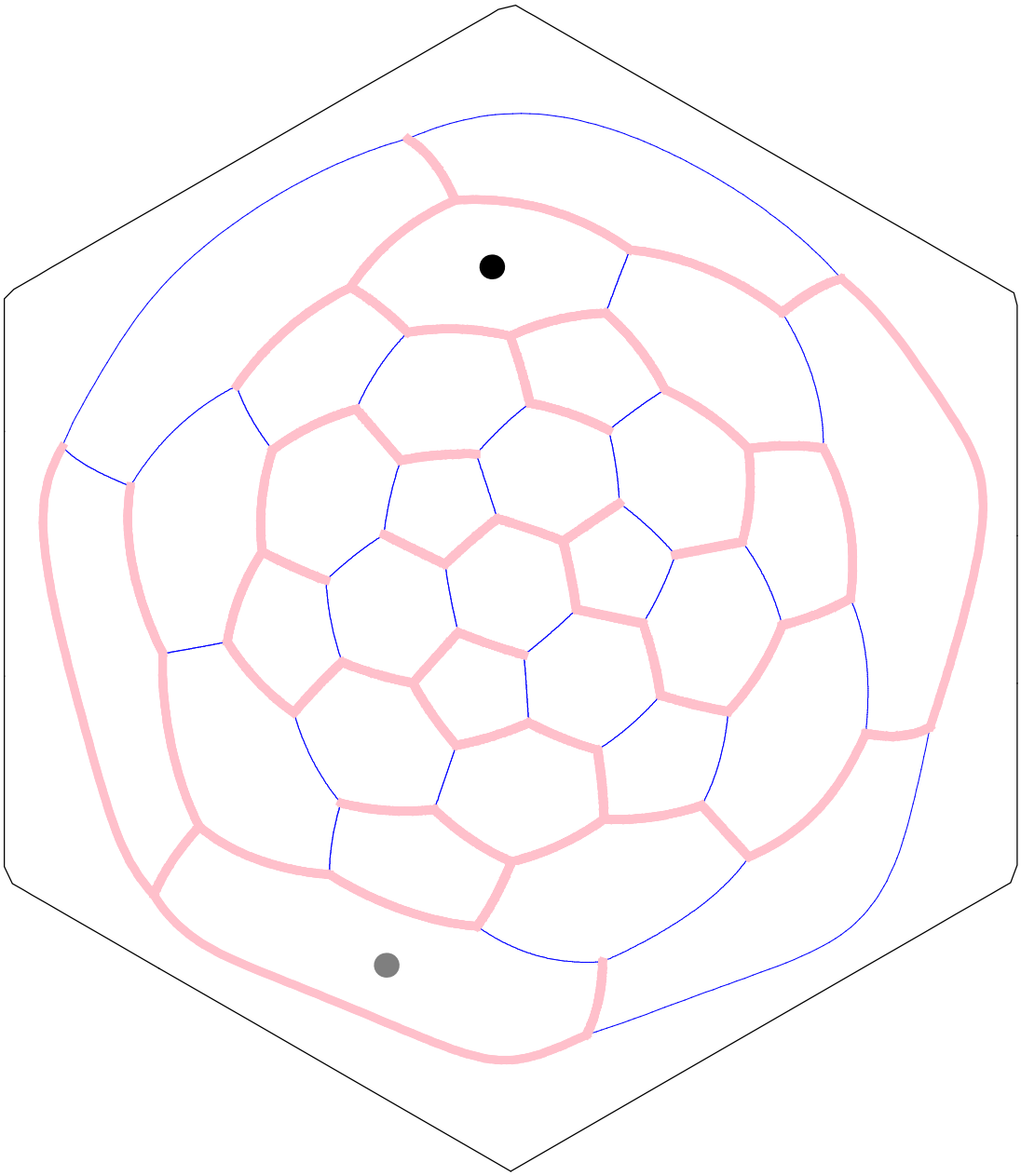
Izidor Hafner

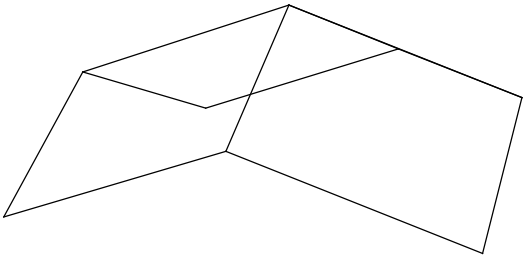
Mazes on Uniform Polyhedra

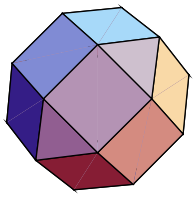


Introduction

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

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

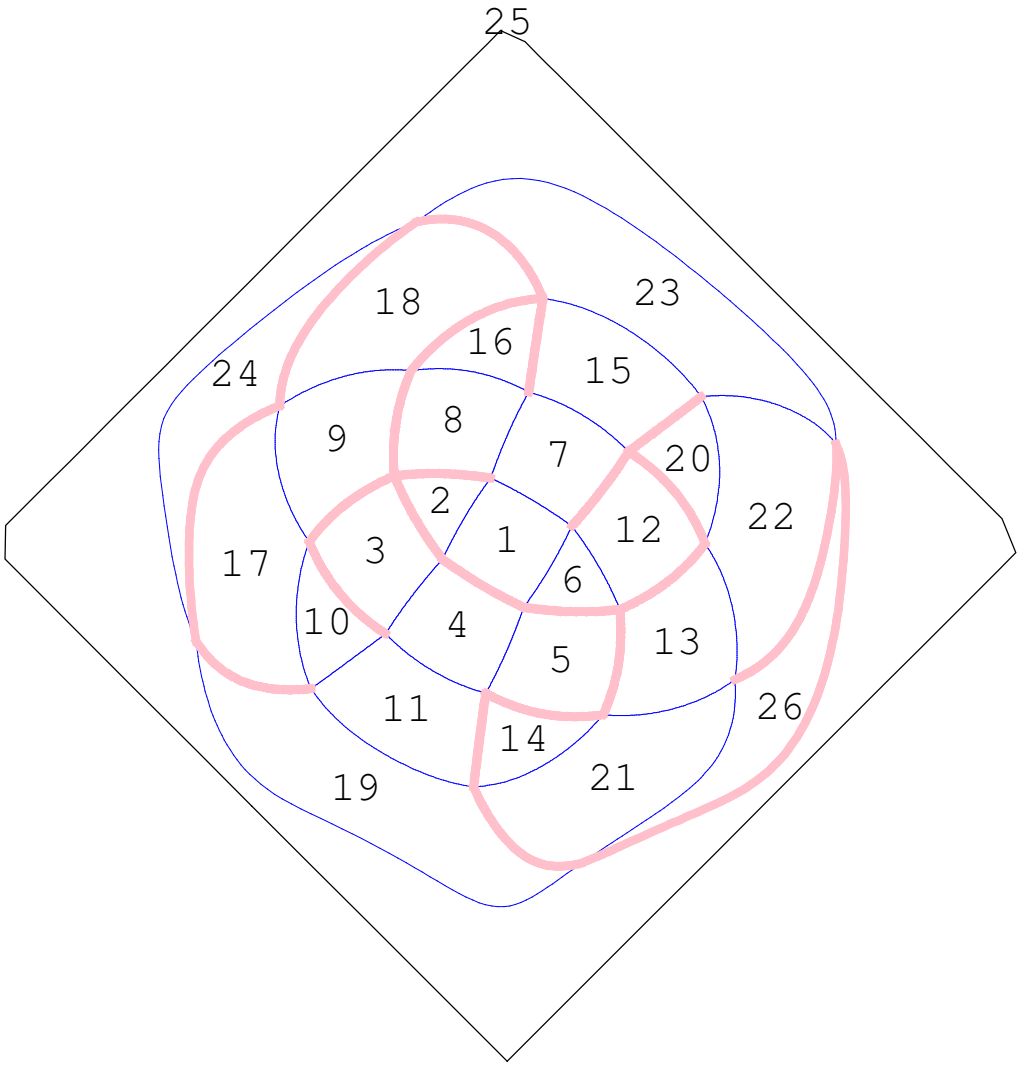




In Mathematica the polyhedron is given by a list of faces and with a list of koordinates of vertices [Roman E. Maeder, The Mathematica Programmer II, Academic Press1996]. The list of faces consists of a list of lists, where a face is represented by a list of vertices, which is given by a matrix. Let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


25
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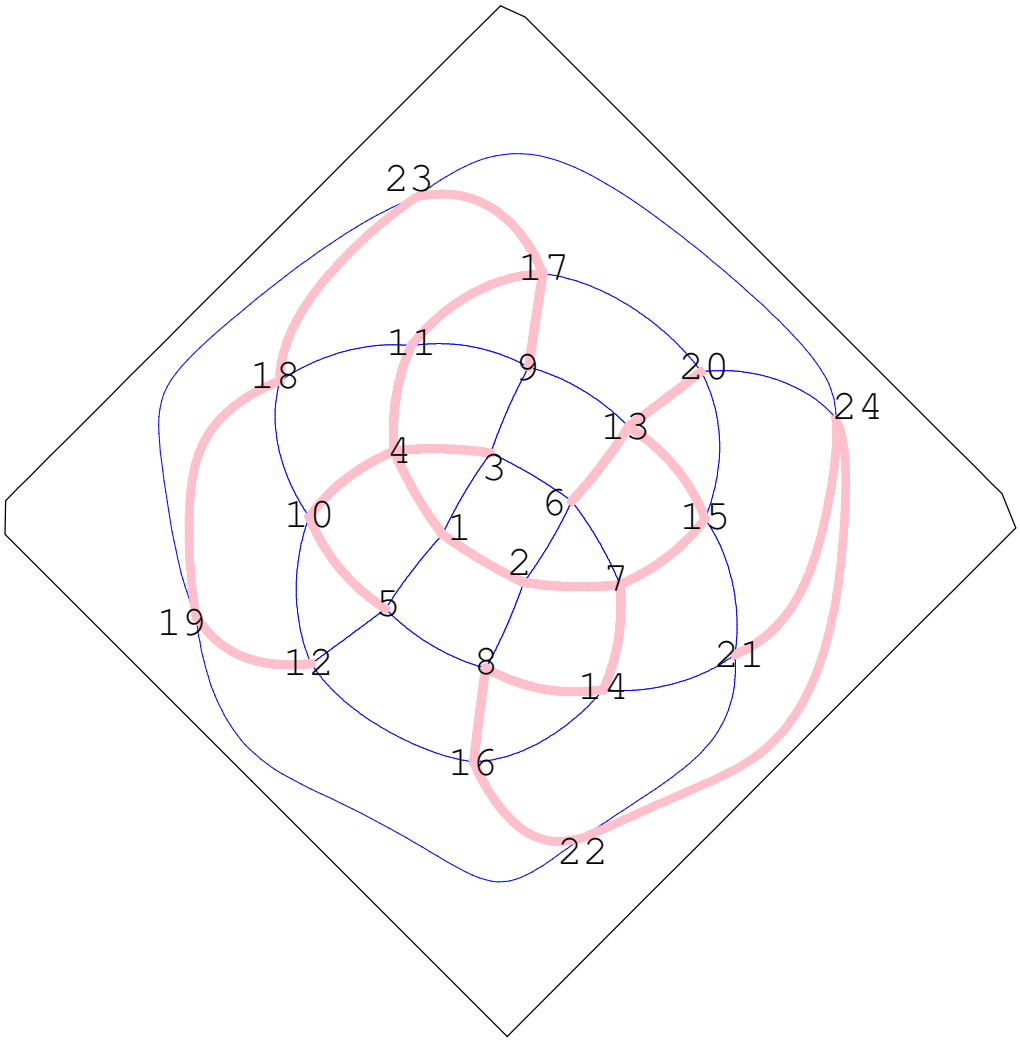
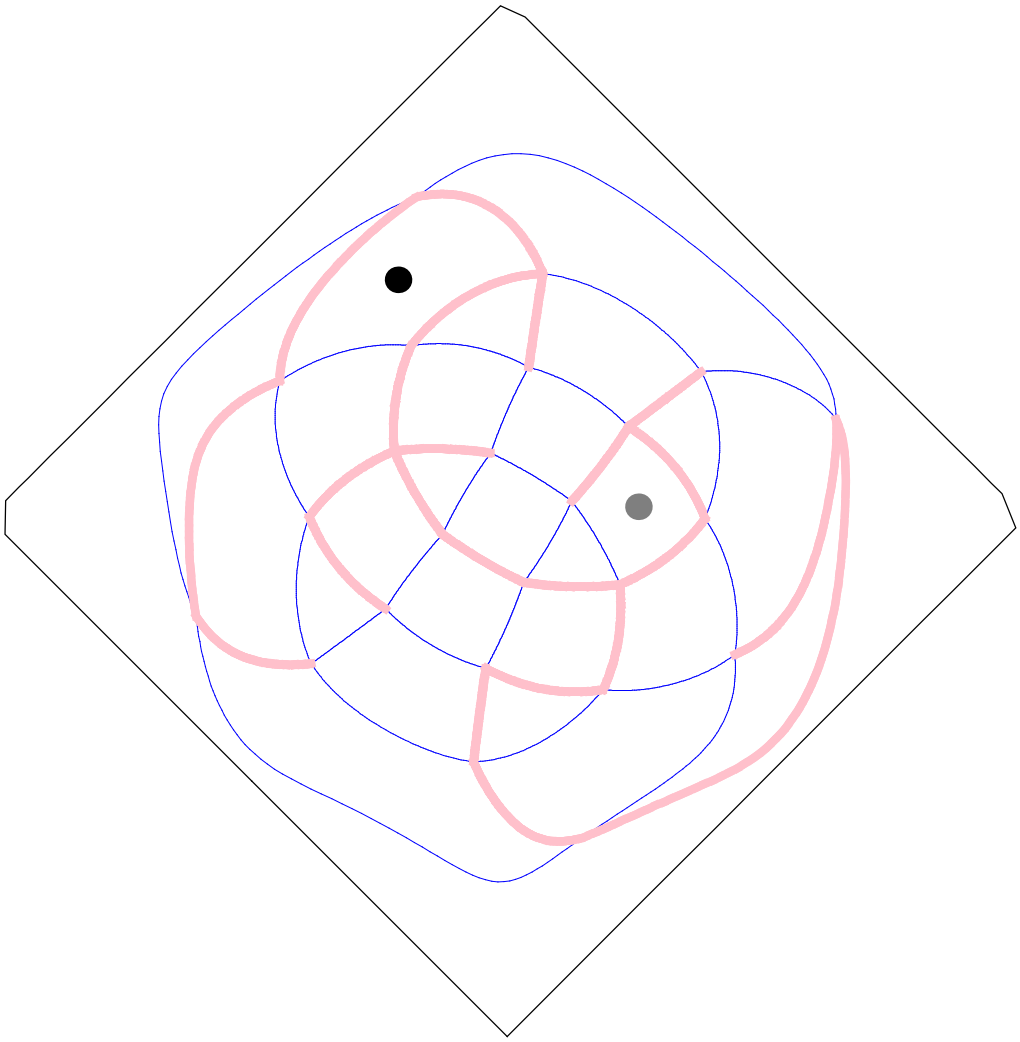
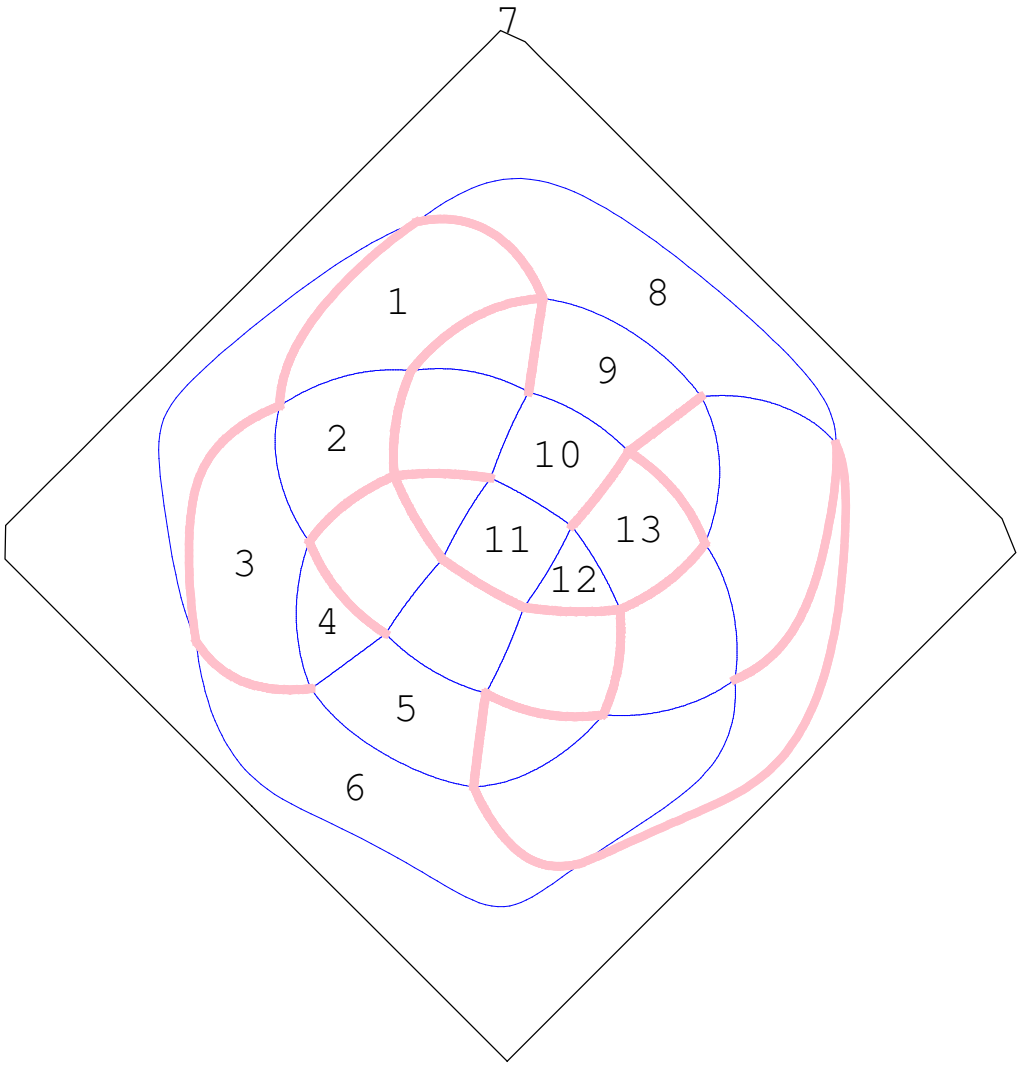


The problem is to find the path from the black dot to gray dot, where thick lines represent walls of a maze.



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


7
1
8
9
2
10
11
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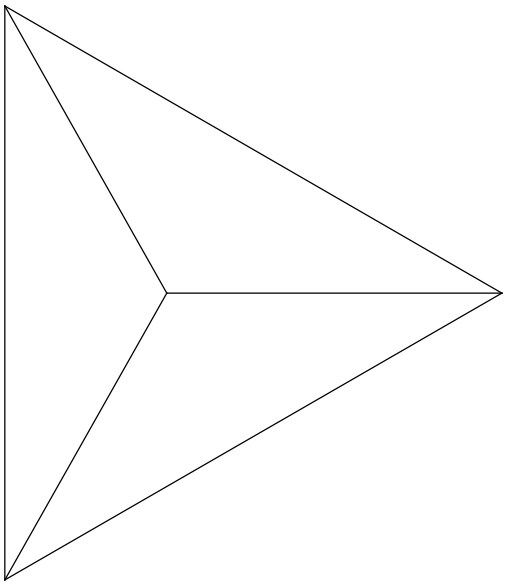
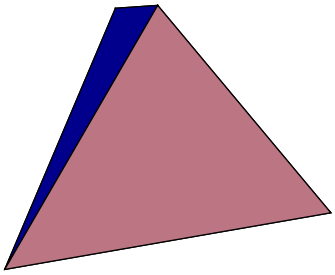
3
12
4
5
6

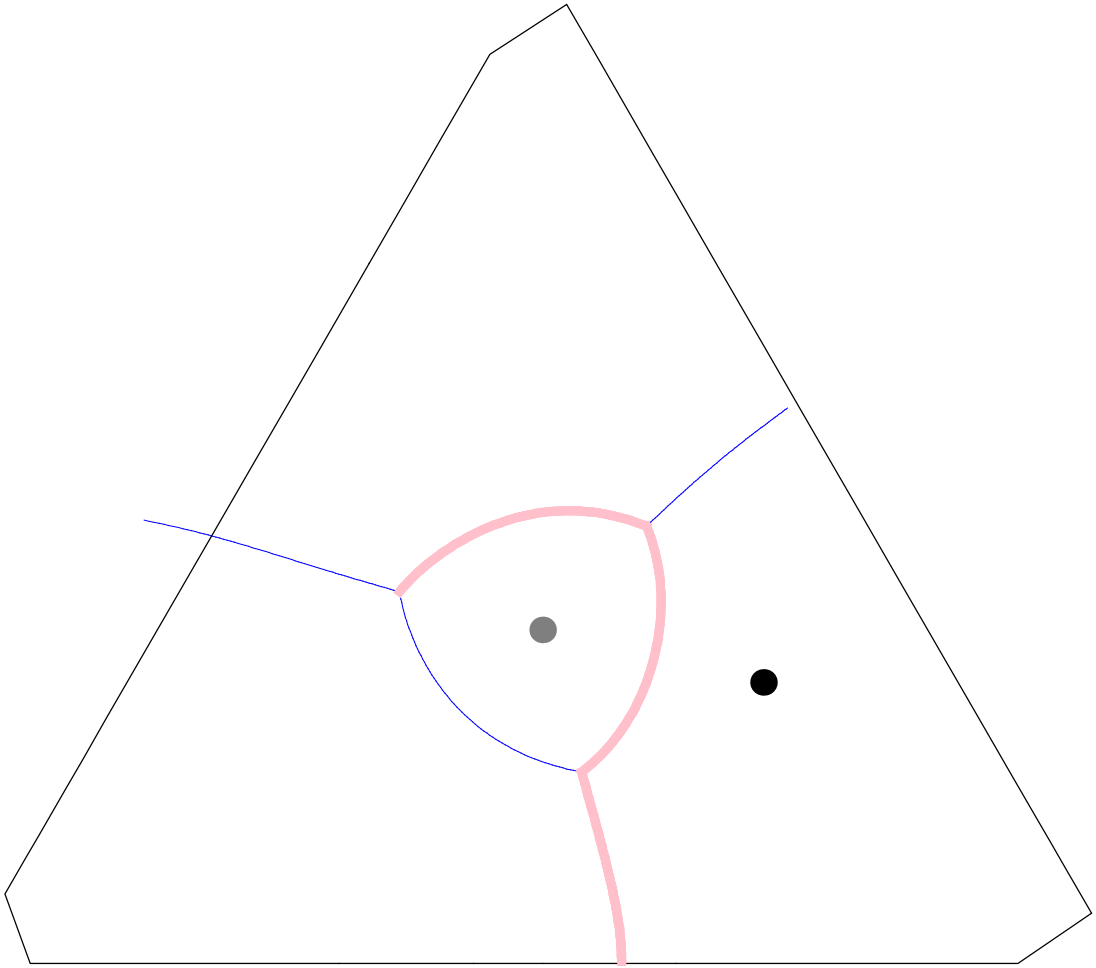
Problems

3.

`tetrahedron` {3, 3, 3}

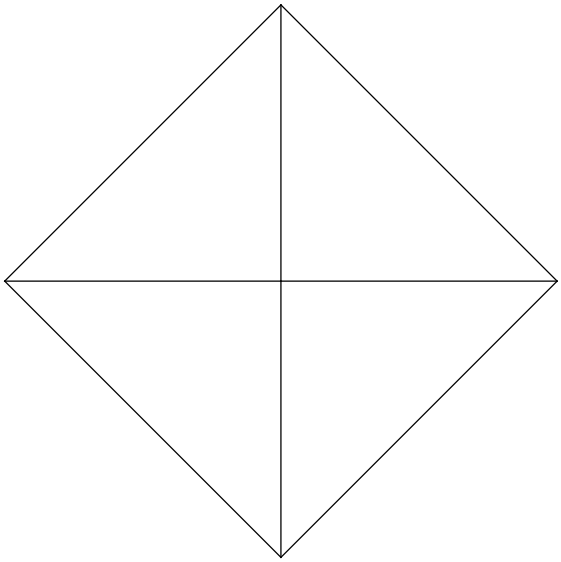


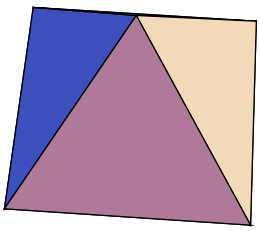


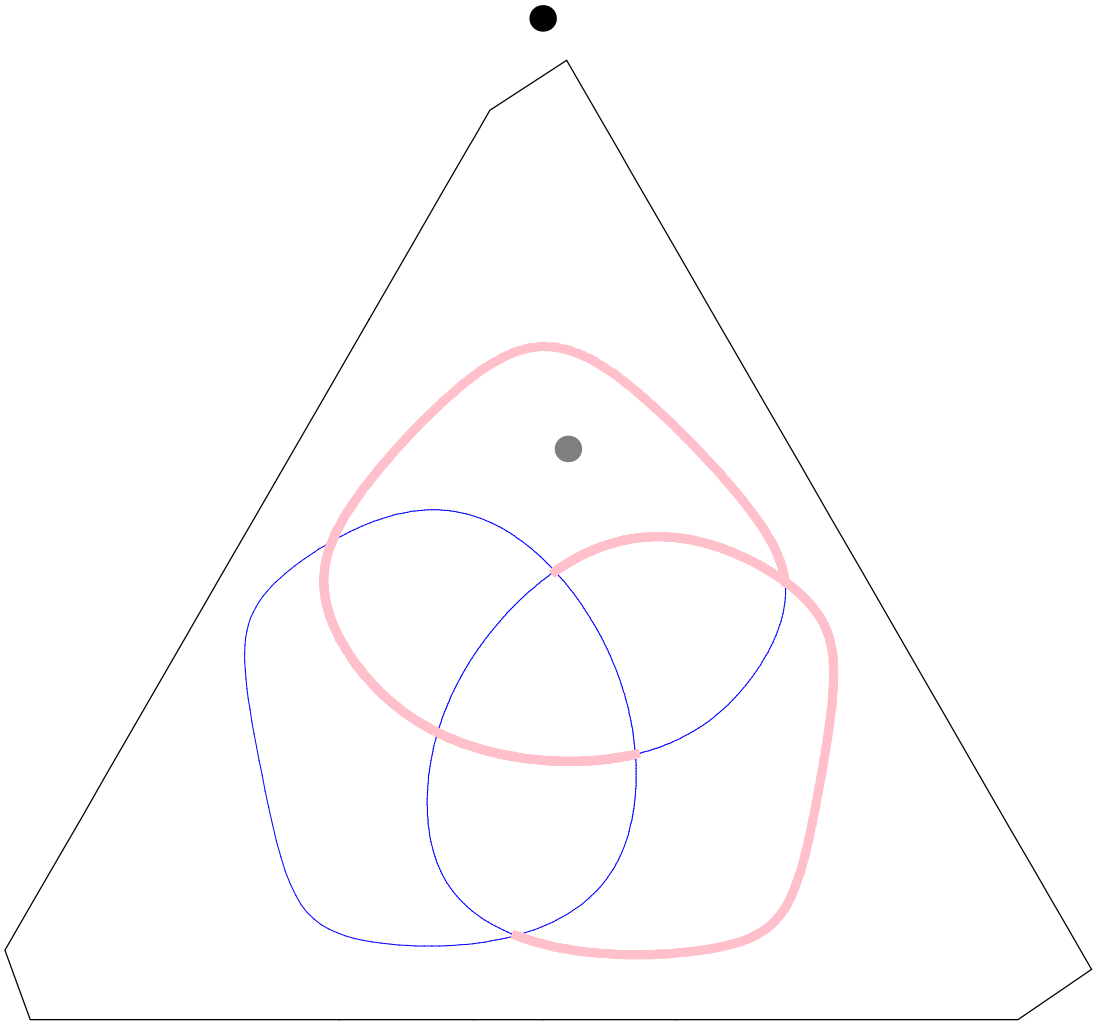


4.

