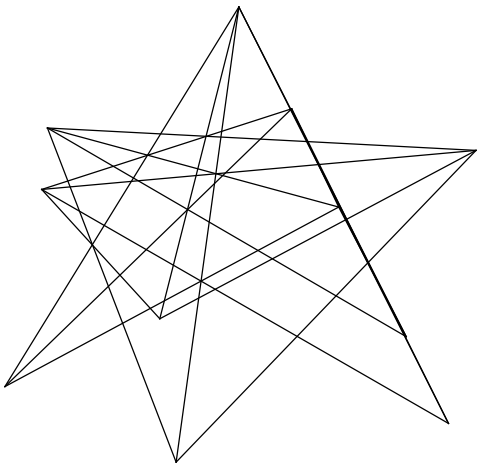
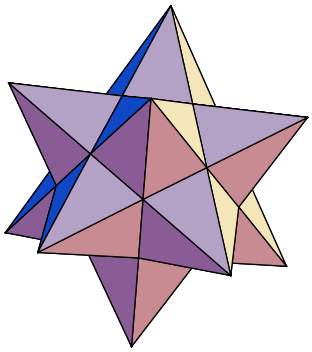
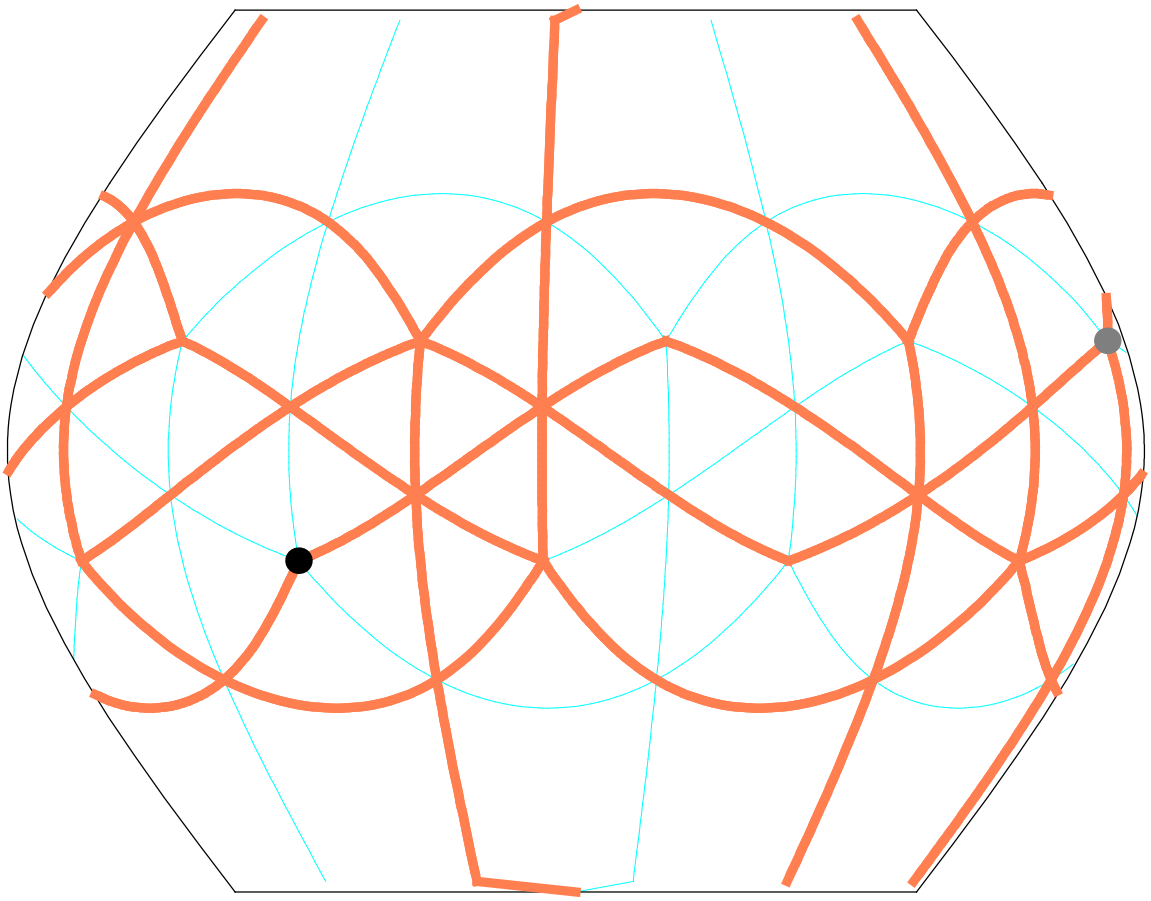
Izidor Hafner

Mazes on Uniform Polyhedra

Ginzburg projection







Introduction

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

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rhombicuboctahedron
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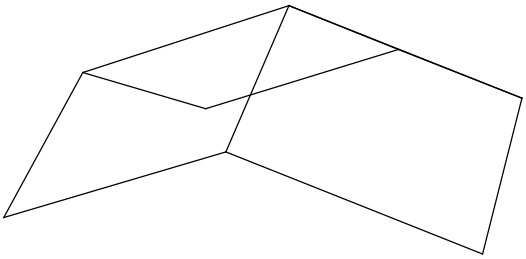
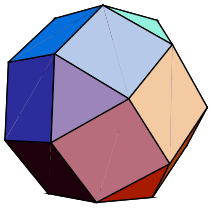
{4, 3, 4, 4}

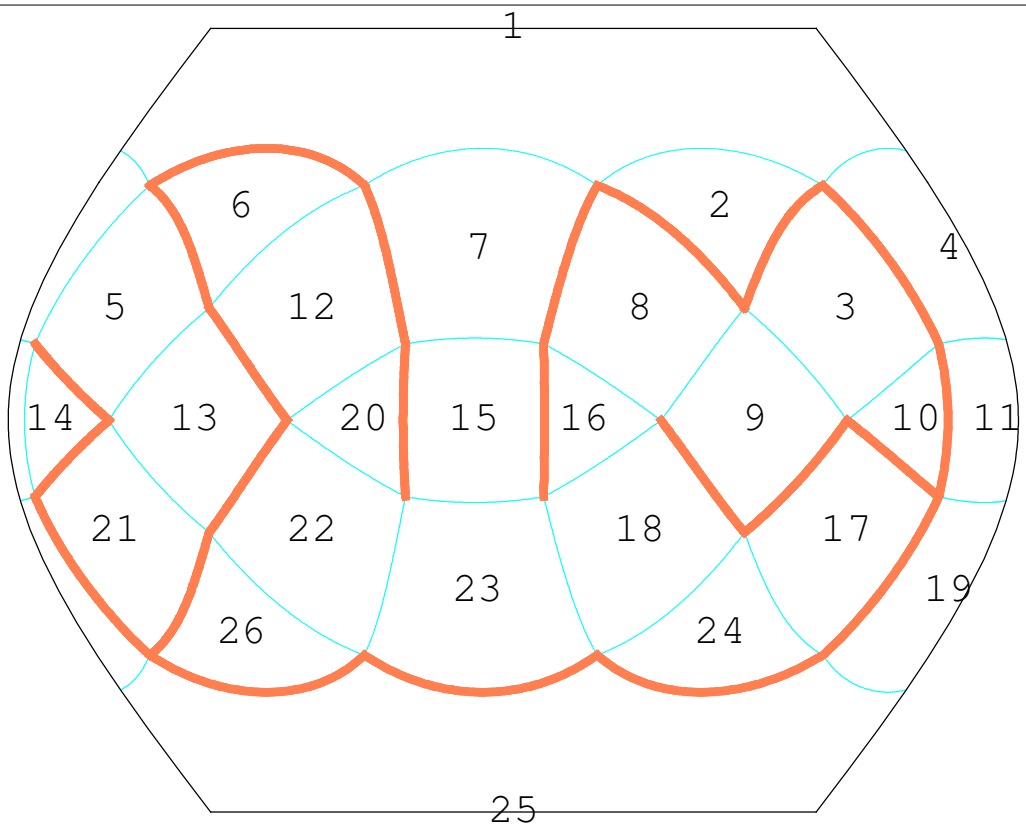


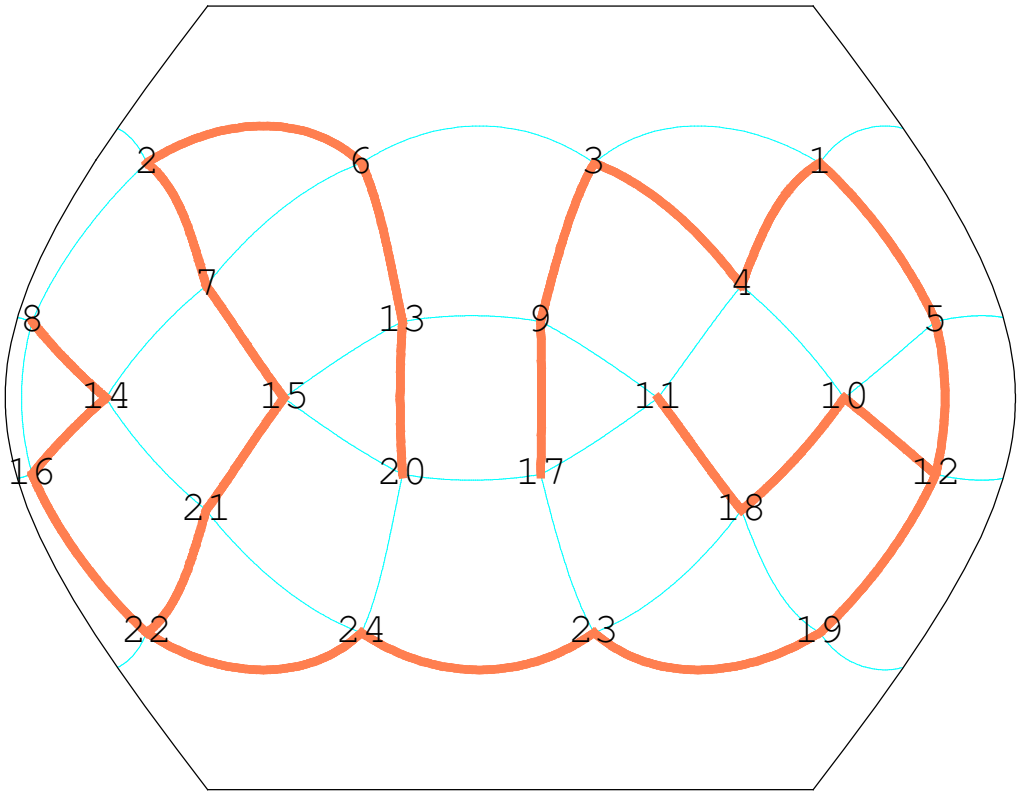


In Mathematica the polyhedron is given by a list of faces and with a list of koordinates of vertices [Roman E. Maeder, The Mathematica Programmer II, Academic Press1996]. The list of faces consists of a list of lists, where a face is represented by a list of vertices, which is given by a matrix. Let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

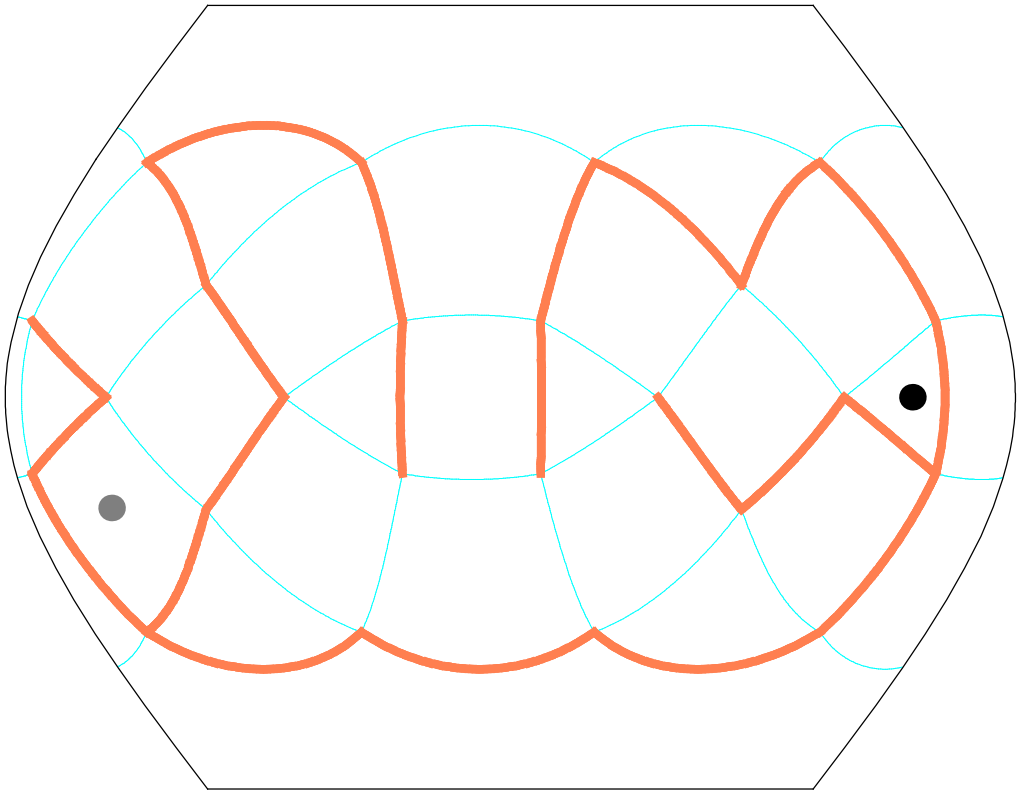
```
{{1, 2, 6, 3},
 {1, 3, 4},
 {1, 4, 10, 5},
 {1, 5, 8, 2},
 {2, 8, 14, 7}}
```

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

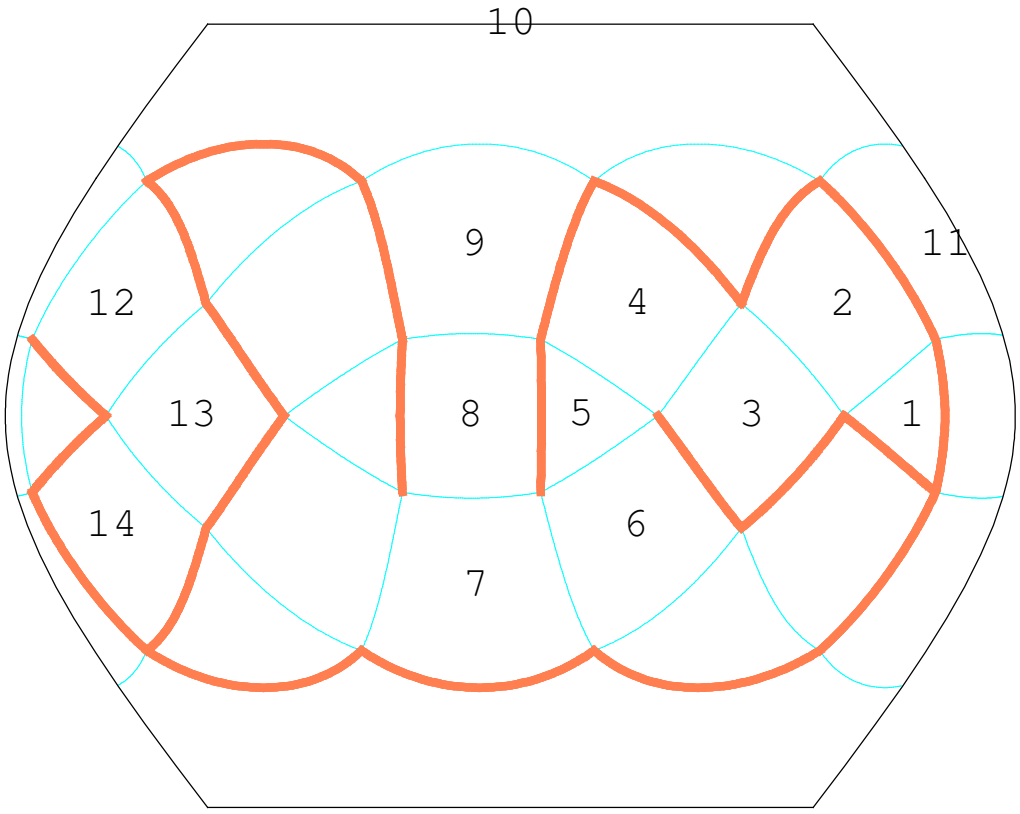




The problem is to find the path from the black dot to gray dot, where thick lines represent walls of a maze.



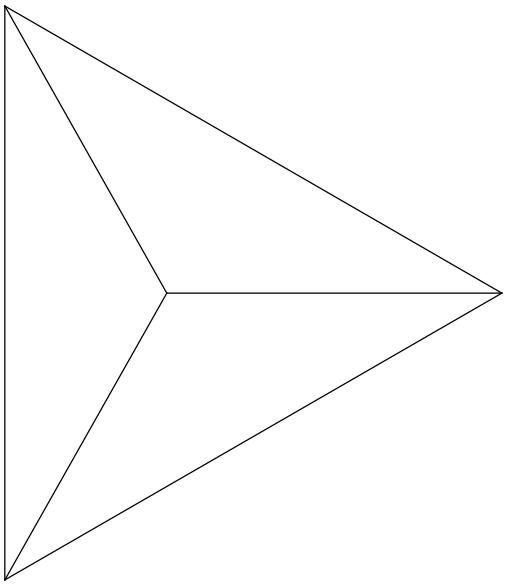
The solution is given by a list of faces passed from the black to gray dot.

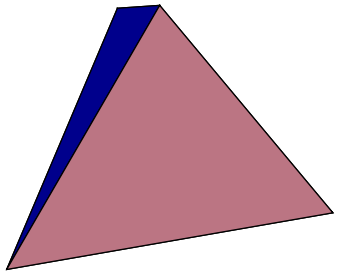


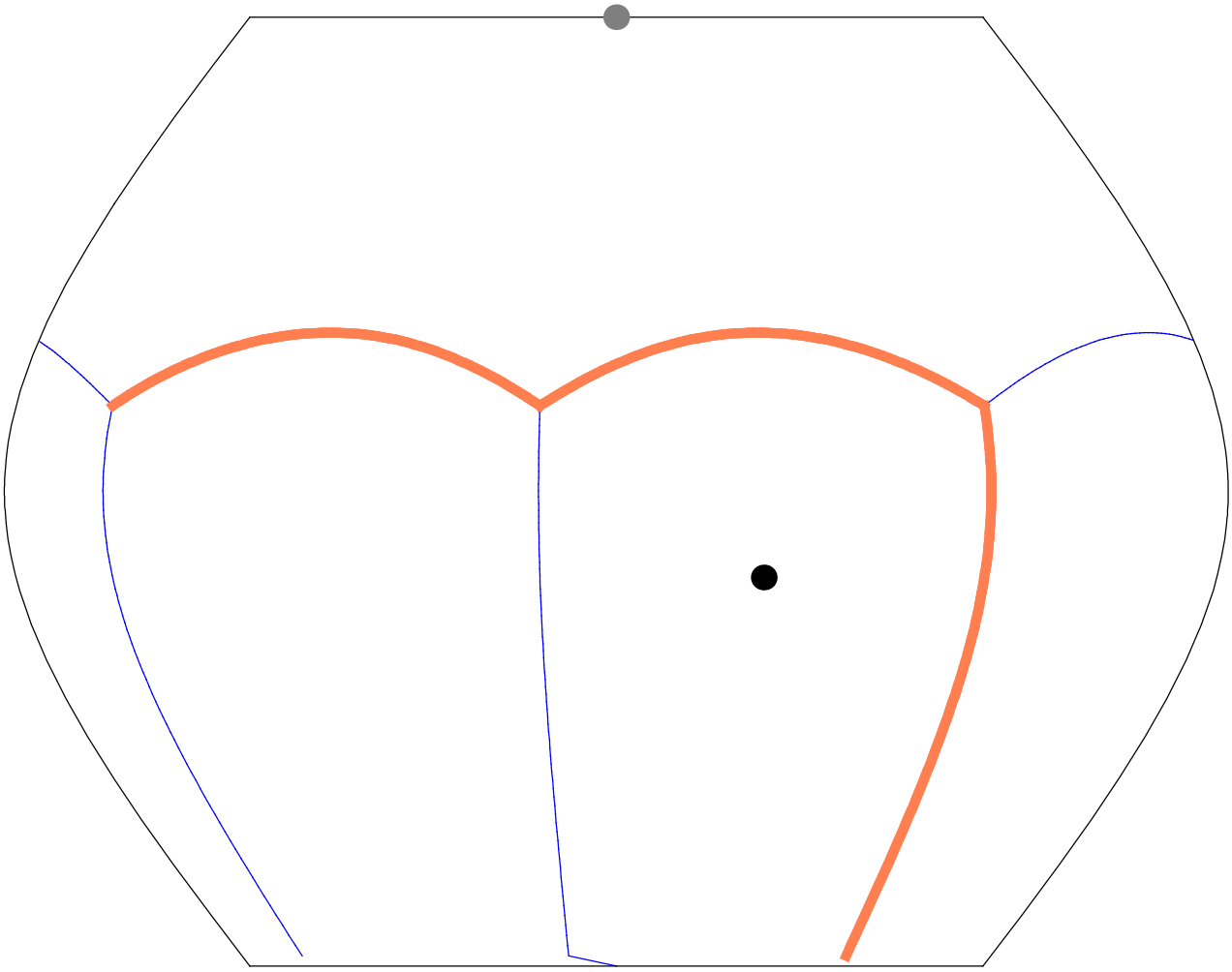
Problems

1.

`tetrahedron` {3, 3, 3}

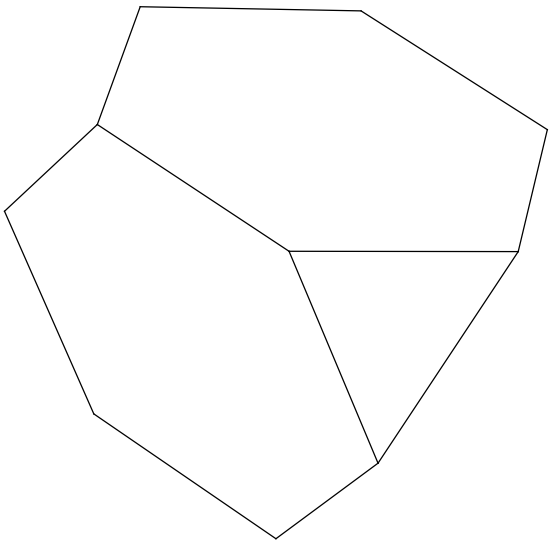


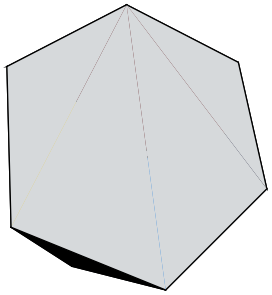


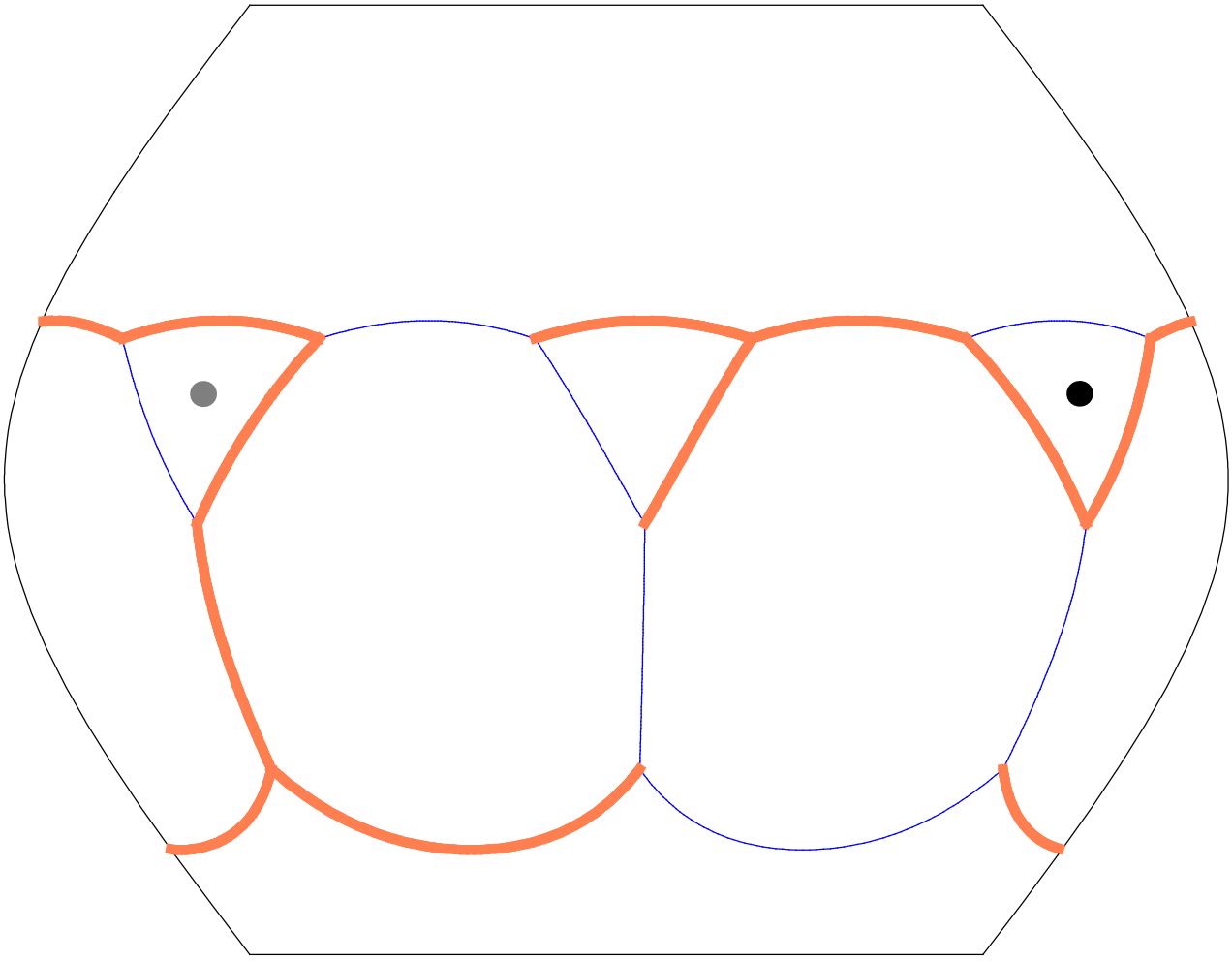


2.

`truncated tetrahedron` {6, 6, 3}

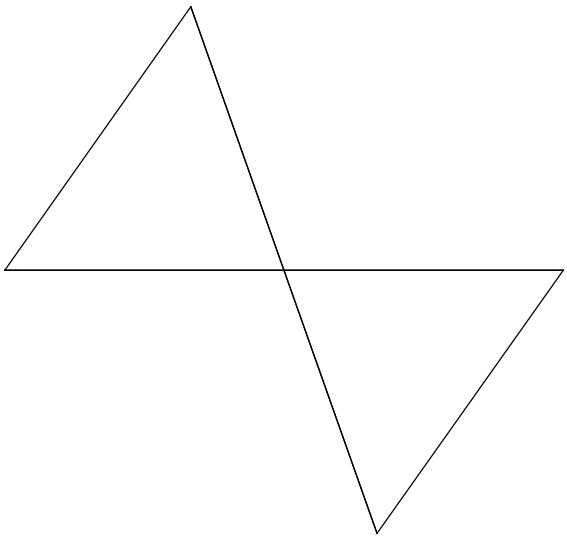


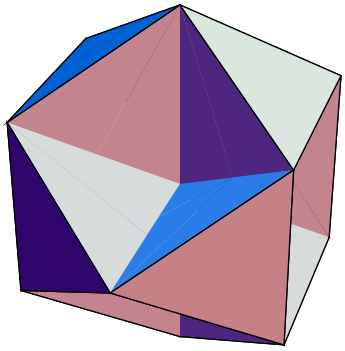


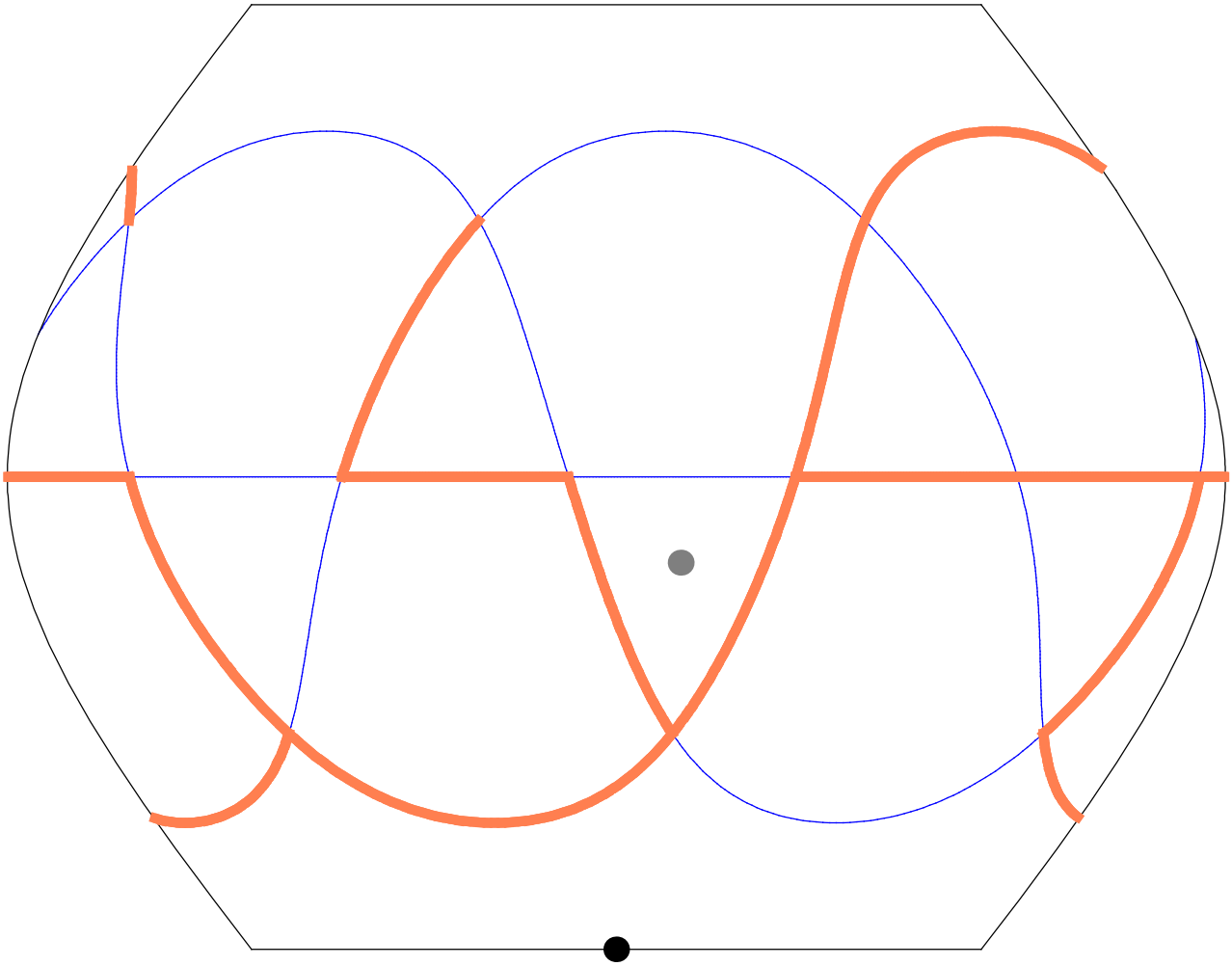


3.

`octahemioctahedron` $\{6, \frac{3}{2}, 6, 3\}$

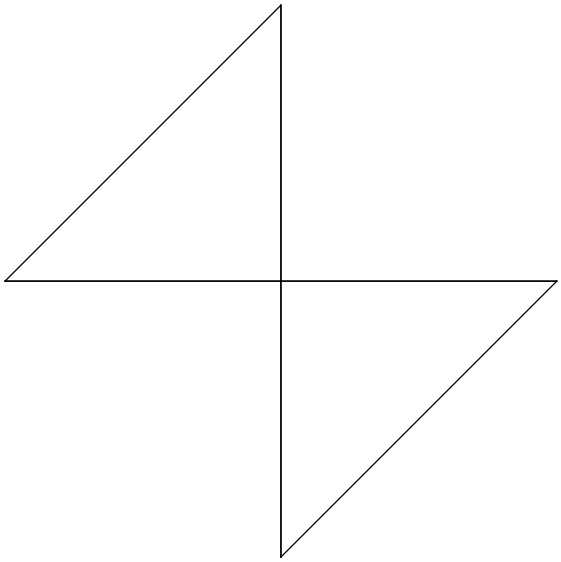


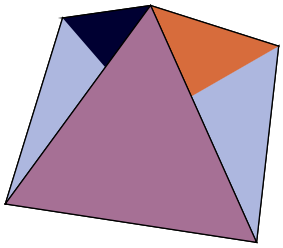


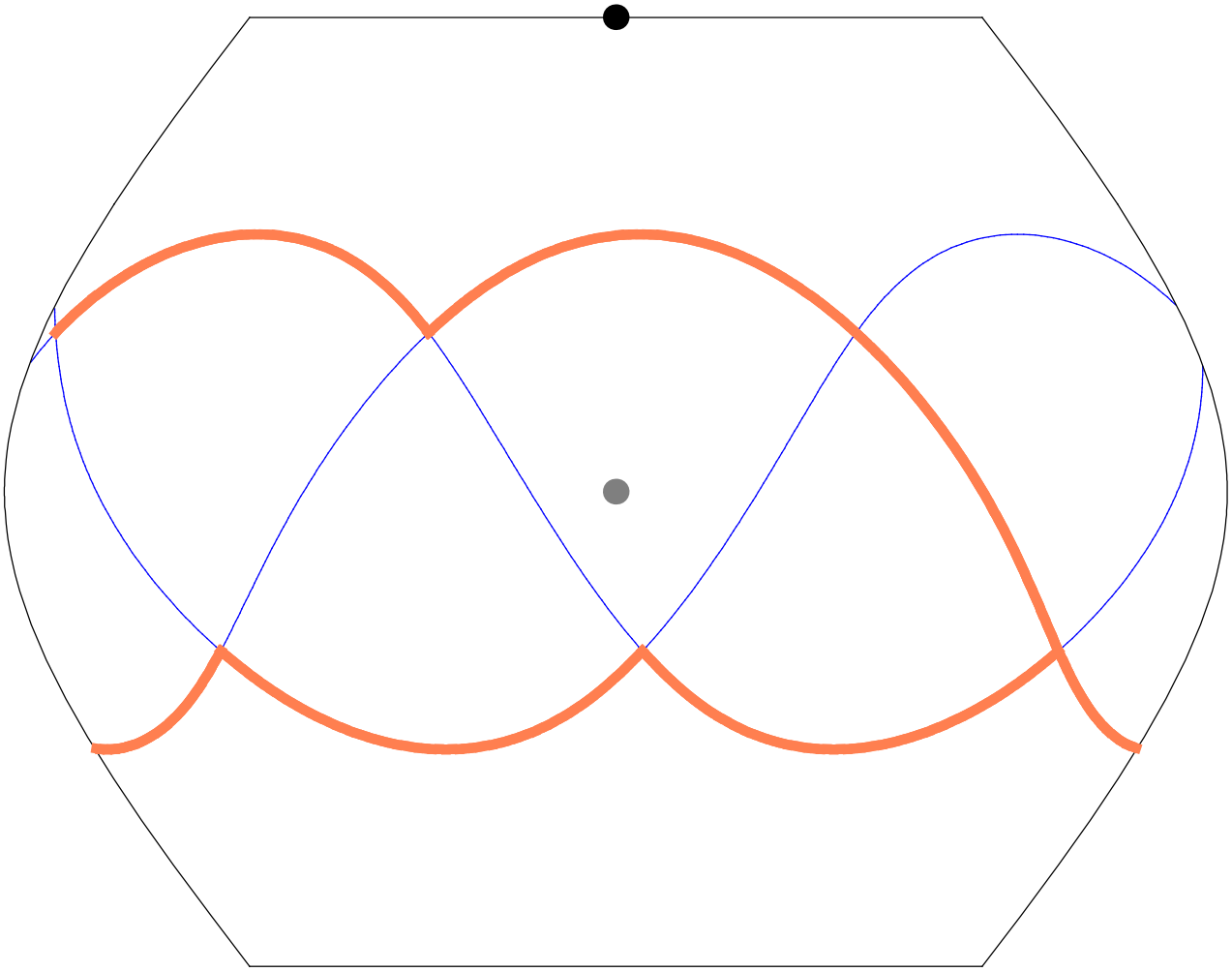


4.

`tetrahemihexahedron` $\{4, \frac{3}{2}, 4, 3\}$

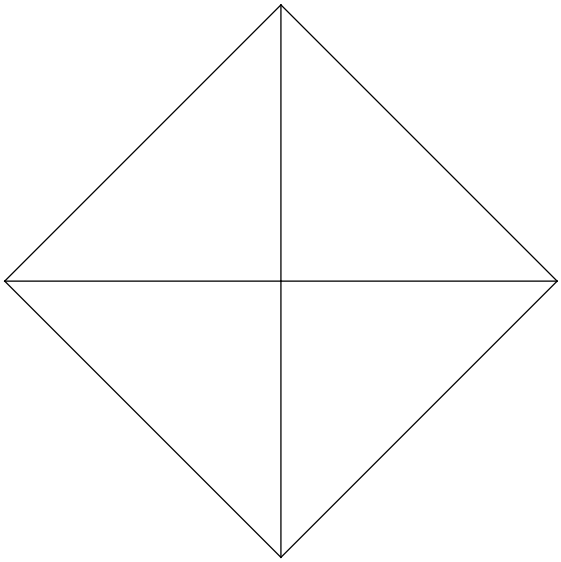


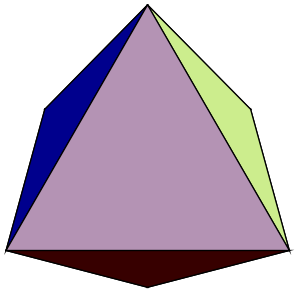


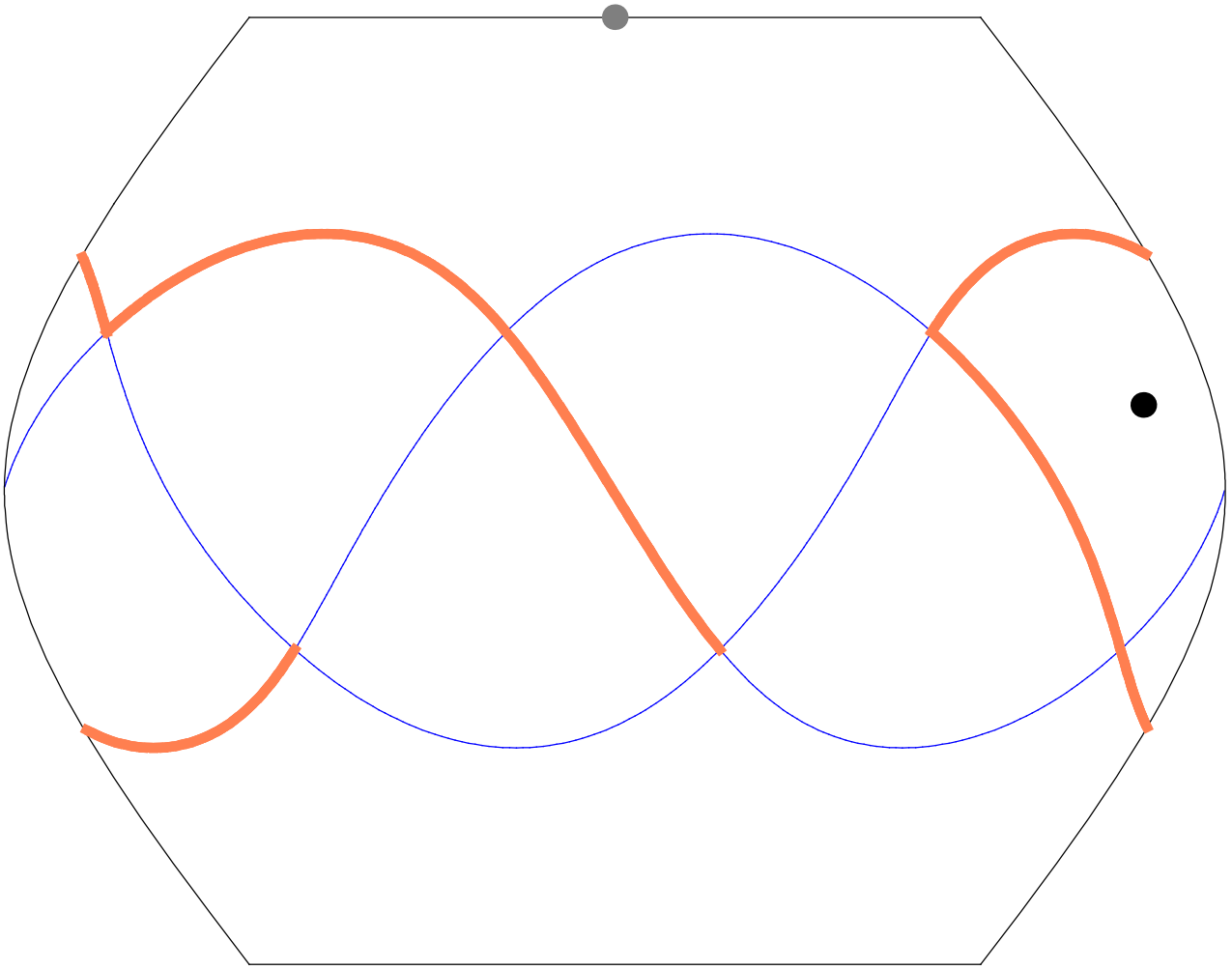


5.

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

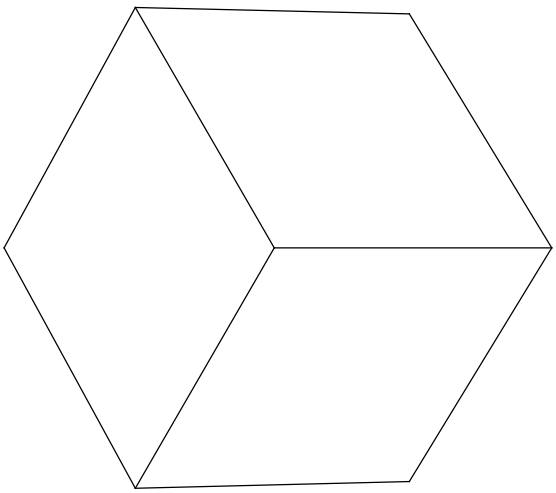


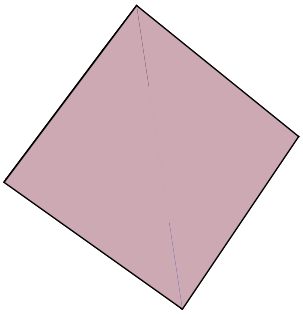


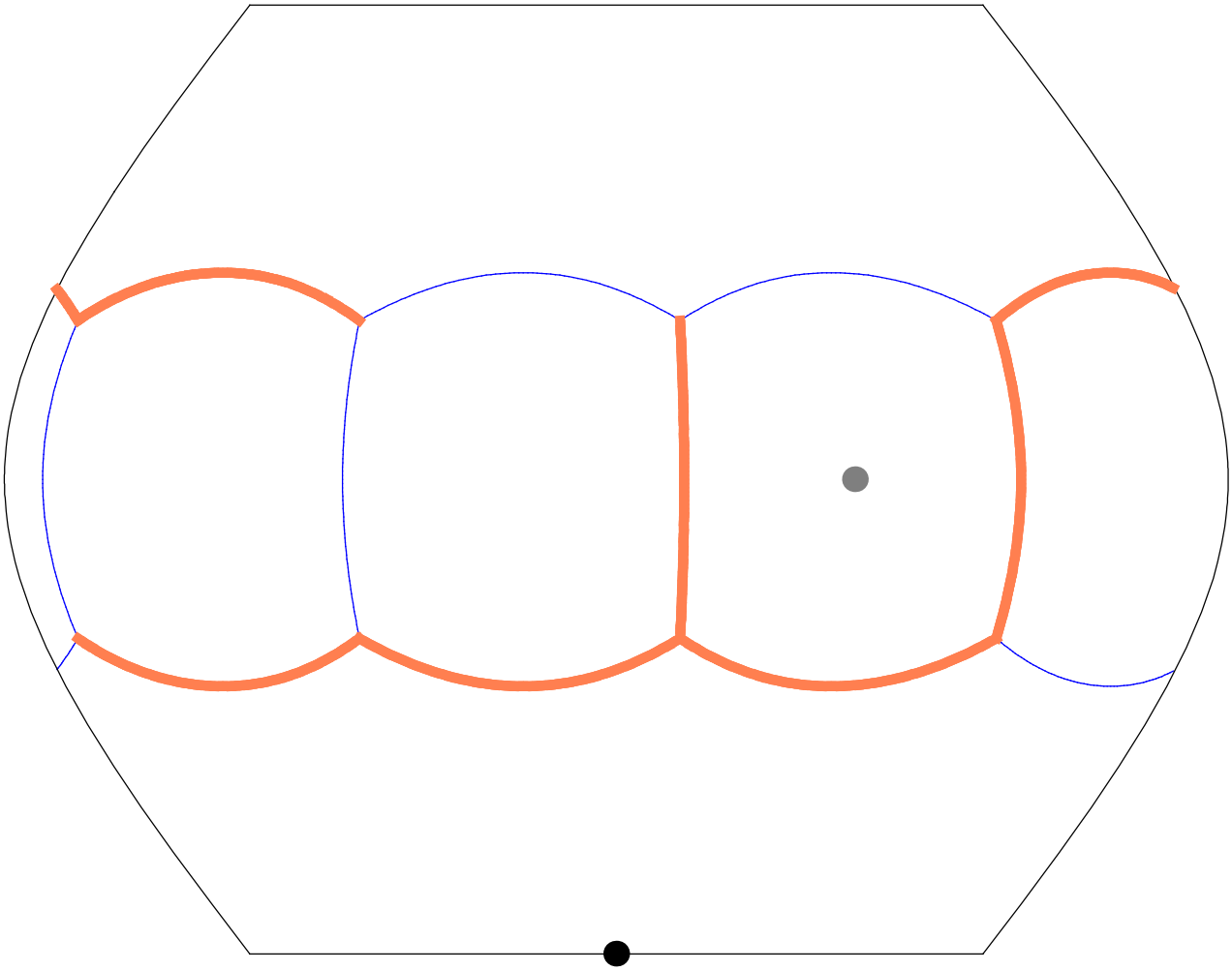


6.

