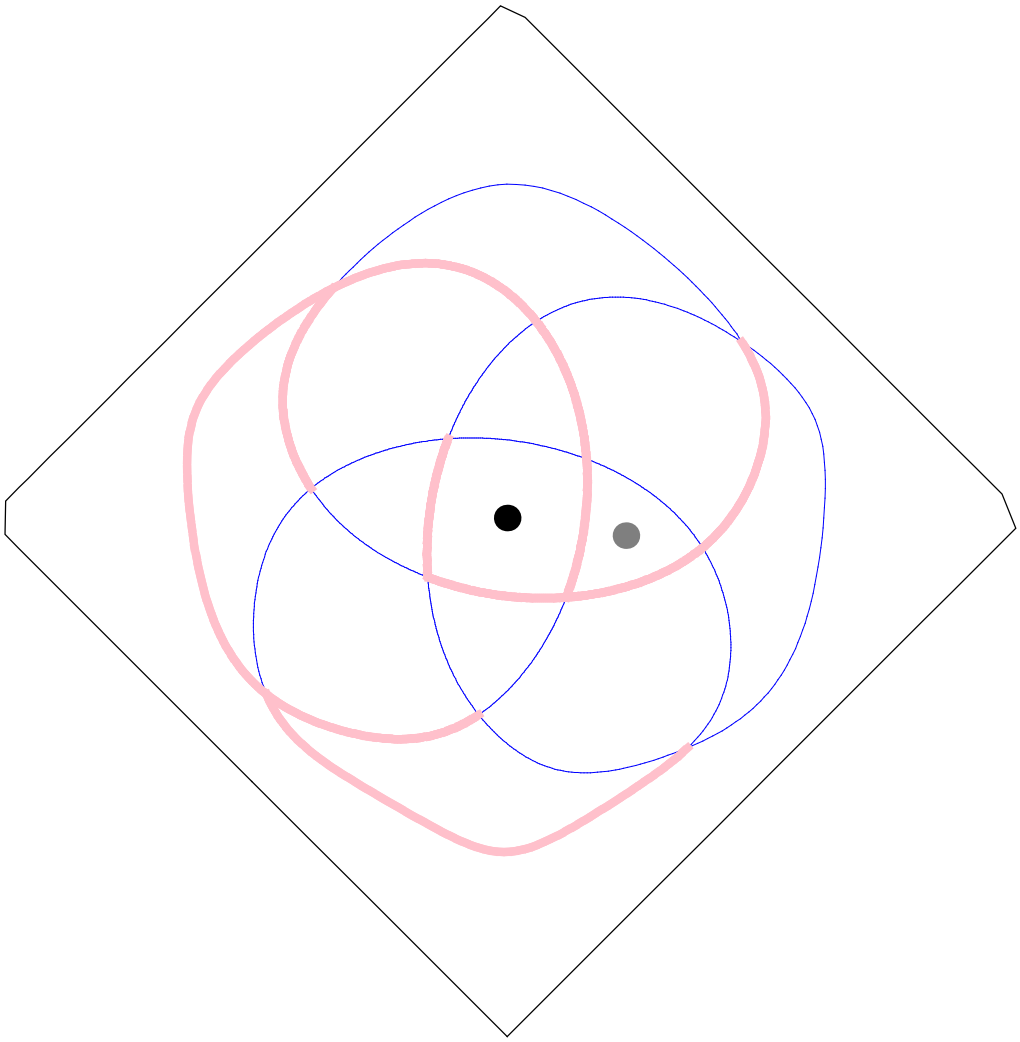


9.

`cuboctahedron` {3, 4, 3, 4}

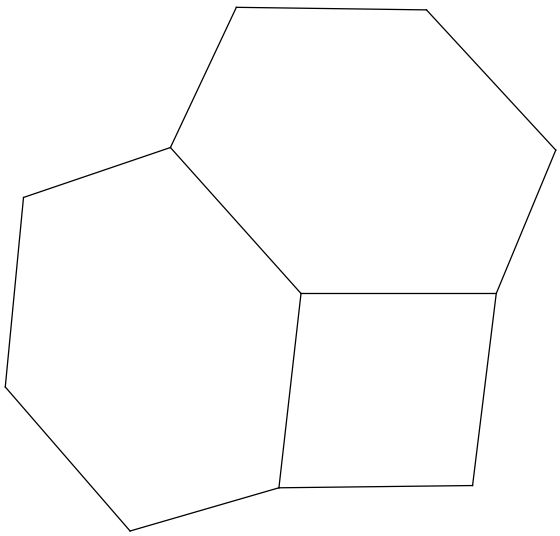


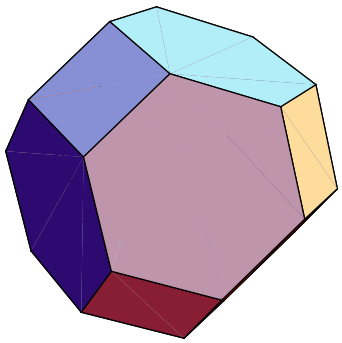


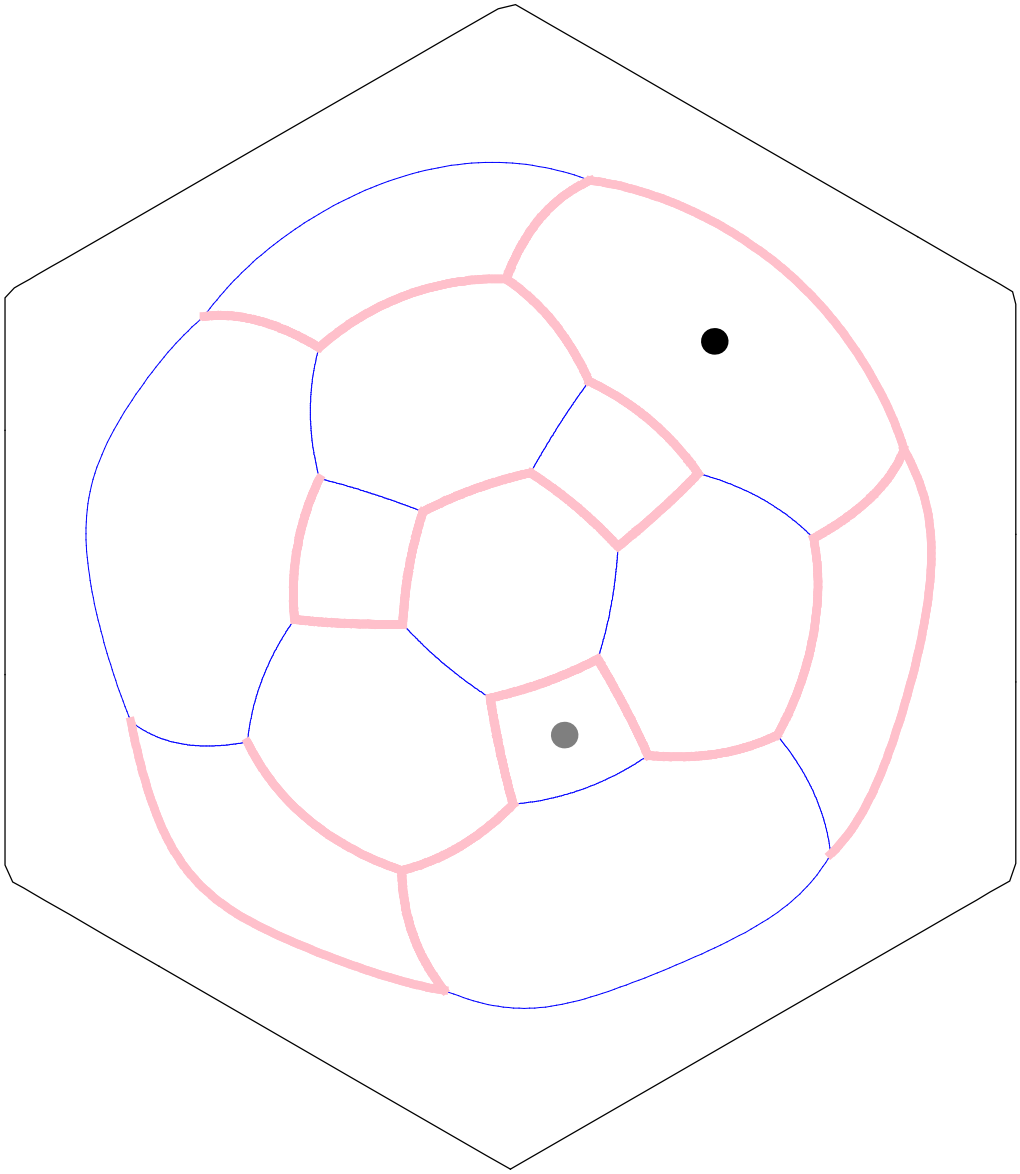


10.

`truncated octahedron` {6, 6, 4}

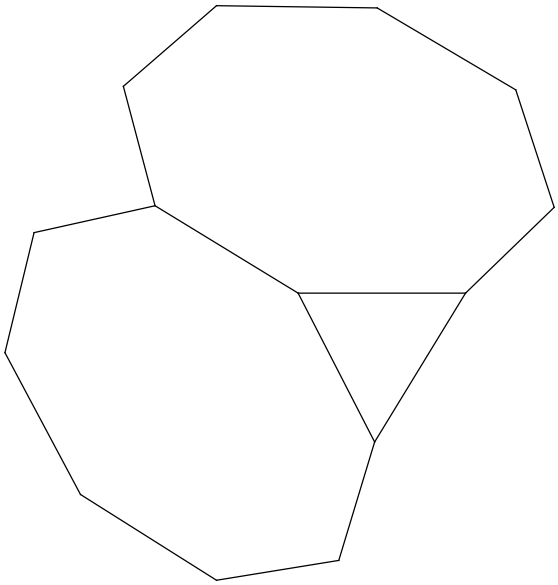


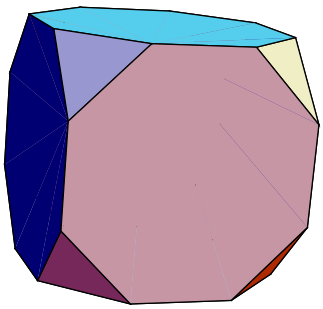


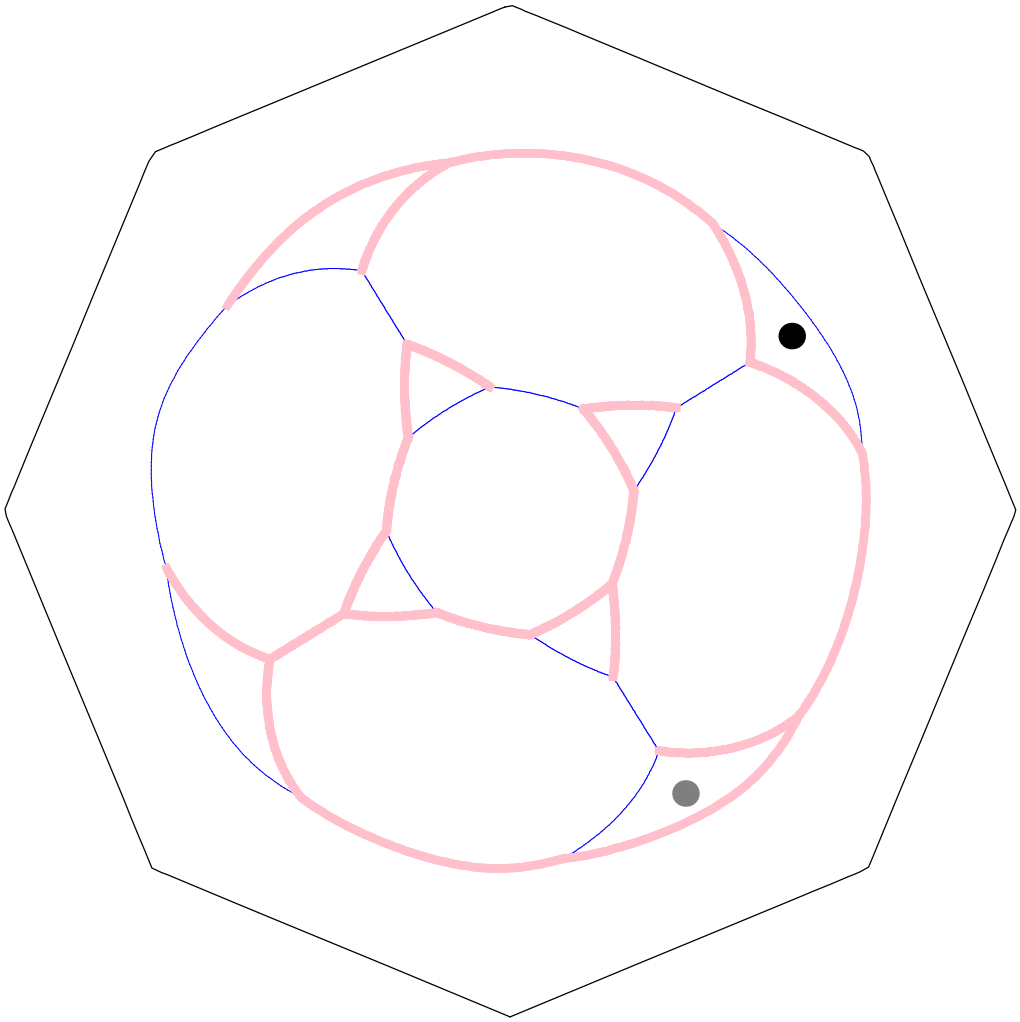


11.

`truncated cube` {8, 8, 3}

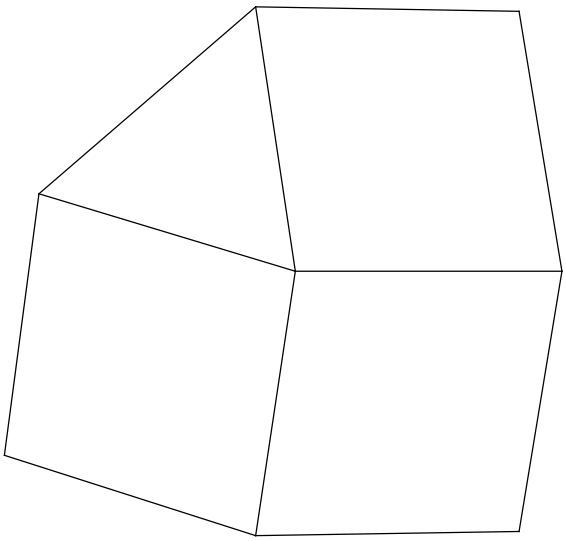


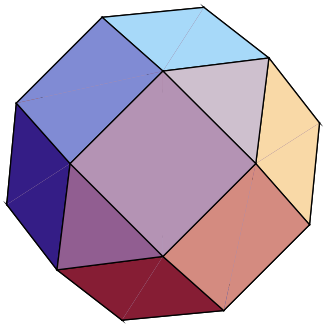


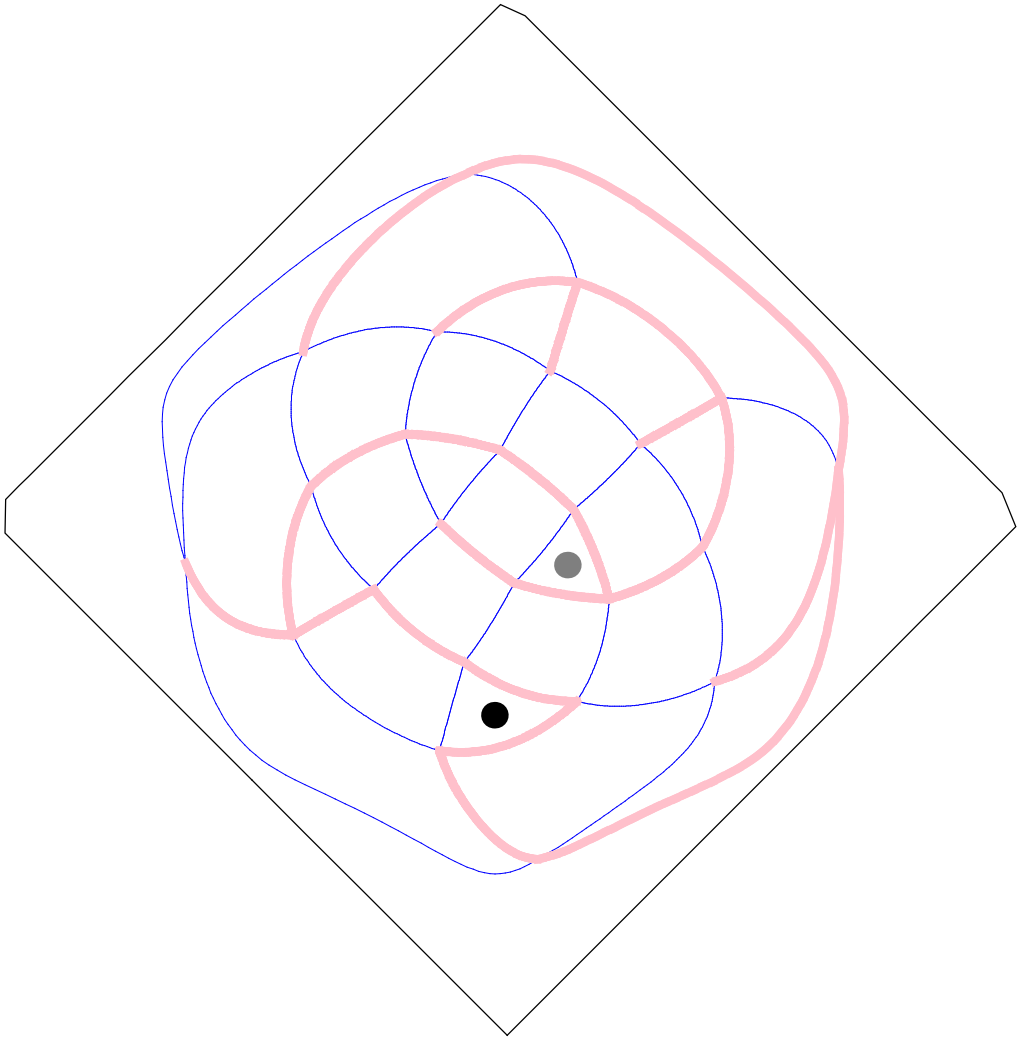


12.

`rhombicuboctahedron` {4, 3, 4, 4}

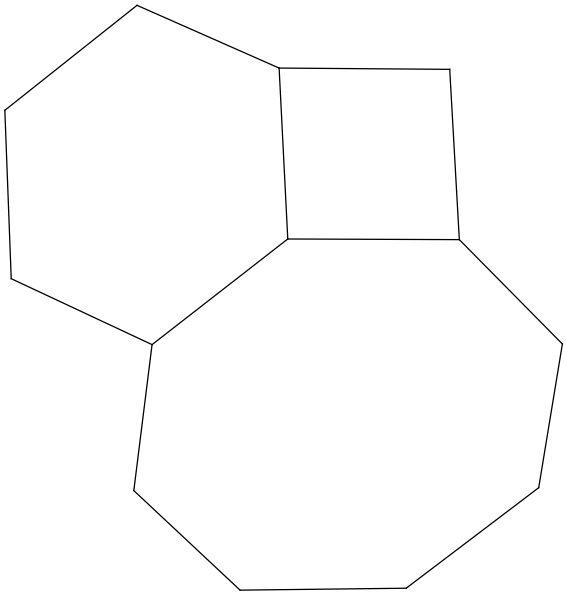


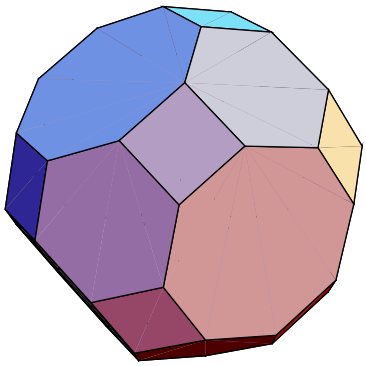


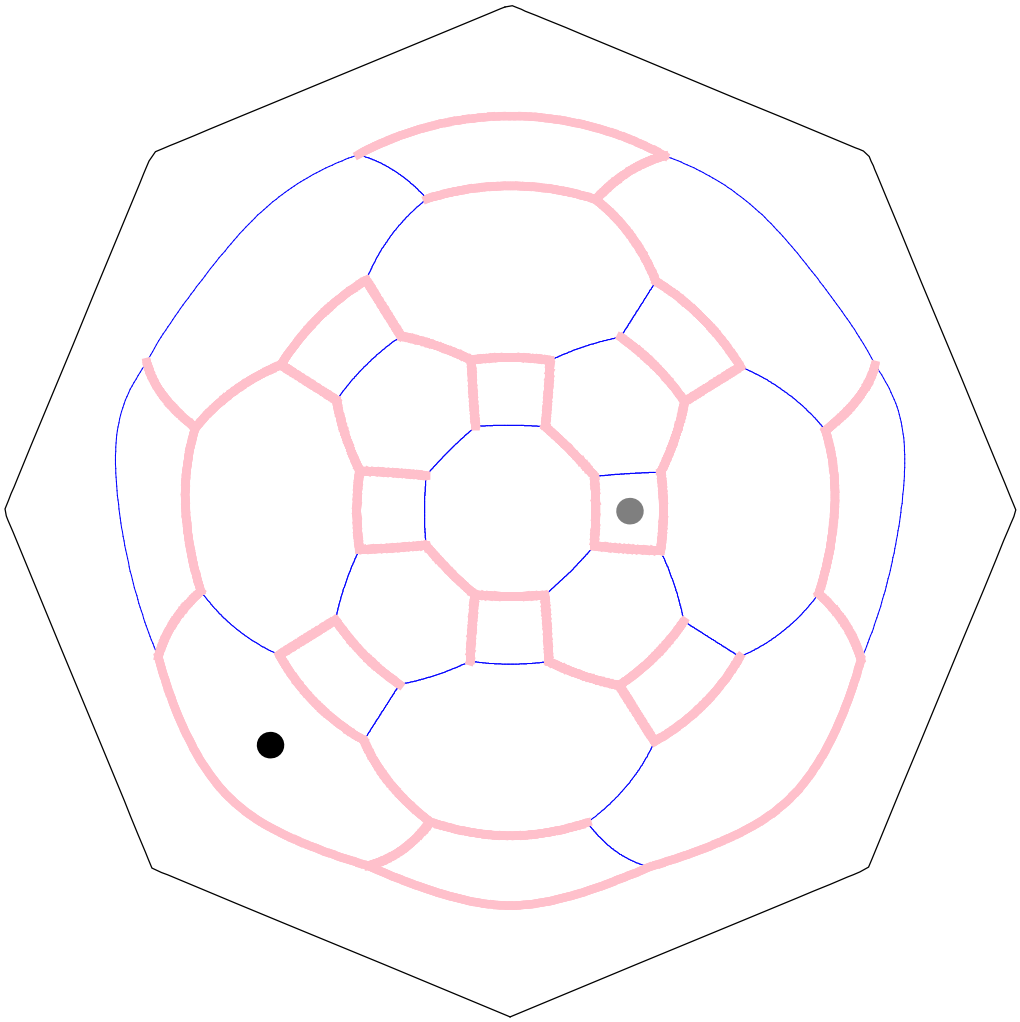


13.

`truncated cuboctahedron` {4, 6, 8}

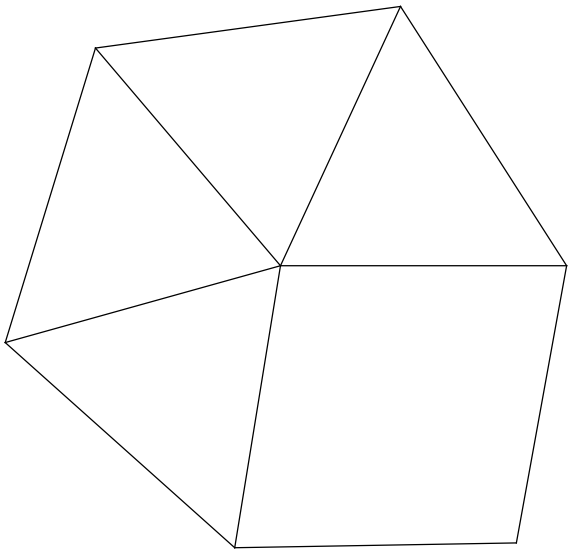


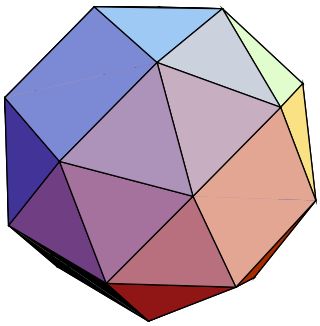


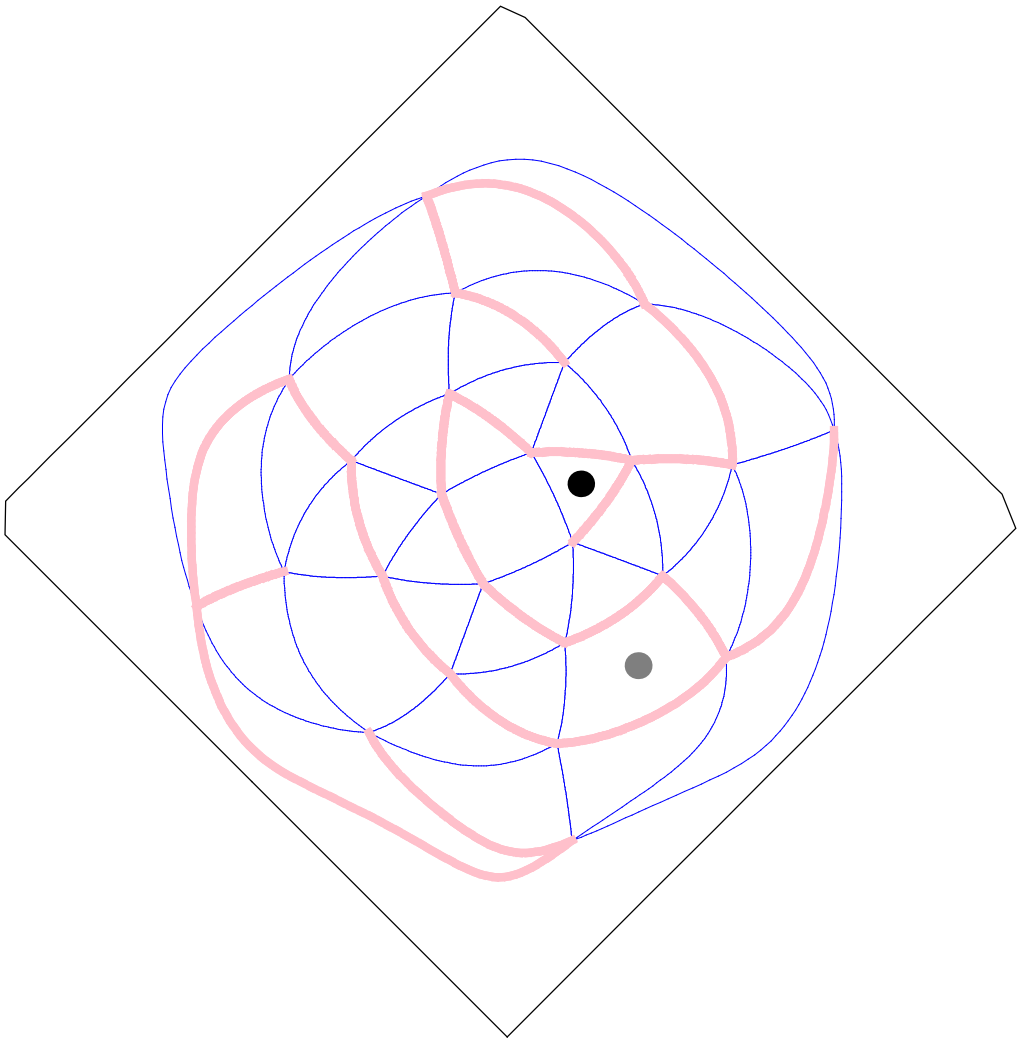


14.

`snub cube` {3, 3, 3, 3, 4}

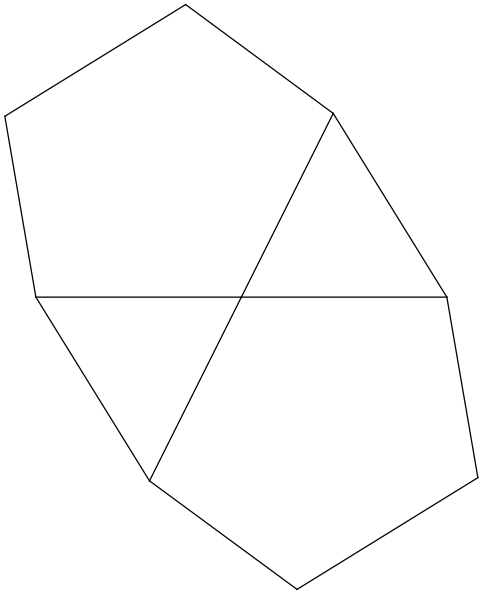


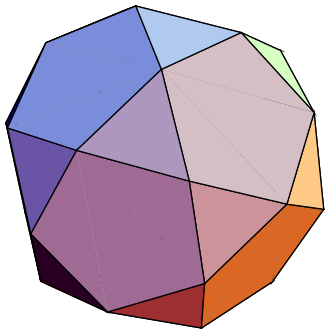


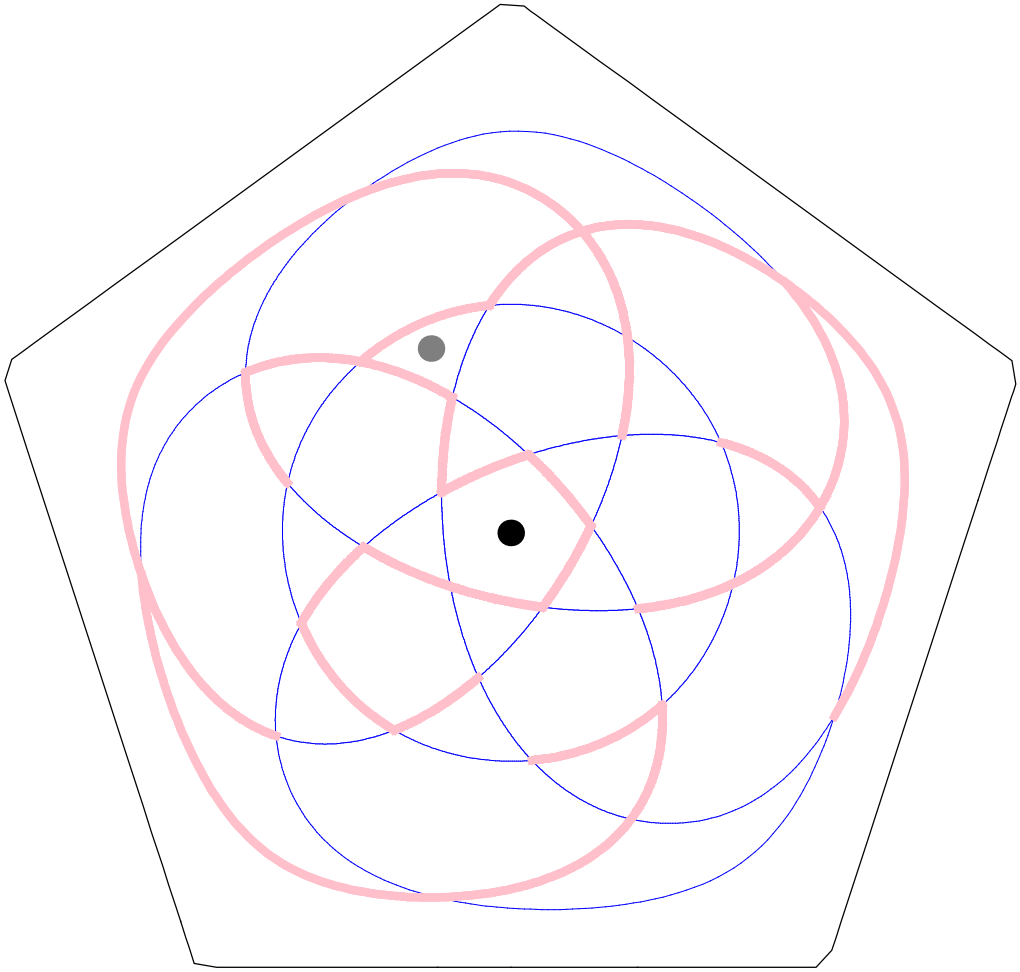


15.