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

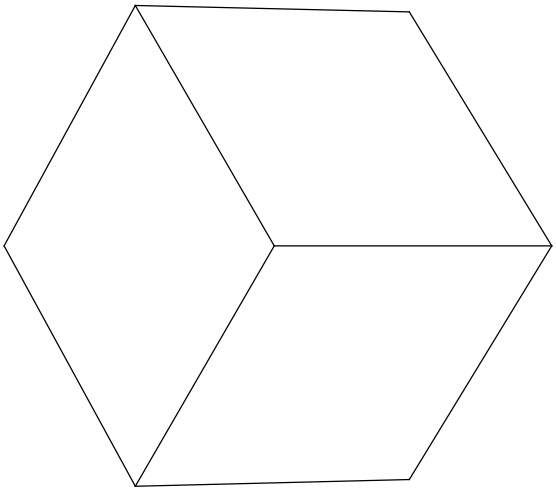


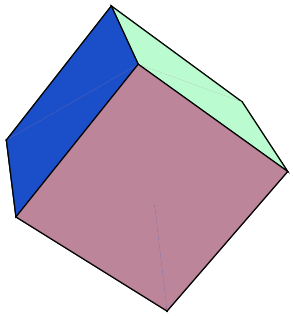


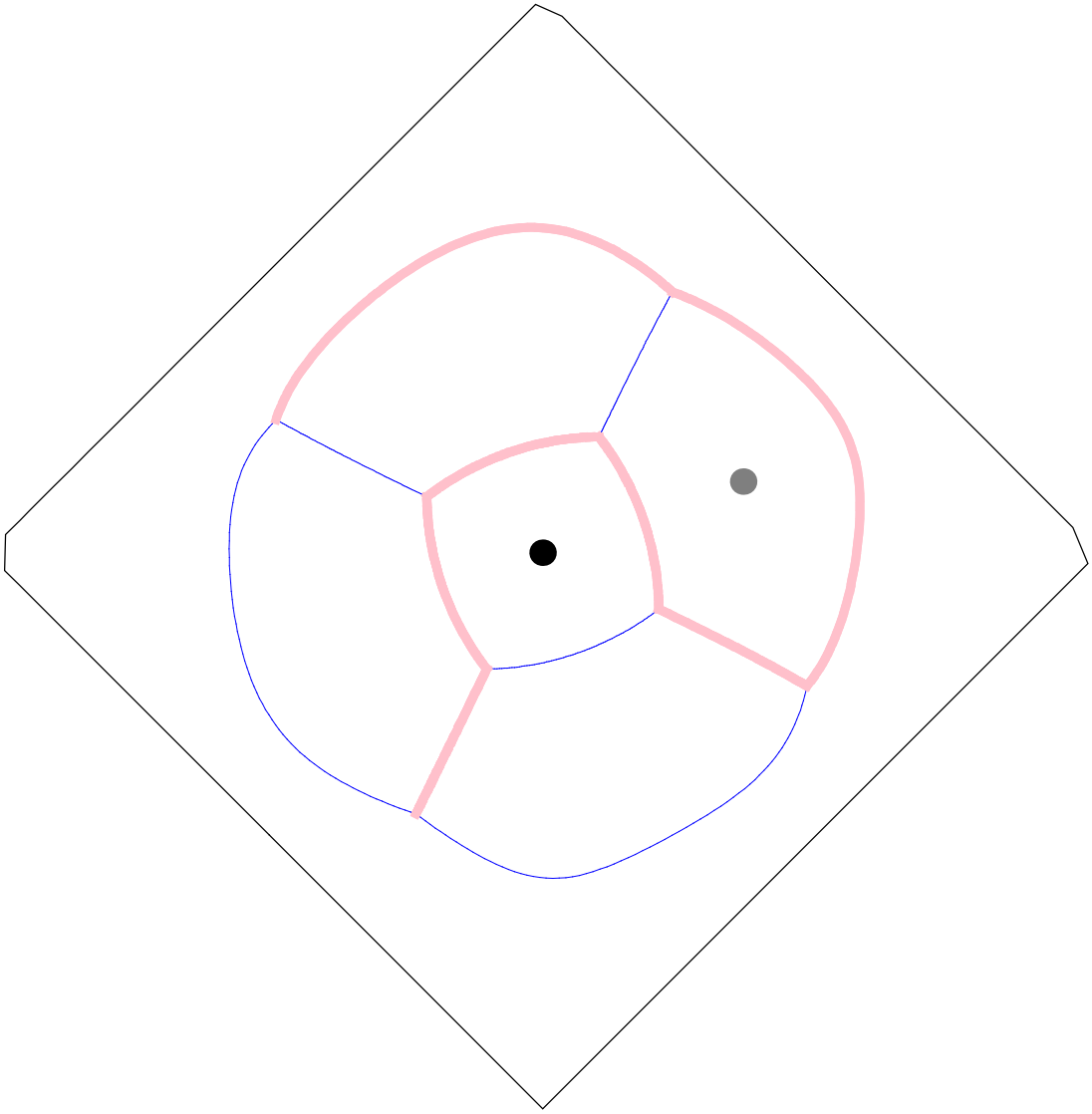


5.

`cube` {4, 4, 4}

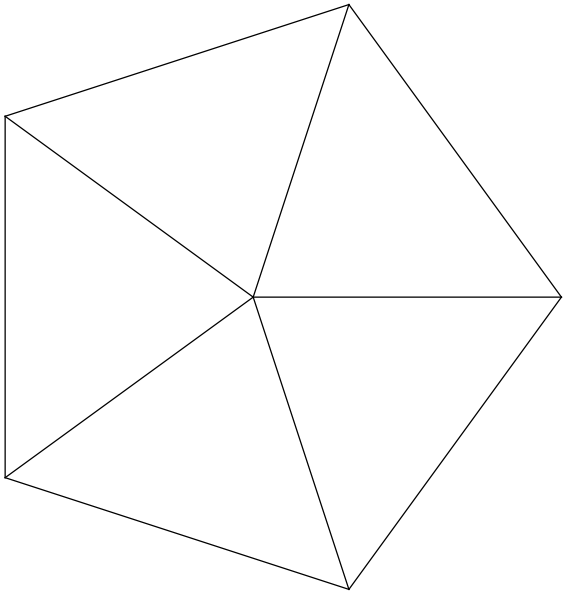


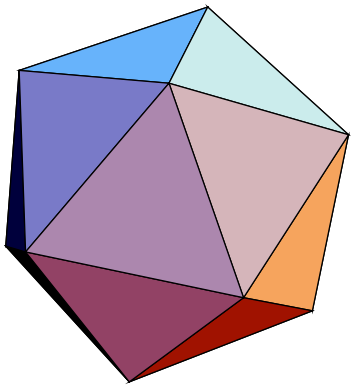


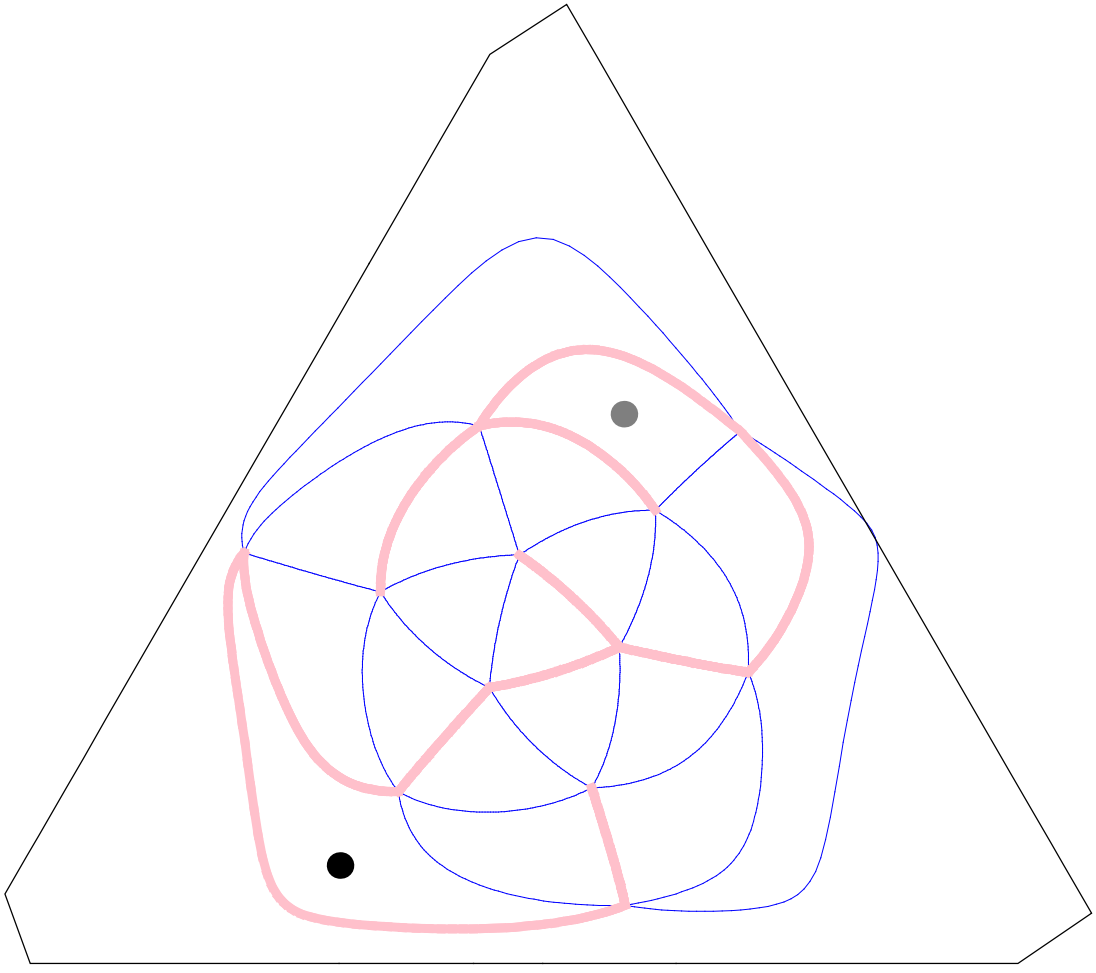


6.

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

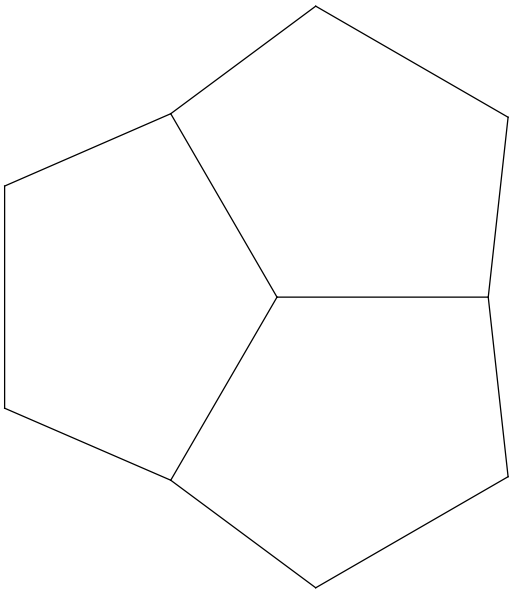


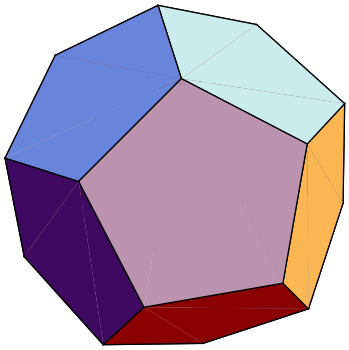


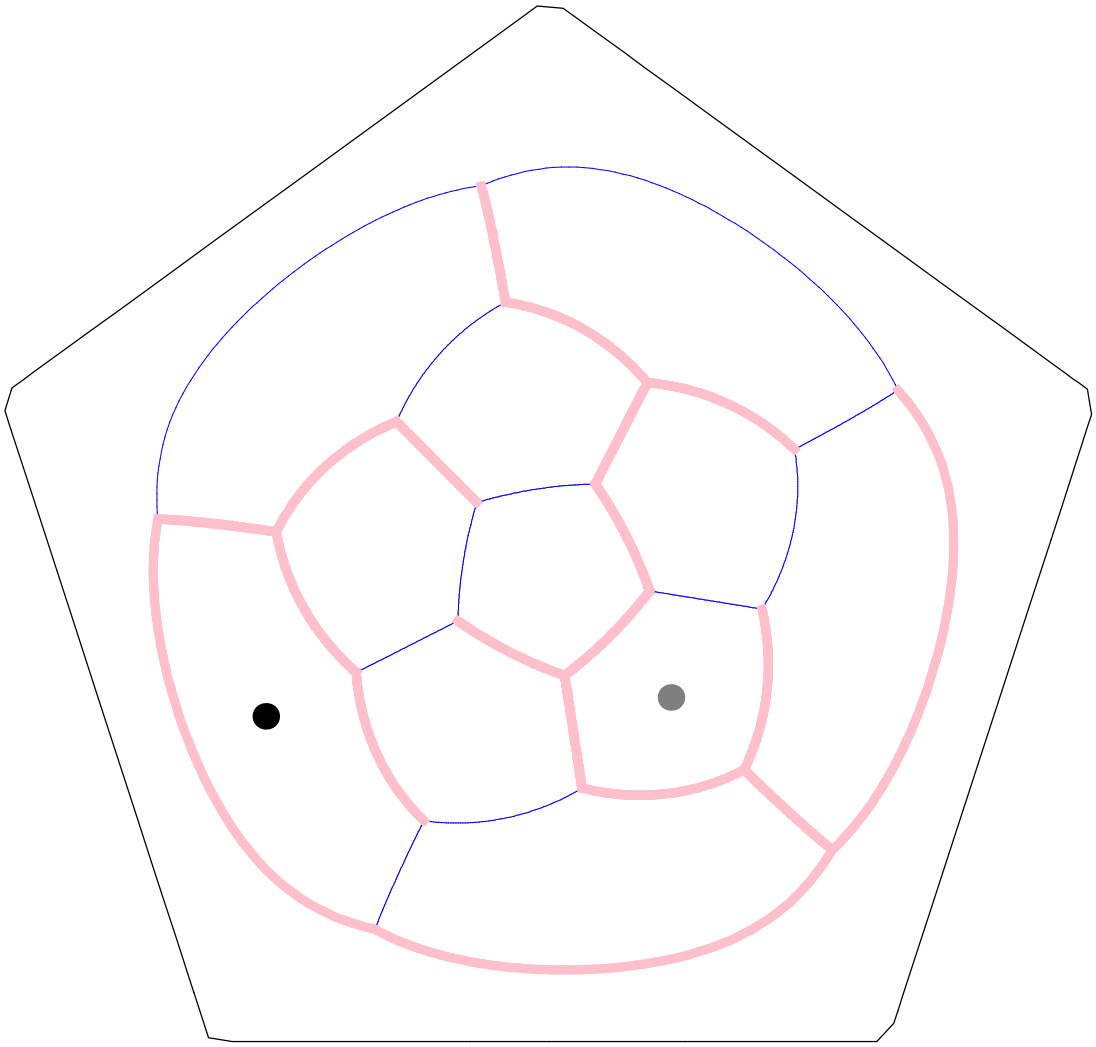


7.

`dodecahedron` {5, 5, 5}

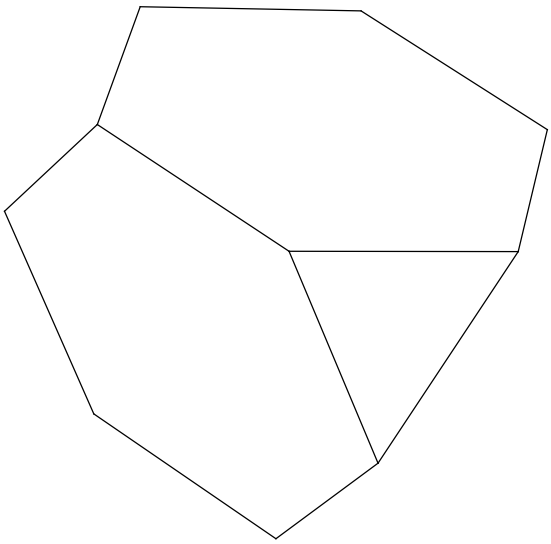


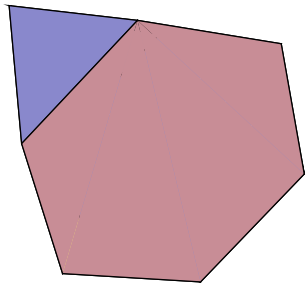


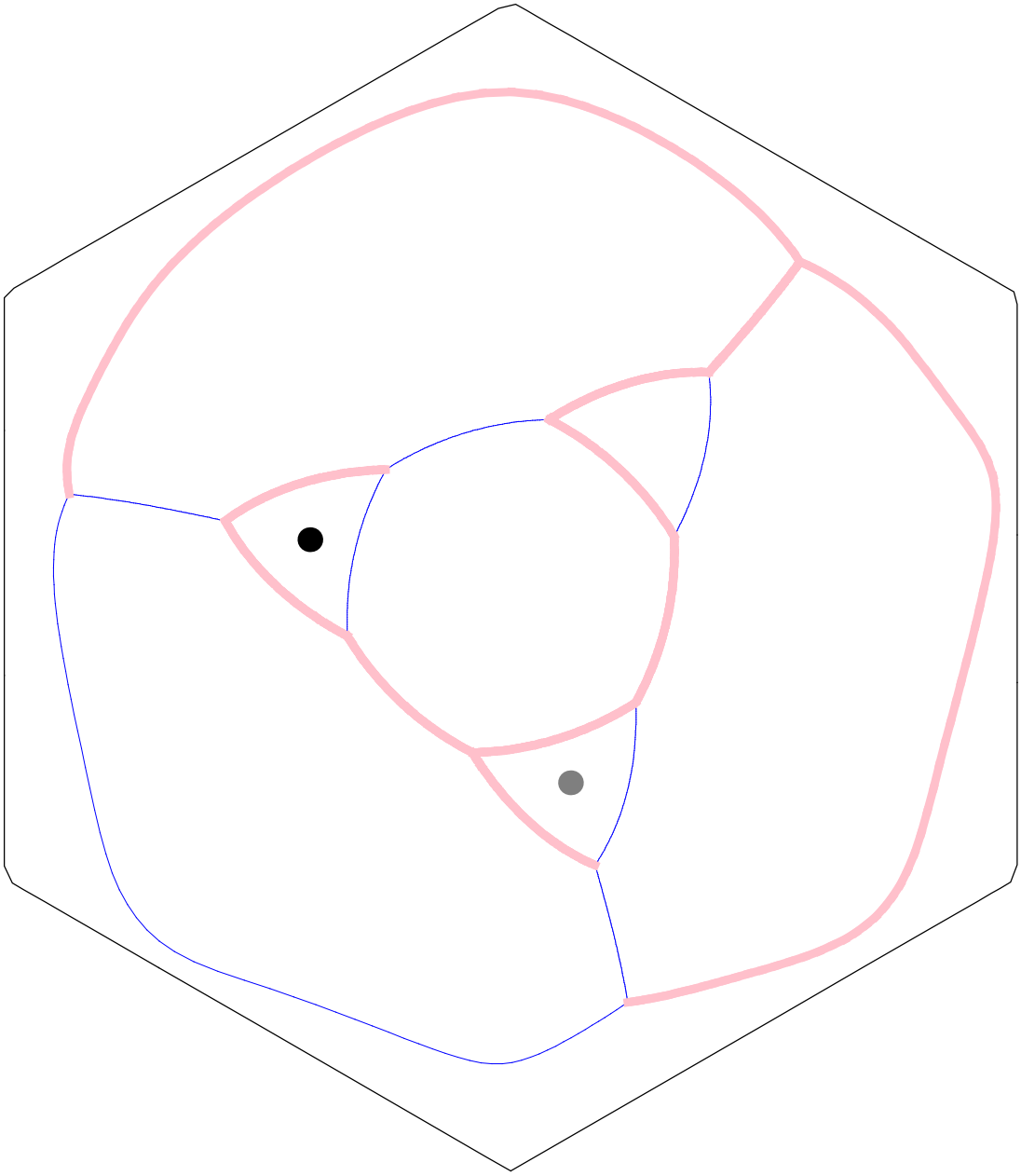


8.

`truncated tetrahedron` {6, 6, 3}

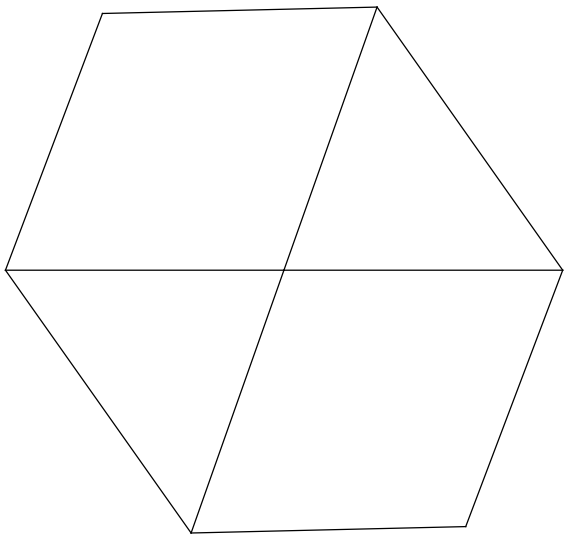


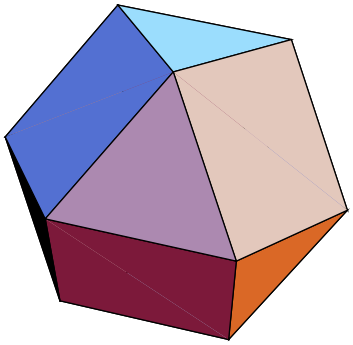


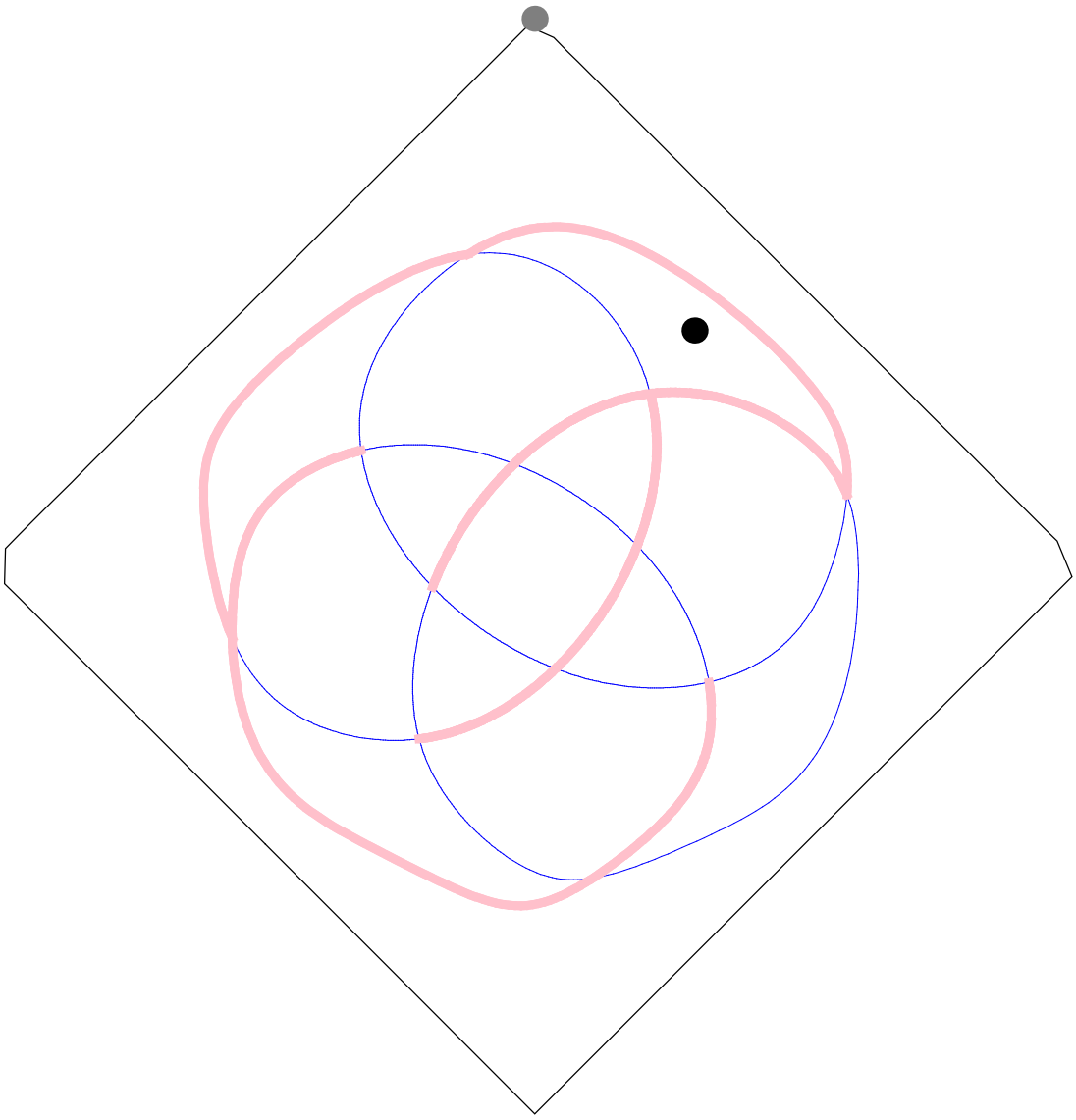


9.

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

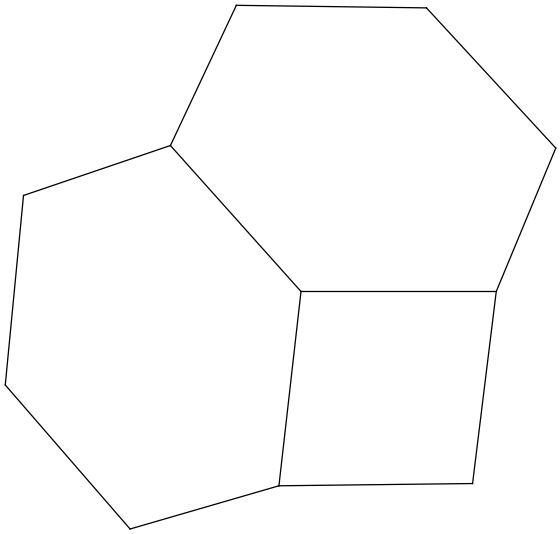


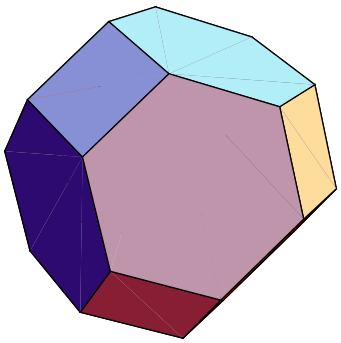


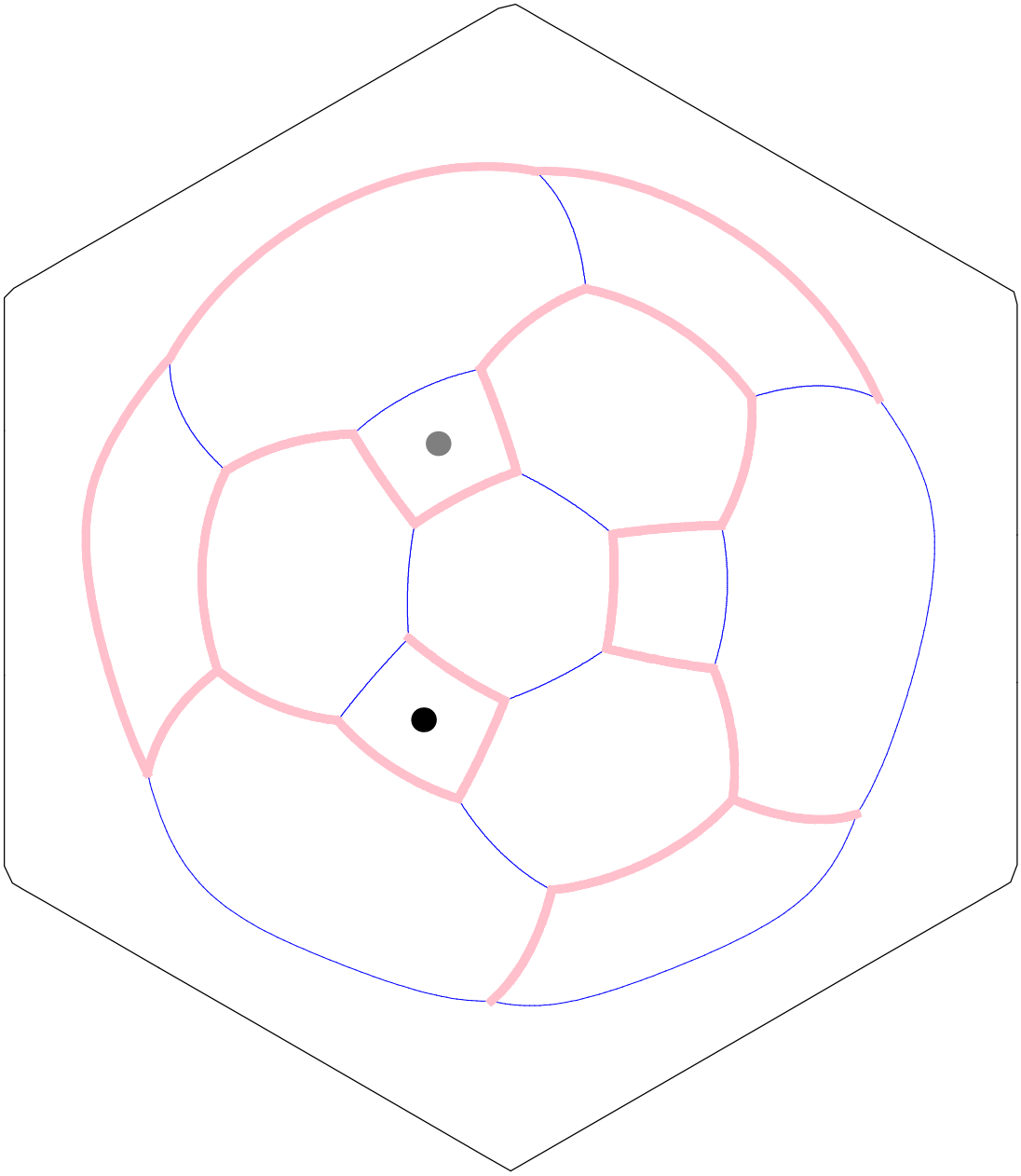


10.