`cube` {4, 4, 4}

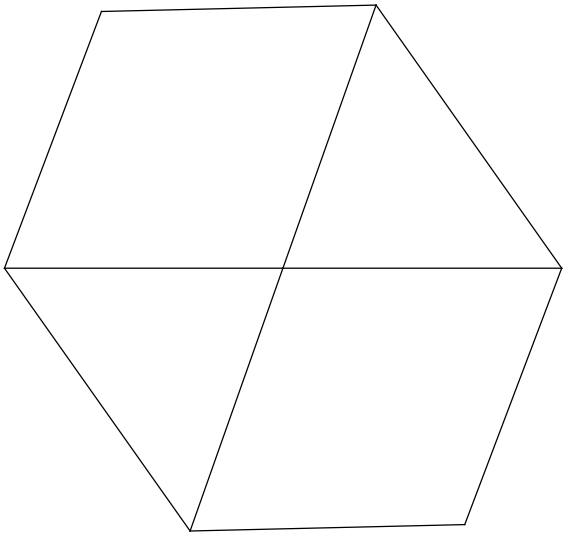


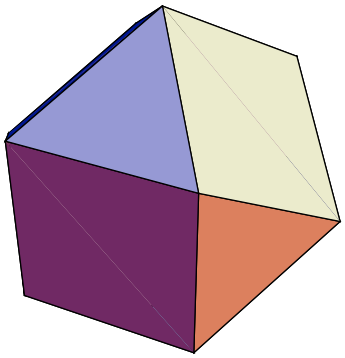


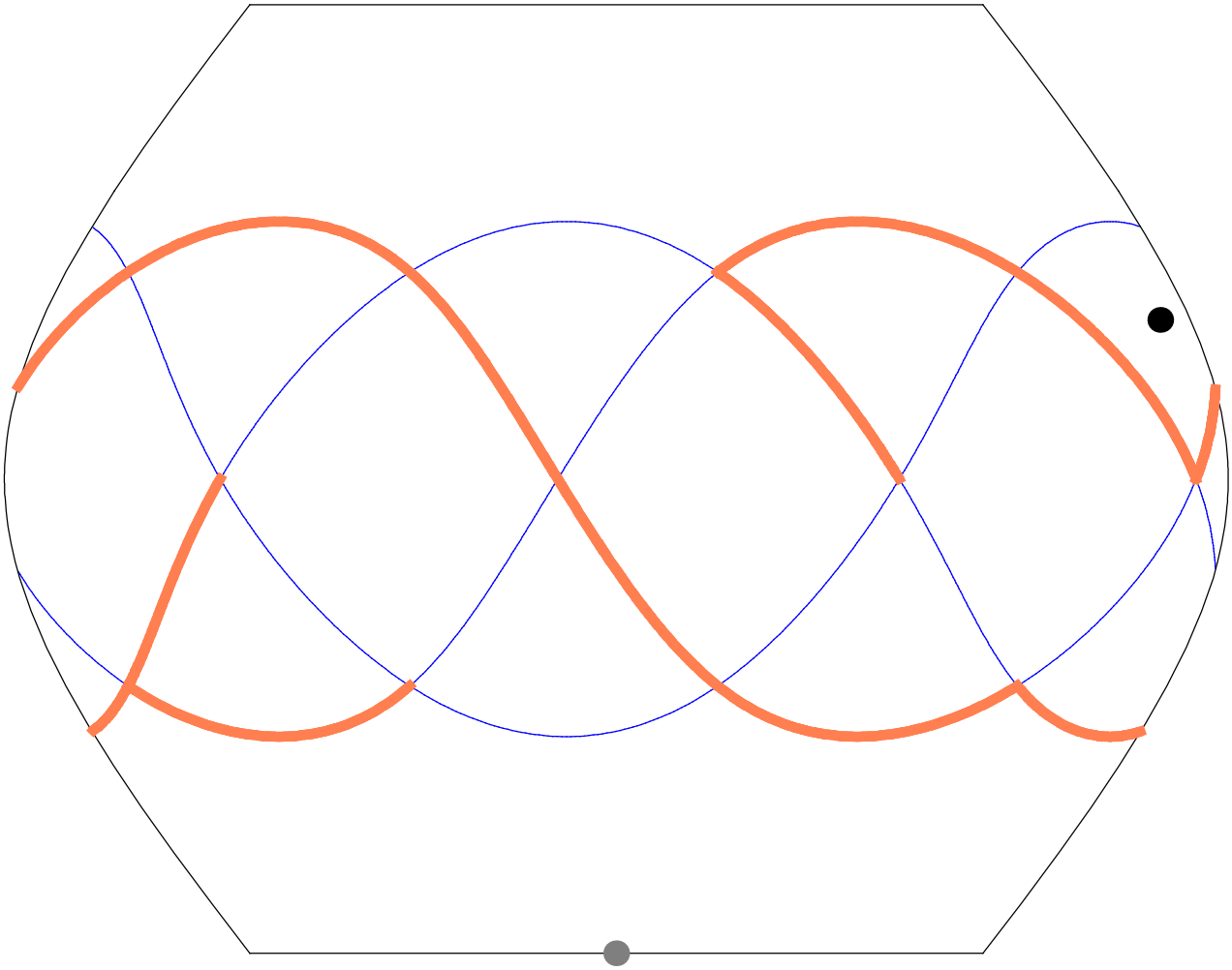


7.

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

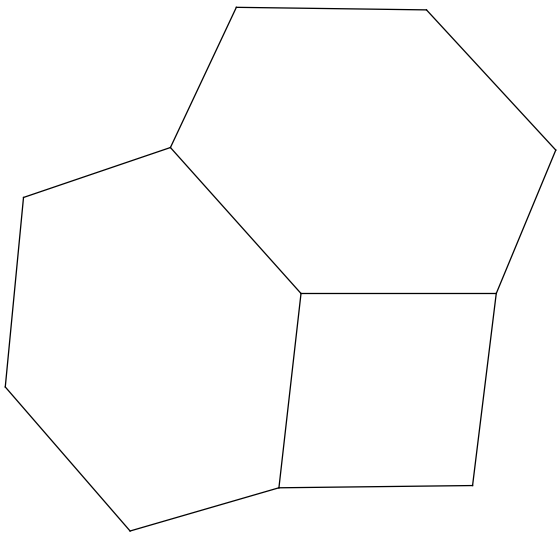


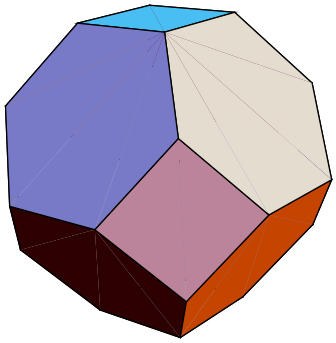


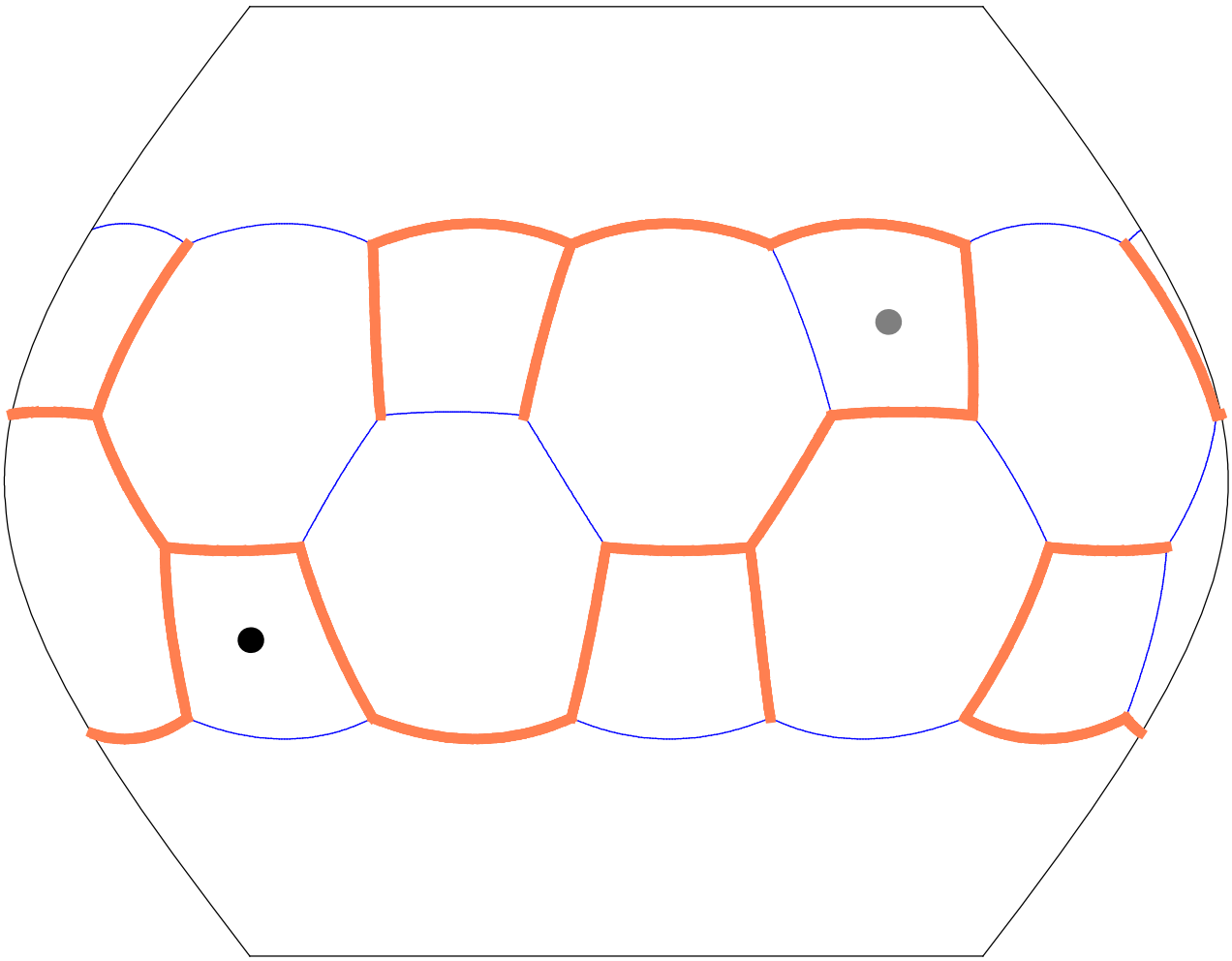


8.

`truncated octahedron` {6, 6, 4}

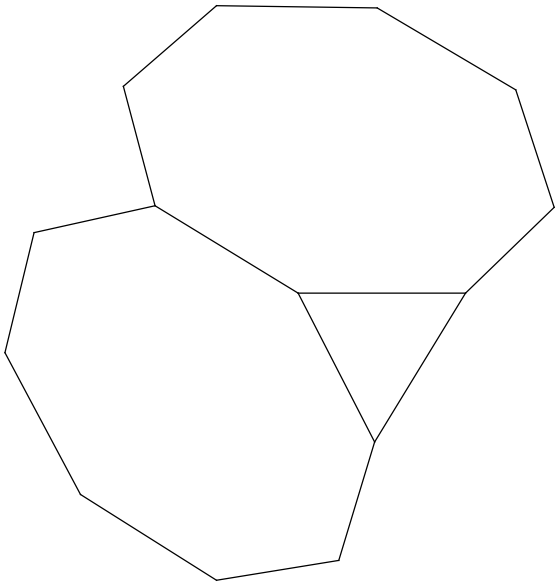


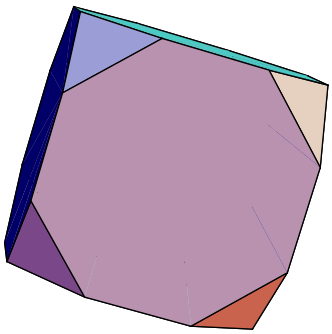


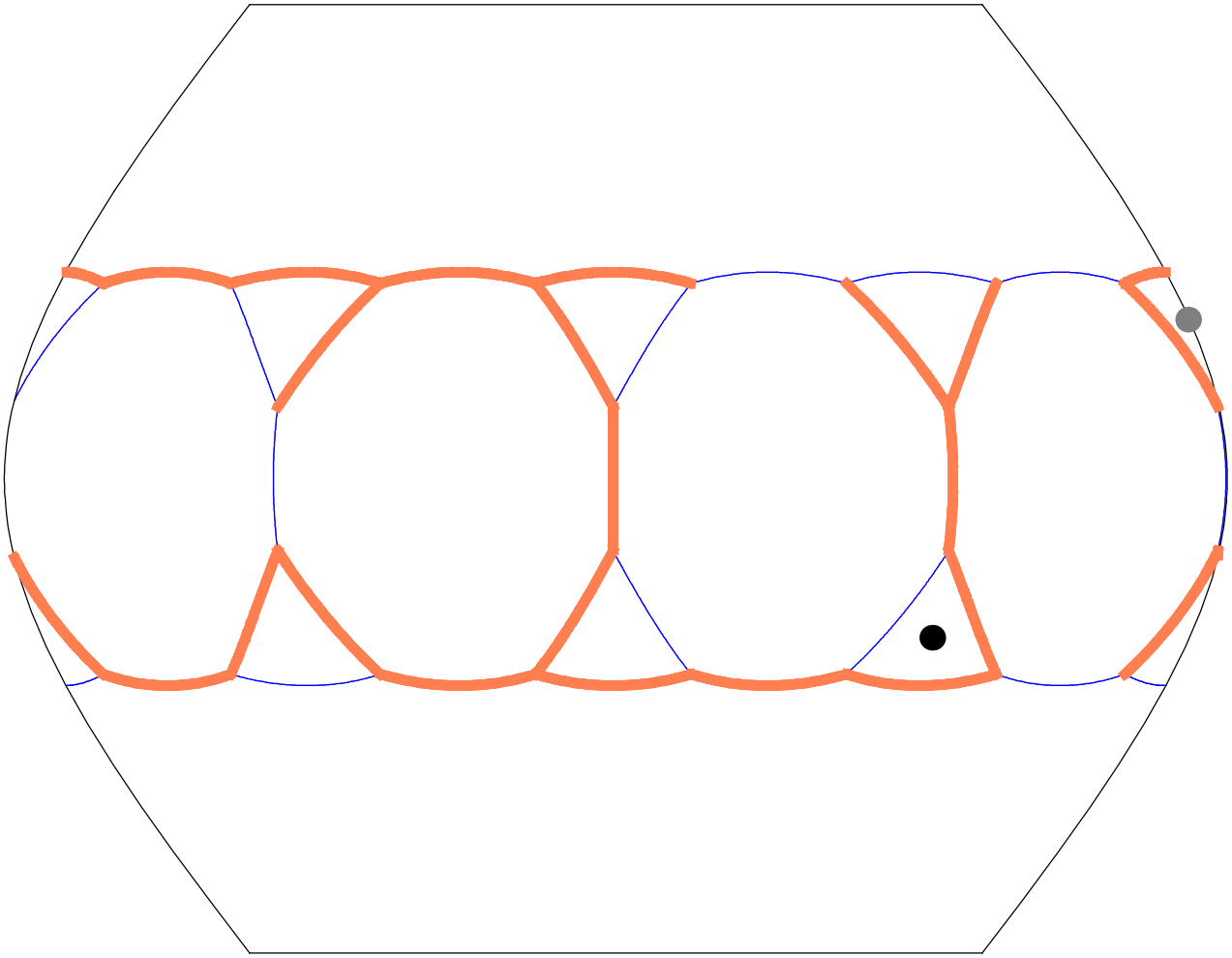


9.

`truncated cube` {8, 8, 3}

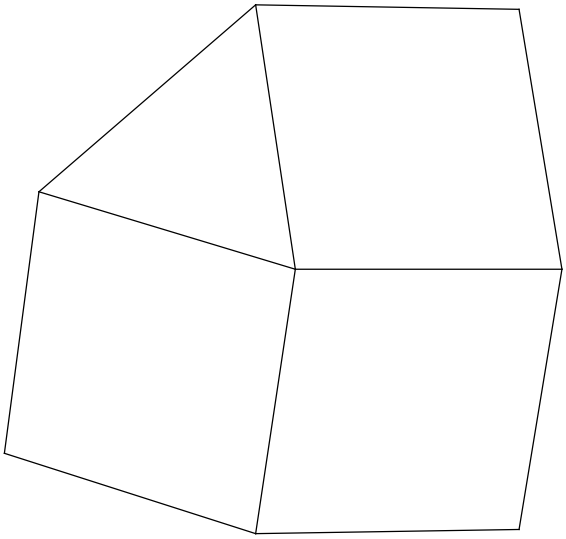


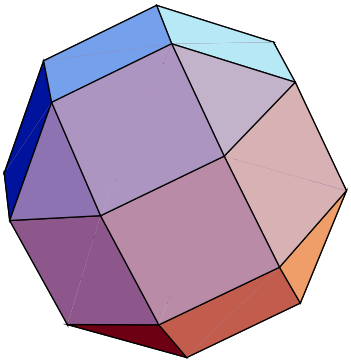


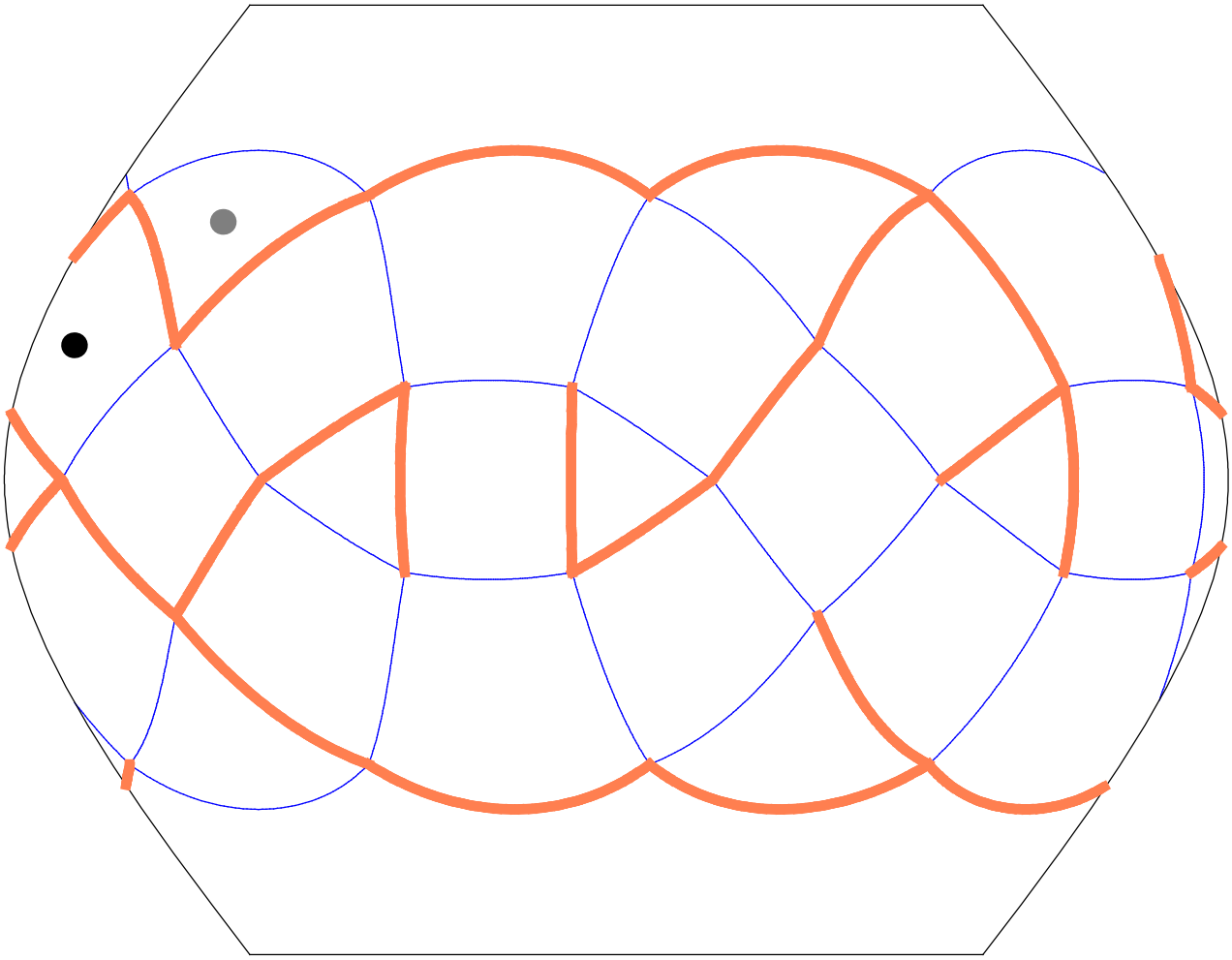


10.

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

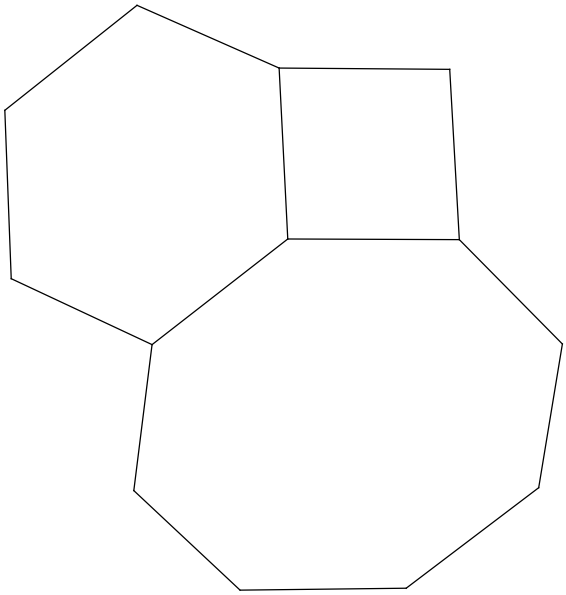


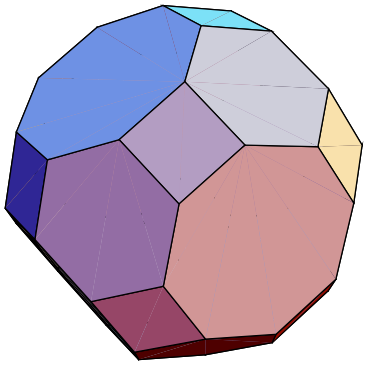


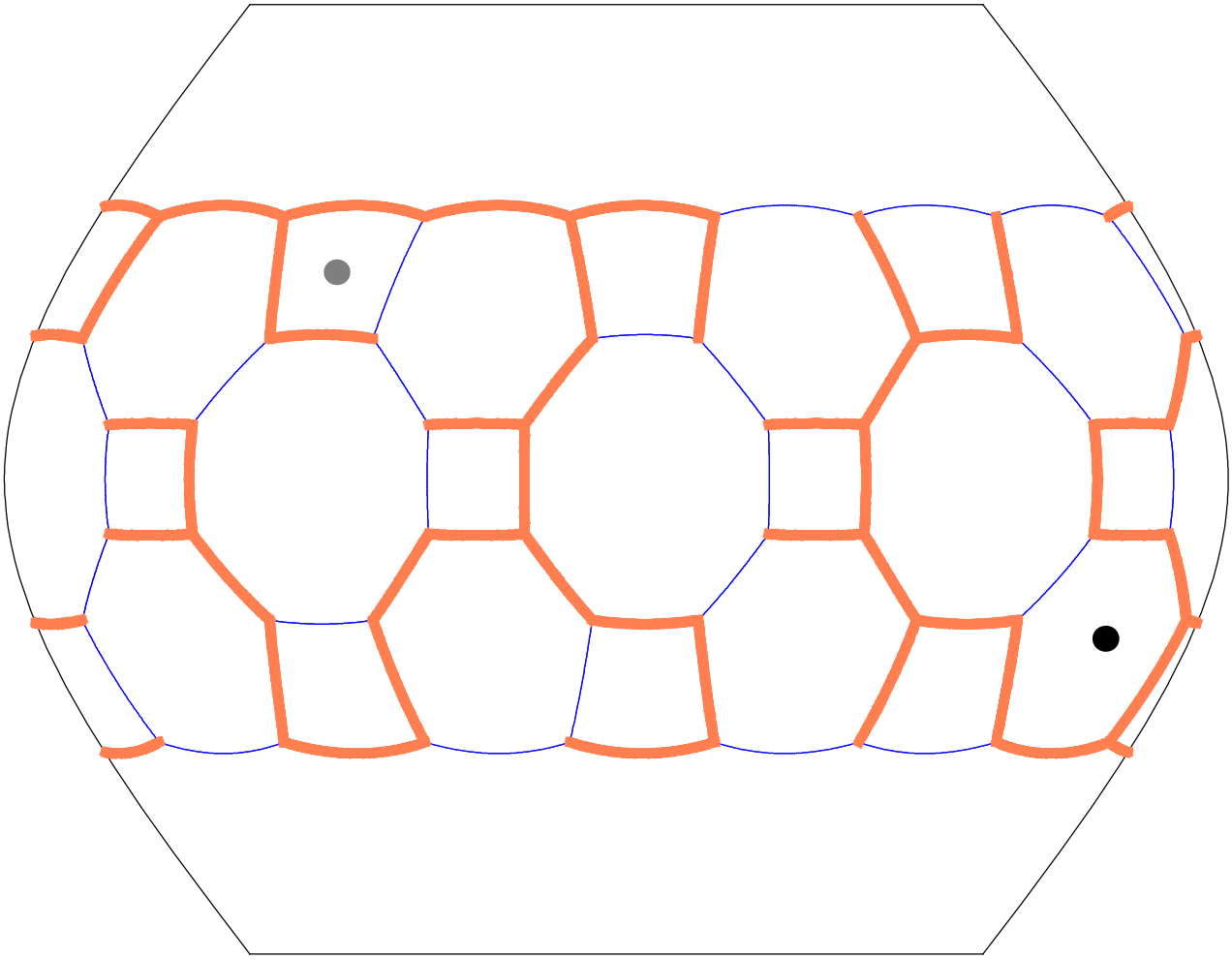


11.

`truncated cuboctahedron` {4, 6, 8}

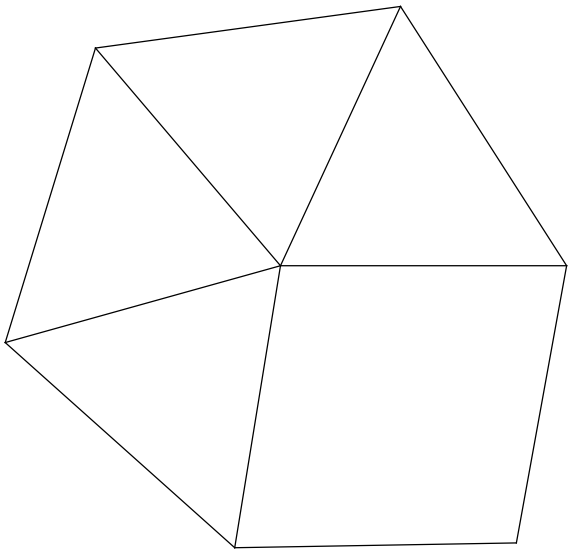


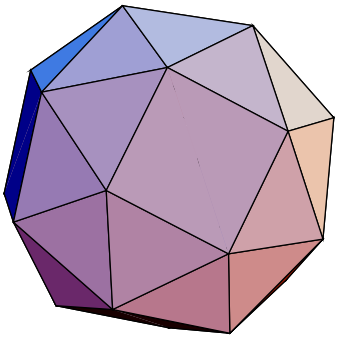


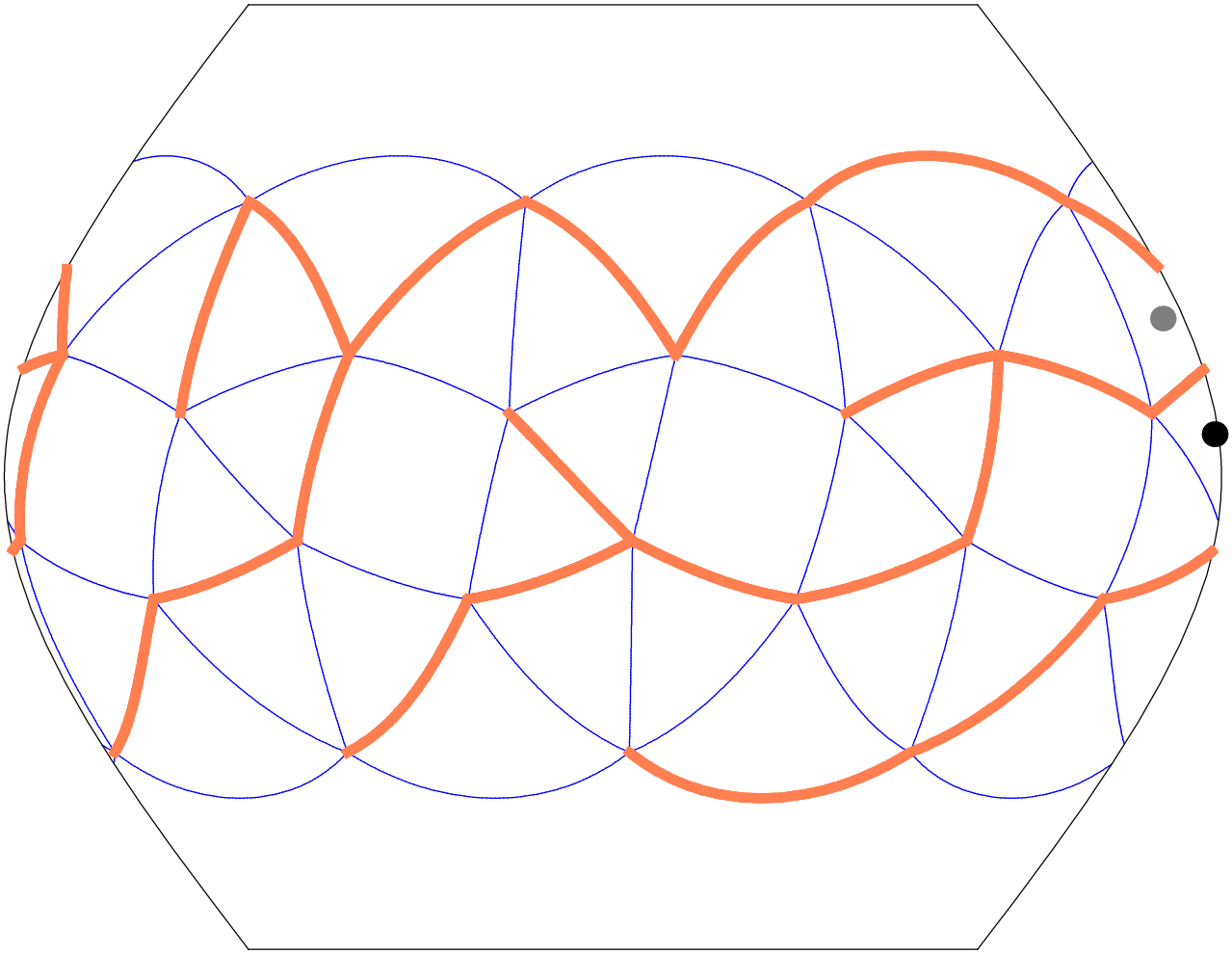


12.

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

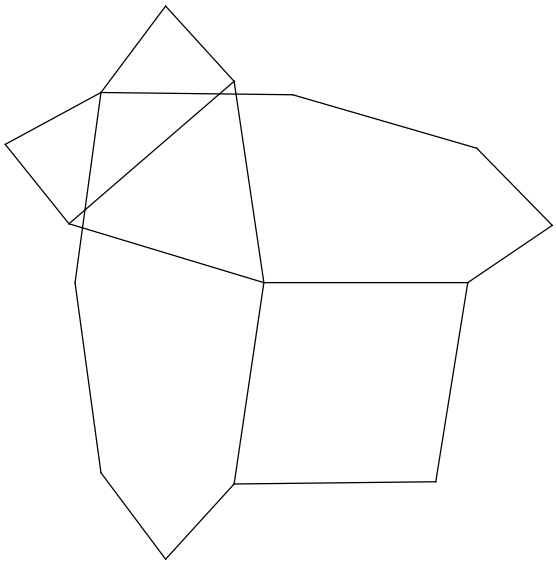


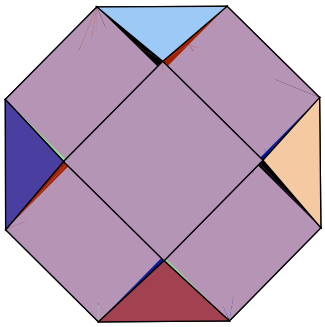


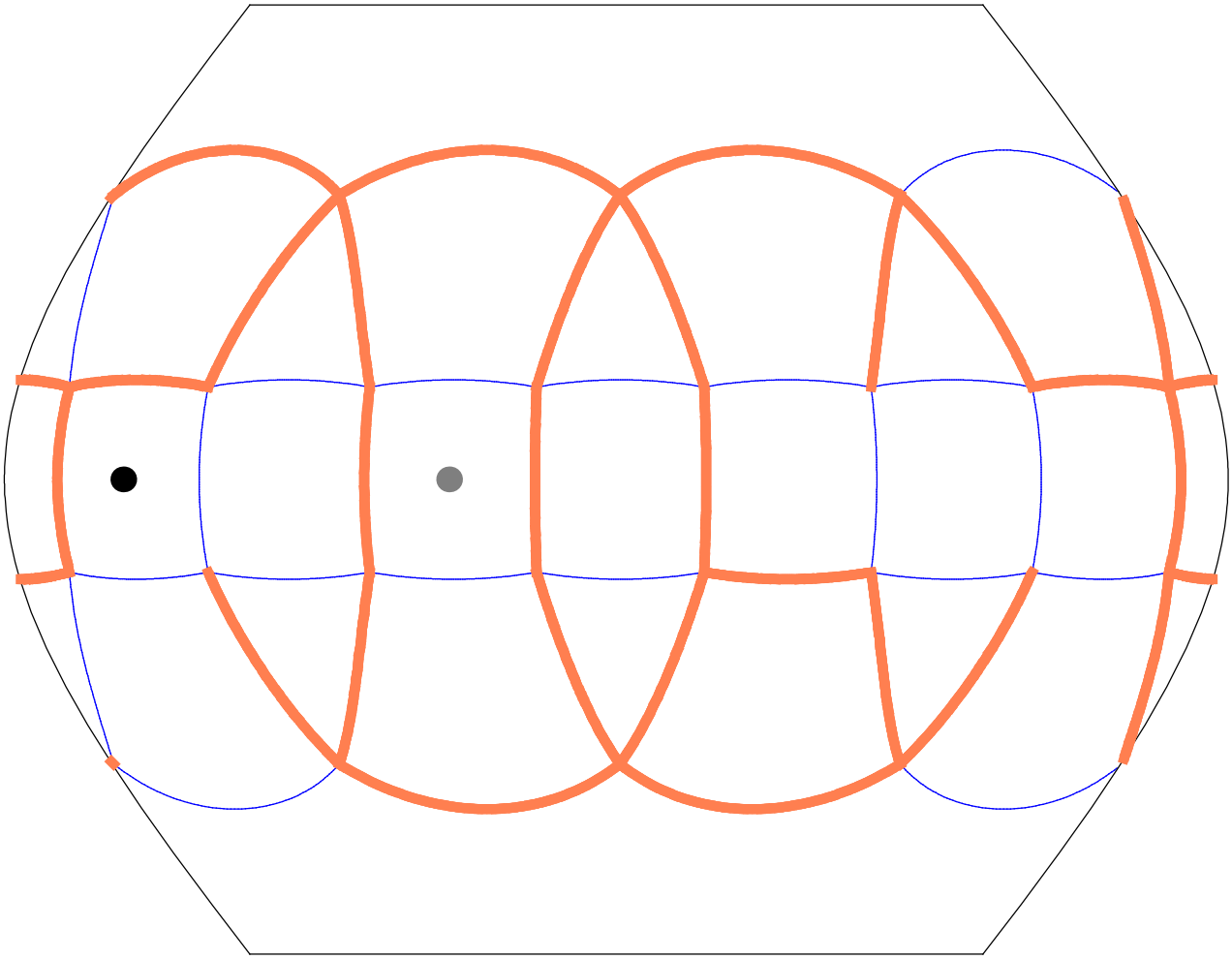


13.

`small cubicuboctahedron` $\left\{8, \frac{3}{2}, 8, 4\right\}$

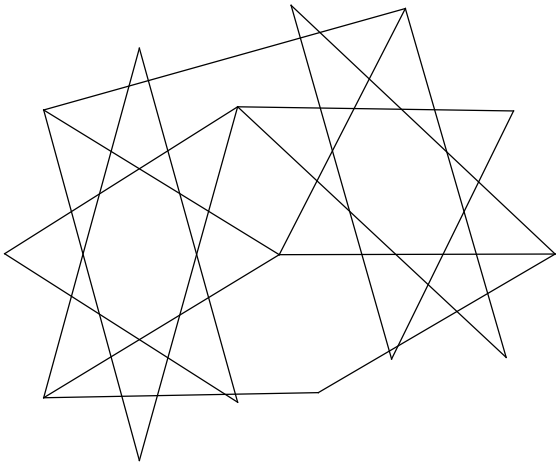


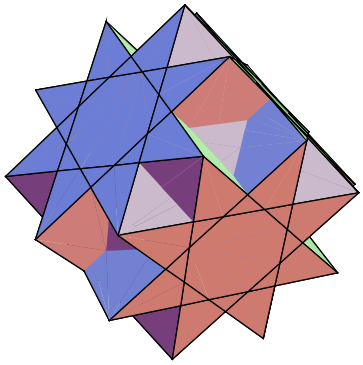


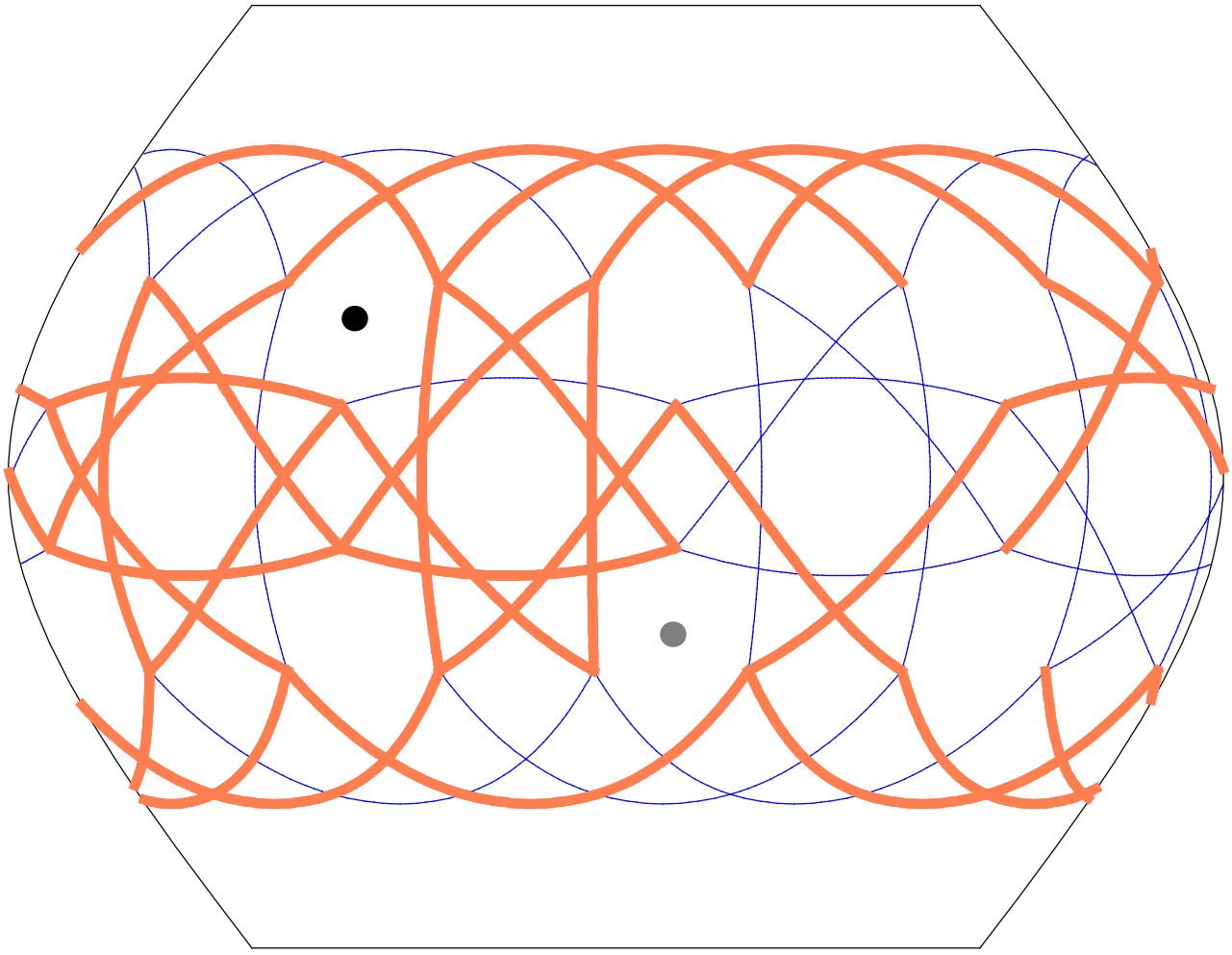


14.

great cubicuboctahedron $\{\frac{8}{3}, 3, \frac{8}{3}, 4\}$

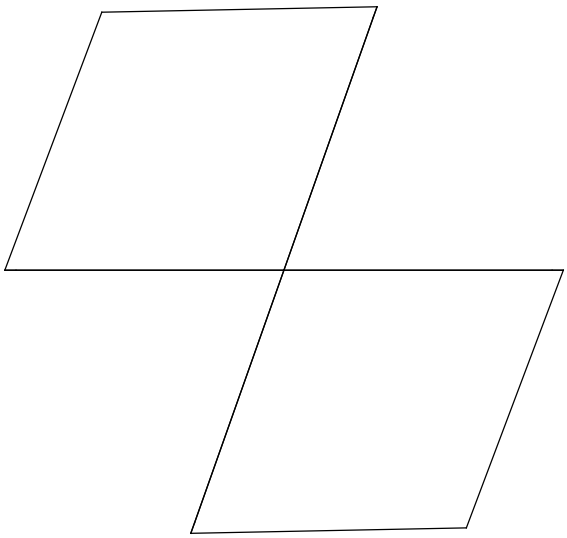


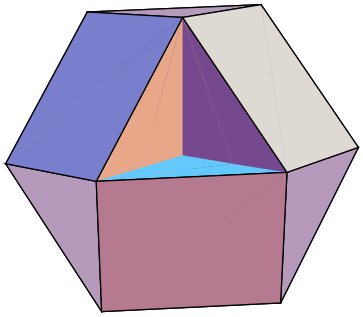


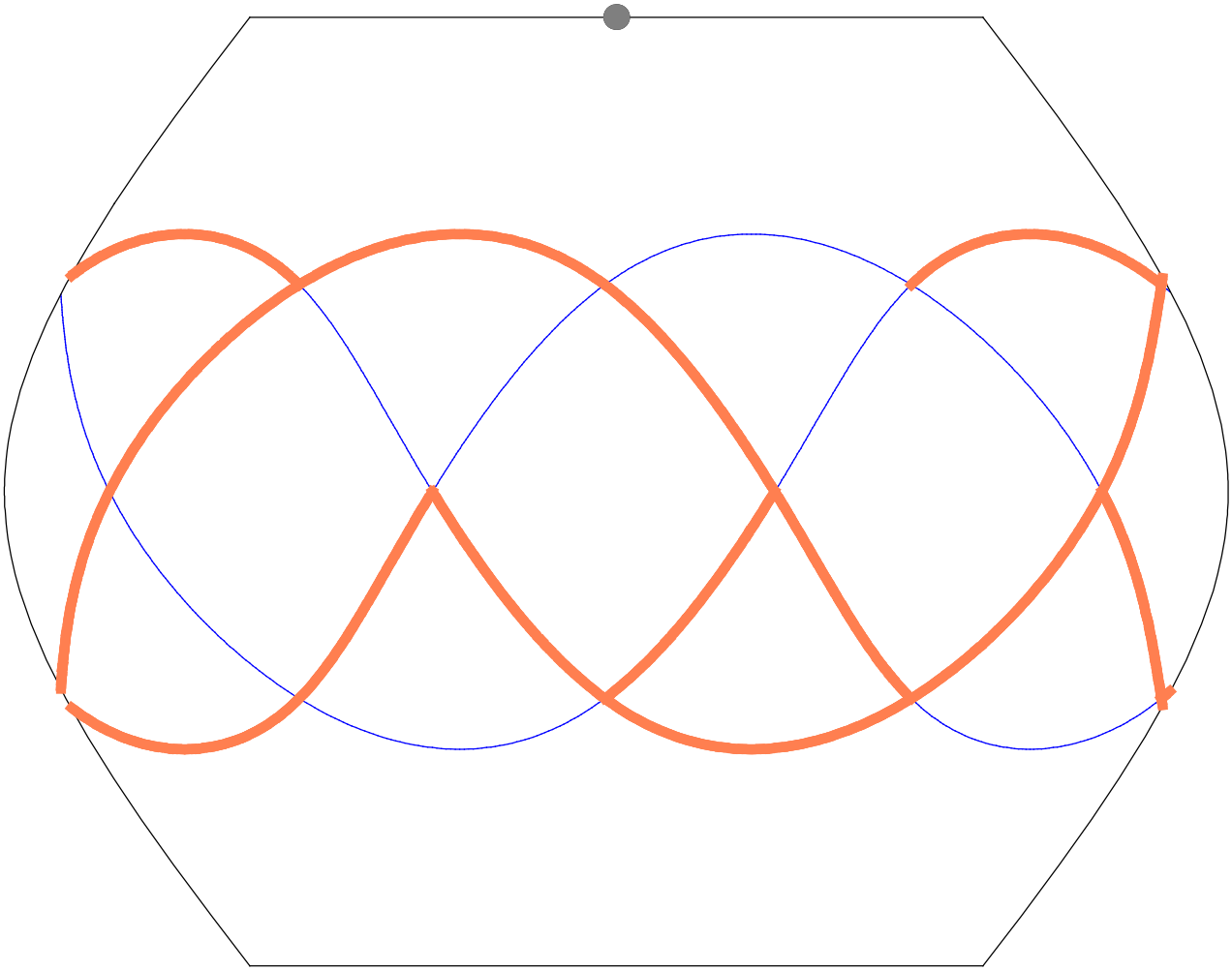


15.

cubohemioctahedron $\{6, \frac{4}{3}, 6, 4\}$

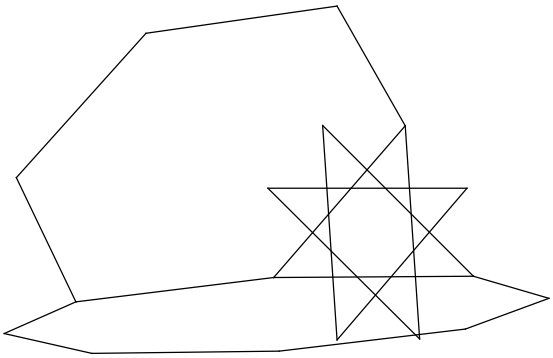


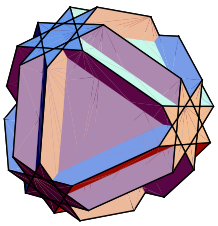


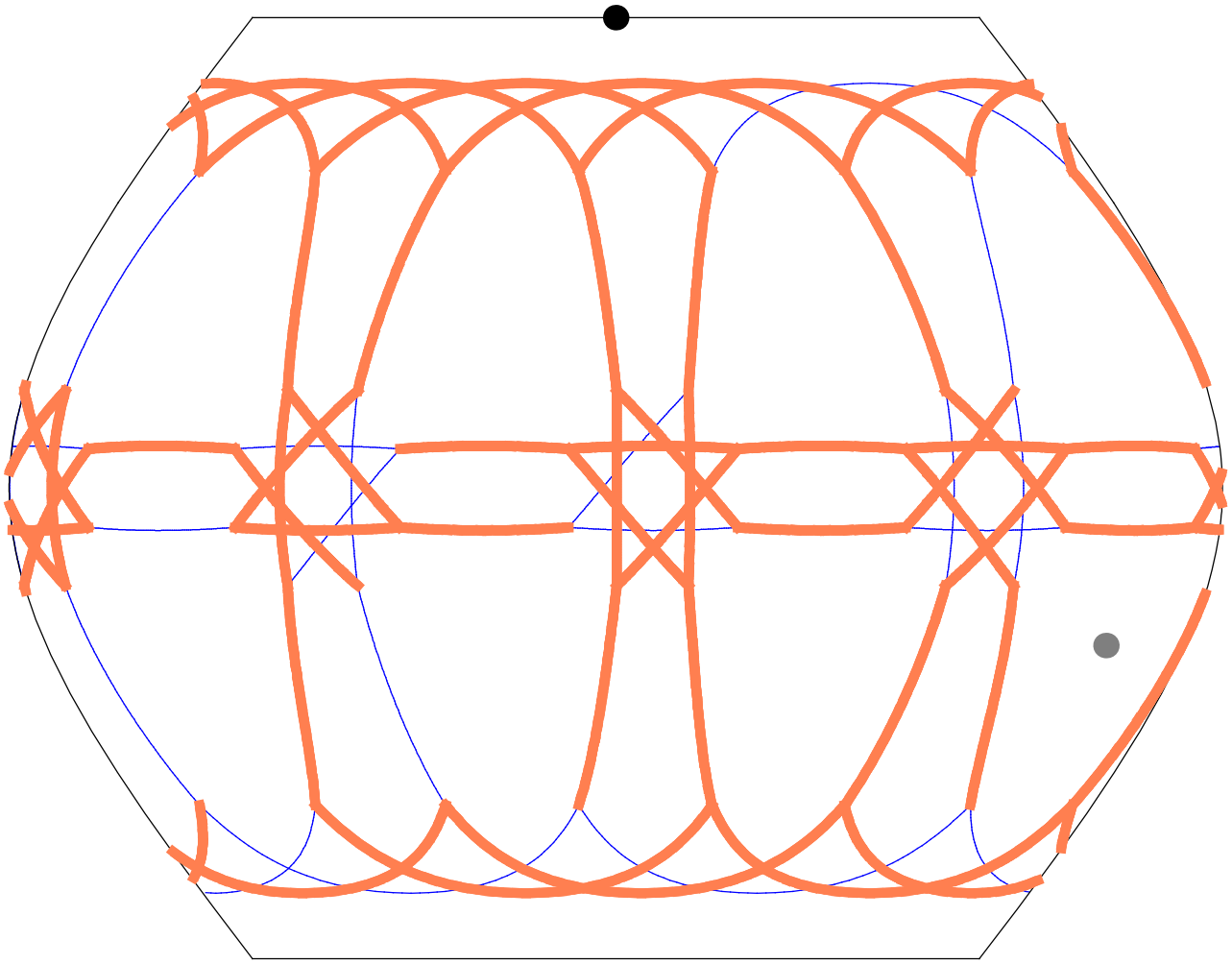


16.