`icosidodecahedron` {3, 5, 3, 5}

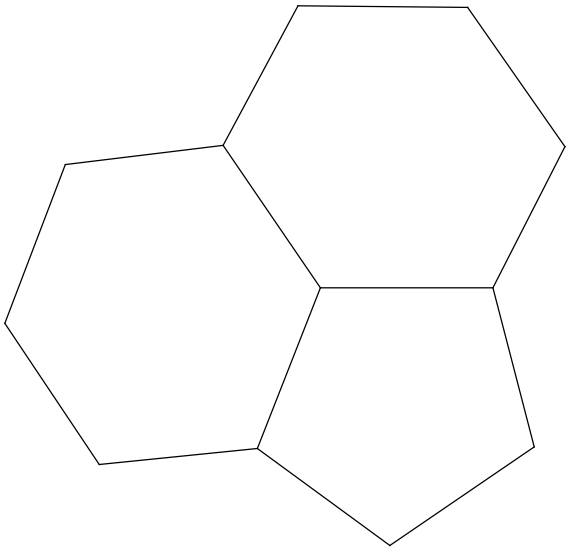


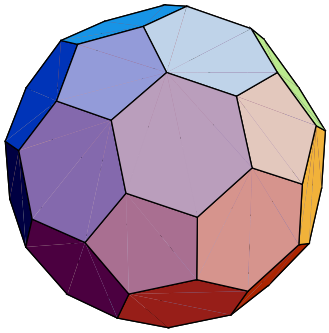


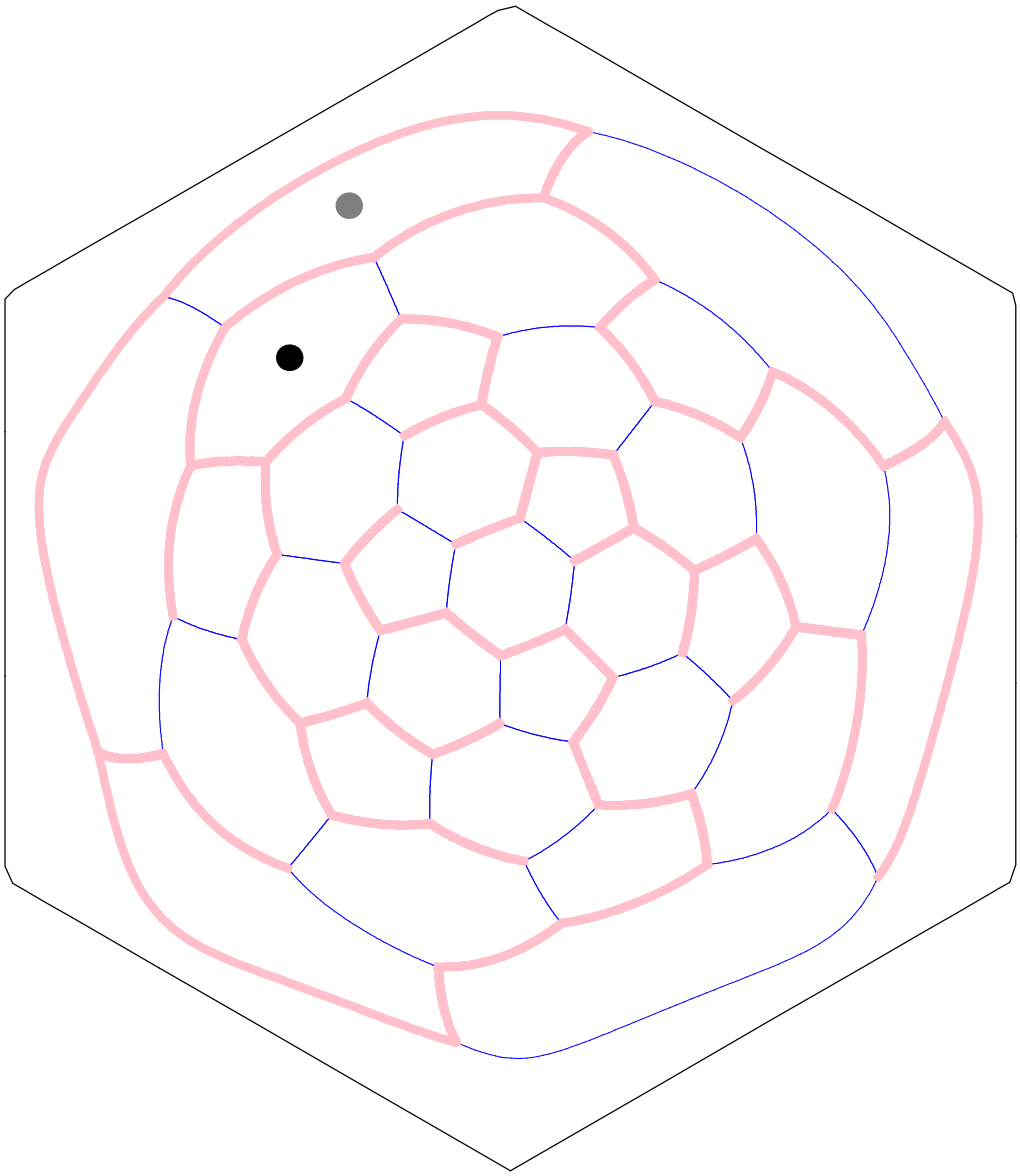


16.

`truncated icosahedron` {6, 6, 5}

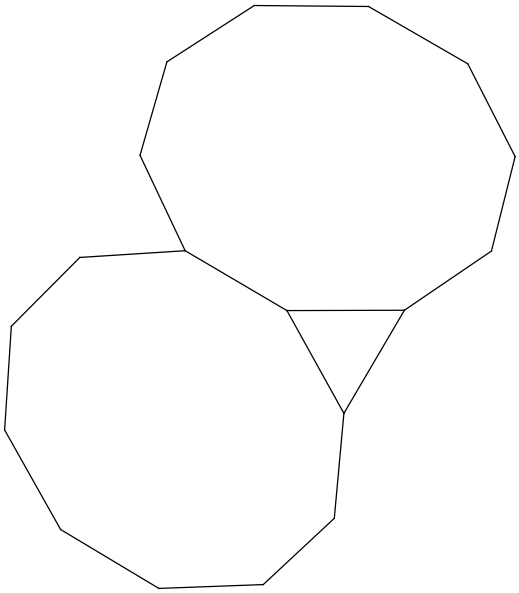


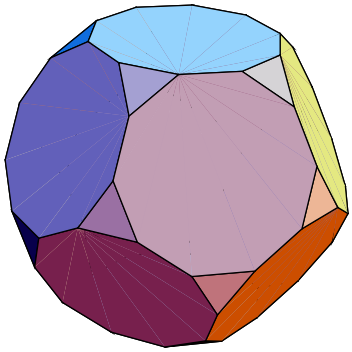


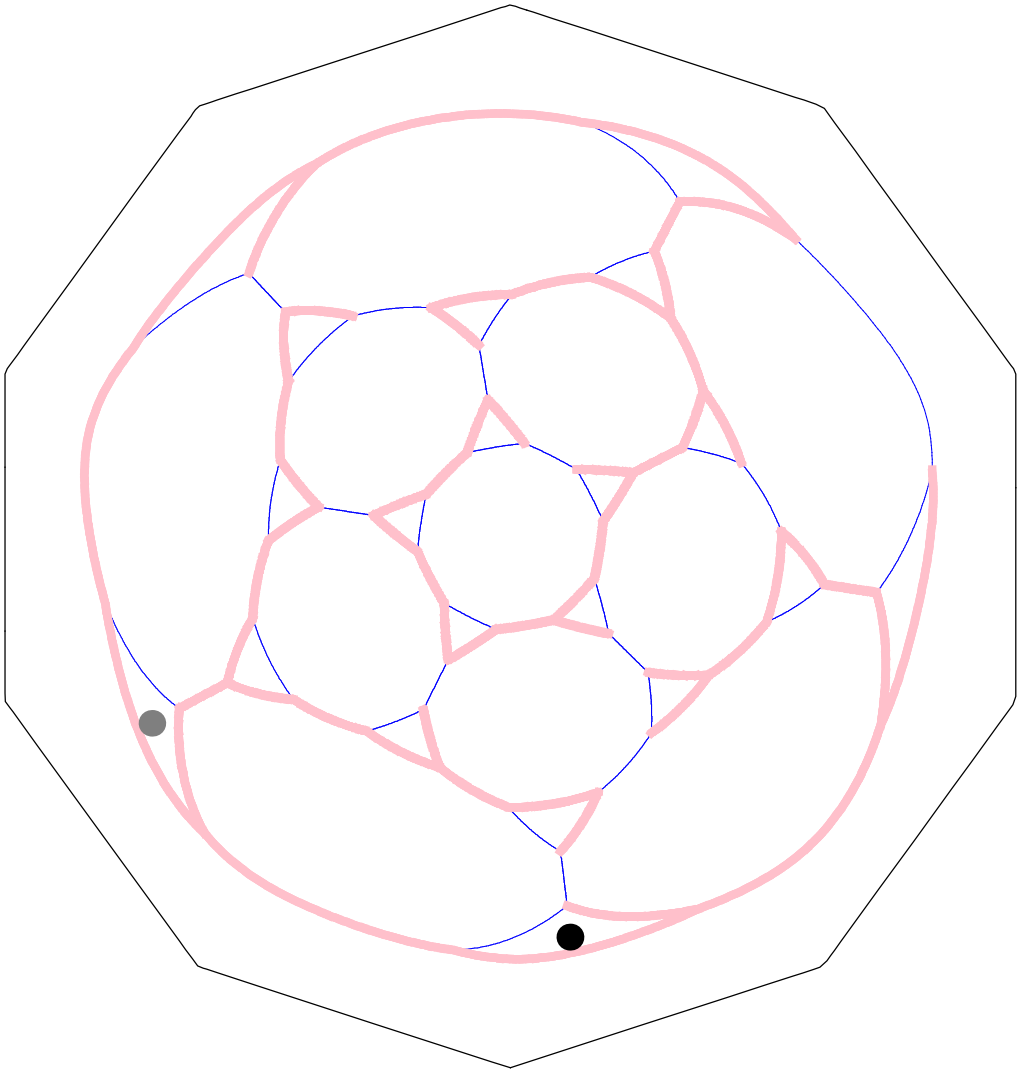


17.

`truncated dodecahedron` {10, 10, 3}

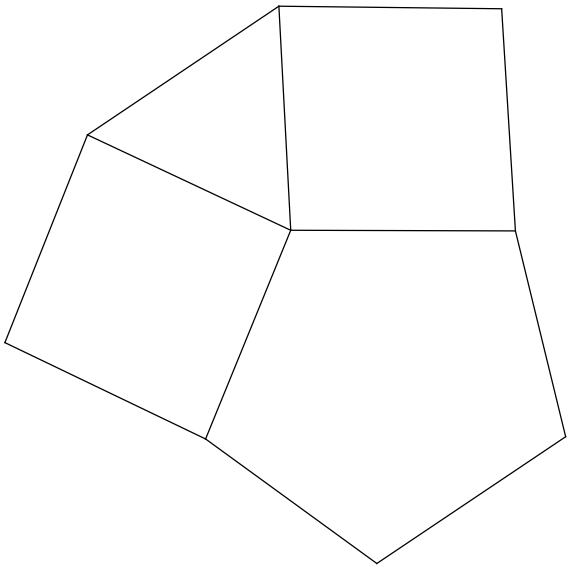


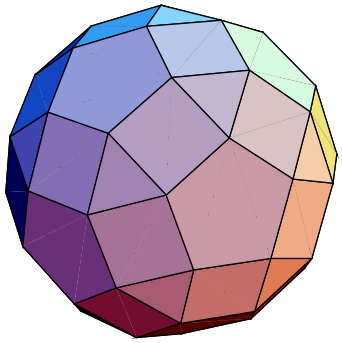


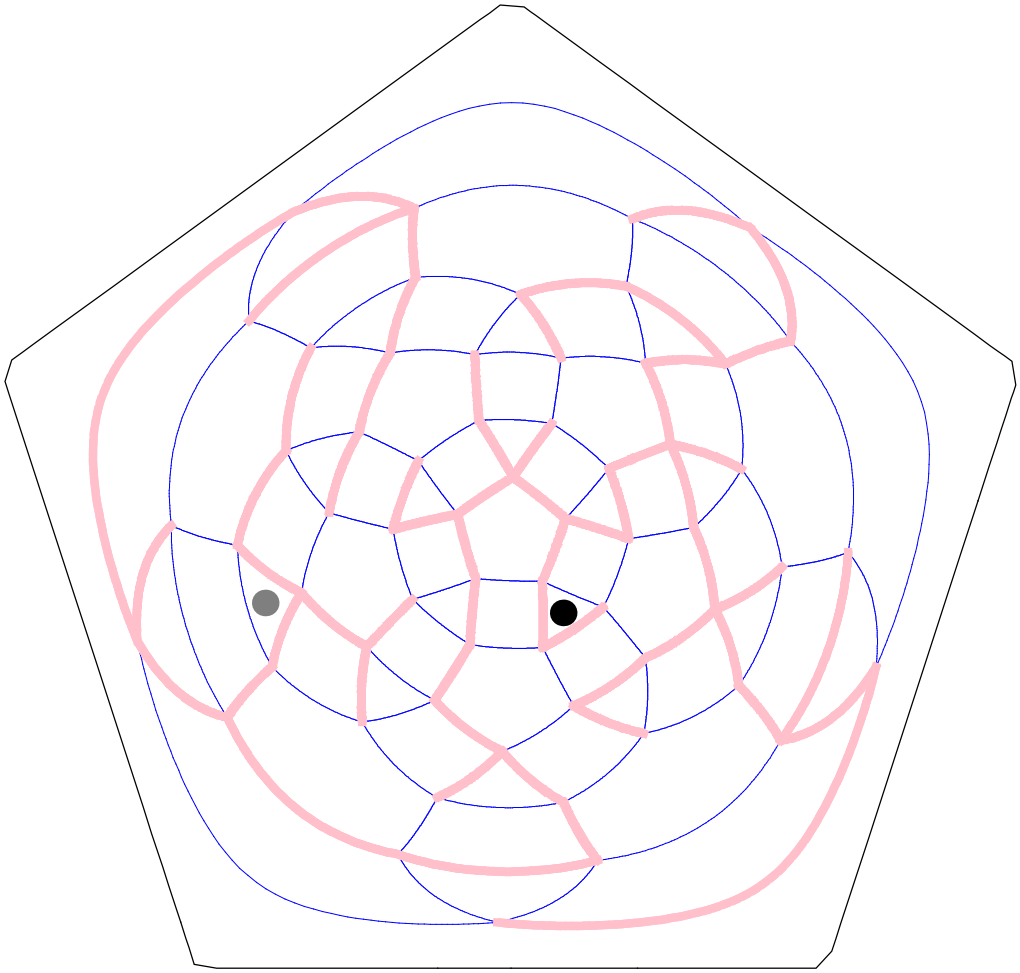


18.

`rhombicosidodecahedron` {4, 3, 4, 5}

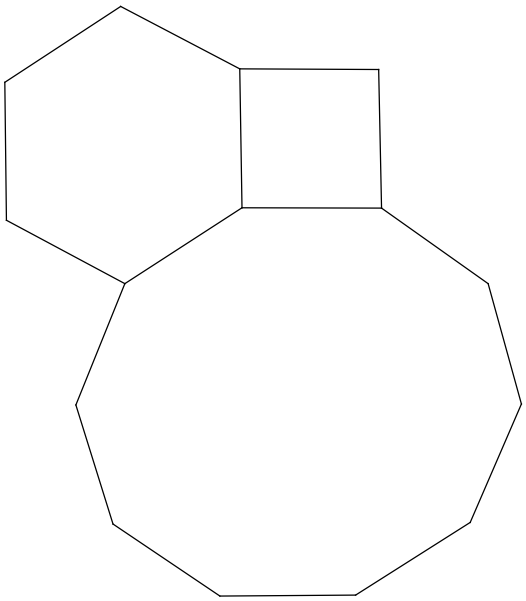


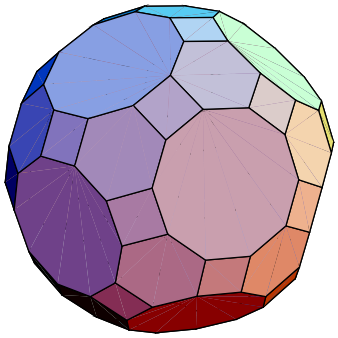


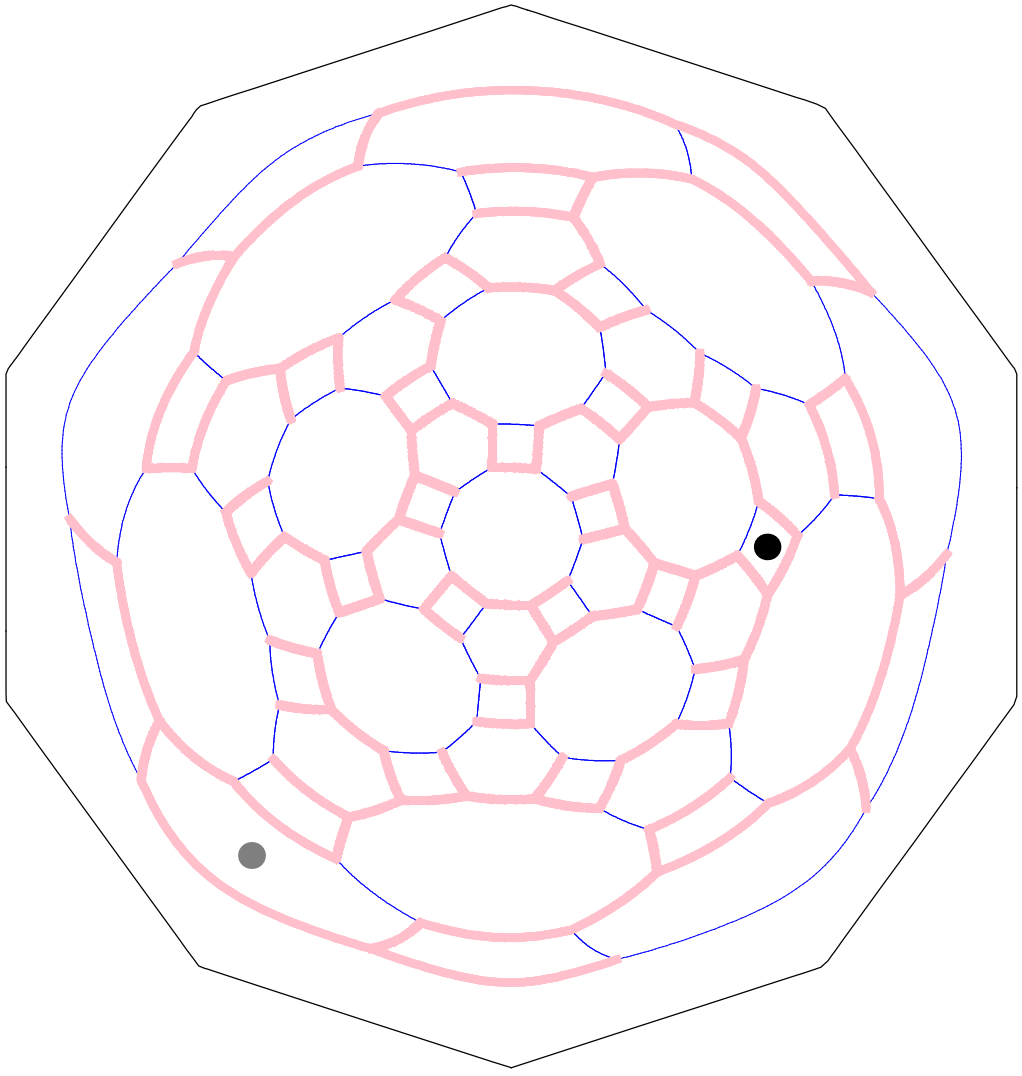


19.

`truncated icosidodecahedron` {4, 6, 10}

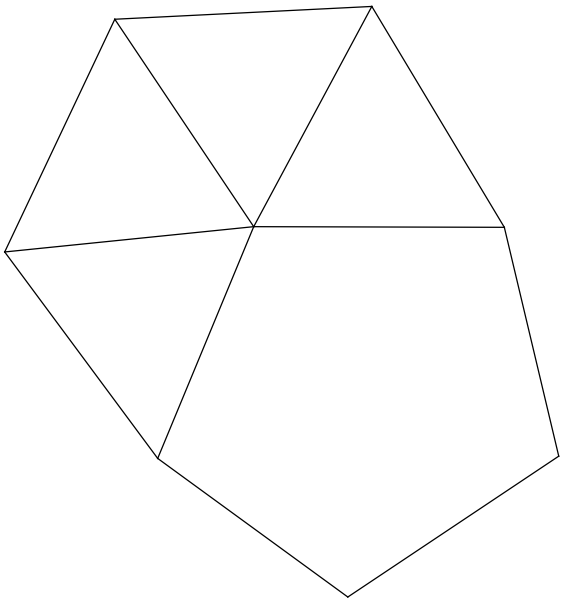


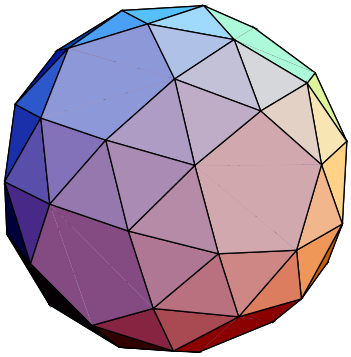


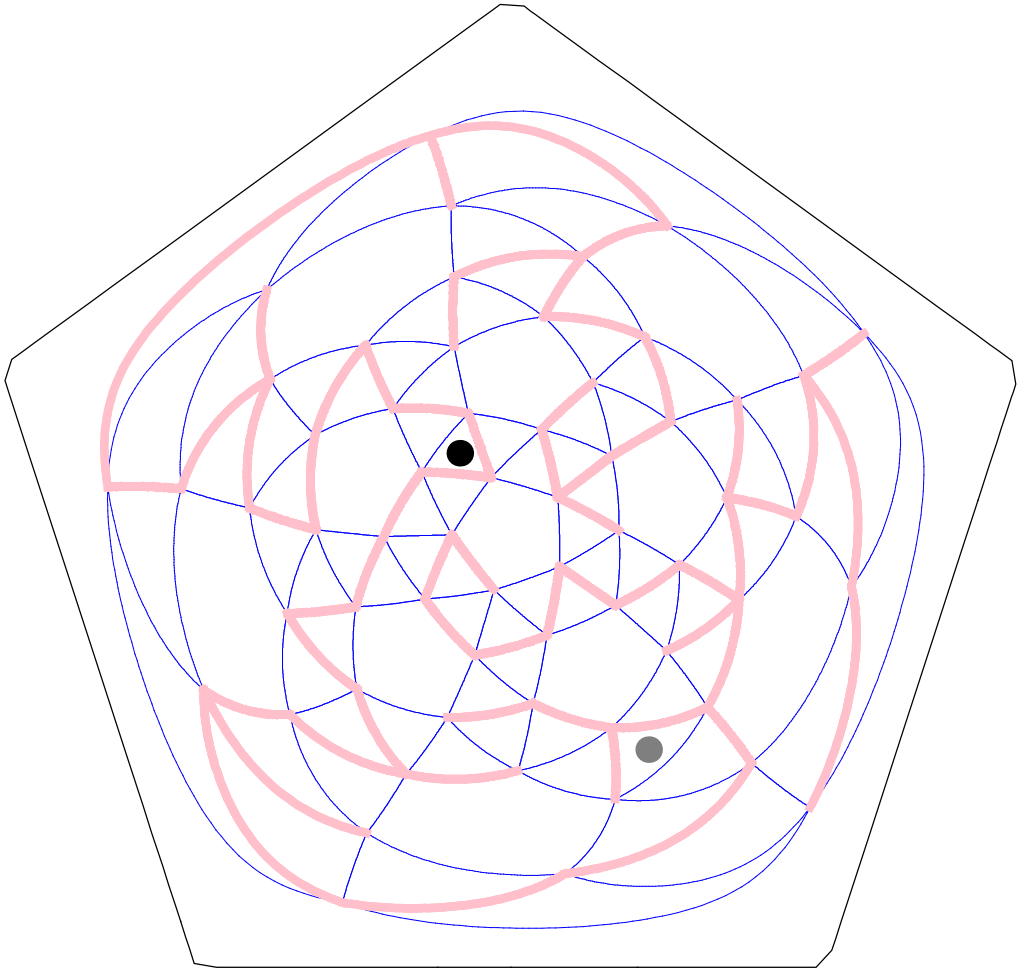


20.

`snub dodecahedron` {3, 3, 3, 3, 5}

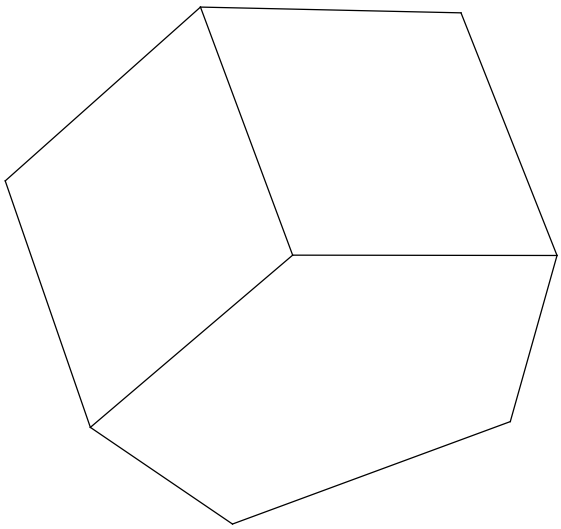


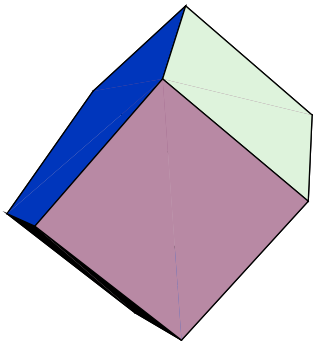


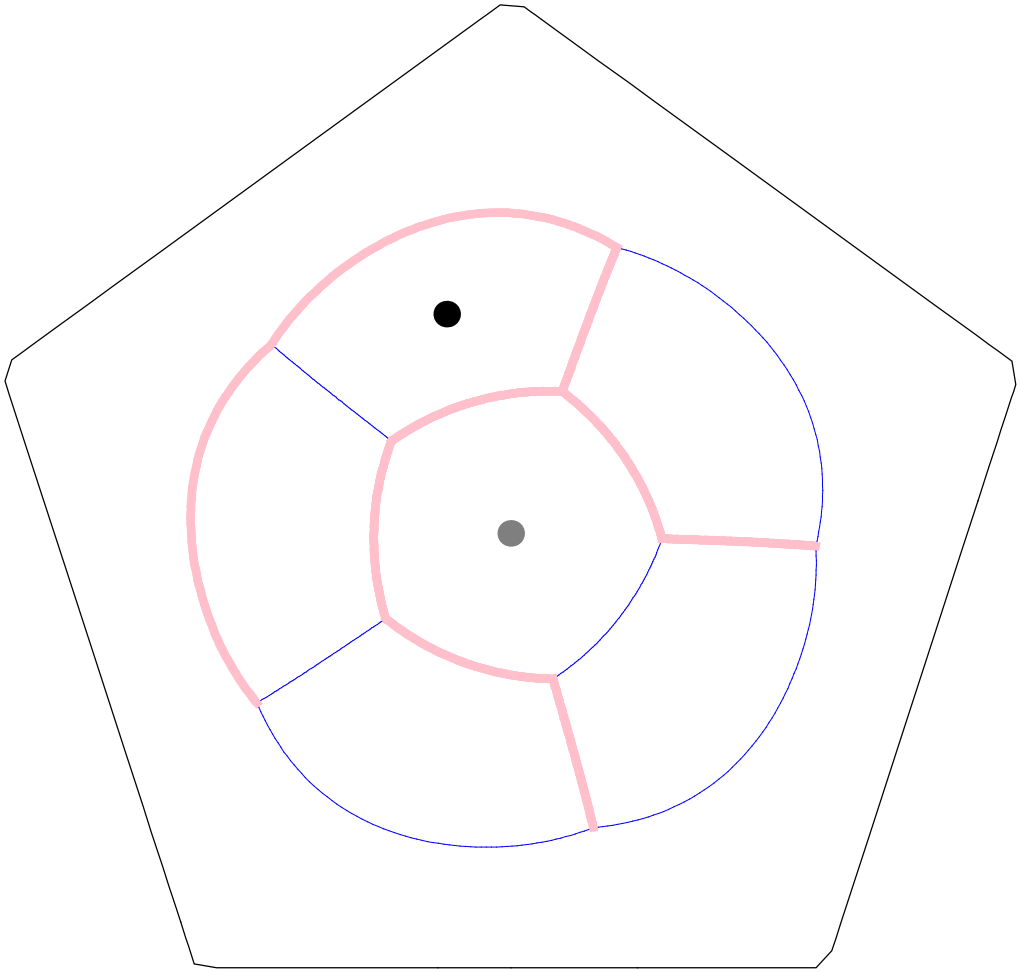


21.

`pentagonal prism` {4, 4, 5}

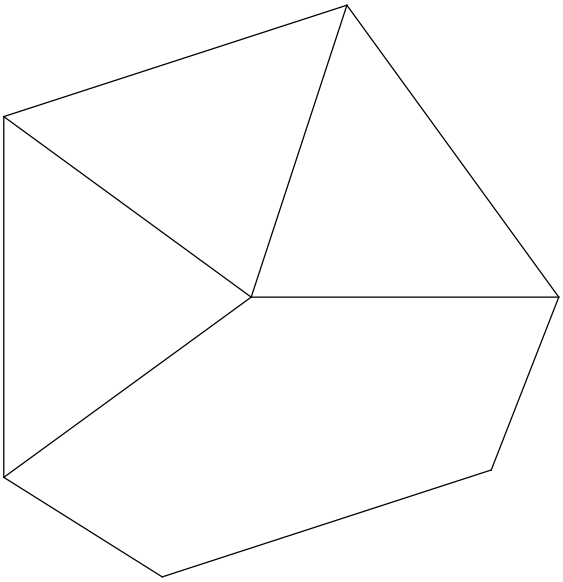


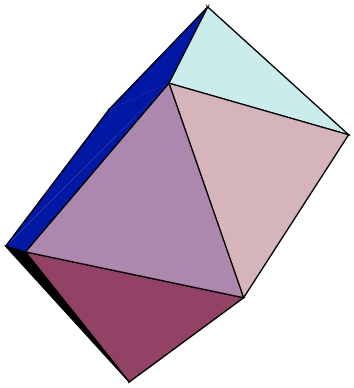


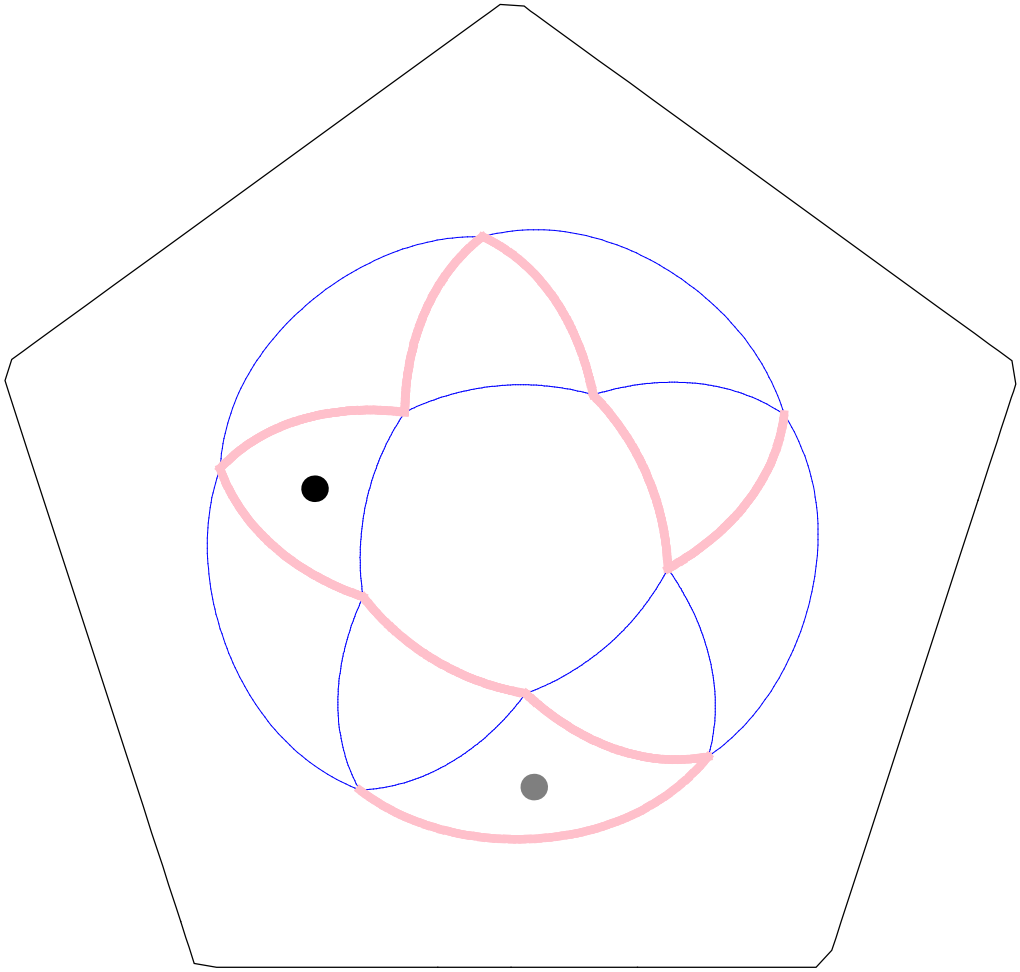


22.