`truncated octahedron` {6, 6, 4}

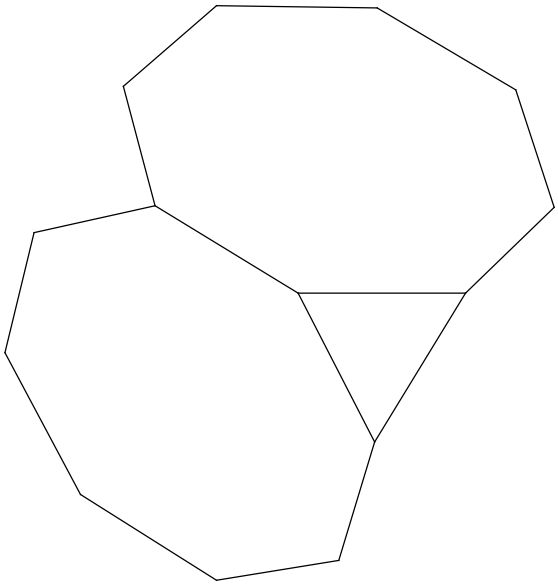


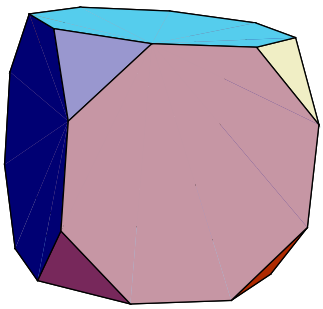


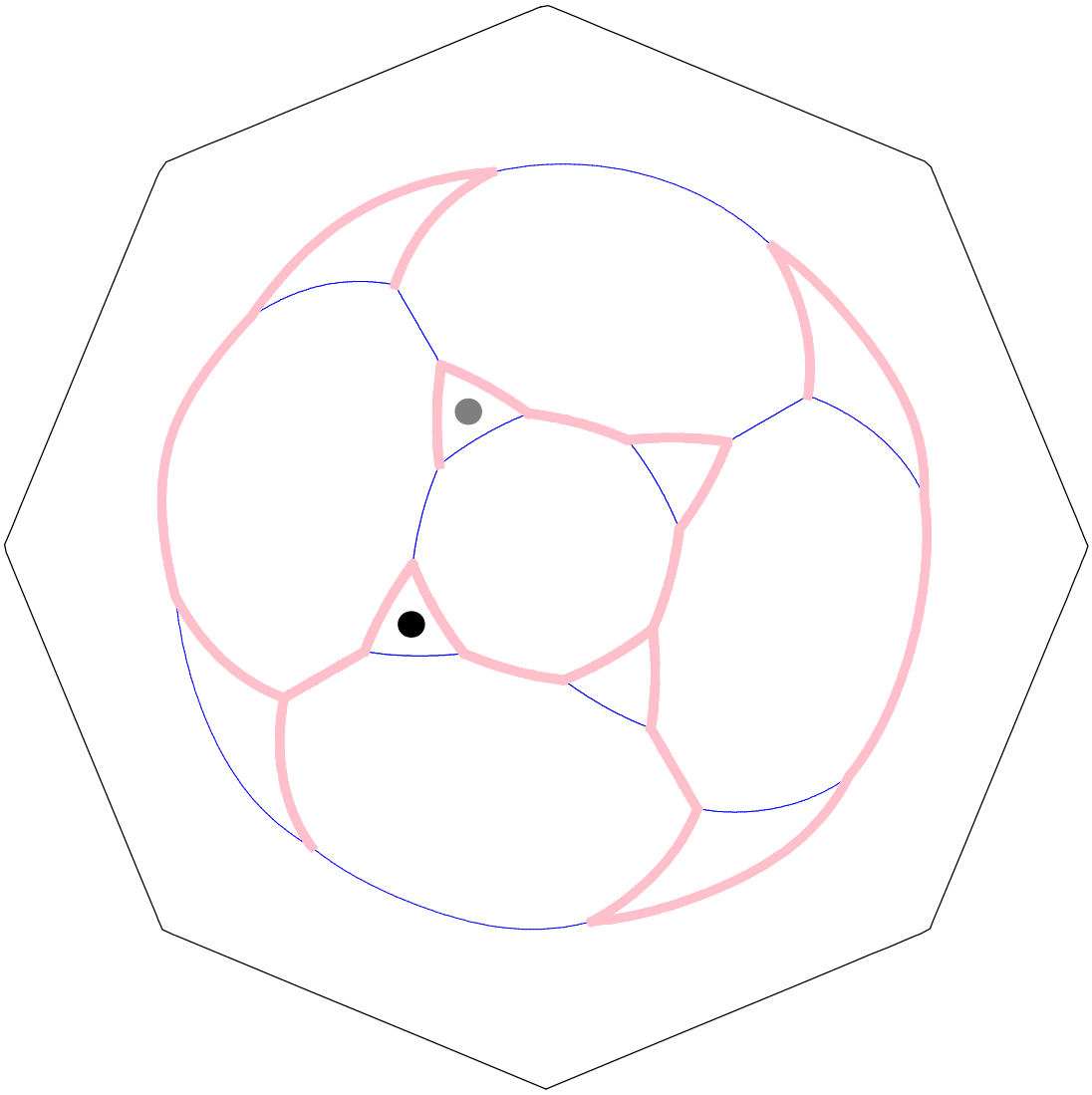


11.

`truncated cube` {8, 8, 3}

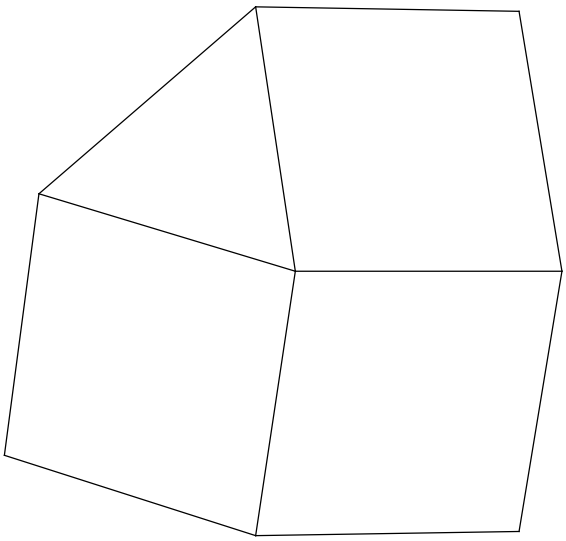


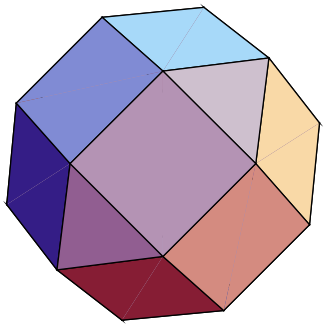


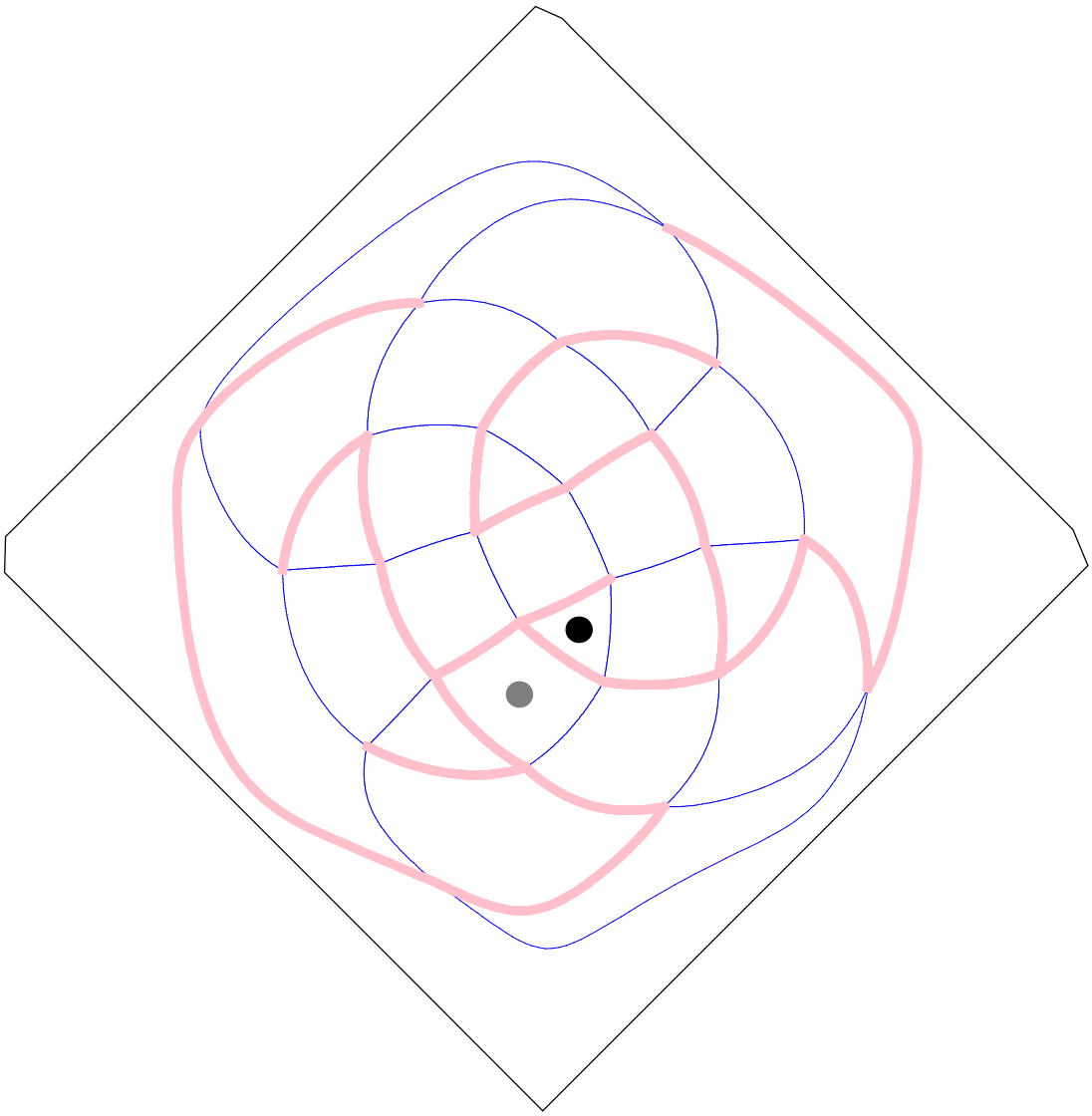


12.

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

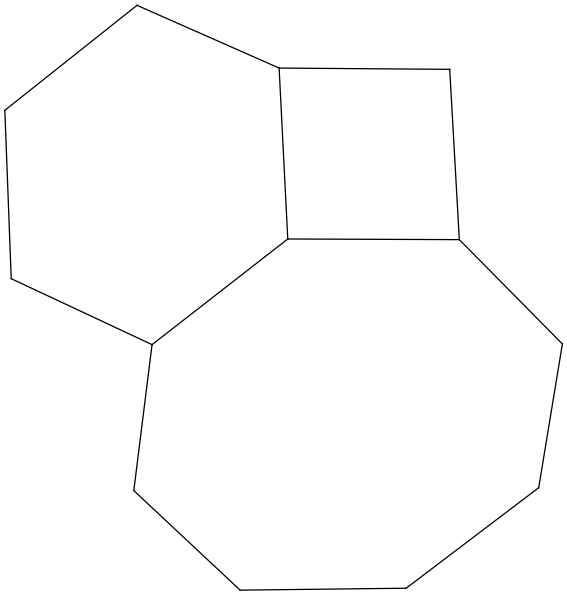


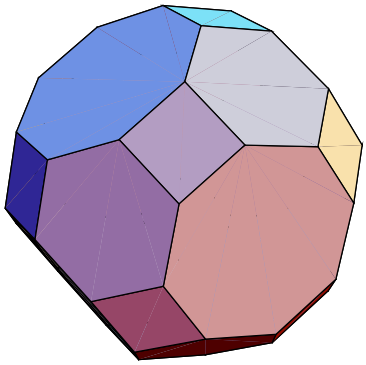


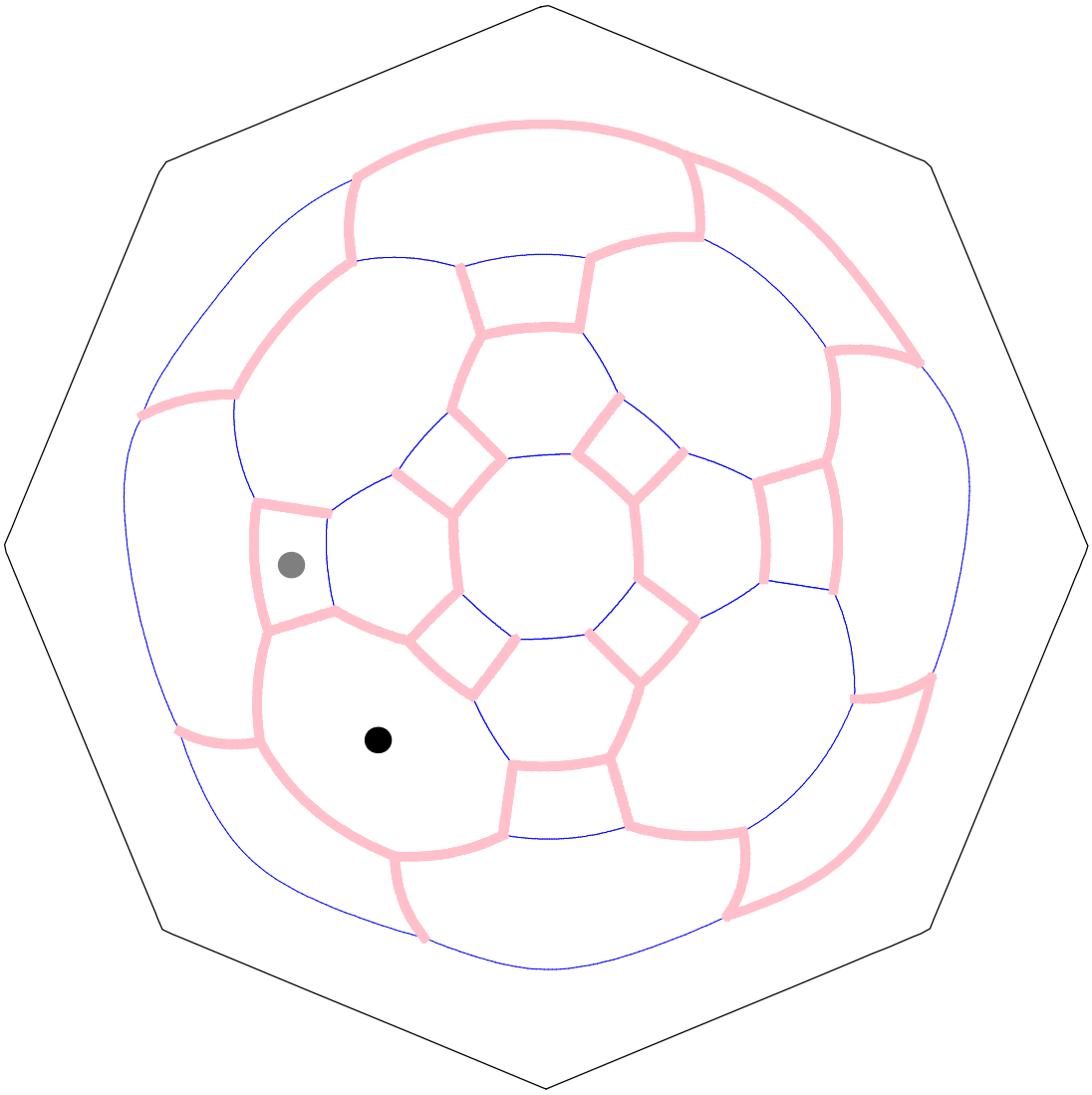


13.

`truncated cuboctahedron` {4, 6, 8}

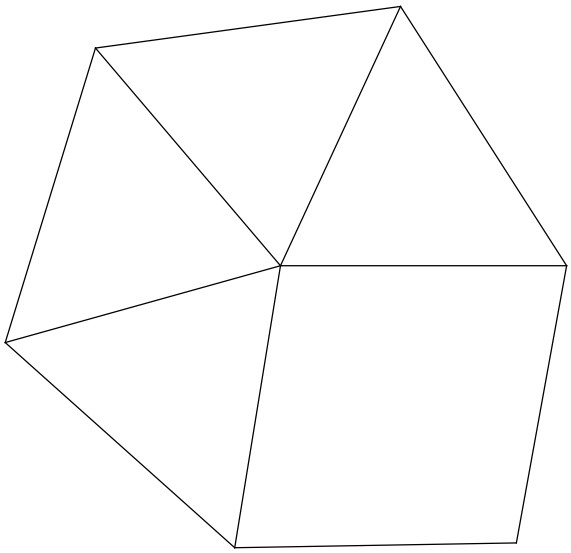


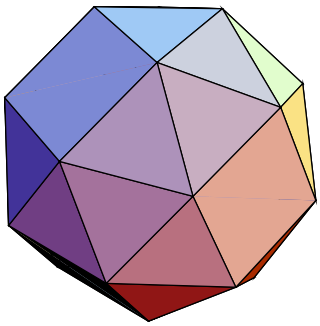


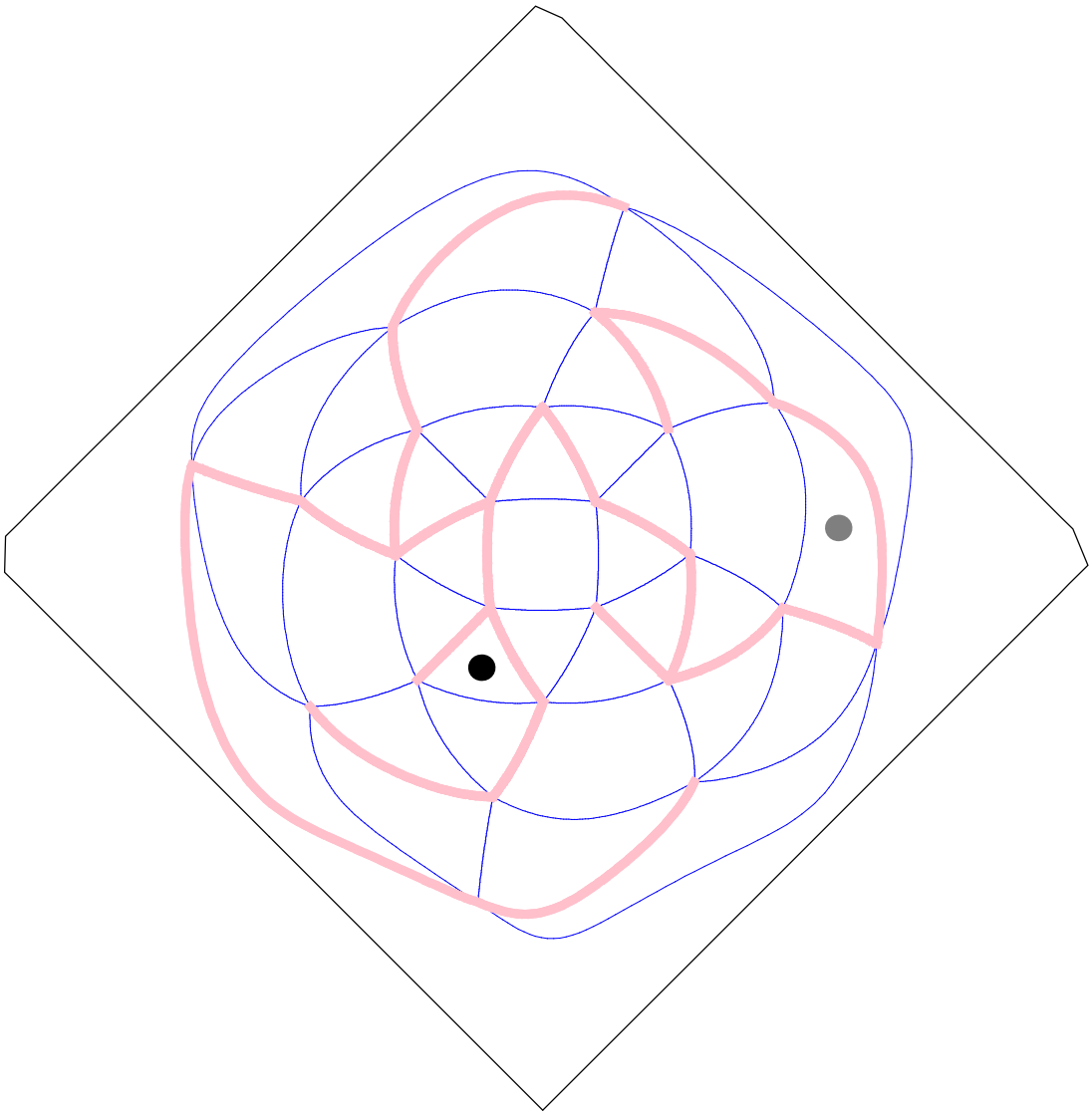


14.

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

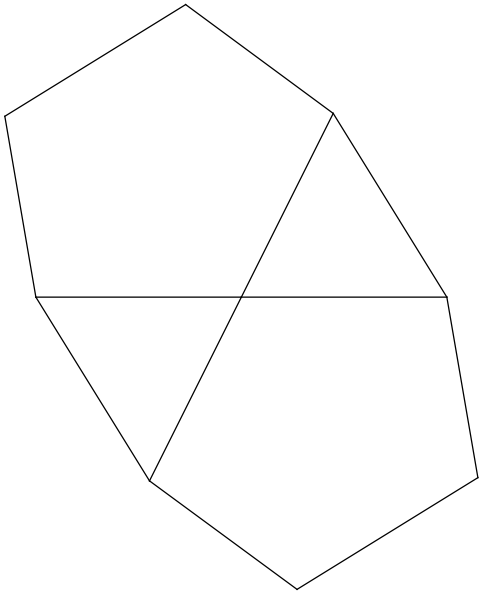


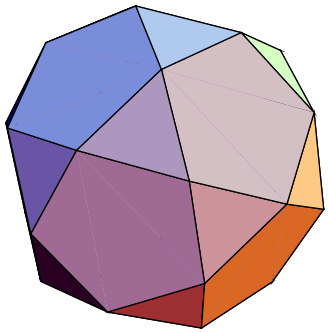


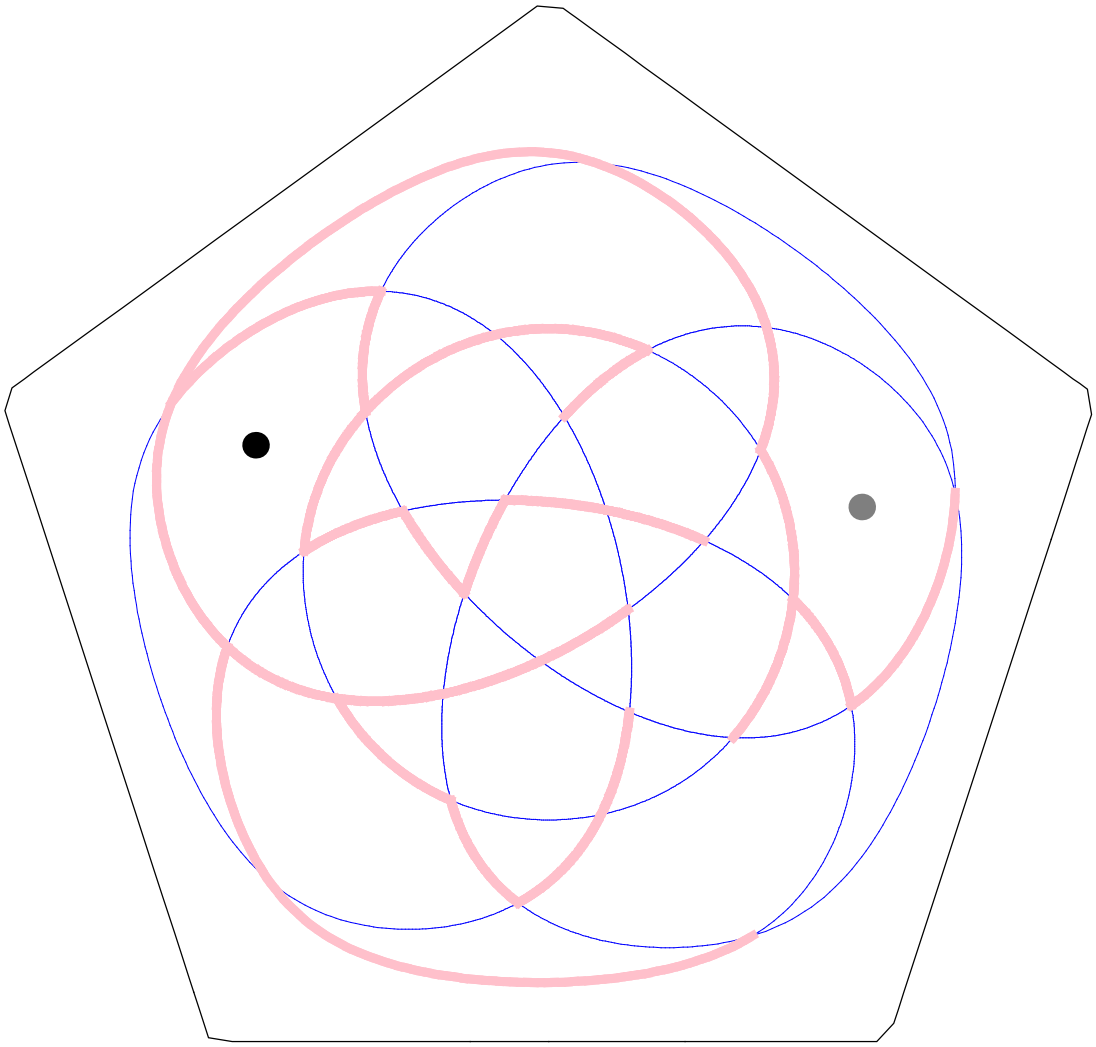


15.

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

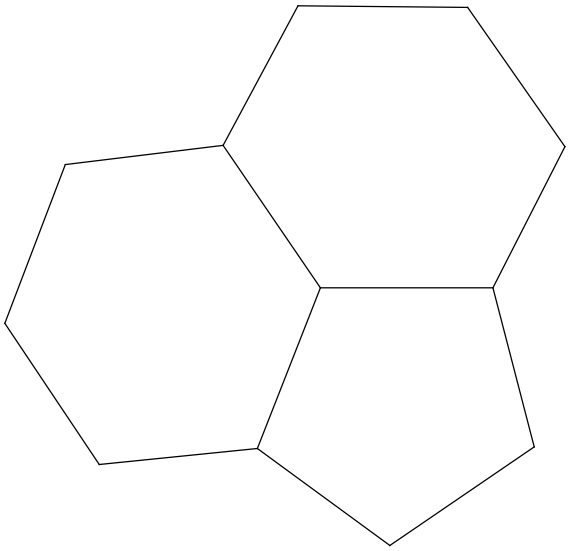


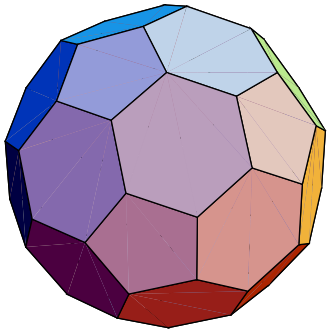


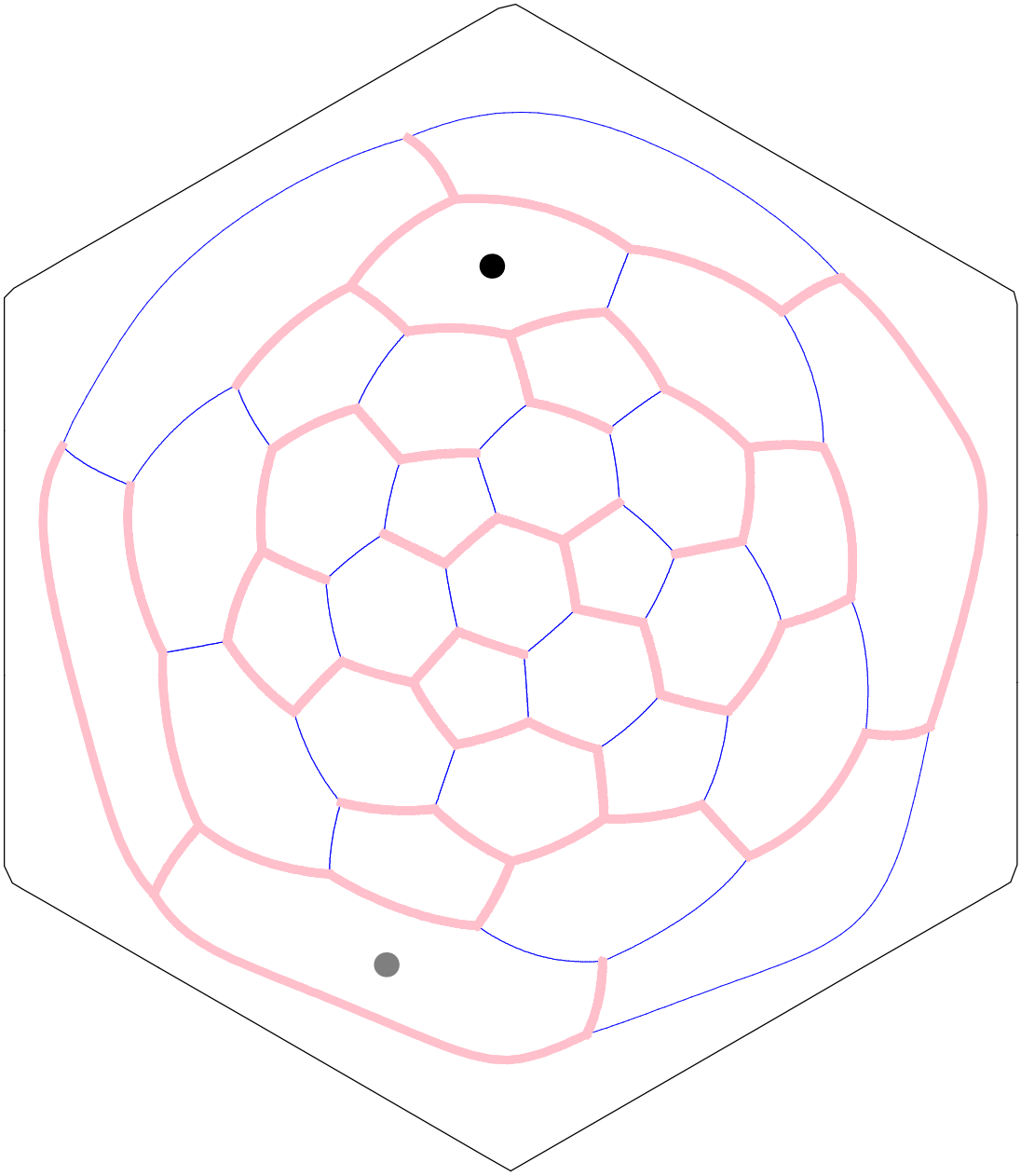


16.