`cubitruncated cuboctahedron` $\{\frac{8}{3}, 6, 8\}$

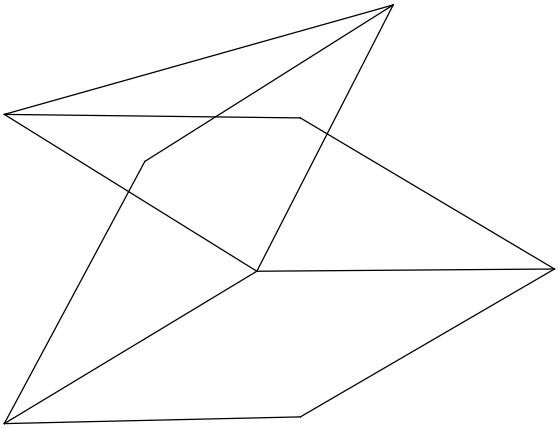


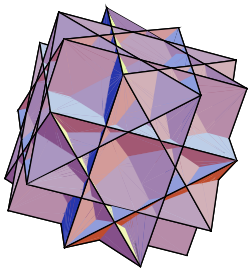


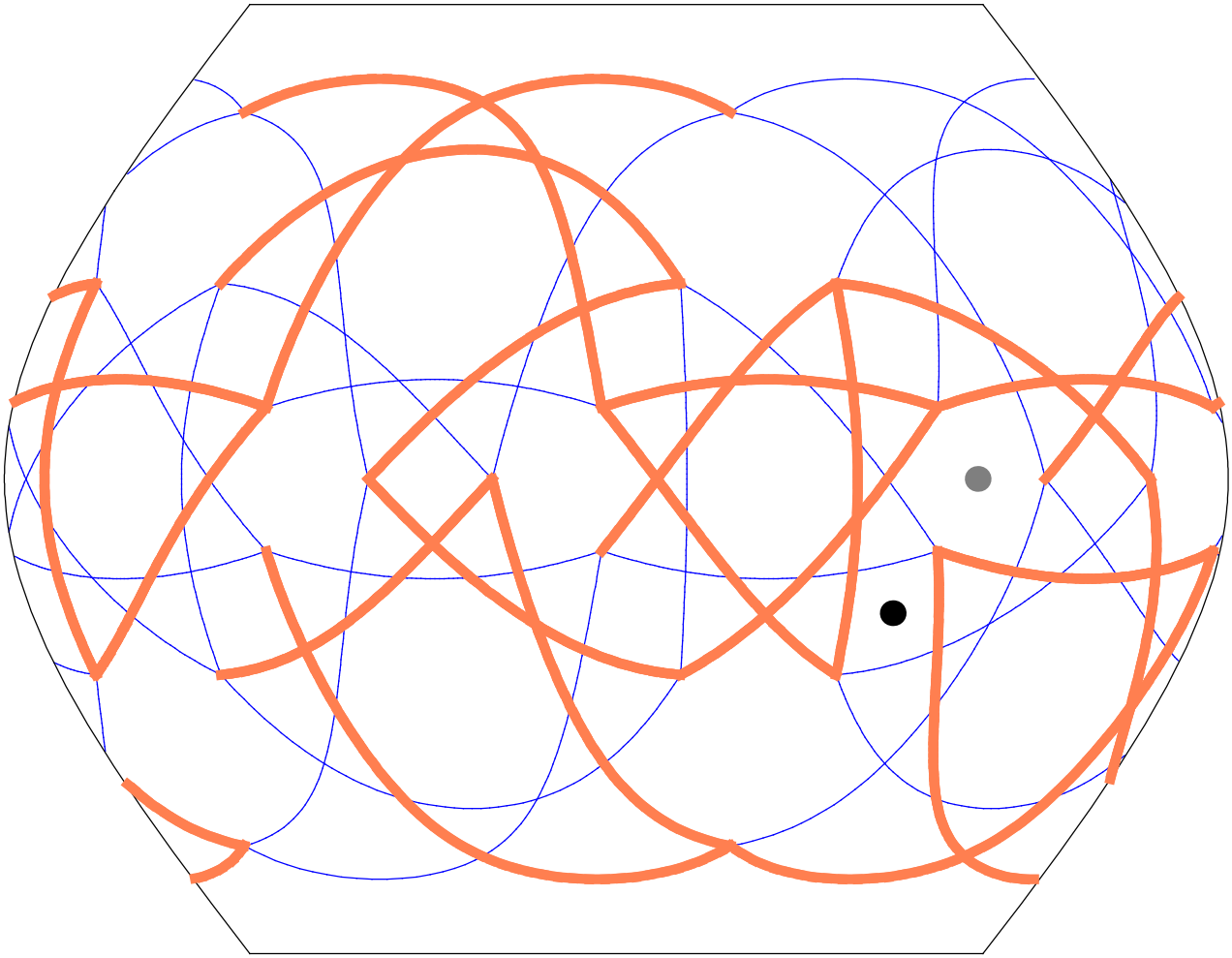


17.

`great rhombicuboctahedron` $\{4, \frac{3}{2}, 4, 4\}$

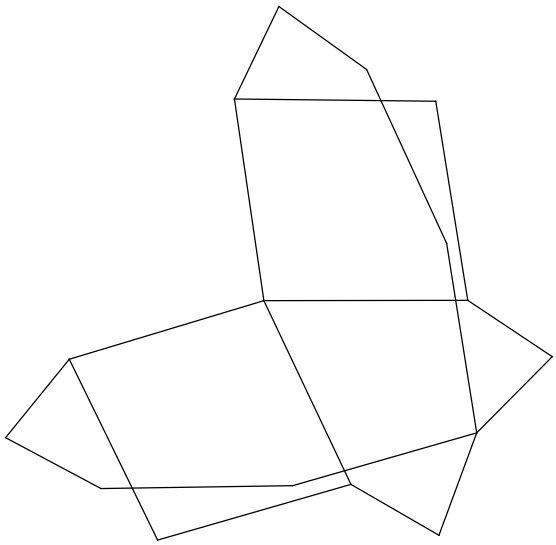


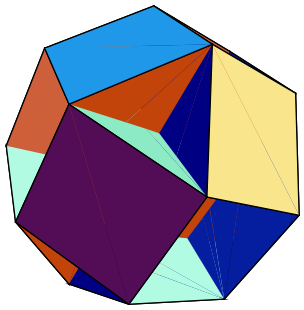


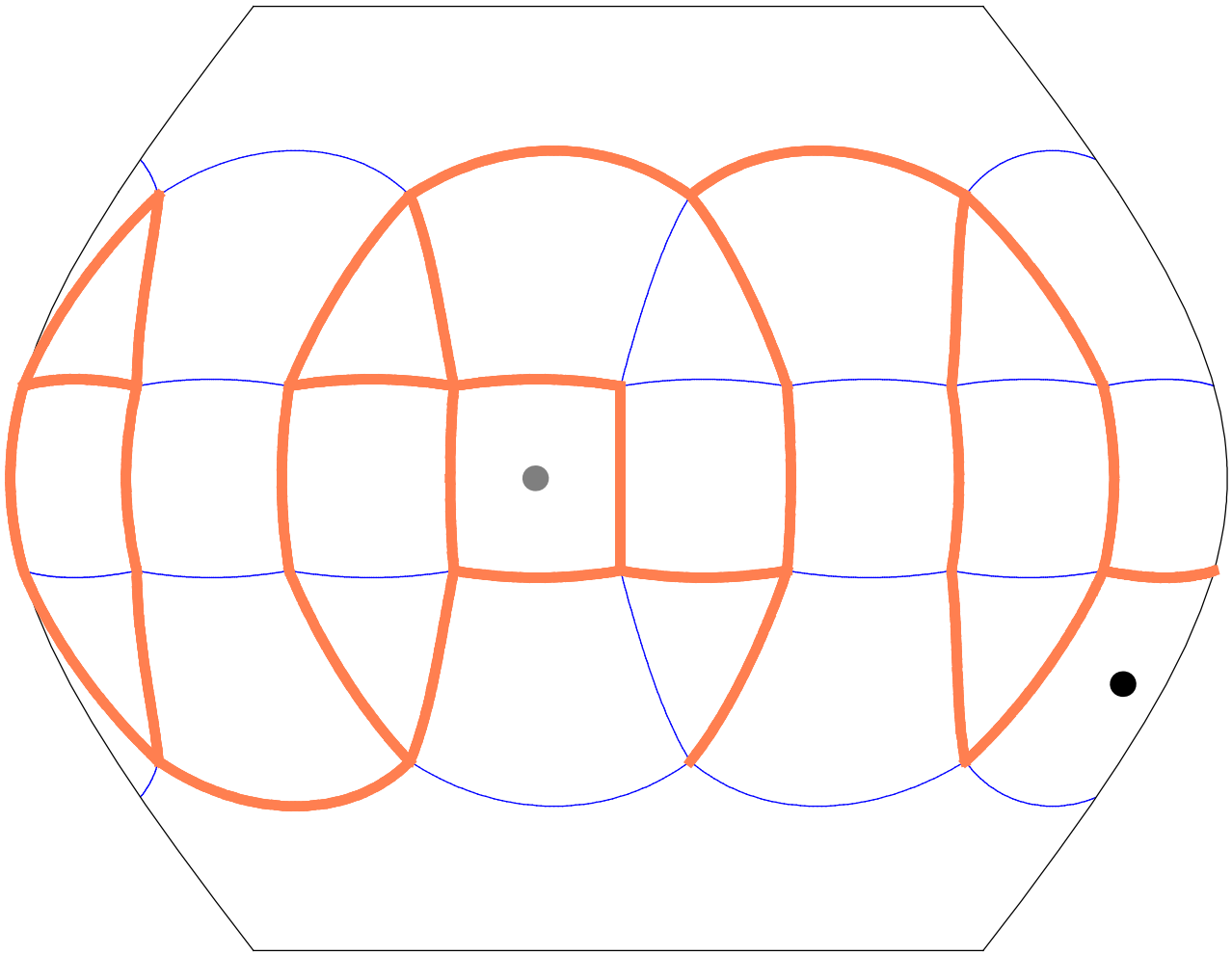


18.

`small rhombihexahedron` $\left\{8, 4, \frac{8}{7}, \frac{4}{3}\right\}$

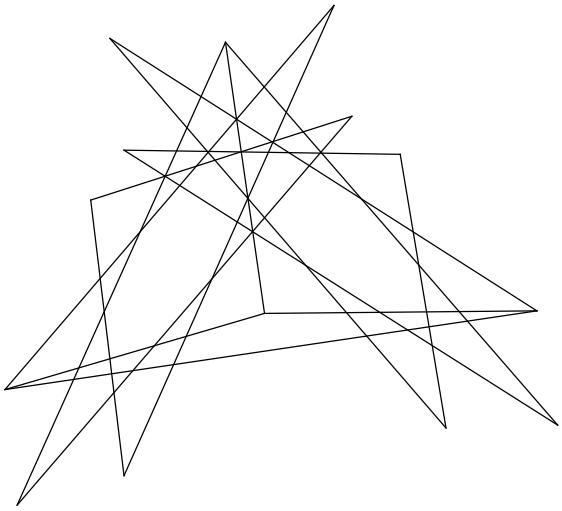


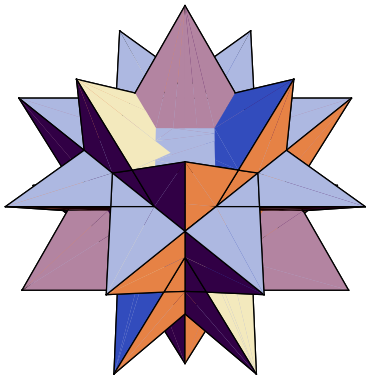


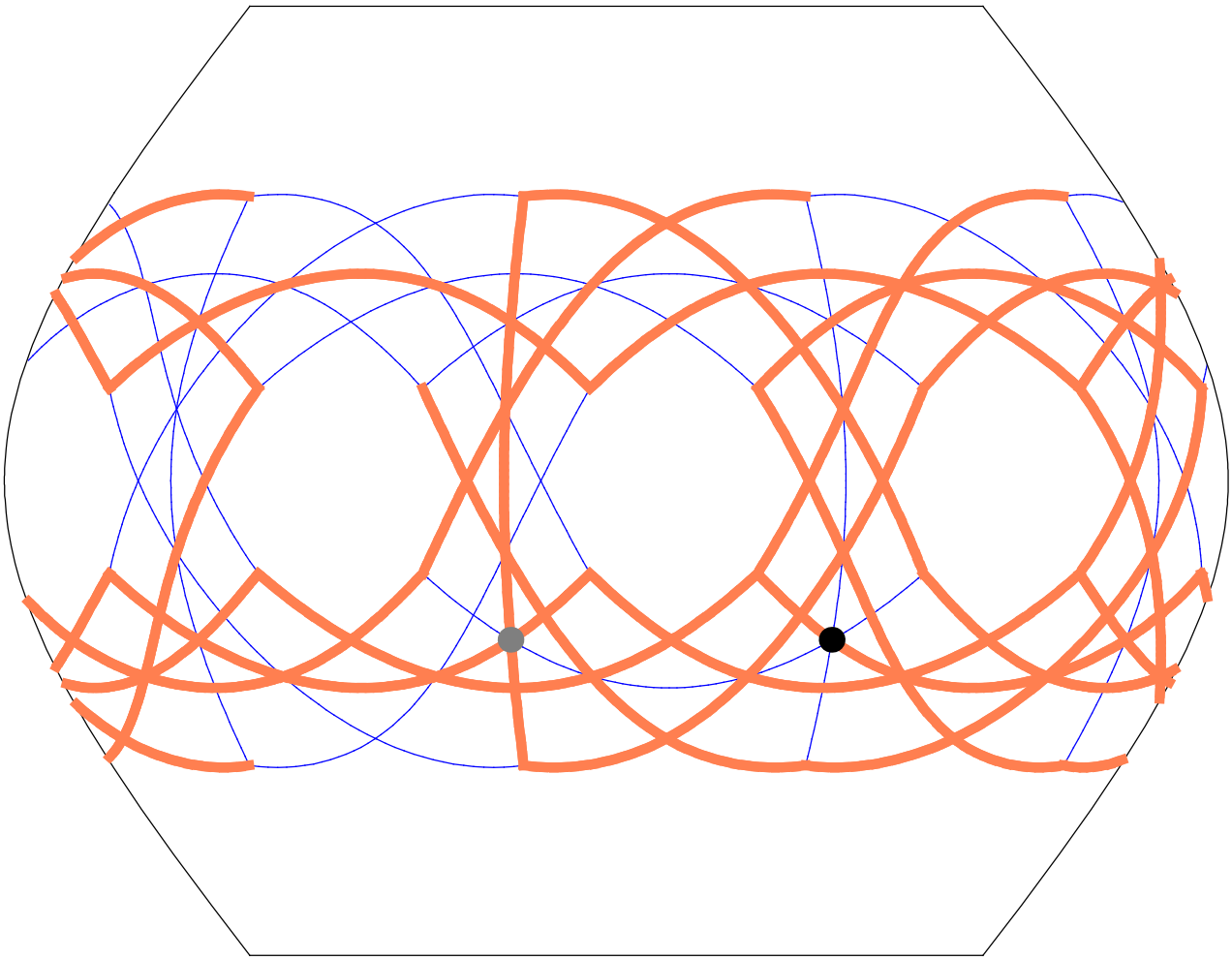


19.

`stellated truncated hexahedron` $\{\frac{8}{3}, \frac{8}{3}, 3\}$

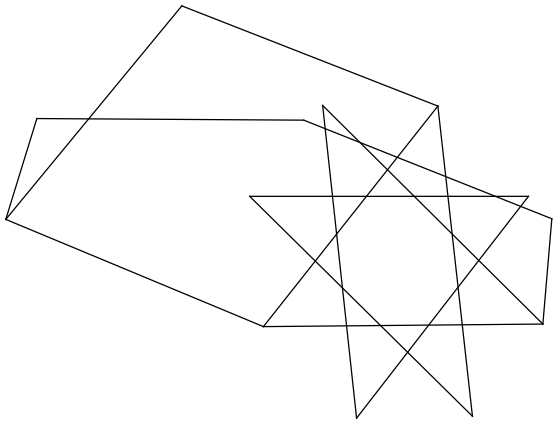


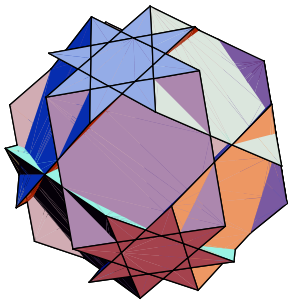


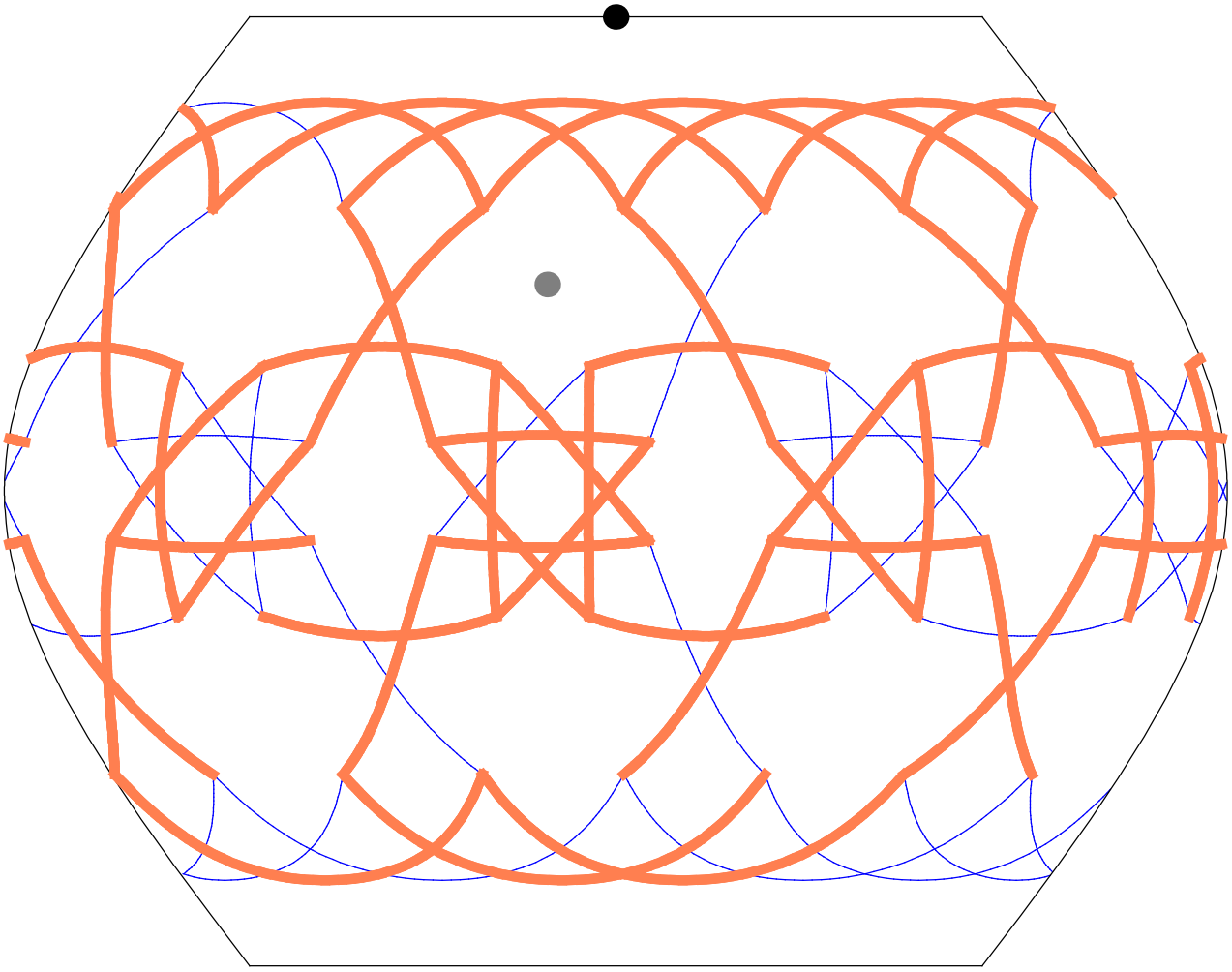


20.

great truncated cuboctahedron $\{\frac{8}{3}, 4, 6\}$

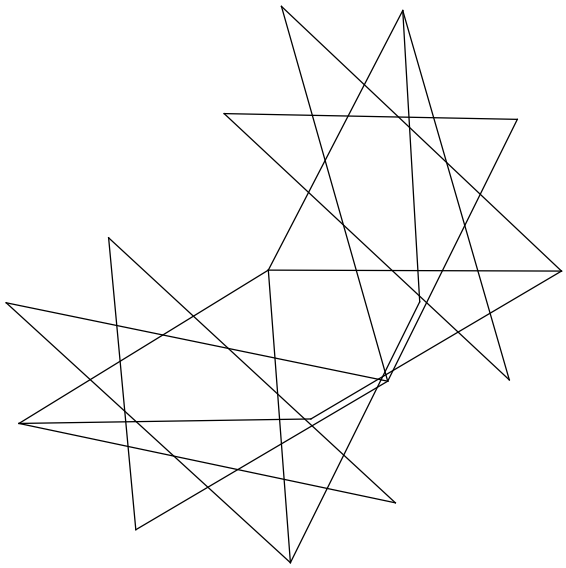


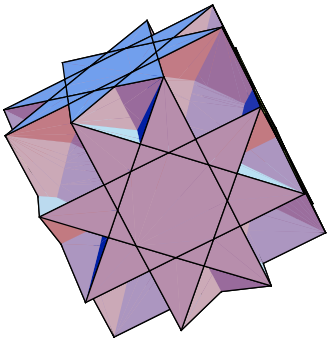


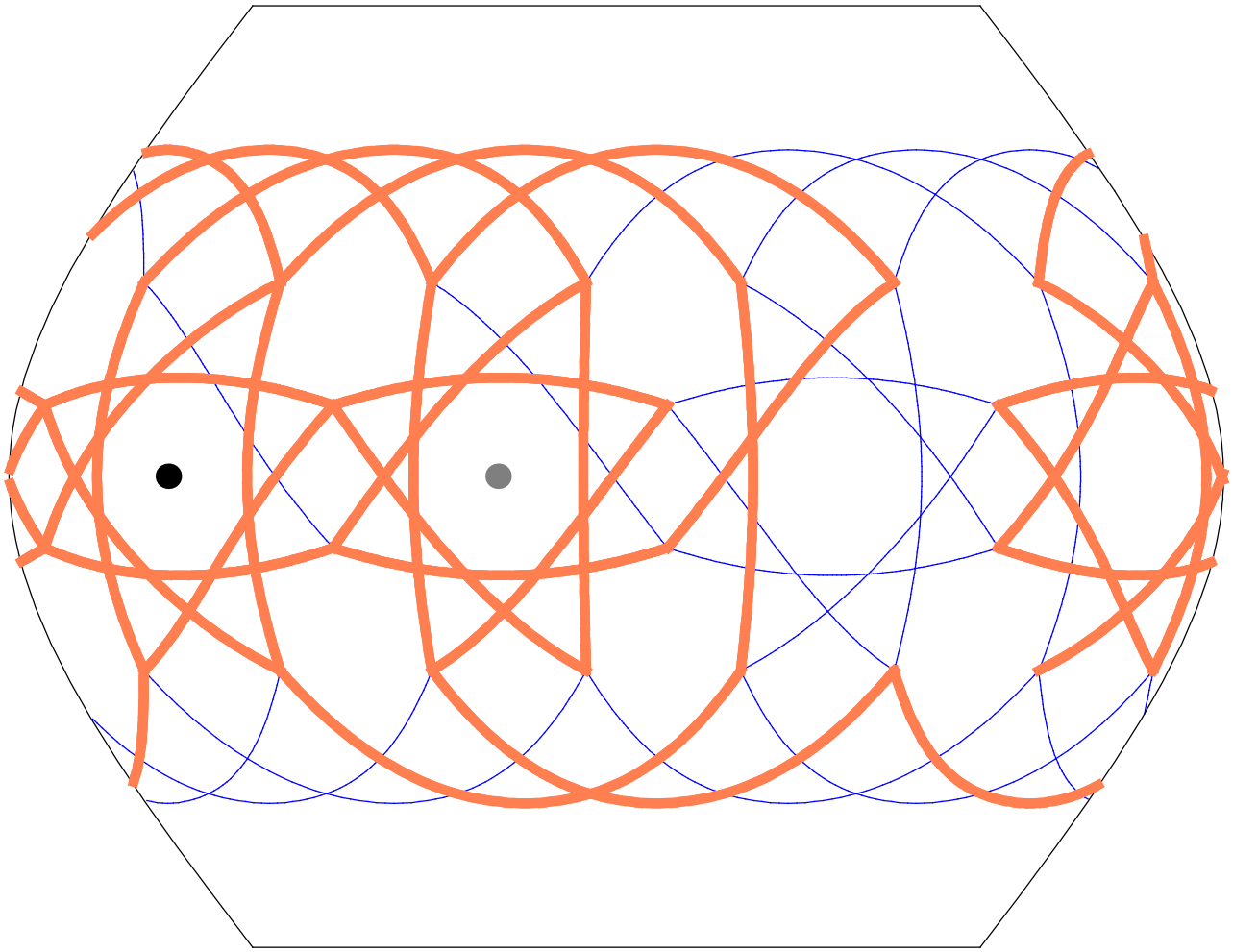


21.

`great rhombihexahedron` $\{4, \frac{8}{3}, \frac{4}{3}, \frac{8}{5}\}$

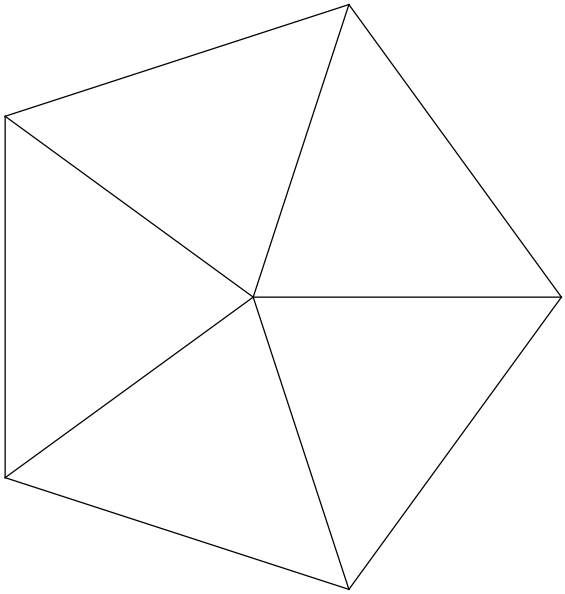


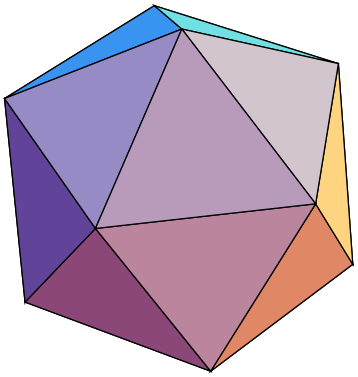


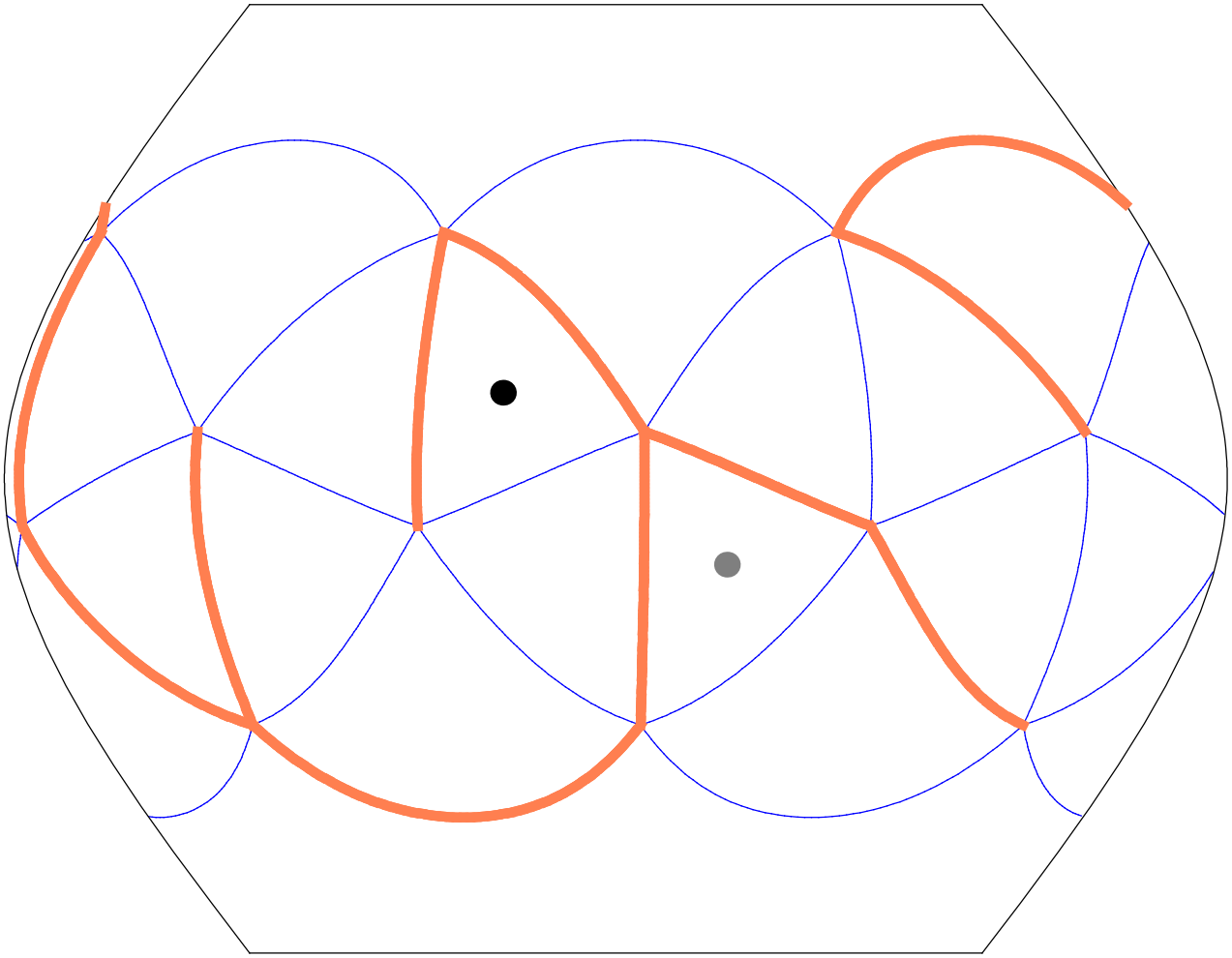


22.

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

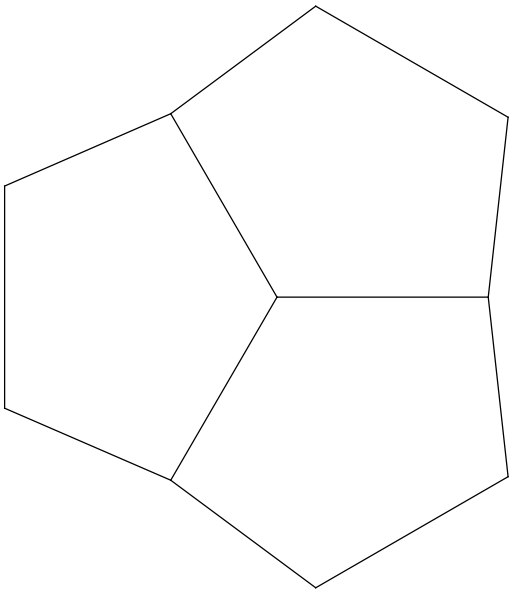


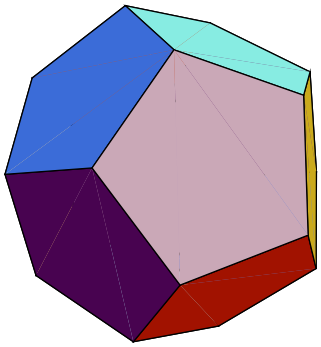


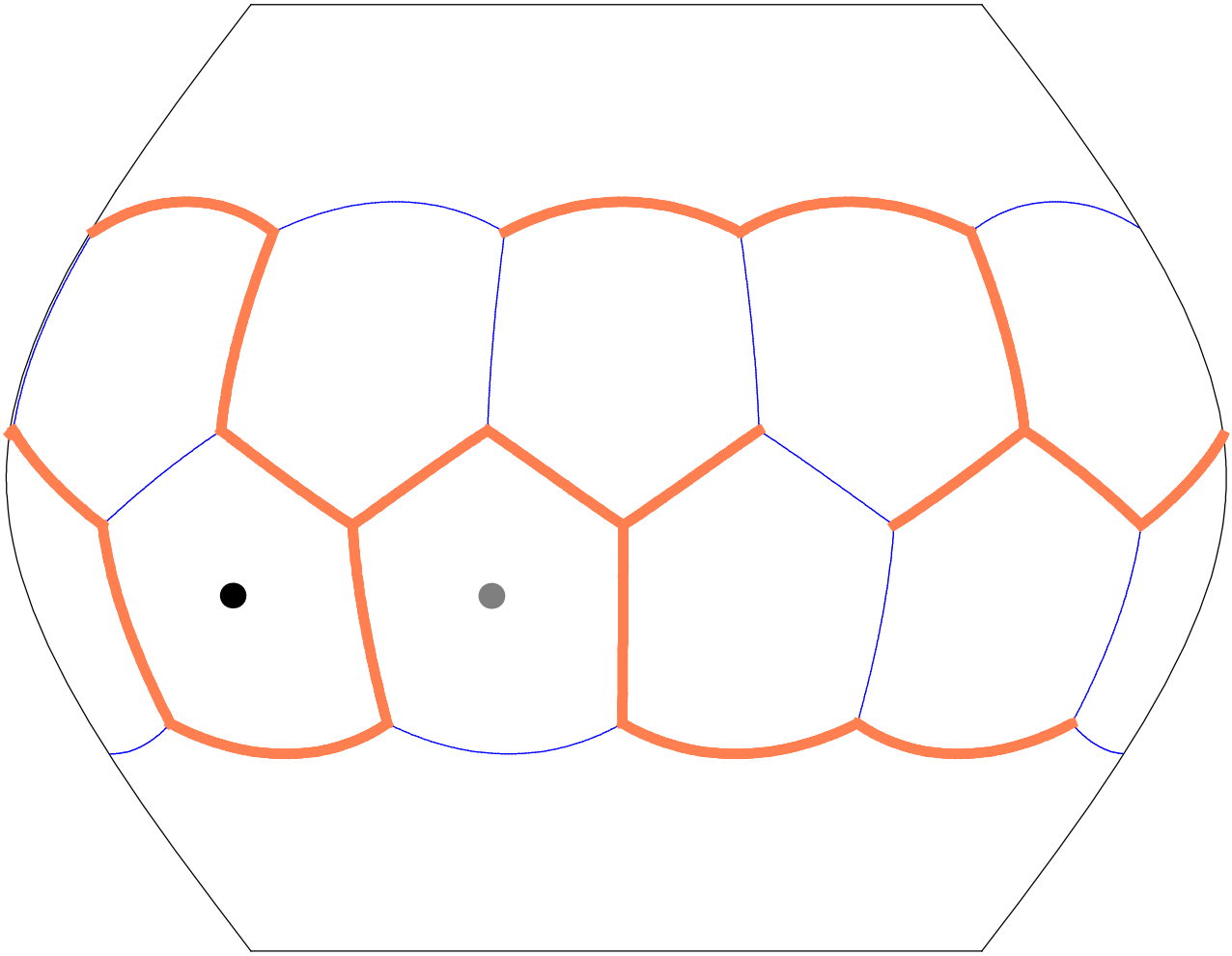


23.

`dodecahedron` {5, 5, 5}

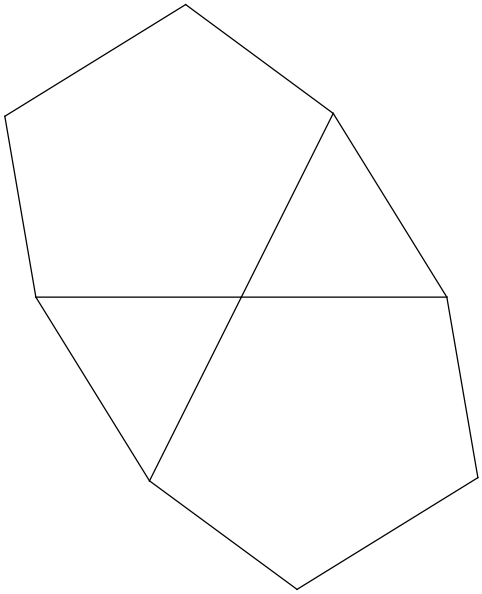


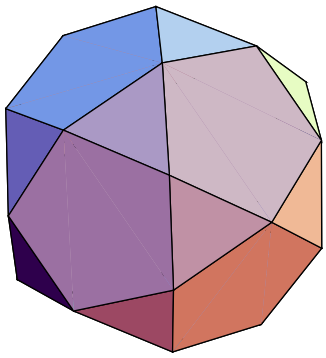


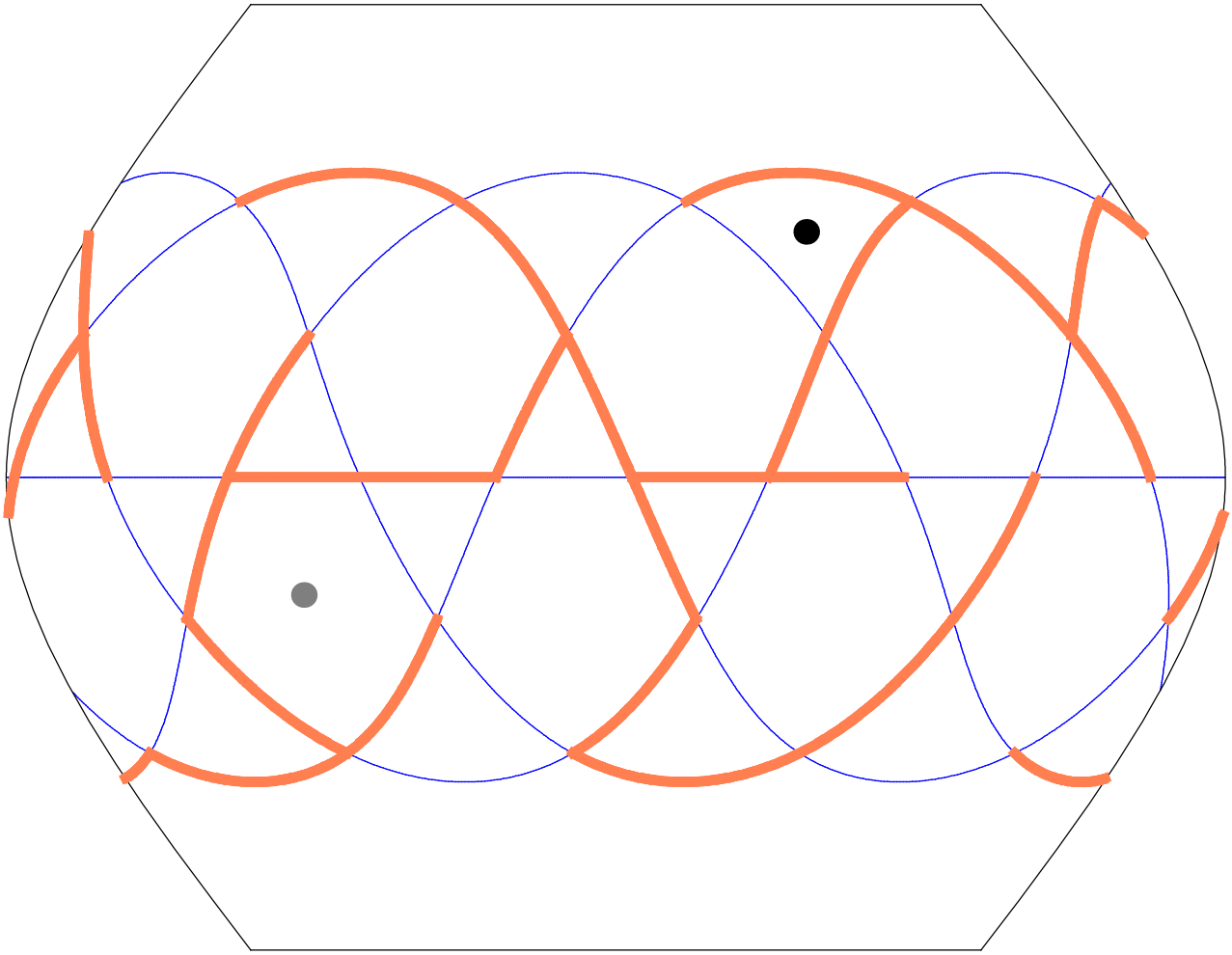


24.

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

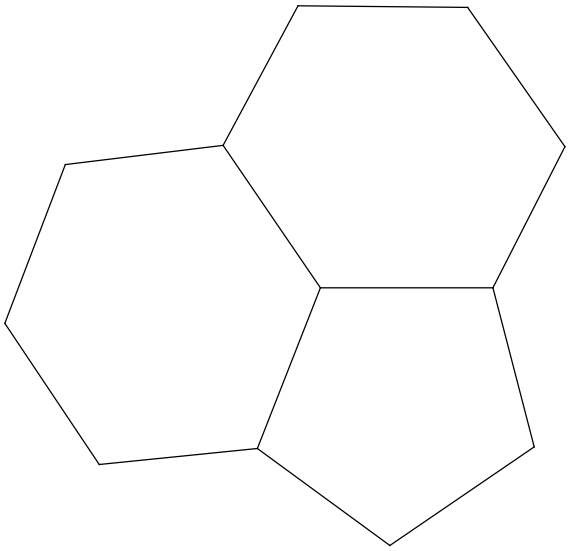


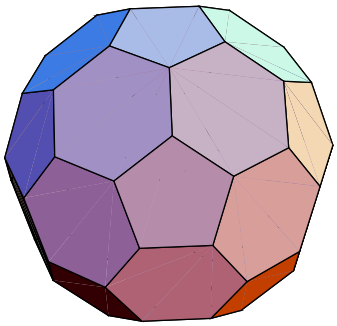


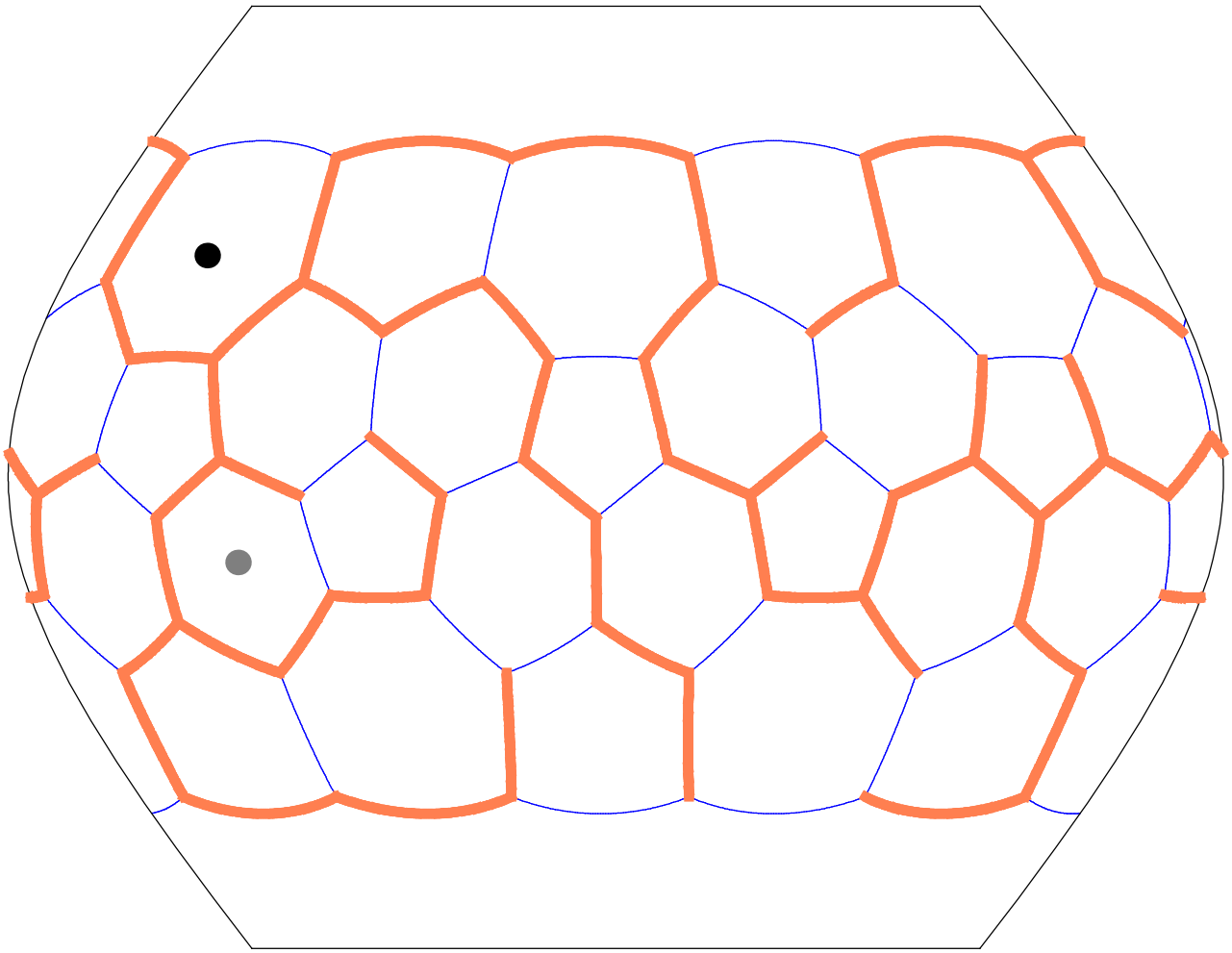


25.