`pentagonal antiprism` {3, 3, 3, 5}

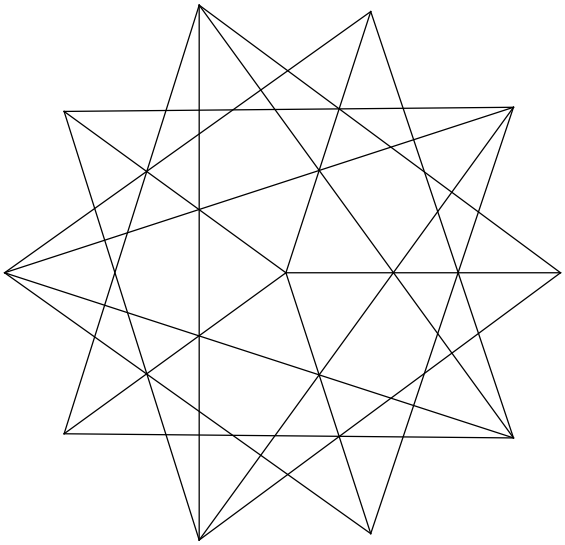


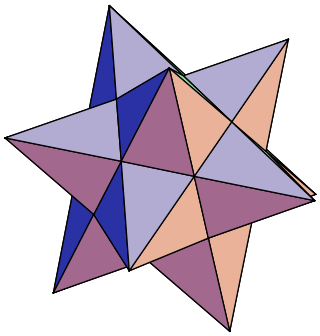


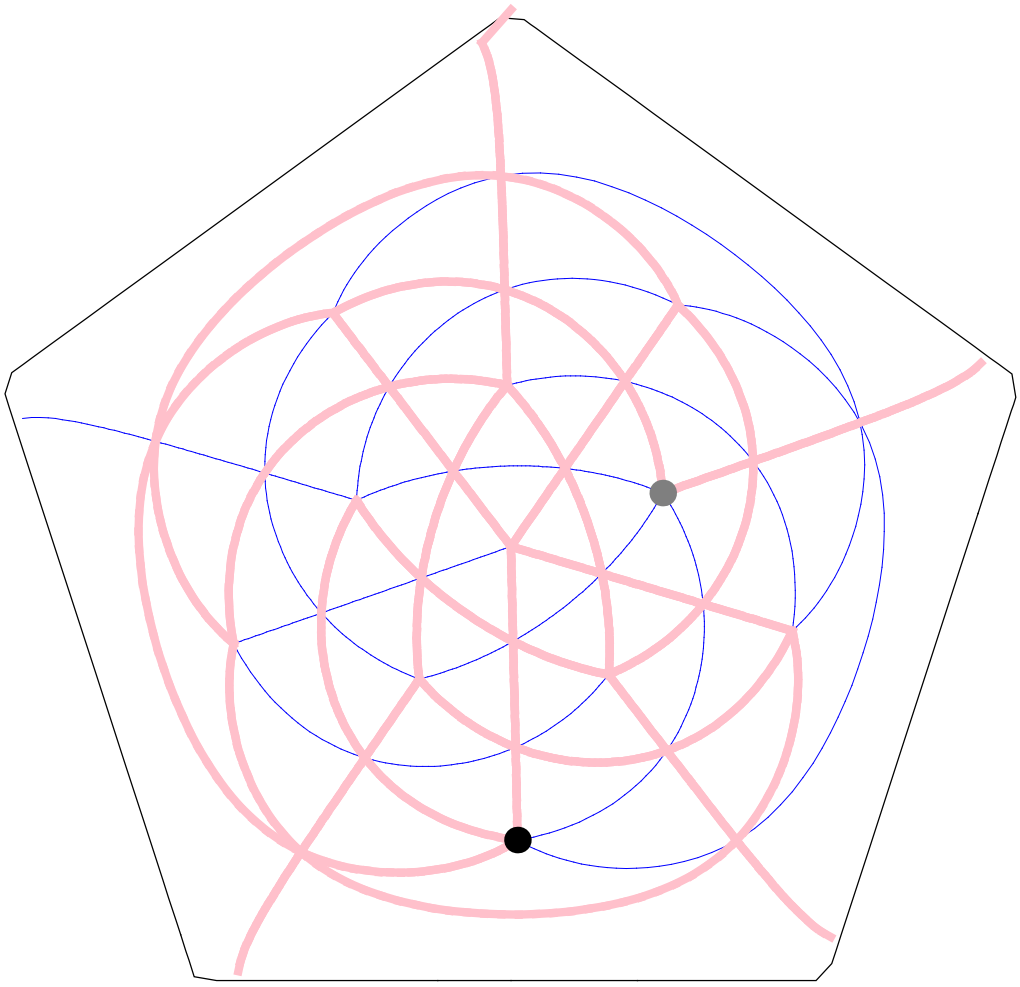


23.

small stellated dodecahedron $\{\frac{5}{2}, \frac{5}{2}, \frac{5}{2}, \frac{5}{2}, \frac{5}{2}\}$

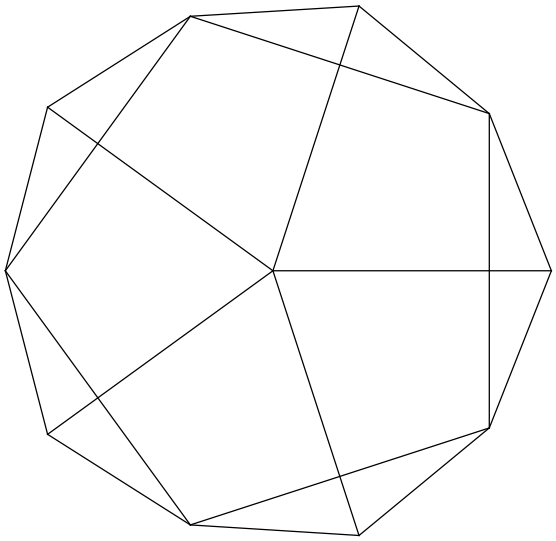


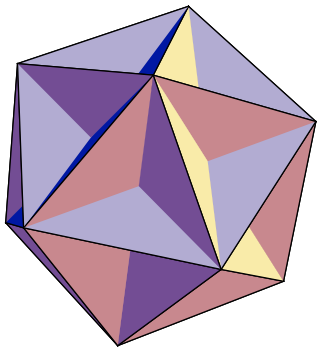


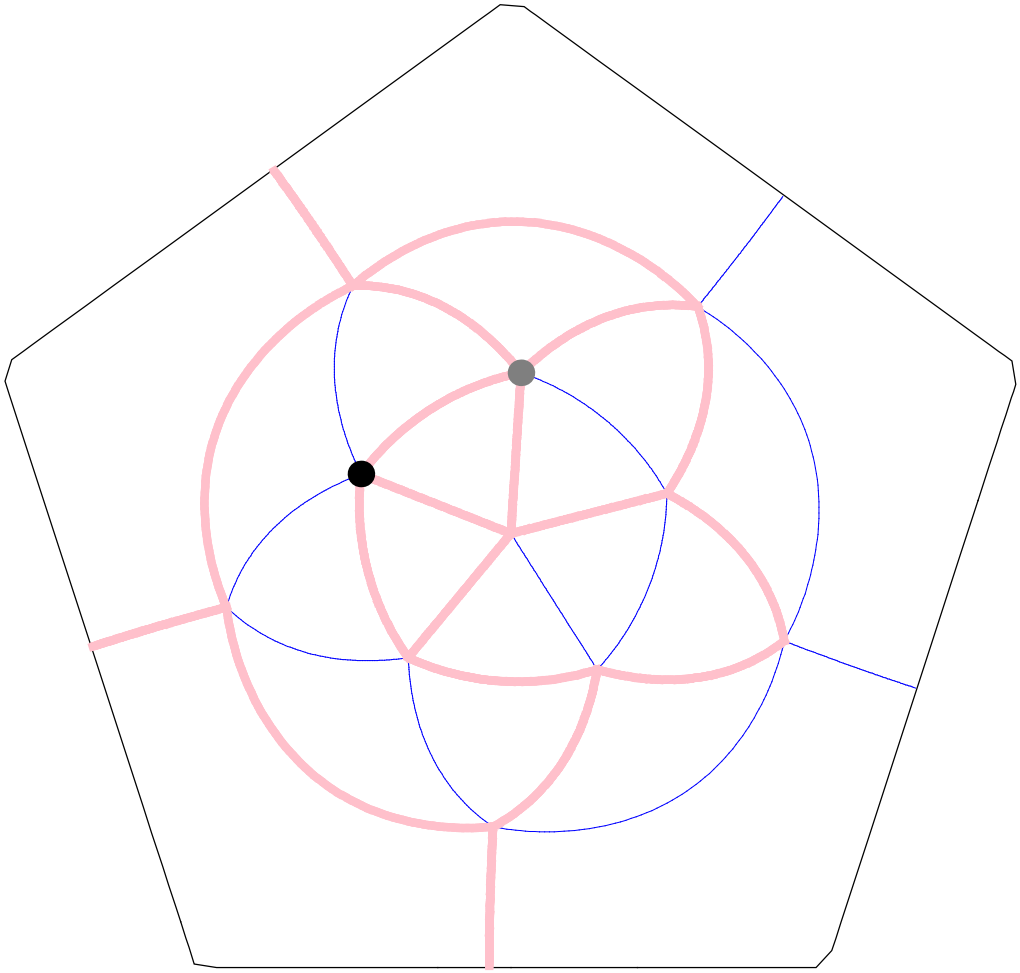


24.

great dodecahedron $\frac{1}{2}\{5, 5, 5, 5, 5\}$

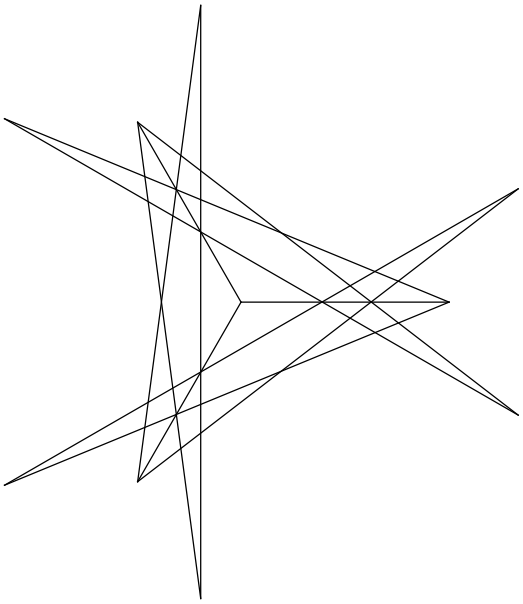


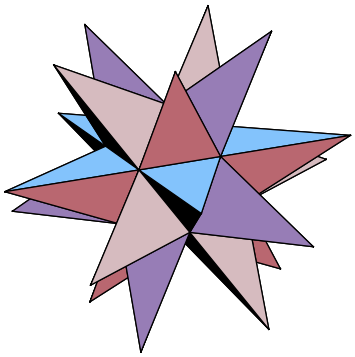


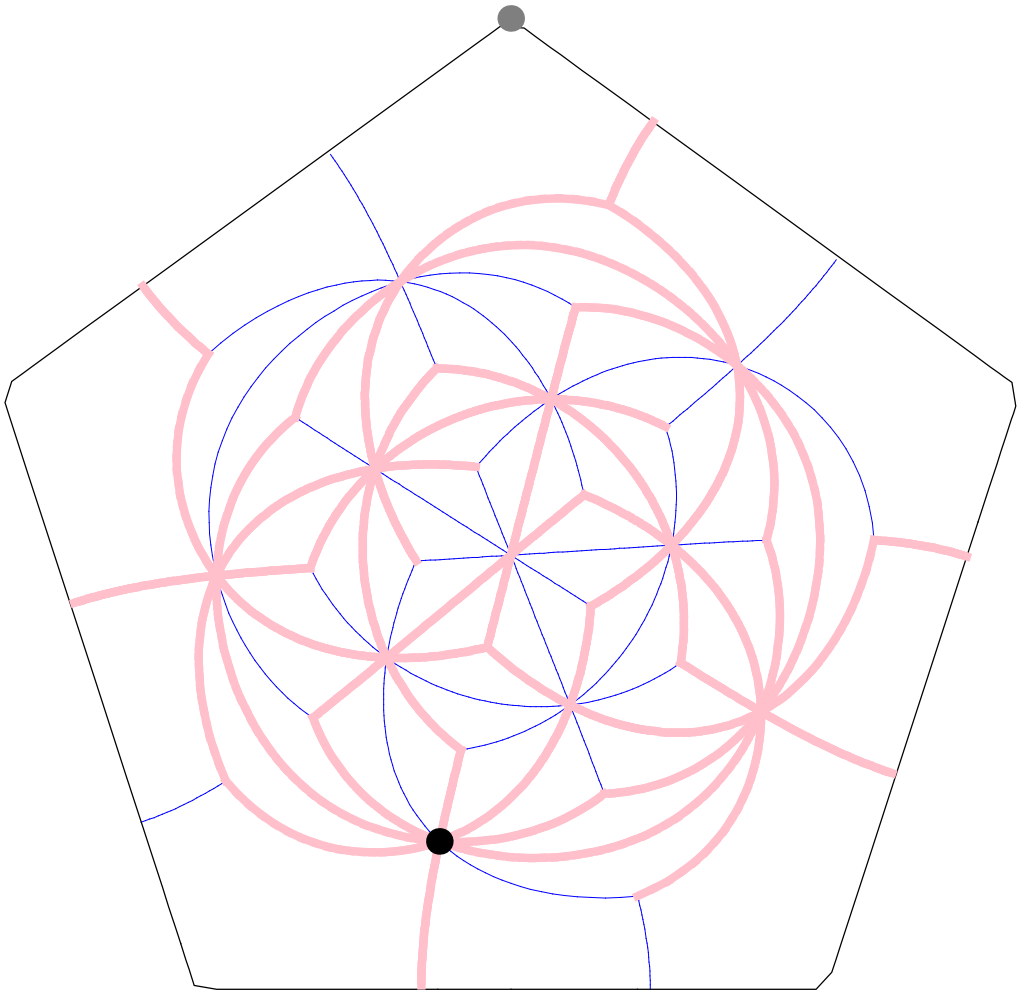


25.

great stellated dodecahedron $\{\frac{5}{2}, \frac{5}{2}, \frac{5}{2}\}$

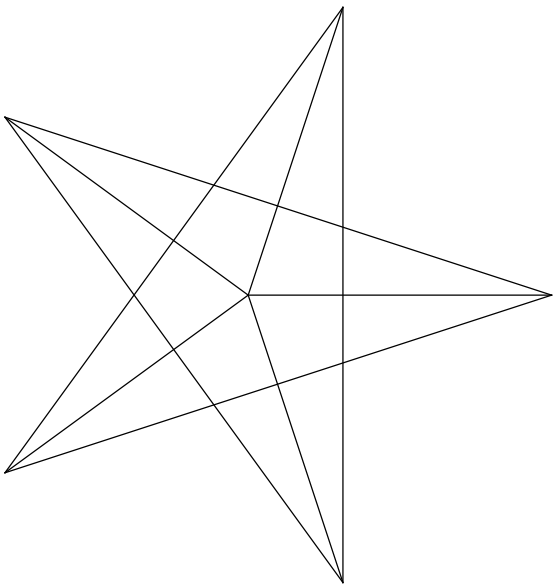


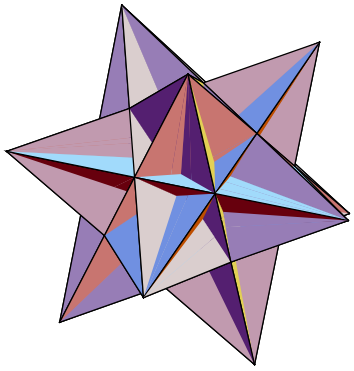


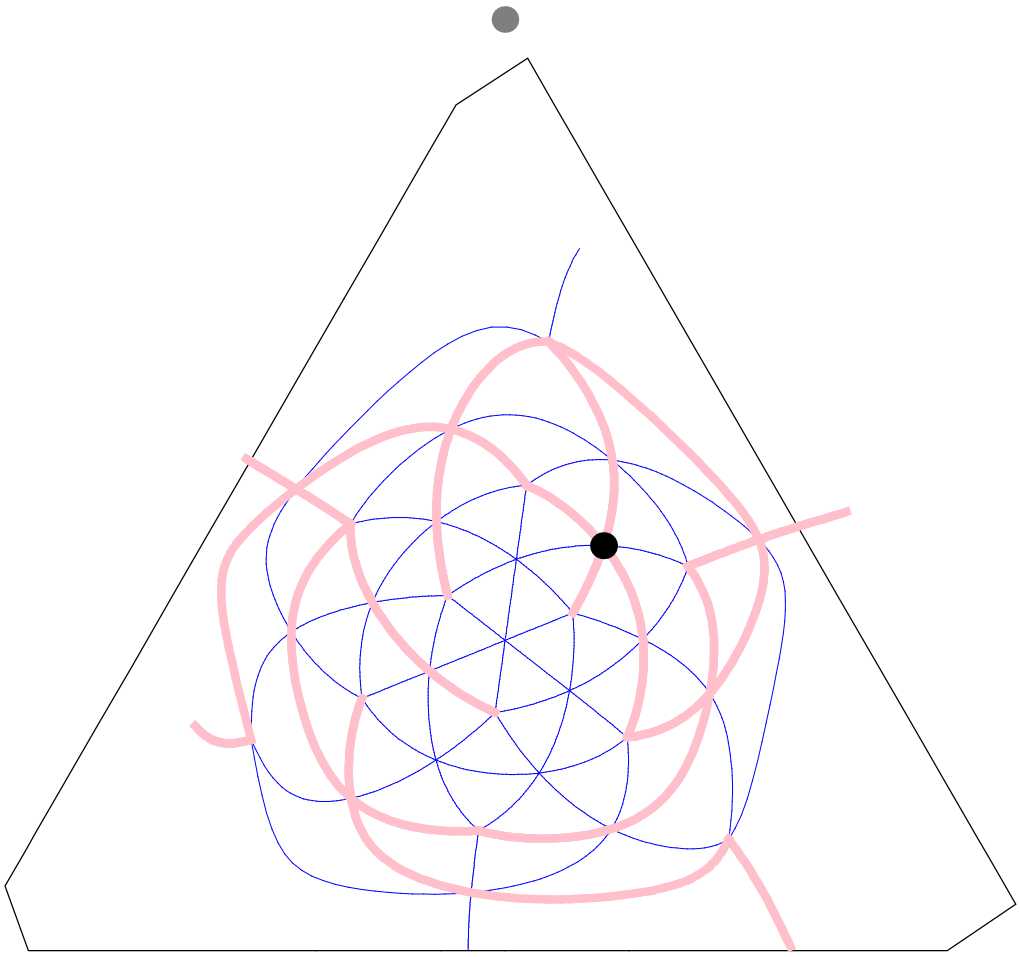


26.

great icosahedron $\frac{1}{2}\{3, 3, 3, 3, 3\}$

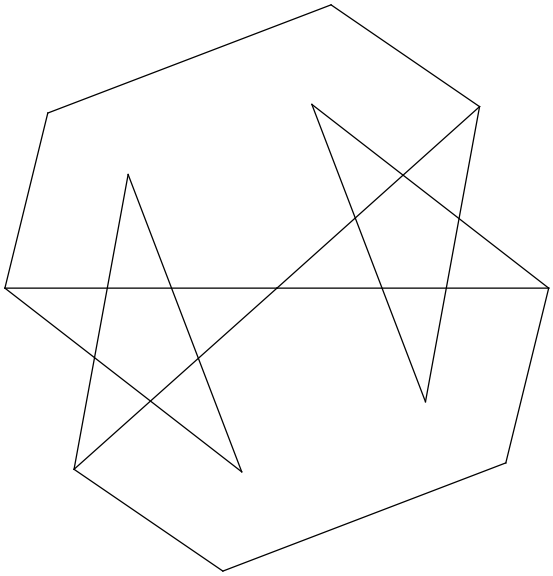


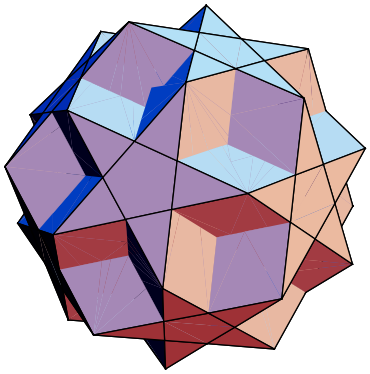


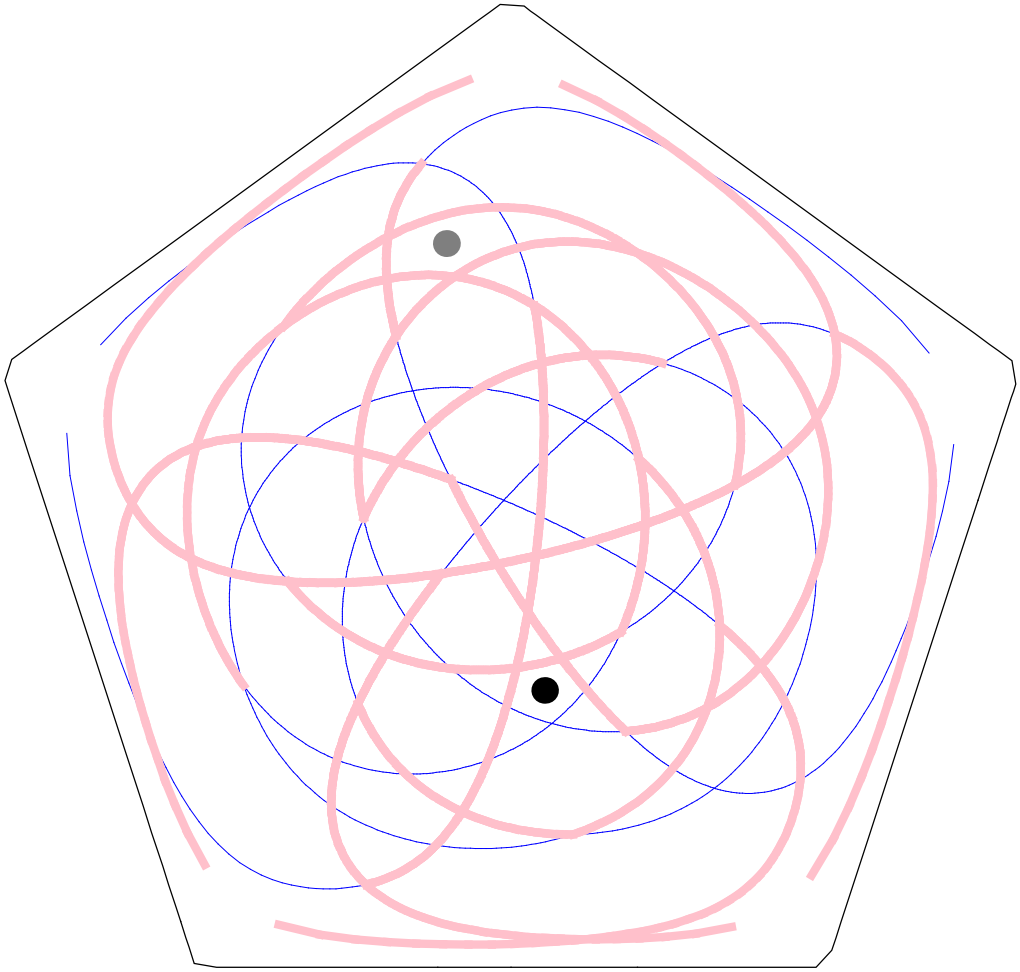


27.

`dodecadodecahedron` $\{\frac{5}{2}, 5, \frac{5}{2}, 5\}$

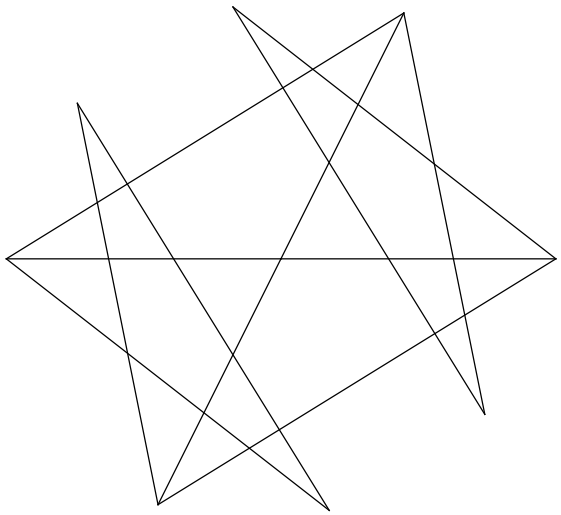


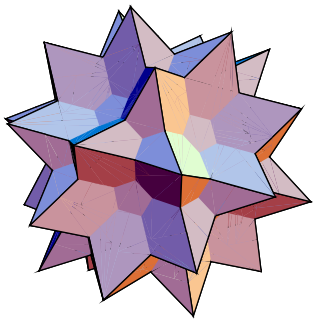


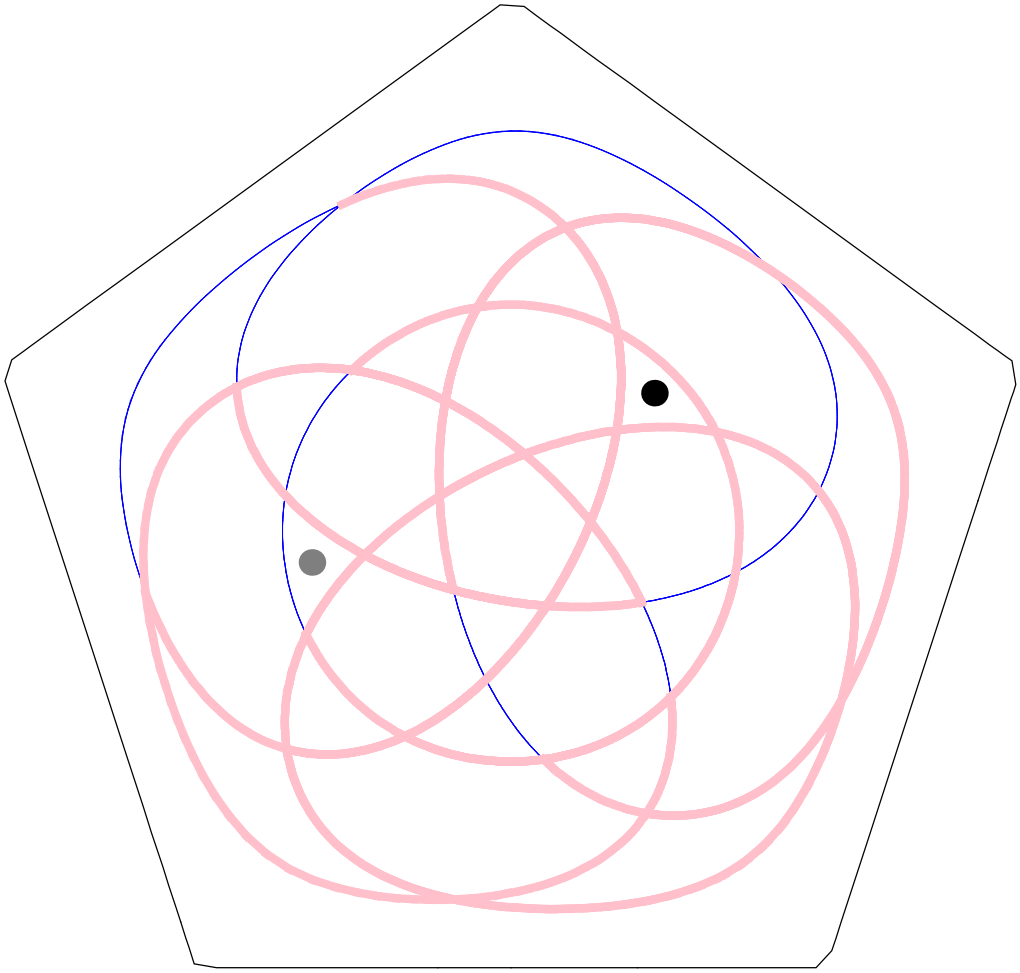


28.

`great icosidodecahedron` $\{\frac{5}{2}, 3, \frac{5}{2}, 3\}$

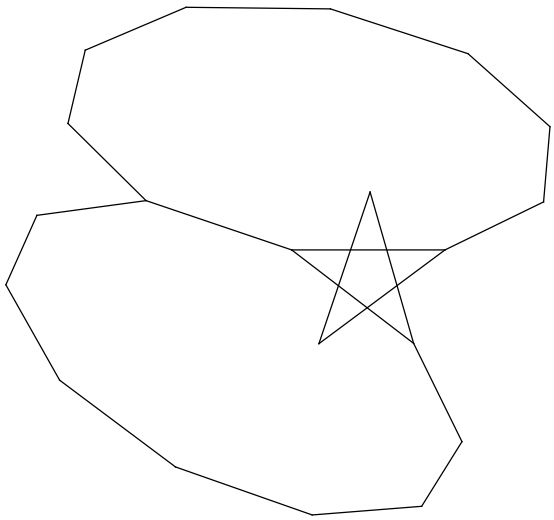


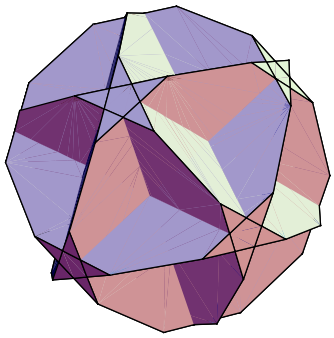


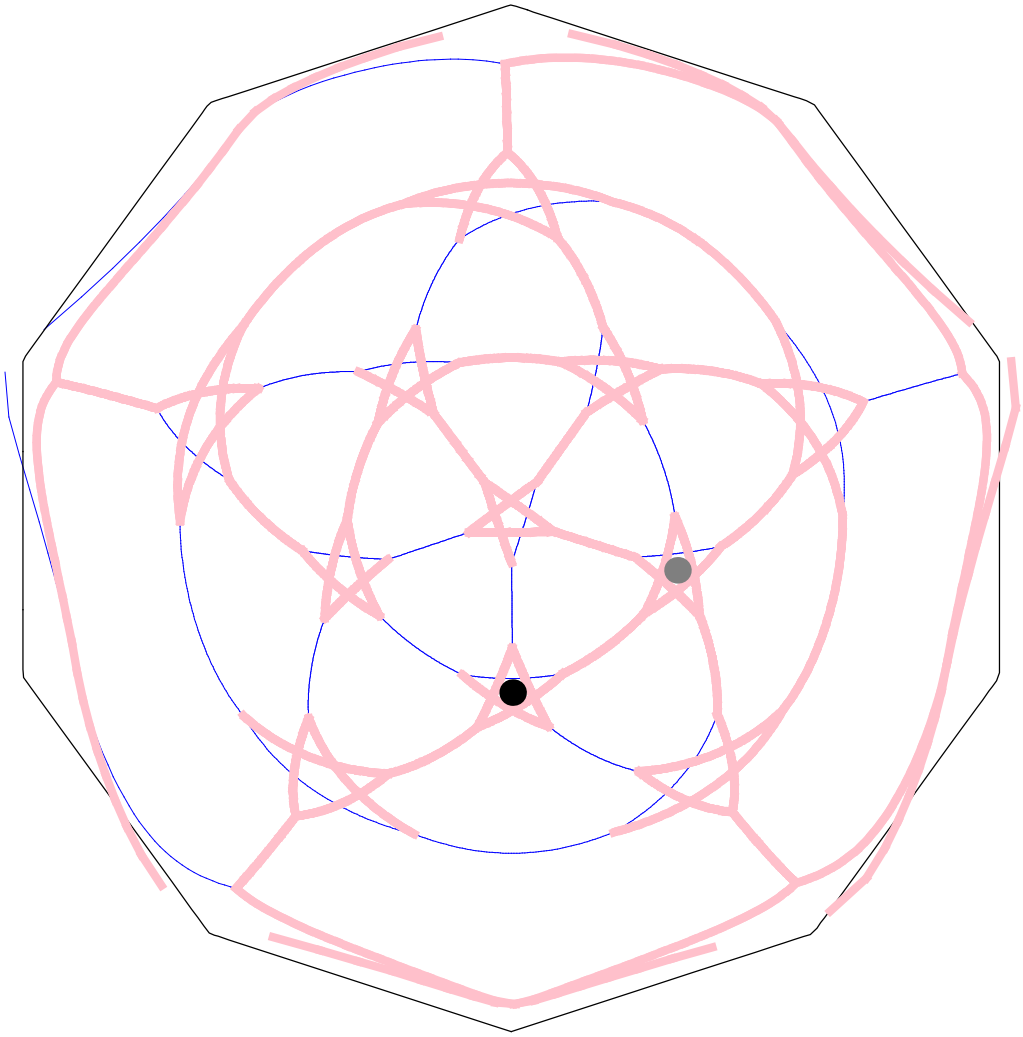


29.

`truncated great dodecahedron` $\{10, 10, \frac{5}{2}\}$

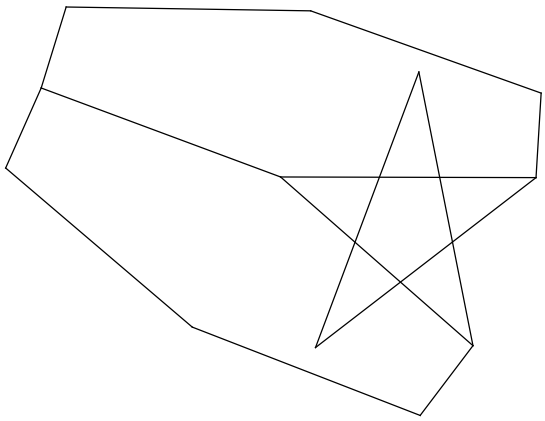


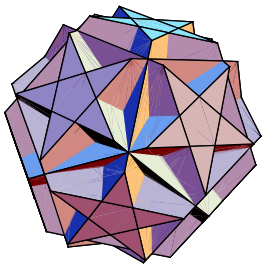


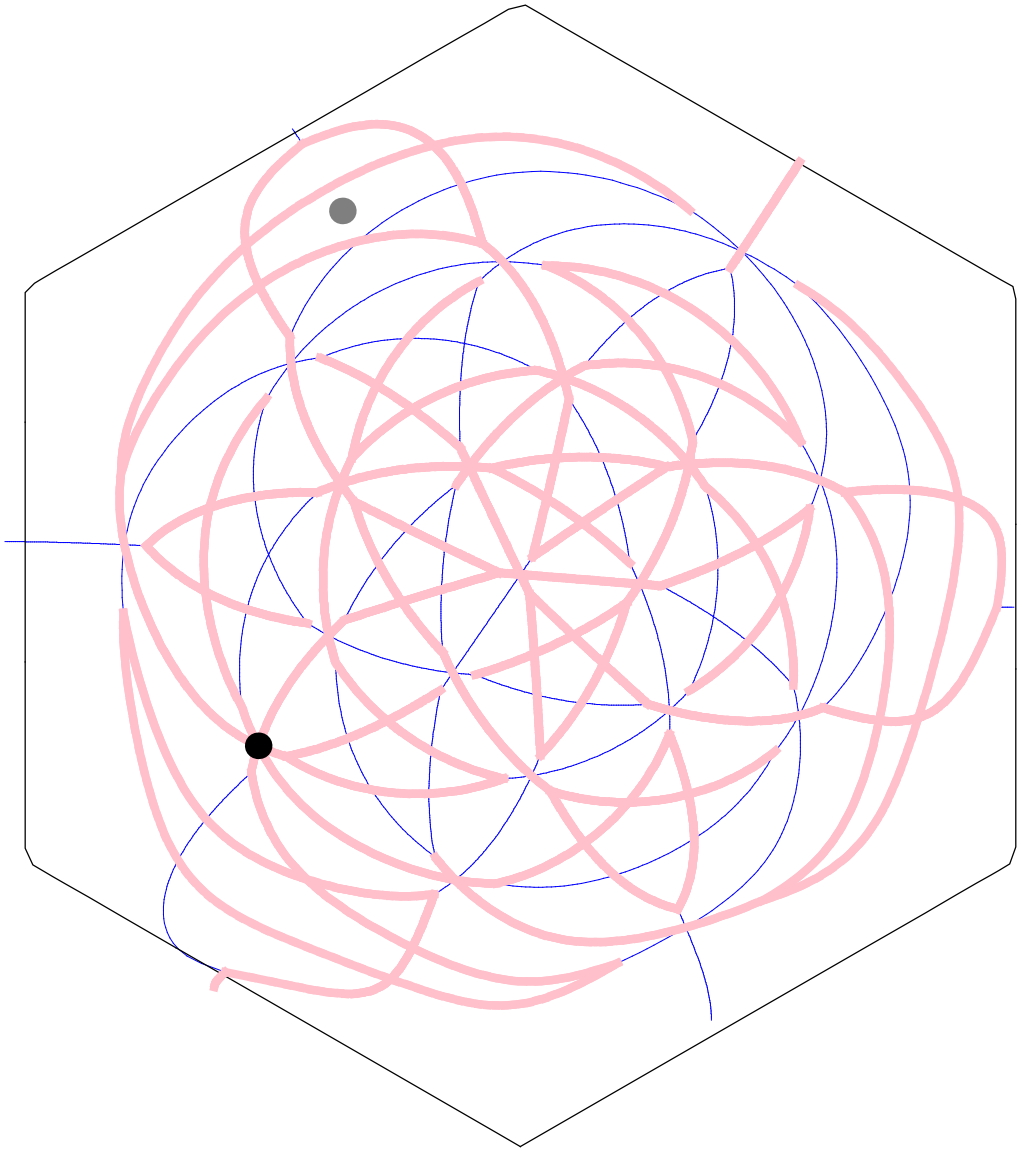


30.

great truncated icosahedron $\{6, 6, \frac{5}{2}\}$

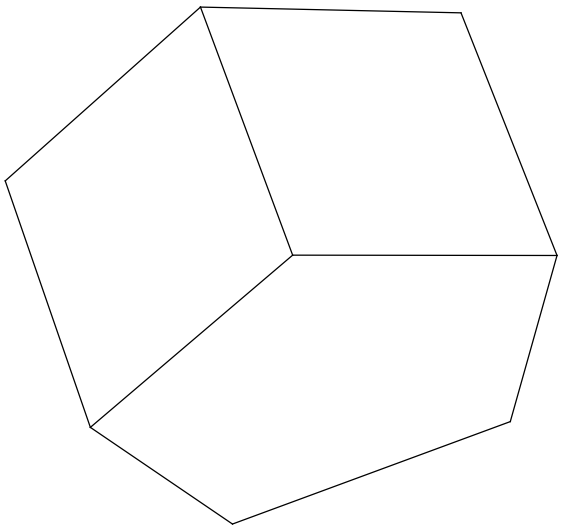


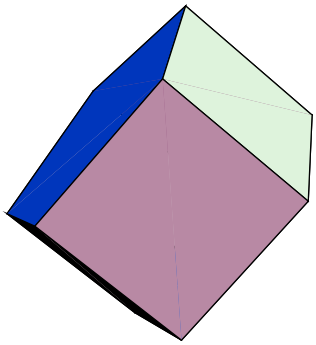


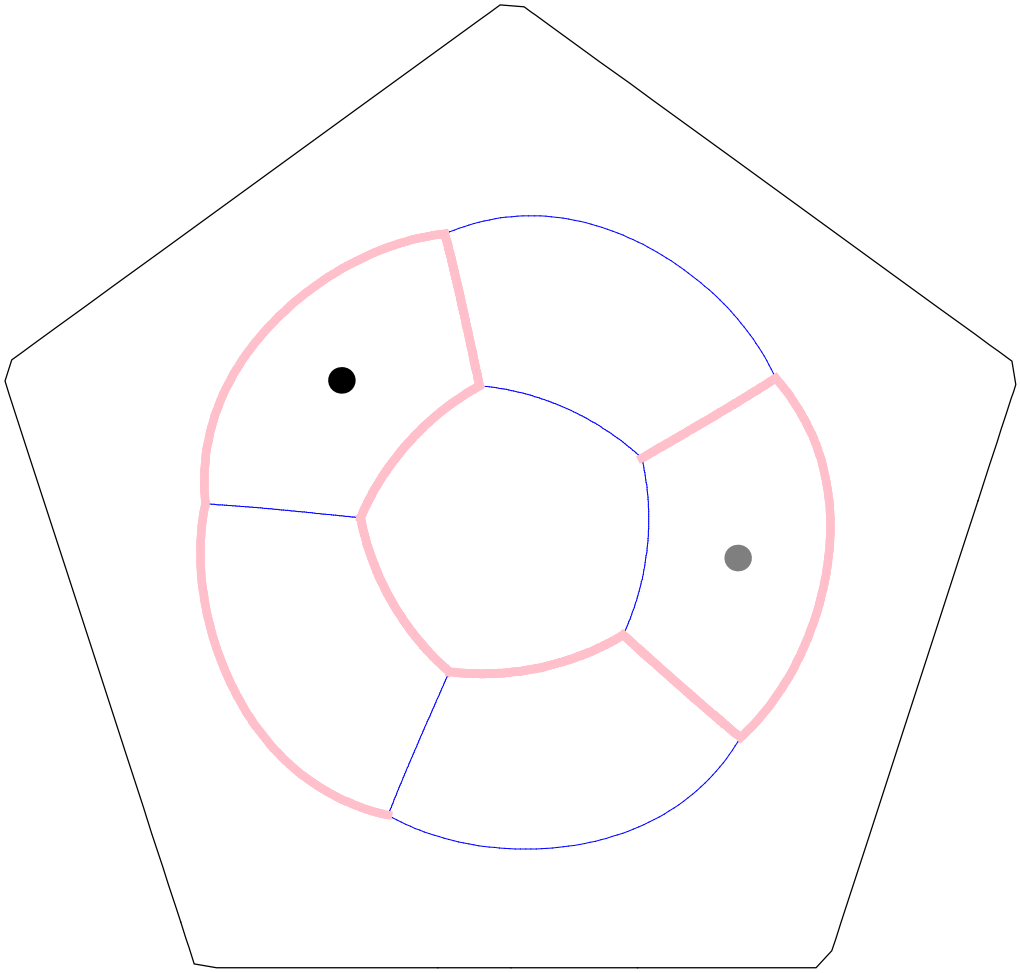


31.