`truncated icosahedron` {6, 6, 5}

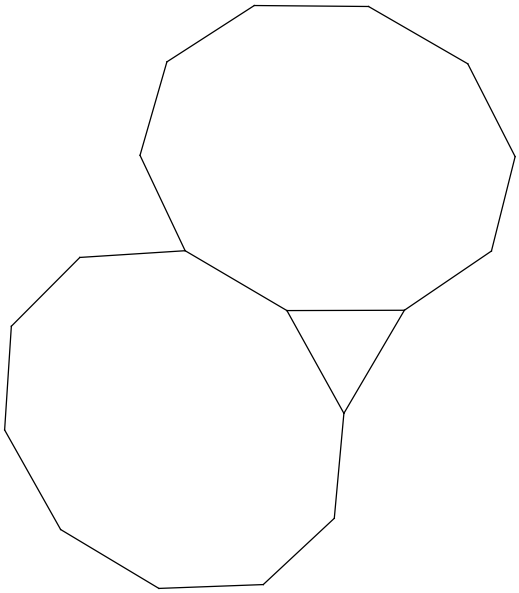


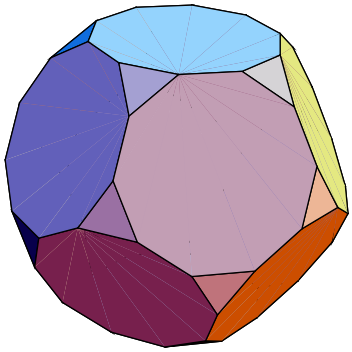


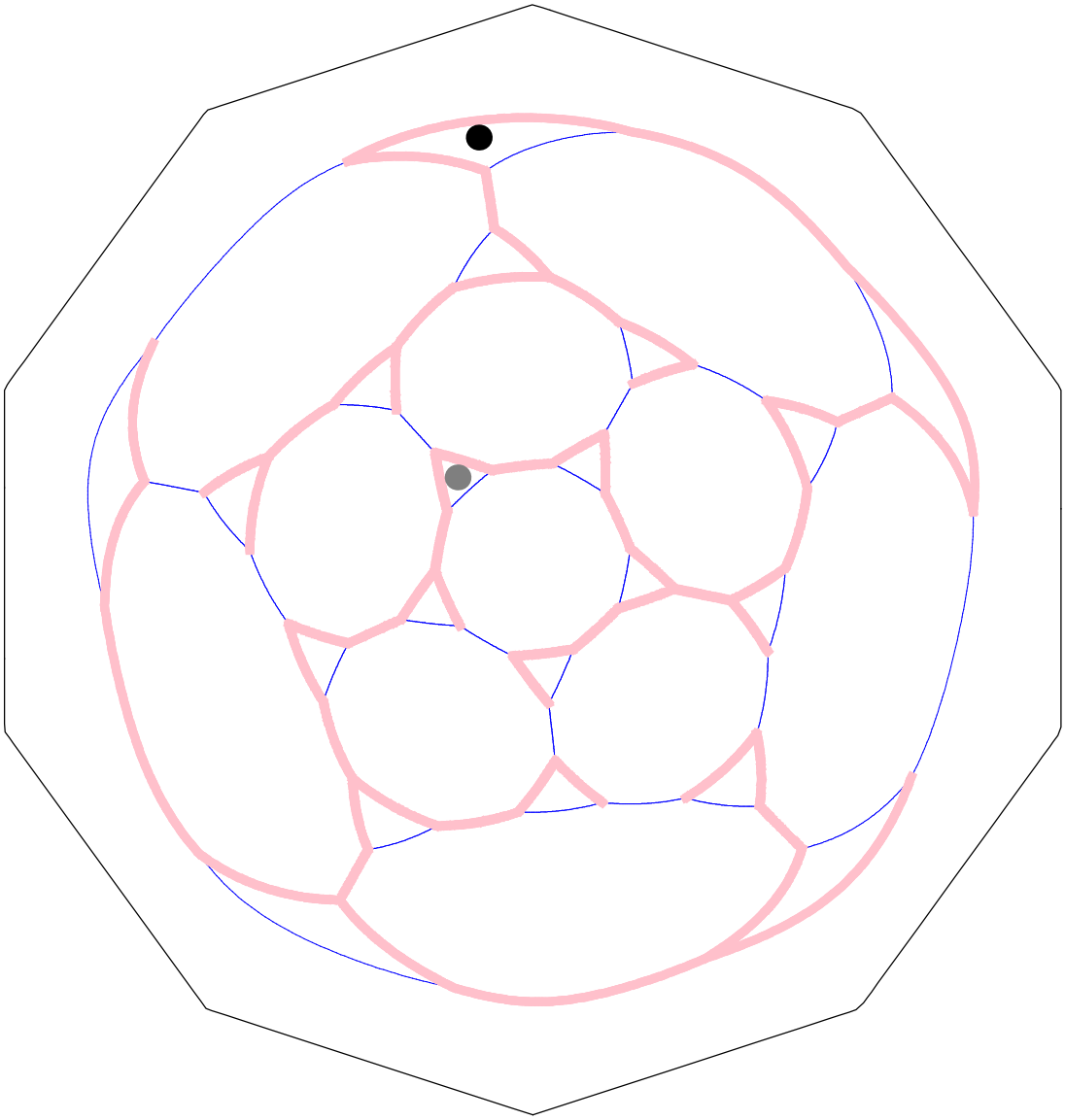


17.

`truncated dodecahedron` {10, 10, 3}

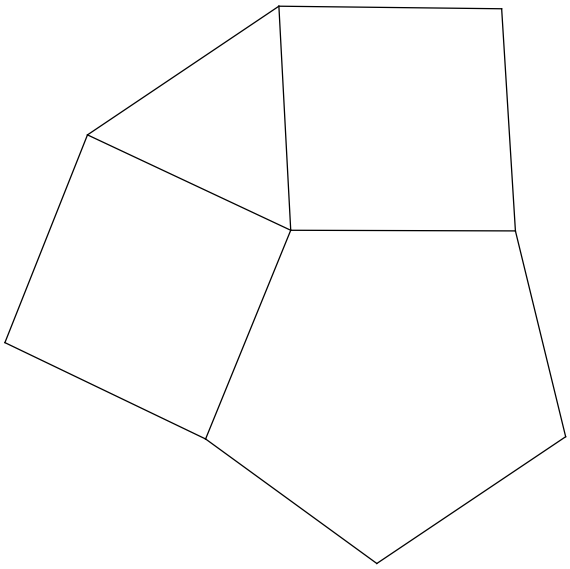


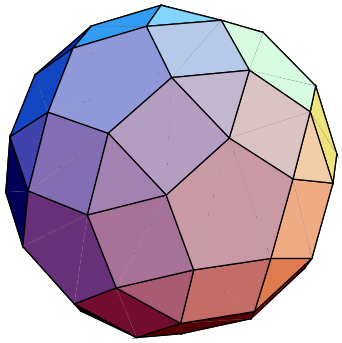


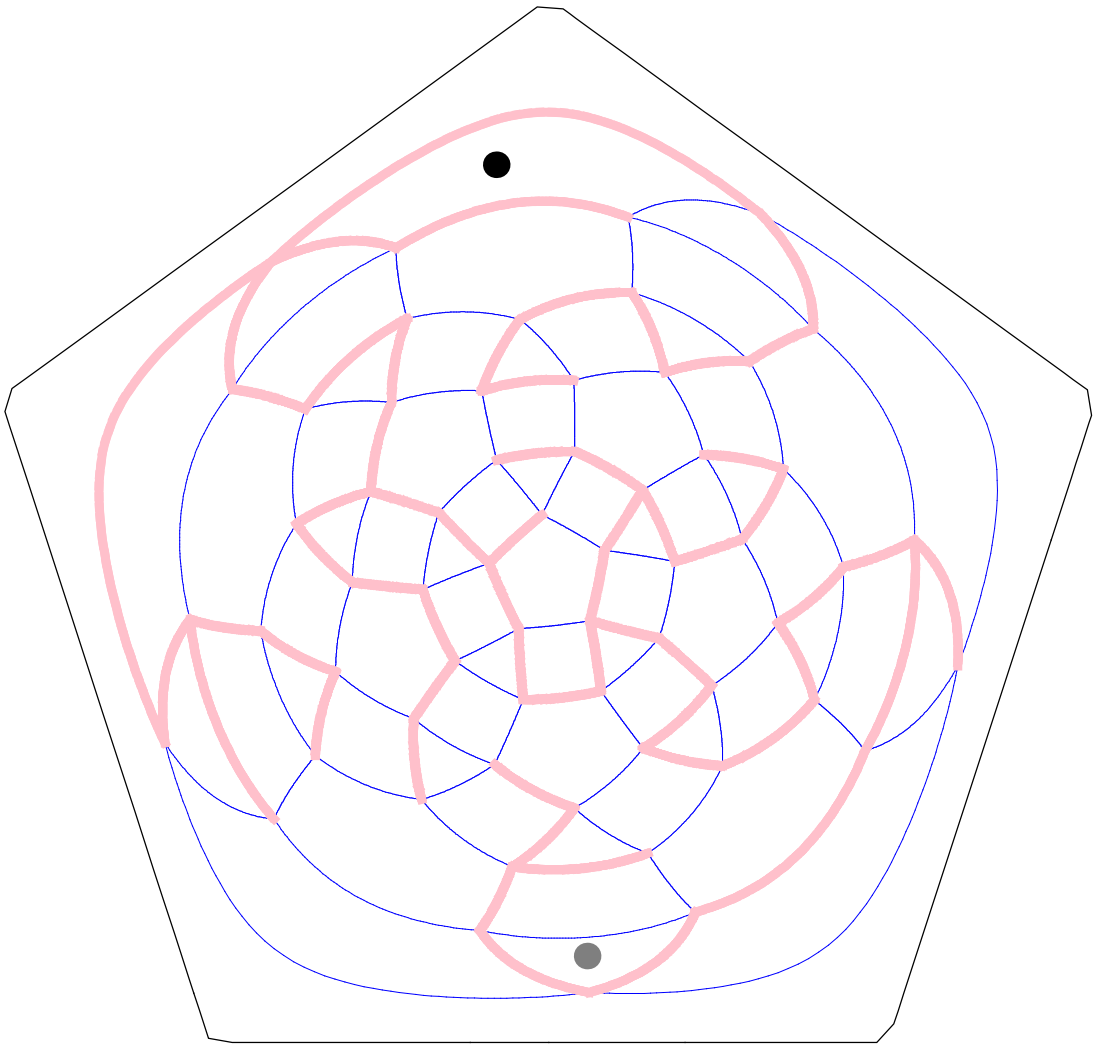


18.

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

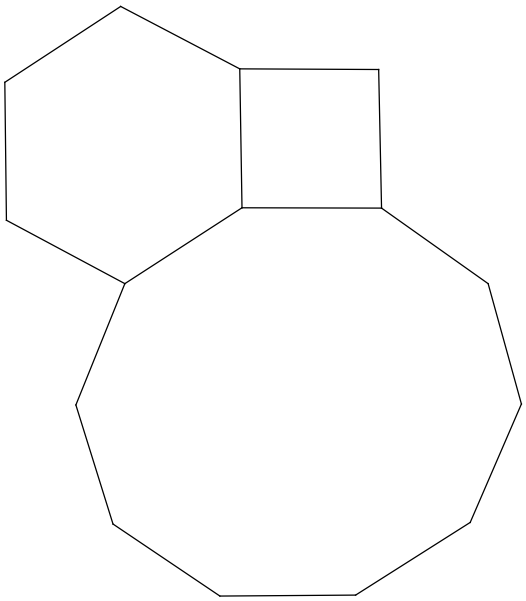


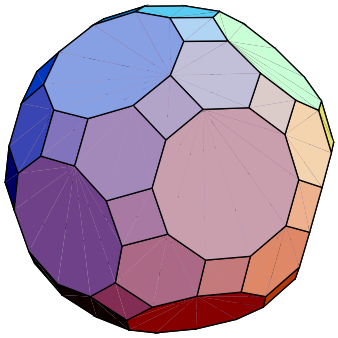


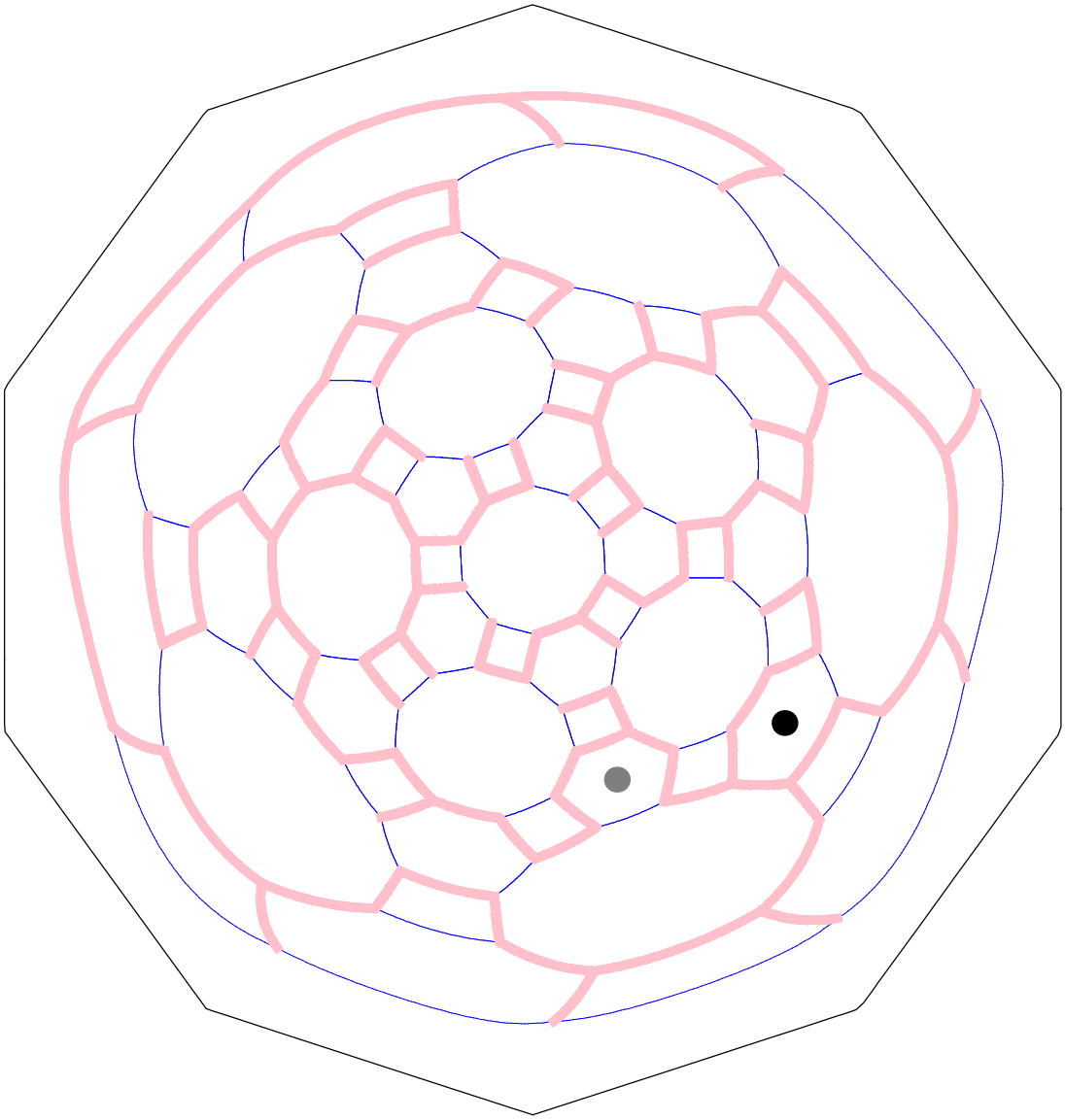


19.

`truncated icosidodecahedron` {4, 6, 10}

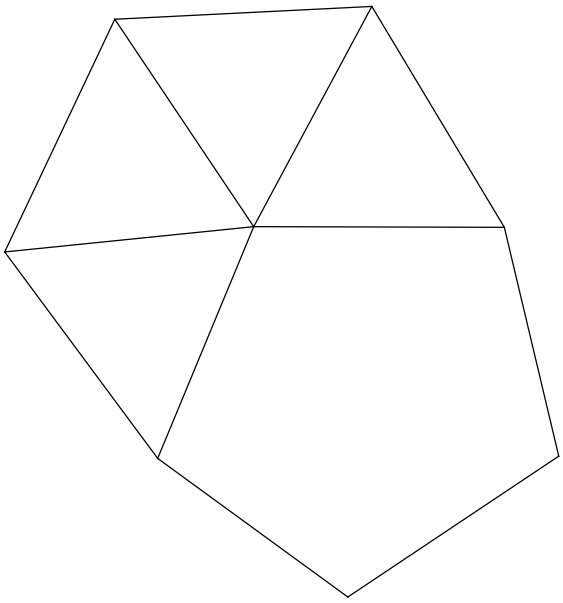


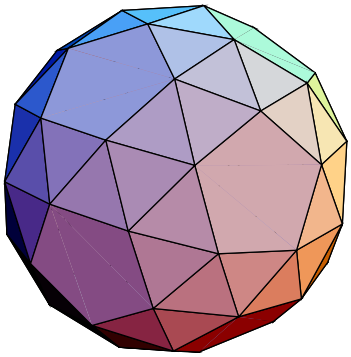


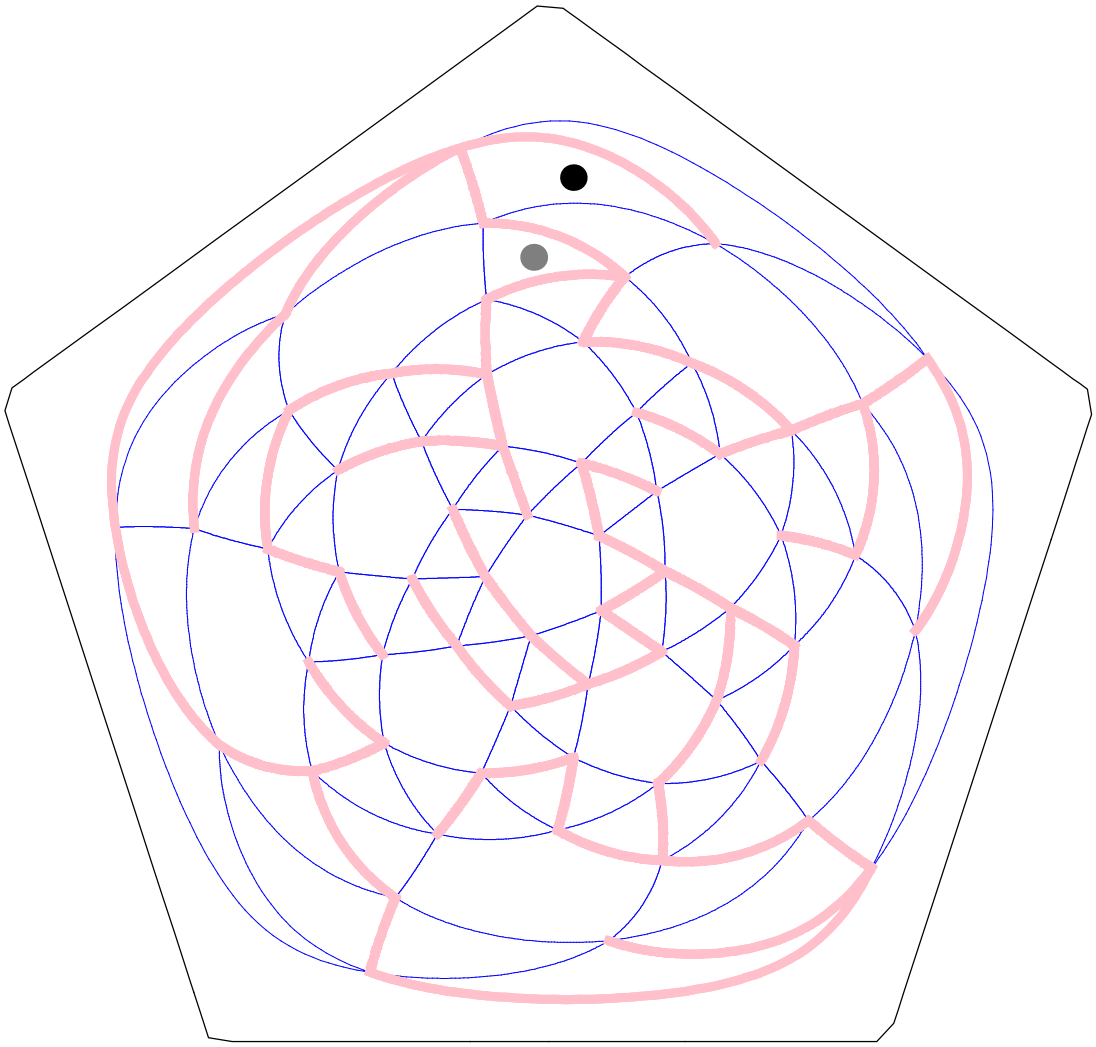


20.

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

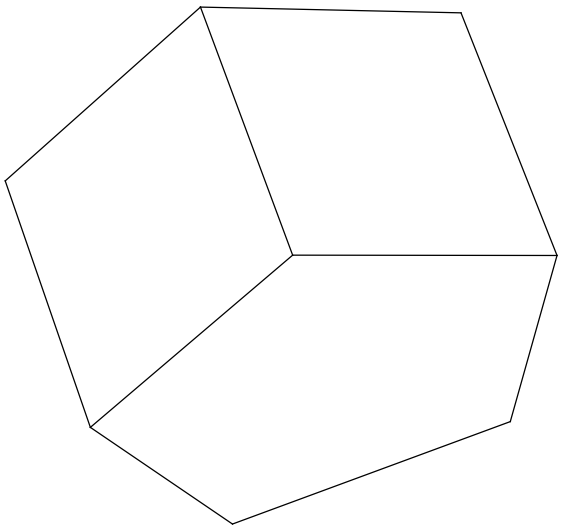


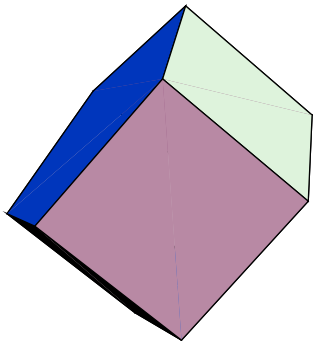


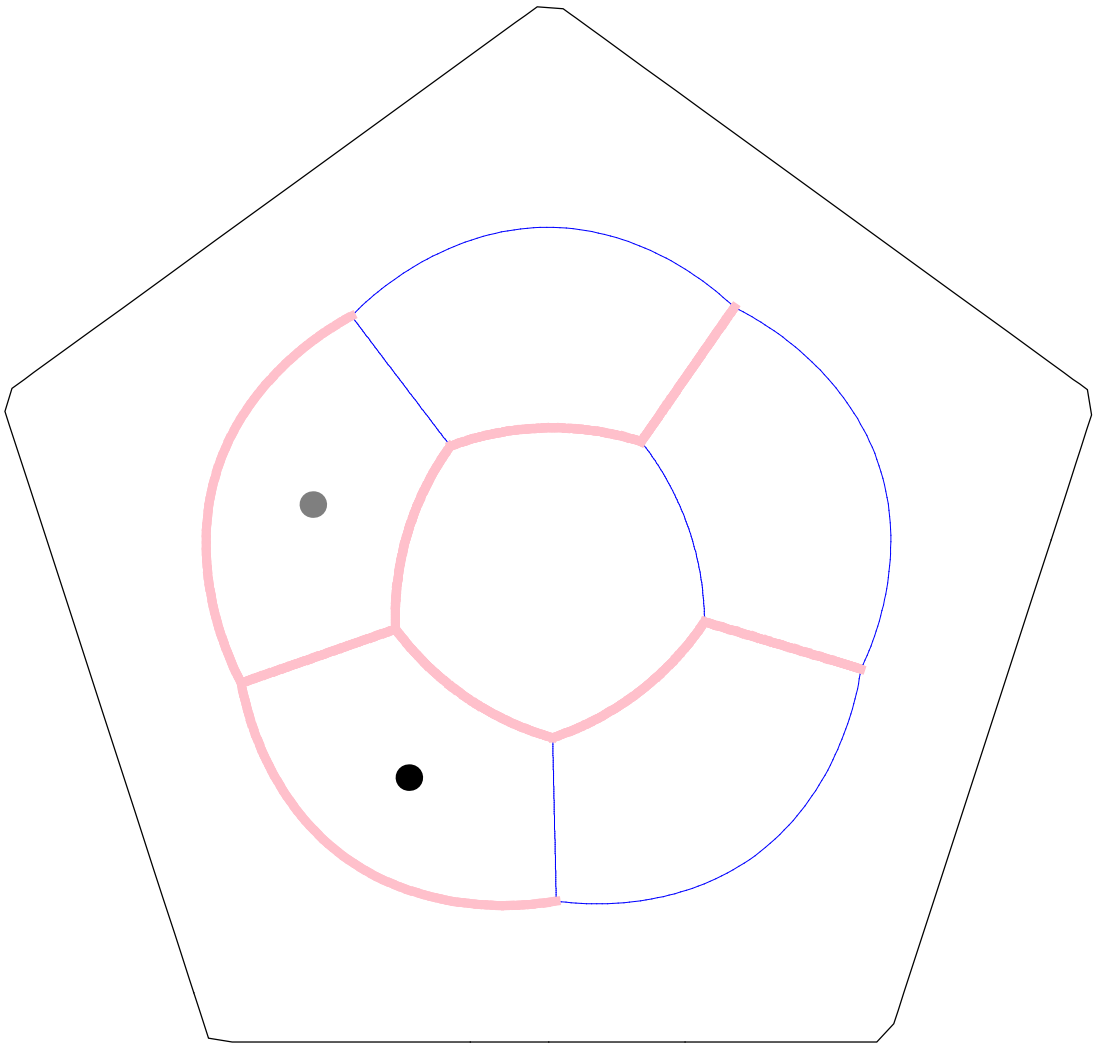


21.

`pentagonal prism` {4, 4, 5}

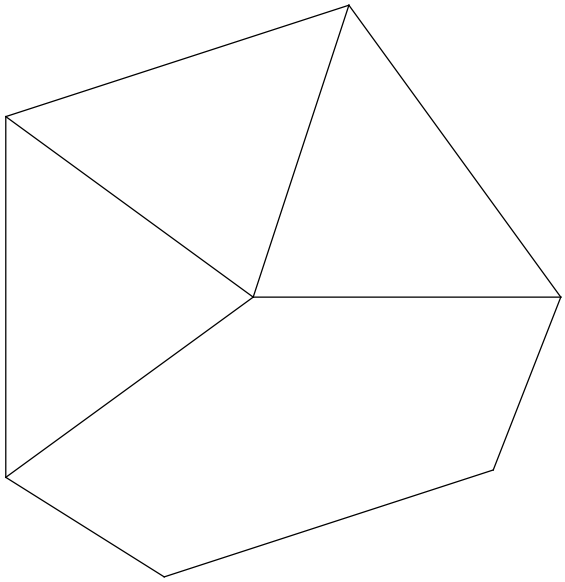


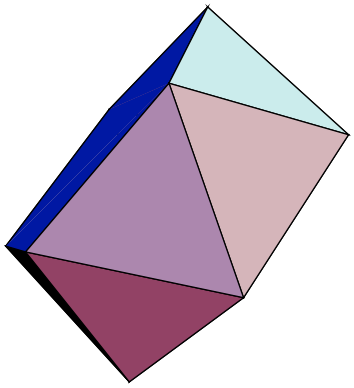


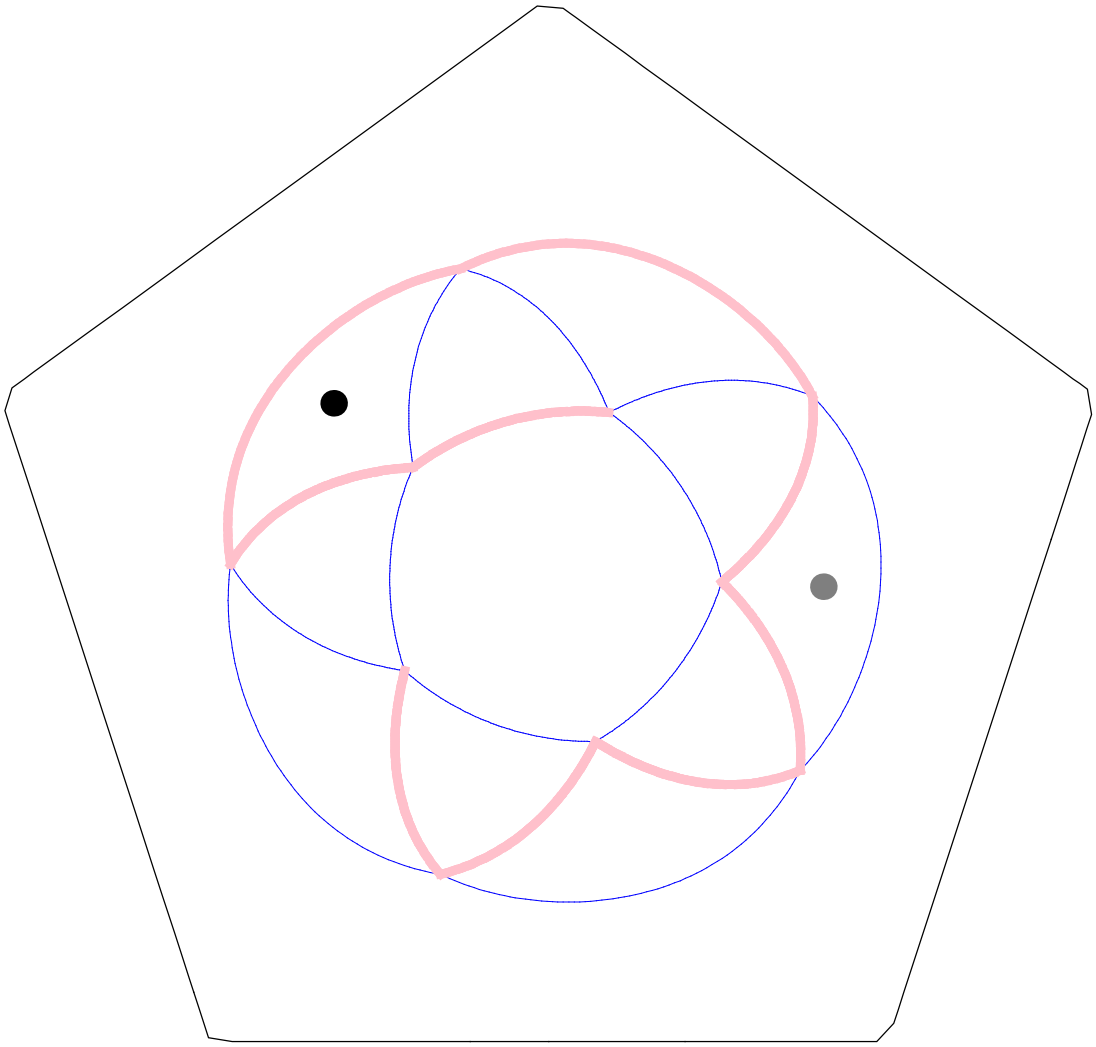


22.