`truncated icosahedron` {6, 6, 5}

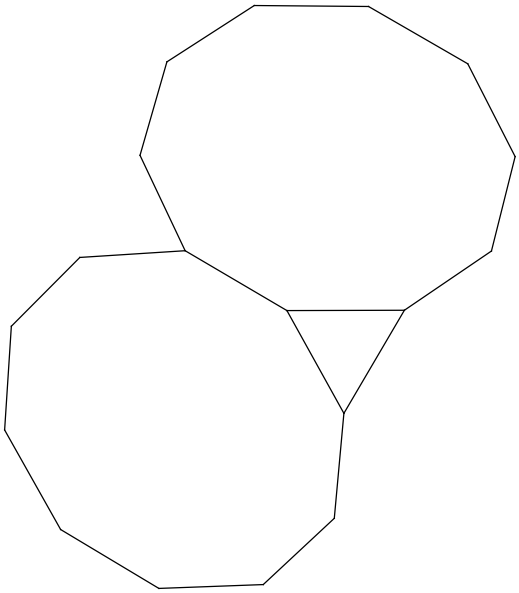


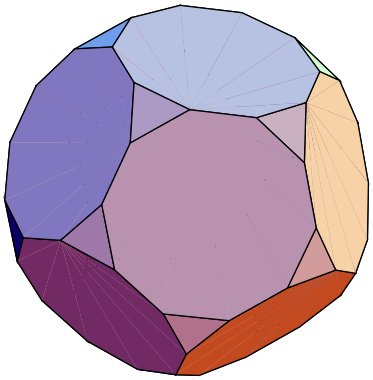


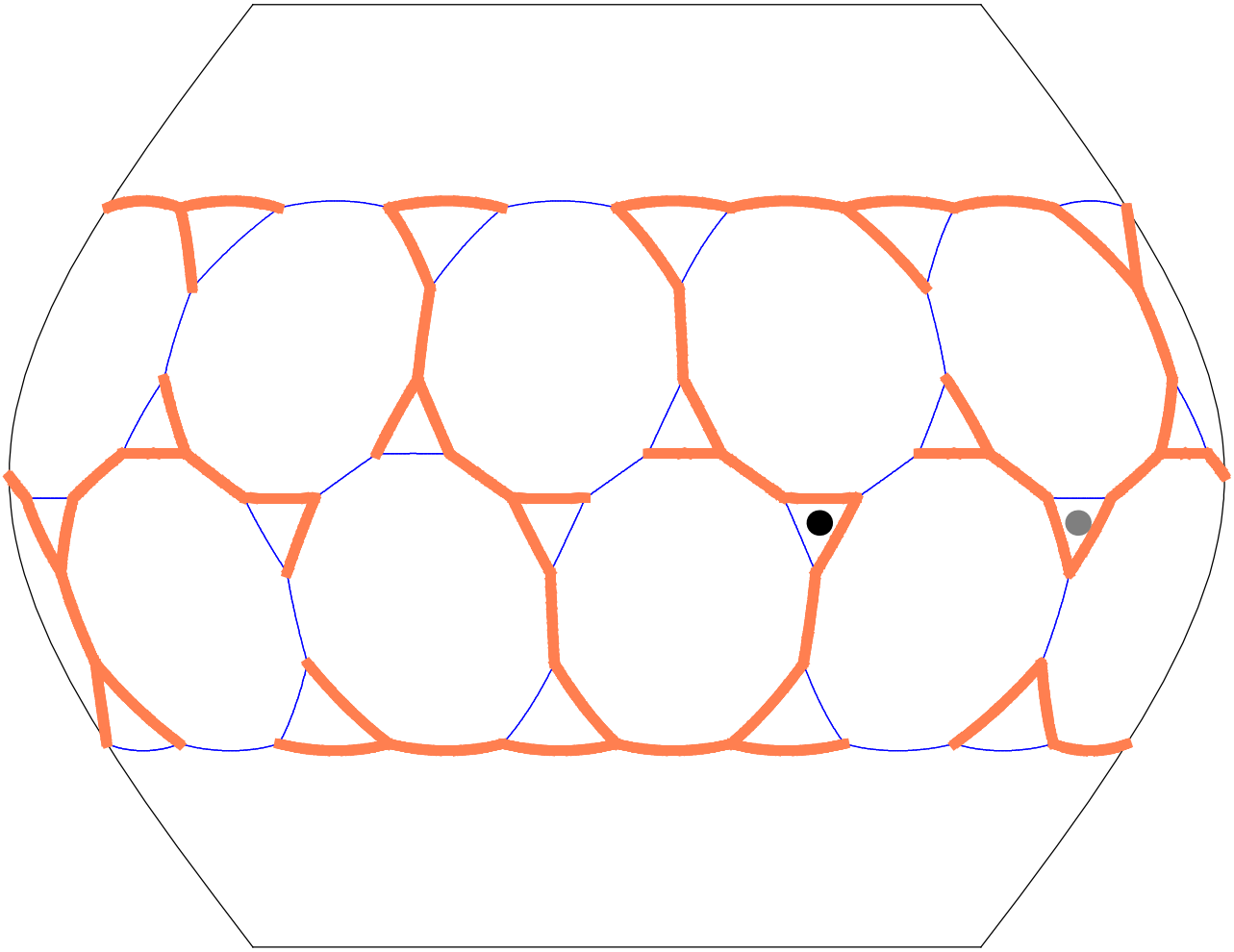


26.

`truncated dodecahedron` {10, 10, 3}

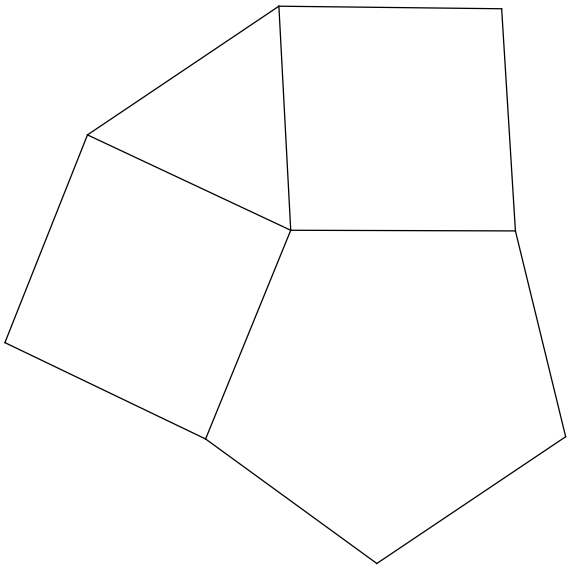


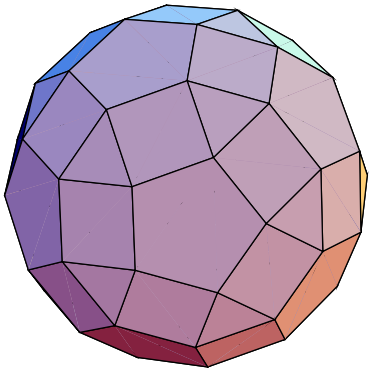


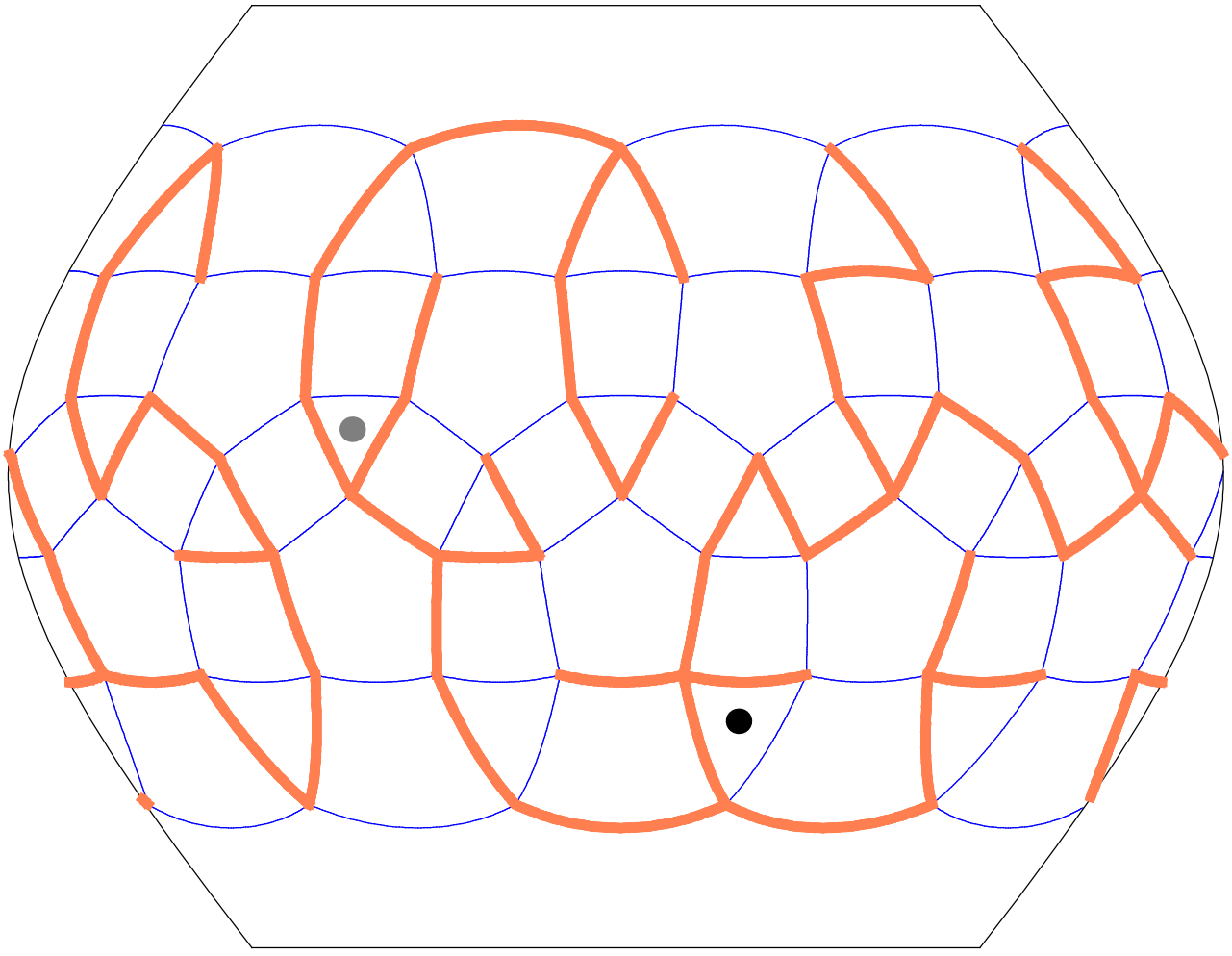


27.

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

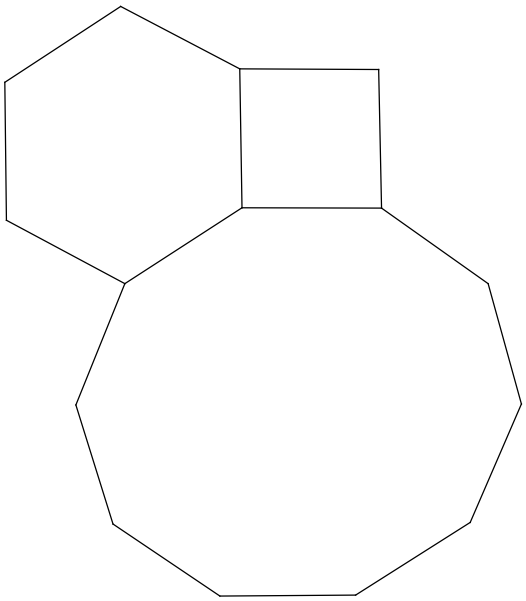


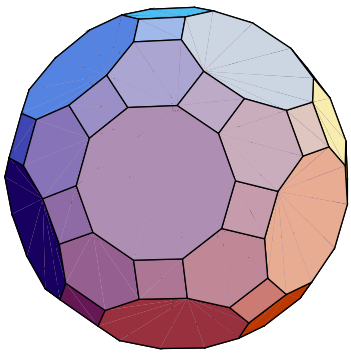


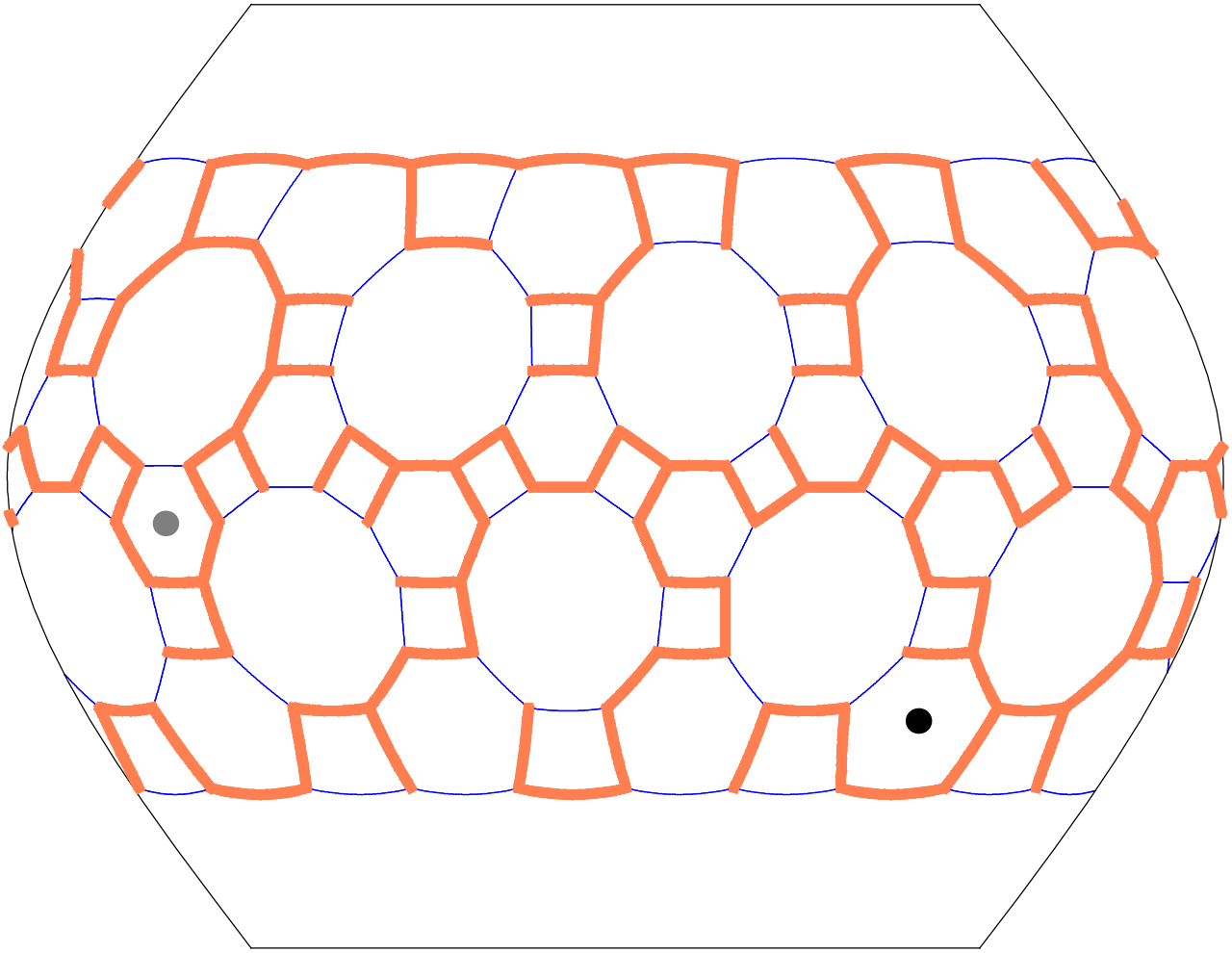


28.

`truncated icosidodecahedron` {4, 6, 10}

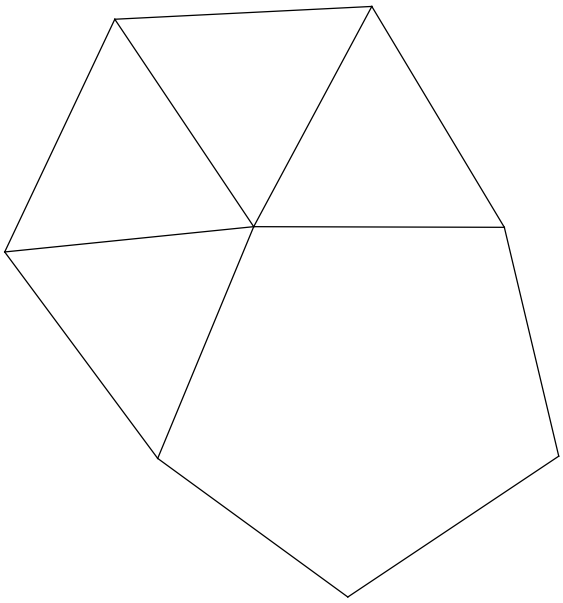


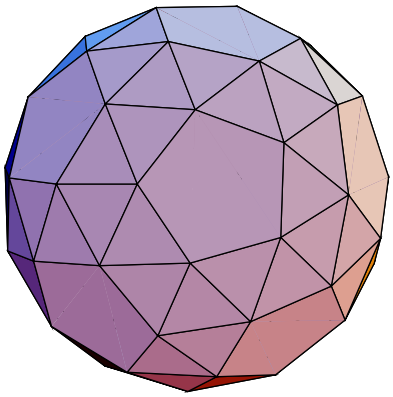


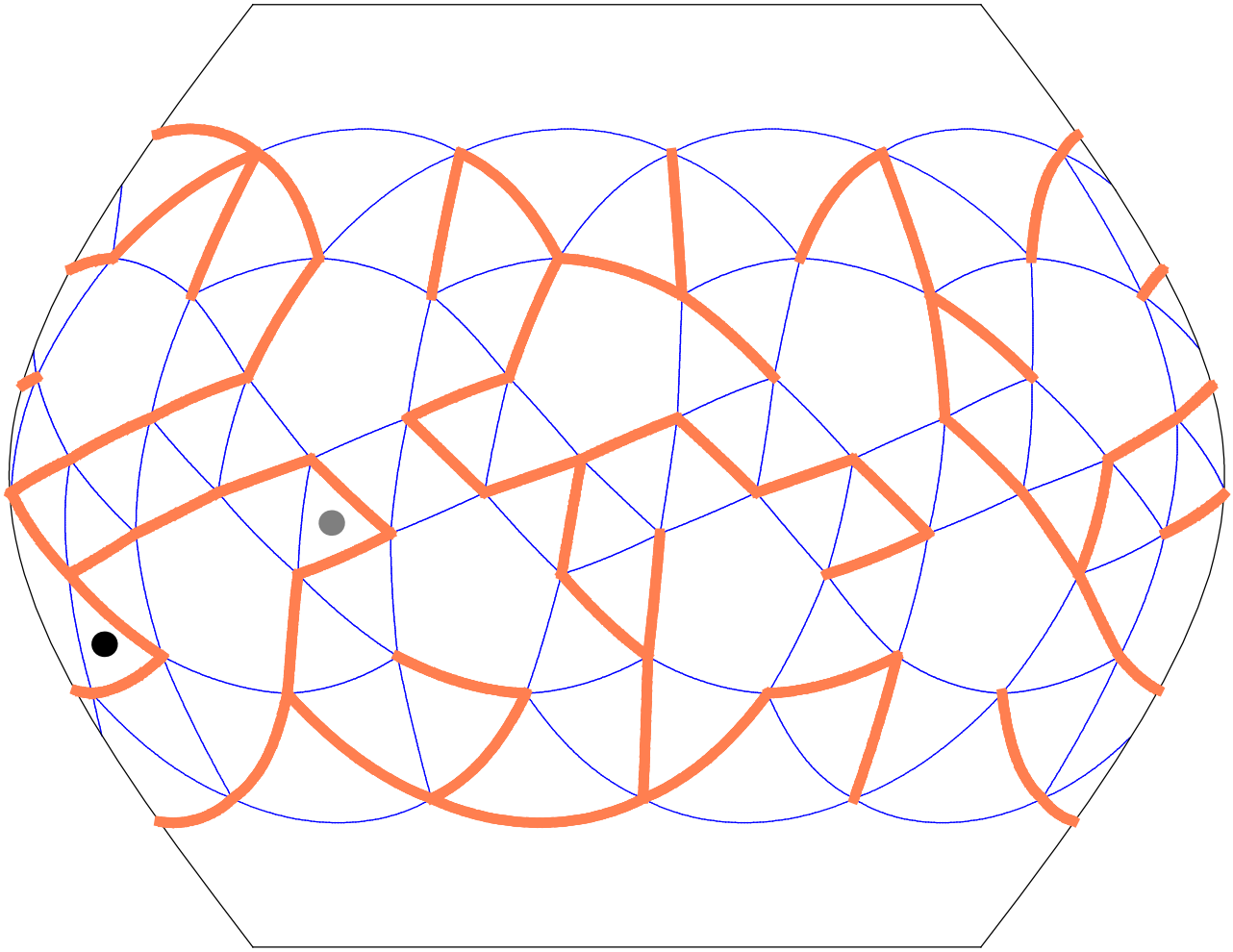


29.

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

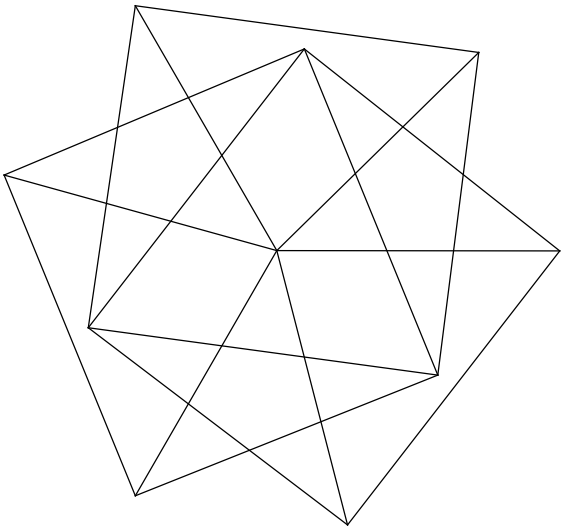


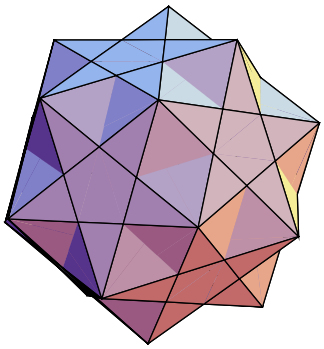


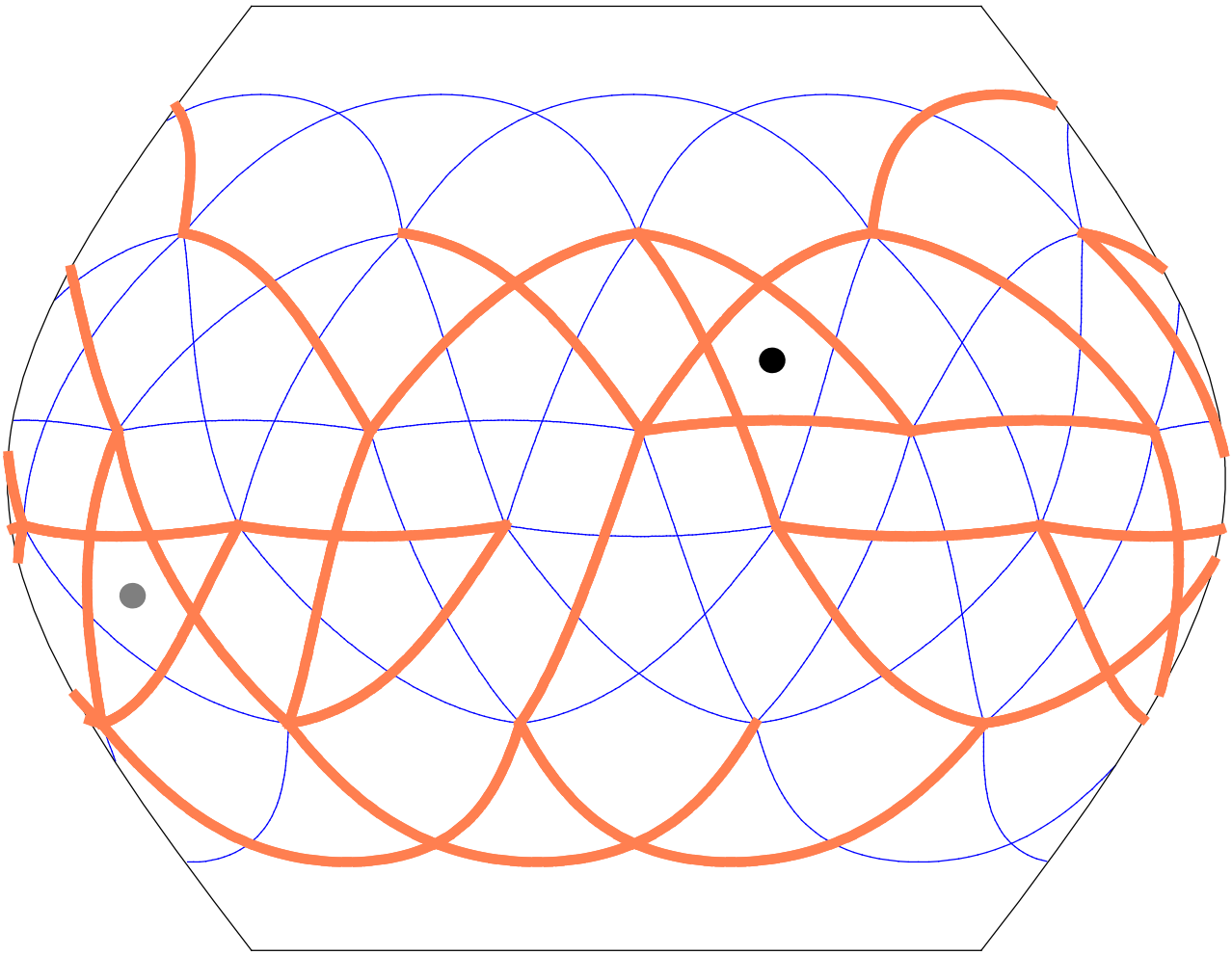


30.

small ditrigonal icosidodecahedron $\{\frac{5}{2}, 3, \frac{5}{2}, 3, \frac{5}{2}, 3\}$

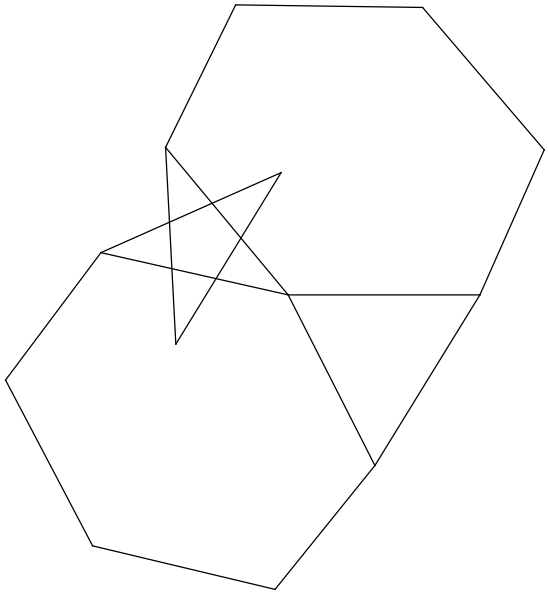


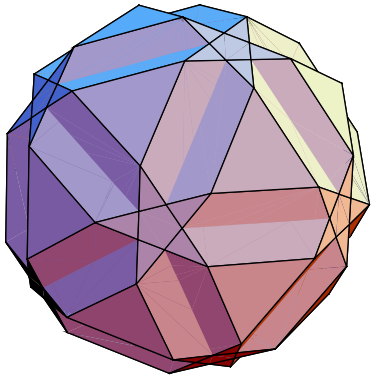


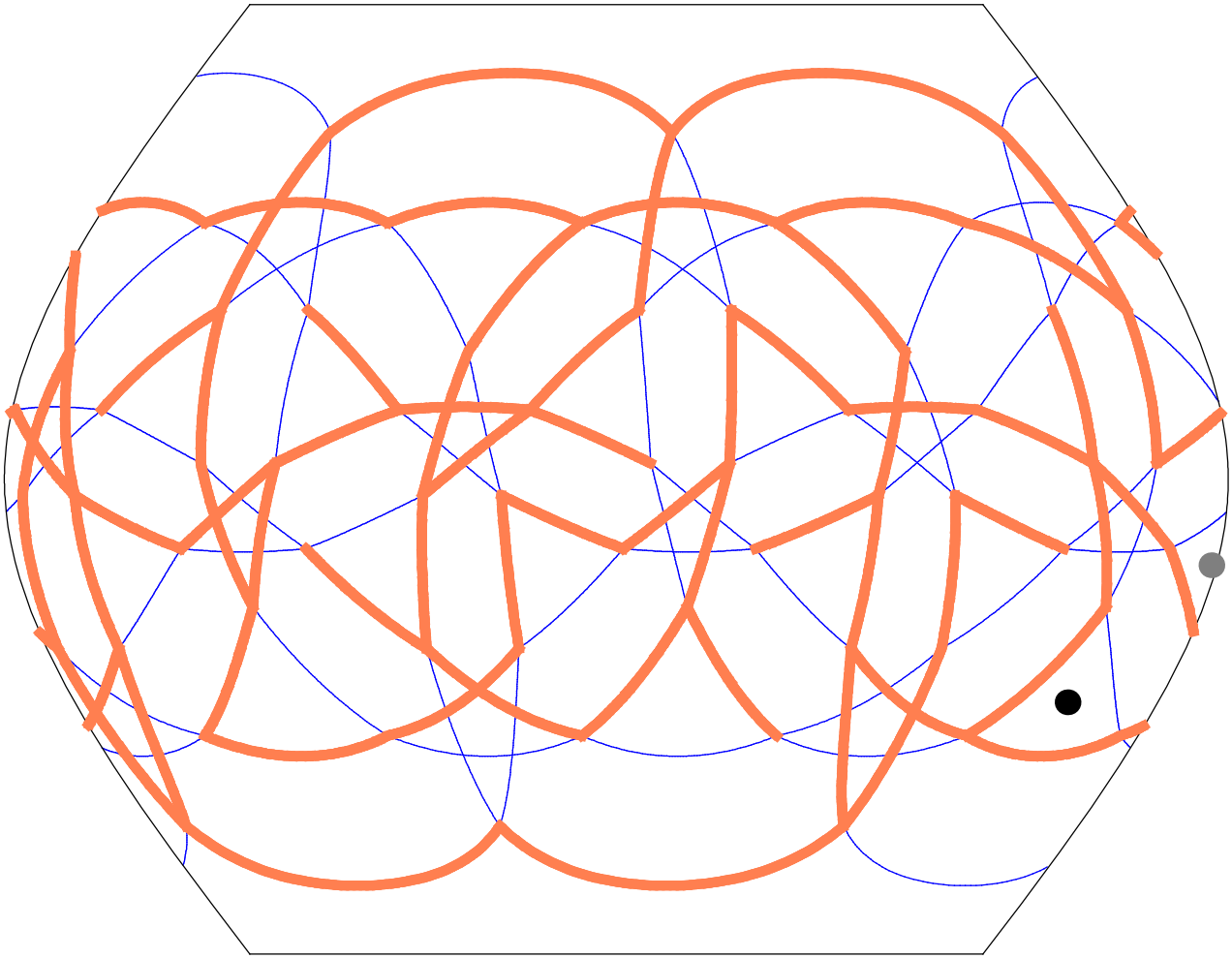


31.

`small icosicosidodecahedron` $\{6, \frac{5}{2}, 6, 3\}$

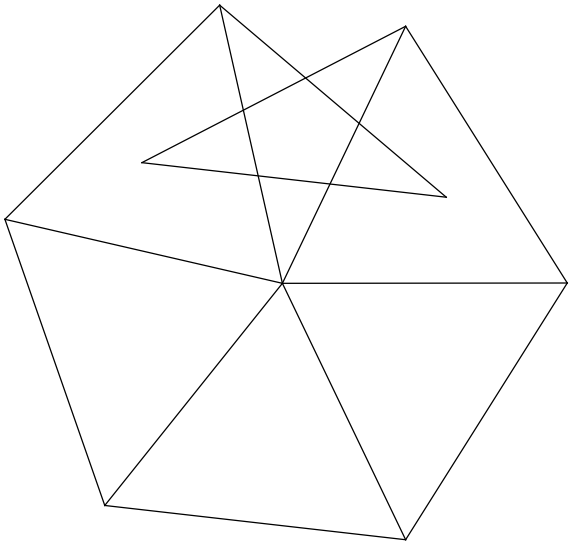


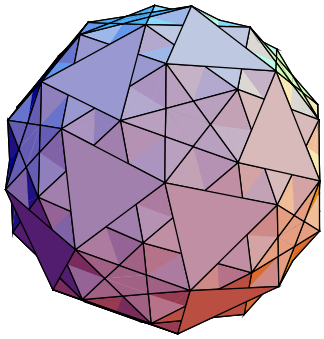


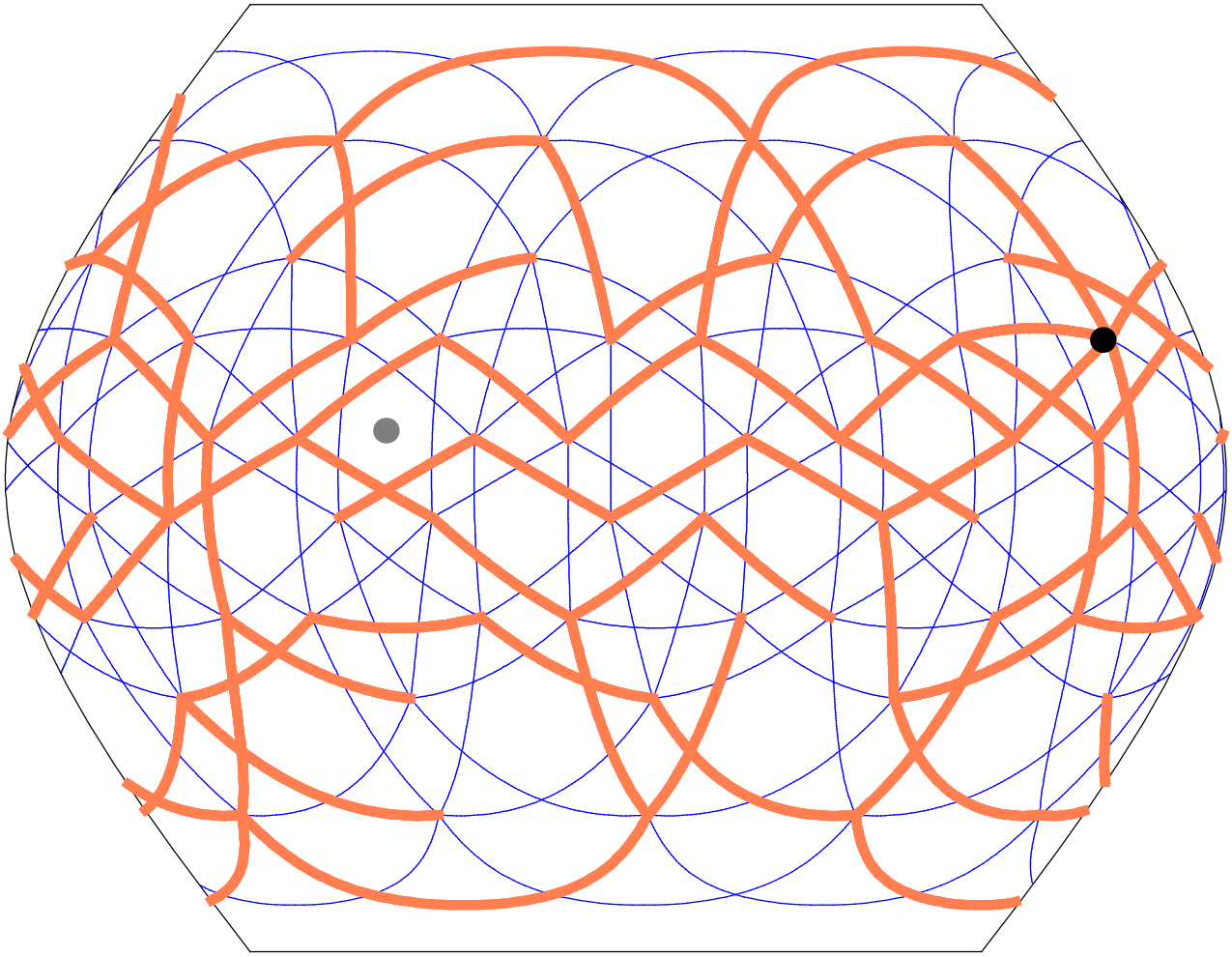


32.

`small snub icosicosidodecahedron` $\left\{3, \frac{5}{2}, 3, 3, 3, 3\right\}$

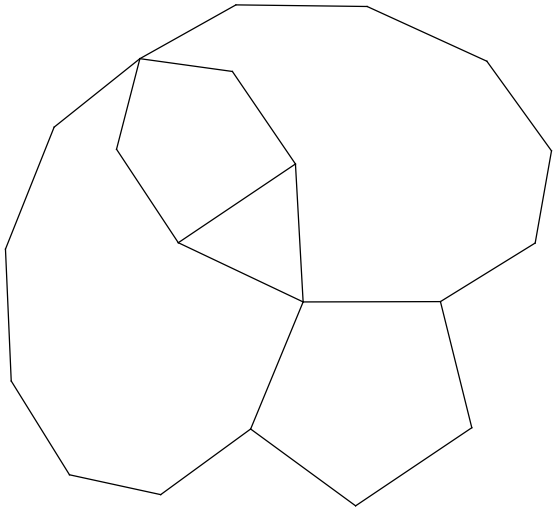


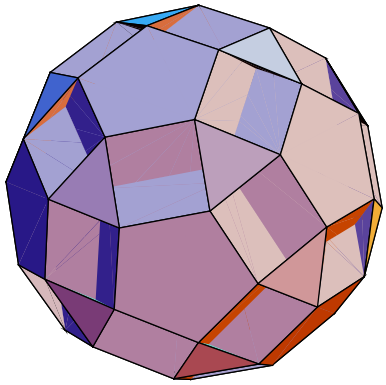


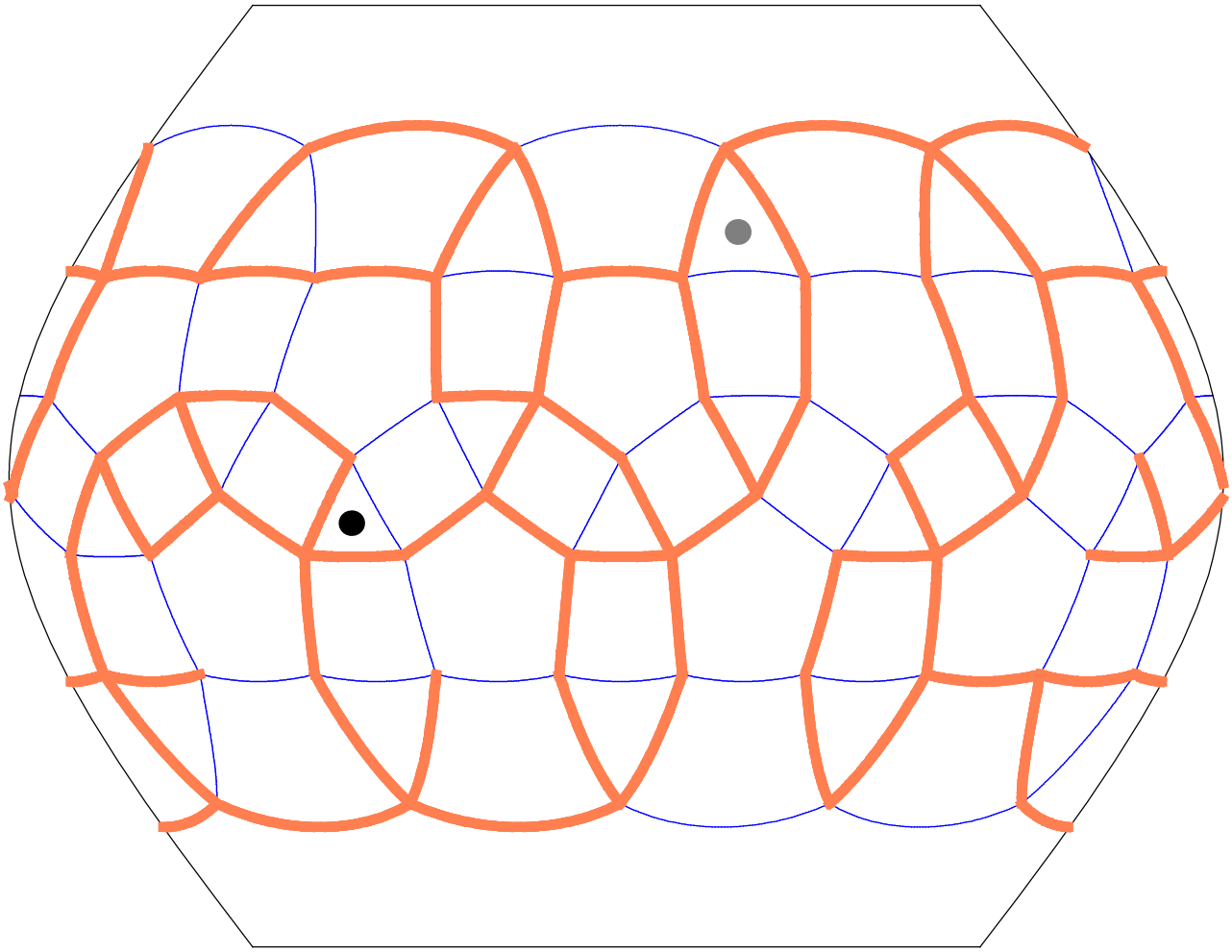


33.

`small dodecicosidodecahedron` $\{10, \frac{3}{2}, 10, 5\}$

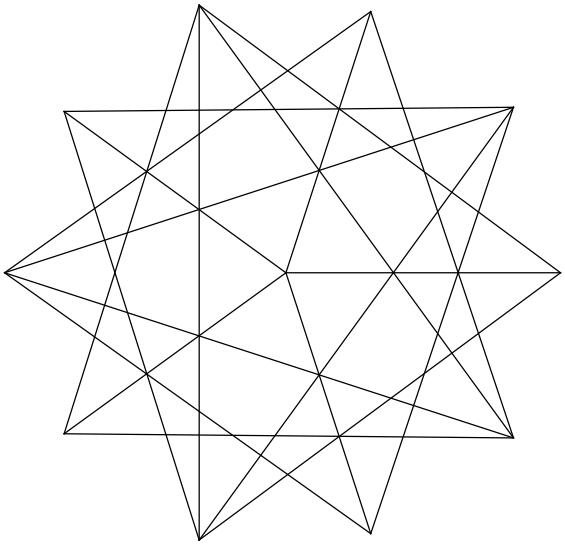


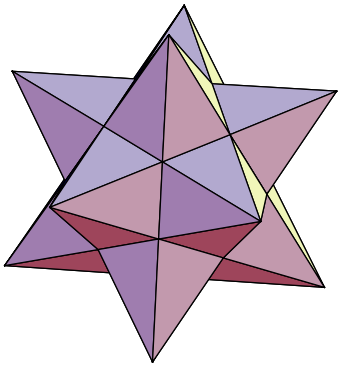


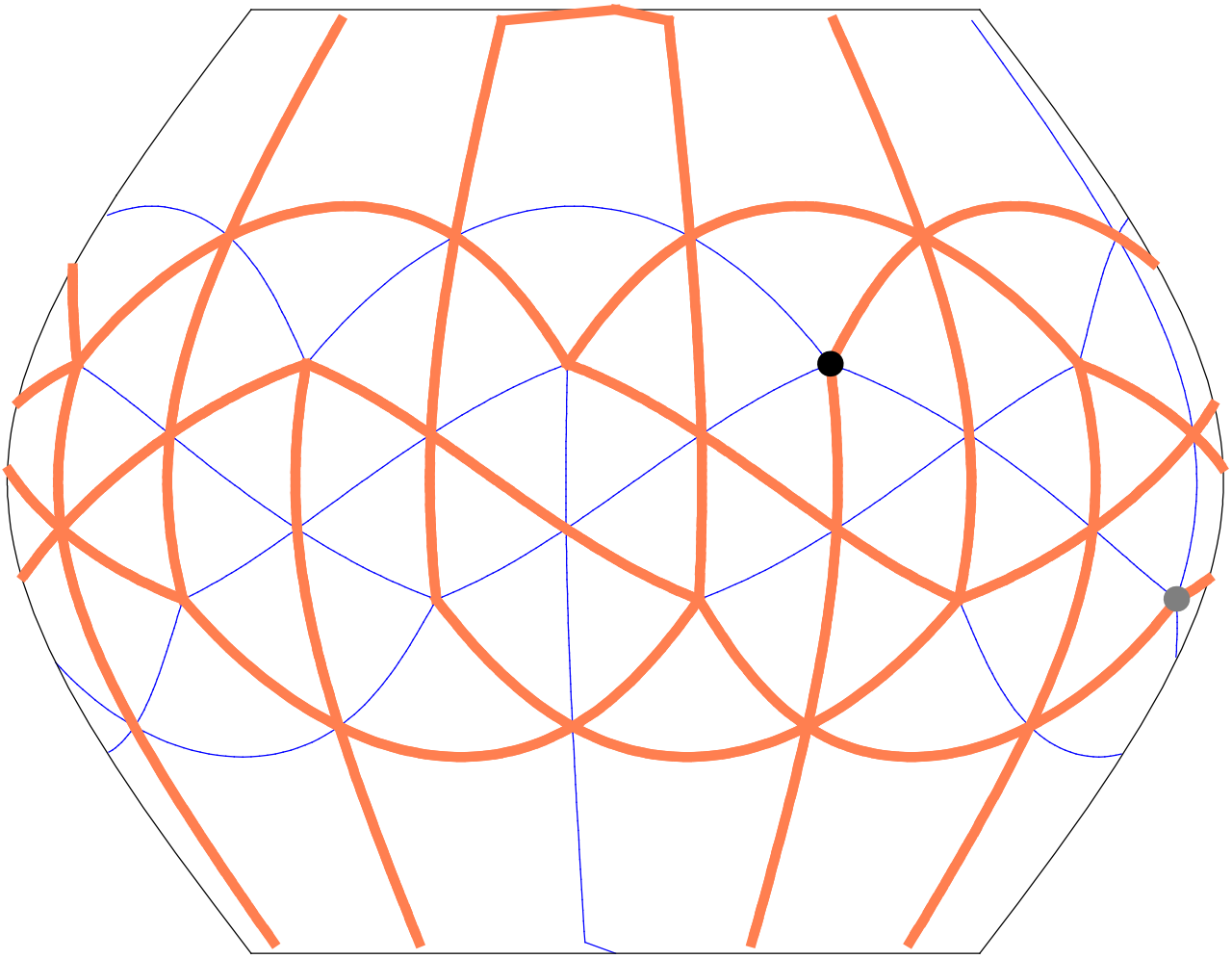


34.

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

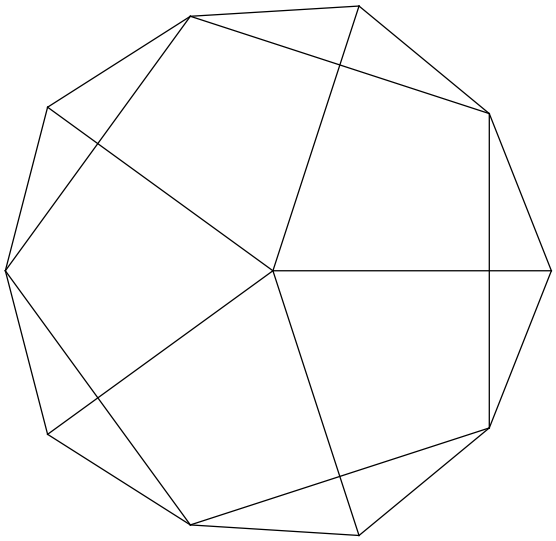


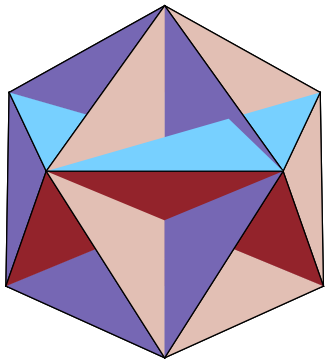


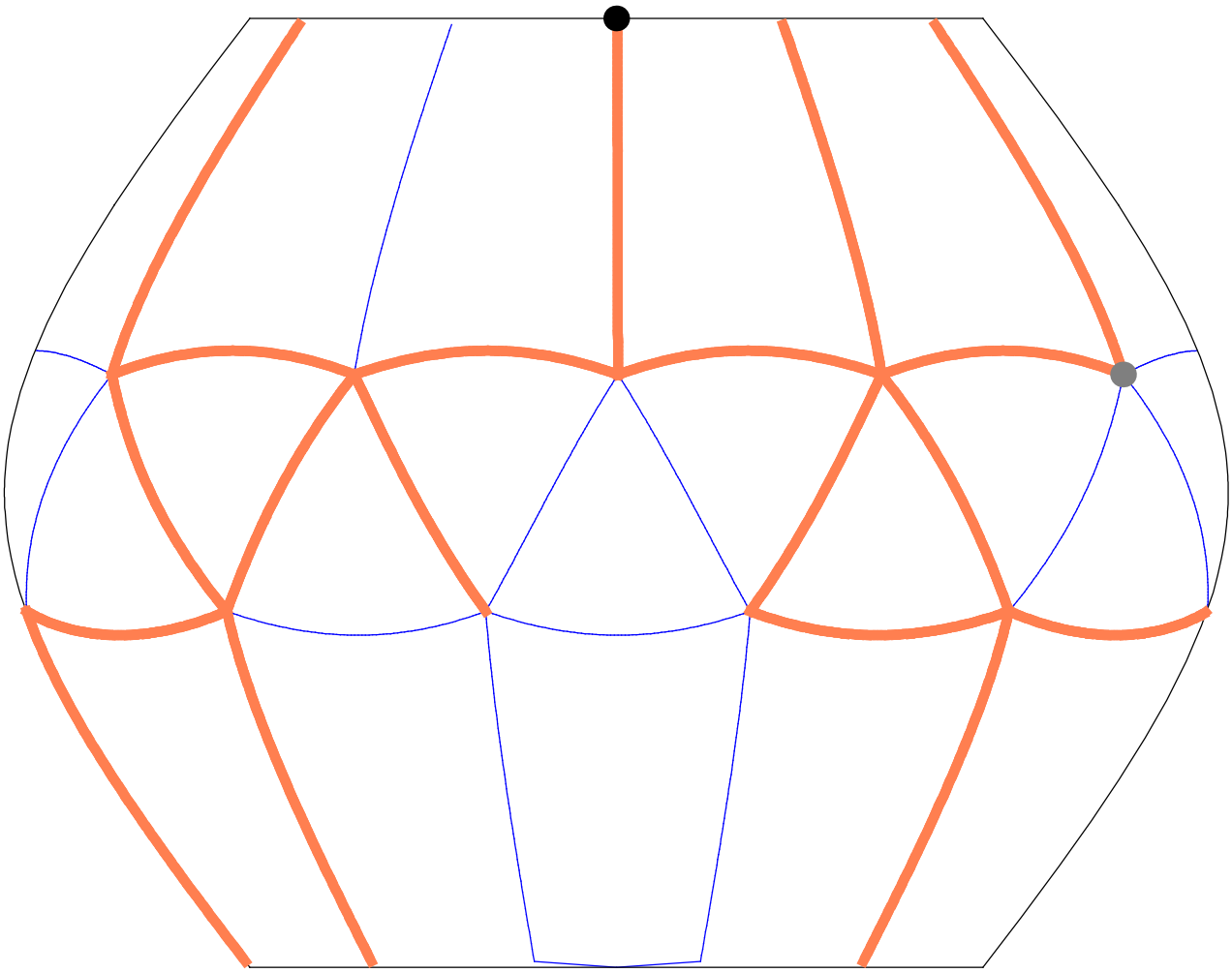


35.