`pentagonal prism` {4, 4, 5}

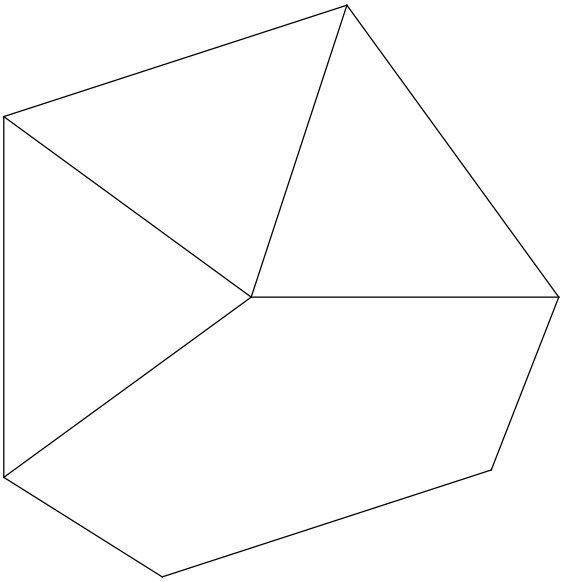


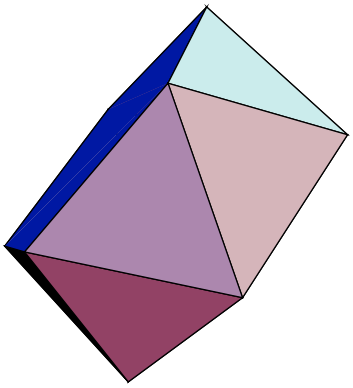


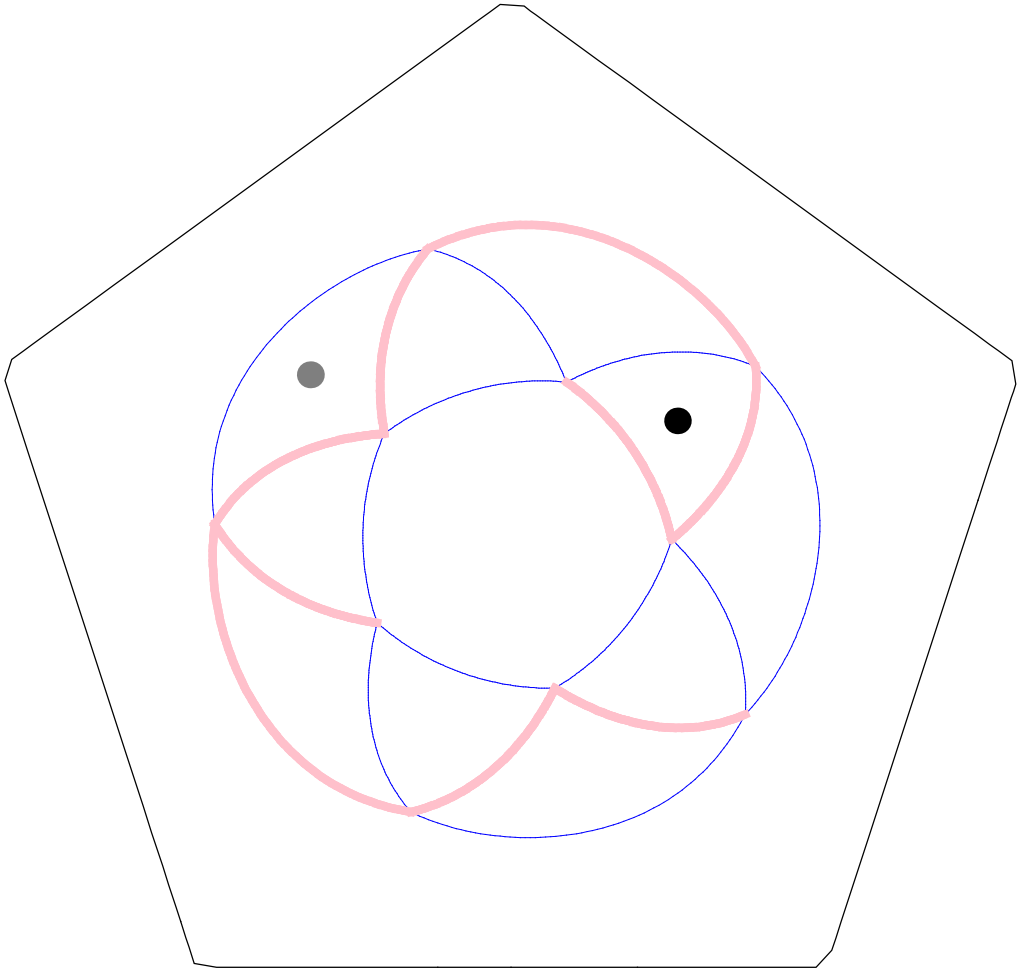


32.

`pentagonal antiprism` {3, 3, 3, 5}

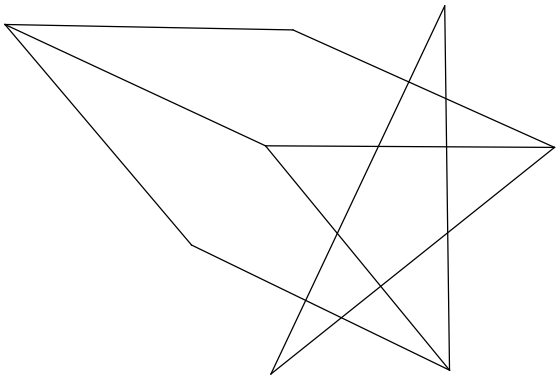


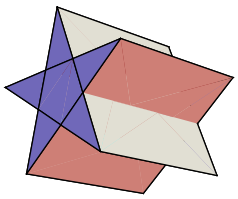


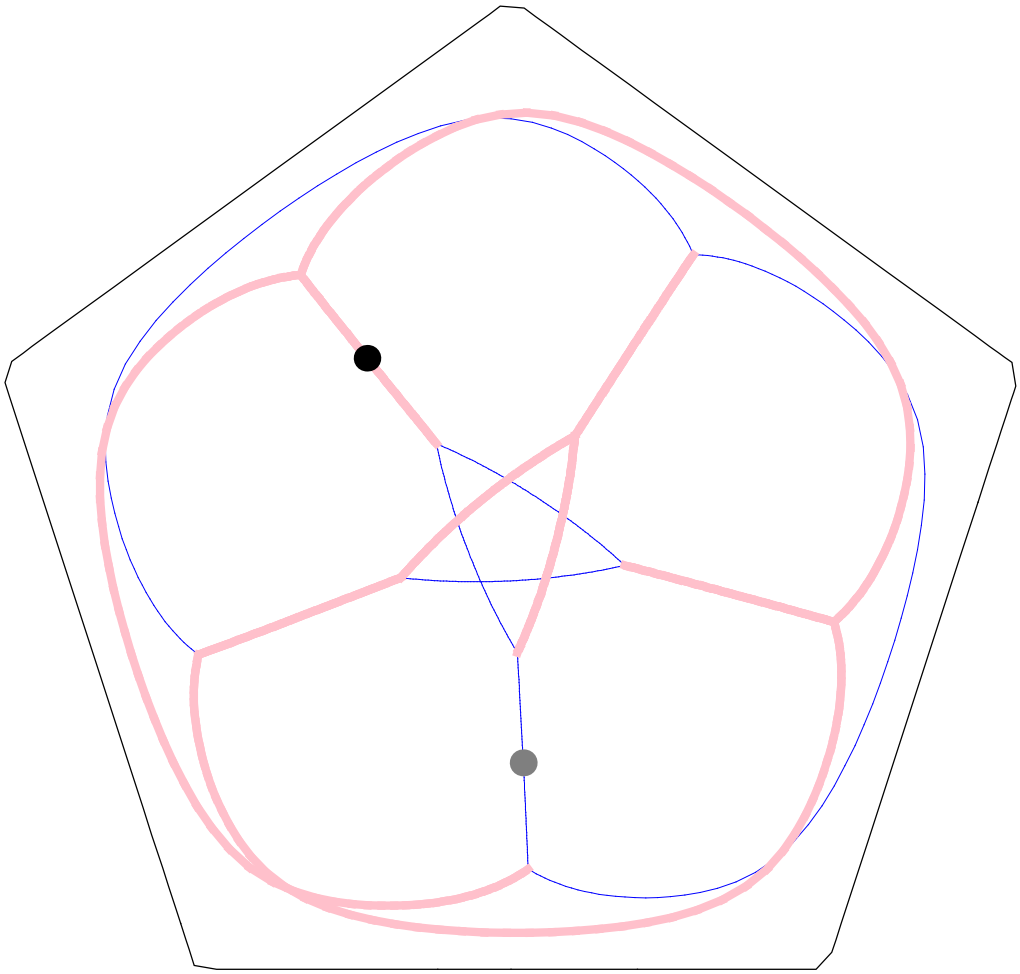


33.

`pentagrammic prism` $\{4, 4, \frac{5}{2}\}$

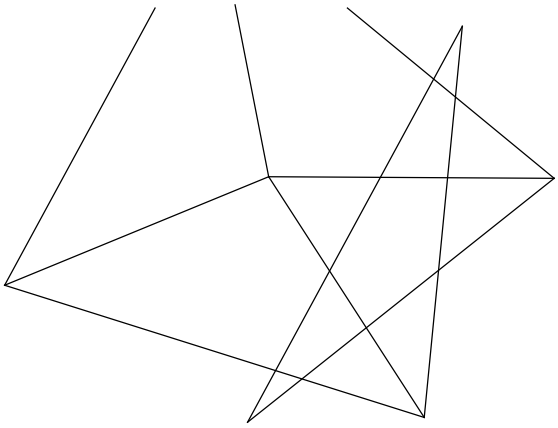


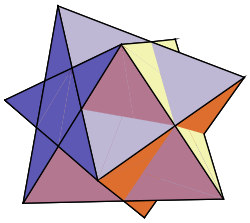


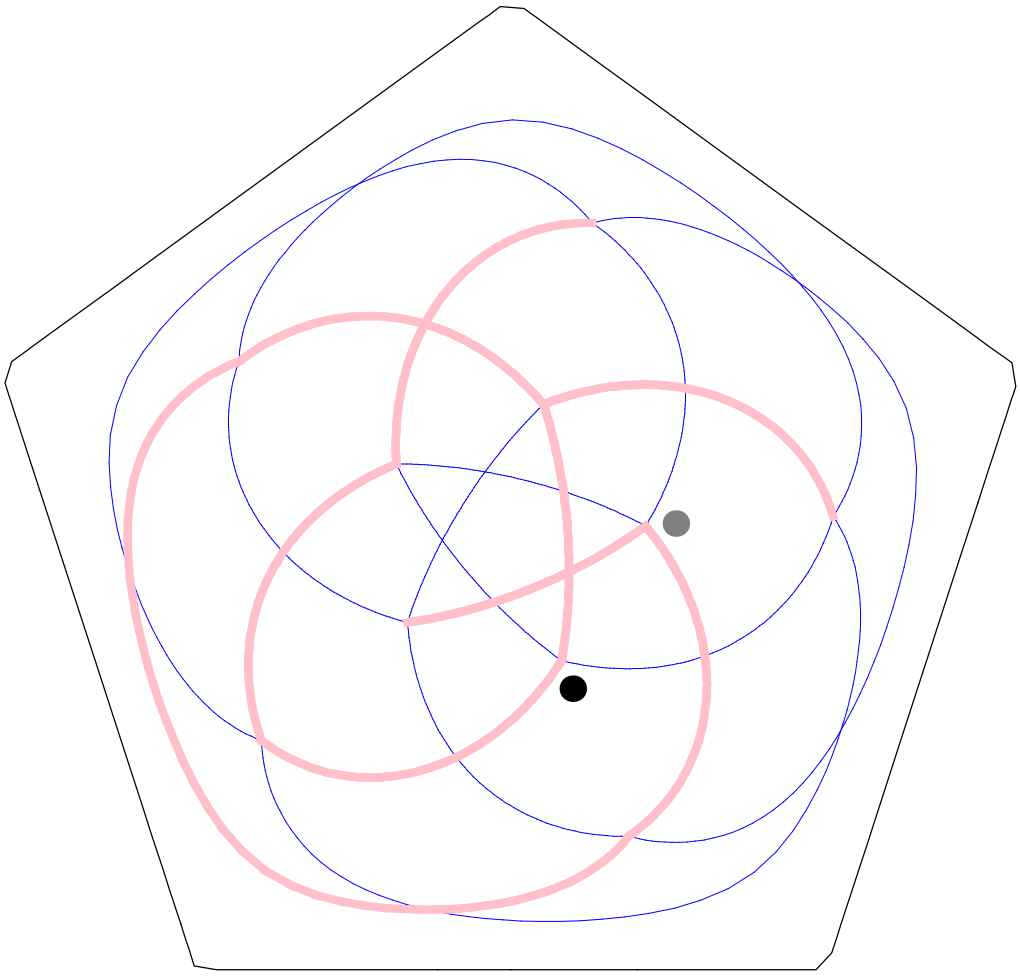


34.

`pentagrammic antiprism` $\left\{3, 3, 3, \frac{5}{2}\right\}$

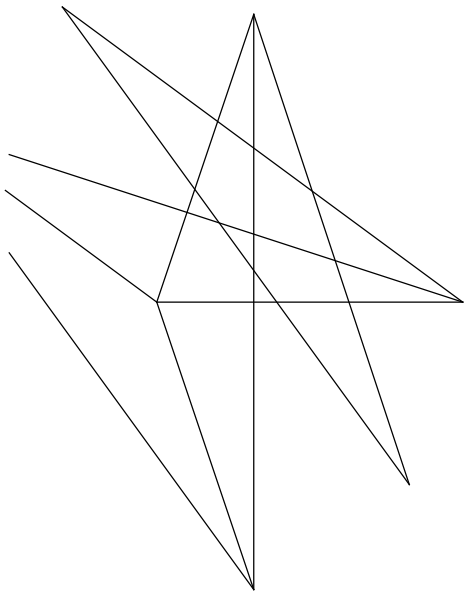


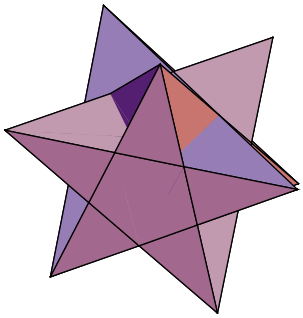


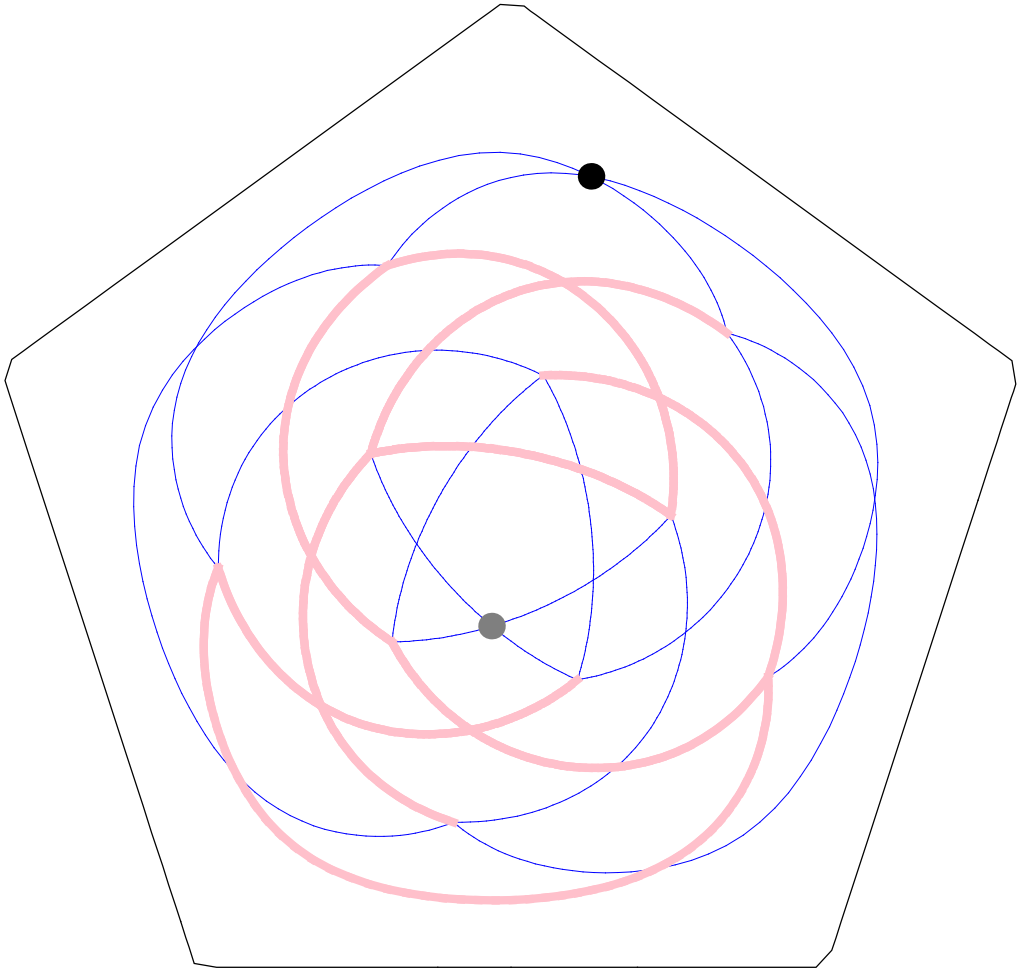


35.

`pentagrammic crossed antiprism` $\left\{3, 3, 3, \frac{5}{3}\right\}$



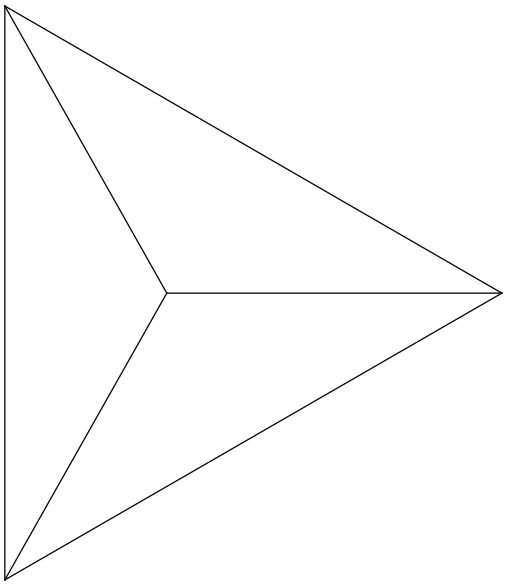


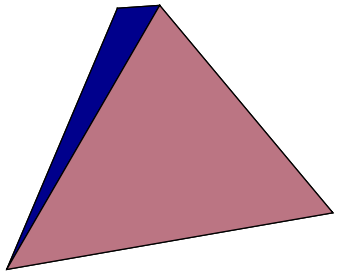


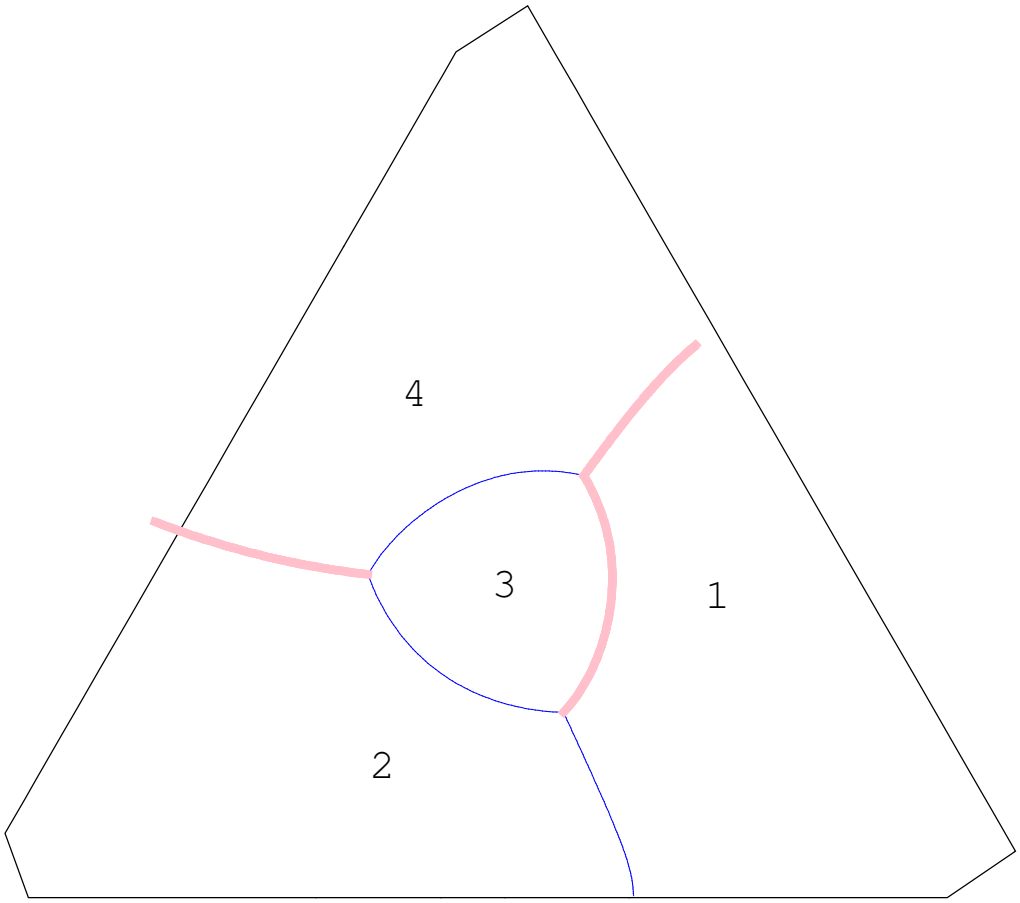
Solutions

3.

`tetrahedron` {3, 3, 3}

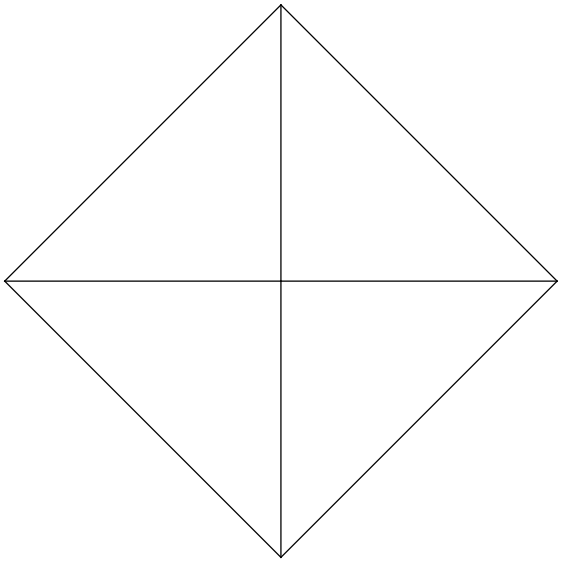


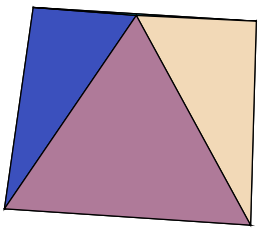


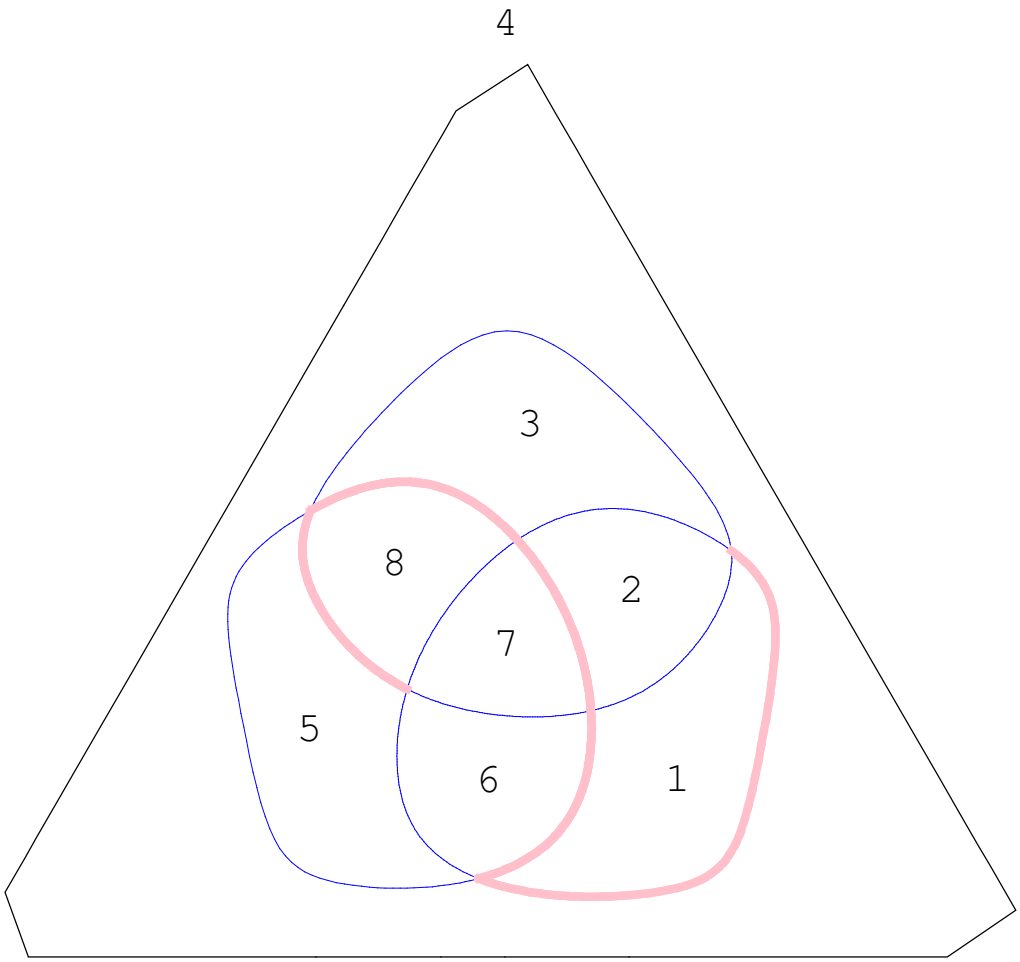


4.

`octahedron` {3, 3, 3, 3}

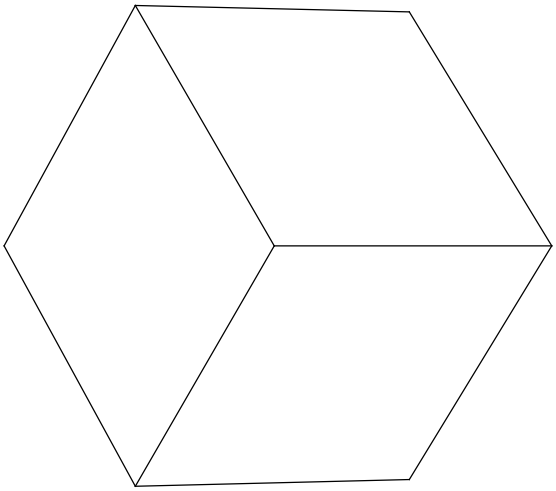


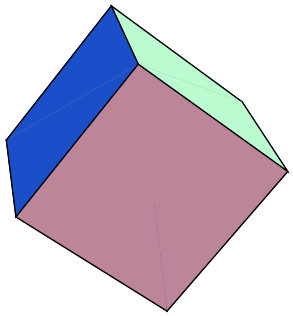


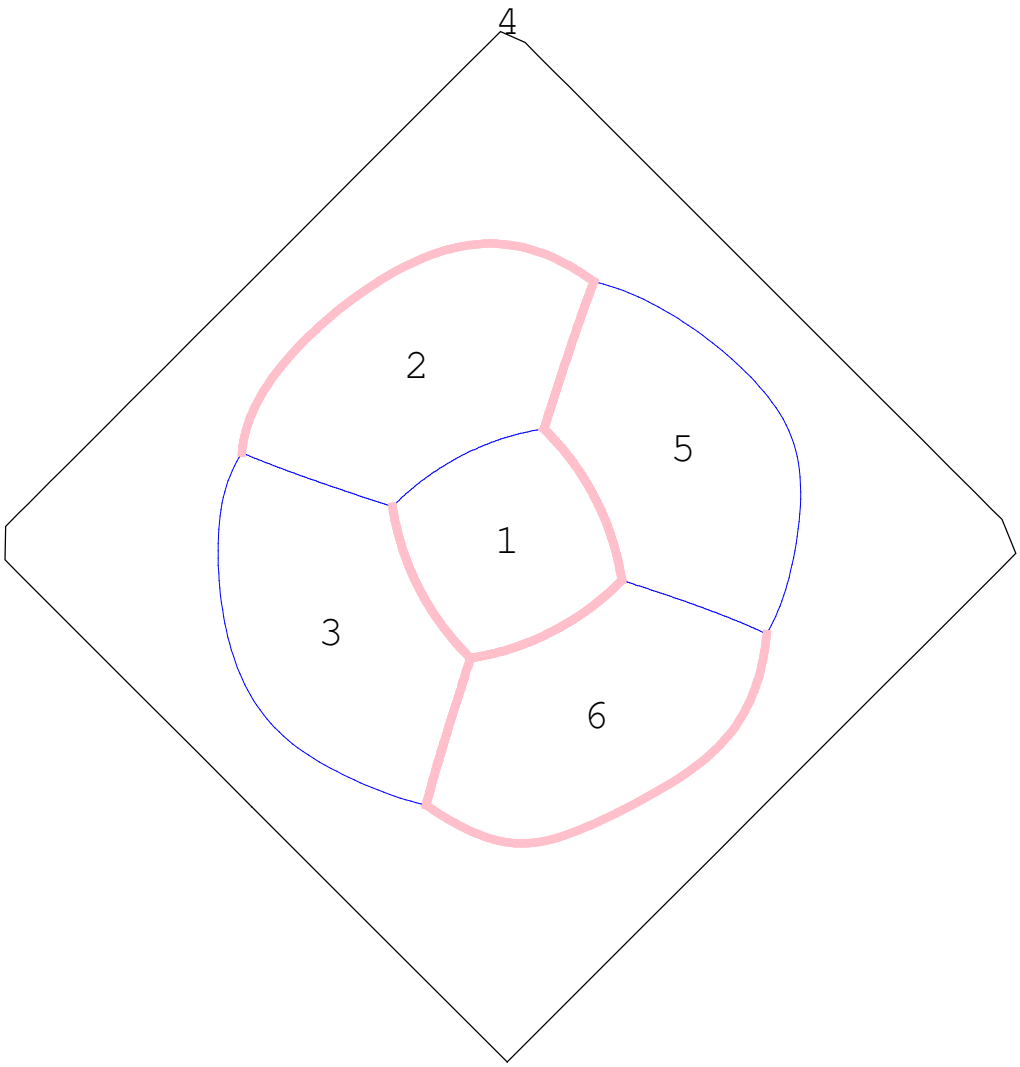


5.