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

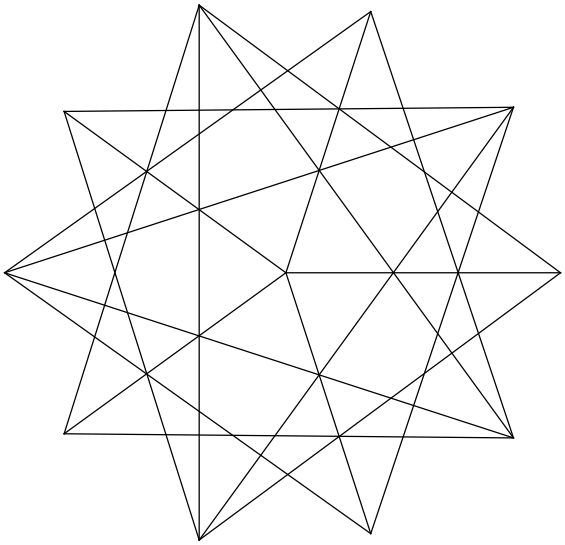


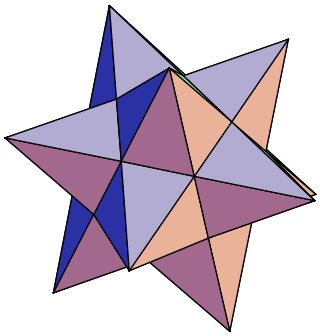


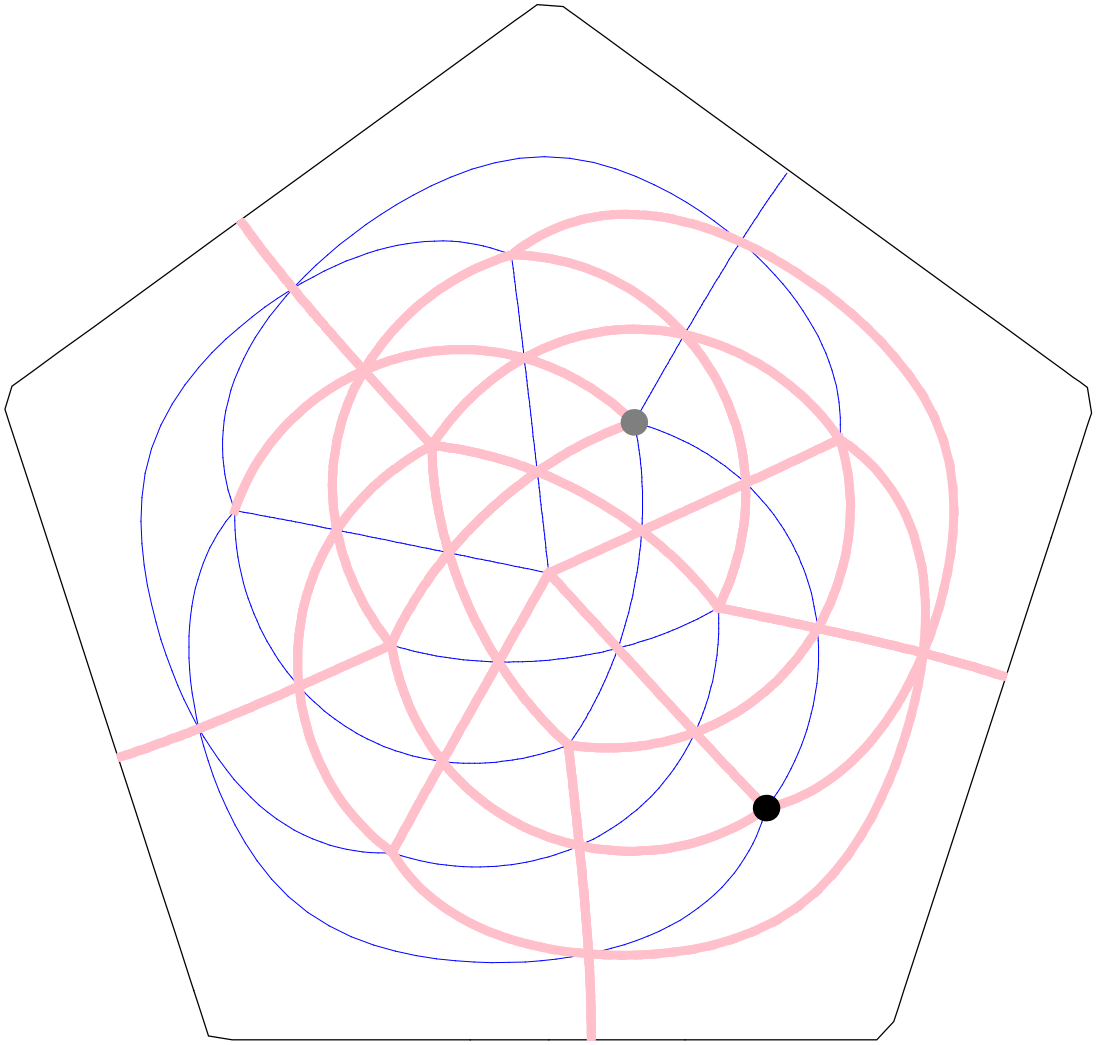


23.

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

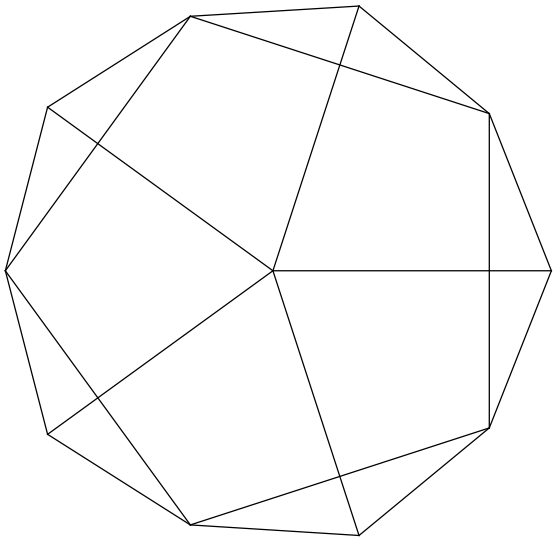


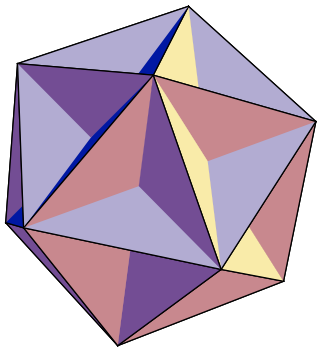


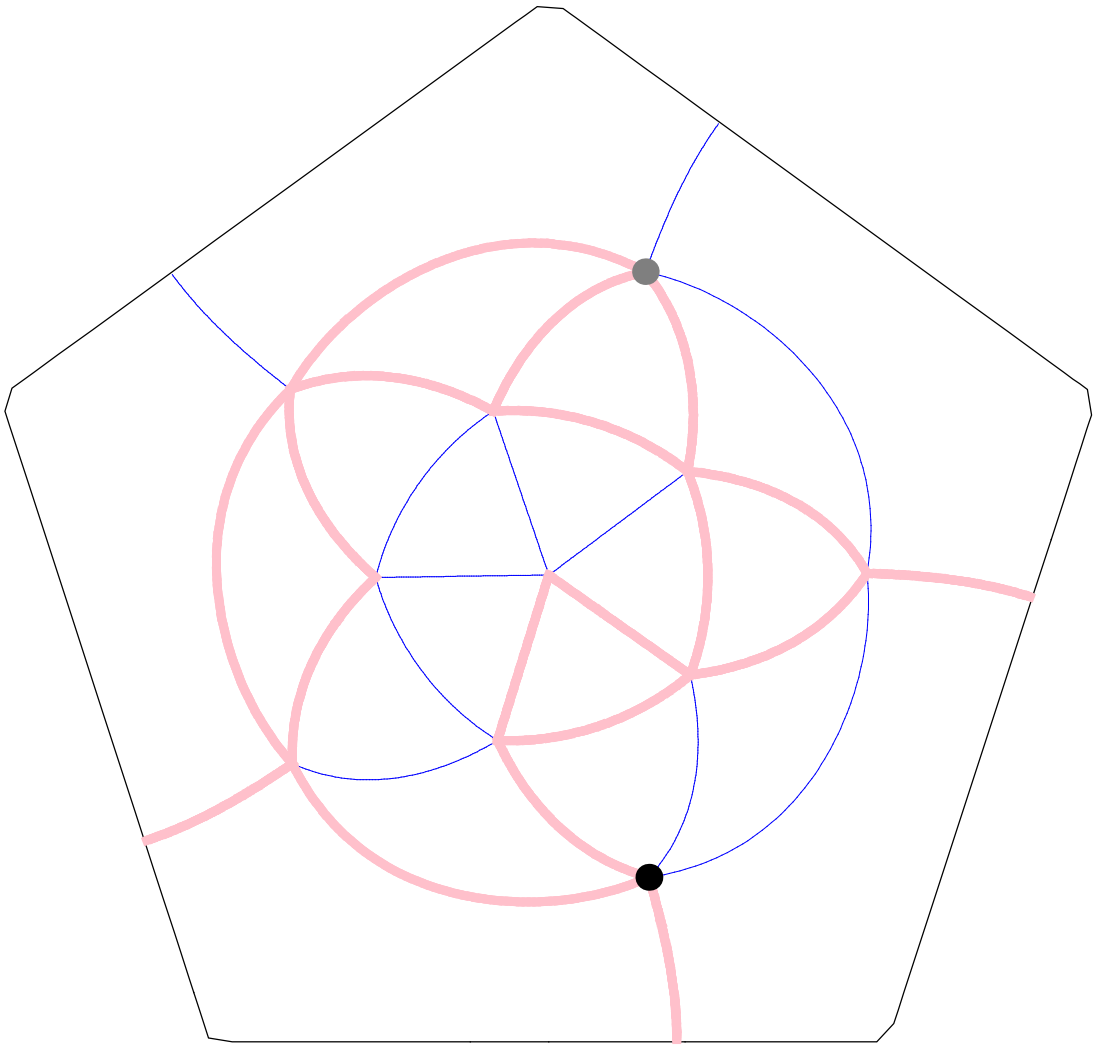


24.

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



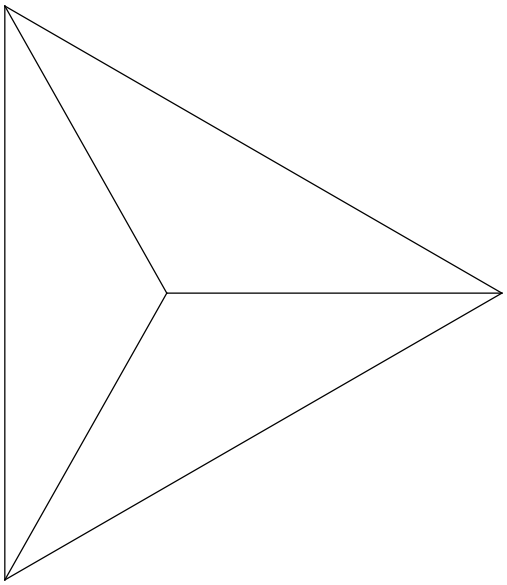


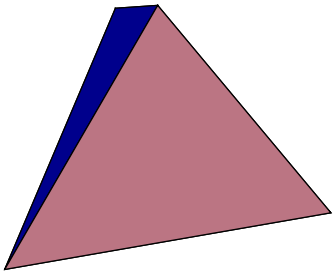


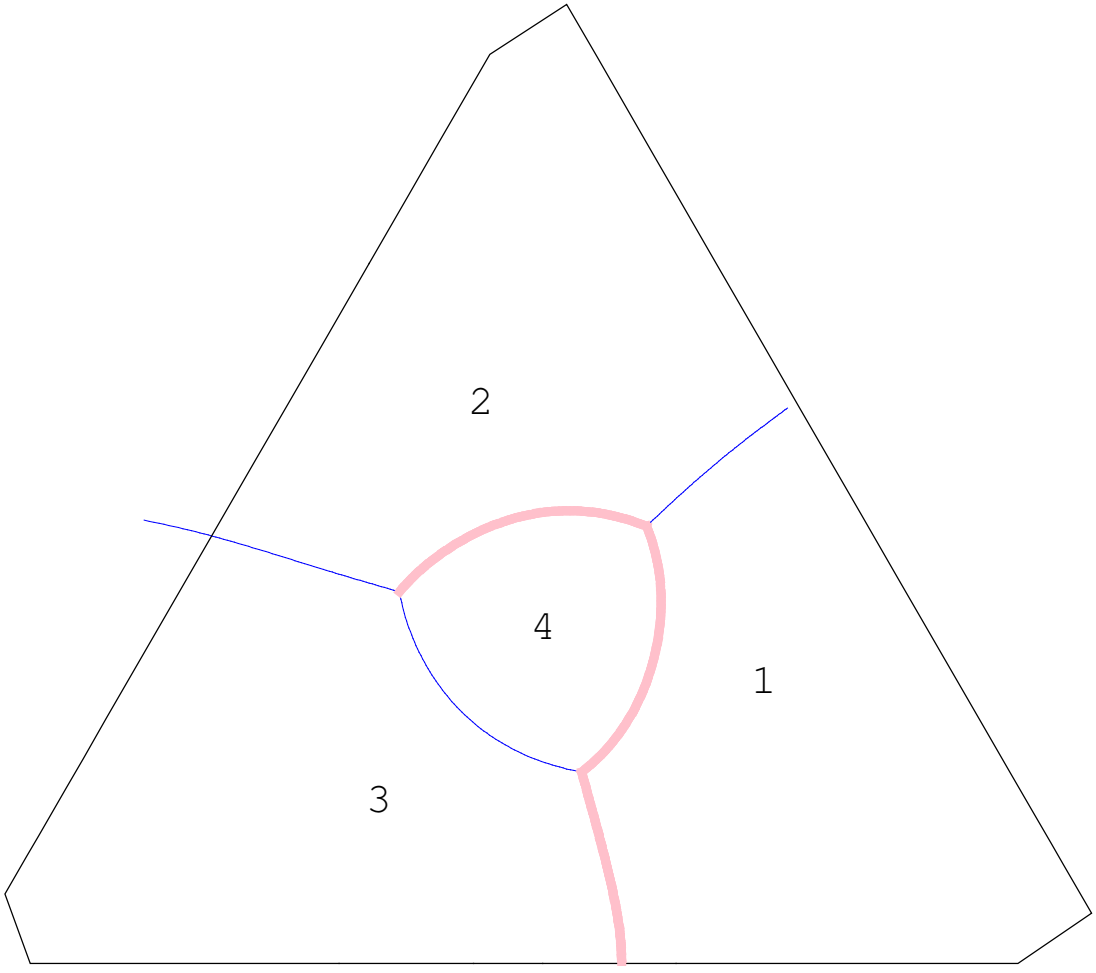
Solutions

3.

`tetrahedron` {3, 3, 3}

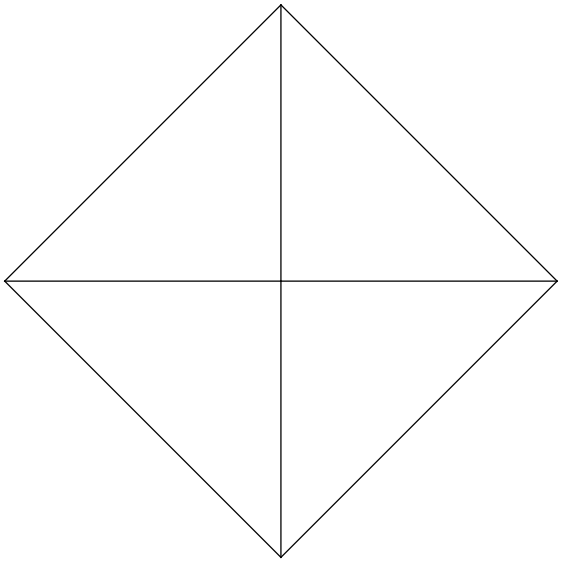


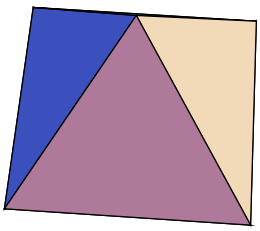


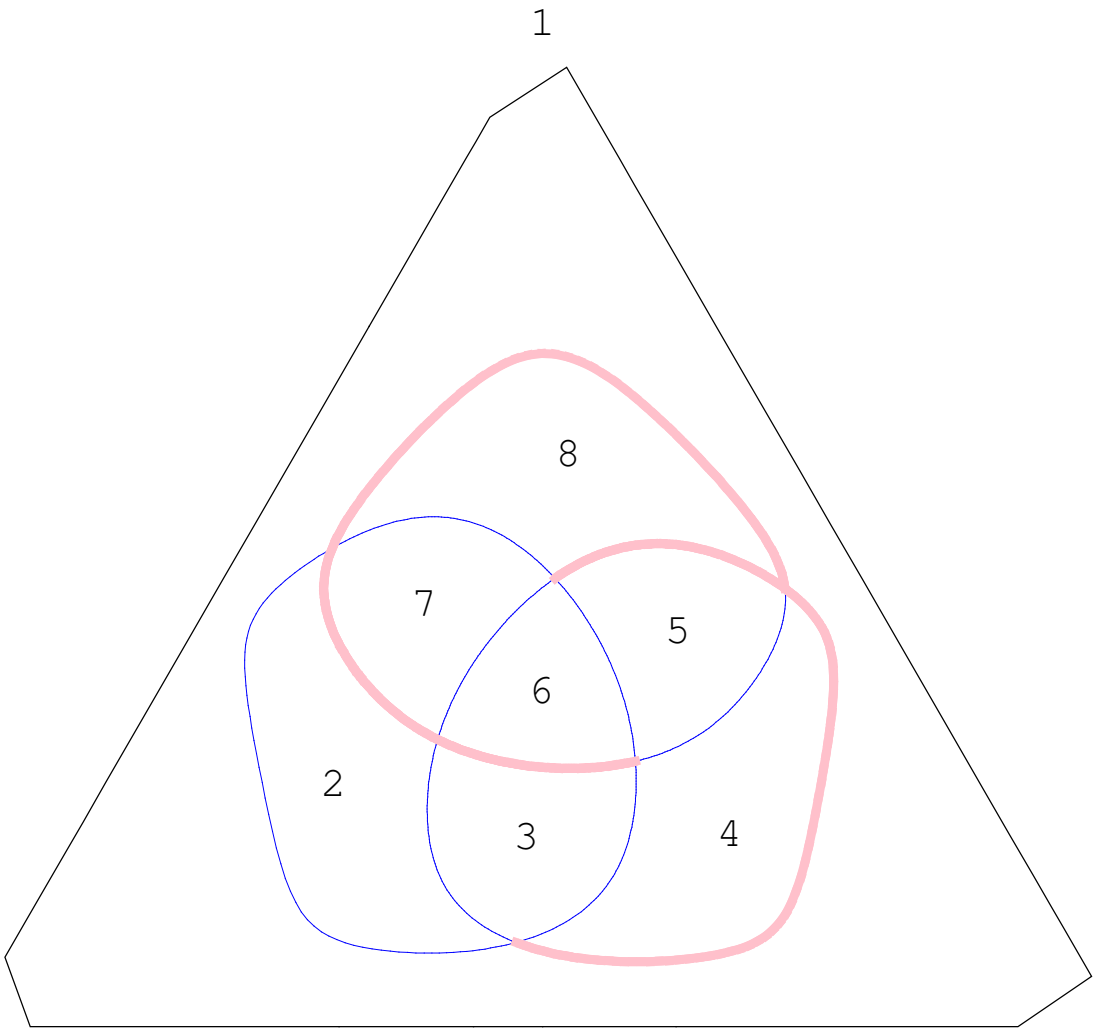


4.

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

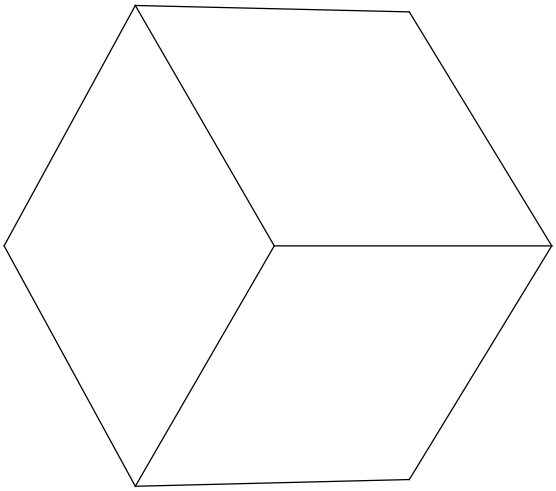


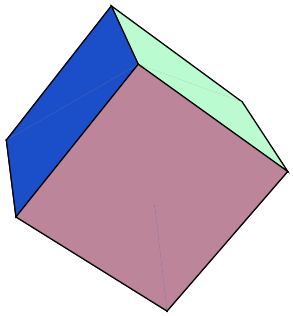


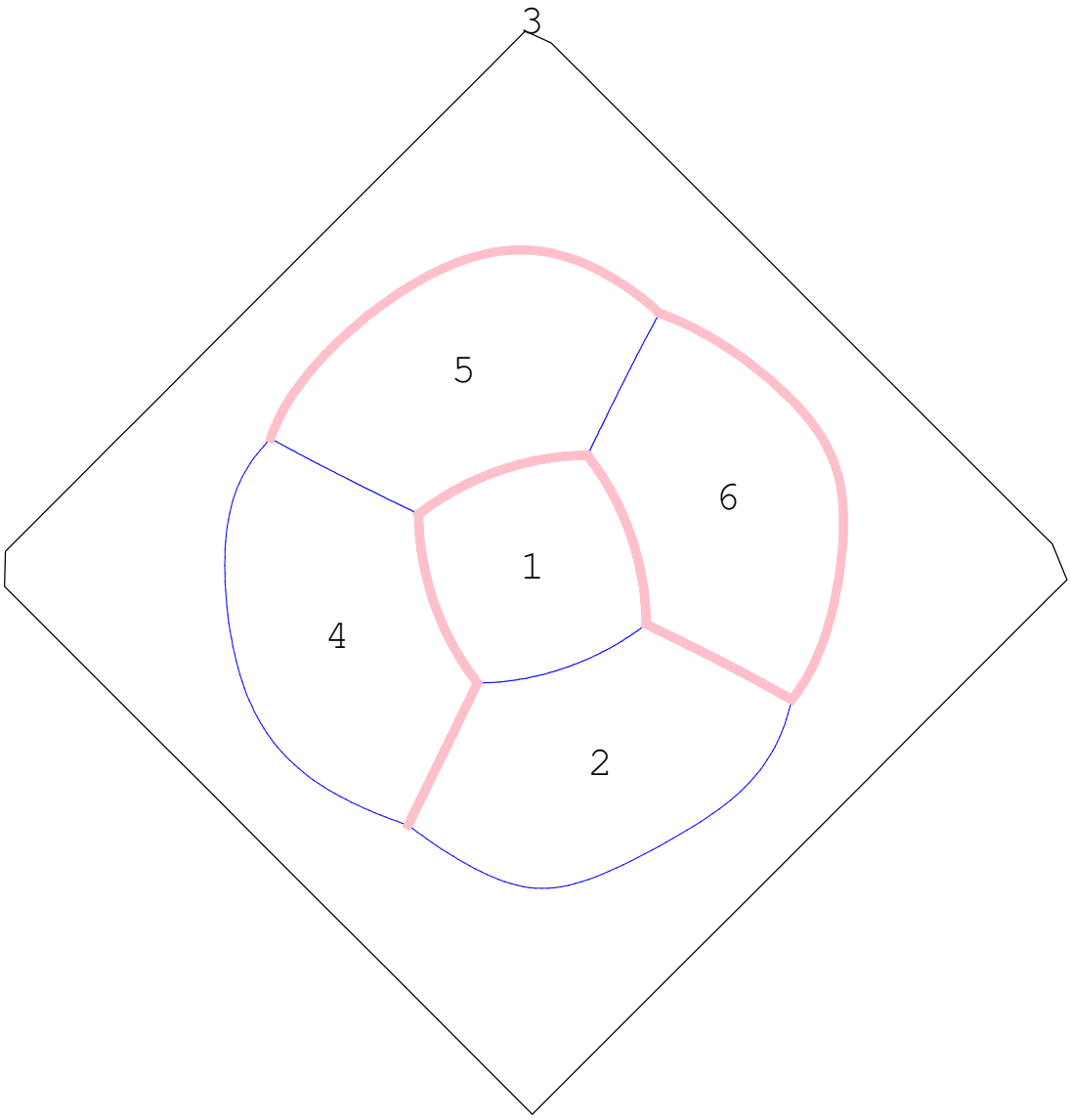


5.

`cube` {4, 4, 4}

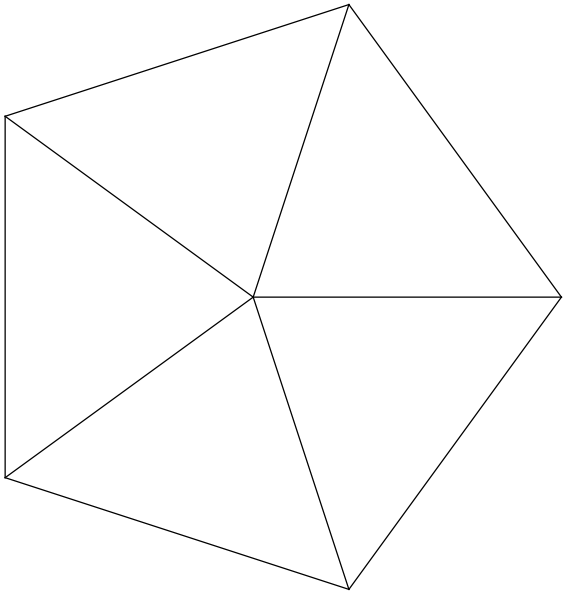


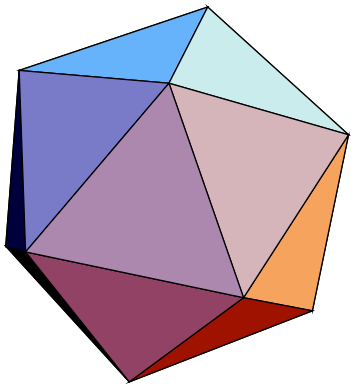


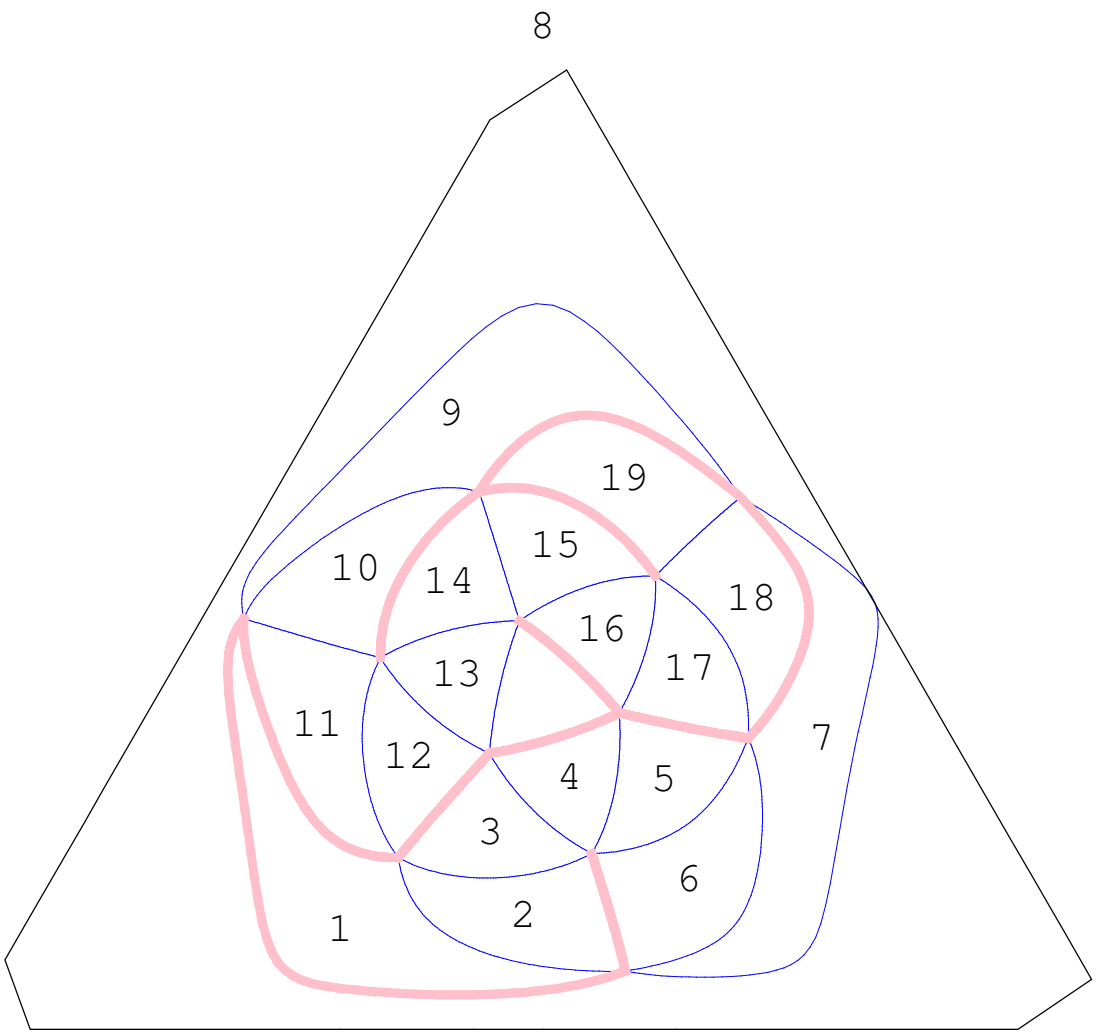


6.