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

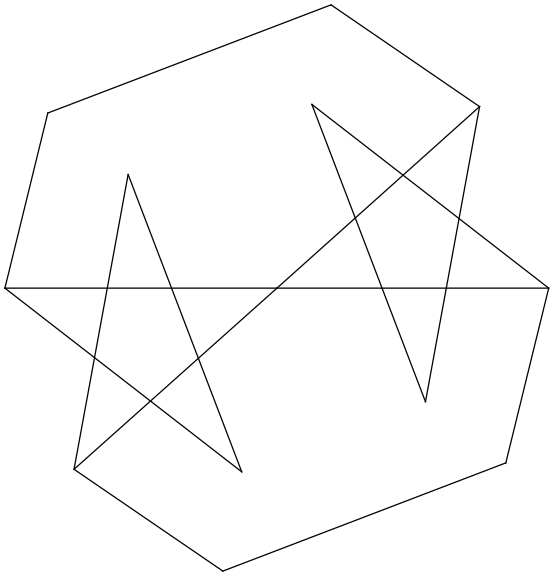


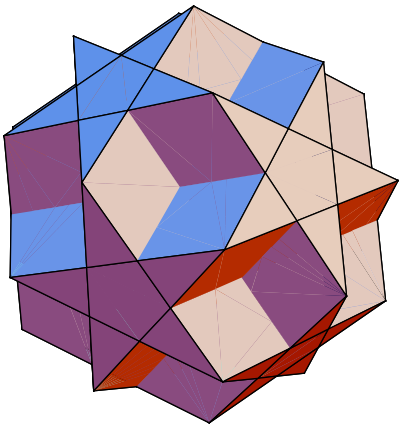


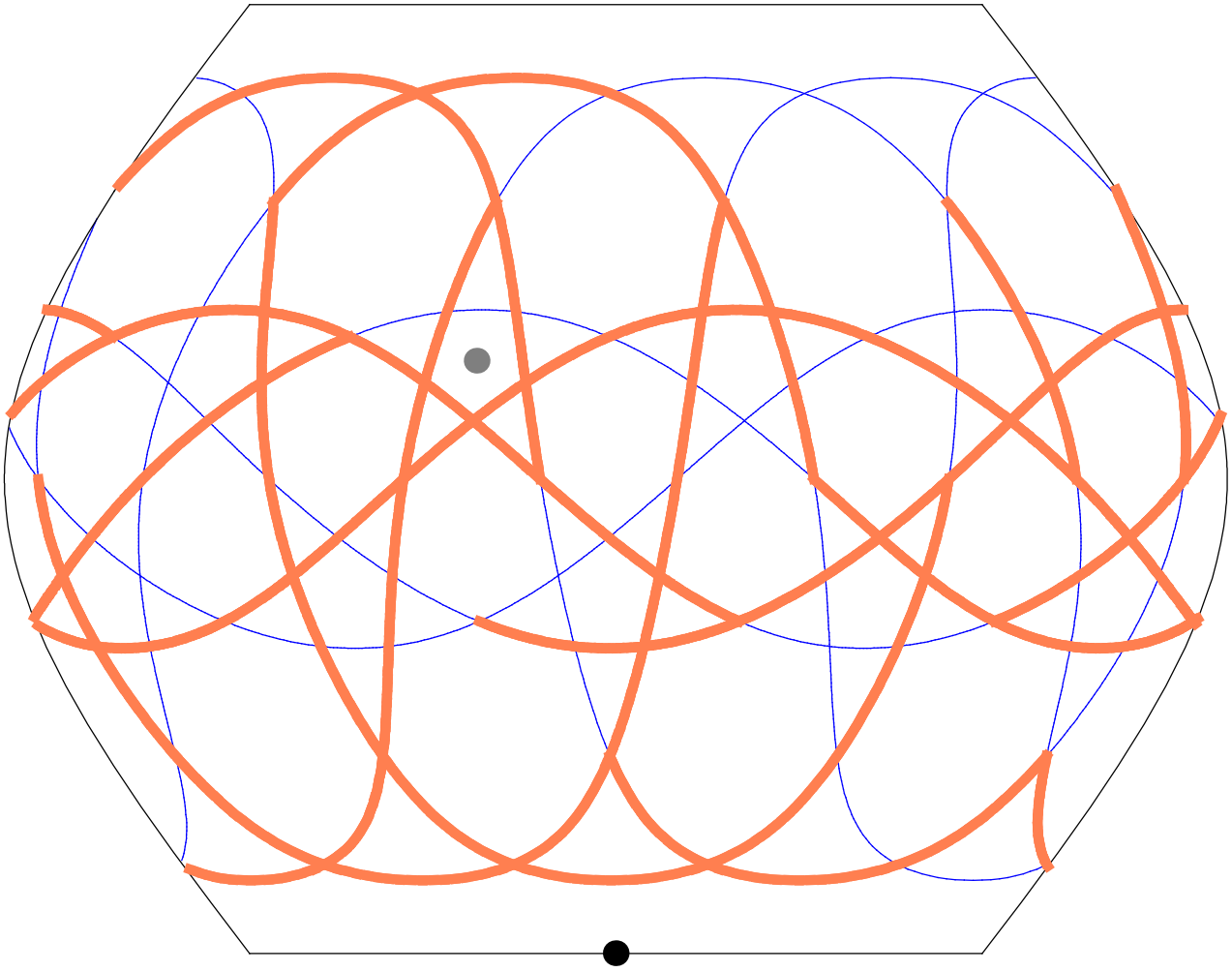


36.

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

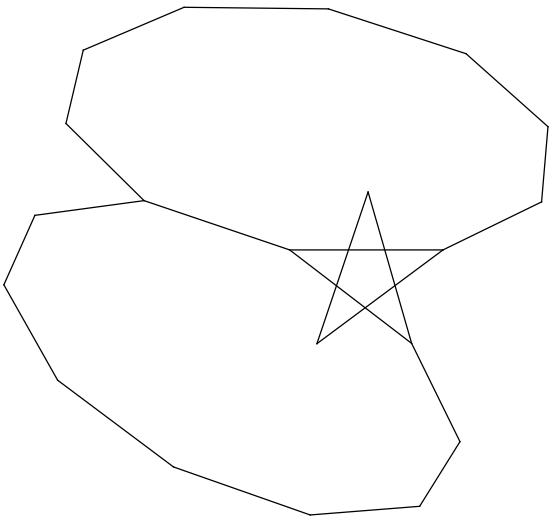


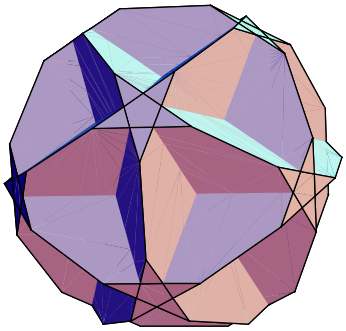


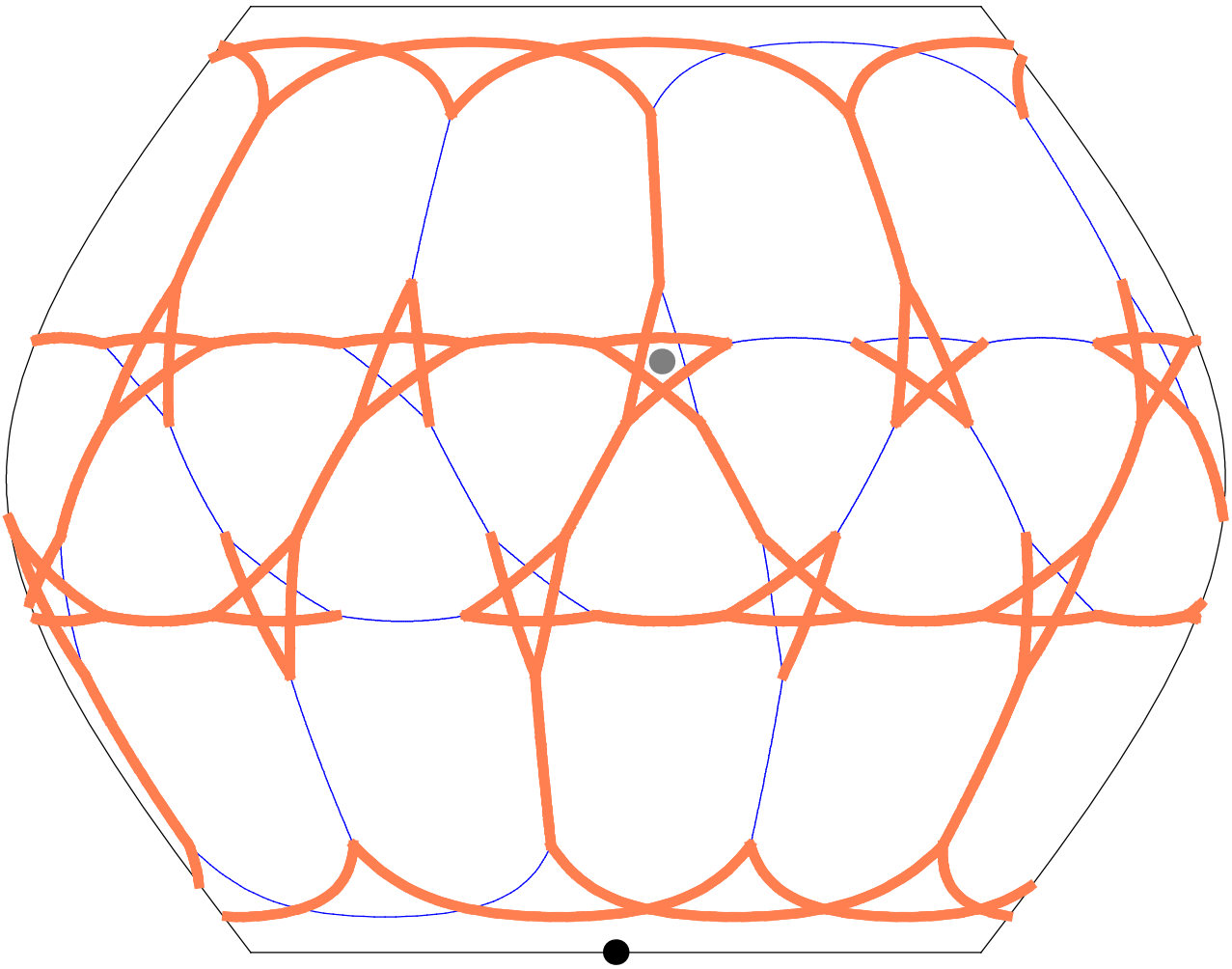


37.

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

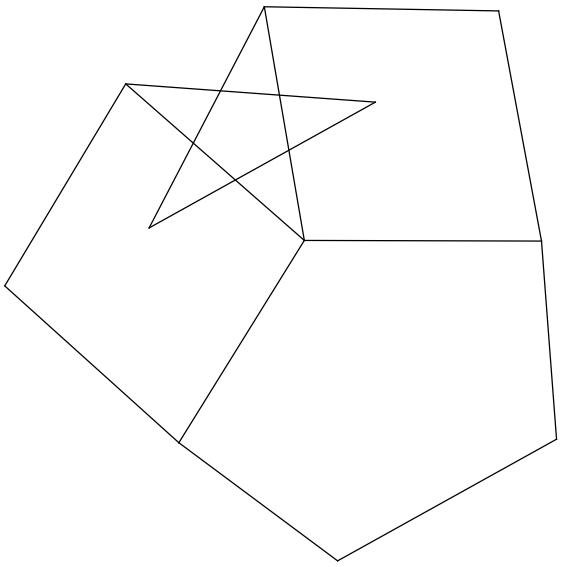


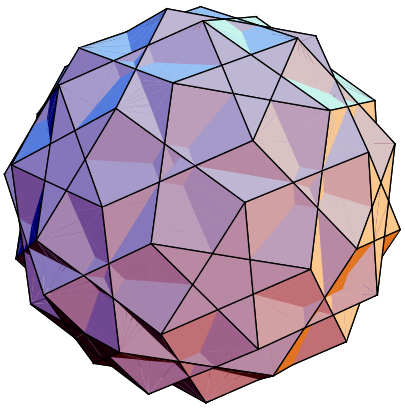


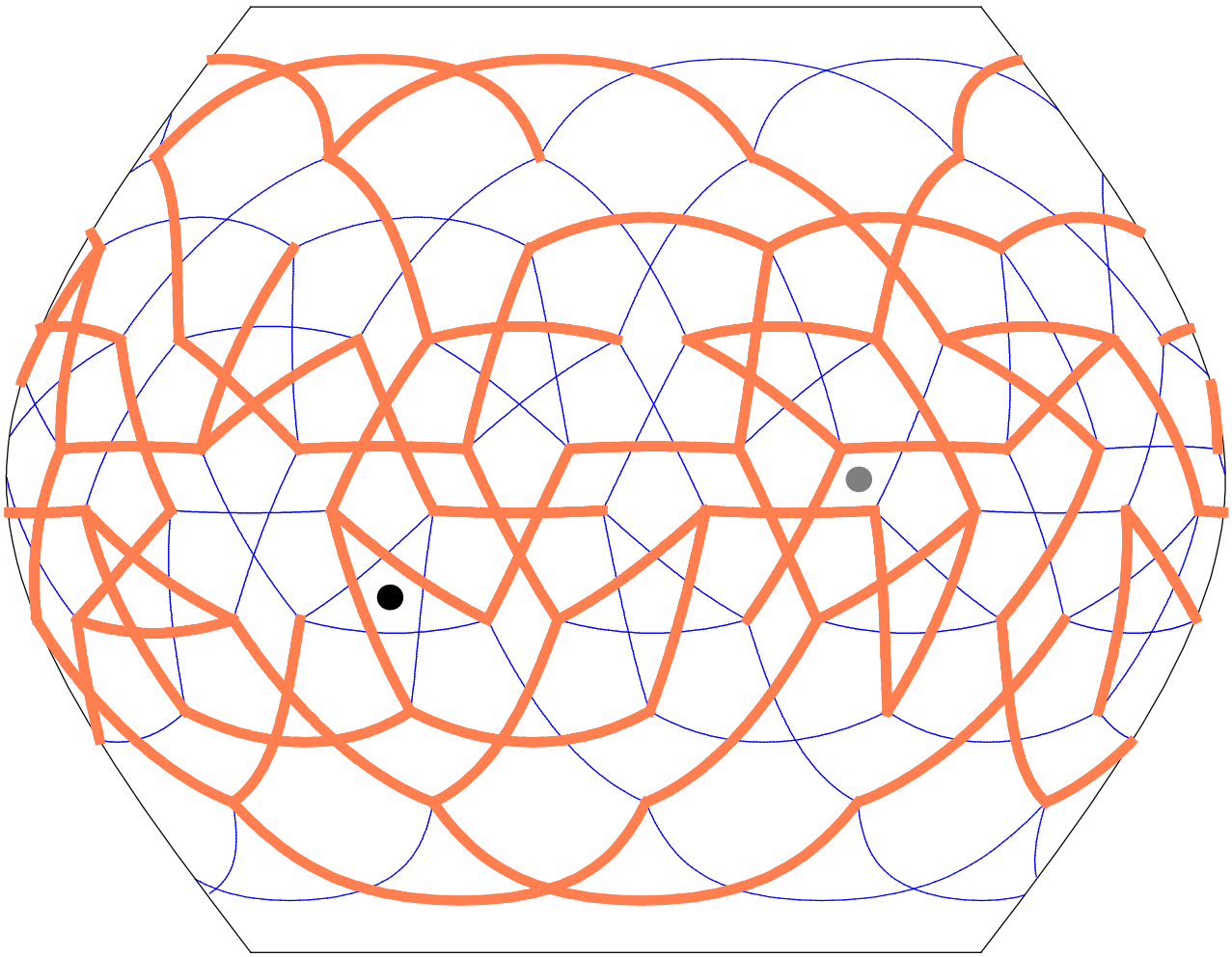


38.

`rhombidodecadodecahedron` $\{4, \frac{5}{2}, 4, 5\}$

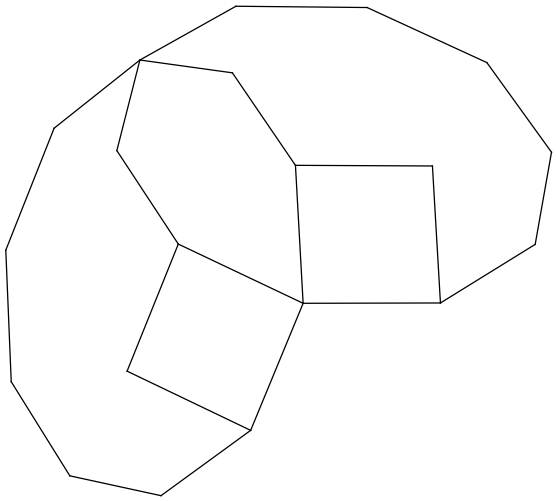


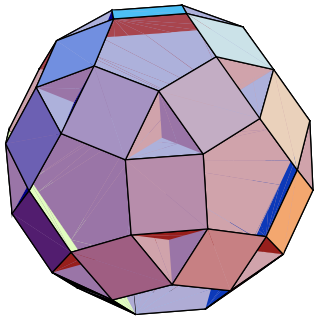


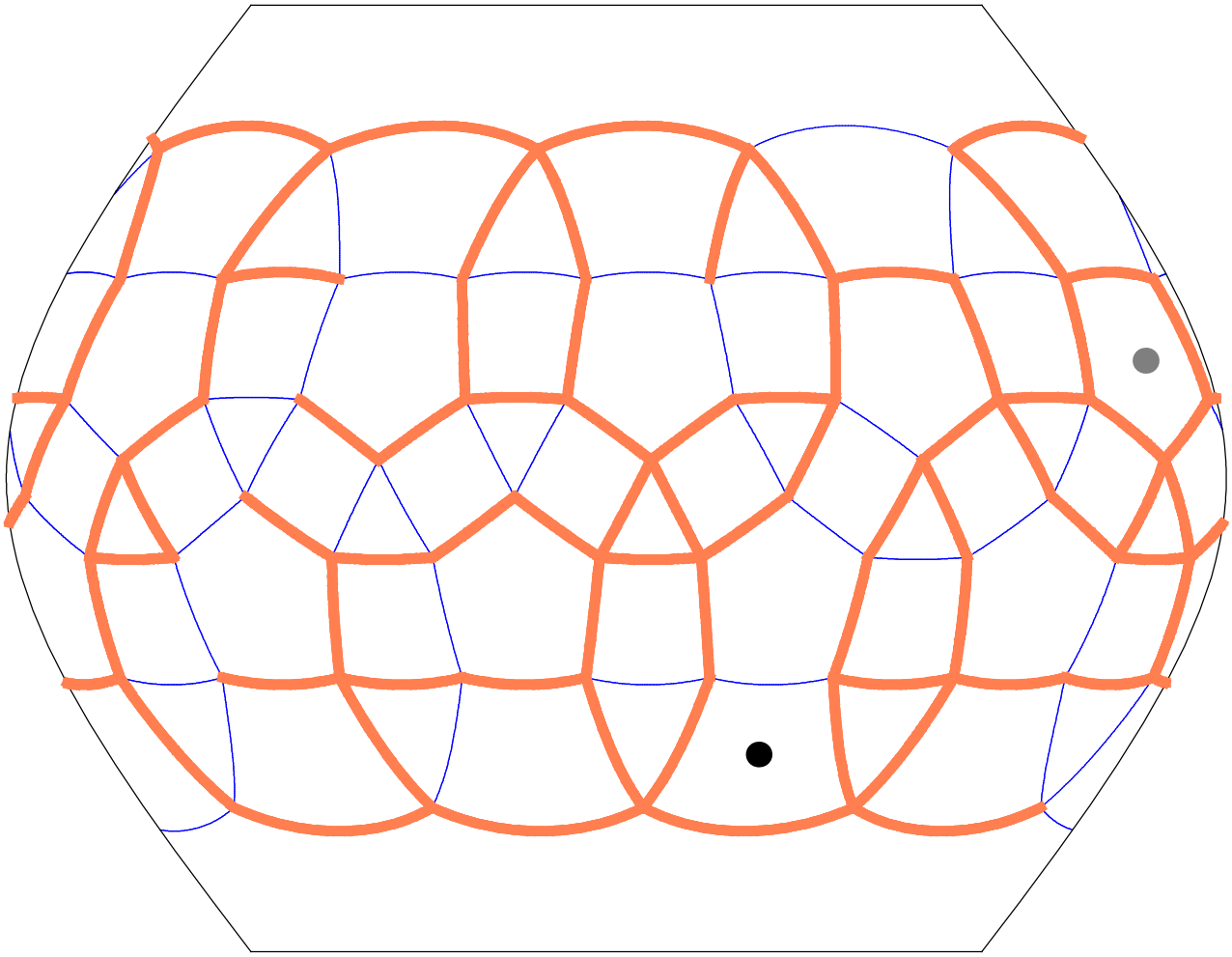


39.

`small rhombidodecahedron` $\{10, 4, \frac{10}{9}, \frac{4}{3}\}$

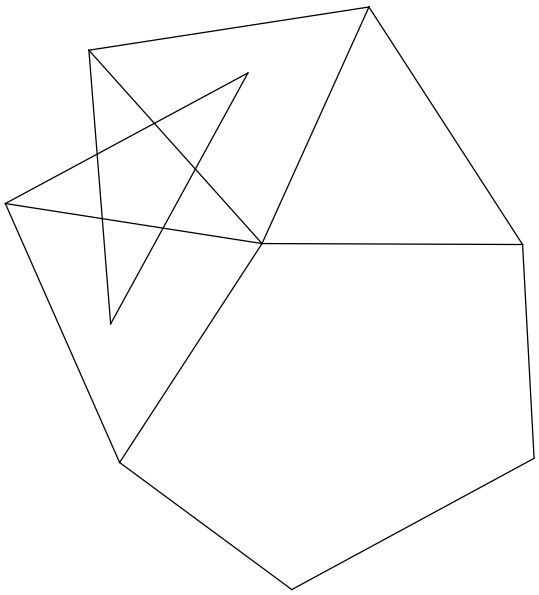


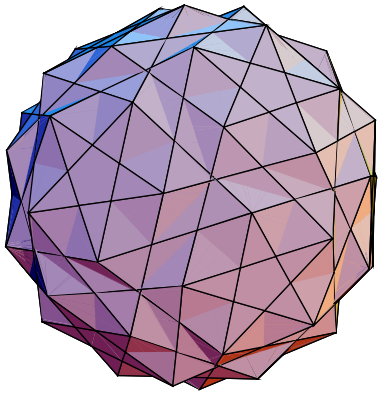


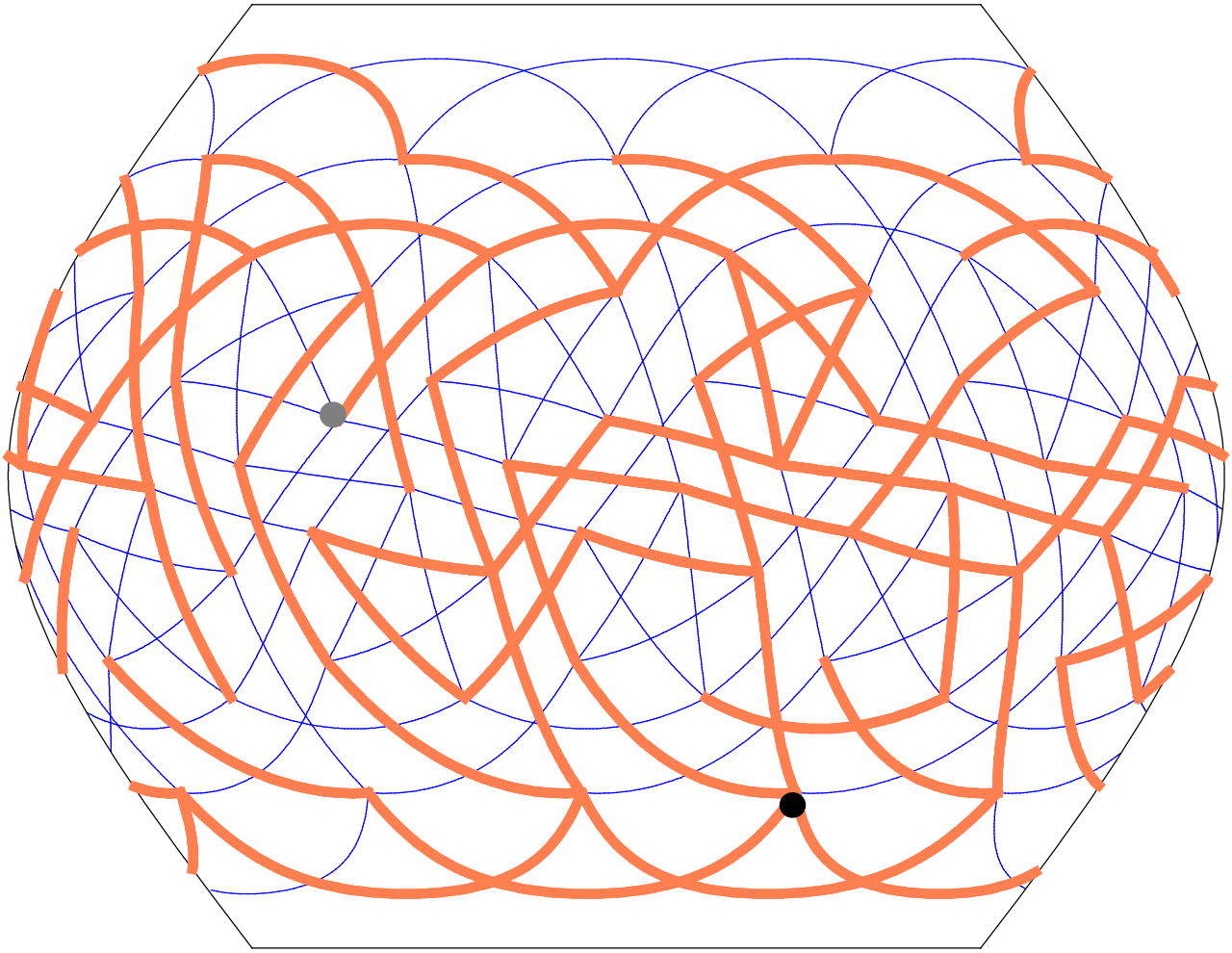


40.

`snub dodecadodecahedron` $\left\{3, 3, \frac{5}{2}, 3, 5\right\}$



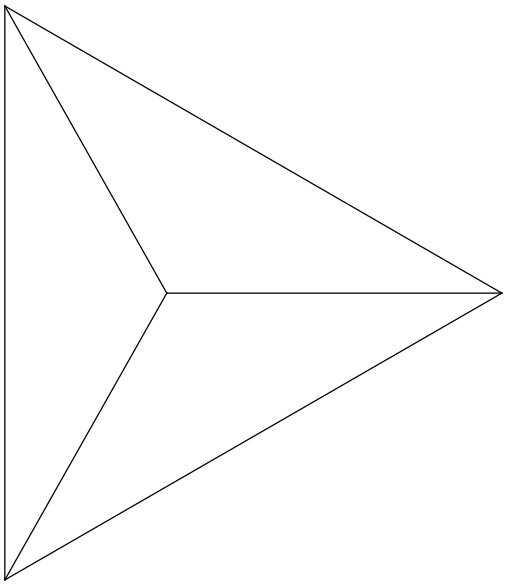


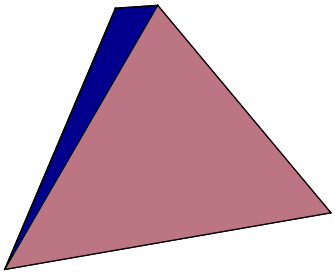


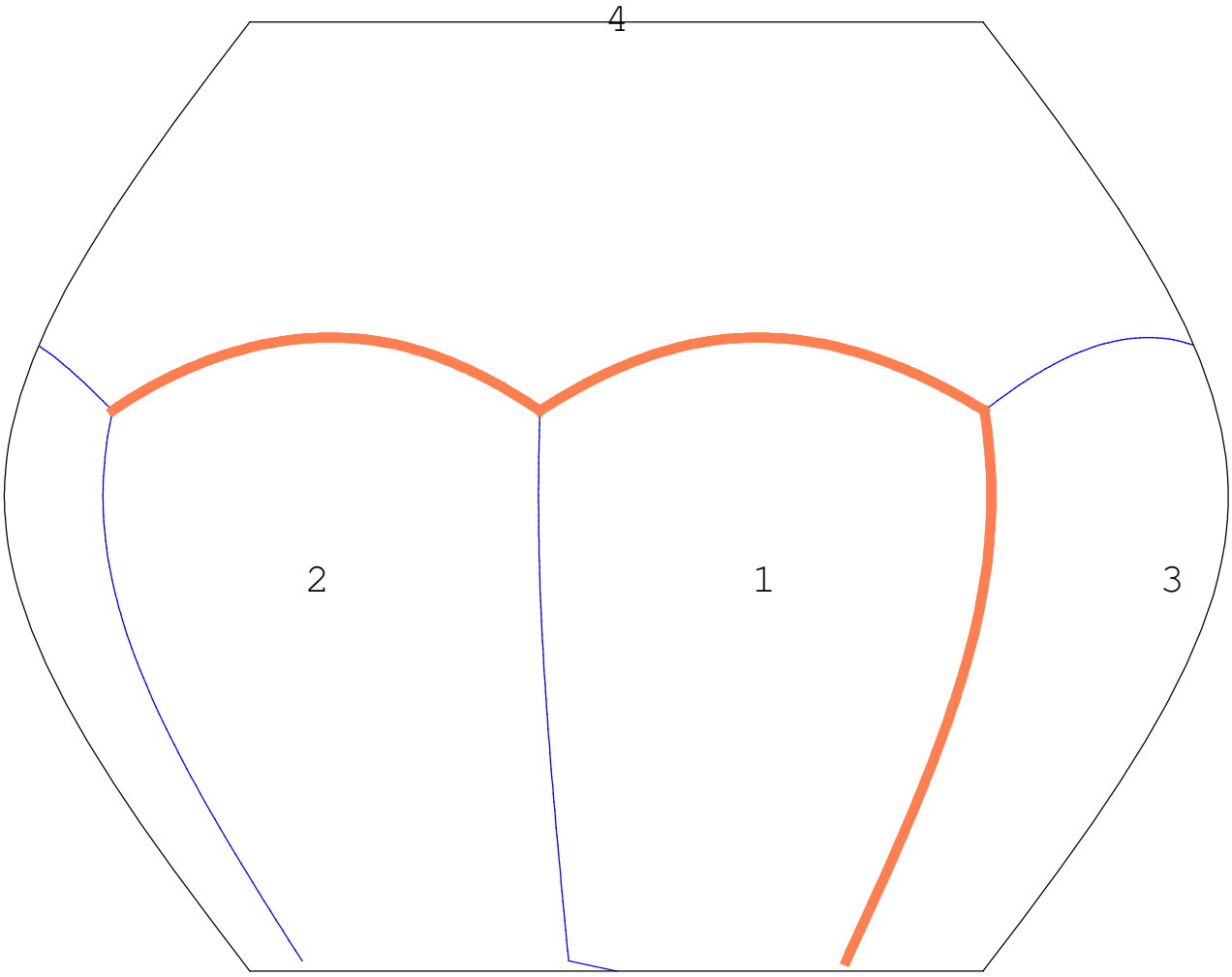
Solutions

1.

`tetrahedron` {3, 3, 3}

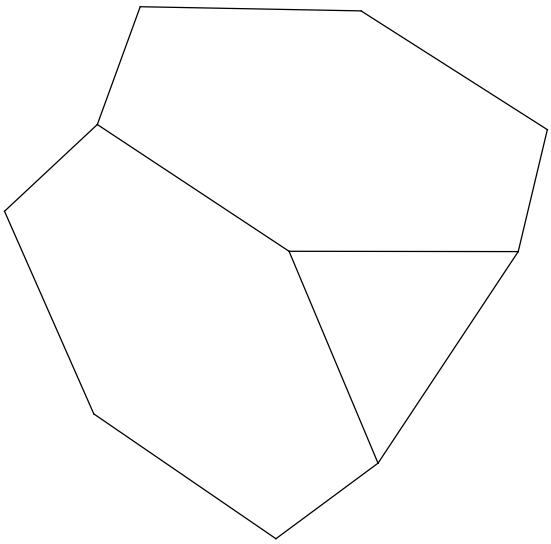


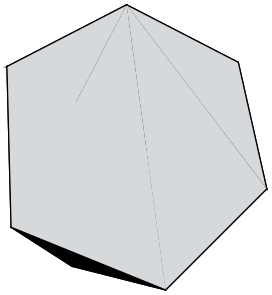


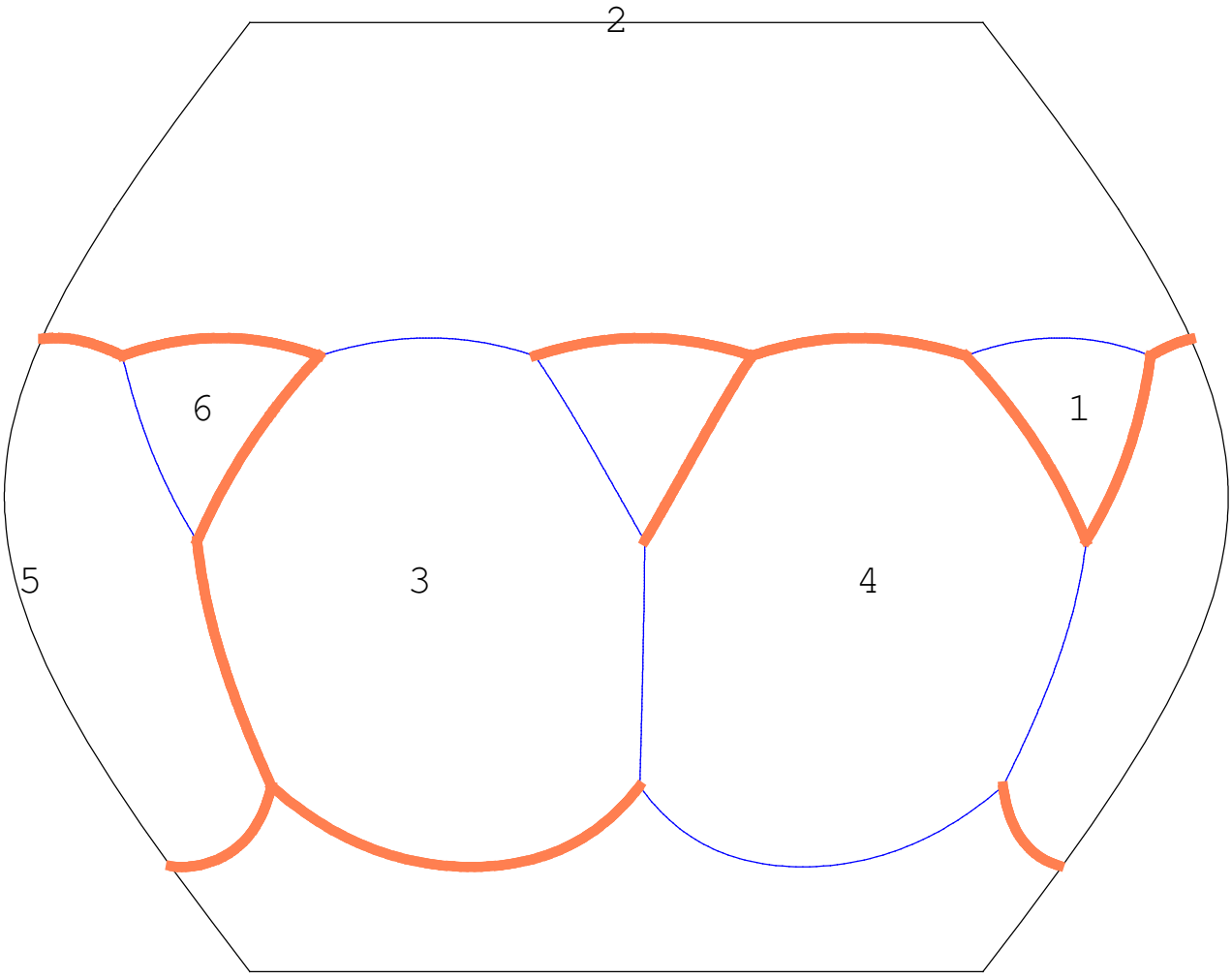


2.

`truncated tetrahedron` {6, 6, 3}

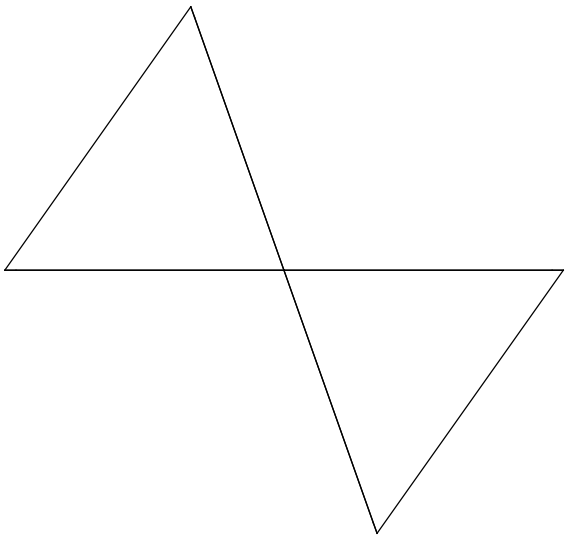


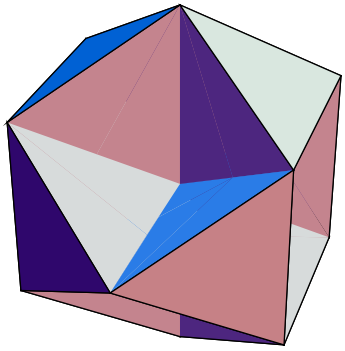


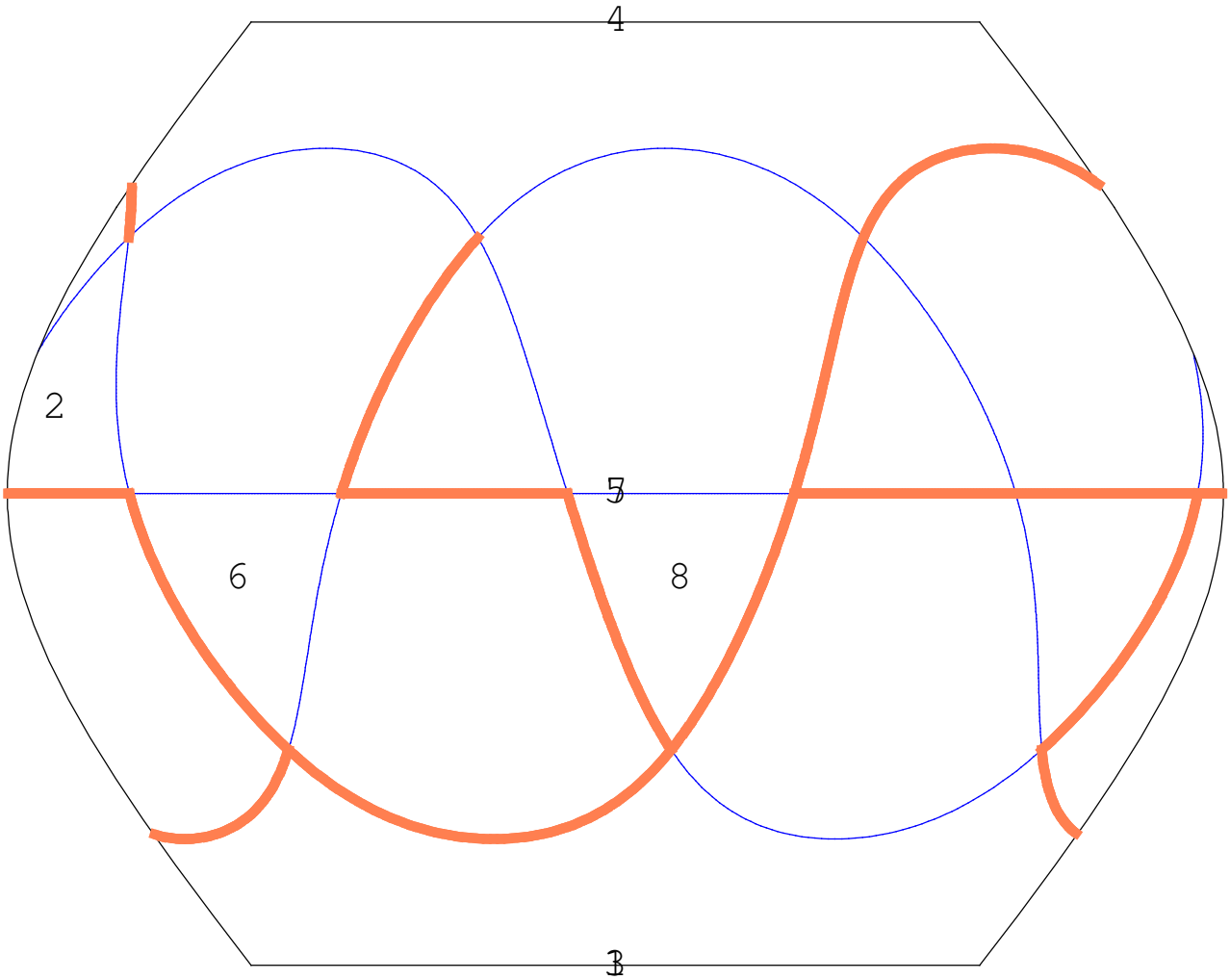


3.

octahemioctahedron $\{6, \frac{3}{2}, 6, 3\}$

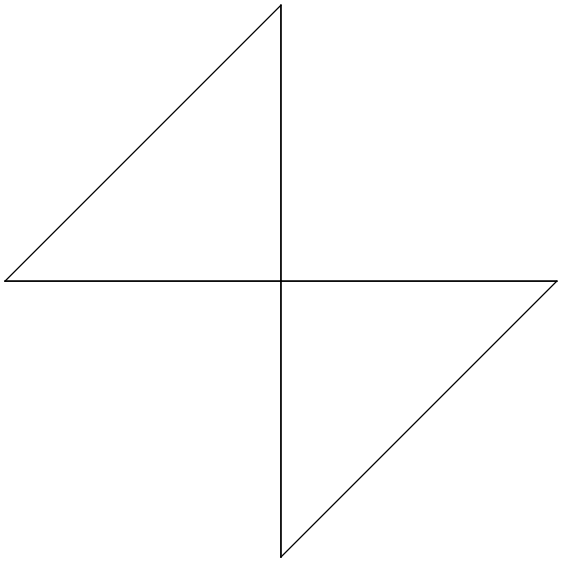


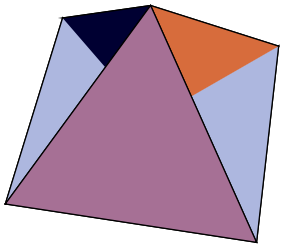


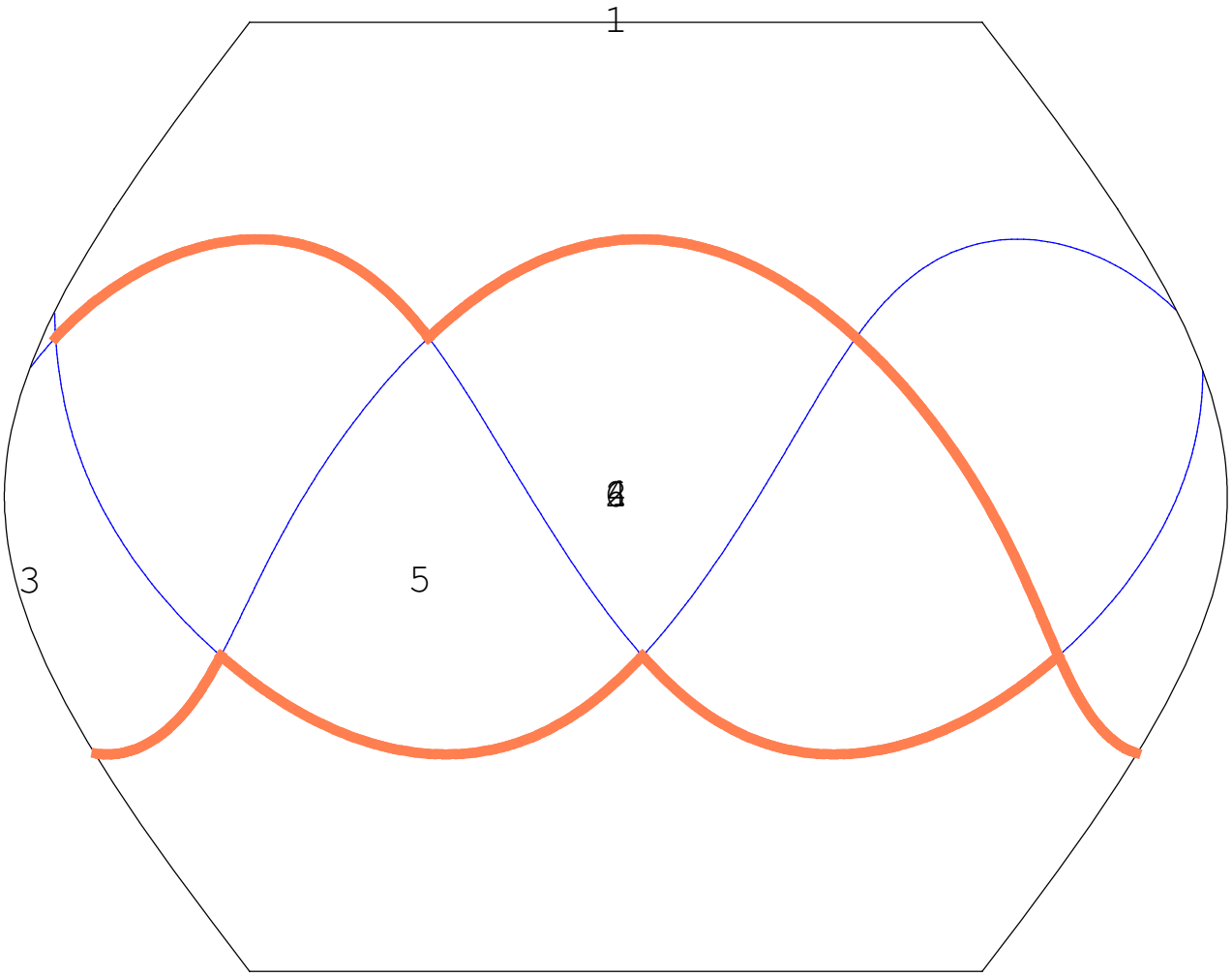


4.