`cube` {4, 4, 4}

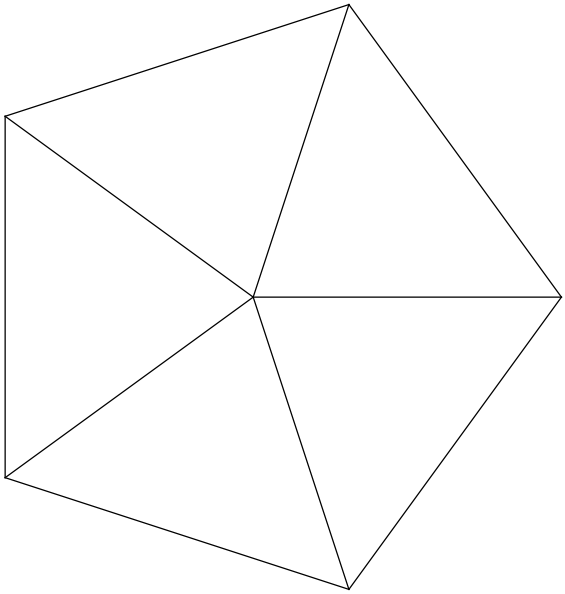


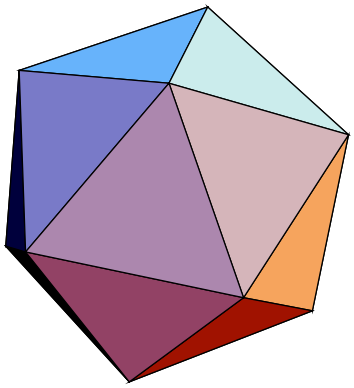


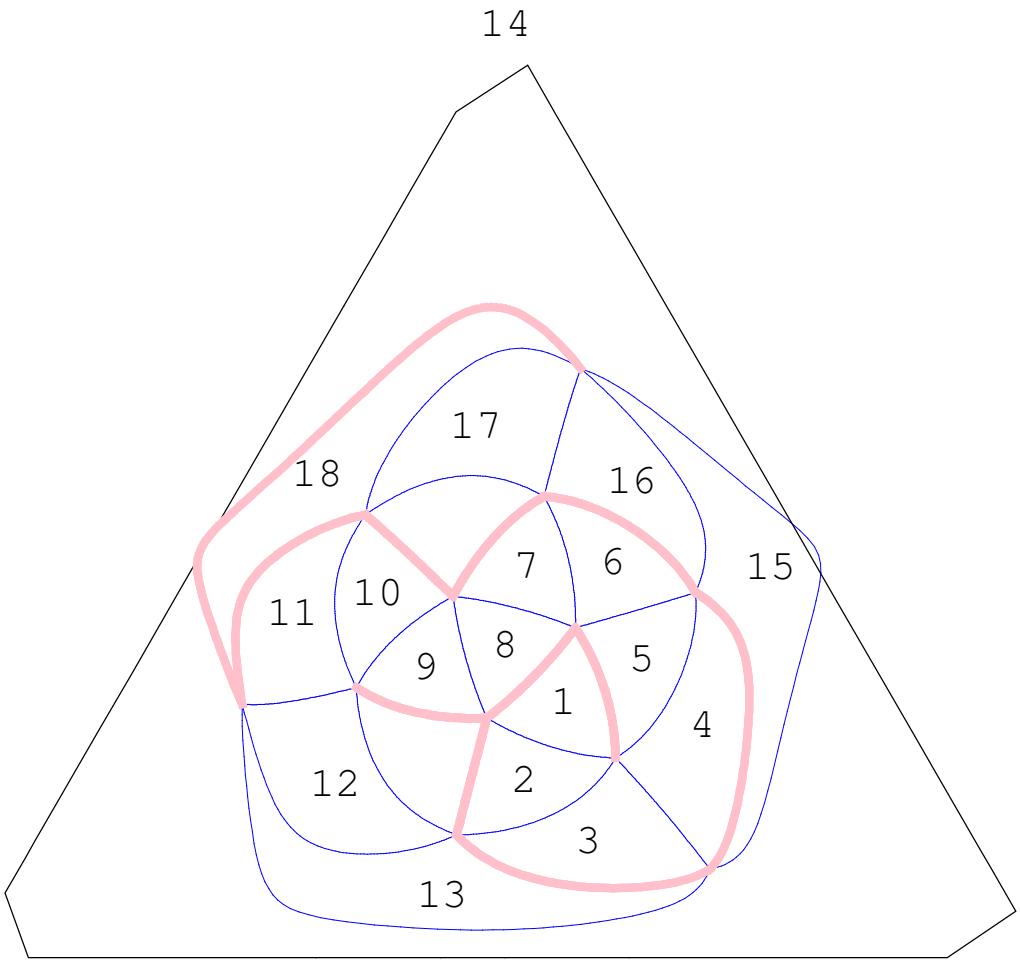


6.

`icosahedron` {3, 3, 3, 3, 3}

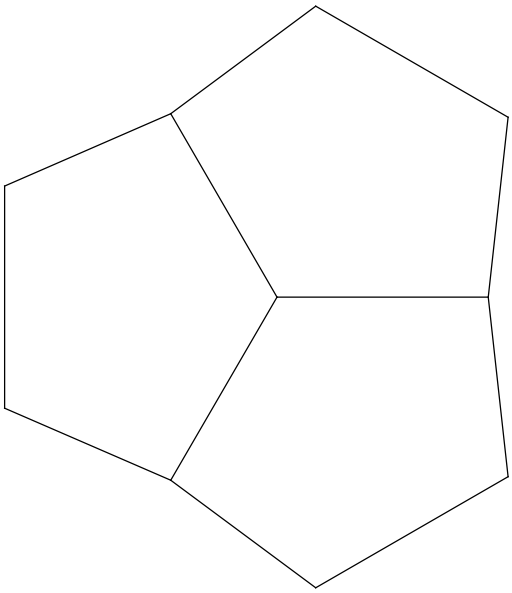


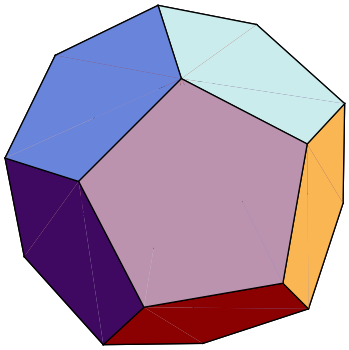


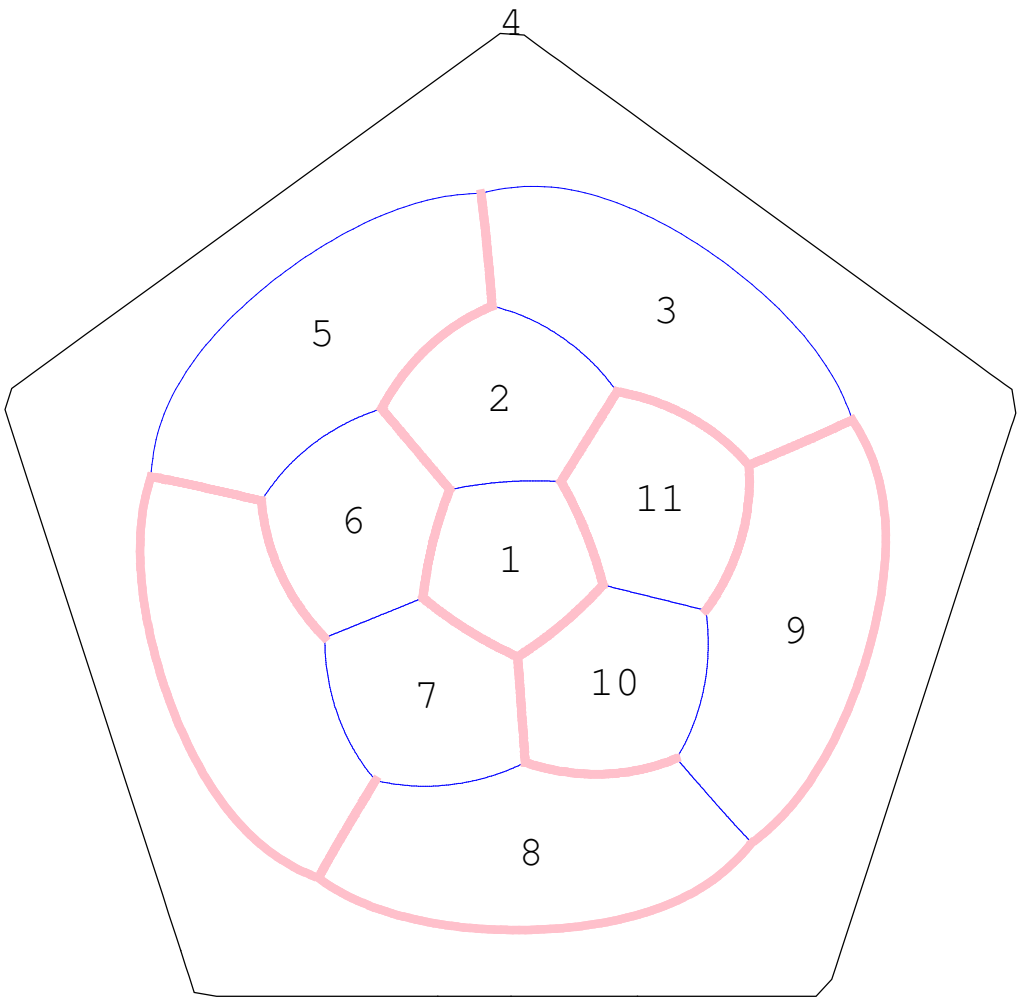


7.

`dodecahedron` {5, 5, 5}

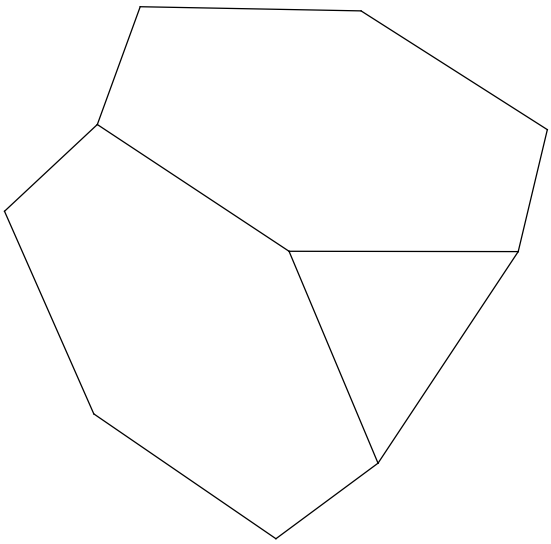


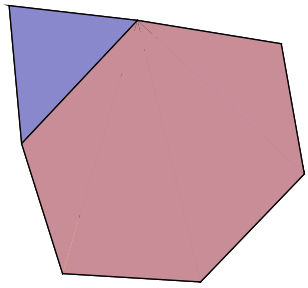


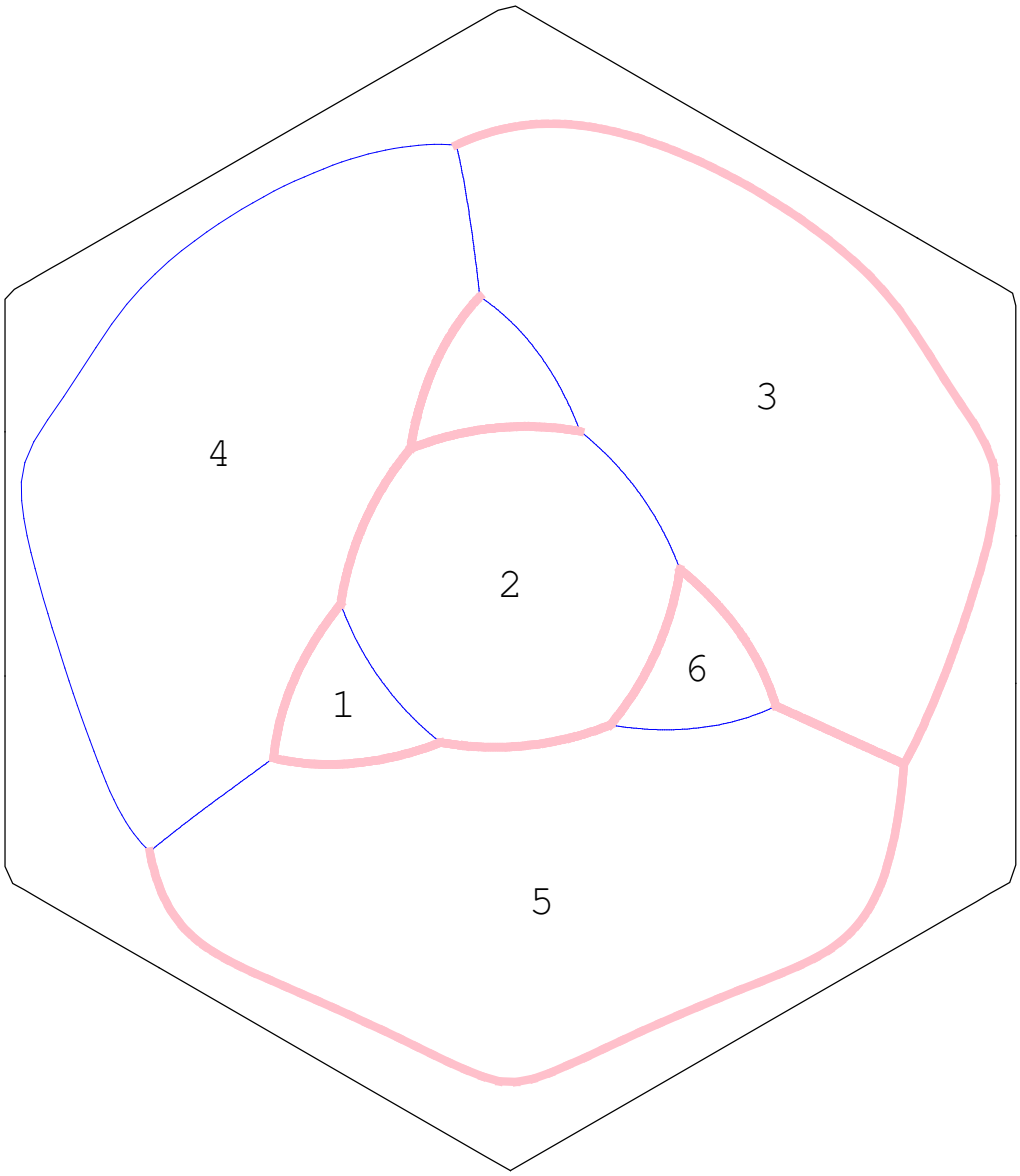


8.

`truncated tetrahedron` {6, 6, 3}

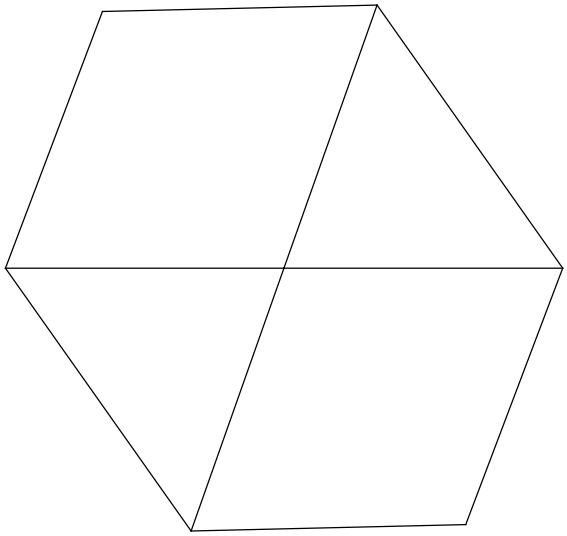


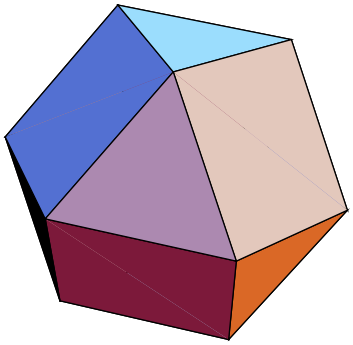


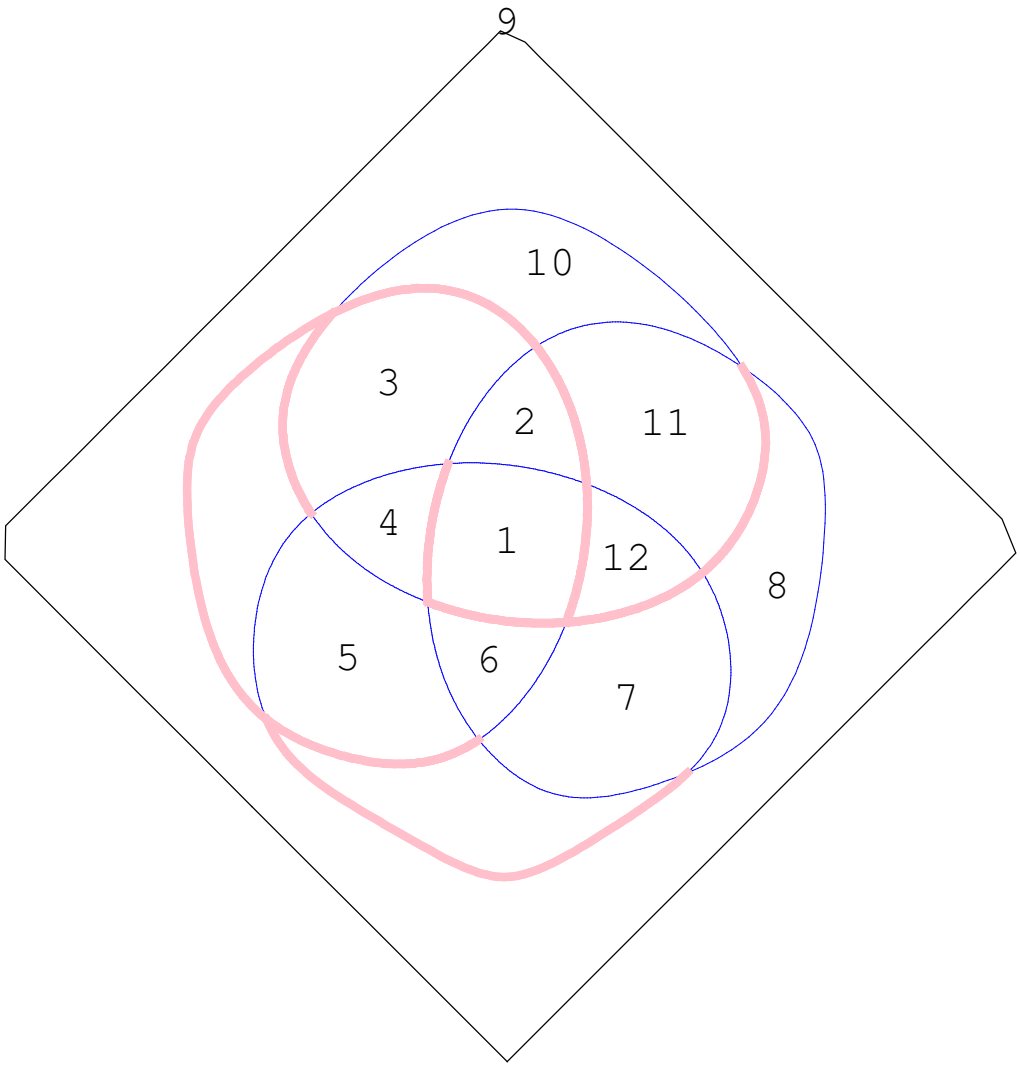


9.

`cuboctahedron` {3, 4, 3, 4}

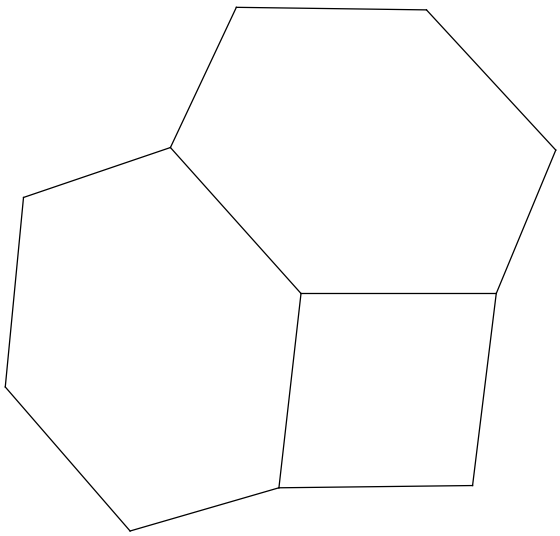


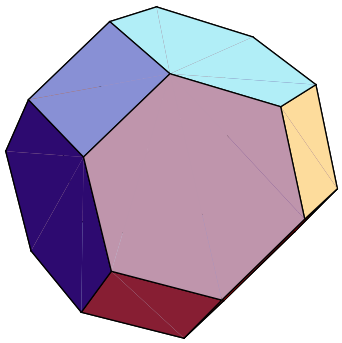


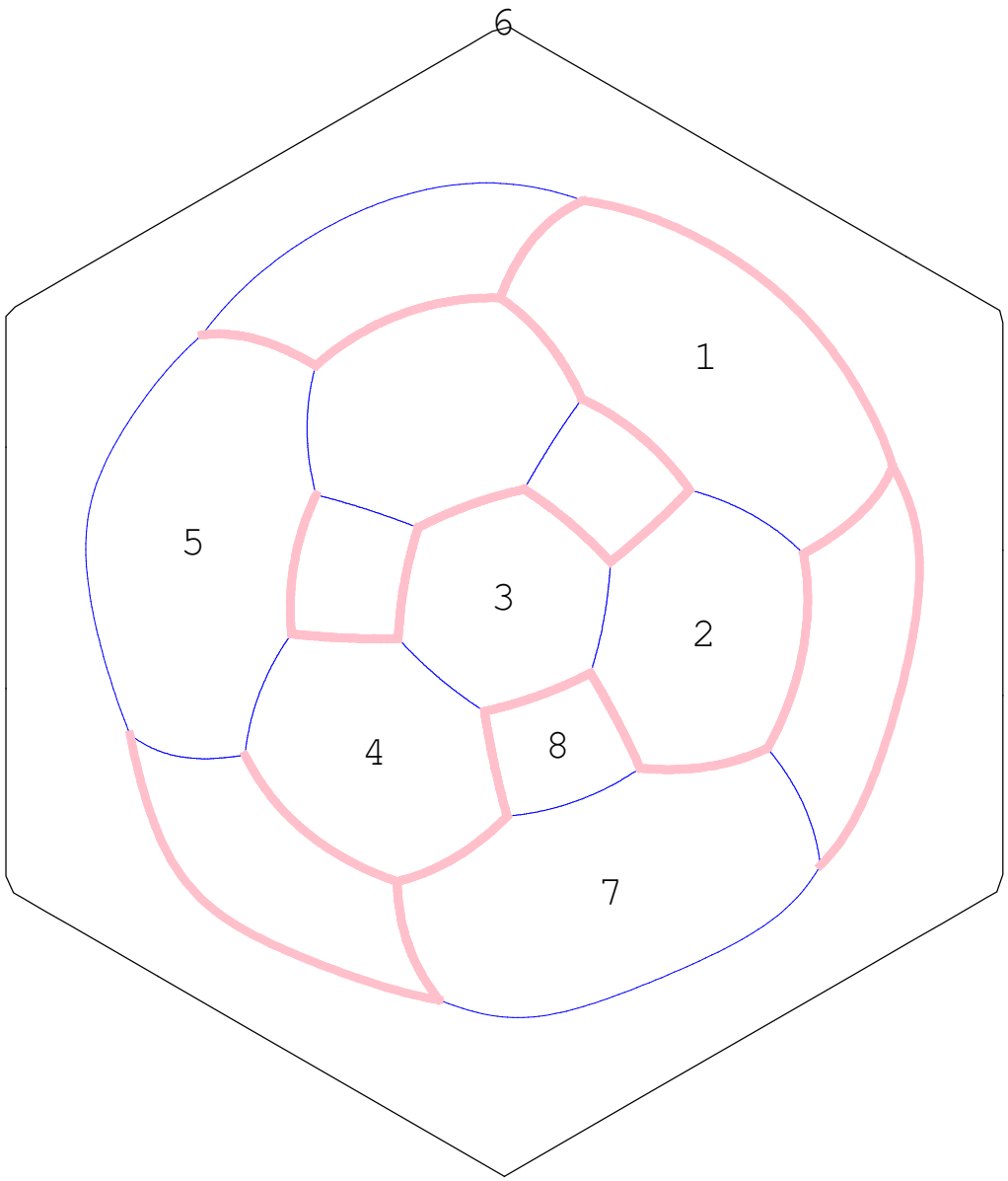


10.

`truncated octahedron` {6, 6, 4}

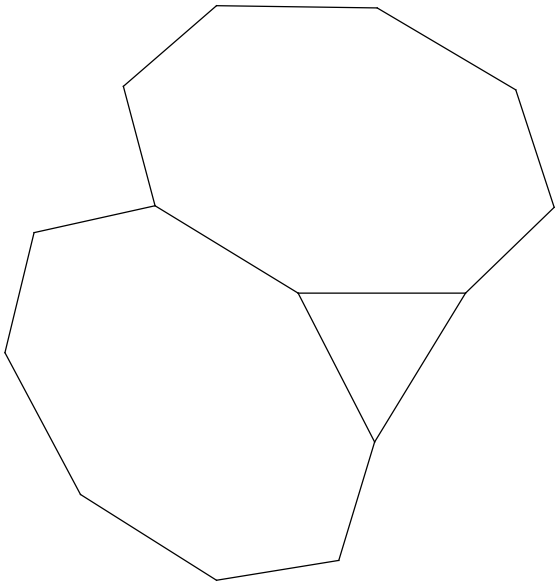


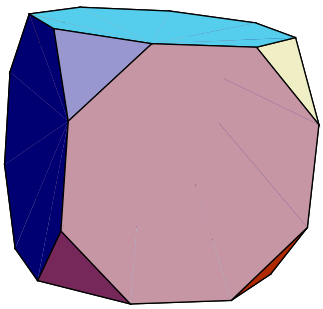


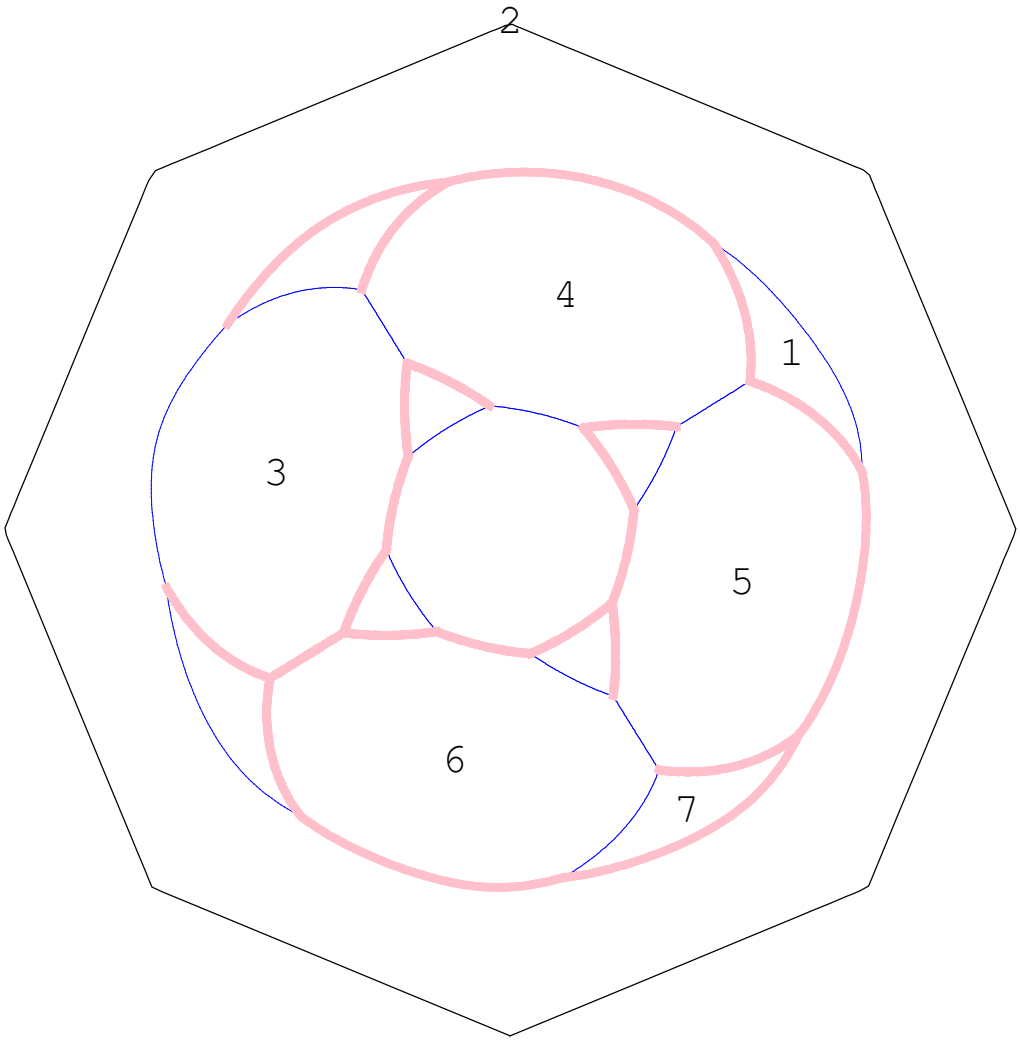


11.

truncated cube {8, 8, 3}

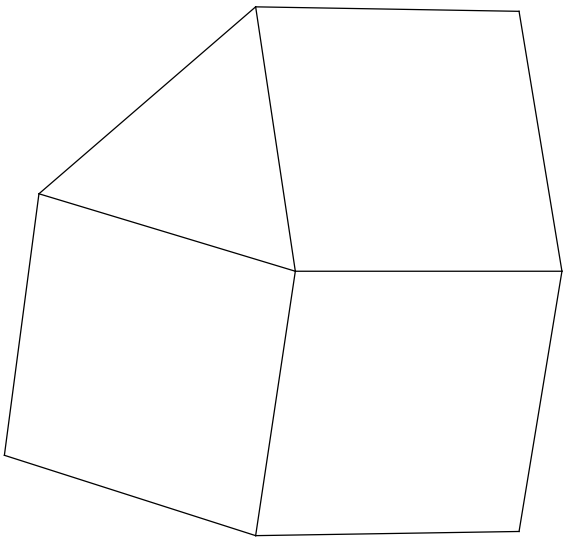


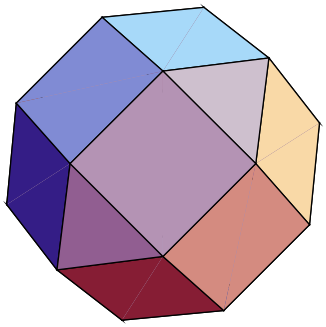


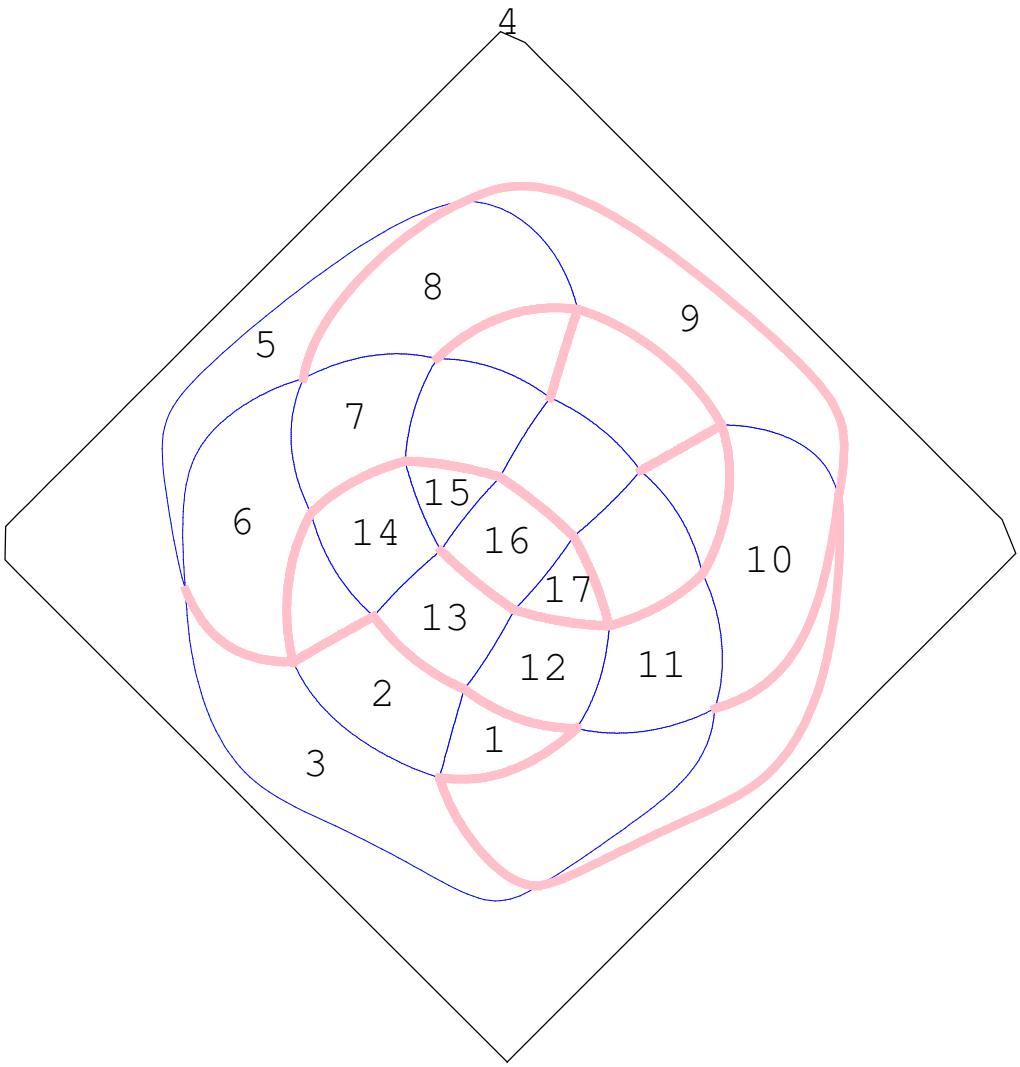


12.