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

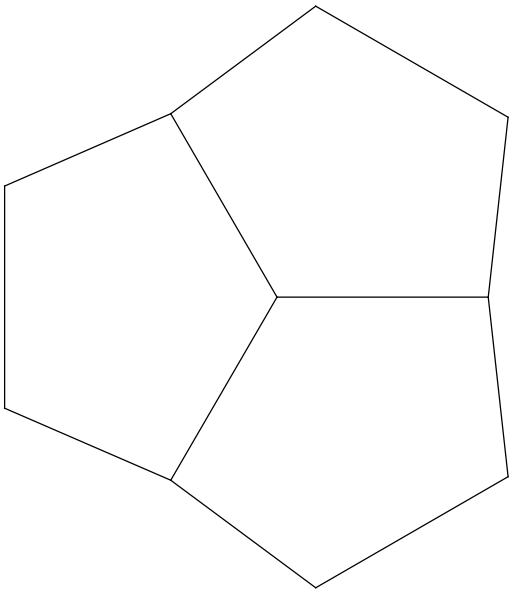


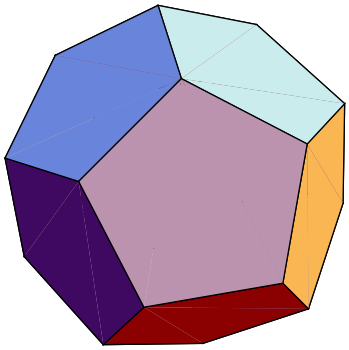


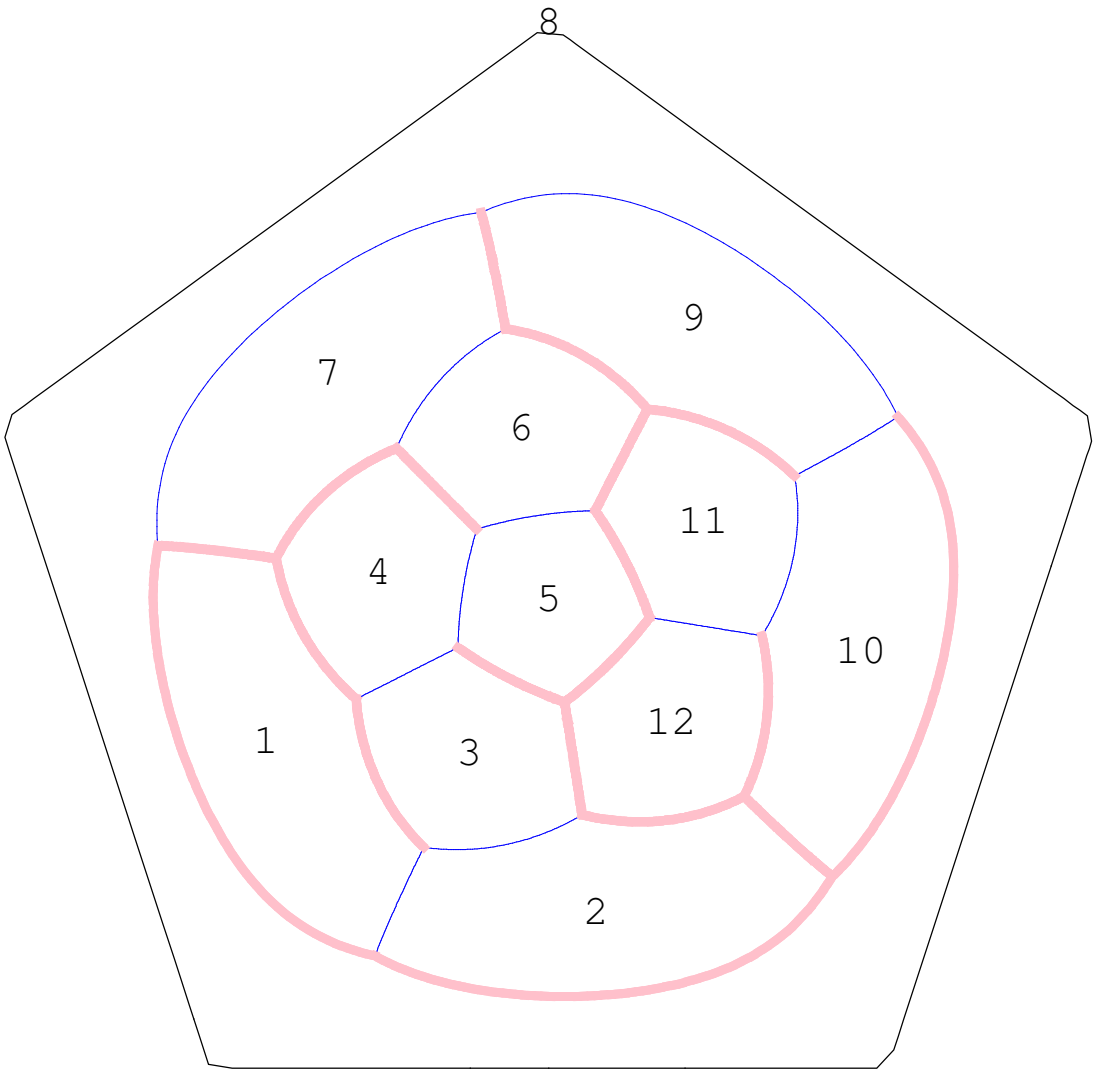


7.

`dodecahedron` {5, 5, 5}

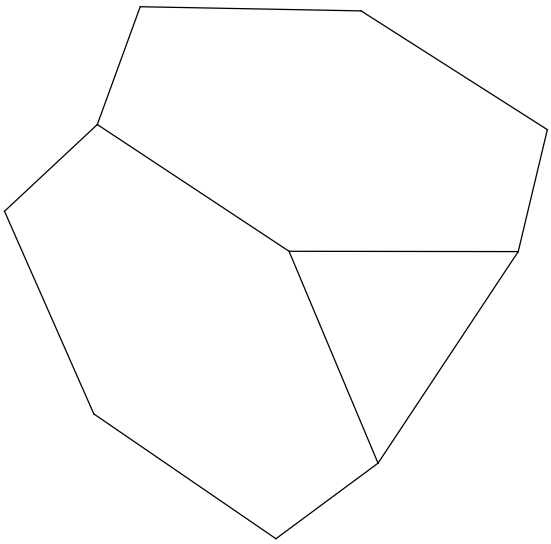


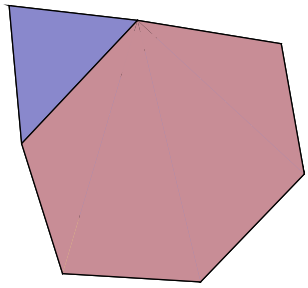


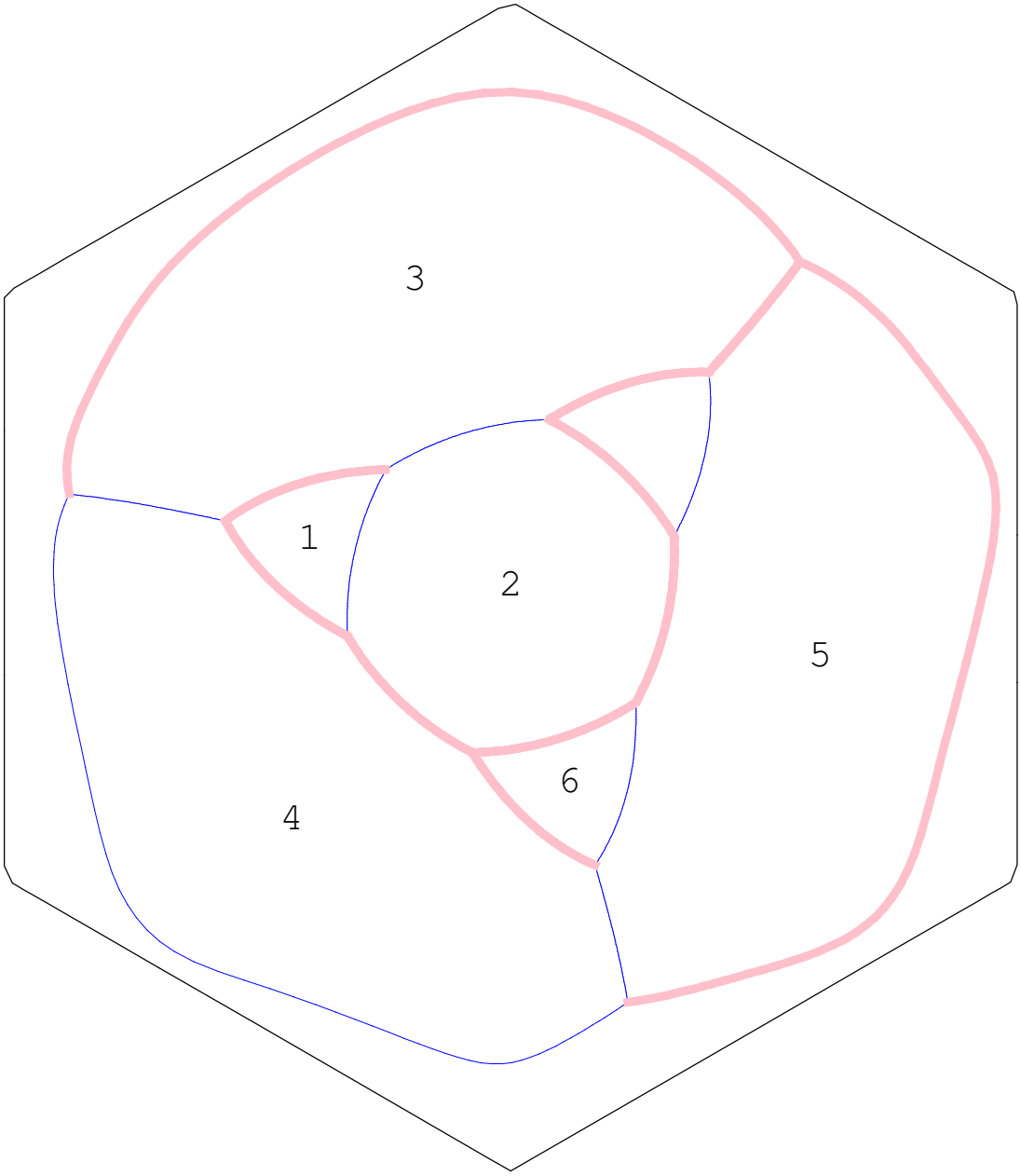


8.

`truncated tetrahedron` {6, 6, 3}

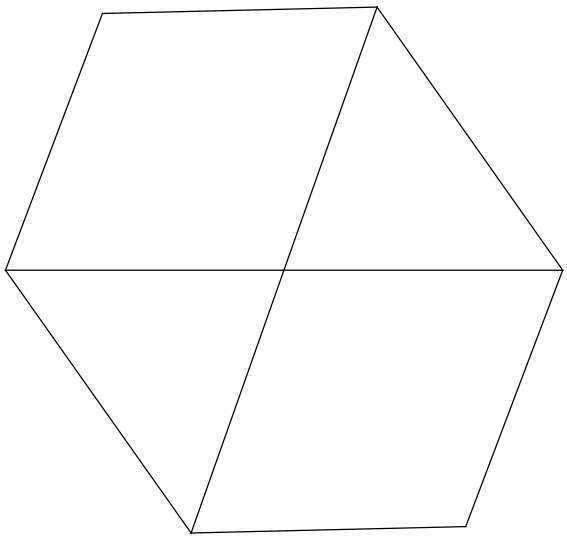


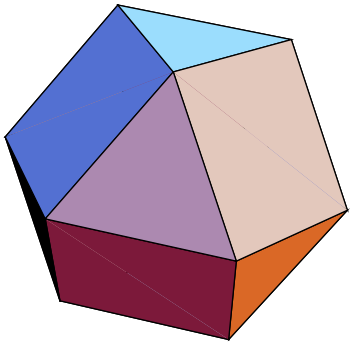


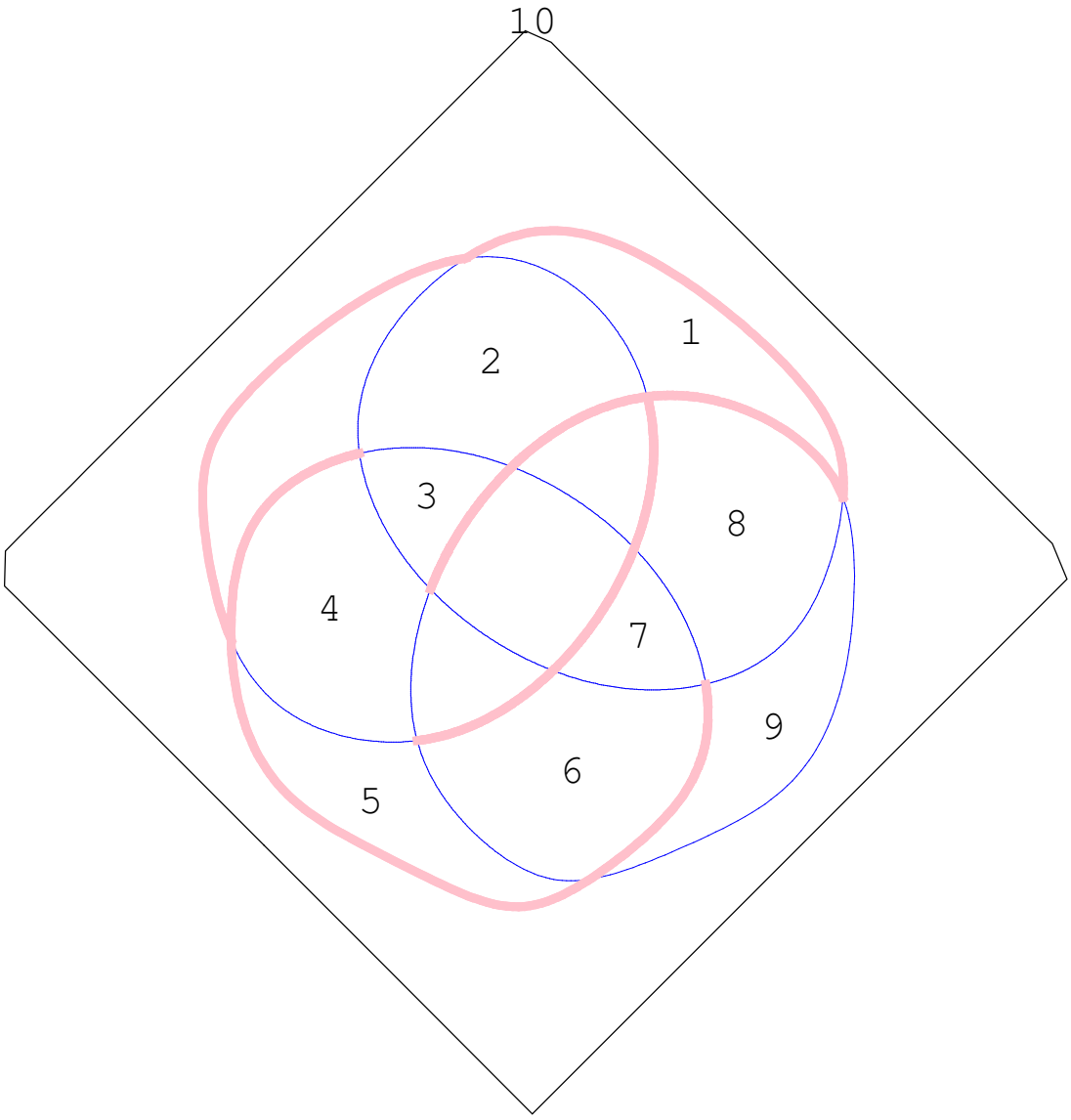

3
1
2
5
6
4

9.

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

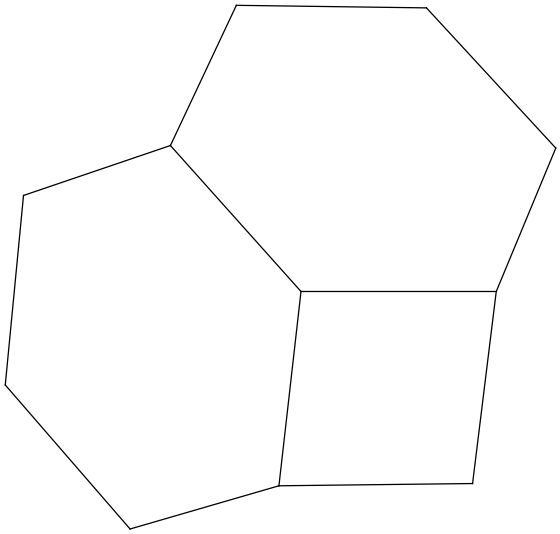


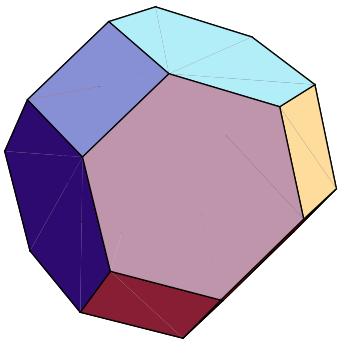


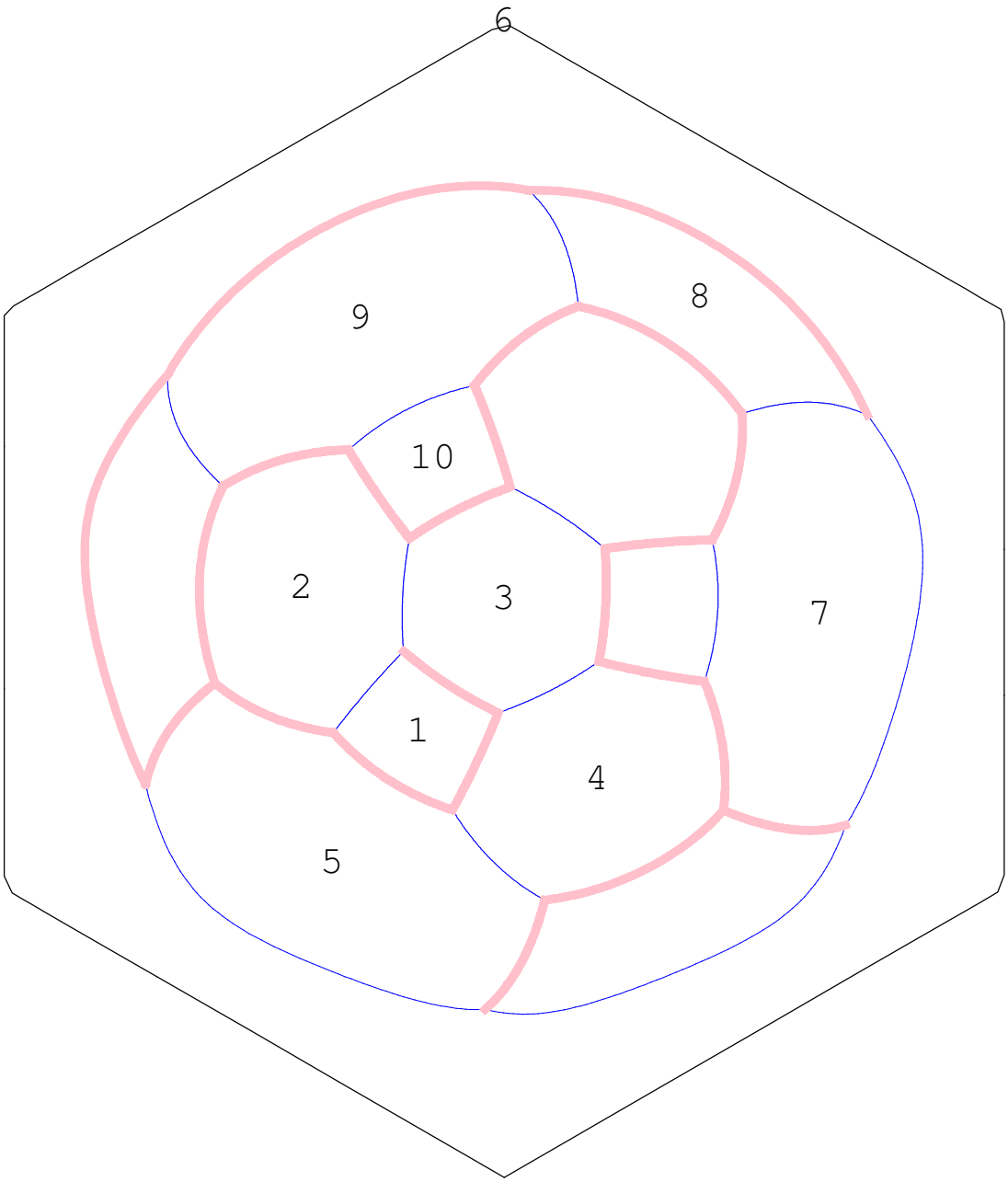


10.

`truncated octahedron` {6, 6, 4}

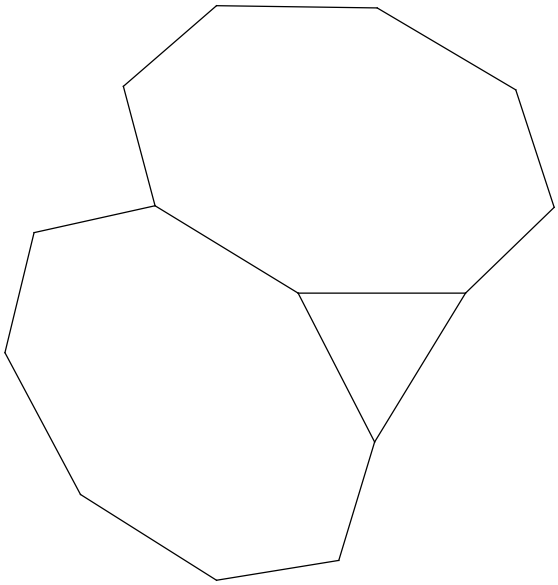


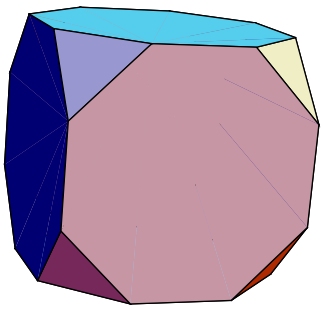


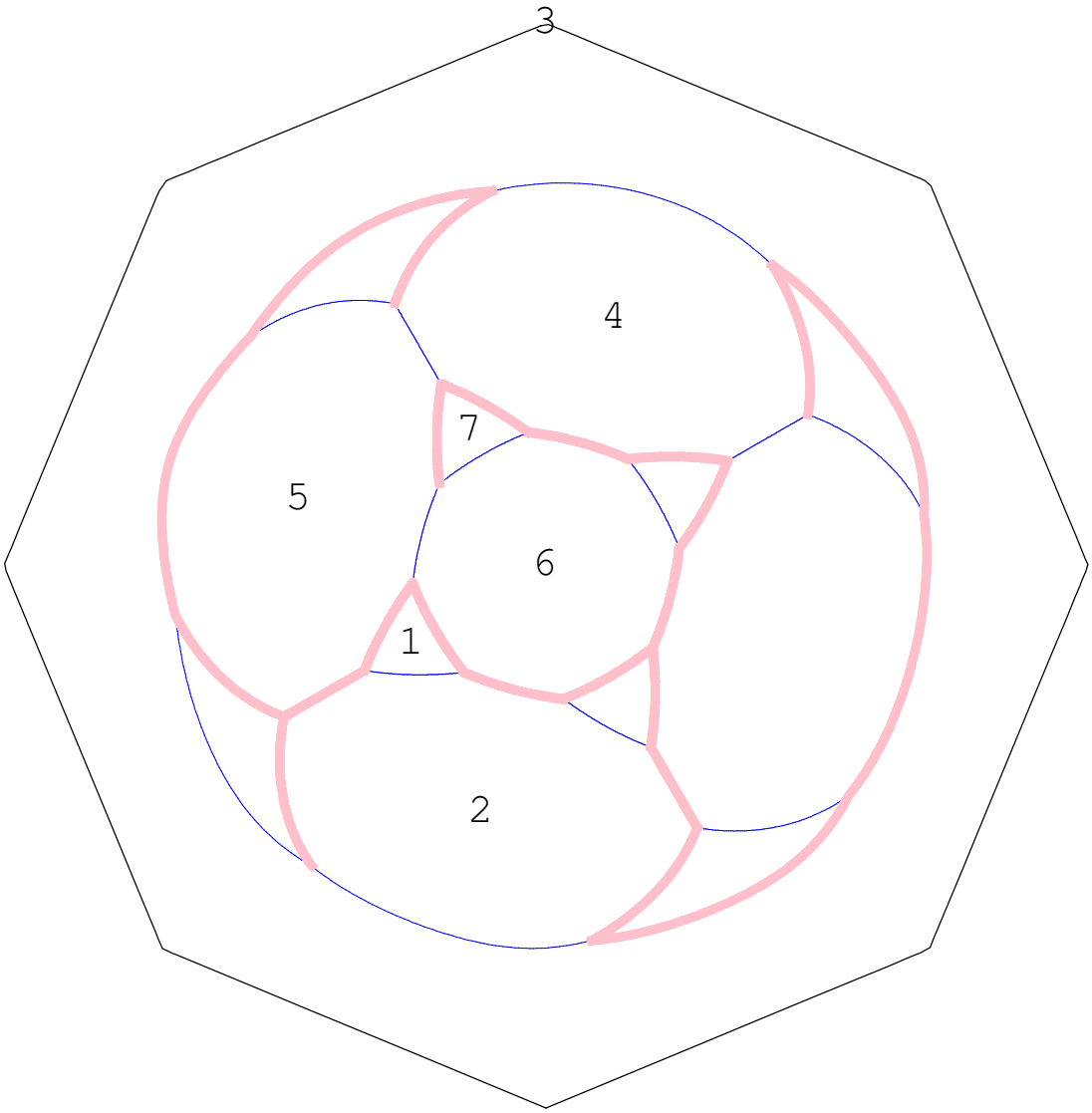

6
9
8
10
2
3
7
1
4
5

11.

`truncated cube` {8, 8, 3}

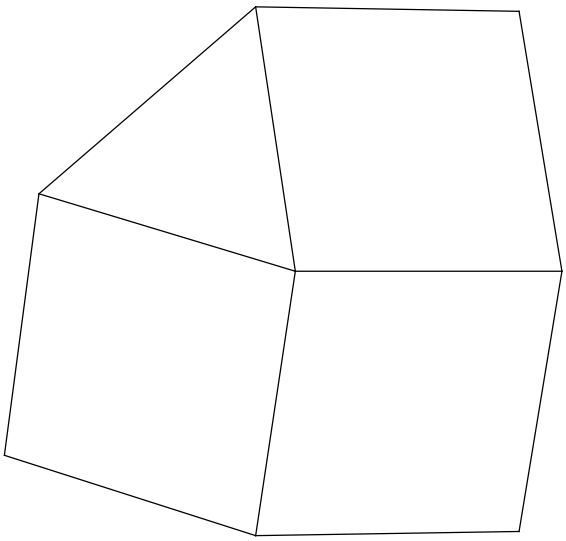


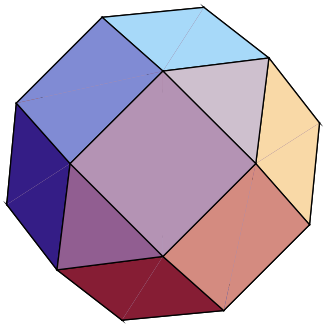


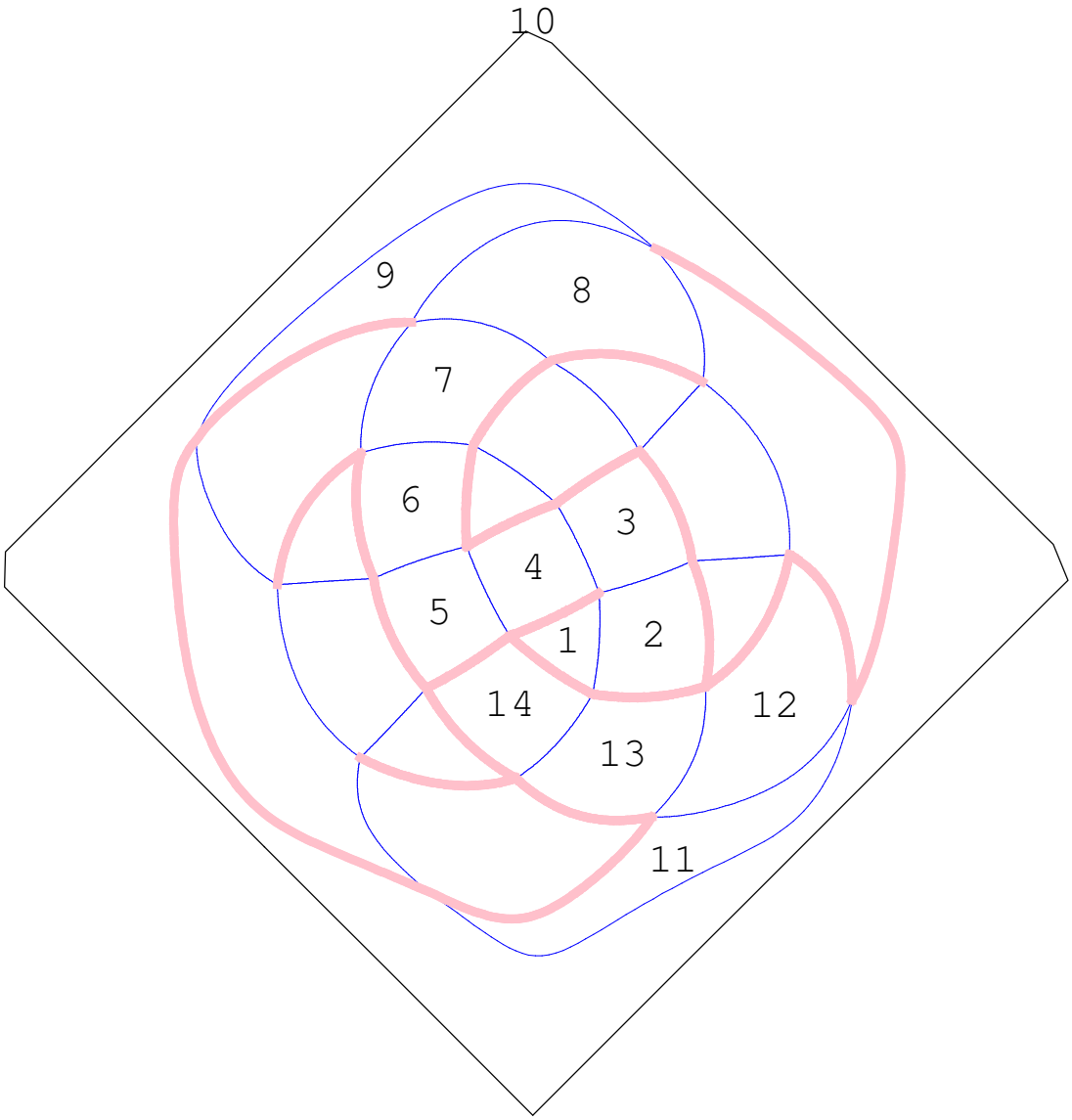


12.