`tetrahemihexahedron` $\{4, \frac{3}{2}, 4, 3\}$

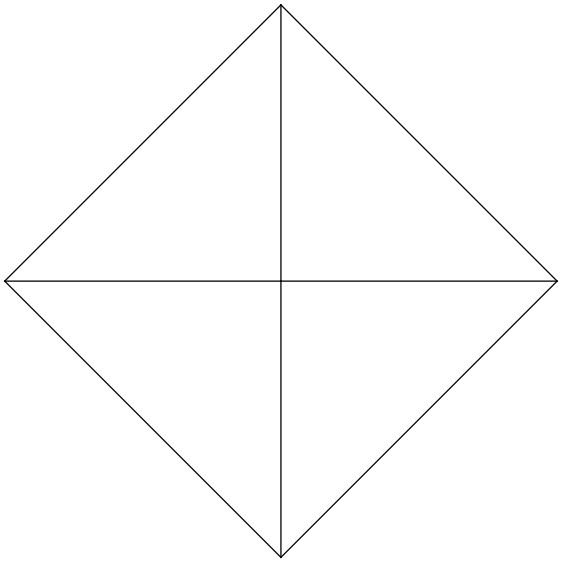


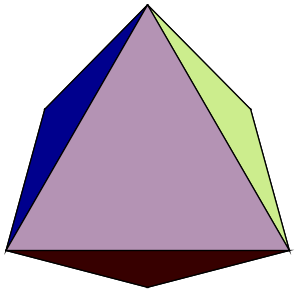


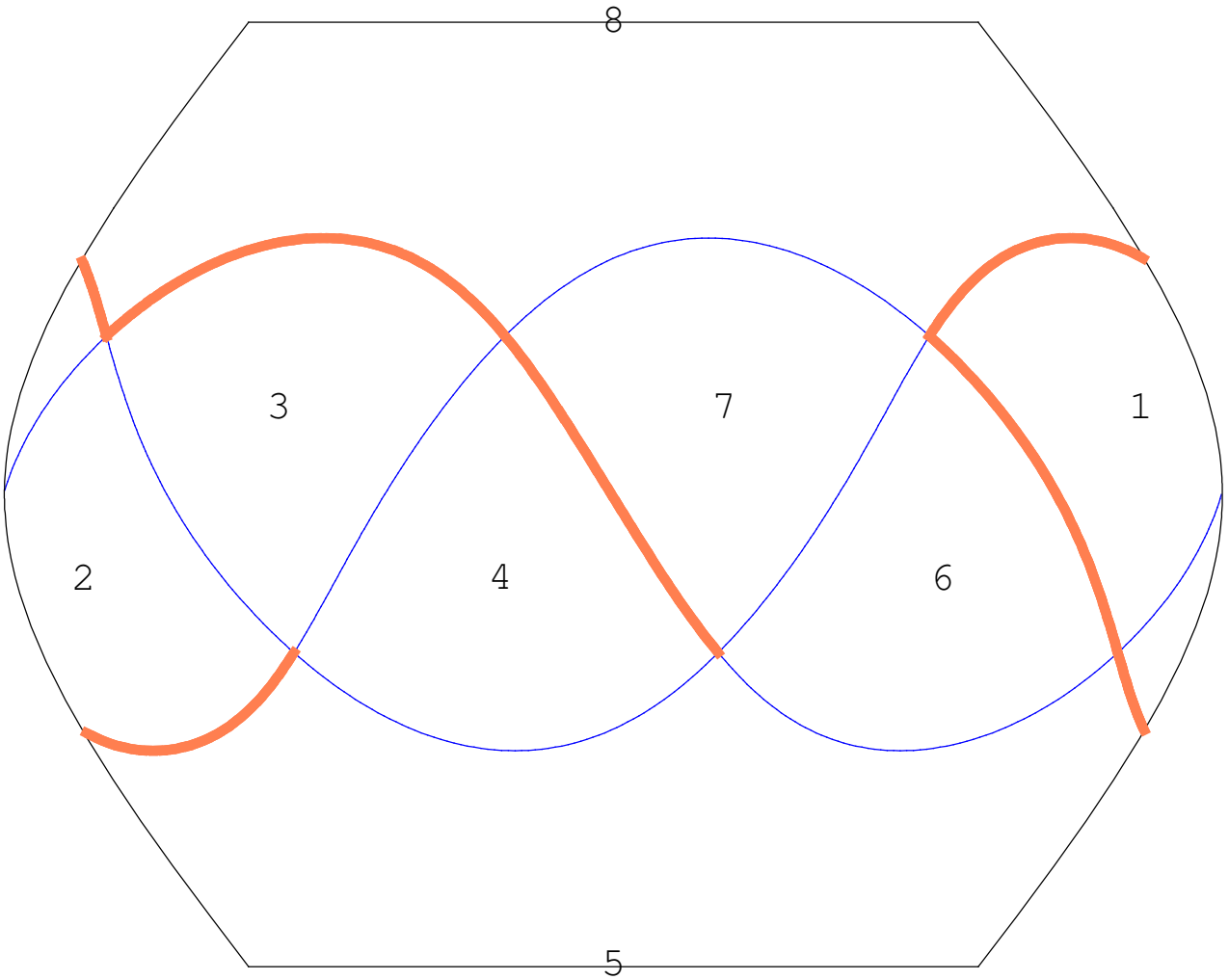


5.

octahedron {3, 3, 3, 3}

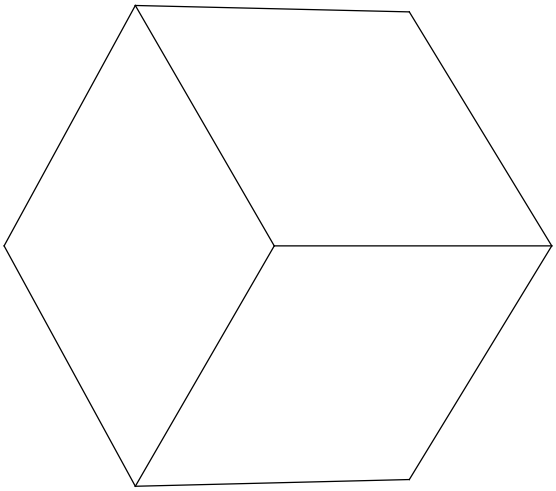


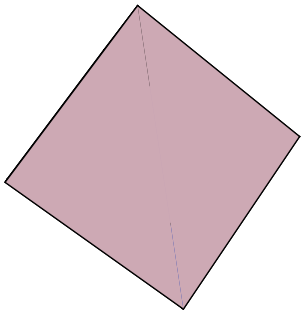


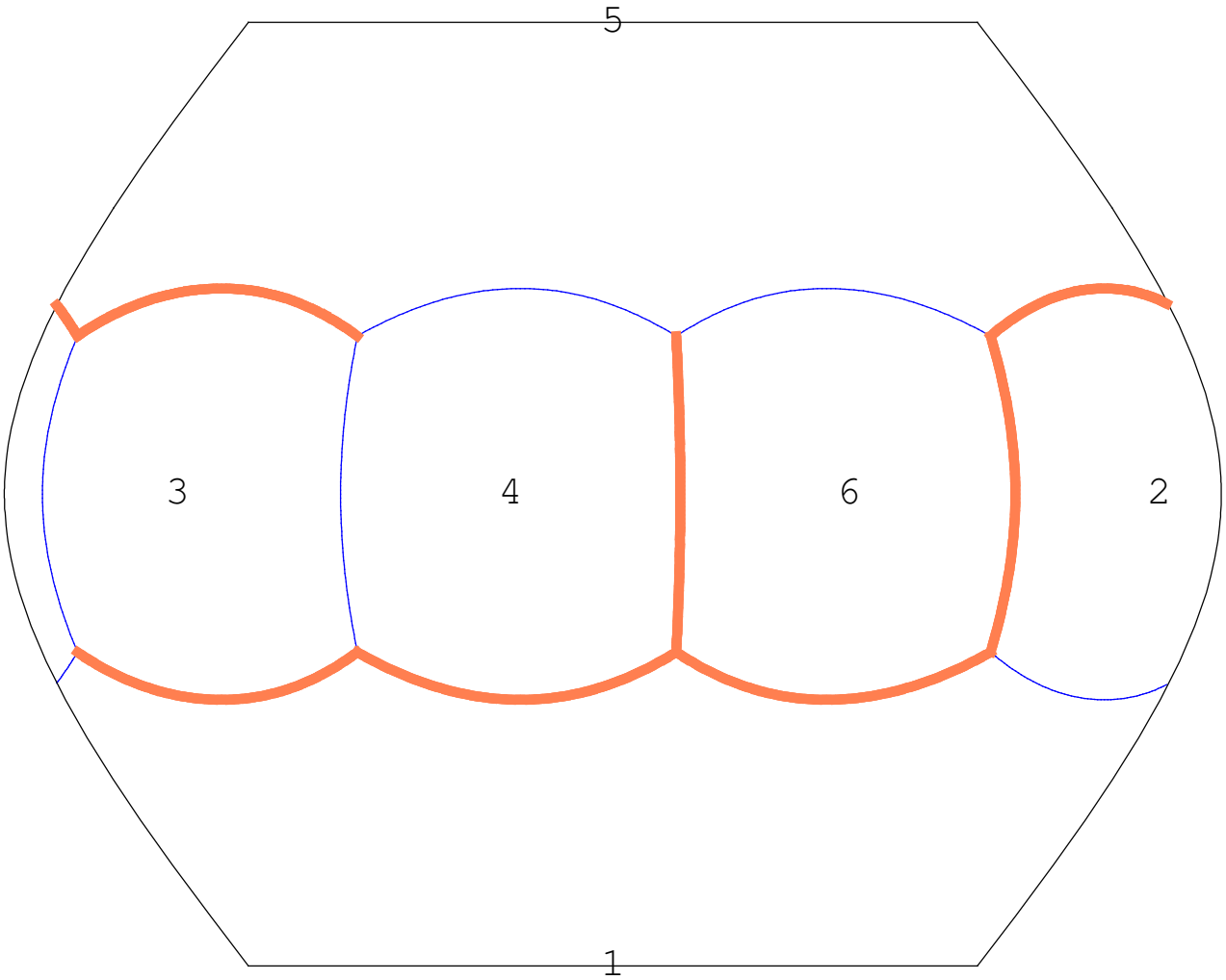


6.

cube {4, 4, 4}

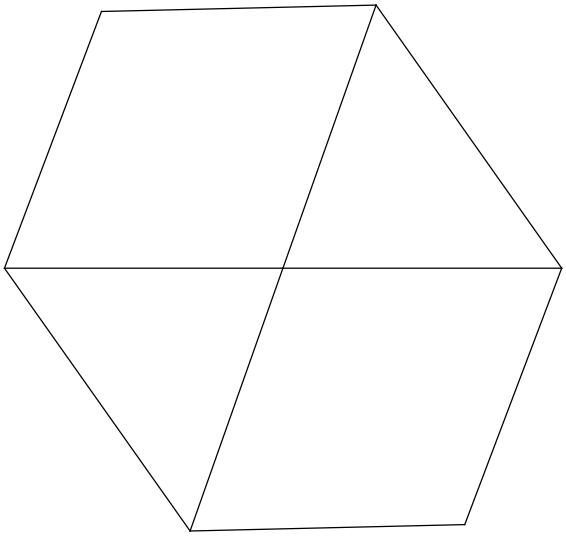


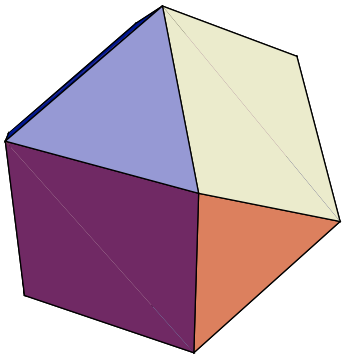


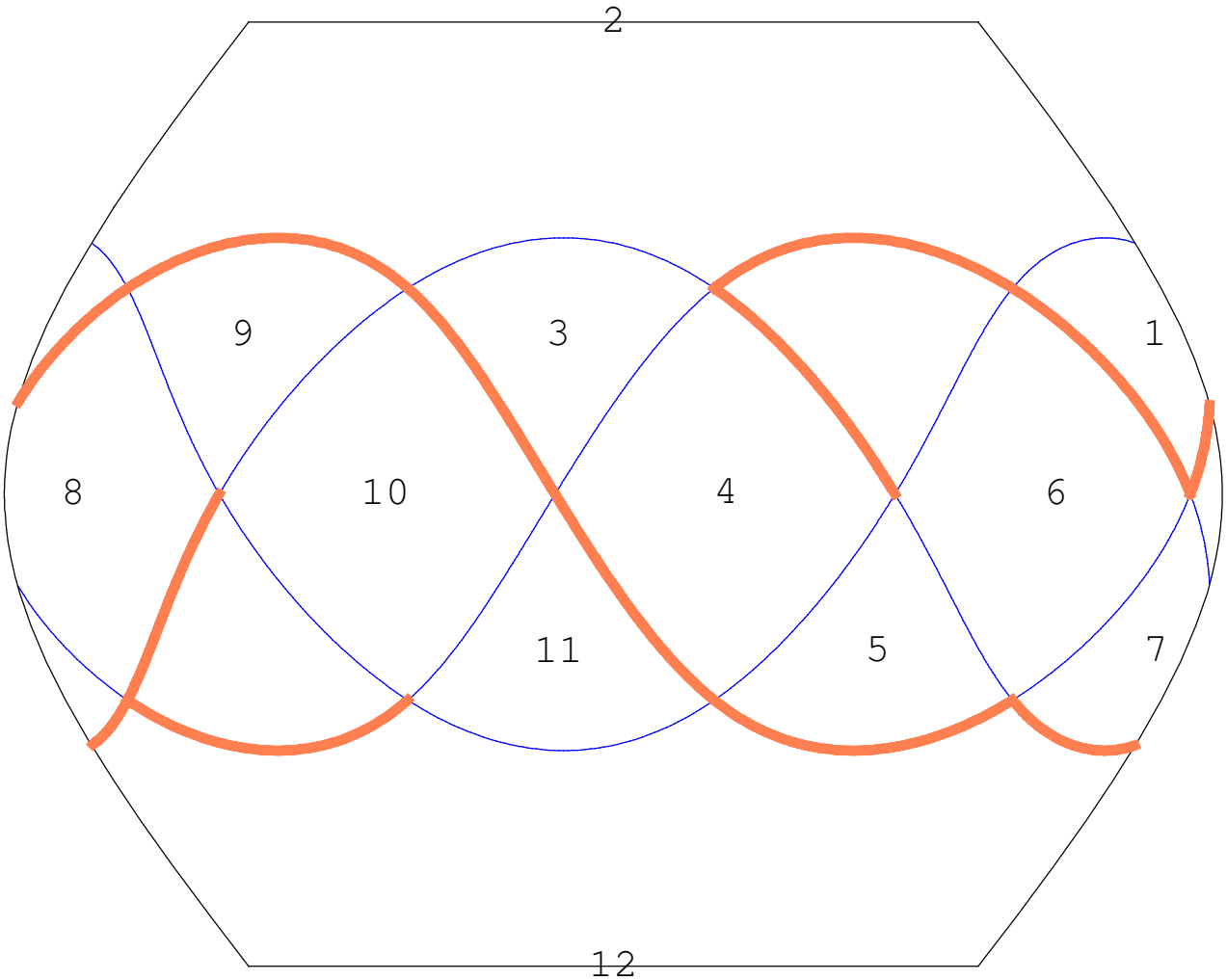


7.

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

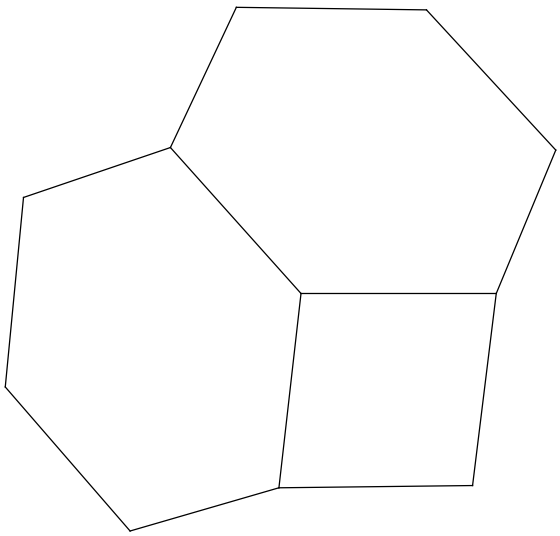


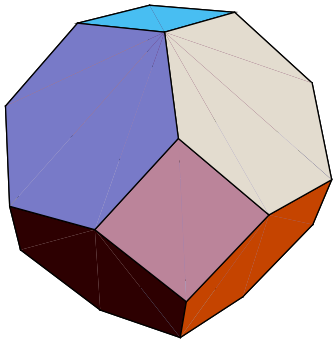


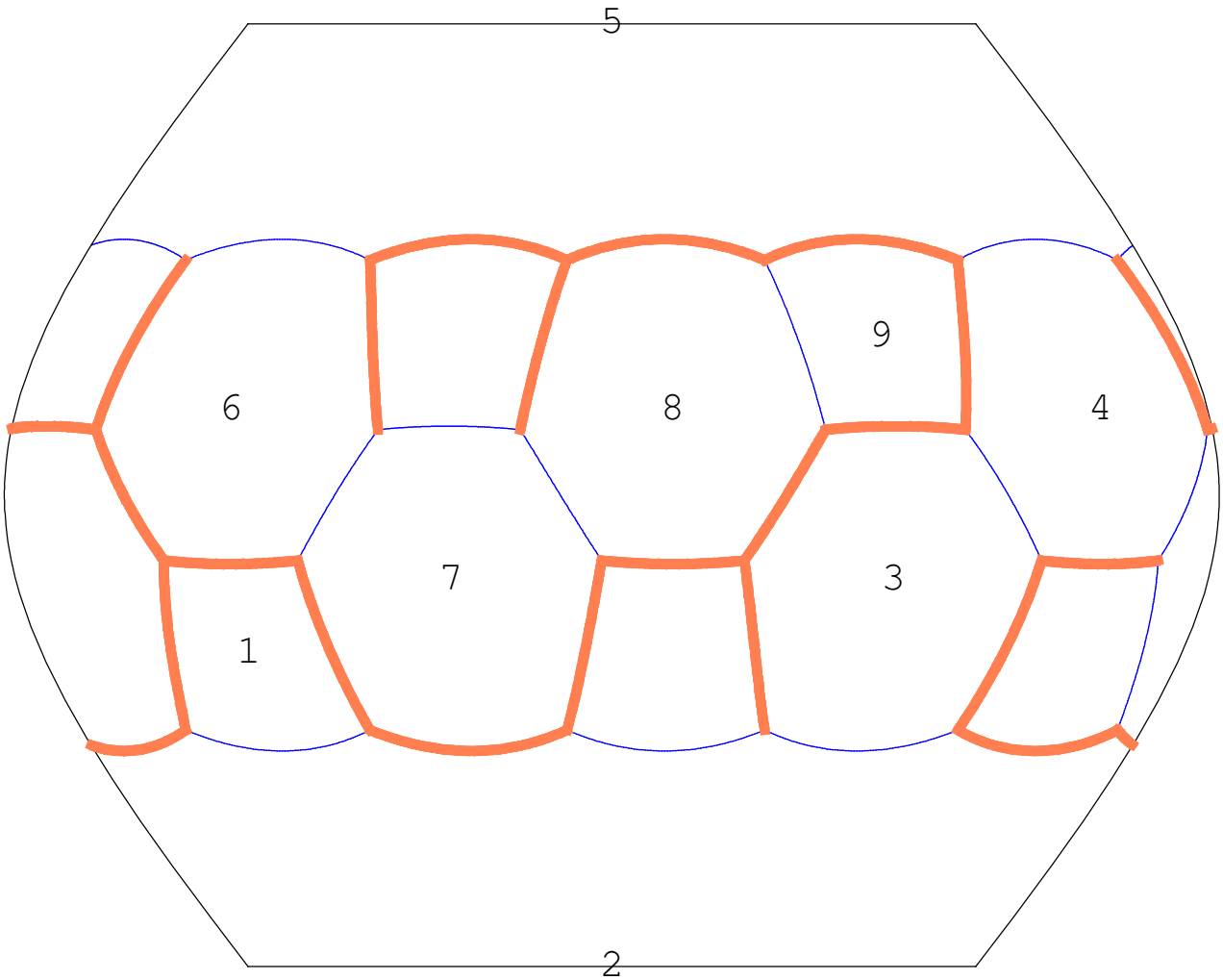


8.

`truncated octahedron` {6, 6, 4}

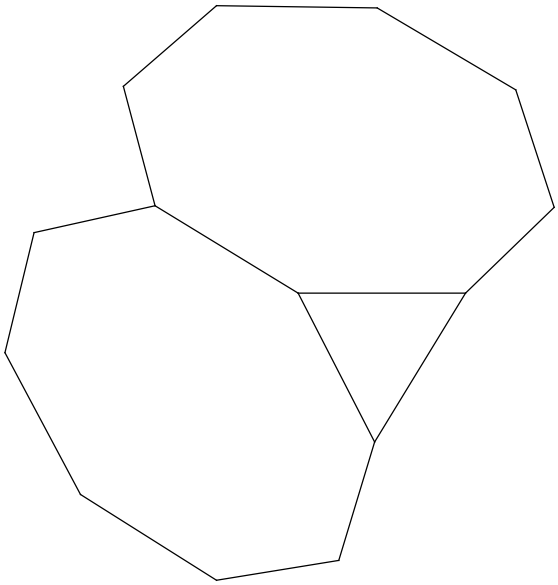


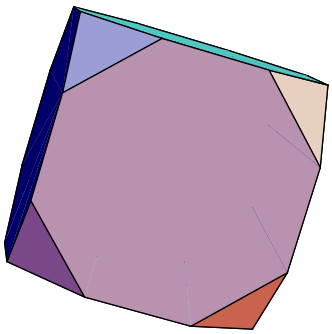


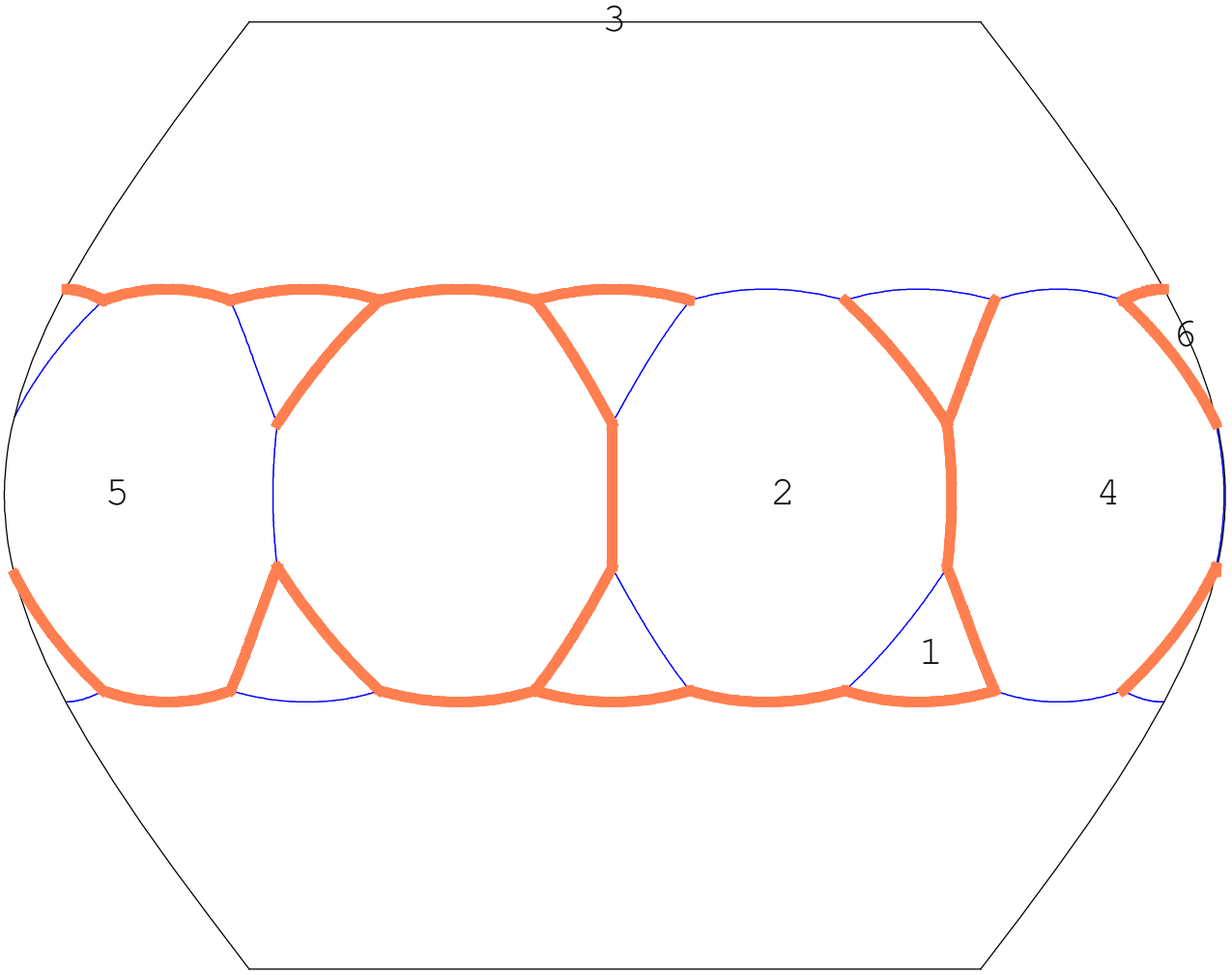


9.

`truncated cube` {8, 8, 3}

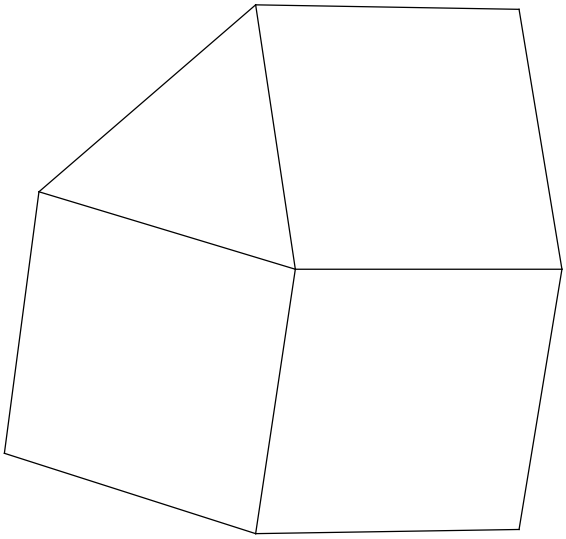


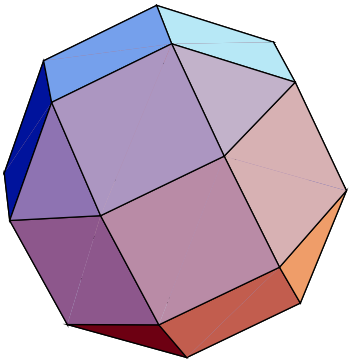


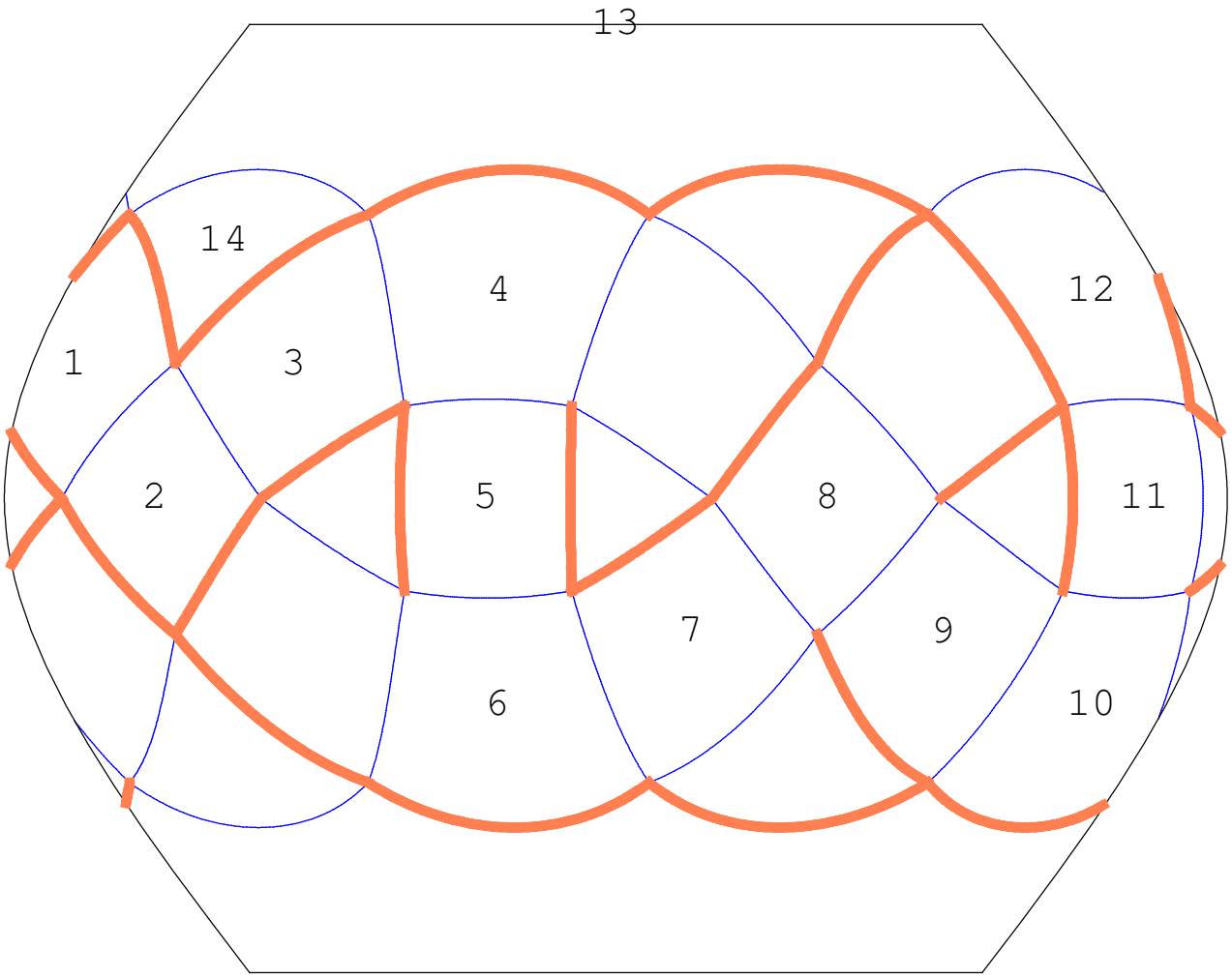


10.

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

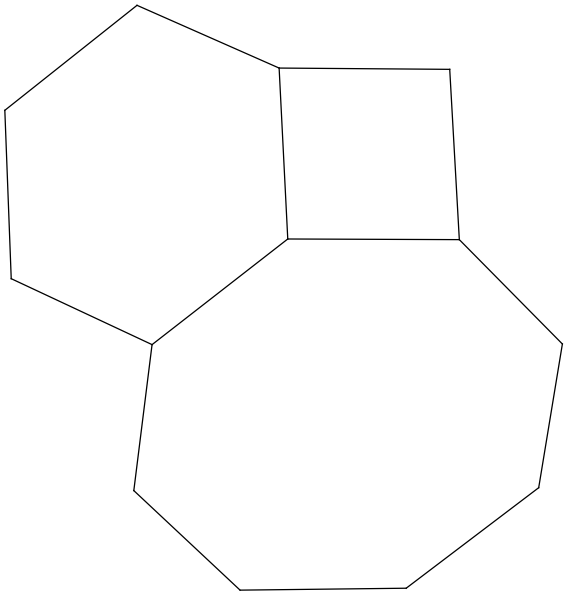


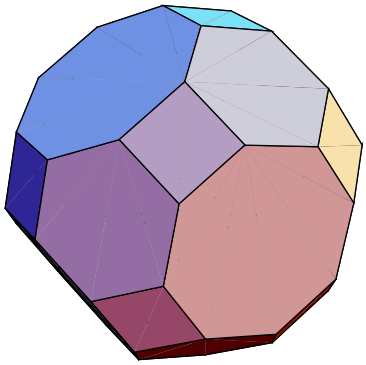


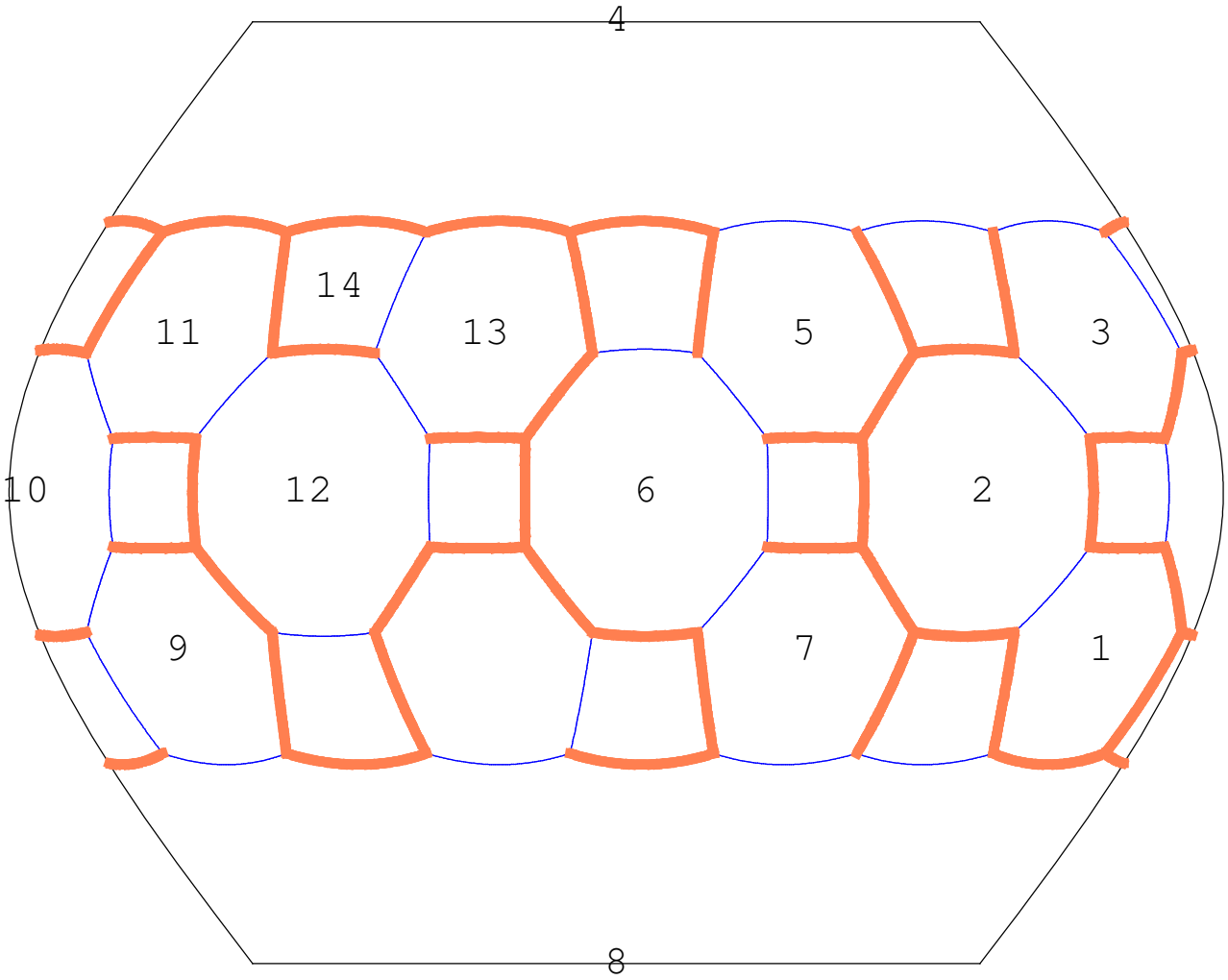


11.

truncated cuboctahedron {4, 6, 8}

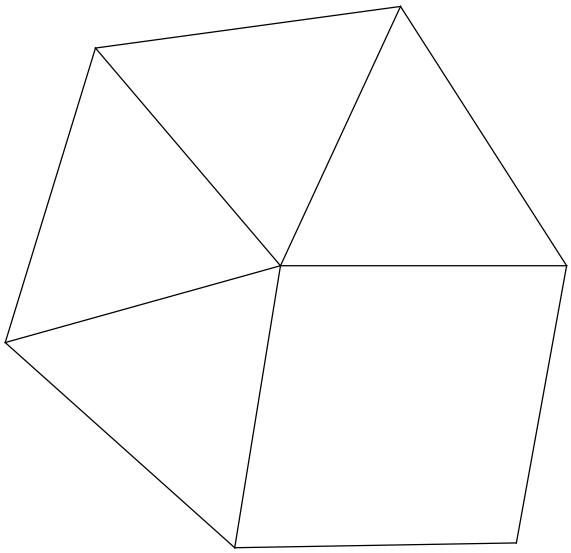


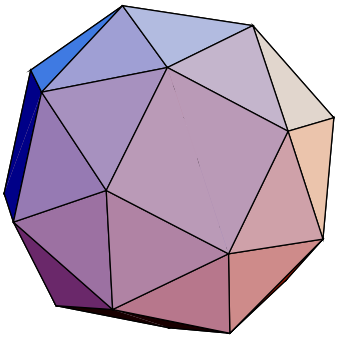


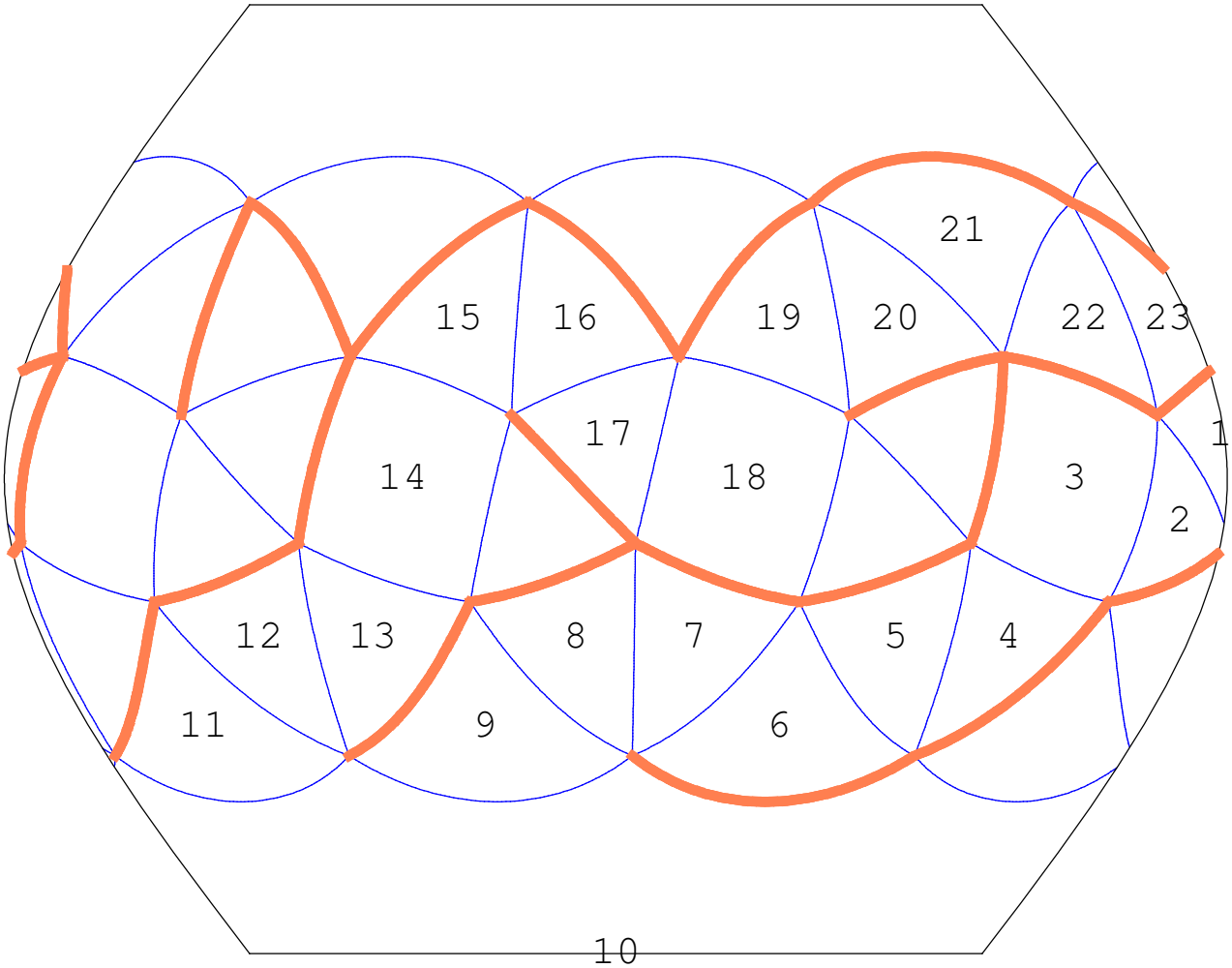


12.

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

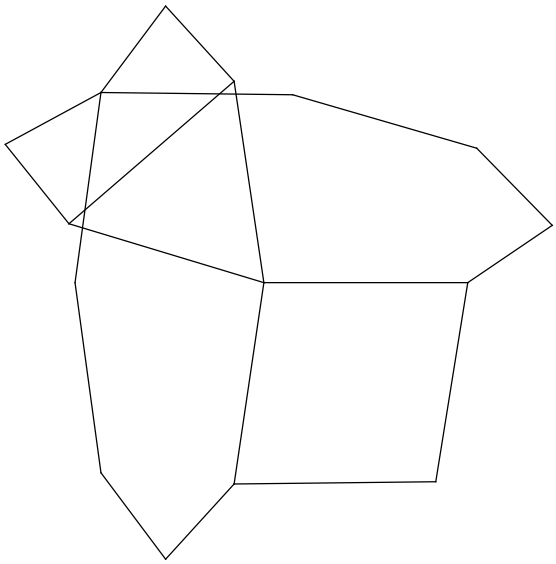


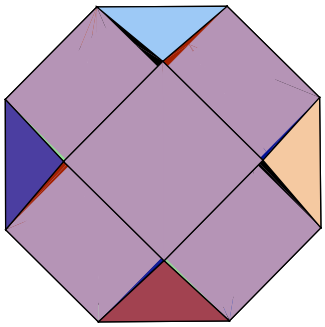


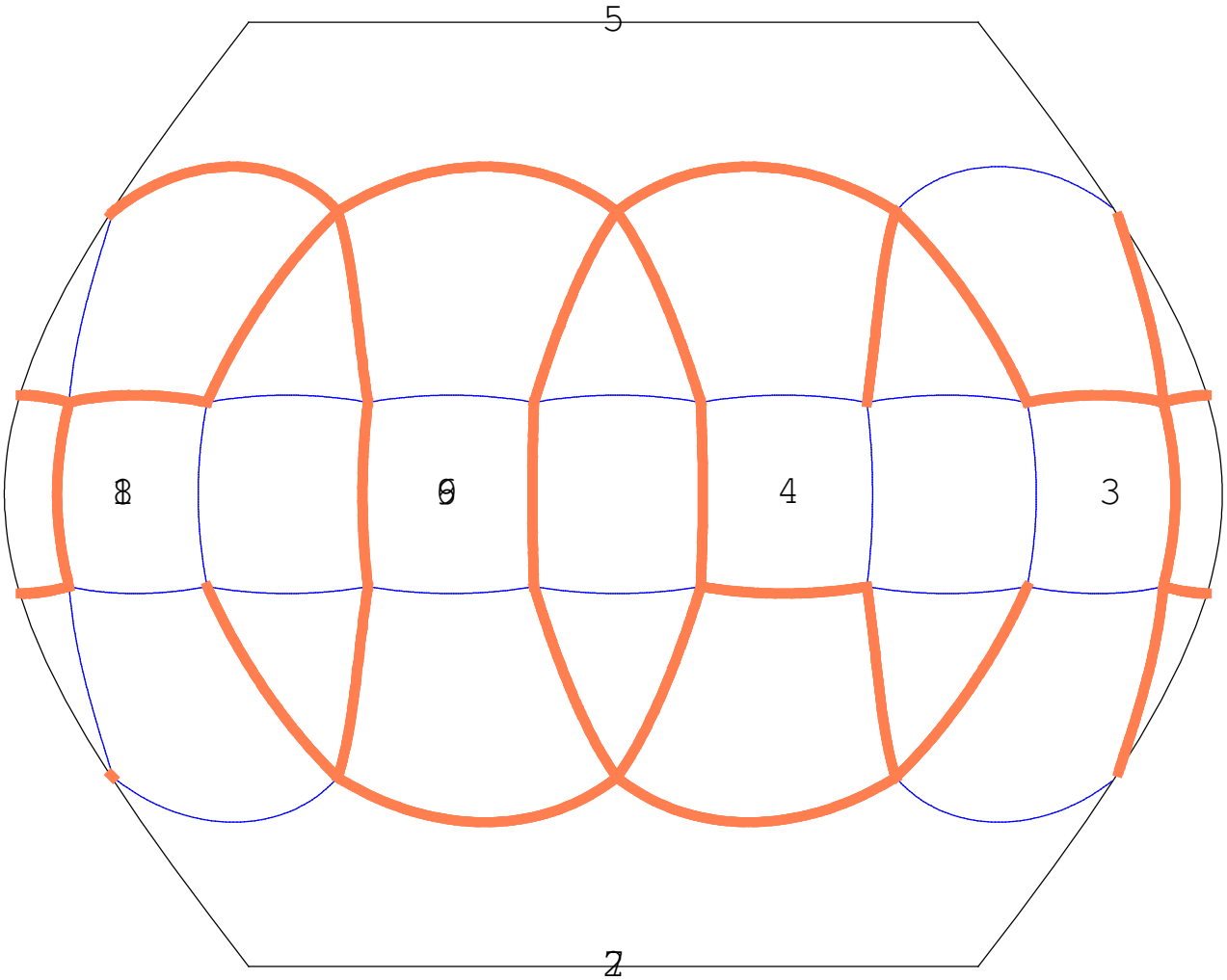


13.