`rhombicuboctahedron` {4, 3, 4, 4}

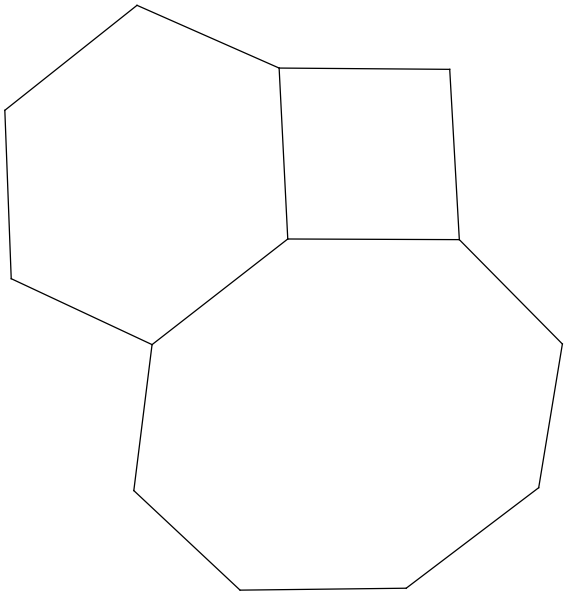


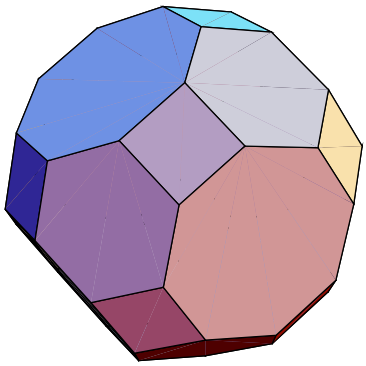


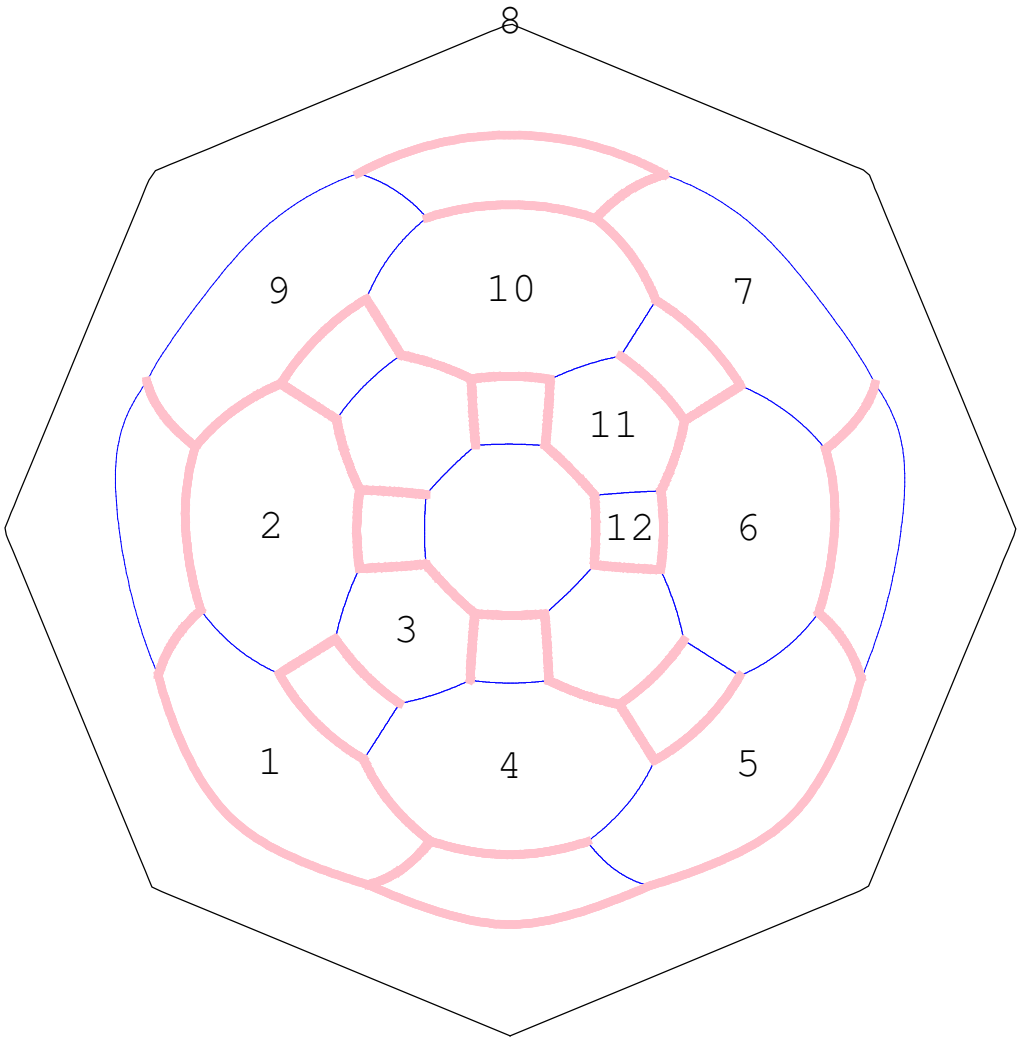


13.

`truncated cuboctahedron` {4, 6, 8}

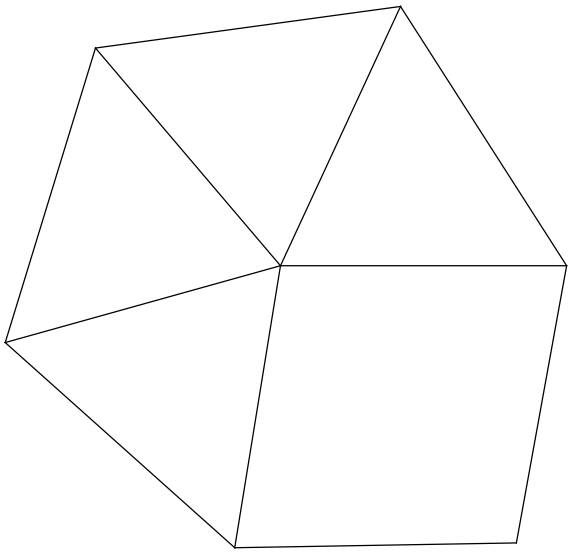


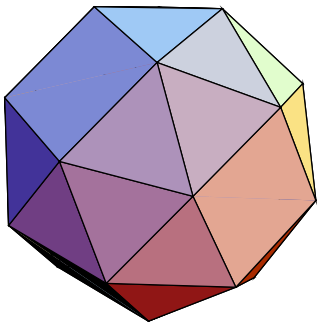


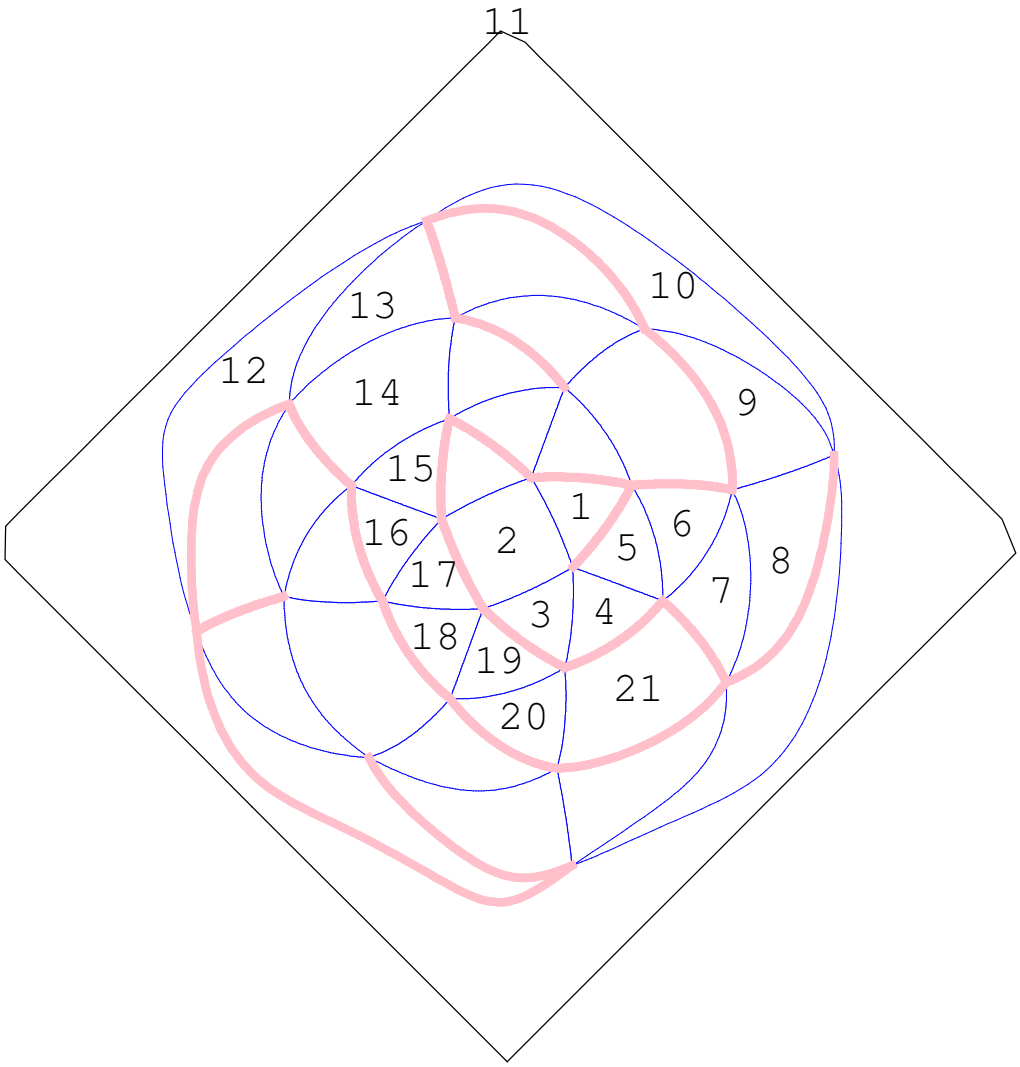


14.

`snub cube` {3, 3, 3, 3, 4}

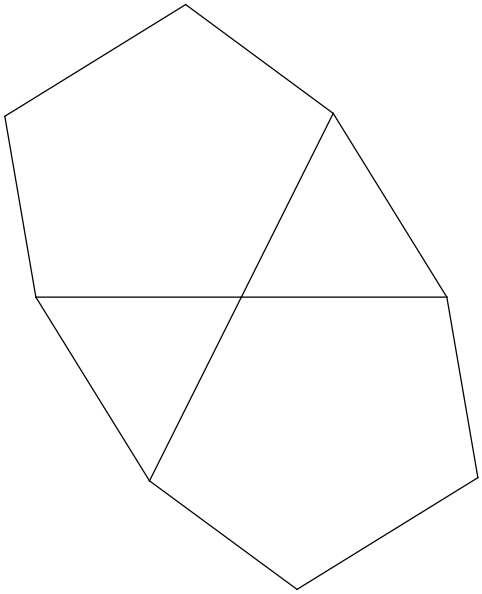


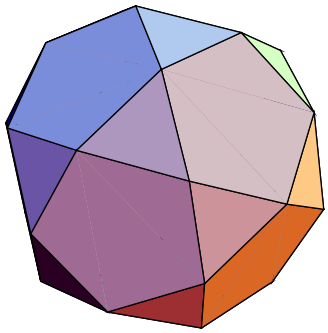


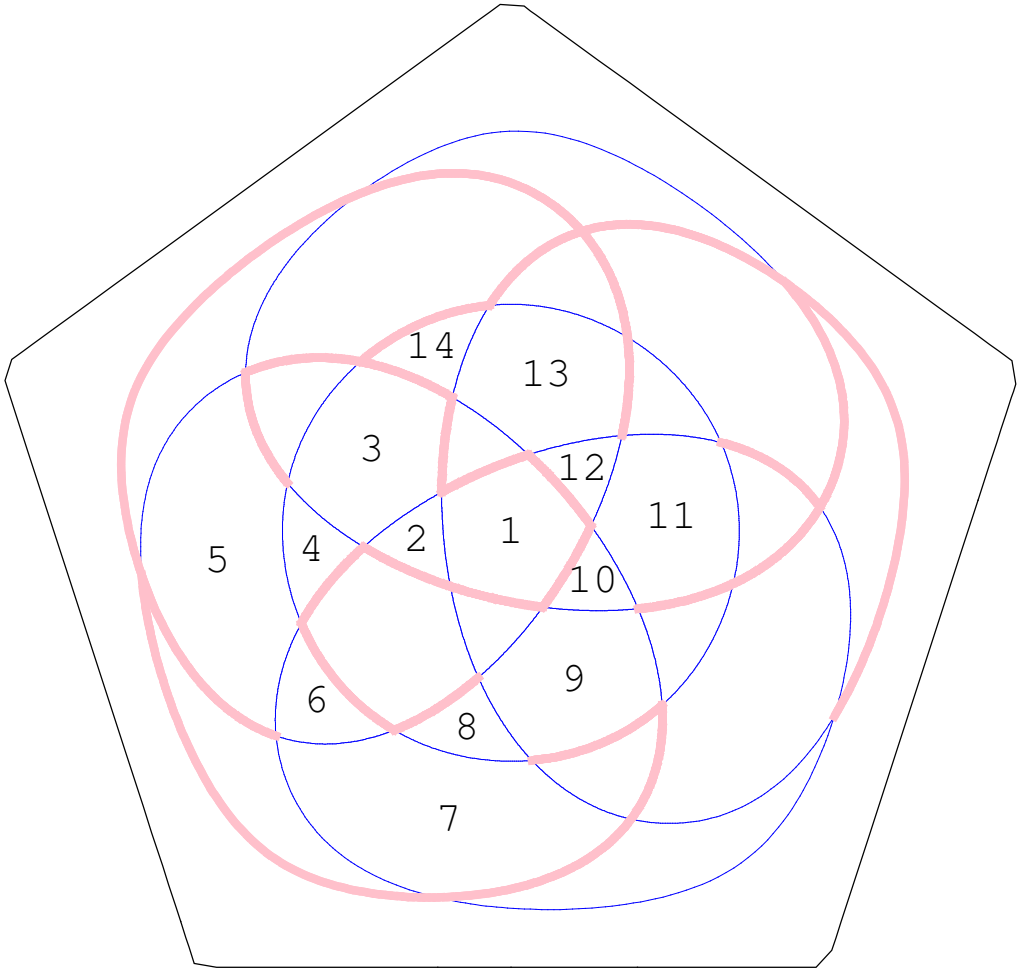


15.

`icosidodecahedron` {3, 5, 3, 5}

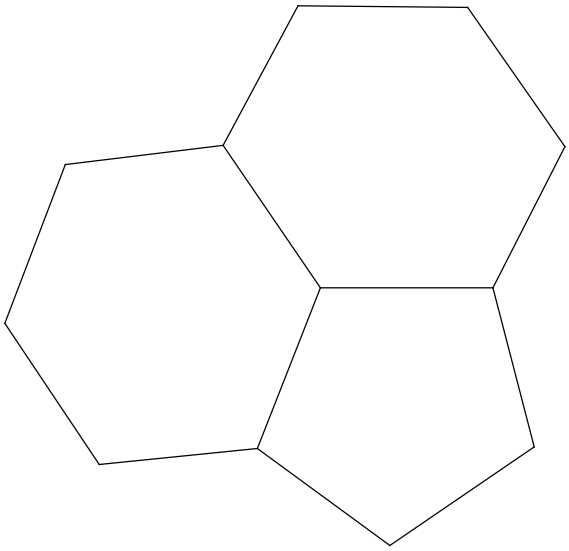


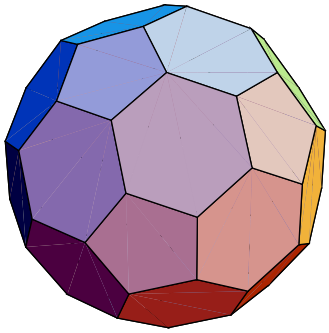


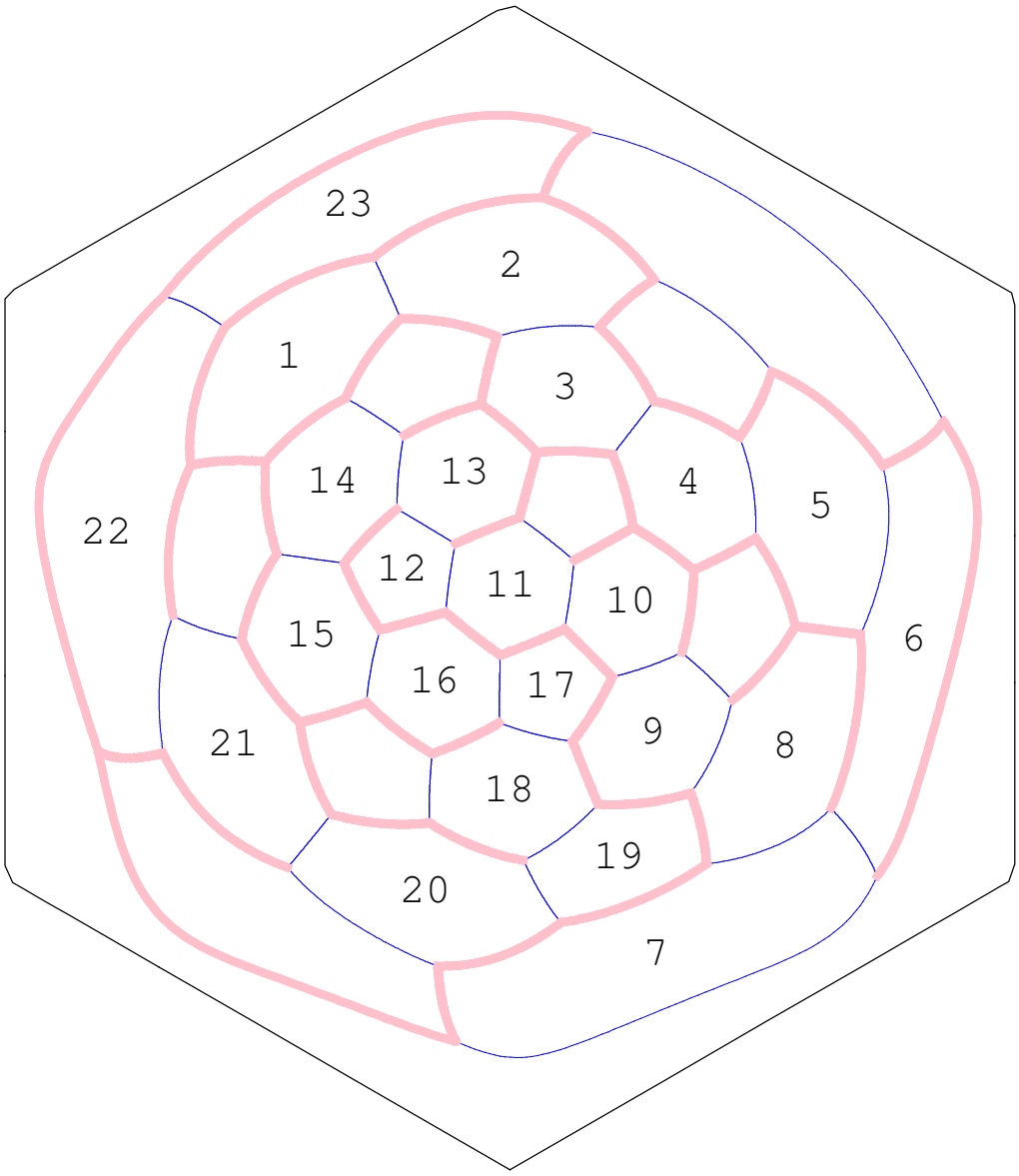


16.

`truncated icosahedron` {6, 6, 5}

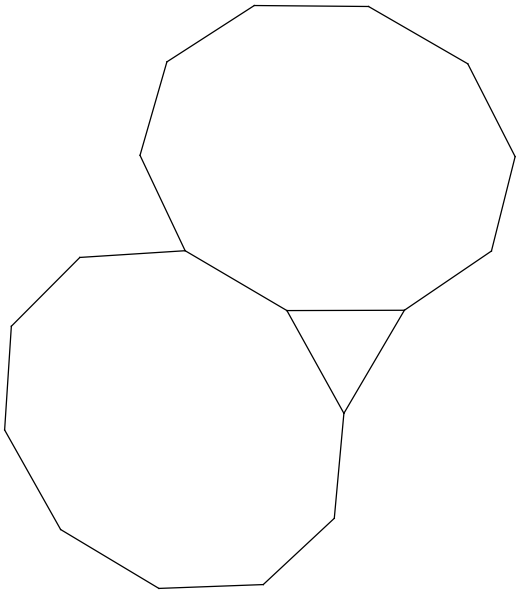


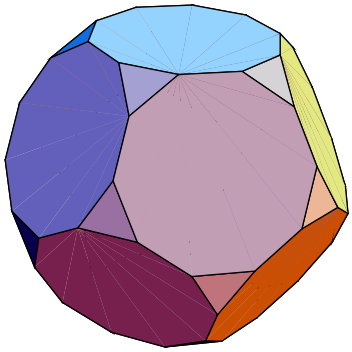


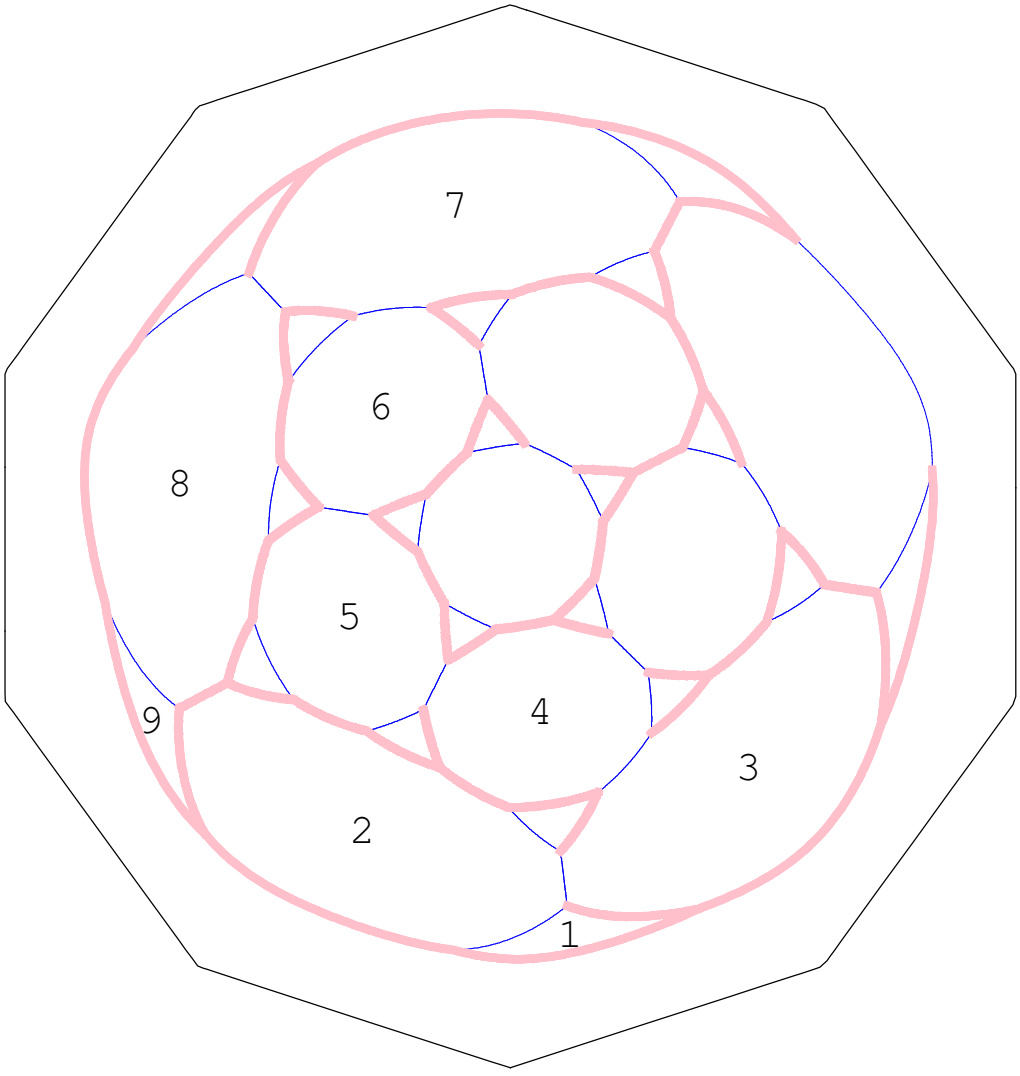


17.

`truncated dodecahedron` {10, 10, 3}

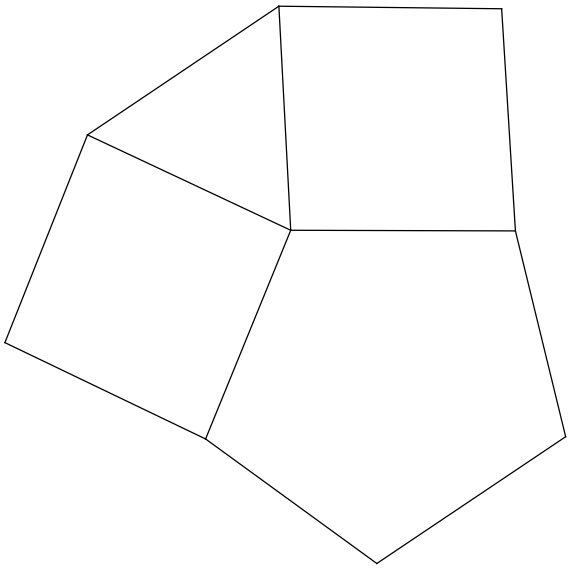


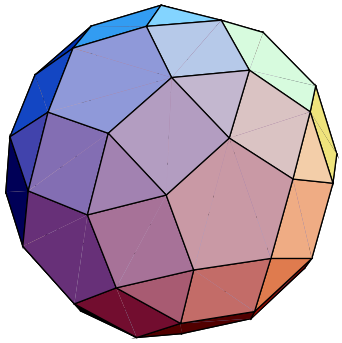


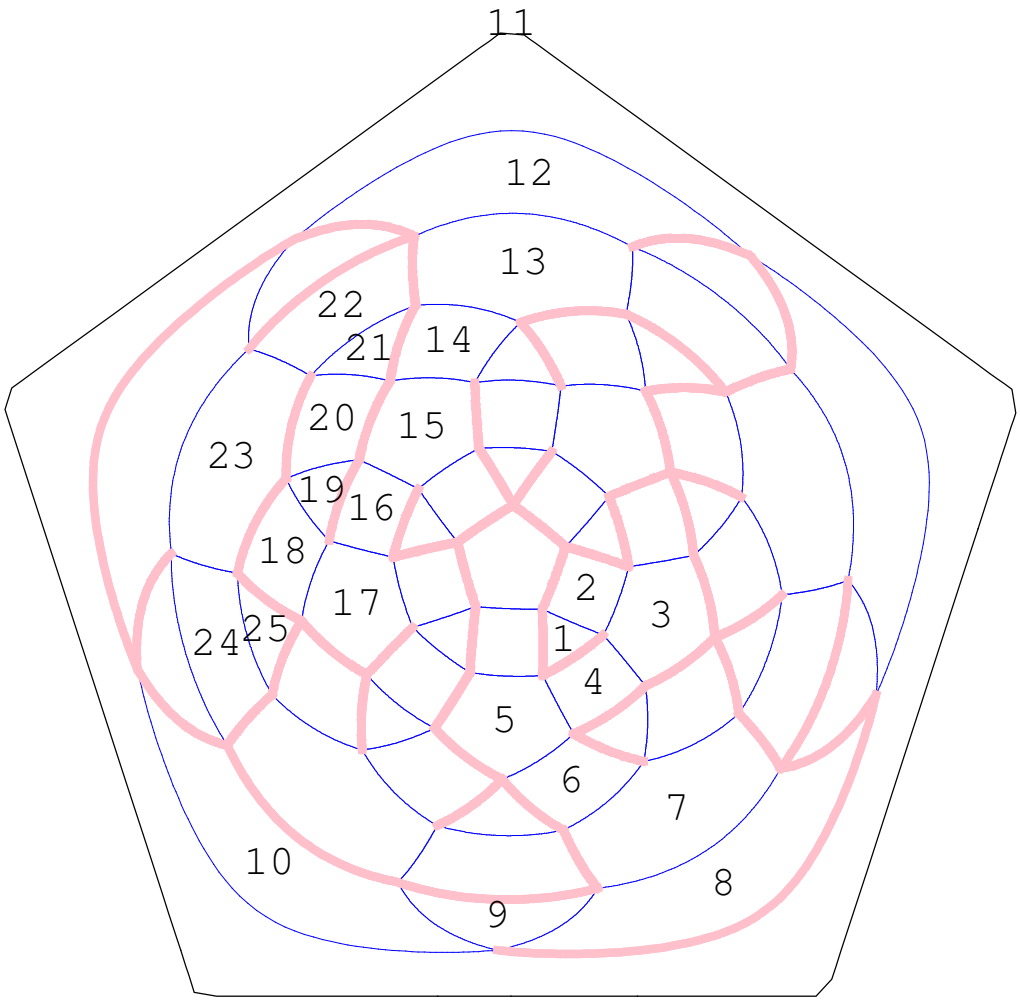


18.

`rhombicosidodecahedron` {4, 3, 4, 5}

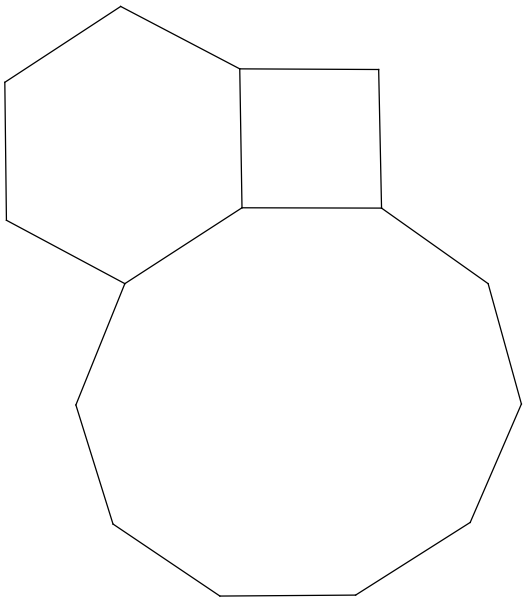


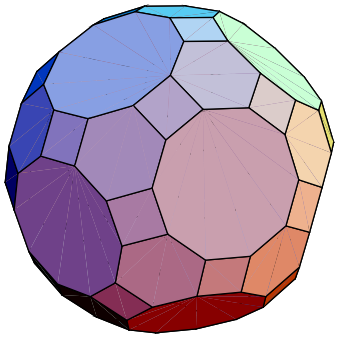


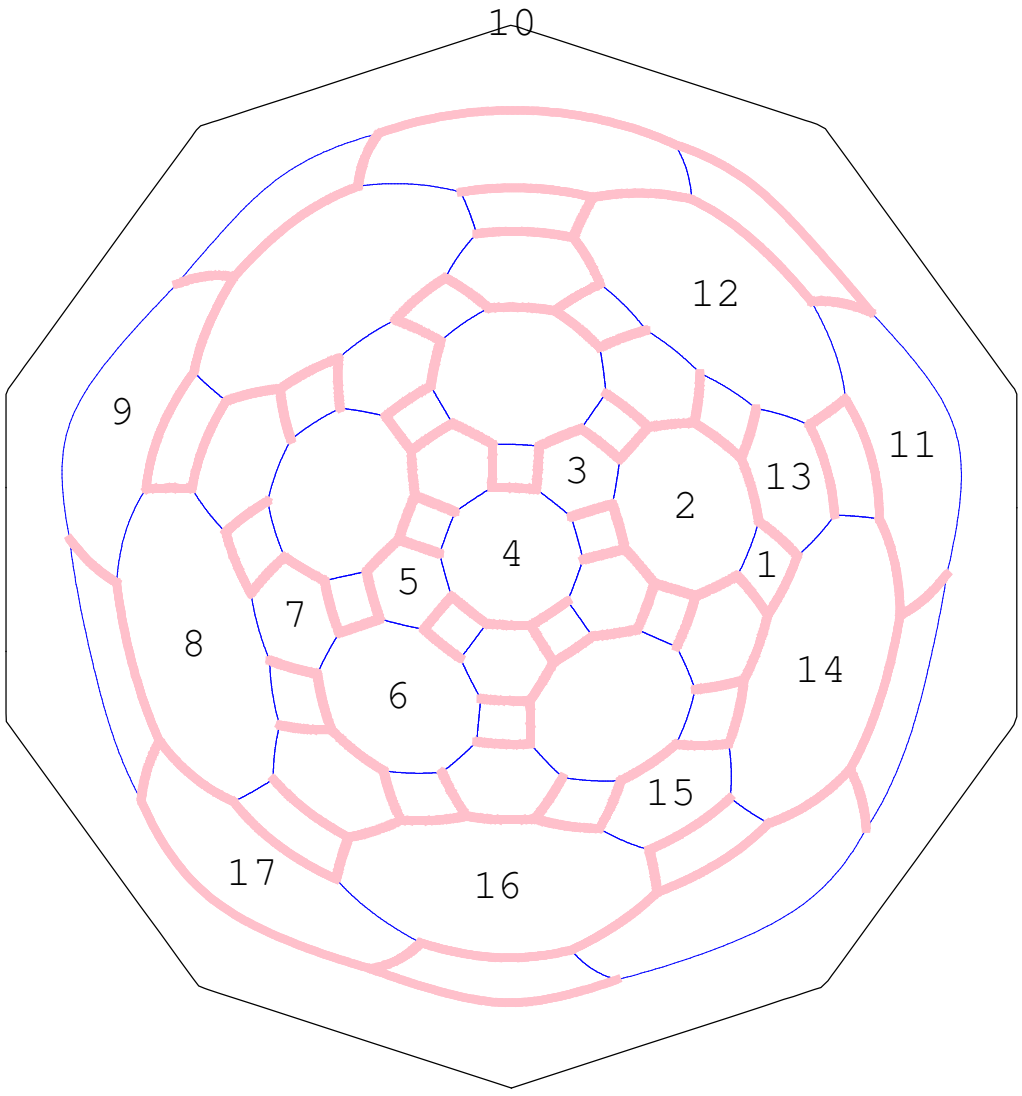


19.