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

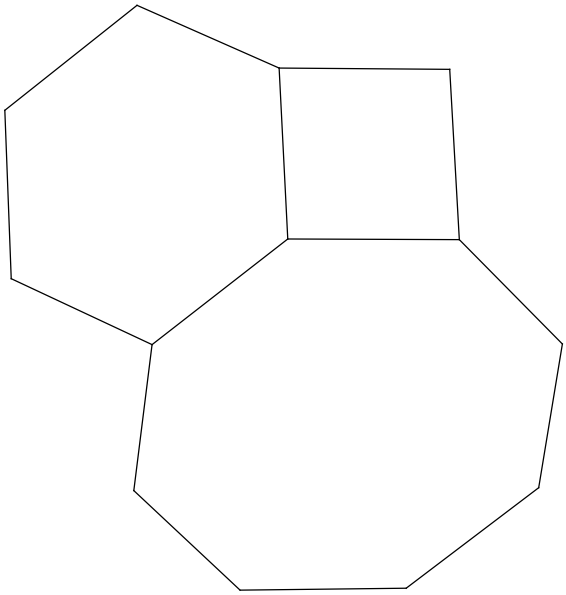


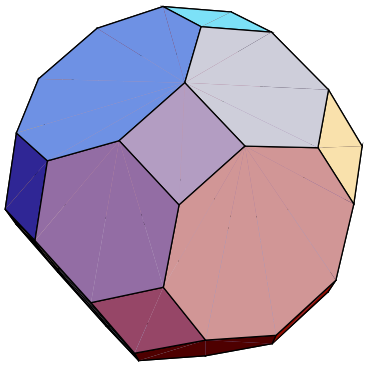


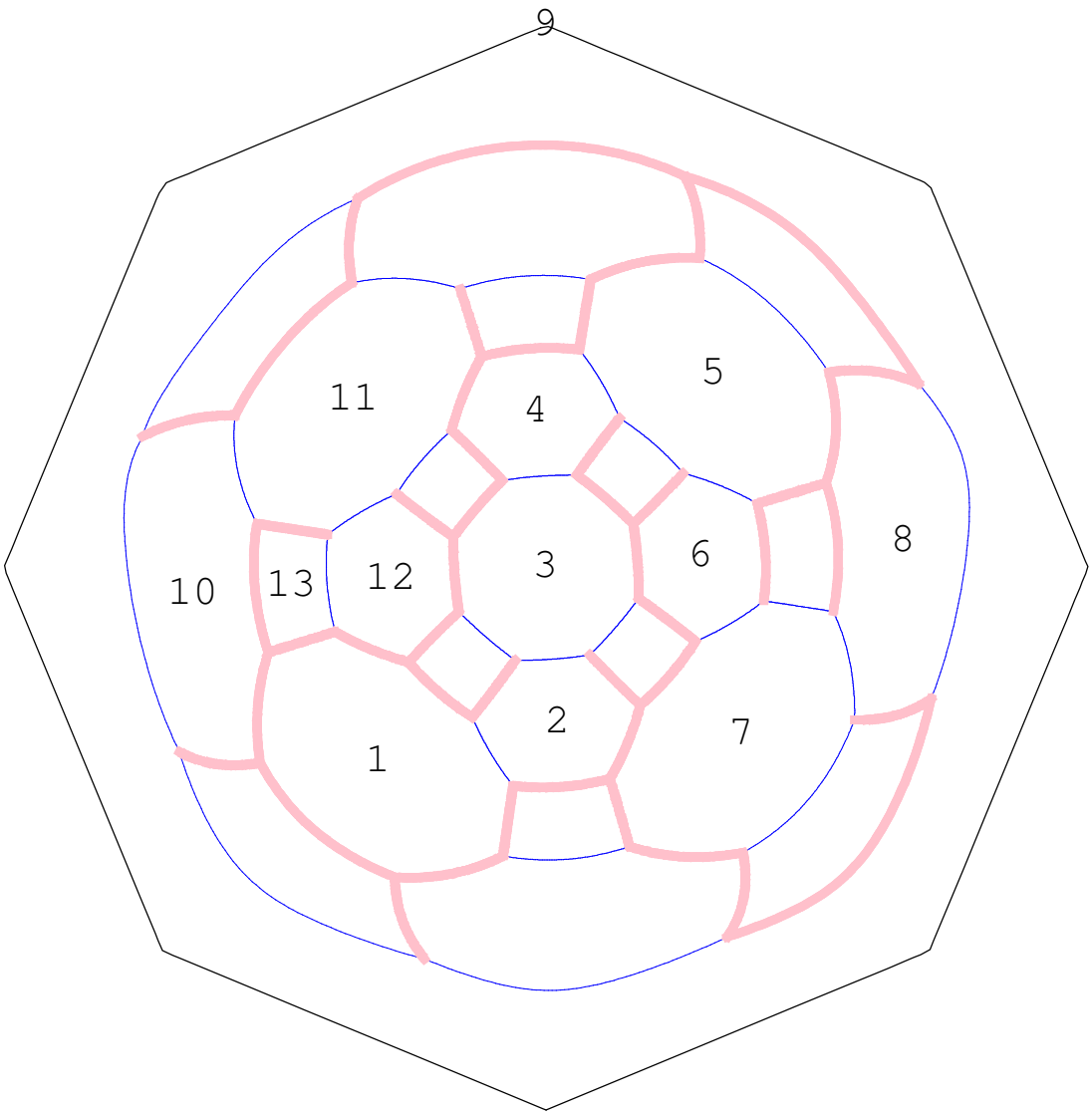


13.

`truncated cuboctahedron` {4, 6, 8}

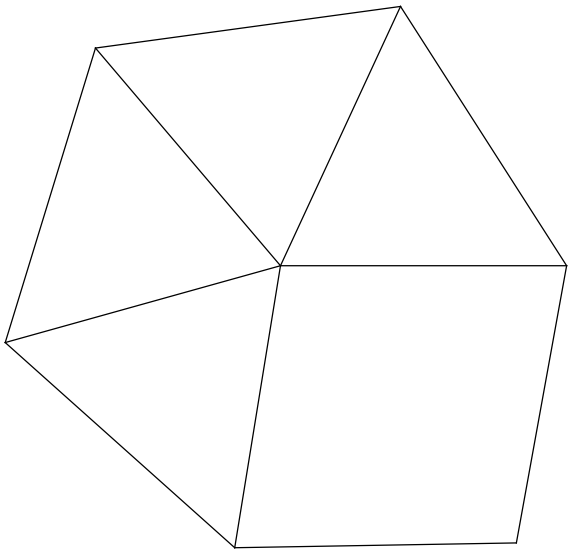


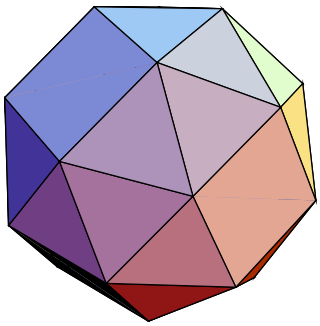


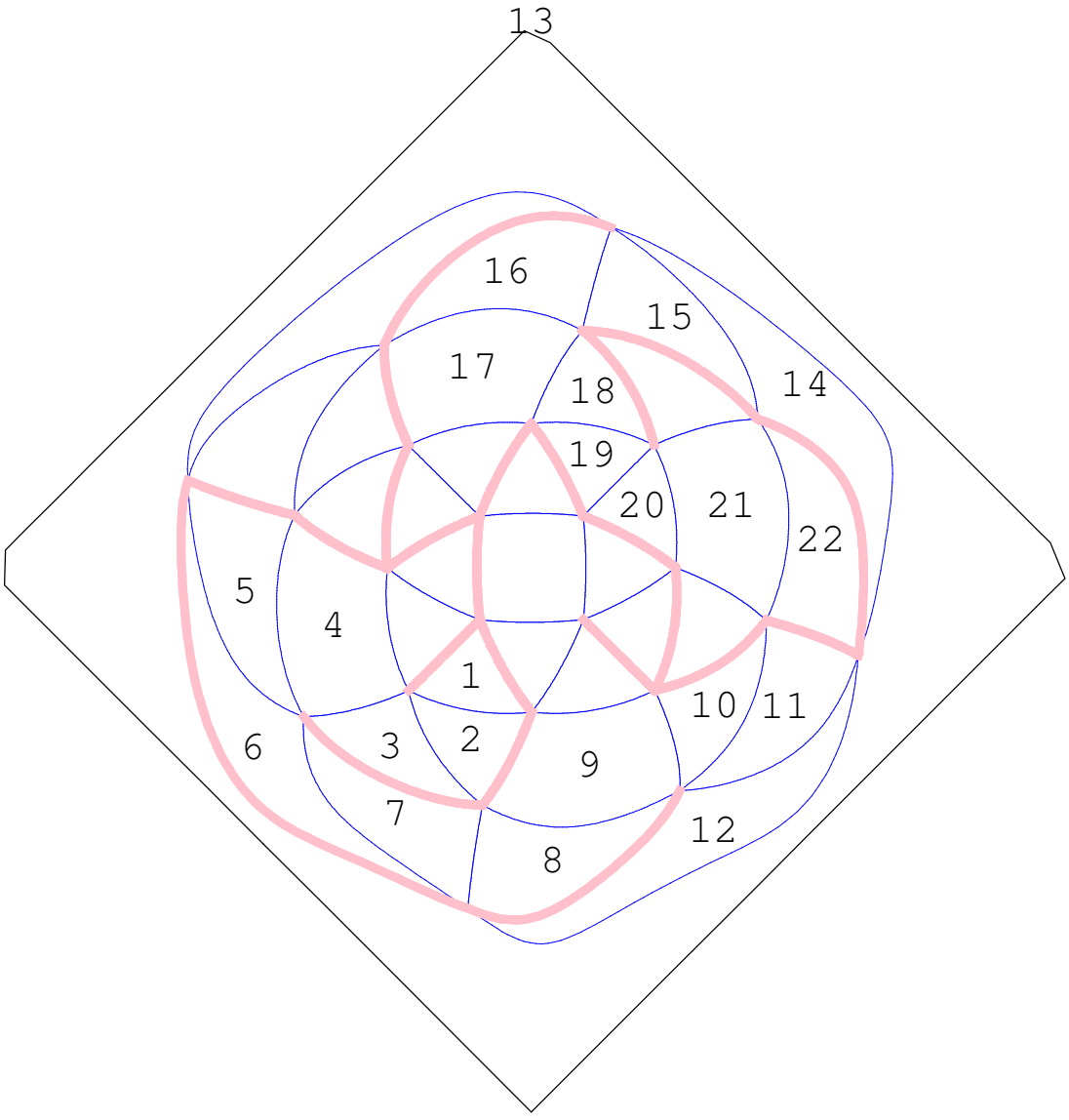


14.

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

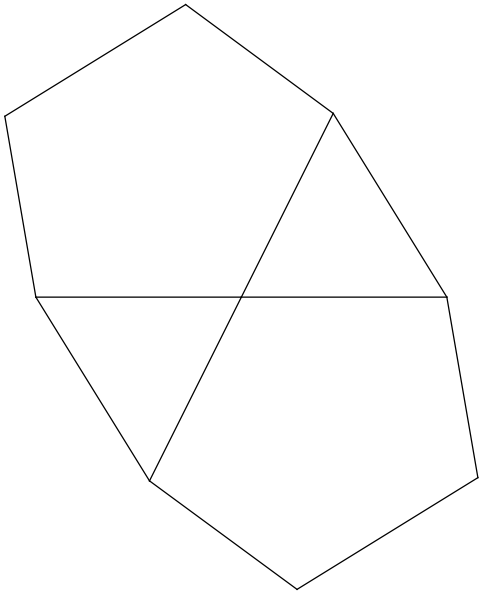


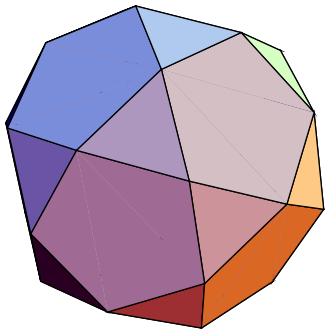


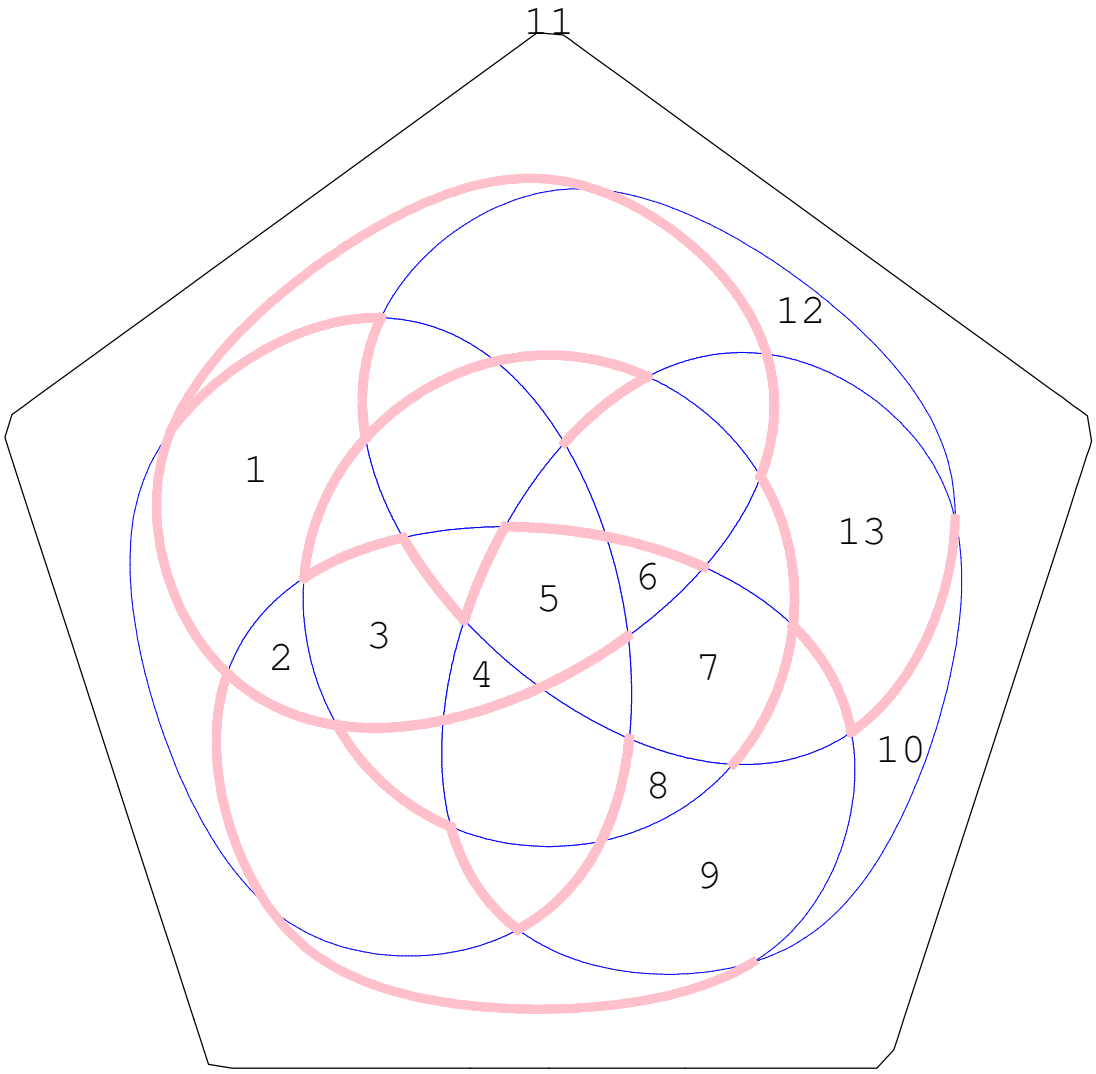


15.

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

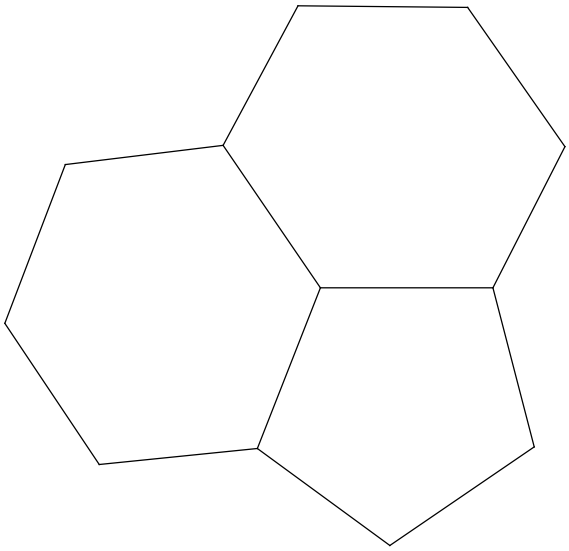


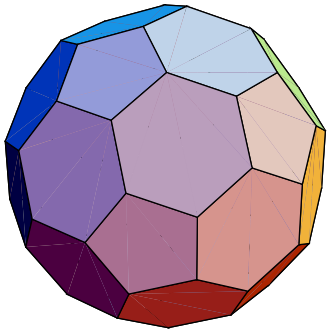


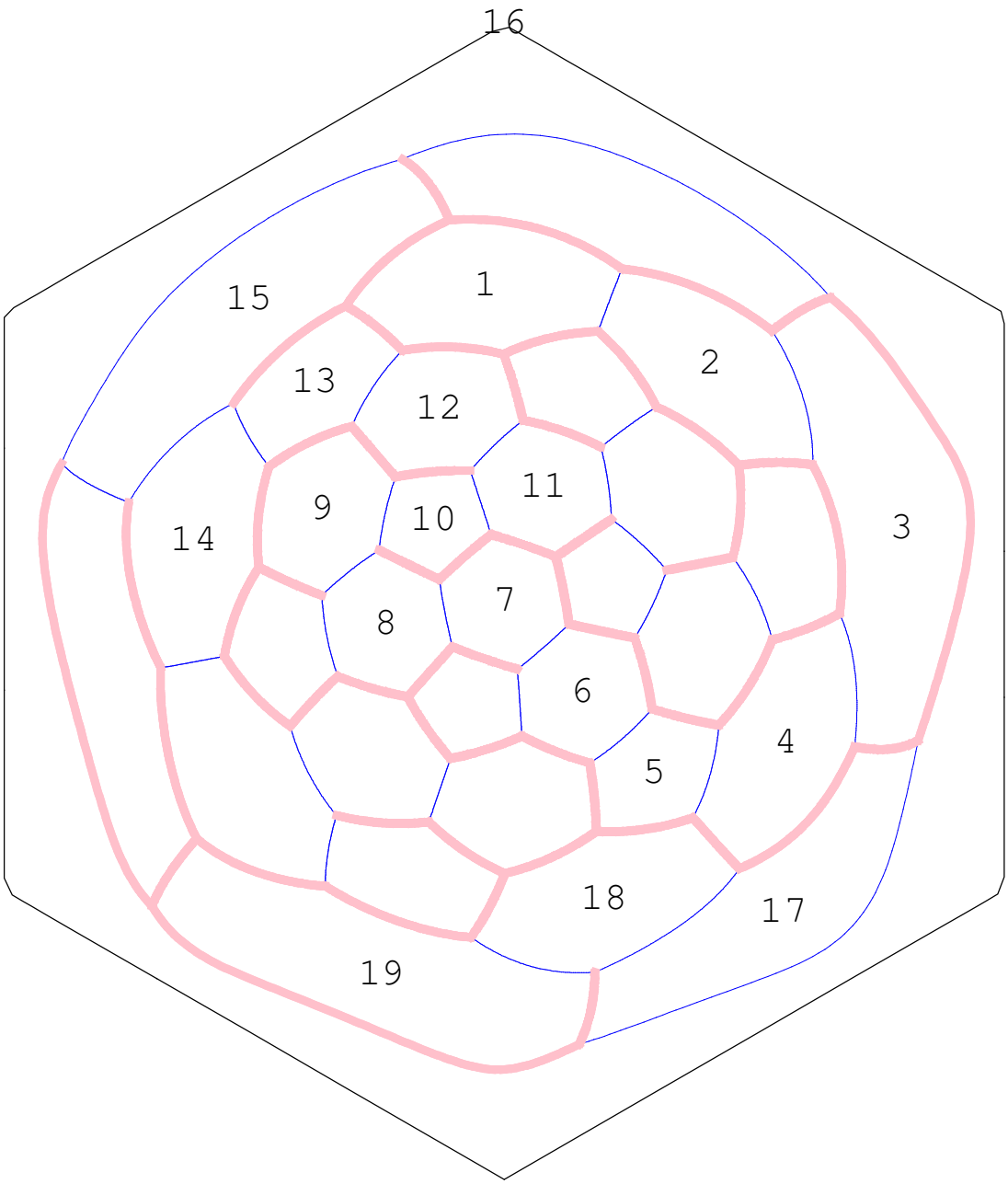


16.

`truncated icosahedron` {6, 6, 5}

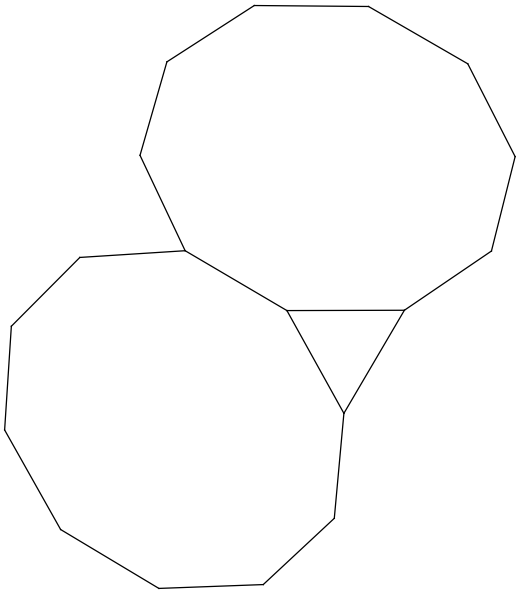


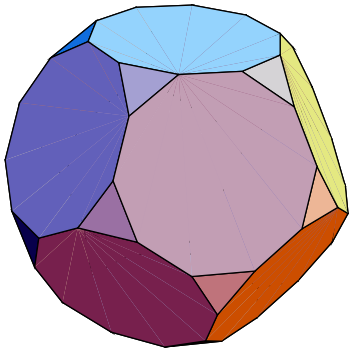


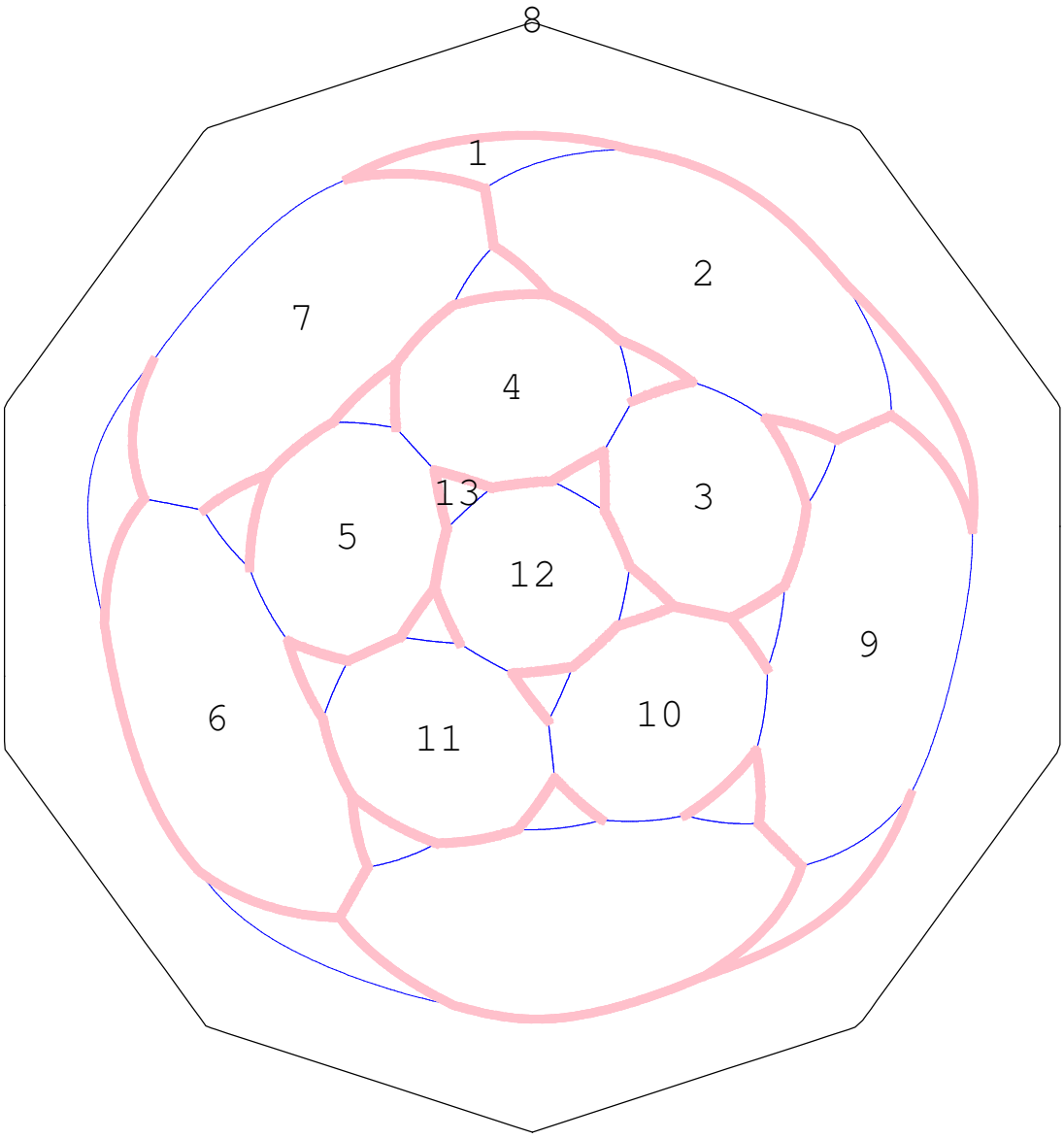

16
15
1
2
13
12
11
9
10
3
14
7
8
6
4
5
18
17
19

17.

truncated dodecahedron {10, 10, 3}

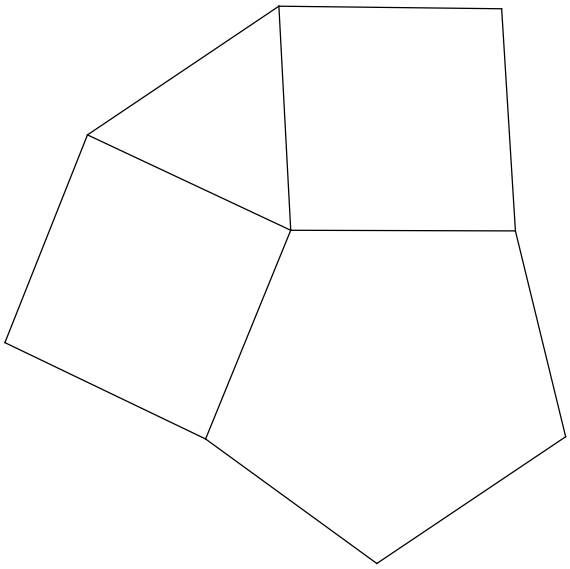


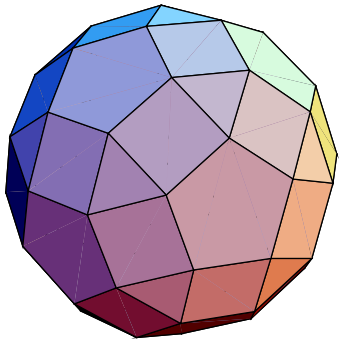


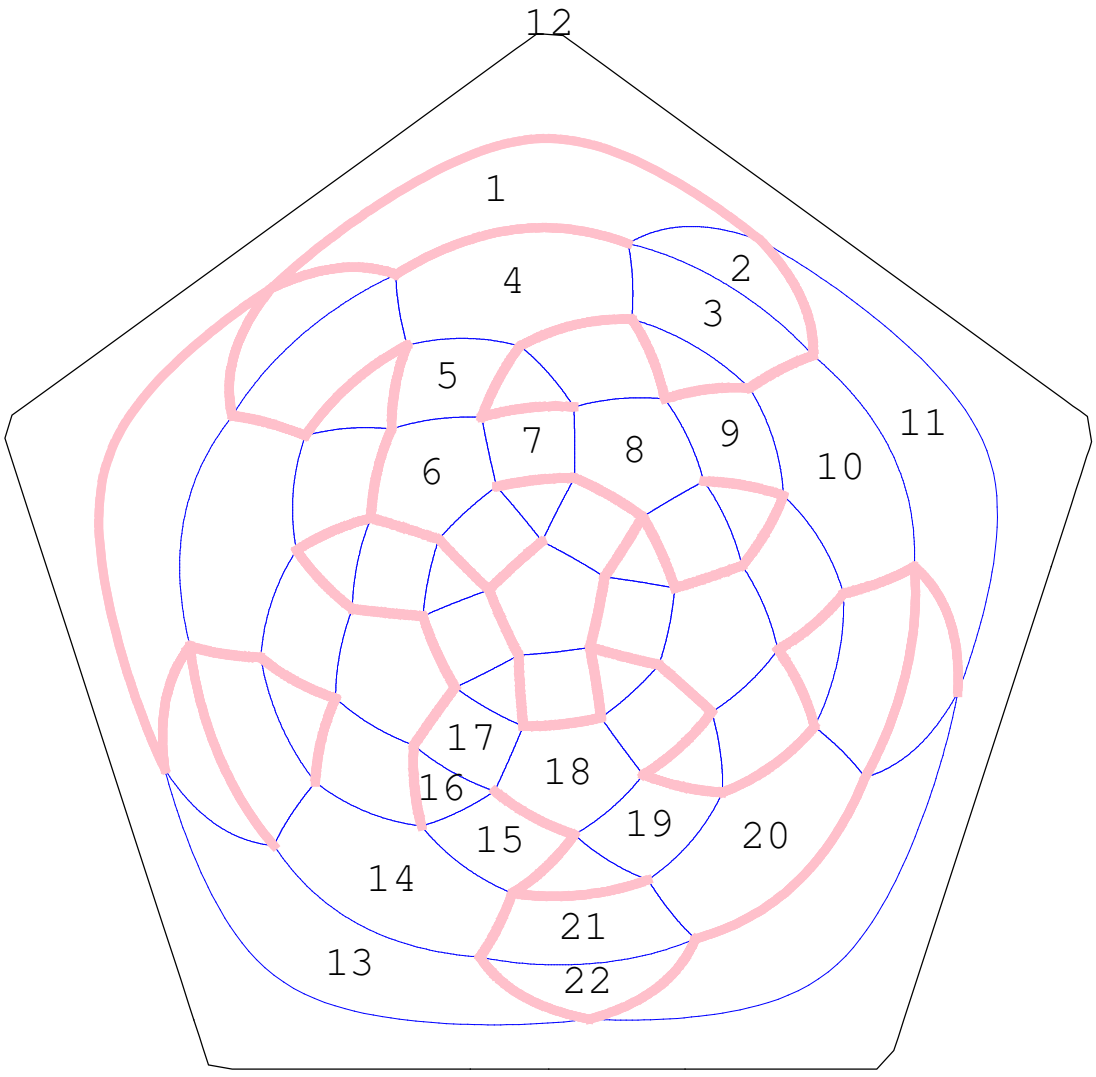


18.