`small cubicuboctahedron` $\{8, \frac{3}{2}, 8, 4\}$

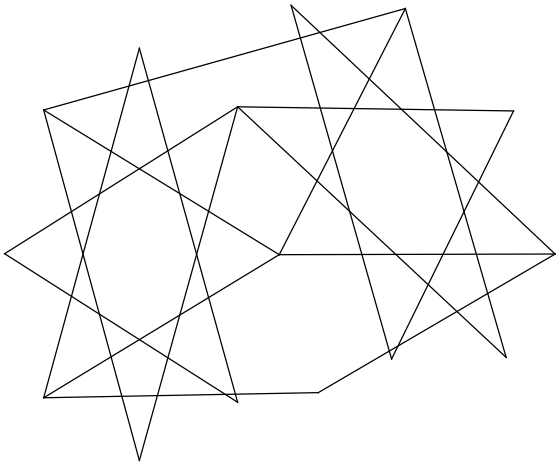


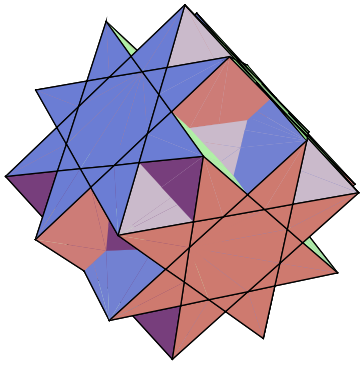


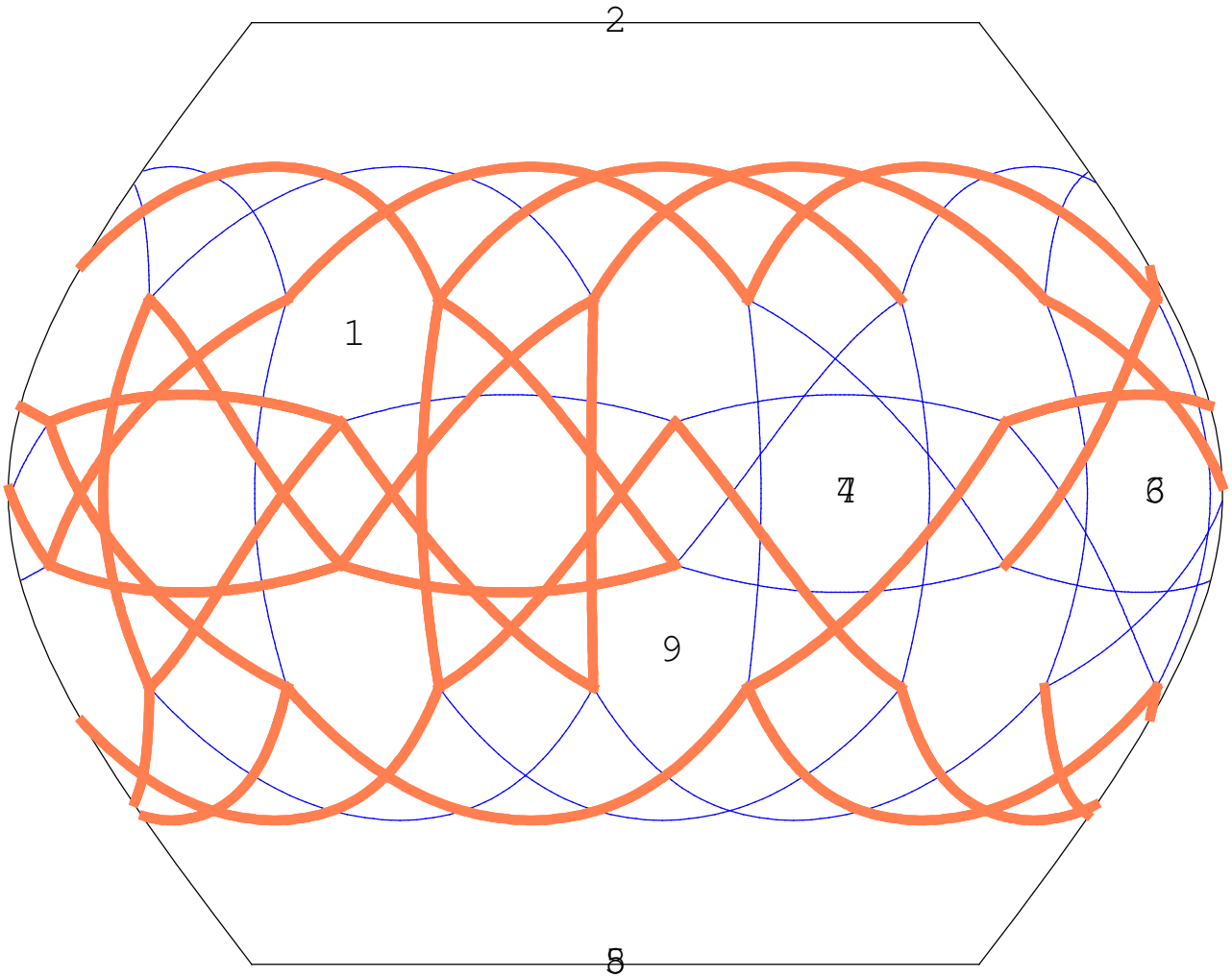


14.

great cubicuboctahedron $\{\frac{8}{3}, 3, \frac{8}{3}, 4\}$

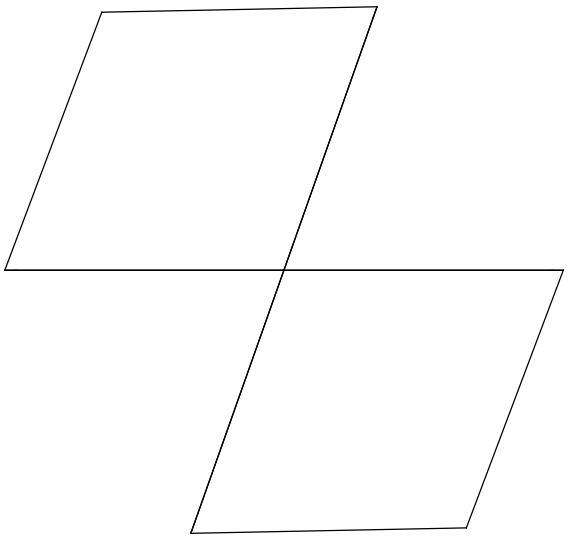


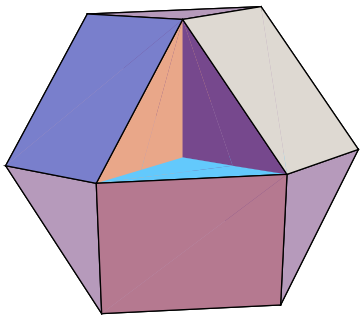


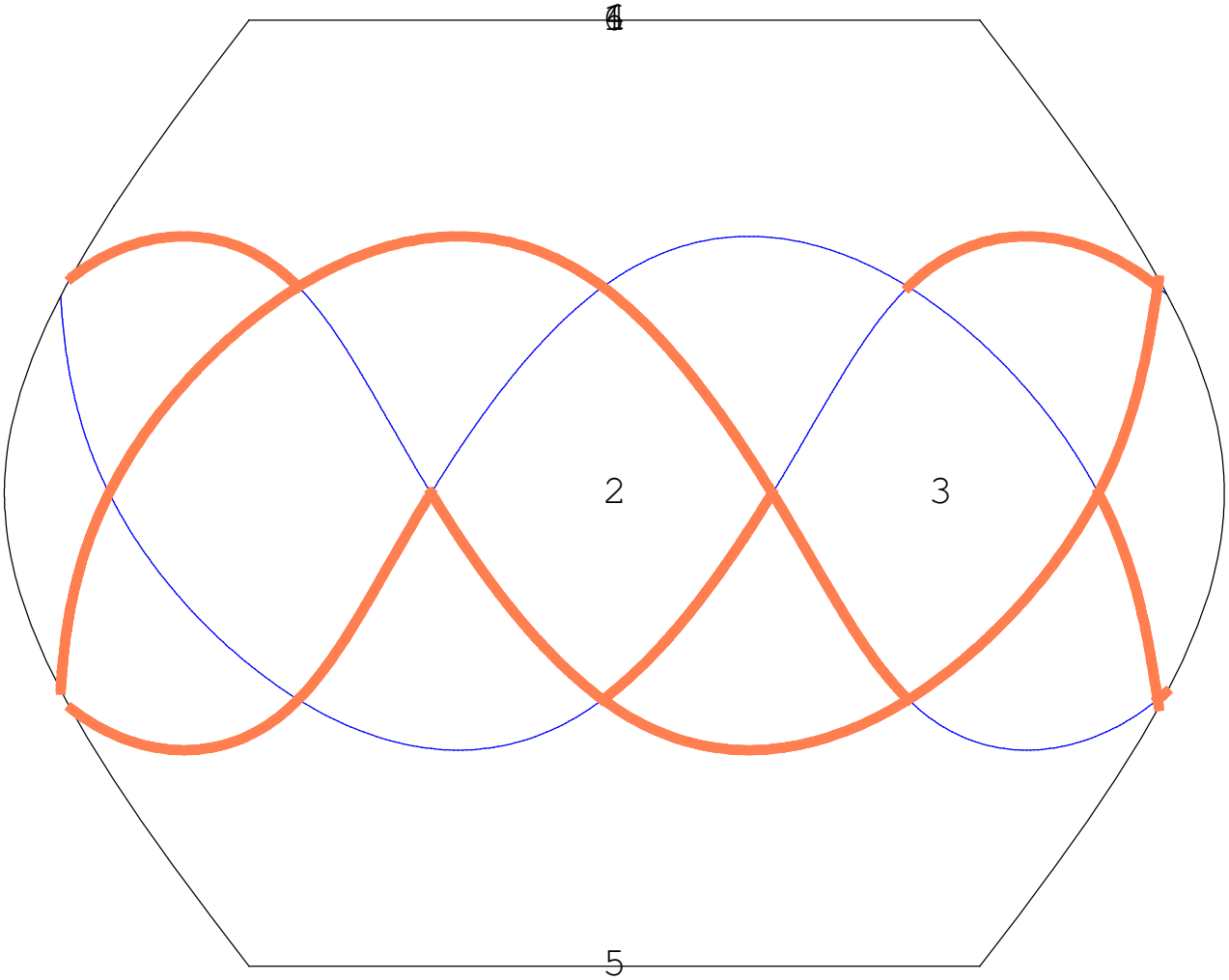


15.

`cubohemioctahedron` $\{6, \frac{4}{3}, 6, 4\}$

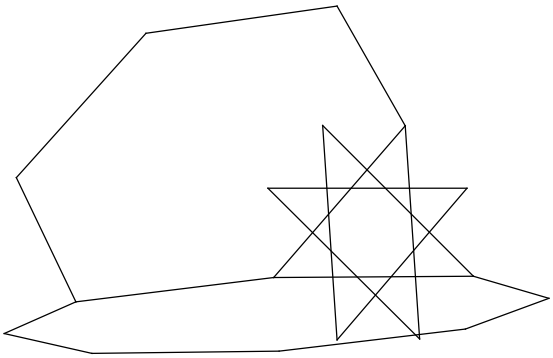


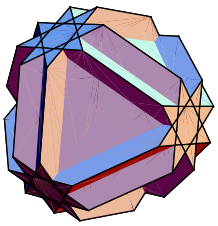


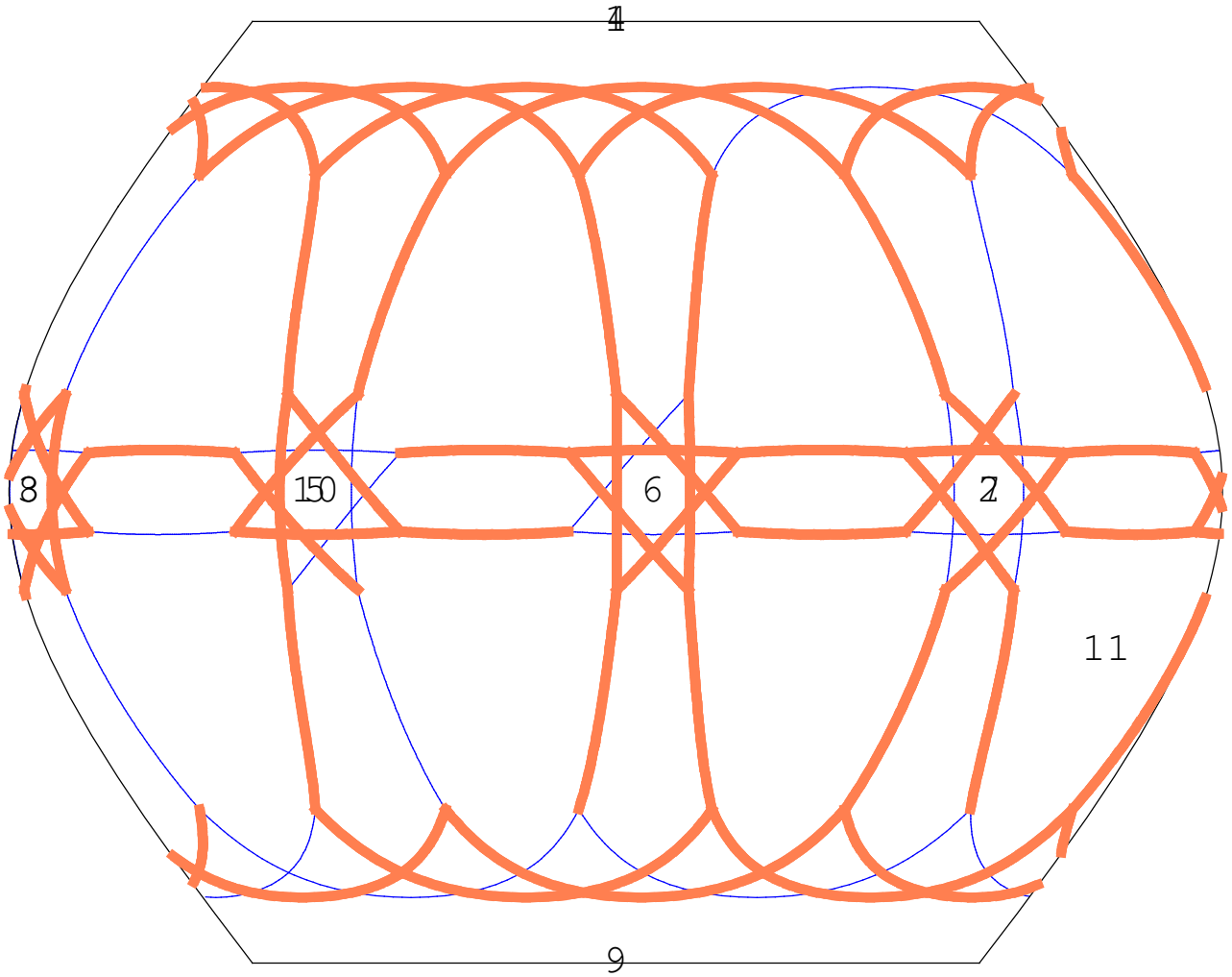


16.

`cubitruncated cuboctahedron` $\{\frac{8}{3}, 6, 8\}$

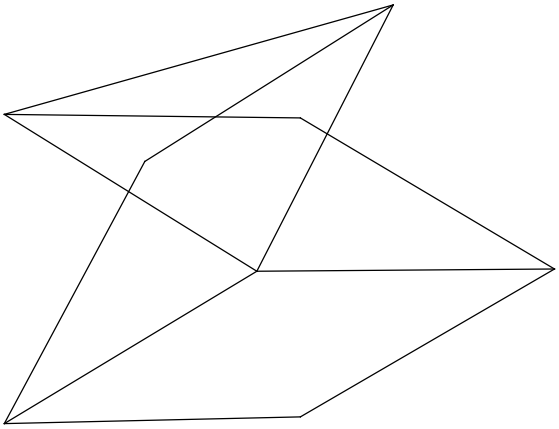


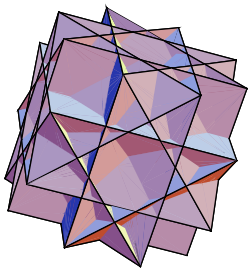


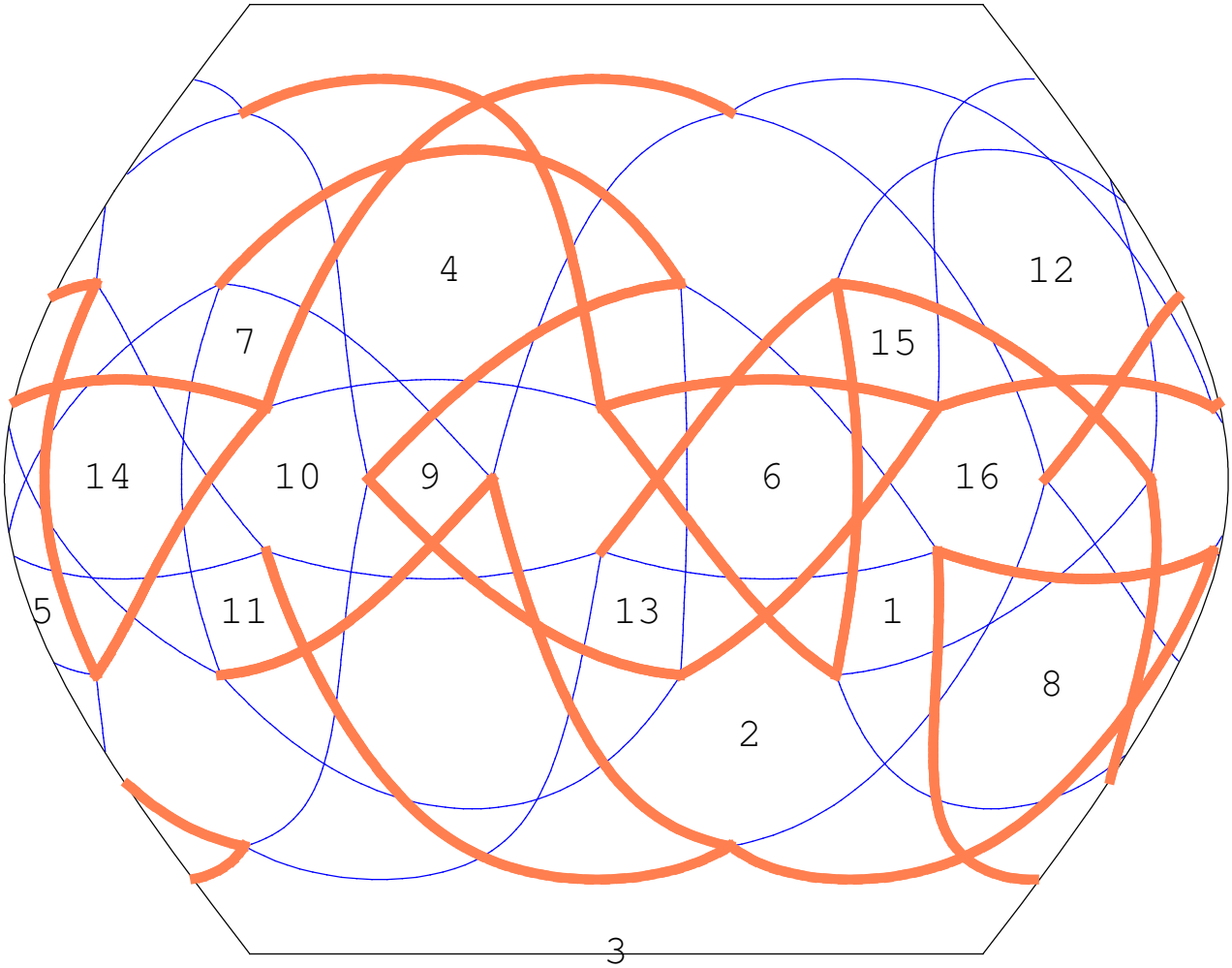


17.

great rhombicuboctahedron $\{4, \frac{3}{2}, 4, 4\}$

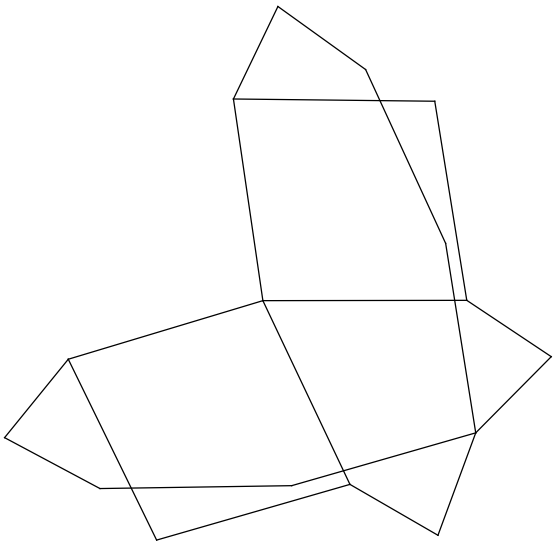


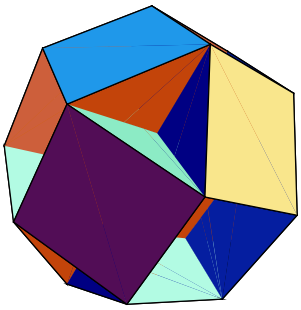


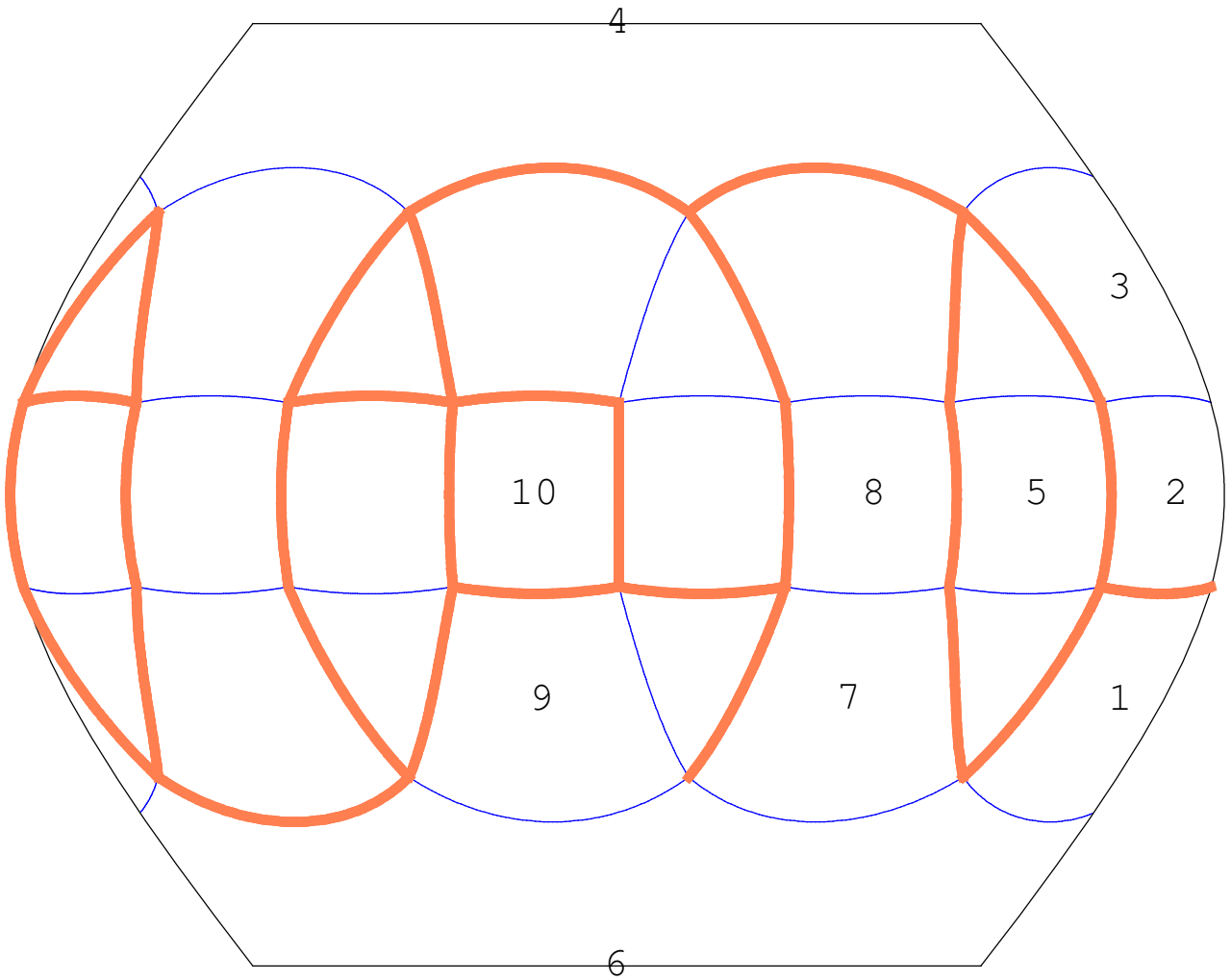


18.

small rhombihexahedron $\{8, 4, \frac{8}{7}, \frac{4}{3}\}$

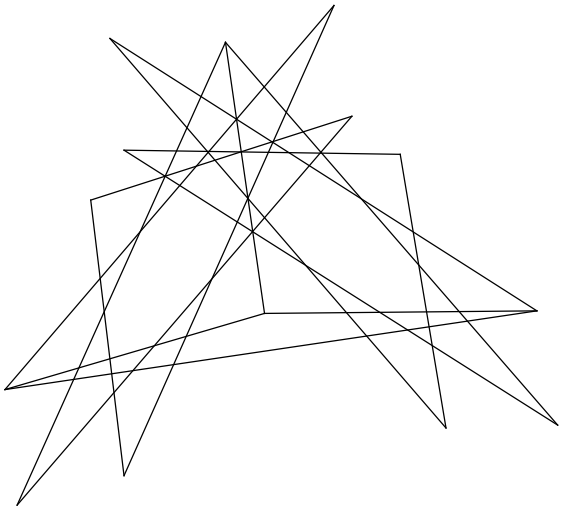


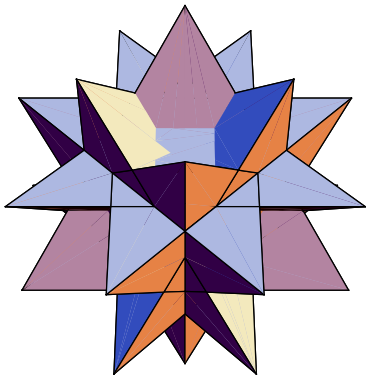


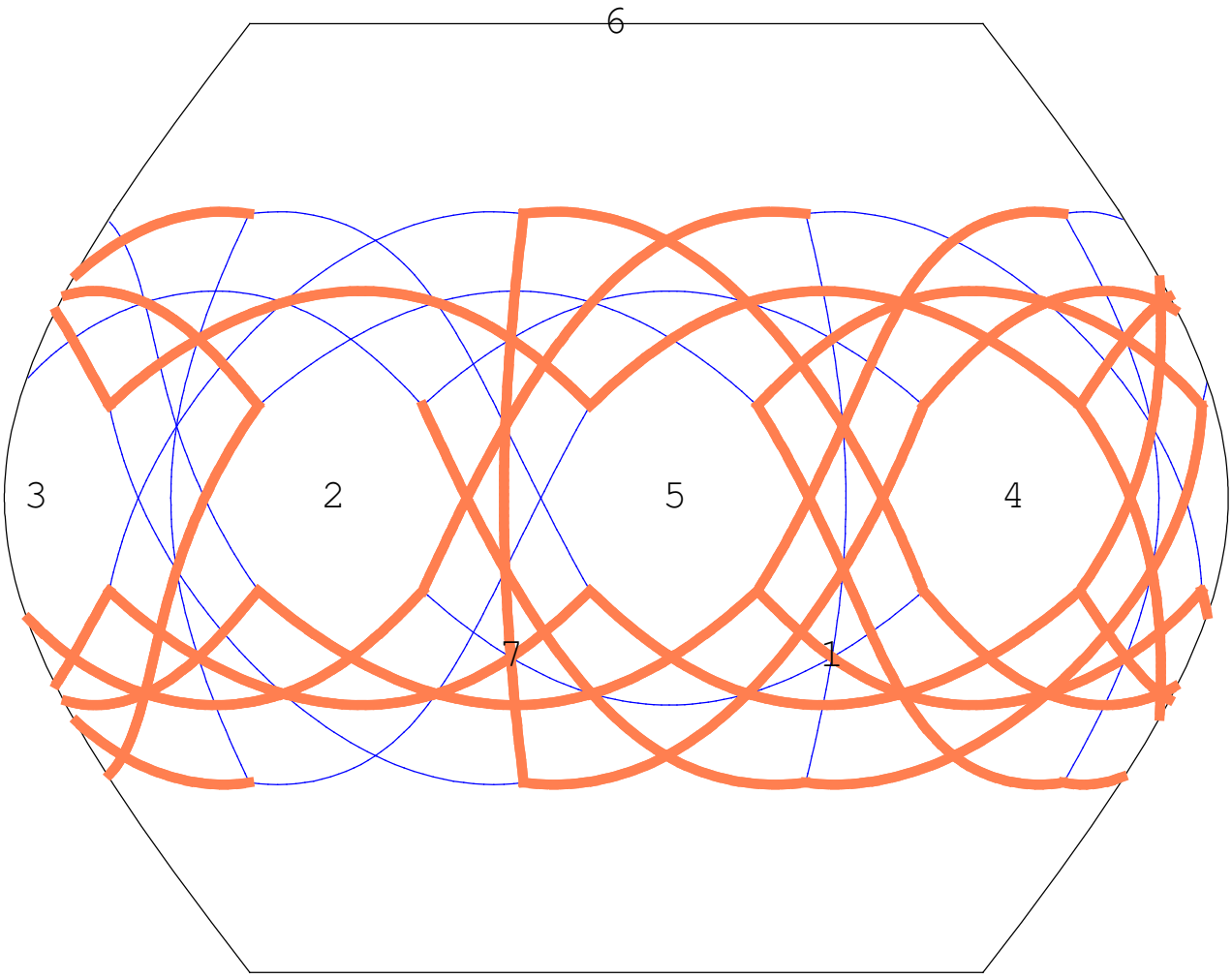


19.

stellated truncated hexahedron $\{\frac{8}{3}, \frac{8}{3}, 3\}$

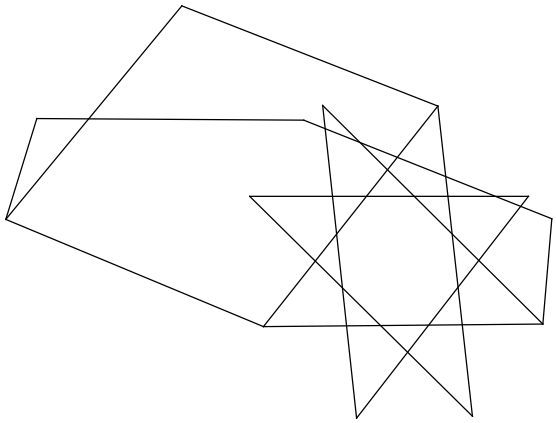


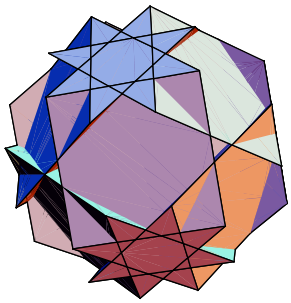


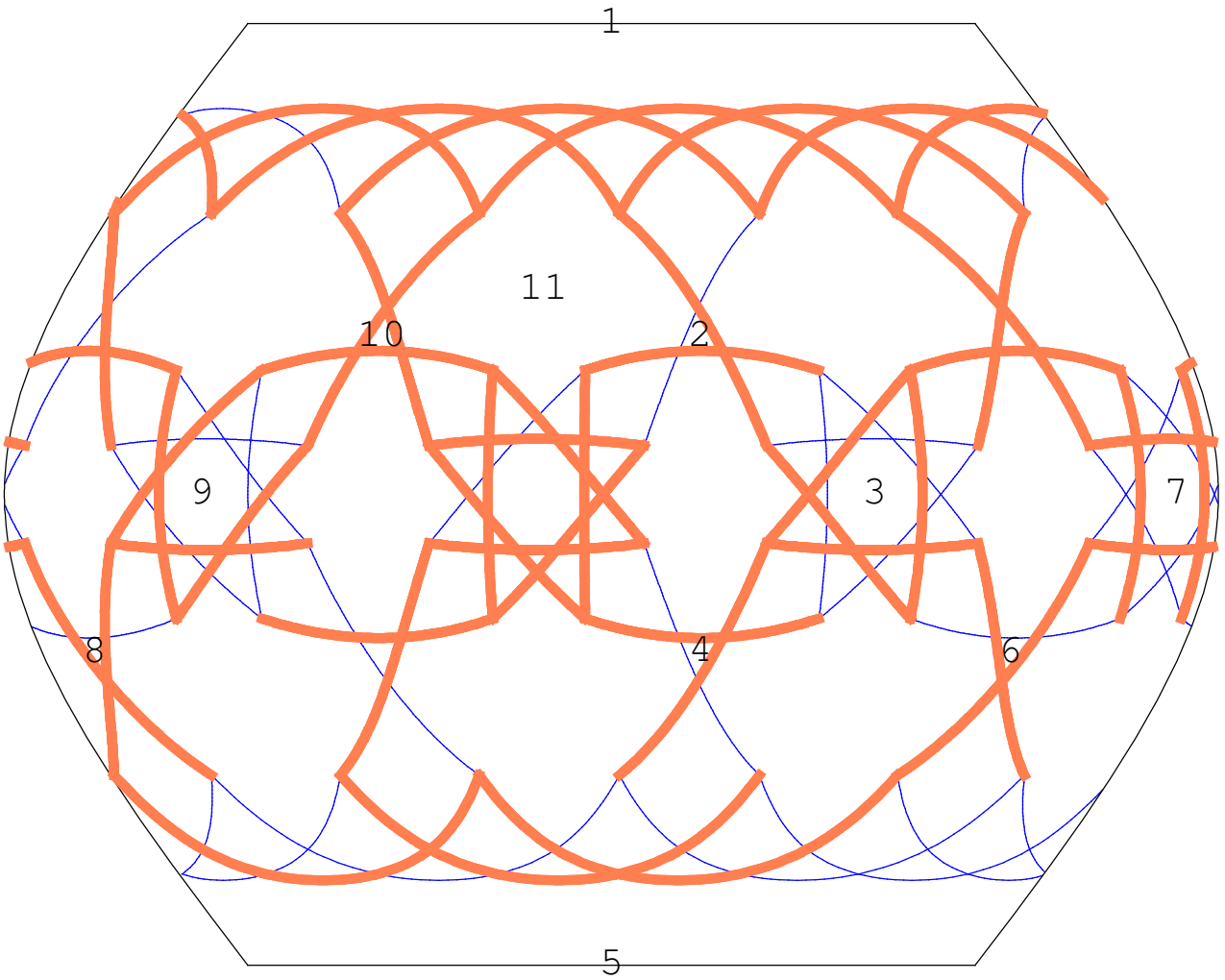


20.

great truncated cuboctahedron $\{\frac{8}{3}, 4, 6\}$

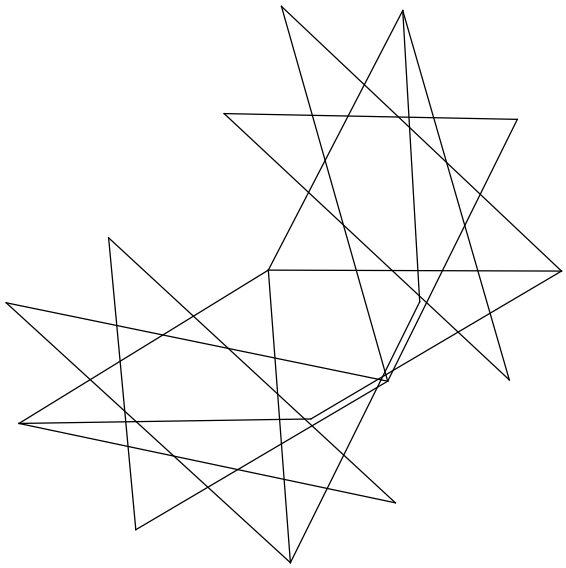


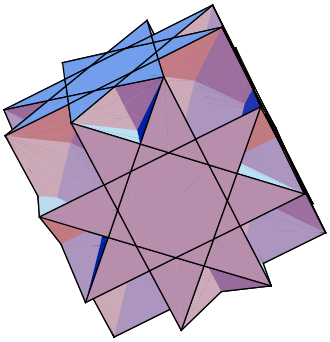


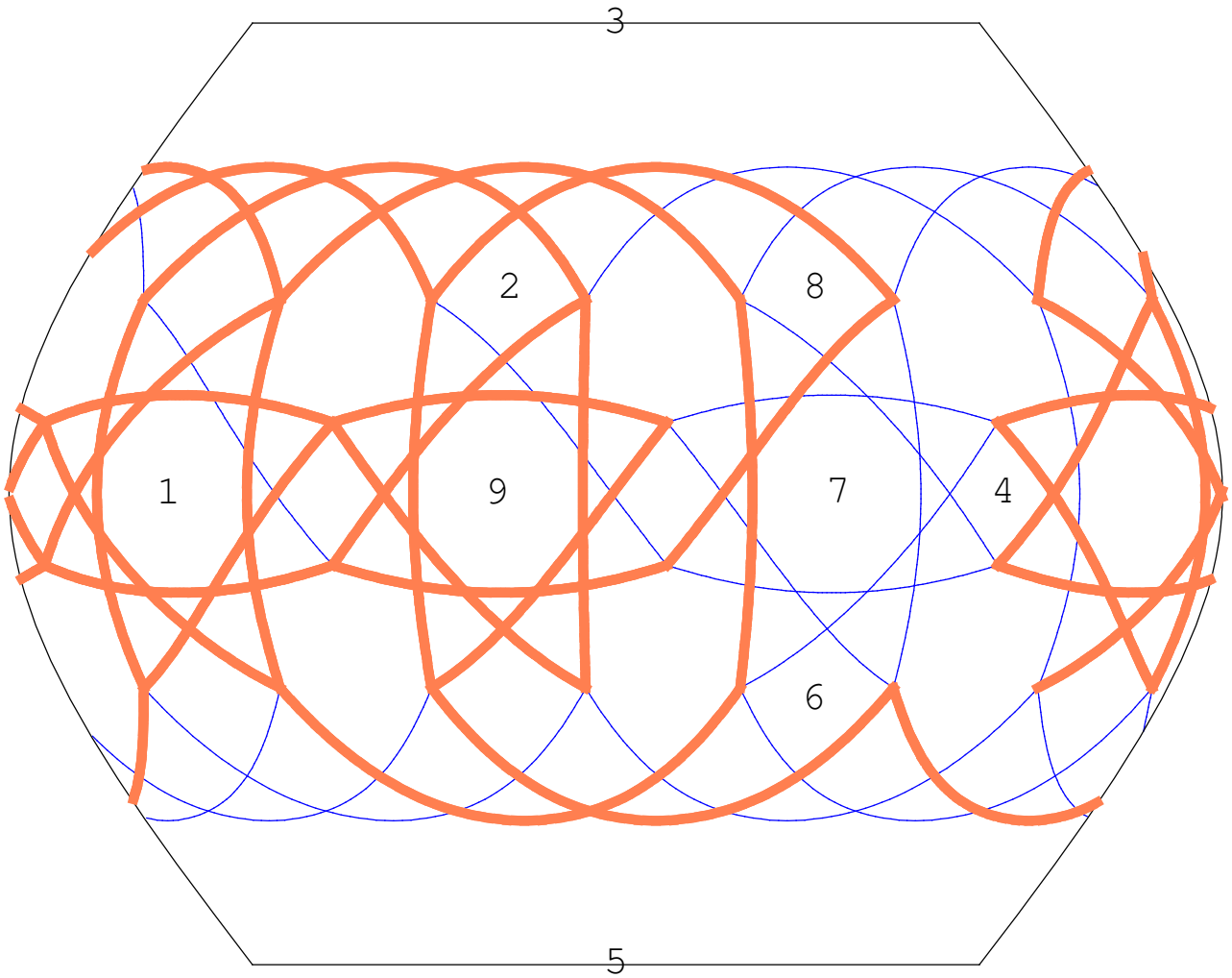


21.

great rhombihexahedron $\{4, \frac{8}{3}, \frac{4}{3}, \frac{8}{5}\}$

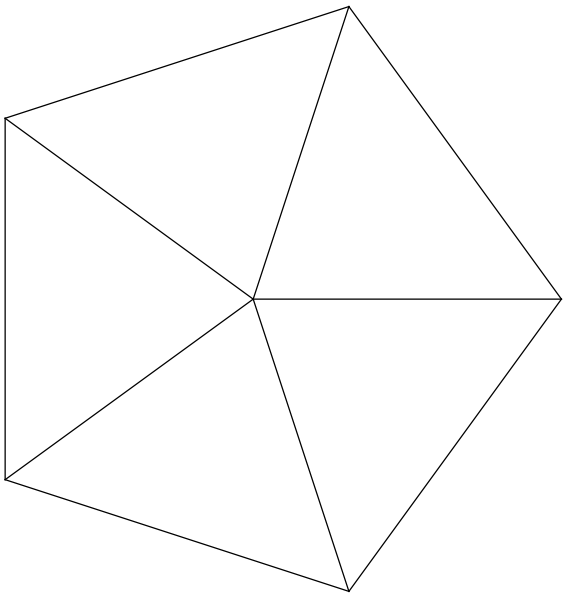


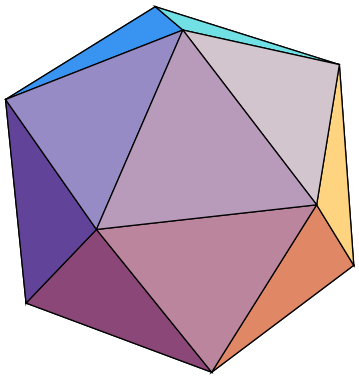


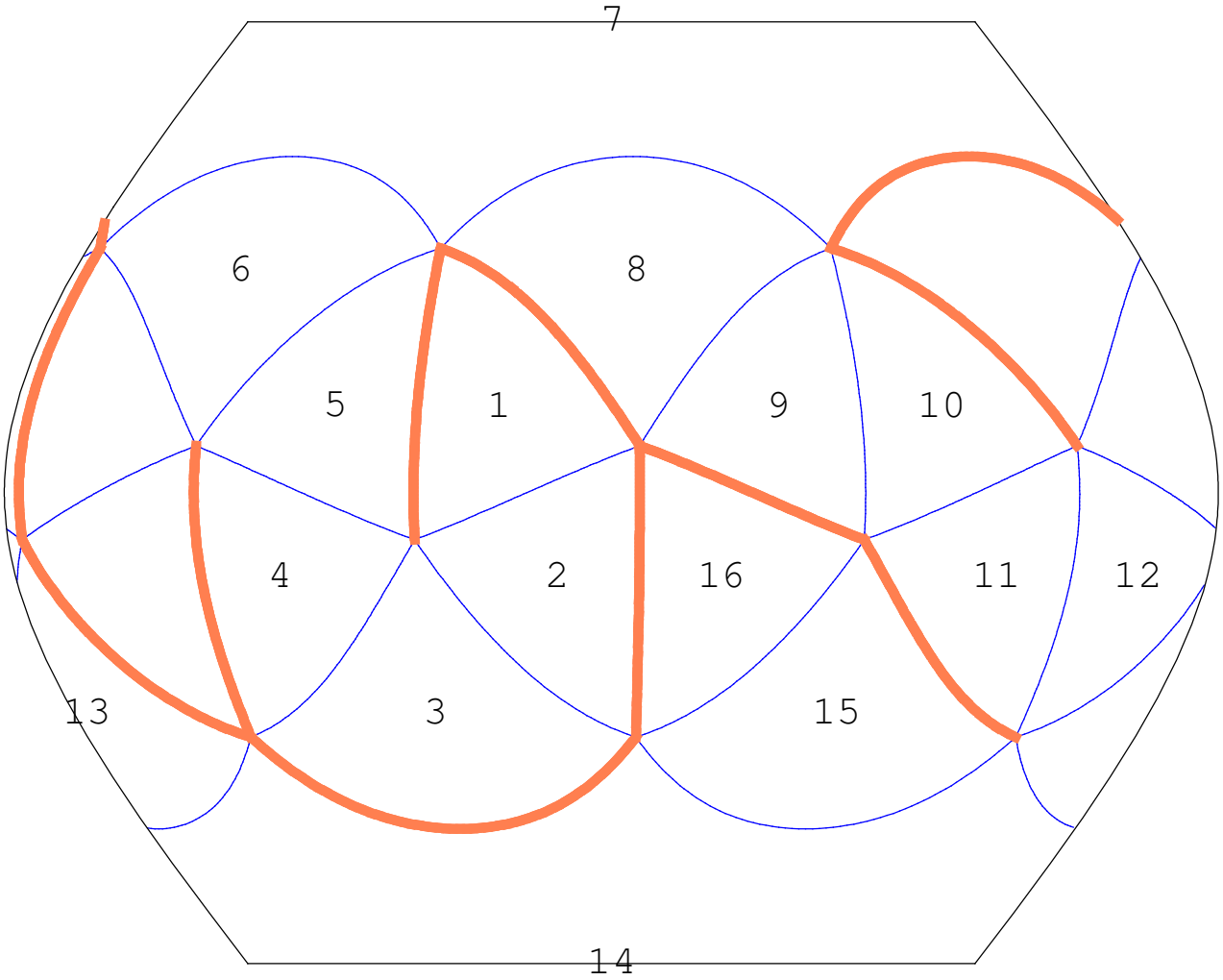


22.

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

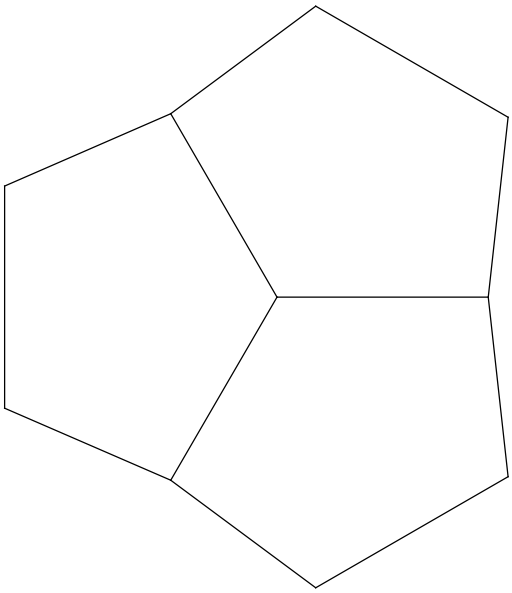


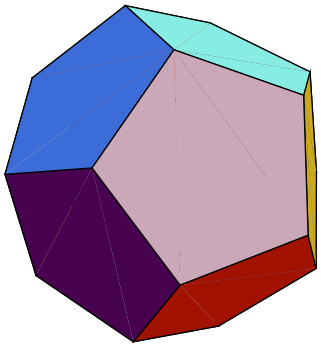


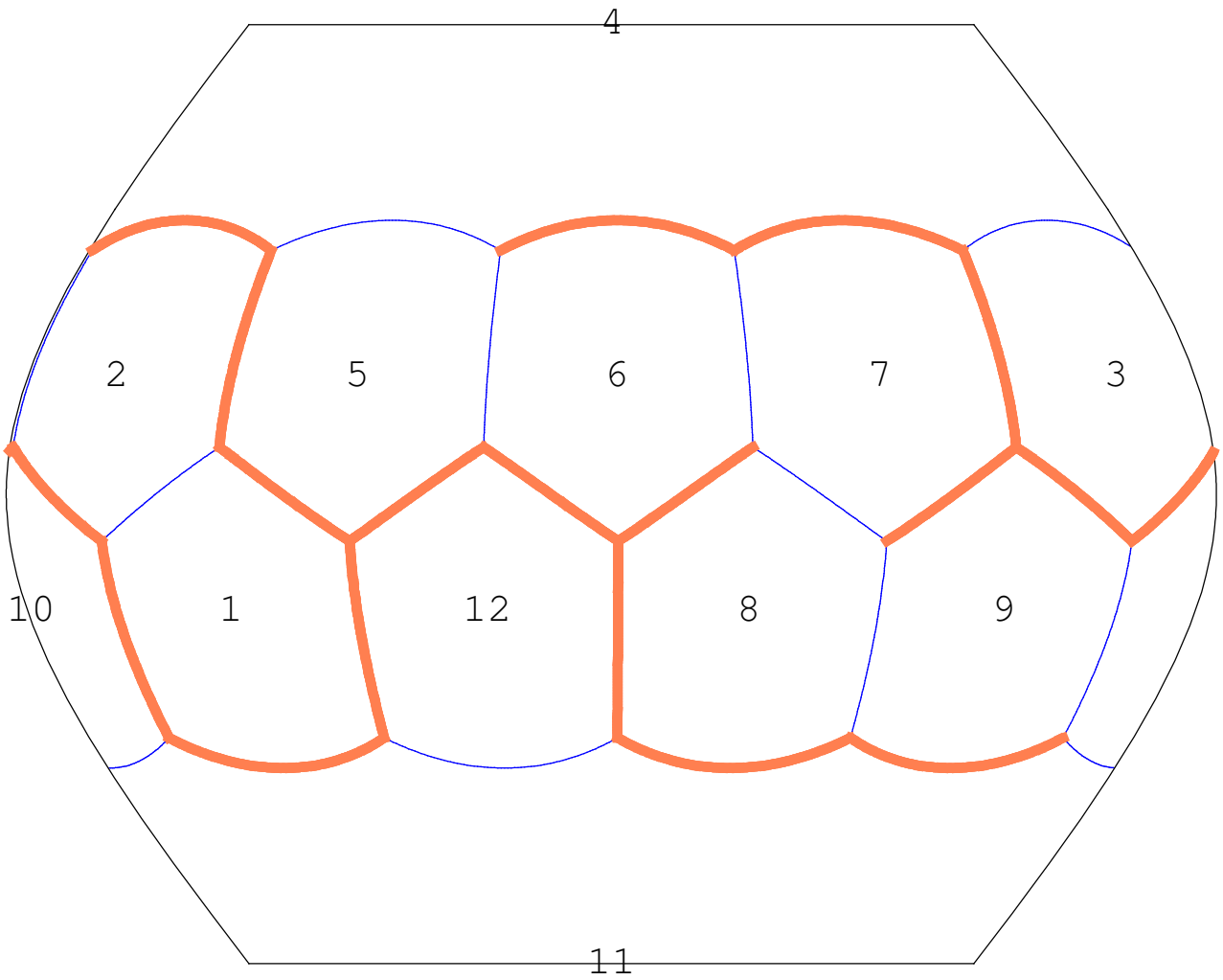


23.