`truncated icosidodecahedron` {4, 6, 10}

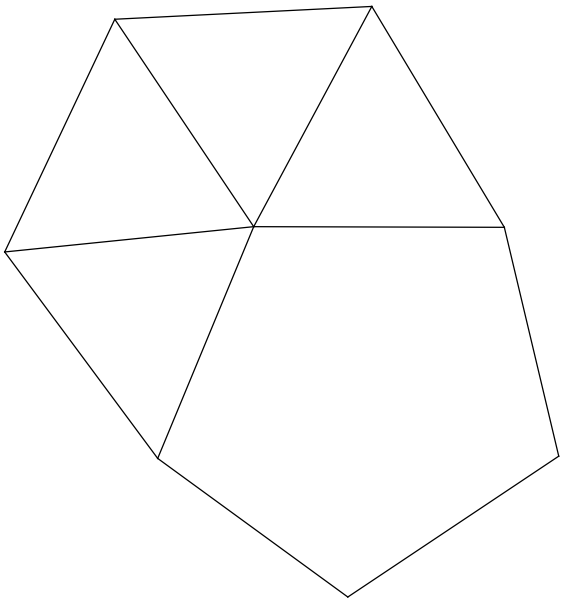


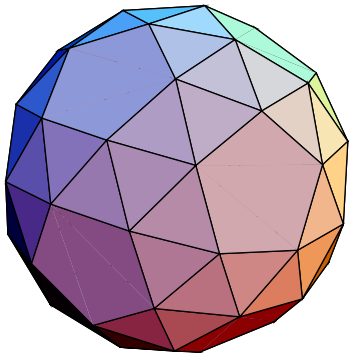


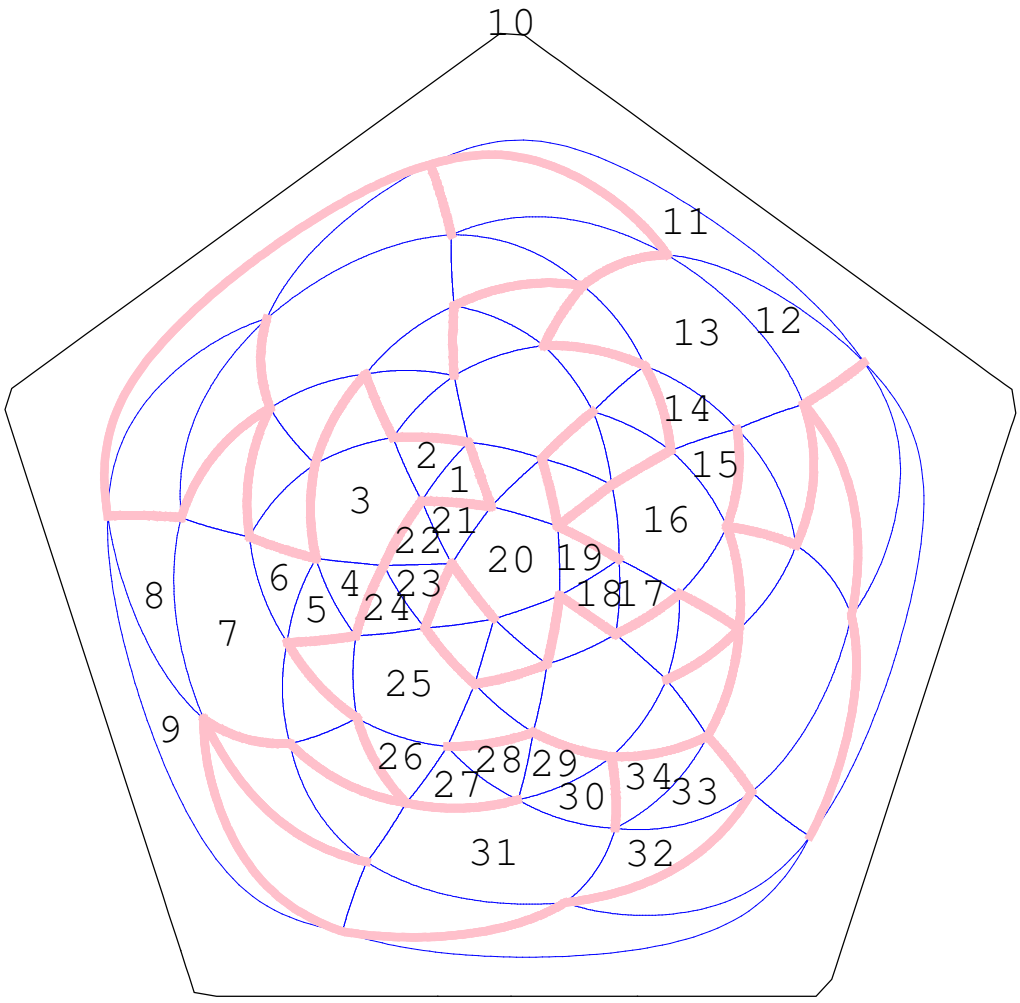


20.

`snub dodecahedron` {3, 3, 3, 3, 5}

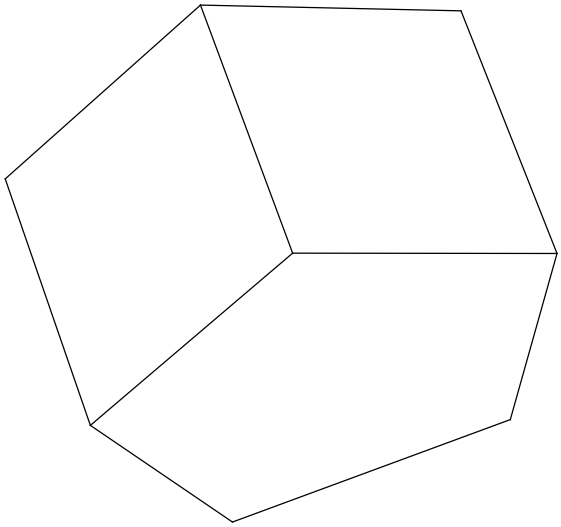


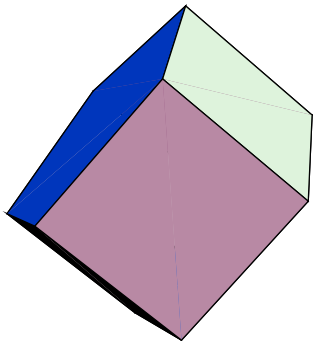


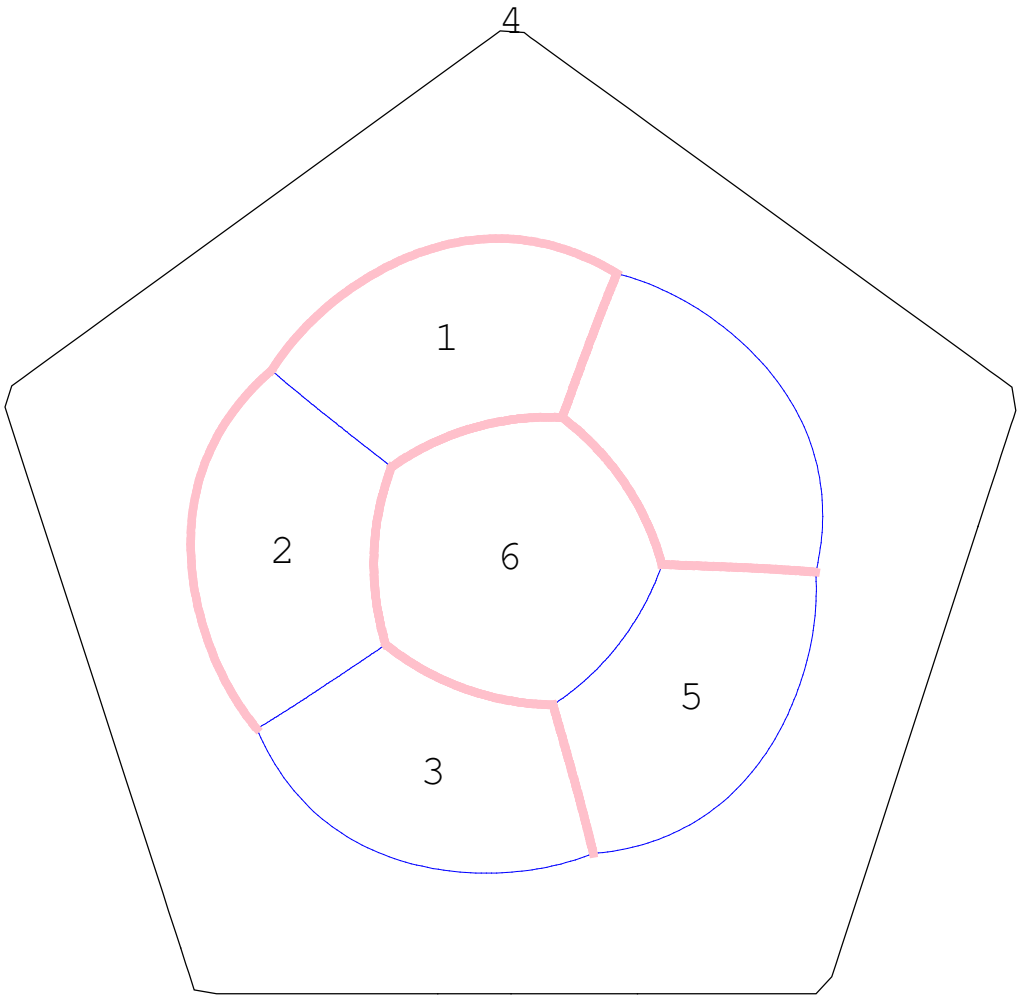


21.

`pentagonal prism` {4, 4, 5}

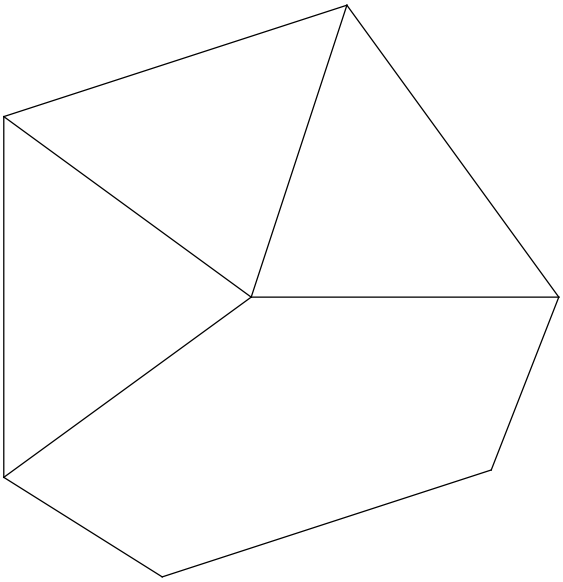


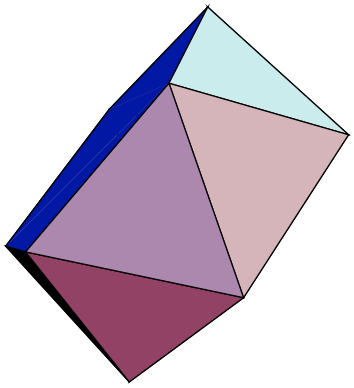


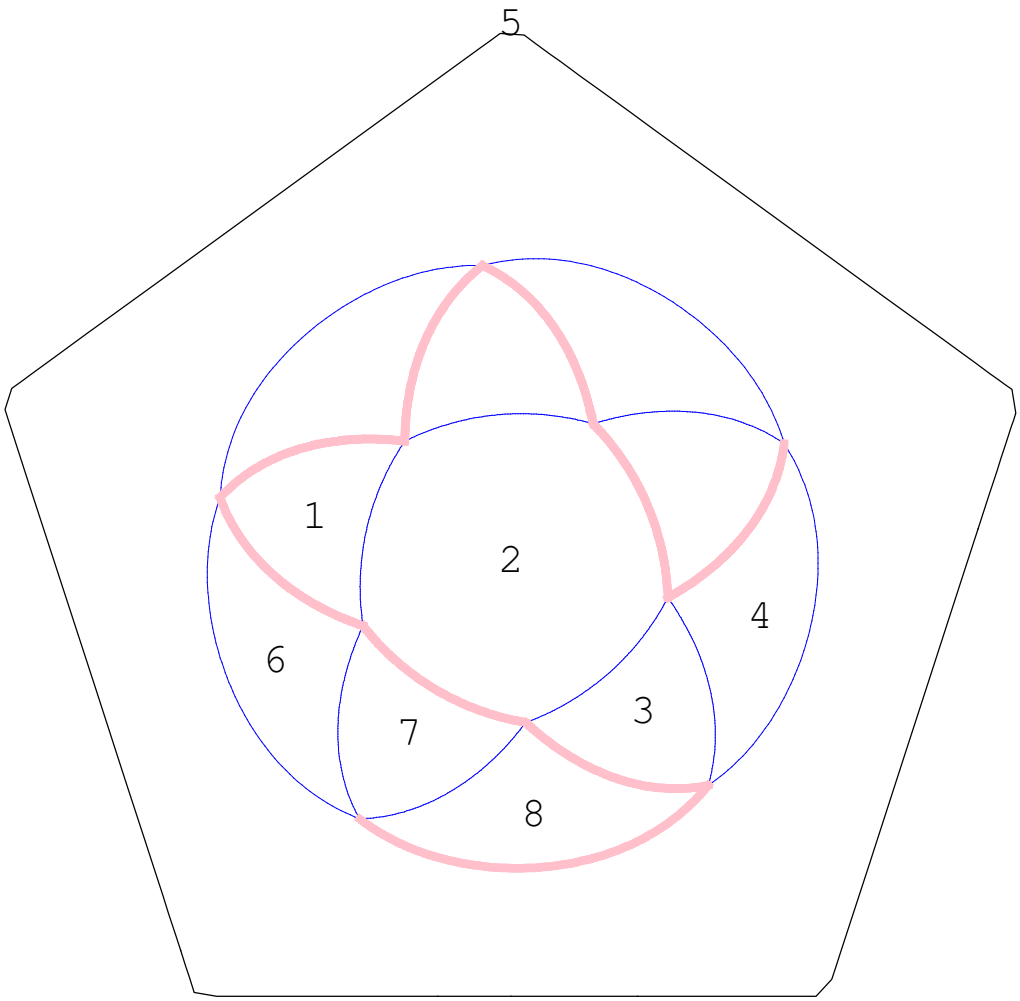


22.

`pentagonal antiprism` {3, 3, 3, 5}

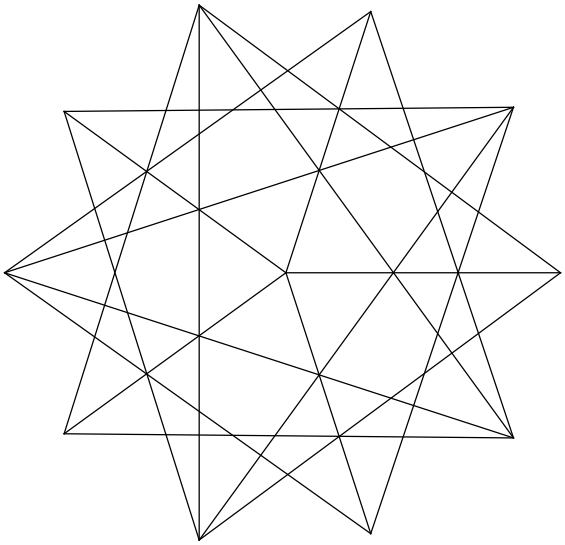


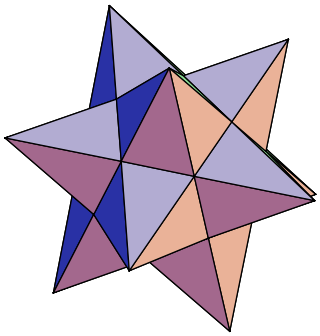


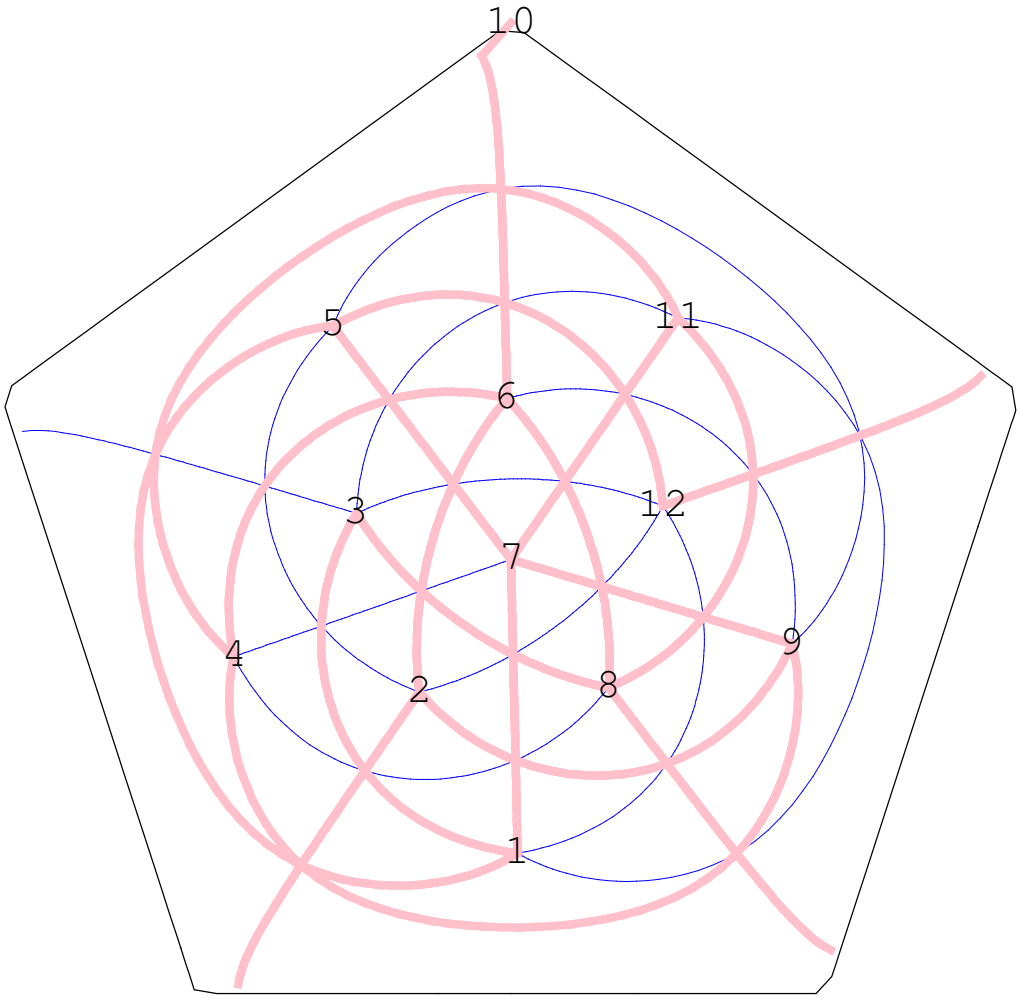


23.

small stellated dodecahedron $\{\frac{5}{2}, \frac{5}{2}, \frac{5}{2}, \frac{5}{2}, \frac{5}{2}\}$

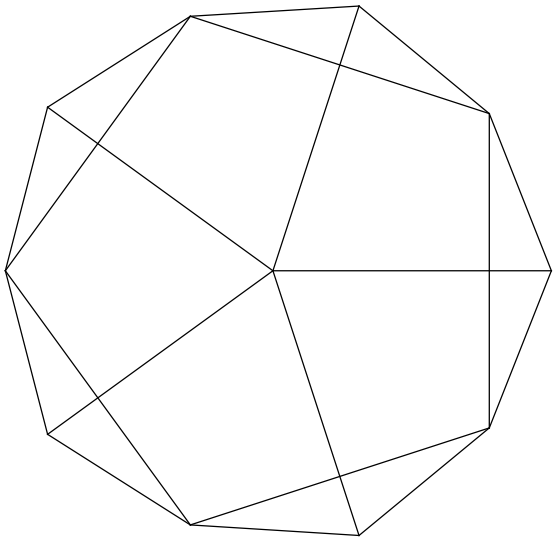


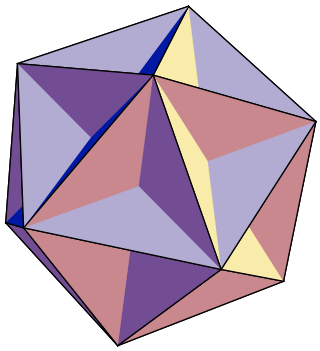


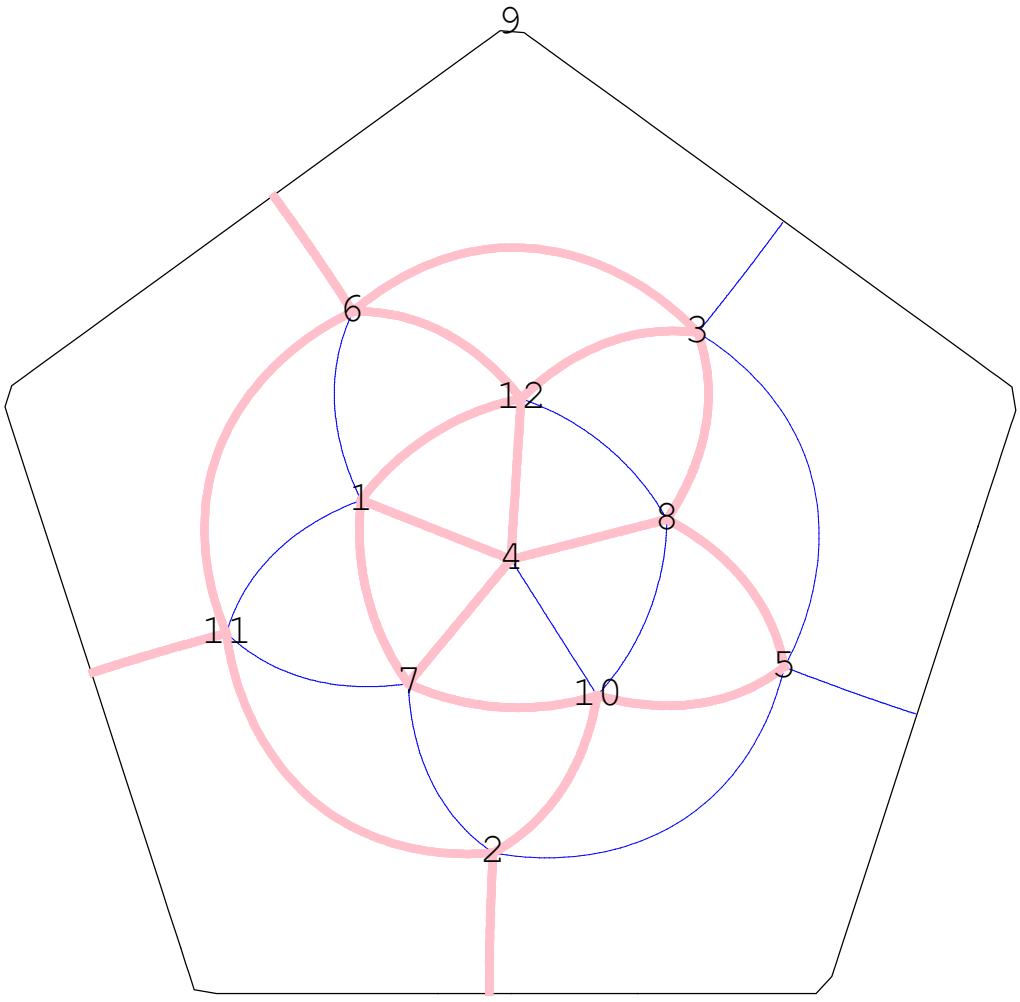


24.

great dodecahedron $\frac{1}{2}\{5, 5, 5, 5, 5\}$

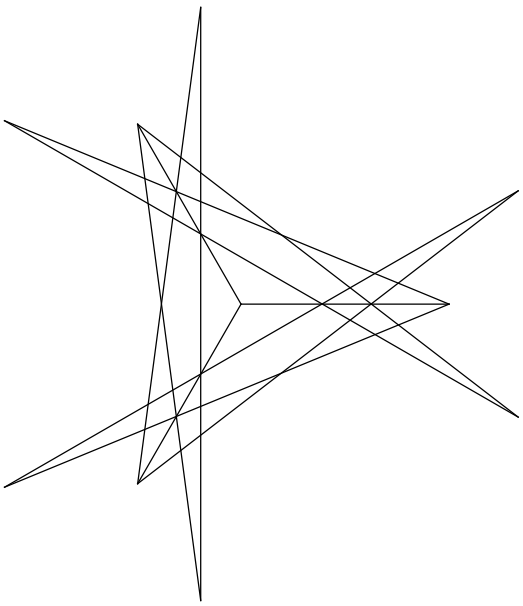


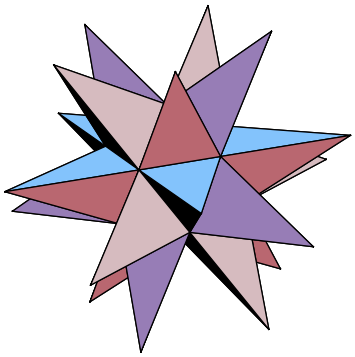


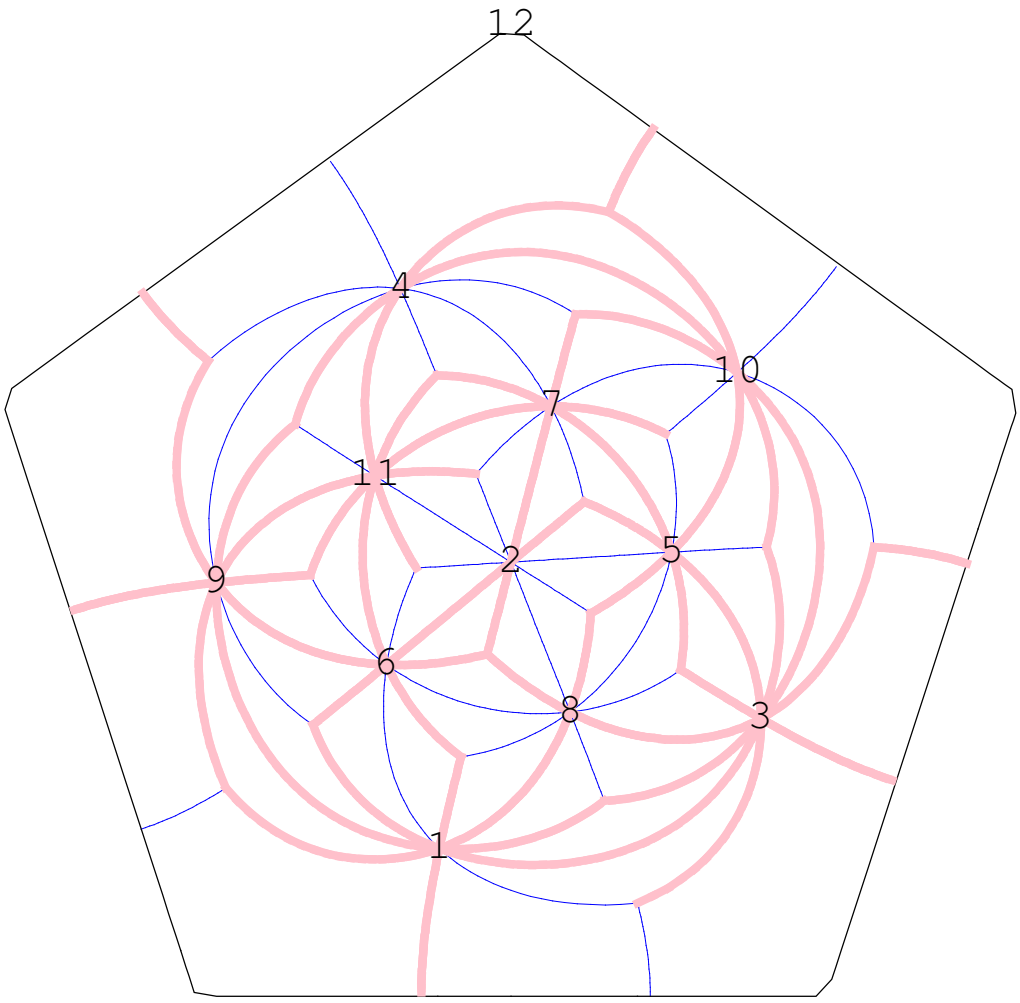


25.

great stellated dodecahedron $\{\frac{5}{2}, \frac{5}{2}, \frac{5}{2}\}$

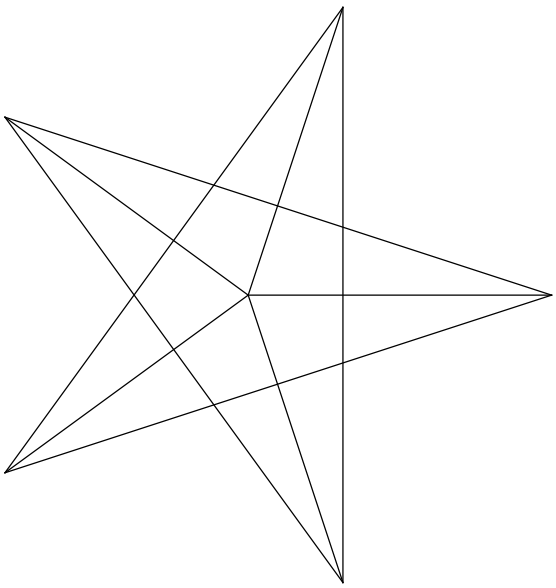


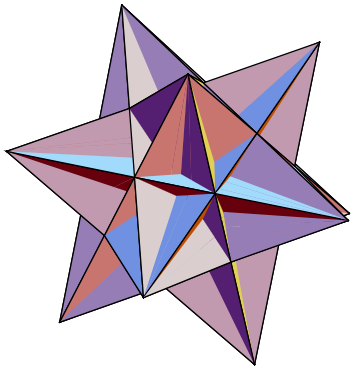


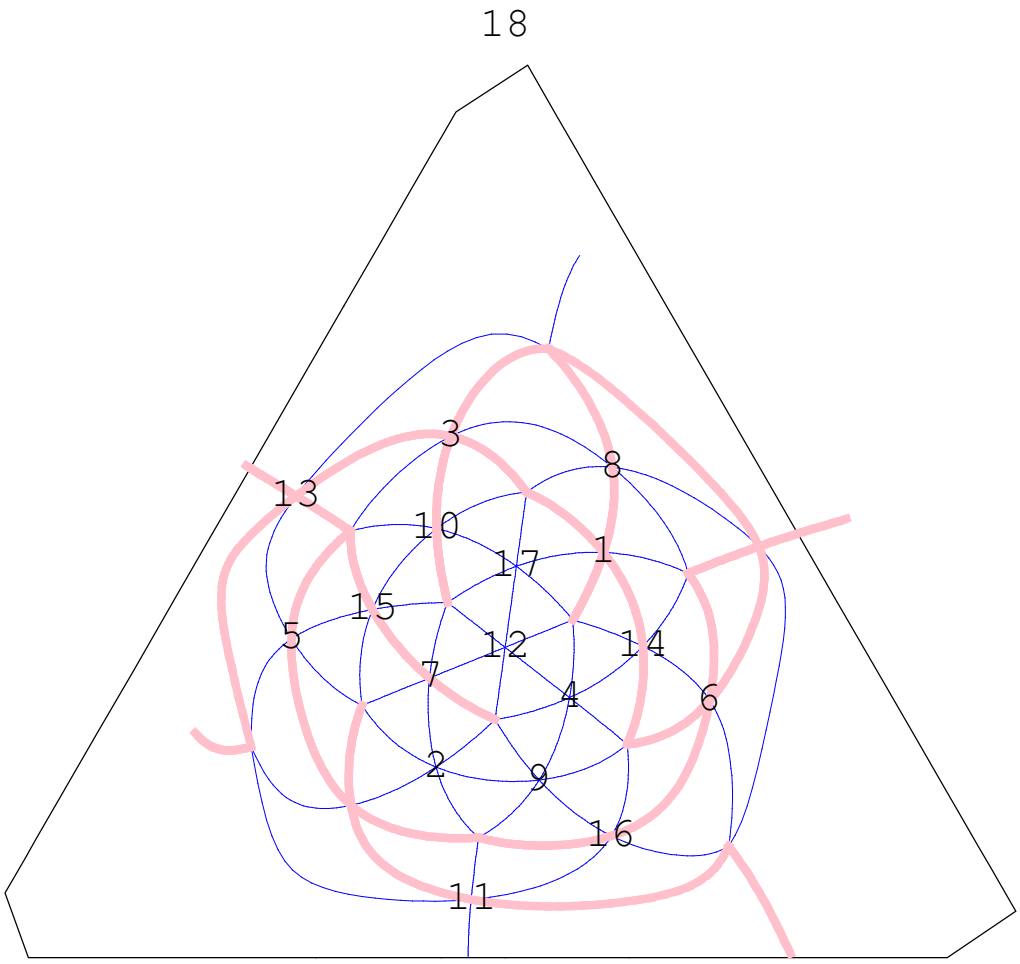


26.