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

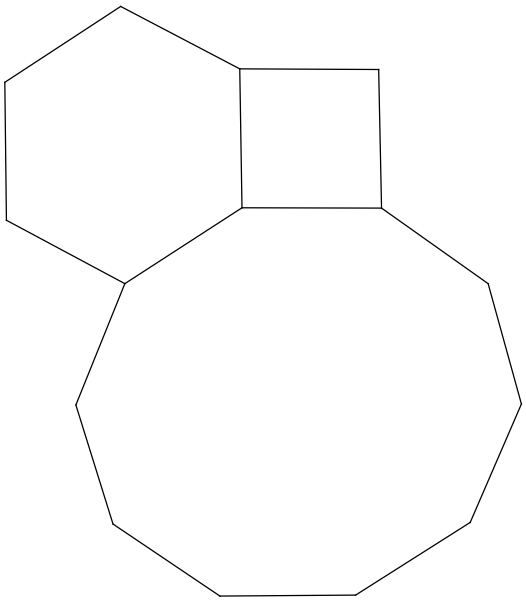


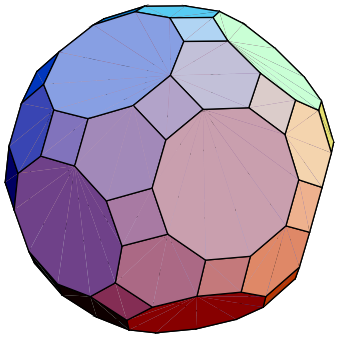


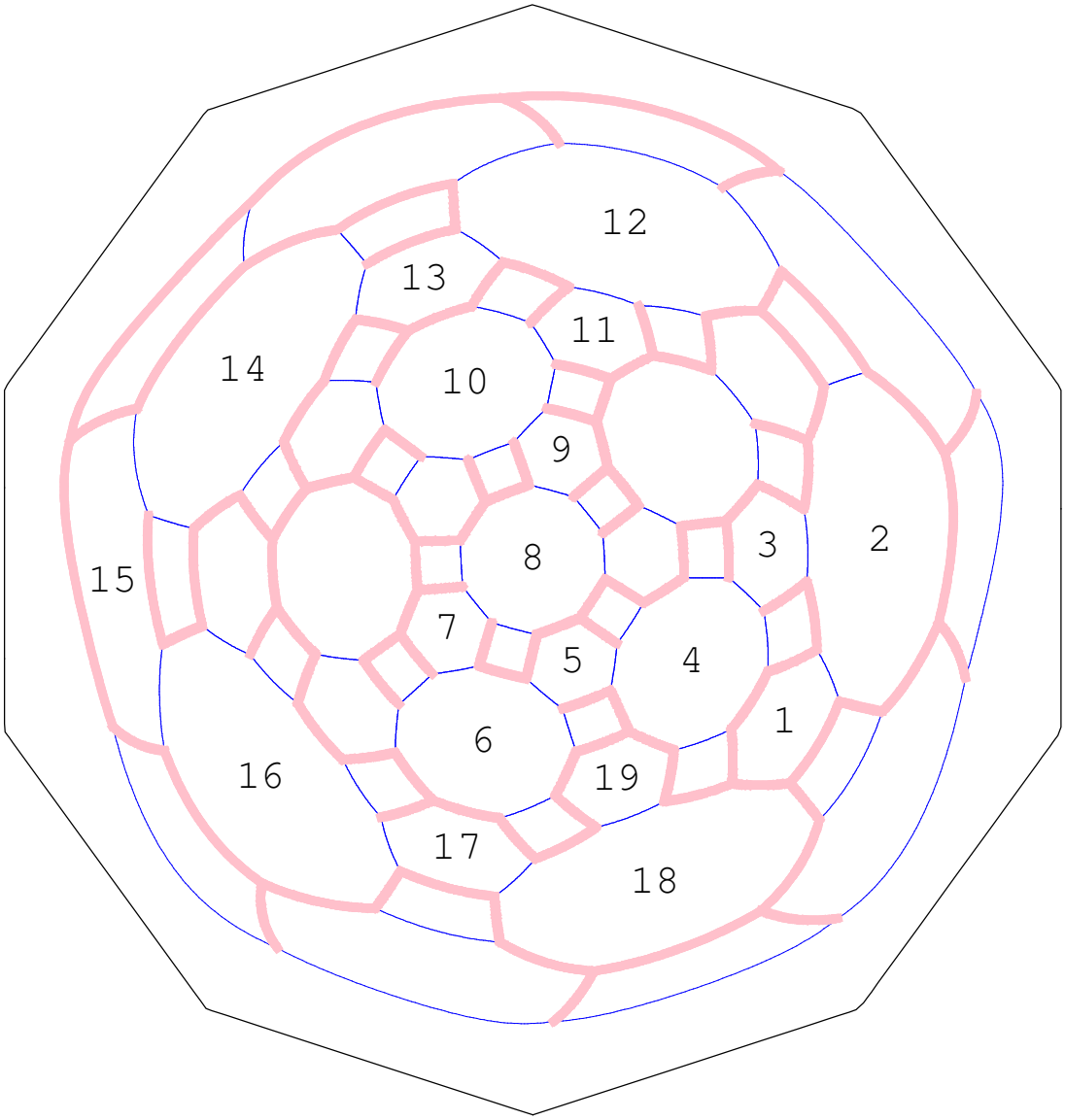


19.

`truncated icosidodecahedron` {4, 6, 10}

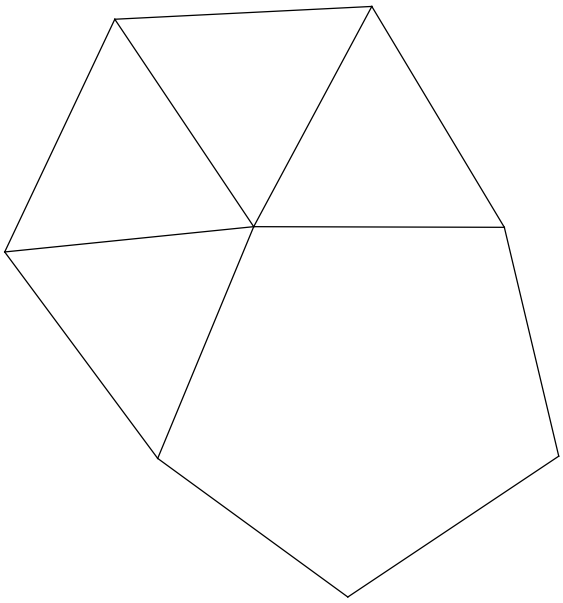


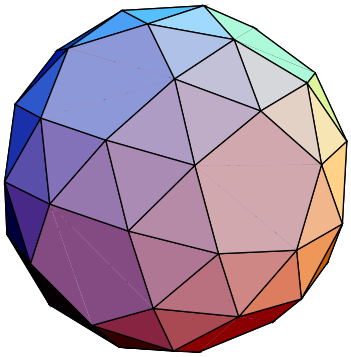


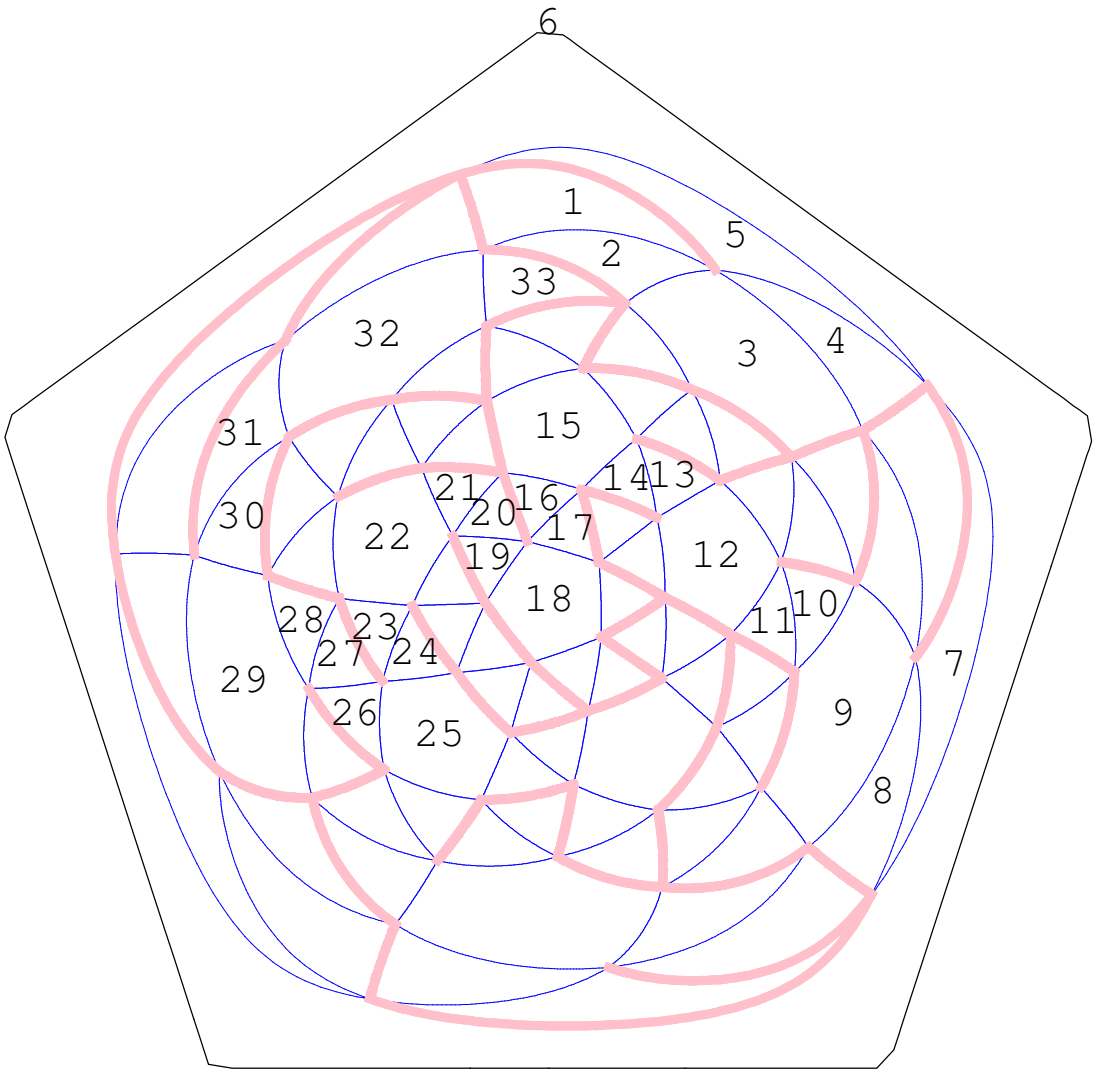


20.

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

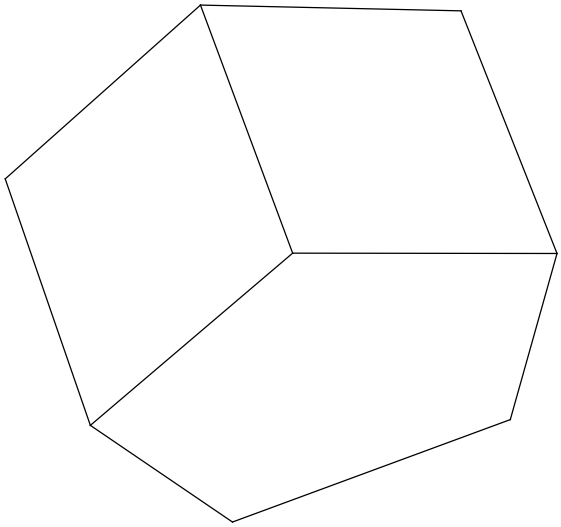


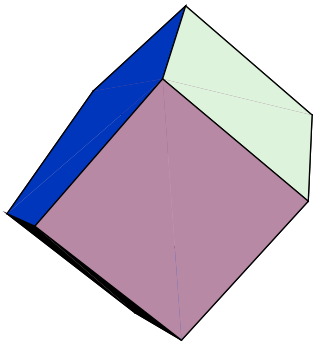


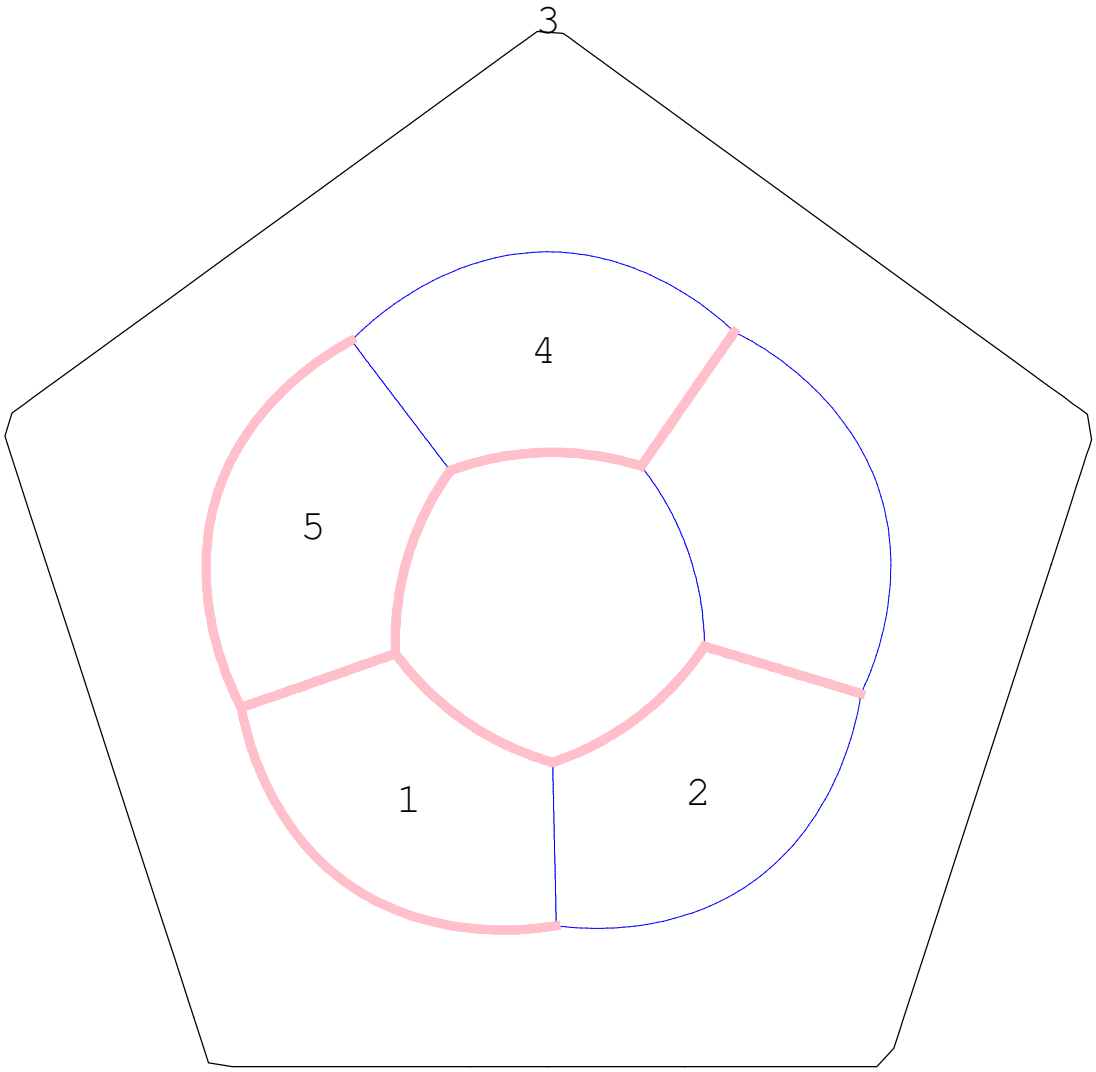


21.

`pentagonal prism` {4, 4, 5}

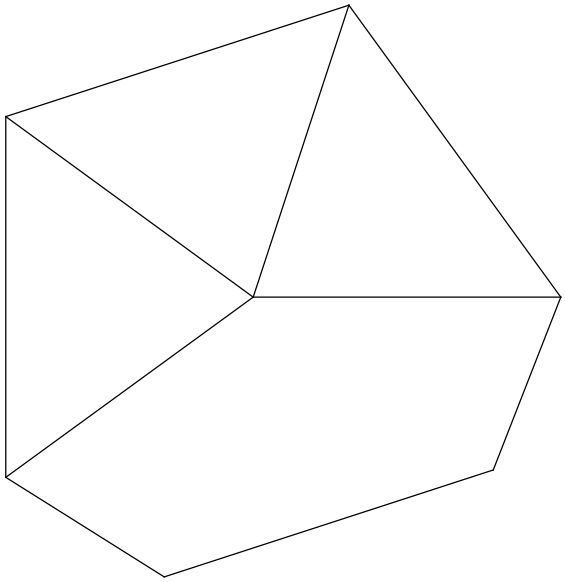


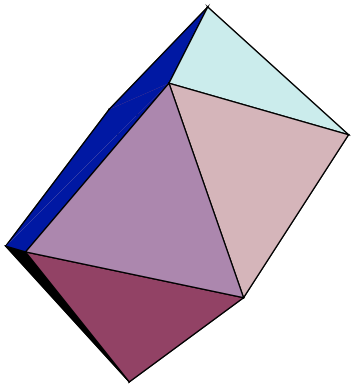


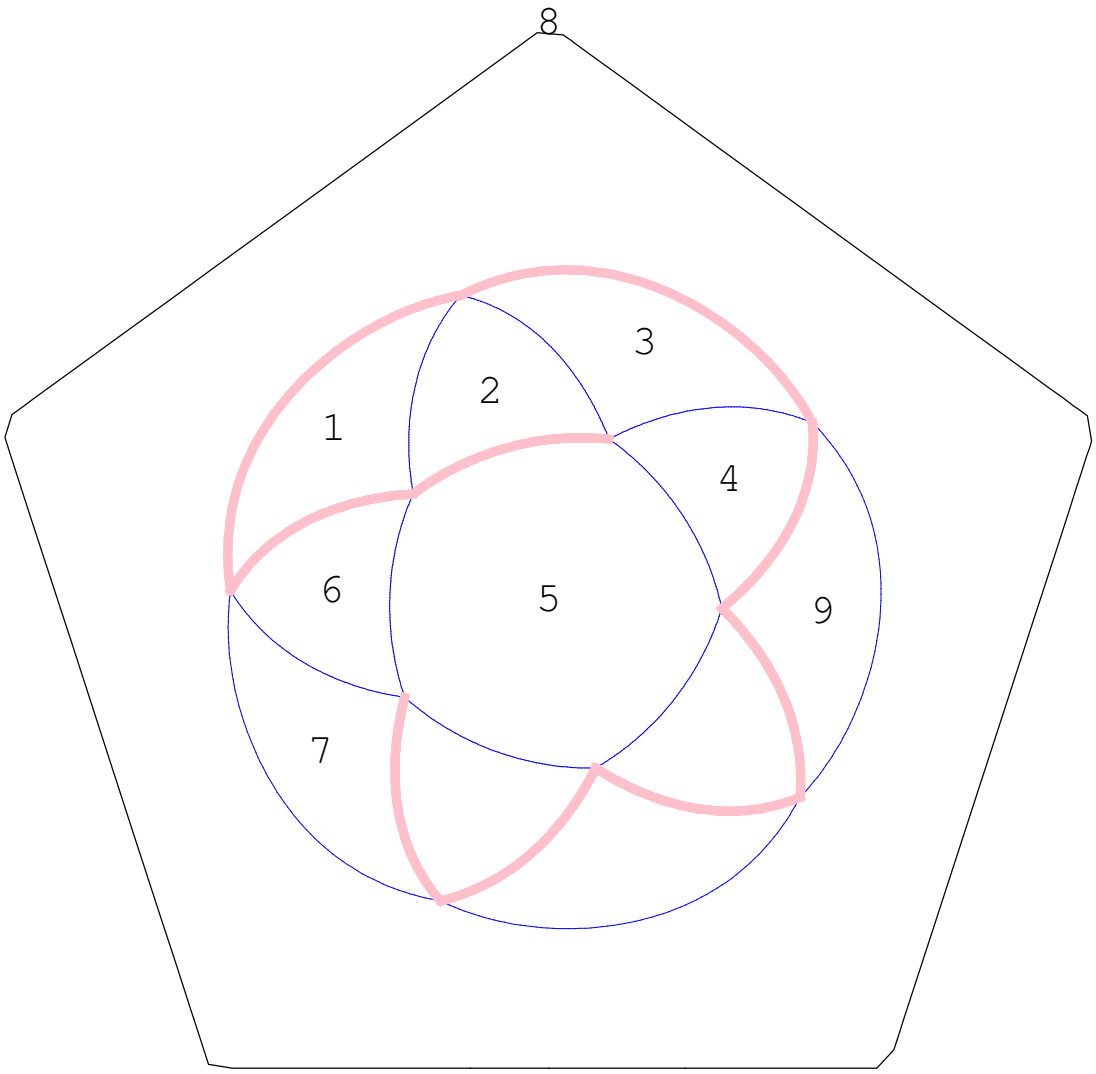


22.

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

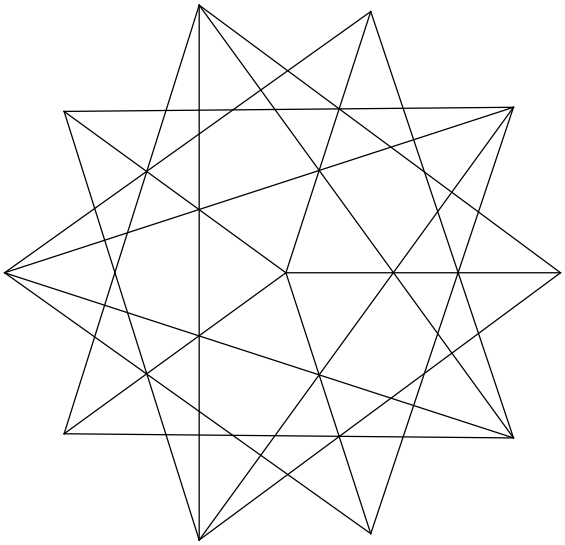


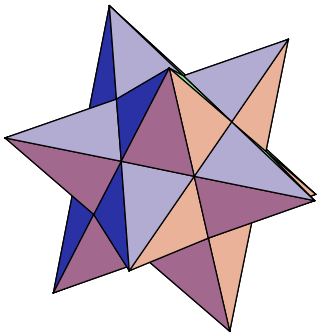


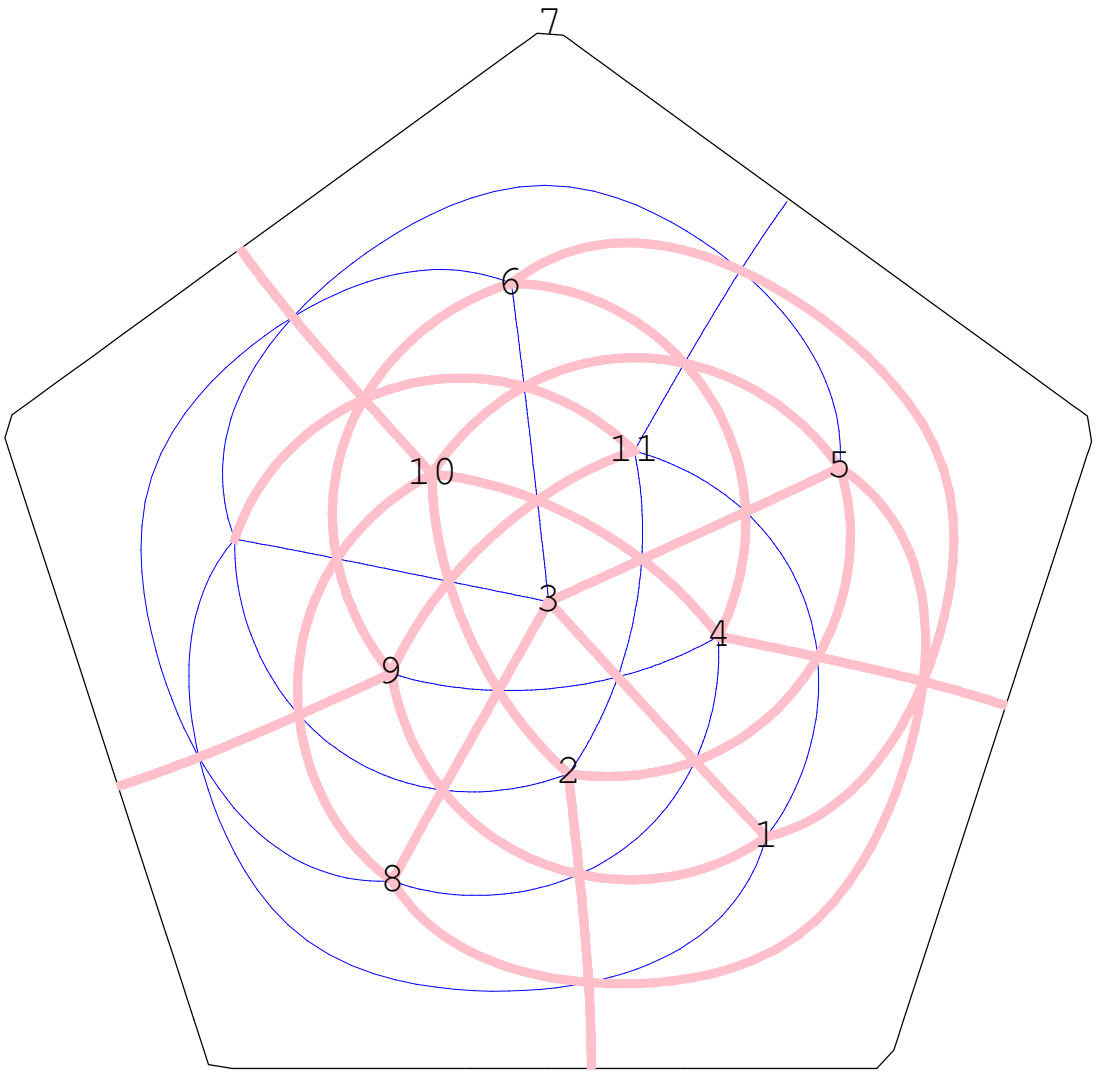


23.

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







24.

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