`great icosahedron` $\frac{1}{2}\{3, 3, 3, 3, 3\}$

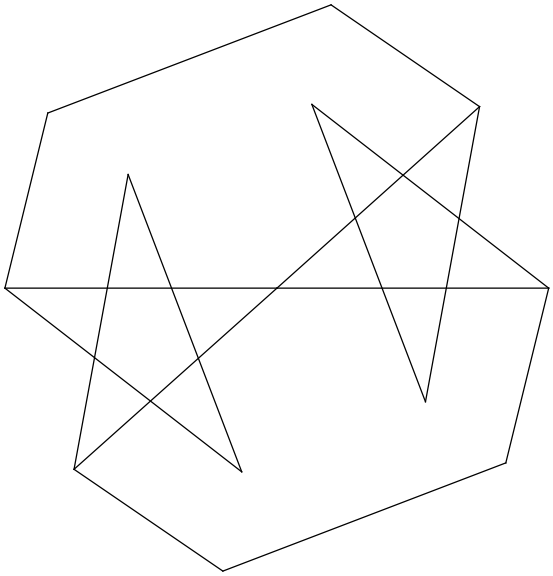


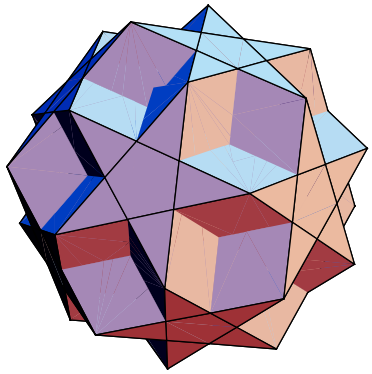


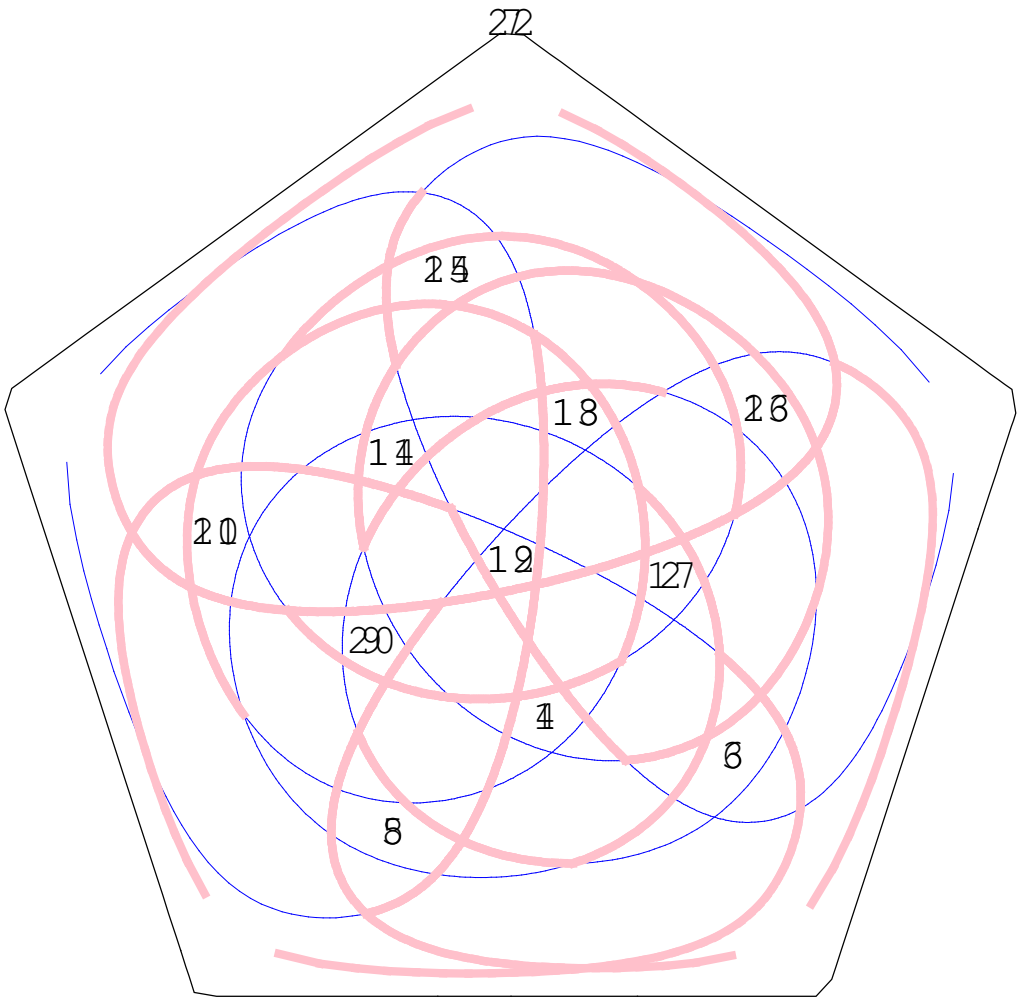


27.

dodecadodecahedron $\{\frac{5}{2}, 5, \frac{5}{2}, 5\}$

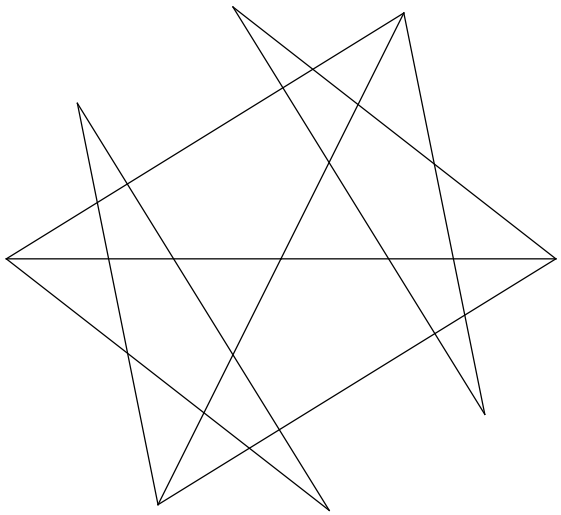


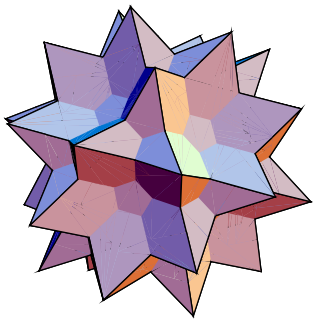


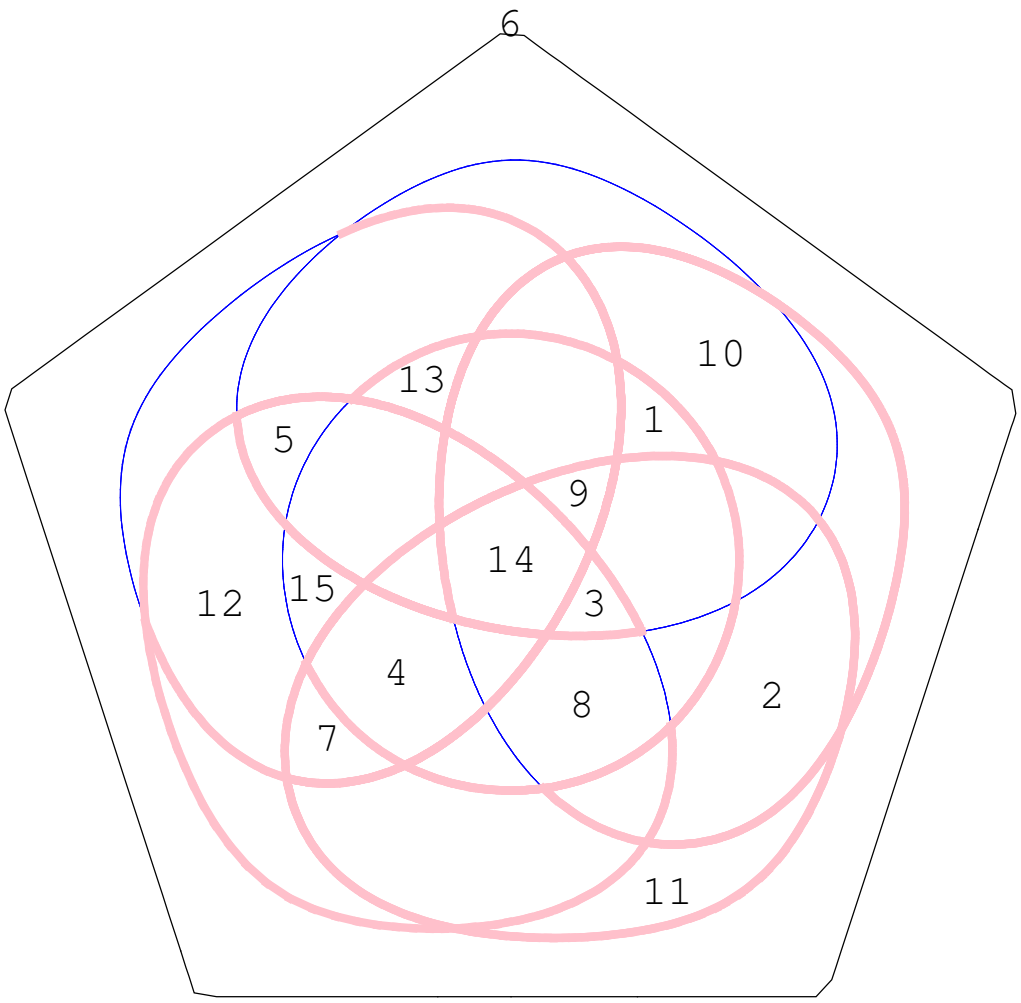


28.

great icosidodecahedron $\{\frac{5}{2}, 3, \frac{5}{2}, 3\}$

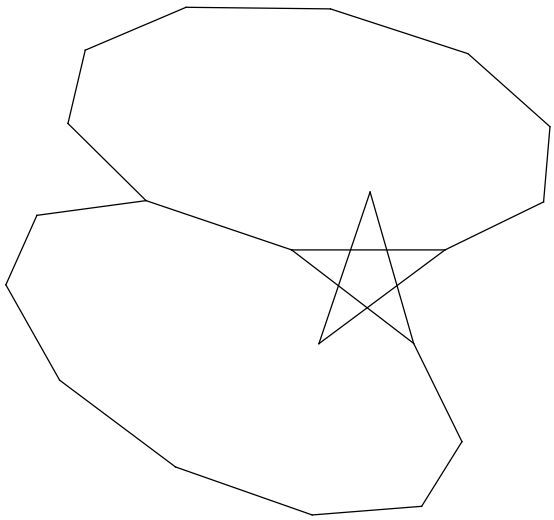


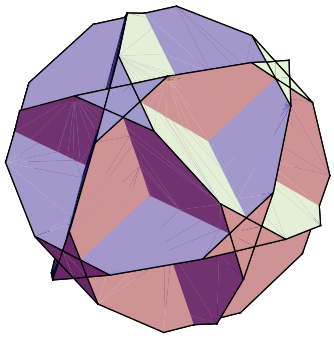


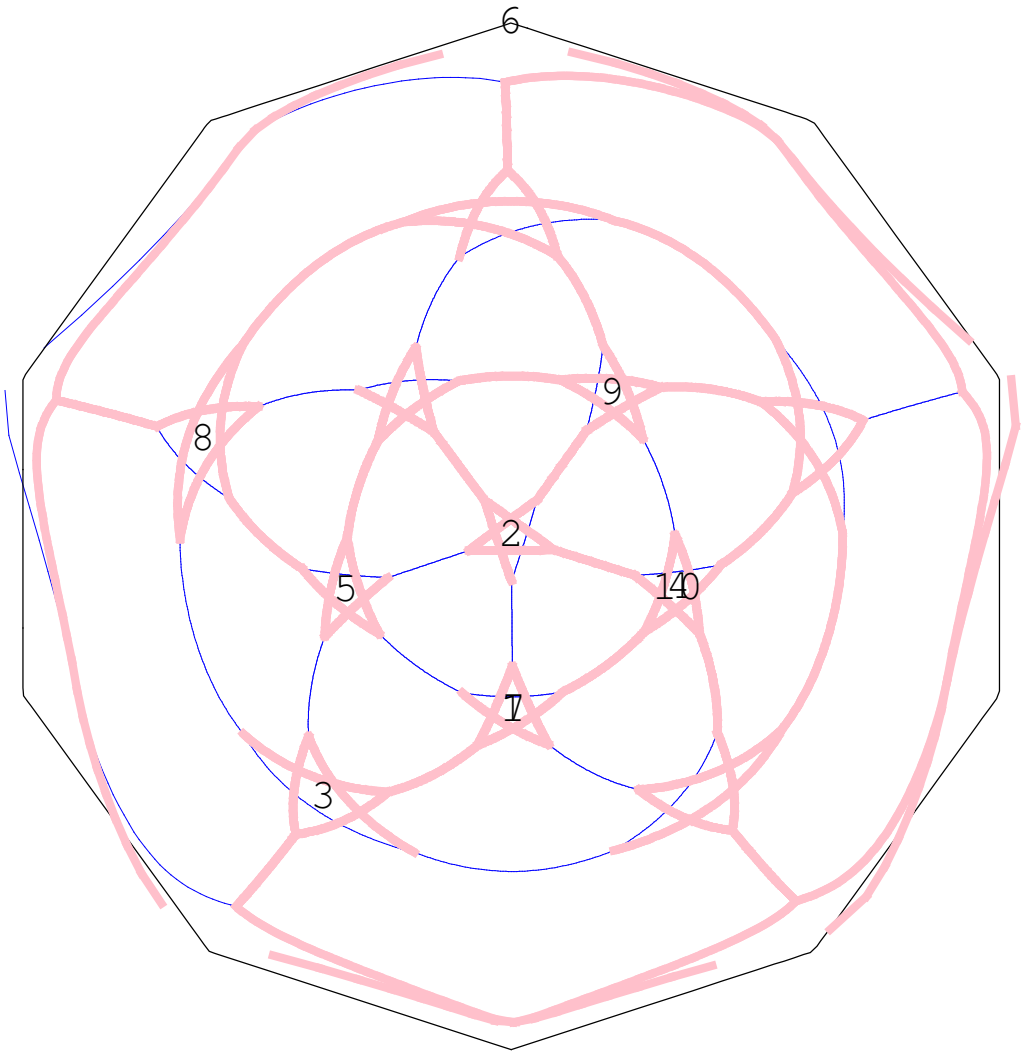


29.

`truncated great dodecahedron` $\{10, 10, \frac{5}{2}\}$

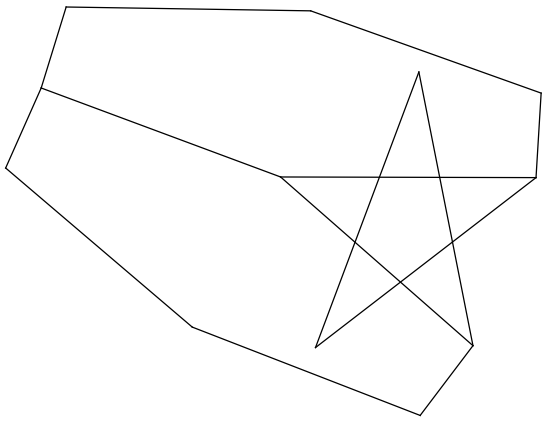


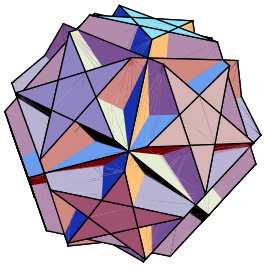


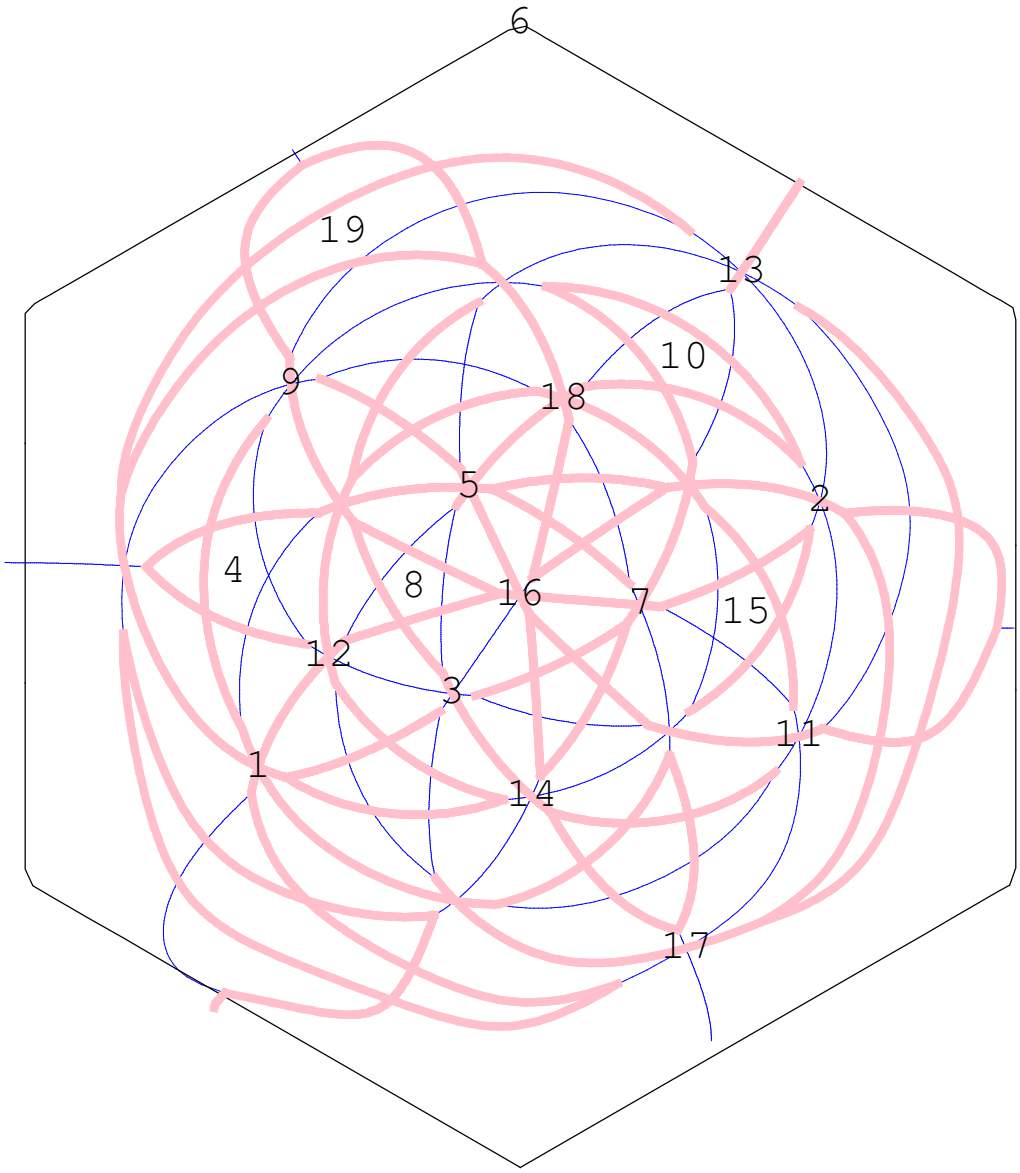


30.

great truncated icosahedron $\{6, 6, \frac{5}{2}\}$

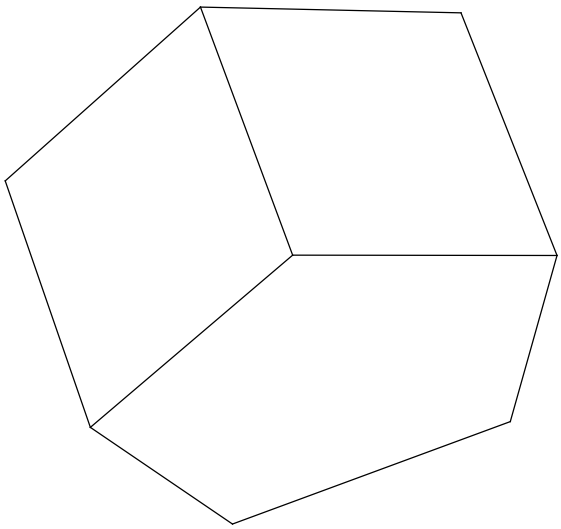


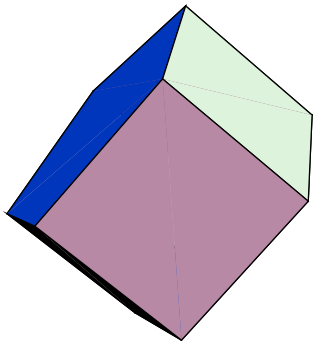


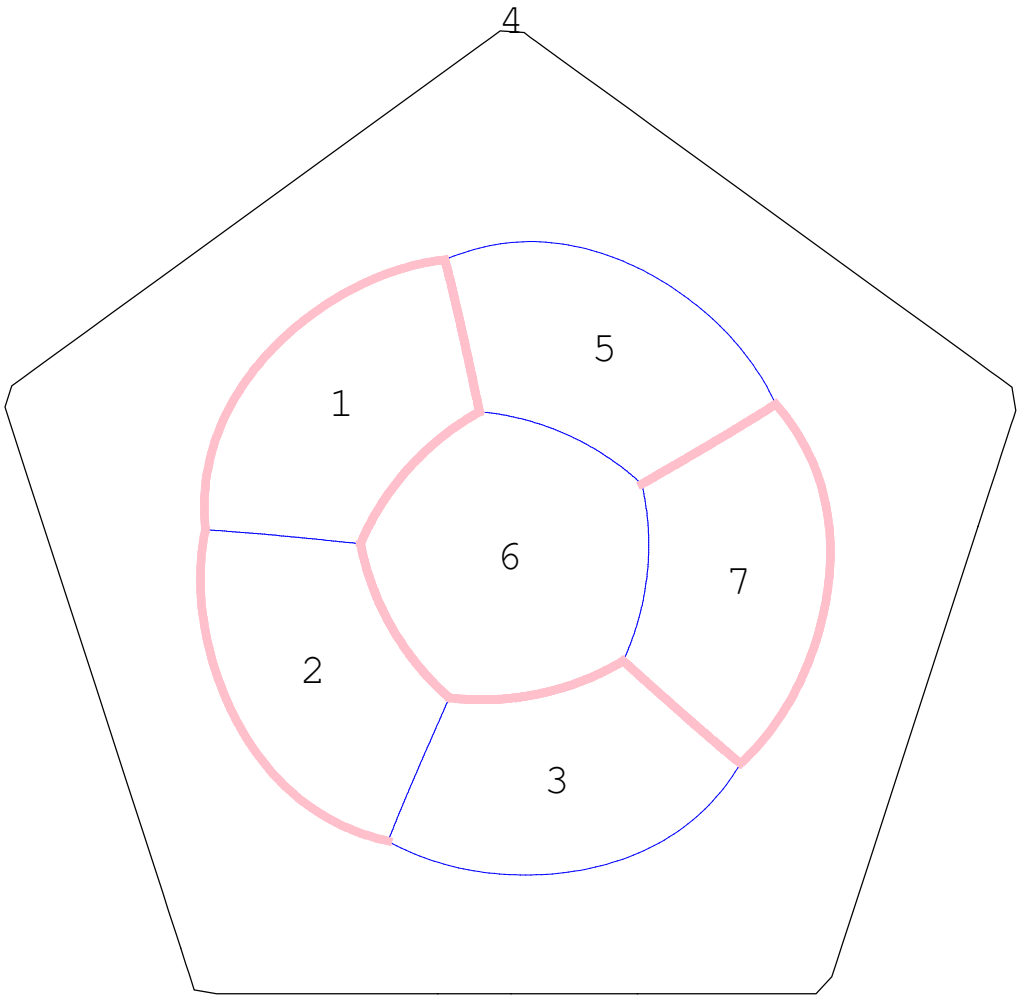


31.

`pentagonal prism` {4, 4, 5}

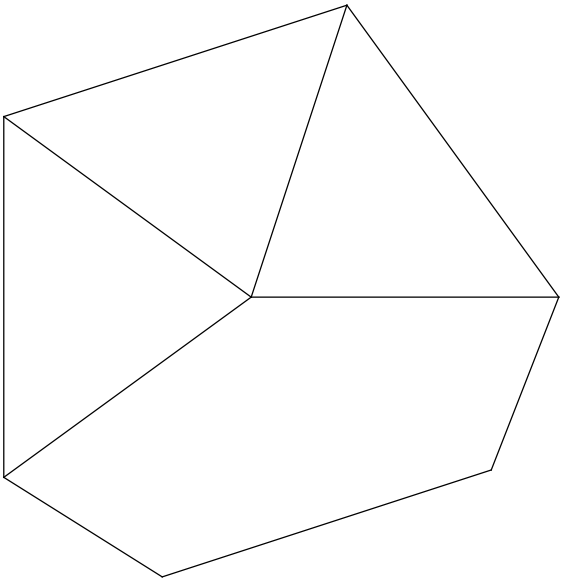


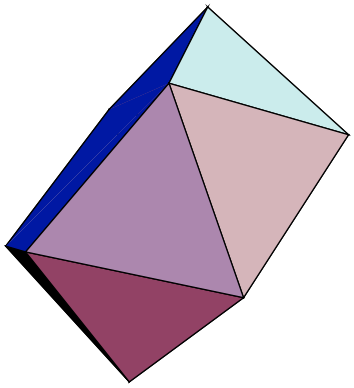


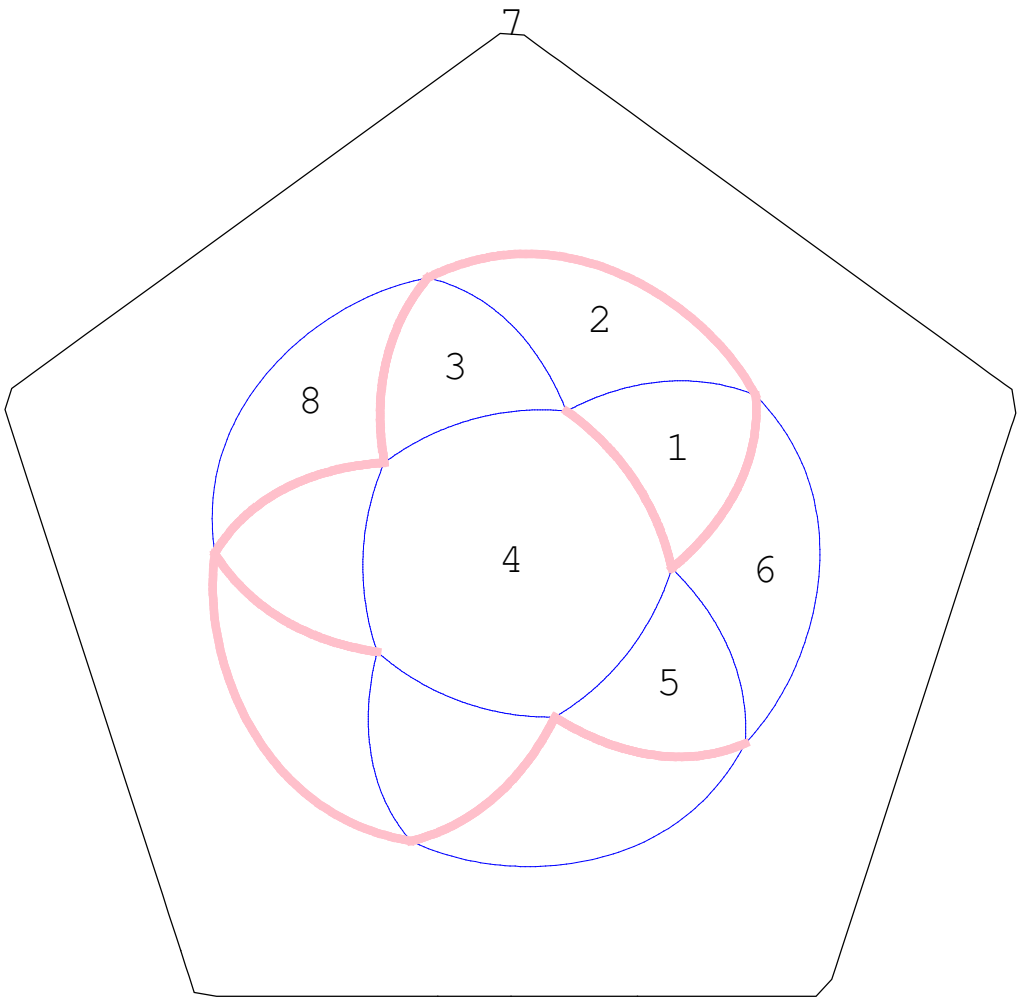


32.

`pentagonal antiprism` {3, 3, 3, 5}

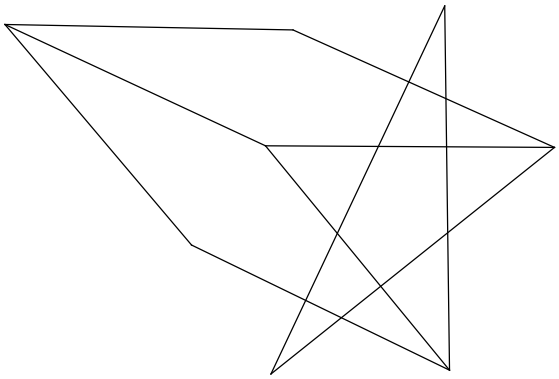


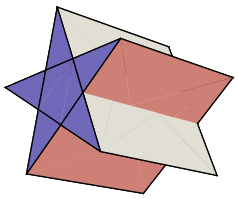


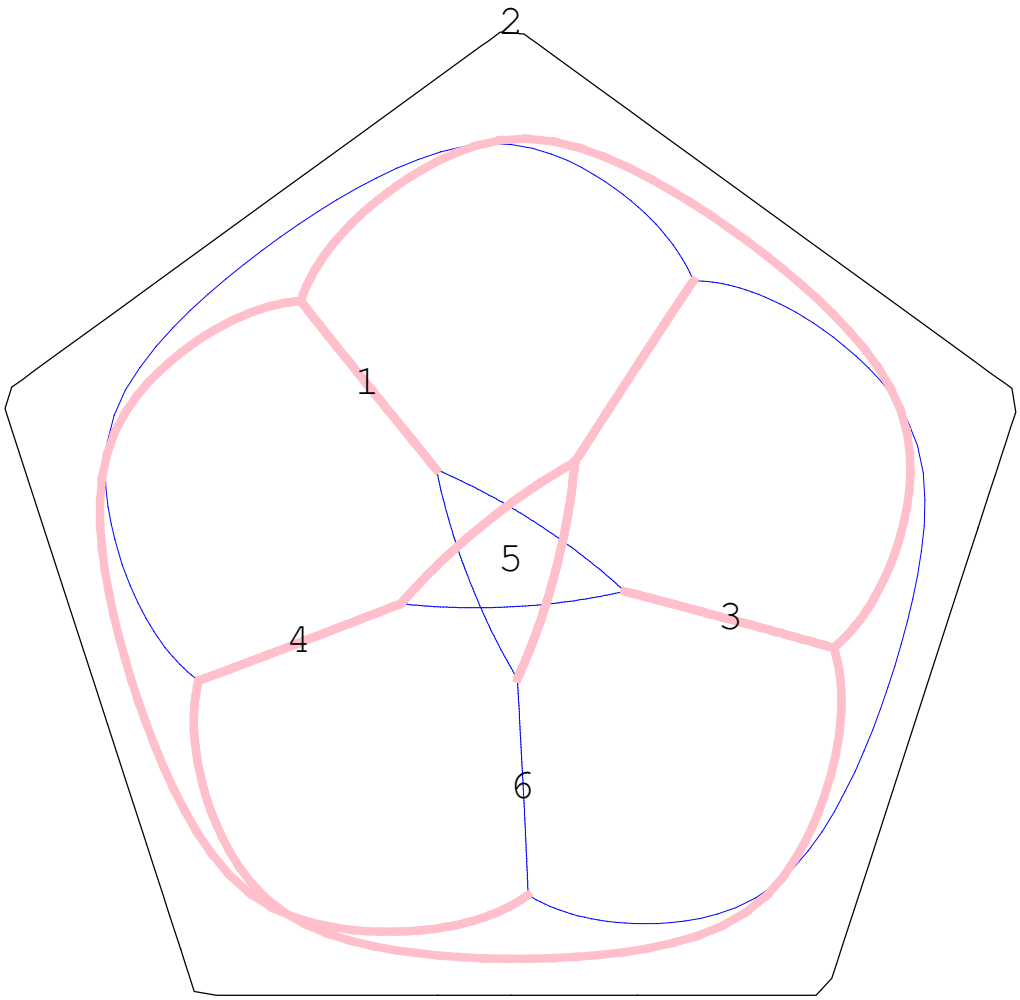


33.

pentagrammic prism $\{4, 4, \frac{5}{2}\}$

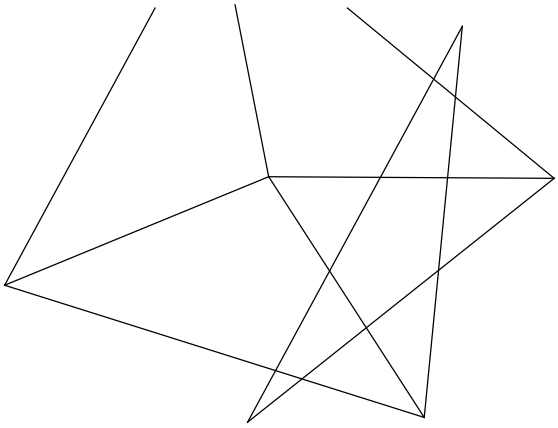


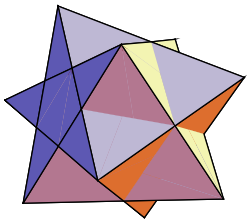


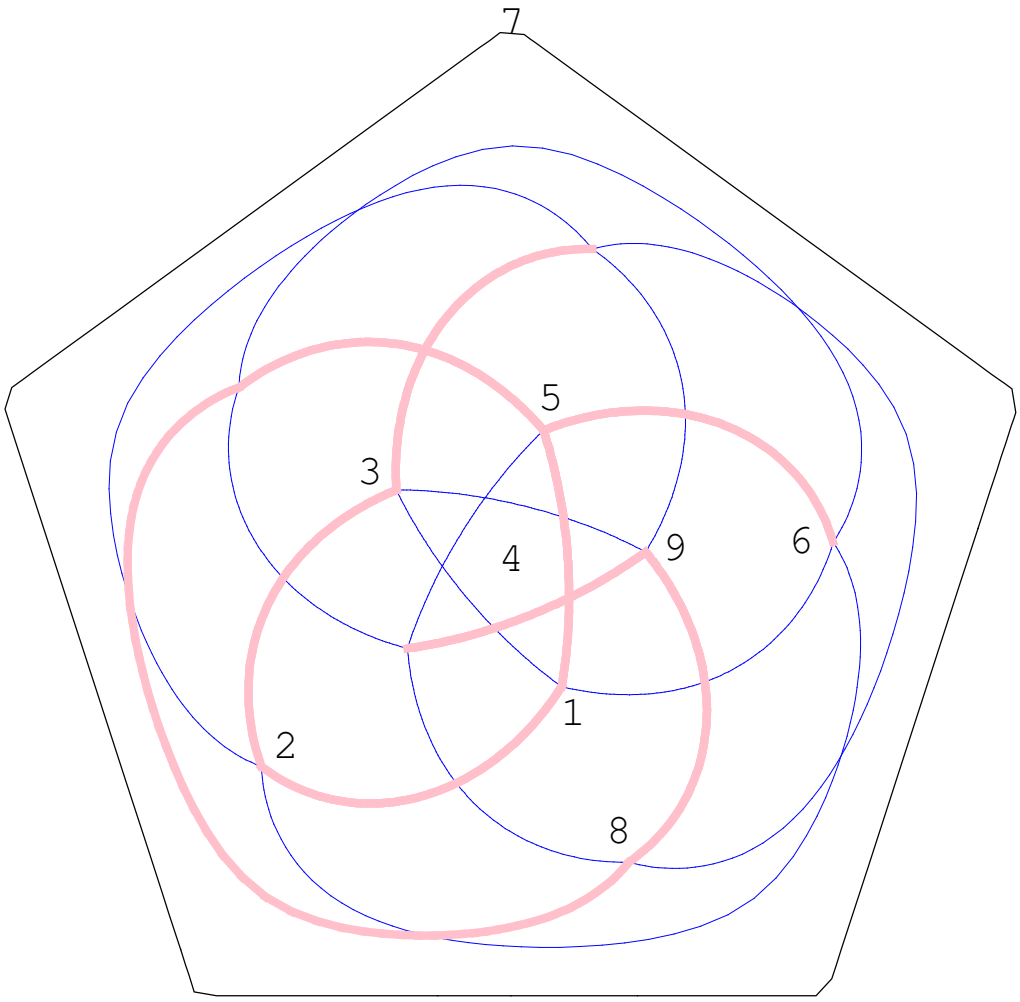


34.

`pentagrammic antiprism` $\left\{3, 3, 3, \frac{5}{2}\right\}$







35.

`pentagrammic crossed antiprism` $\{3, 3, 3, \frac{5}{3}\}$