`dodecahedron` {5, 5, 5}

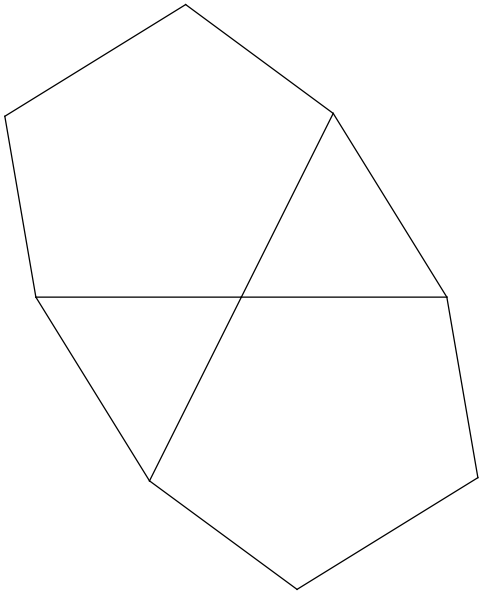


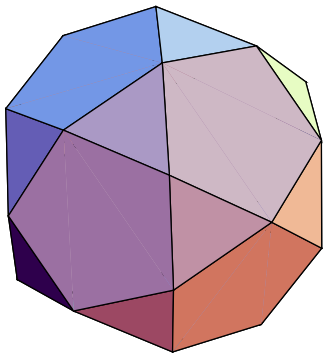


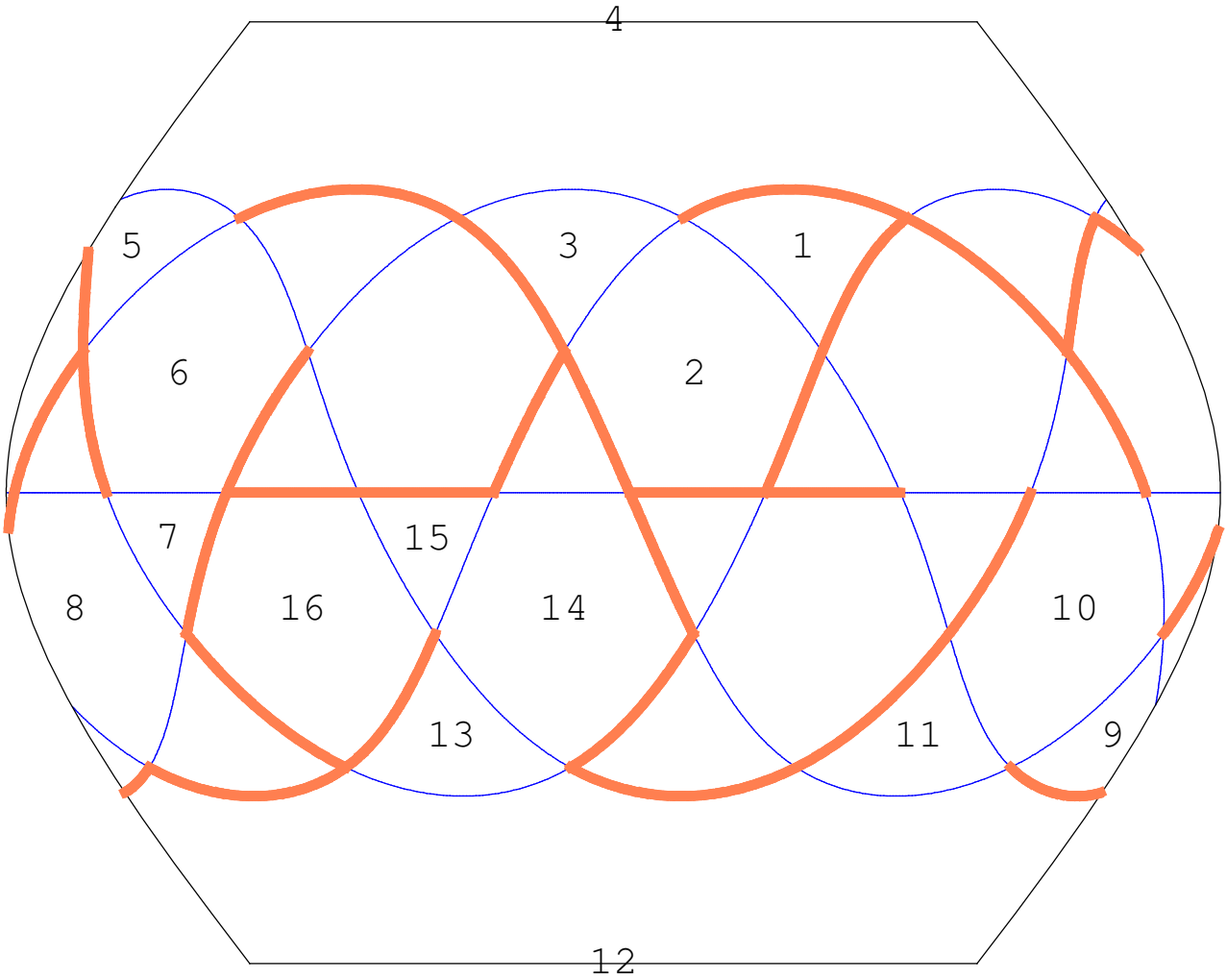


24.

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

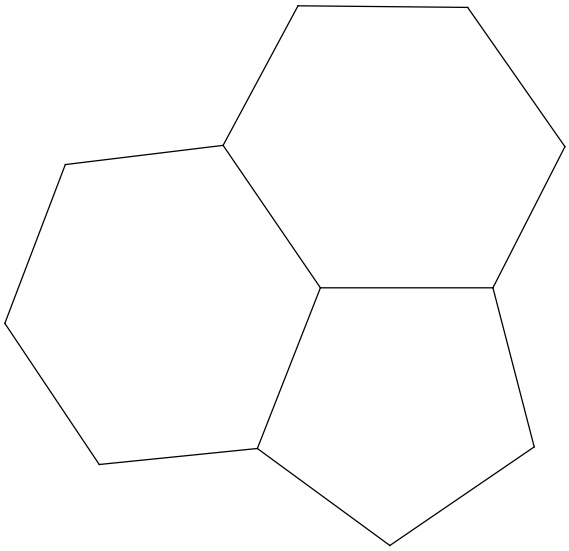


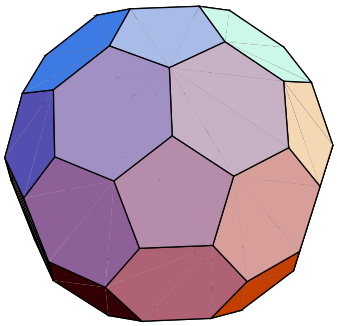


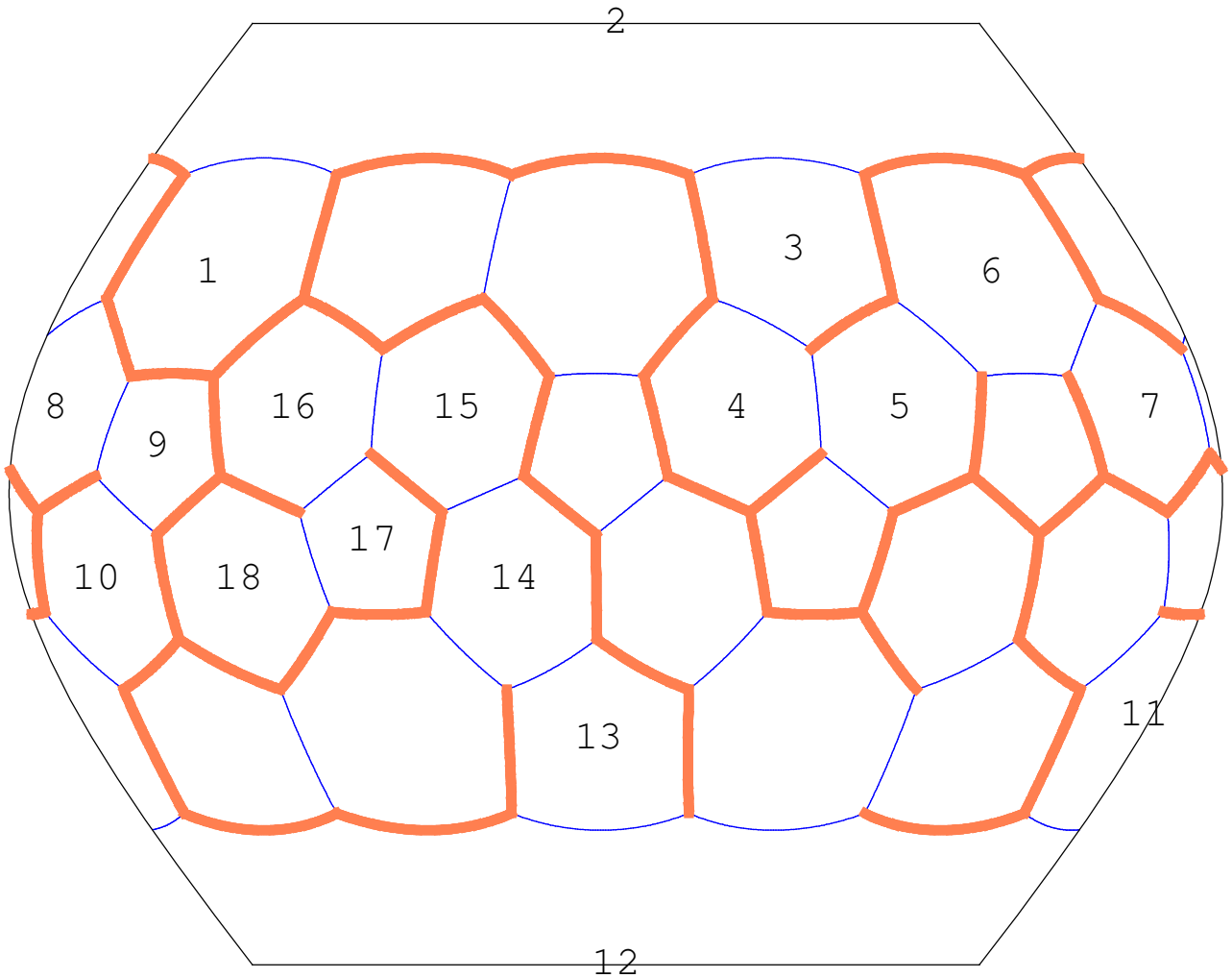


25.

truncated icosahedron {6, 6, 5}

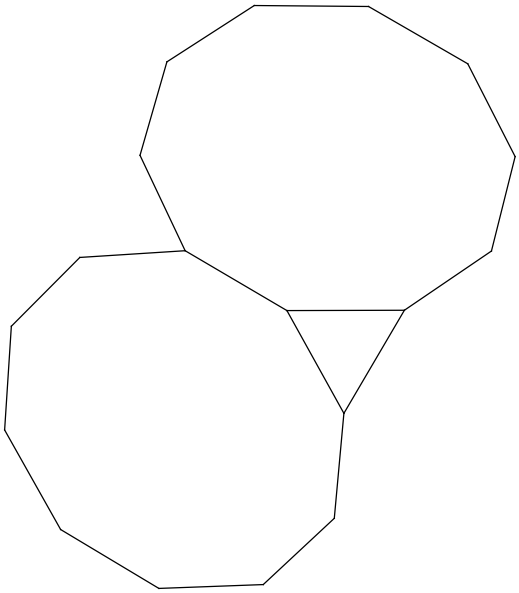


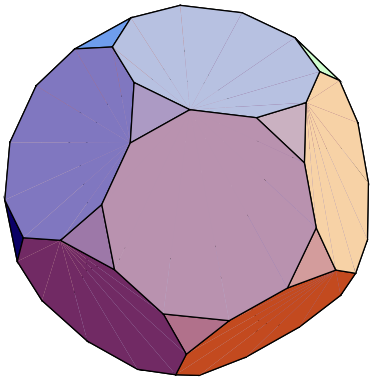


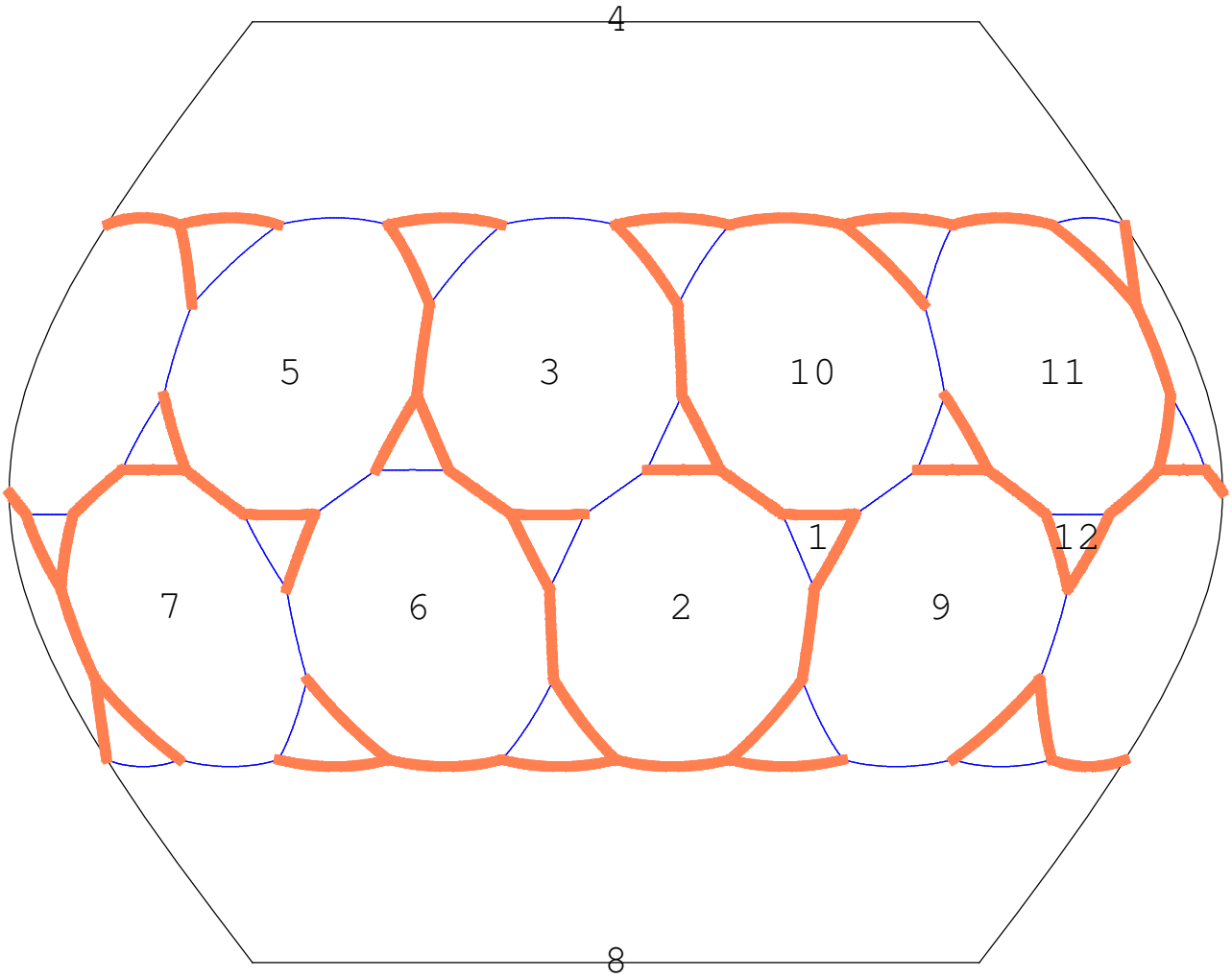


26.

`truncated dodecahedron` {10, 10, 3}

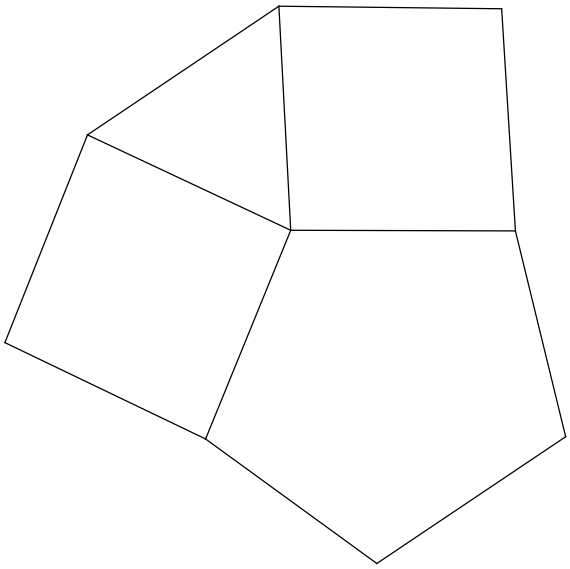


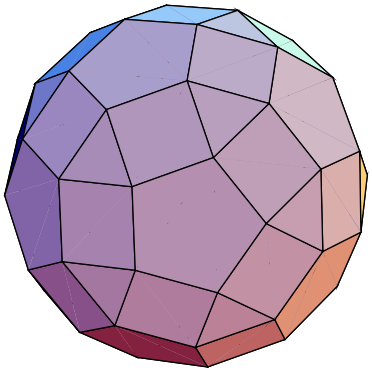


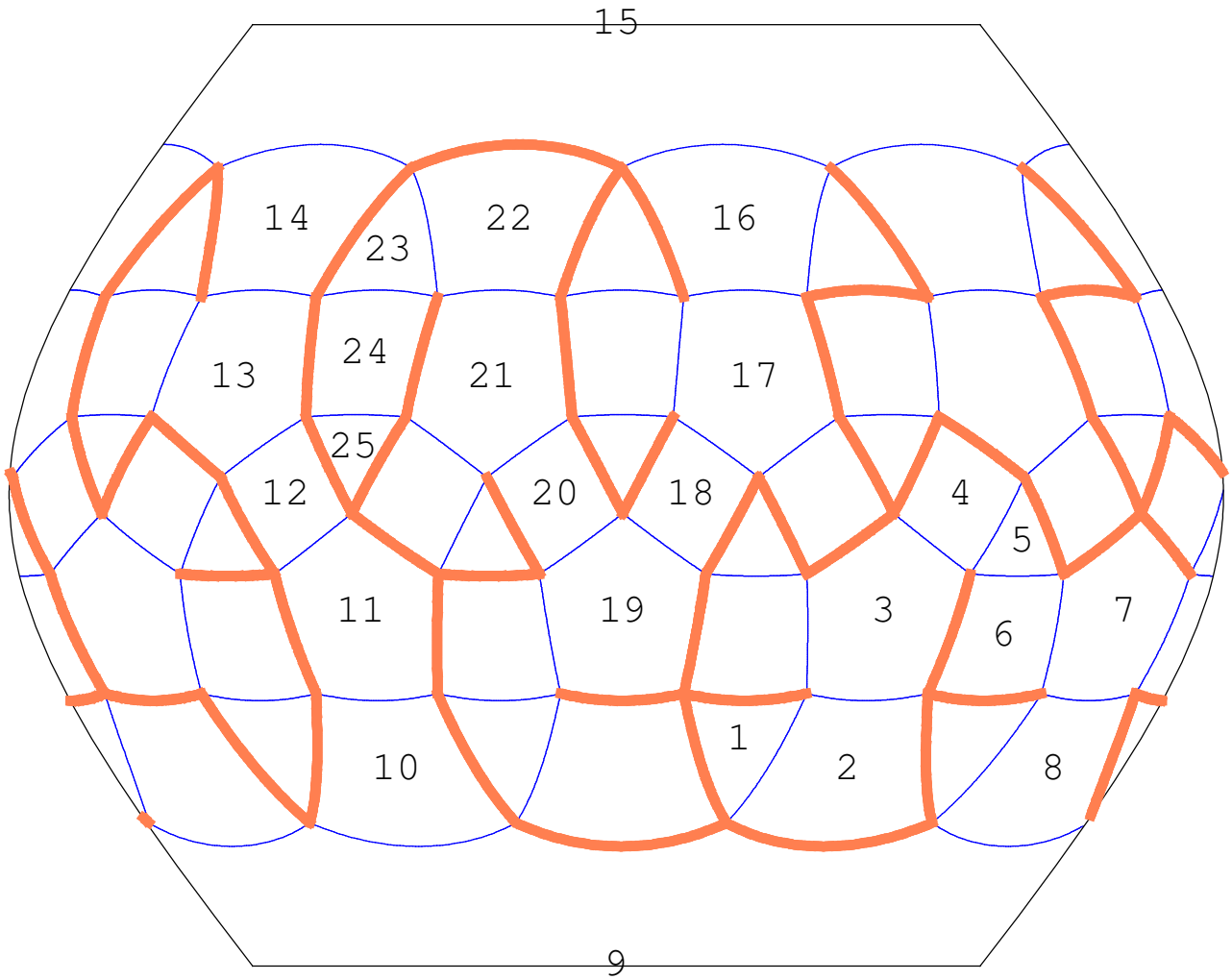


27.

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

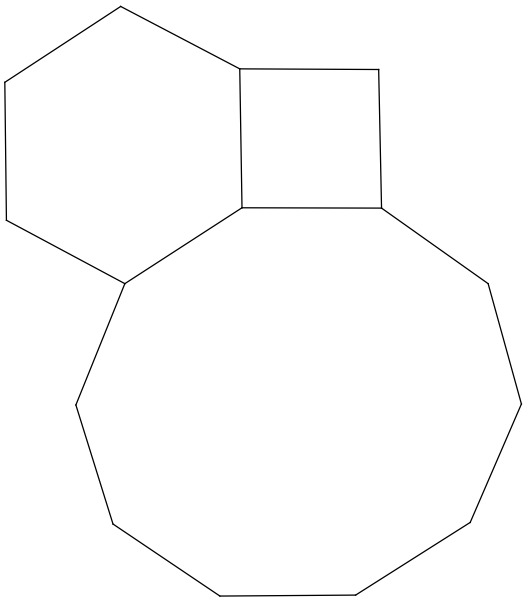


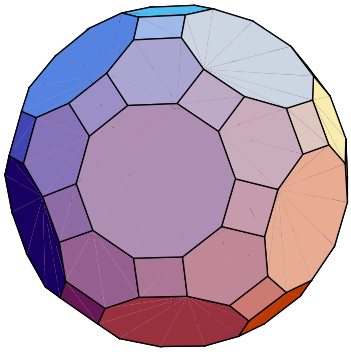


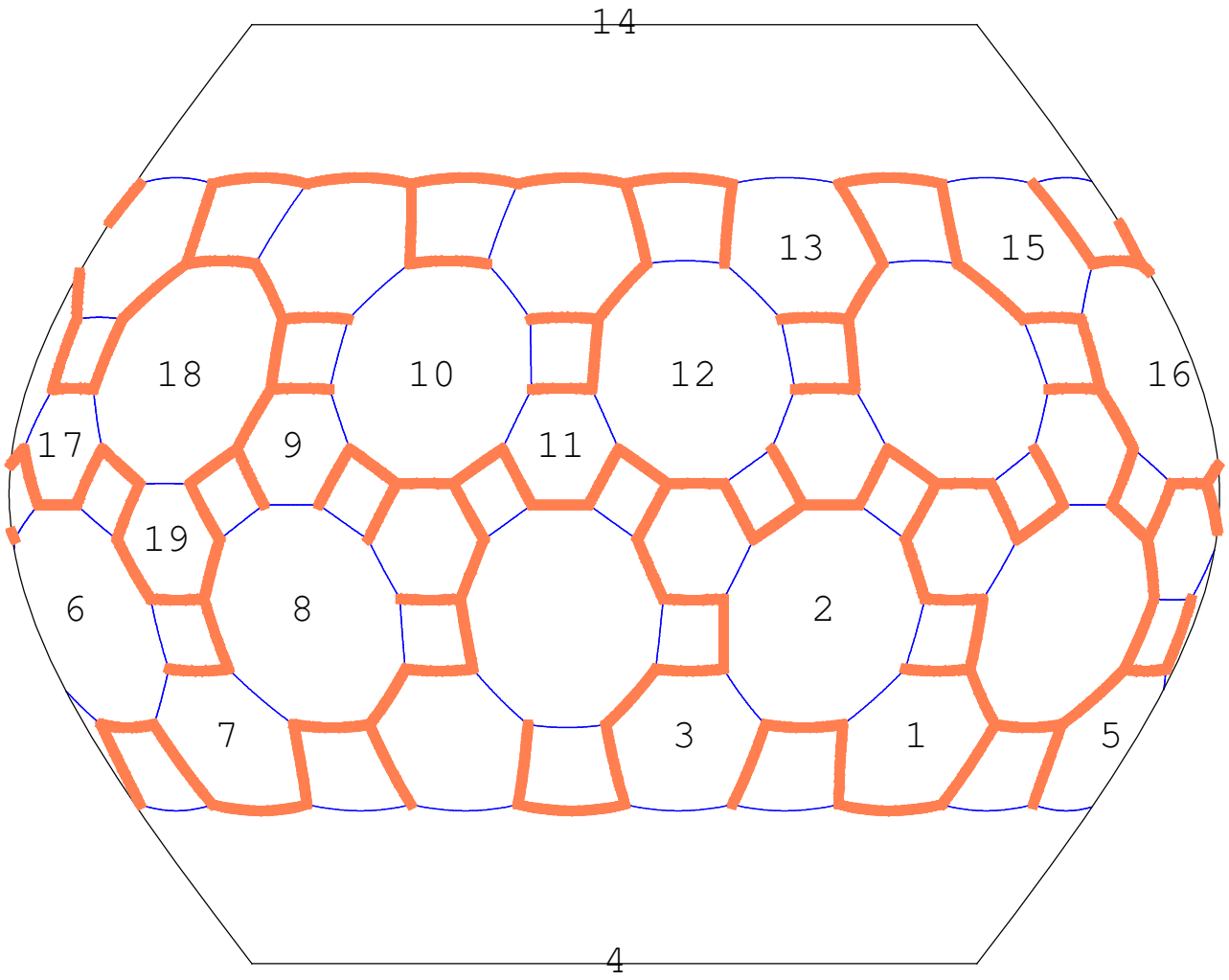


28.

`truncated icosidodecahedron` {4, 6, 10}

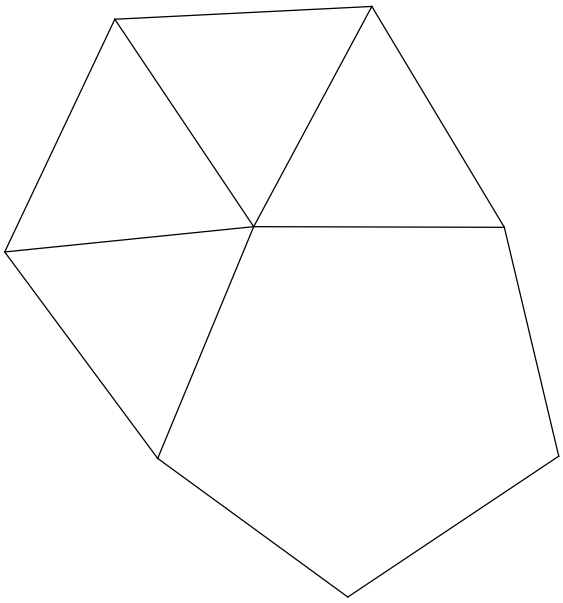


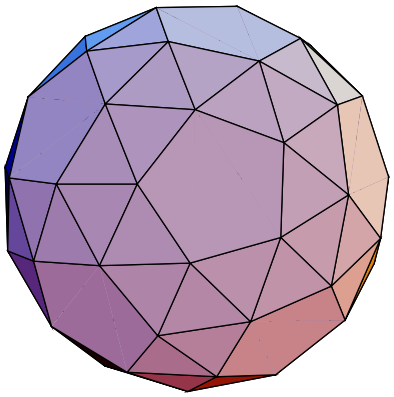


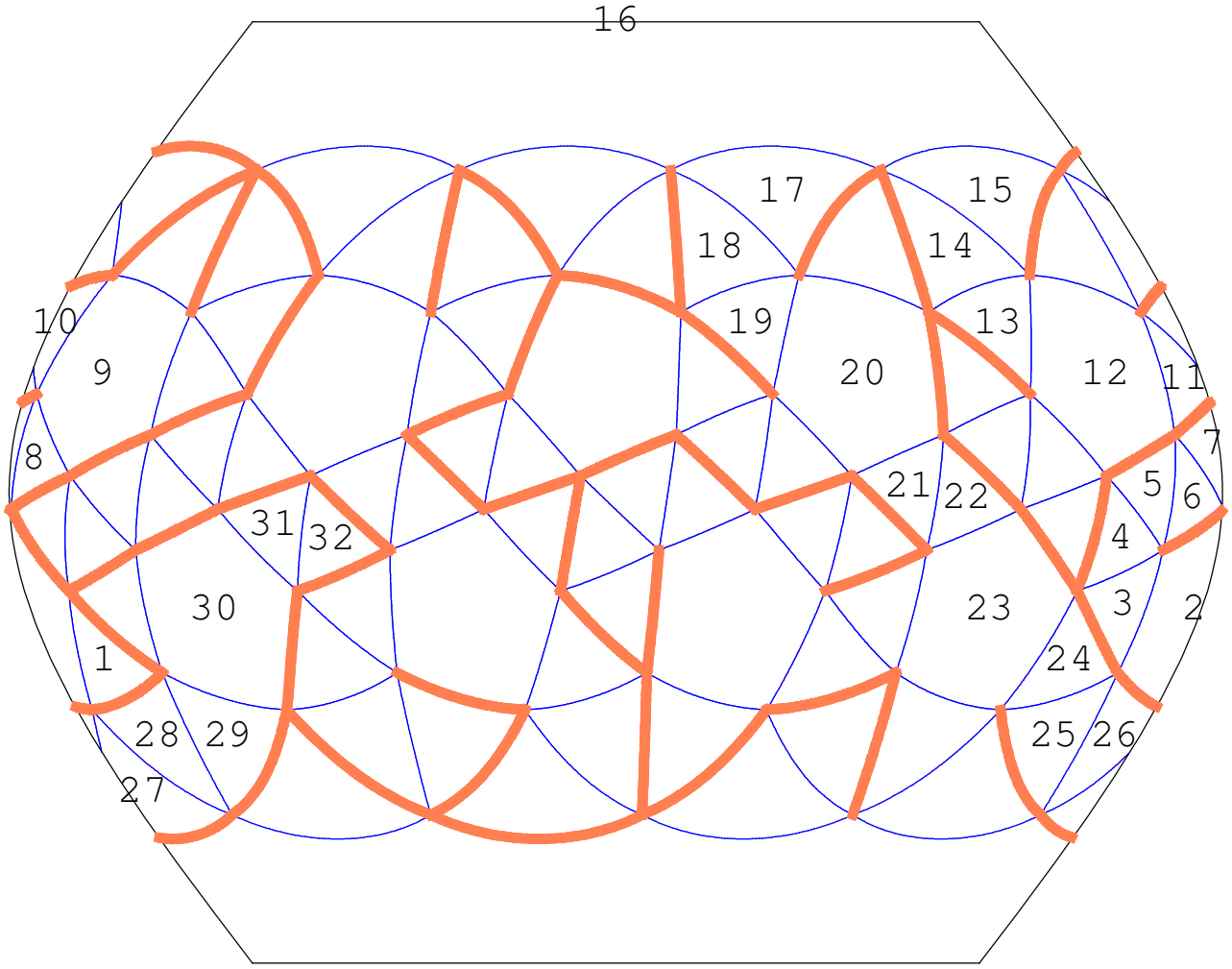


29.

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

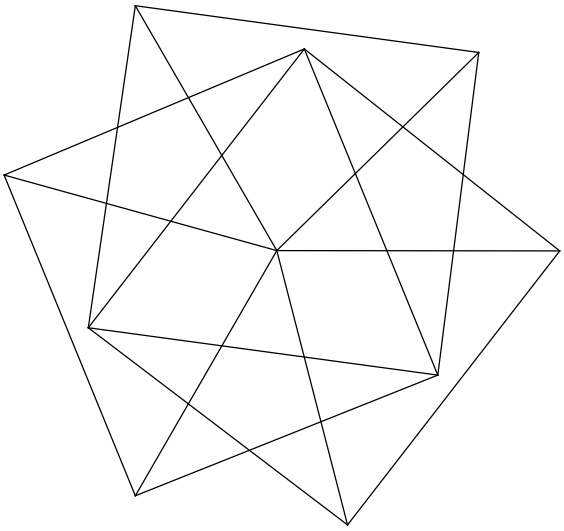


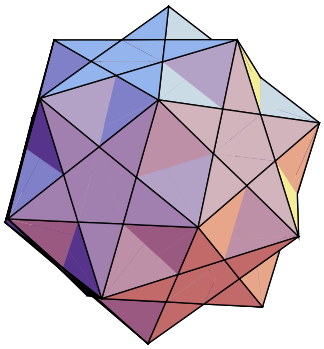


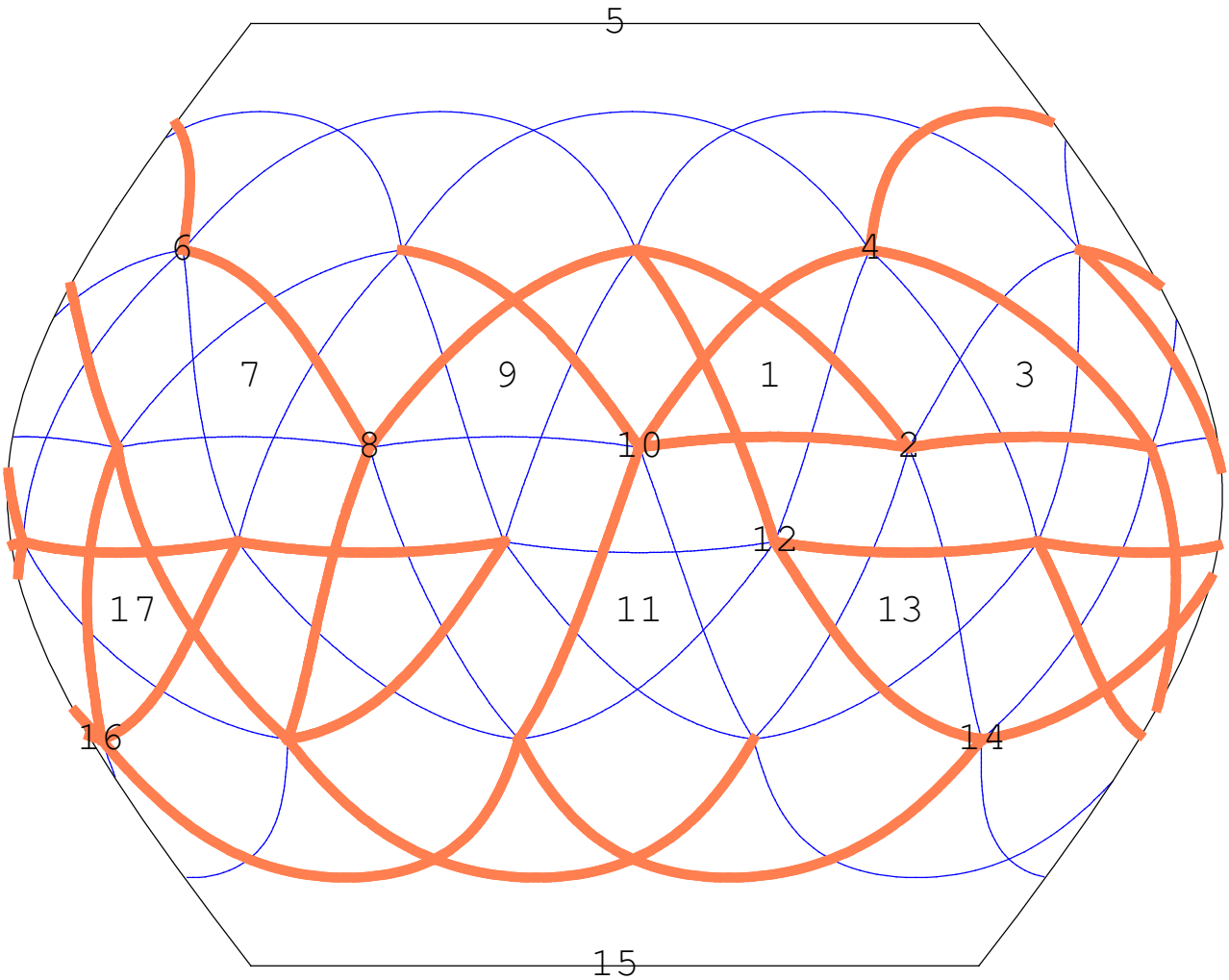


30.

small ditrigonal icosidodecahedron $\{\frac{5}{2}, 3, \frac{5}{2}, 3, \frac{5}{2}, 3\}$

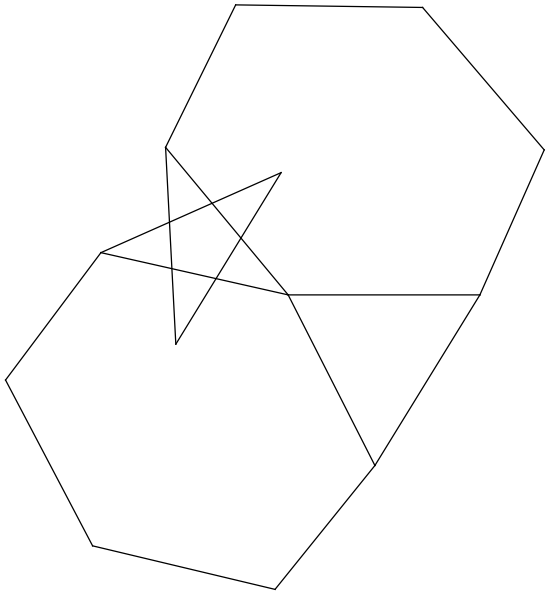


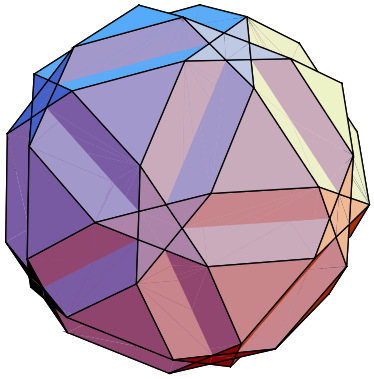


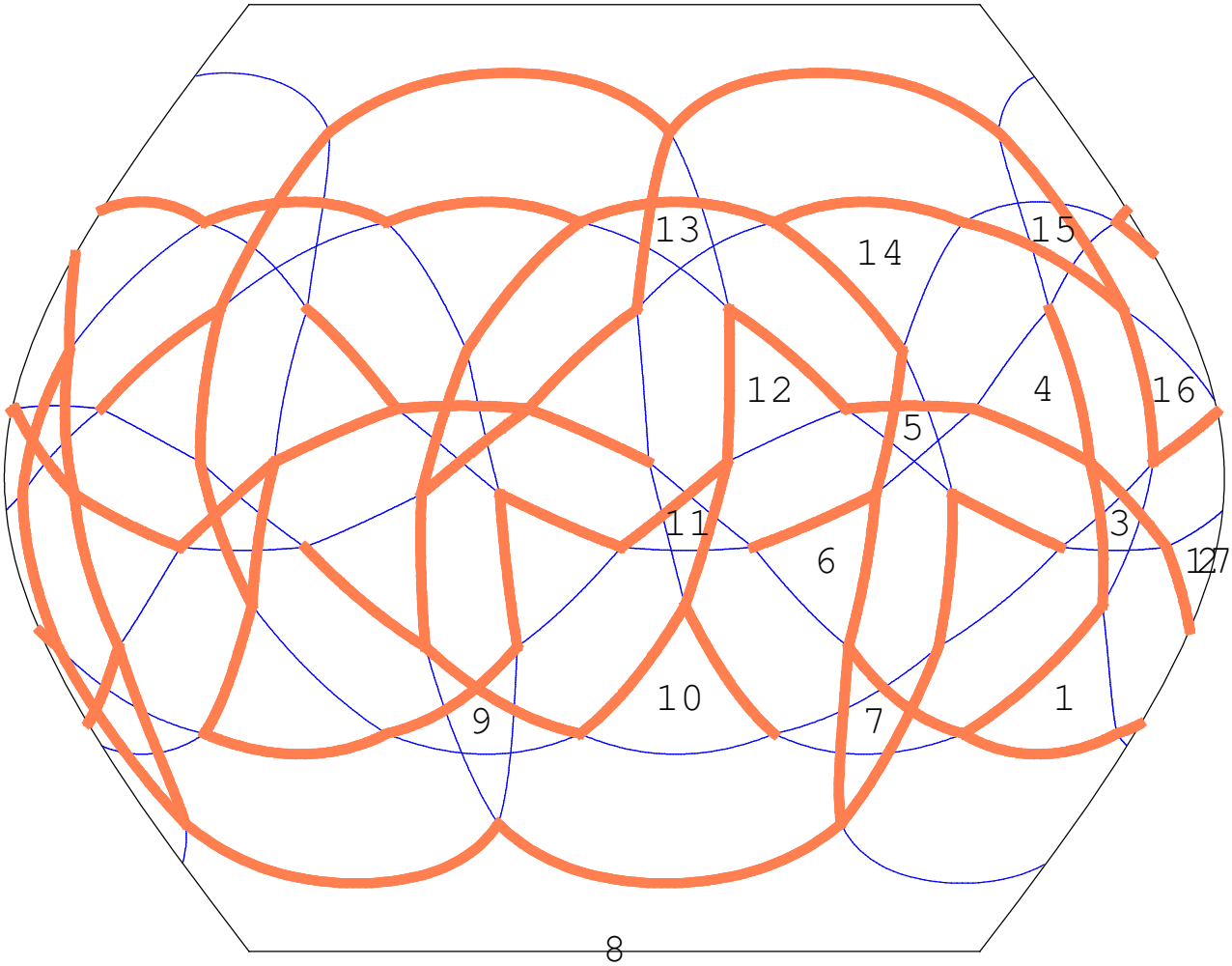


31.

small icosicosidodecahedron $\{6, \frac{5}{2}, 6, 3\}$

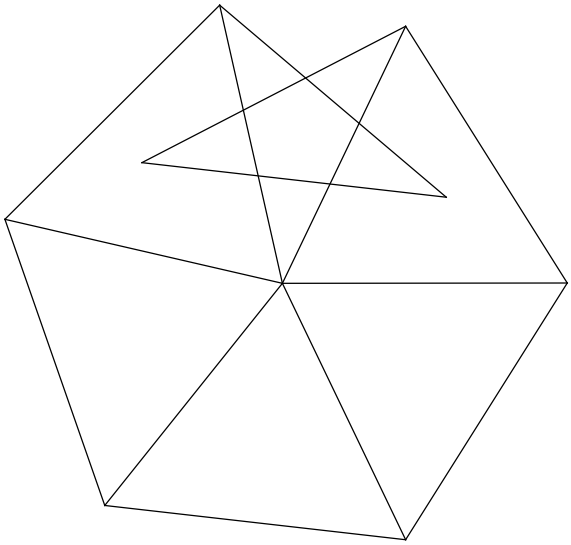


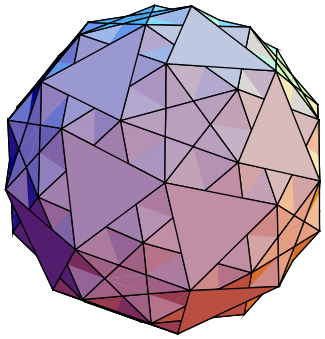


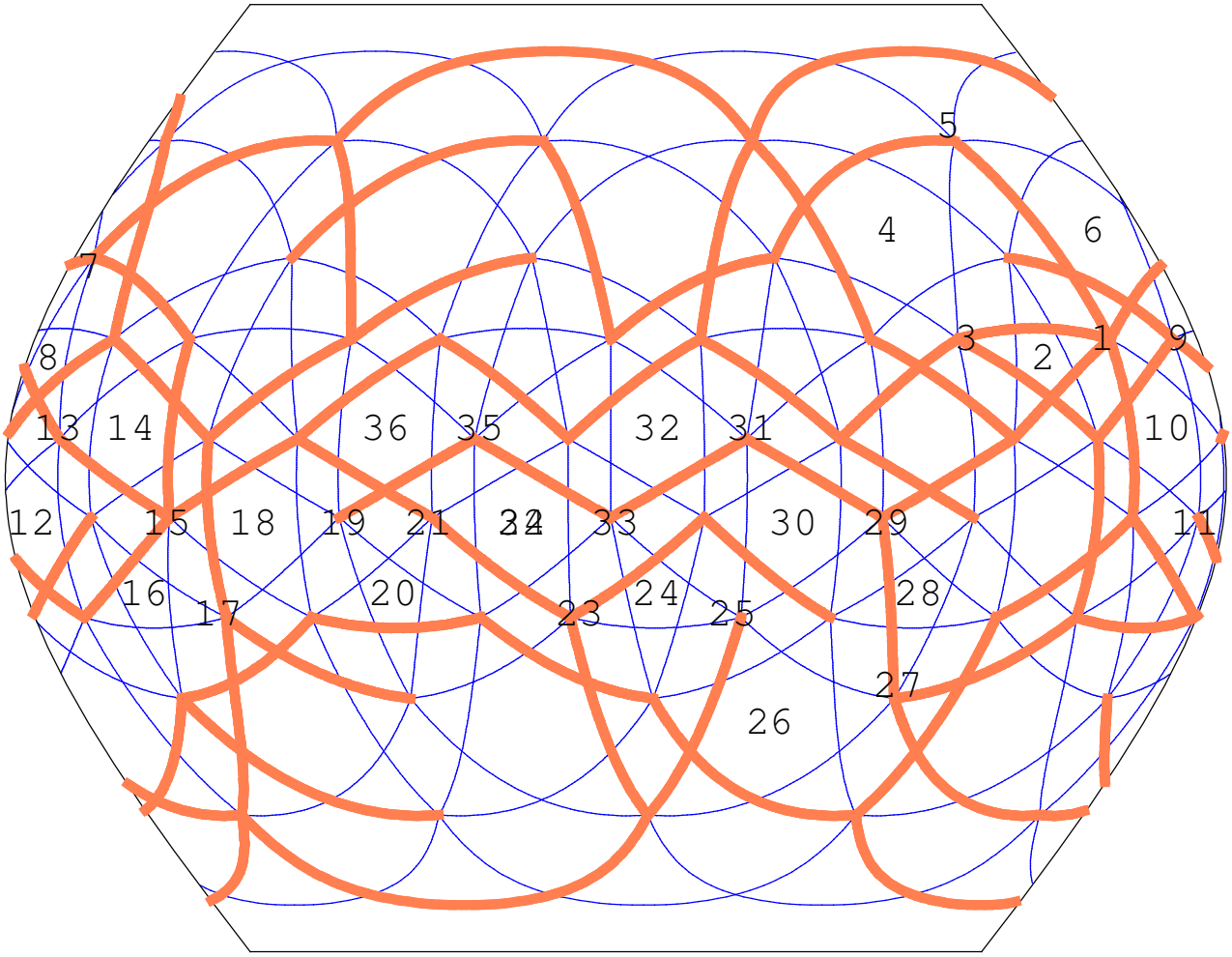


32.

small snub icosicosidodecahedron $\{3, \frac{5}{2}, 3, 3, 3, 3\}$

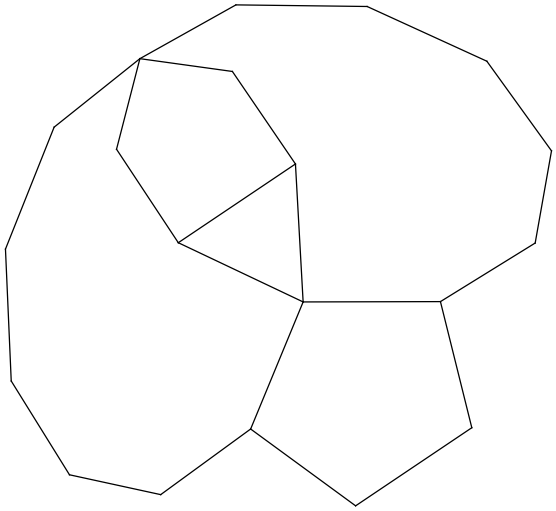


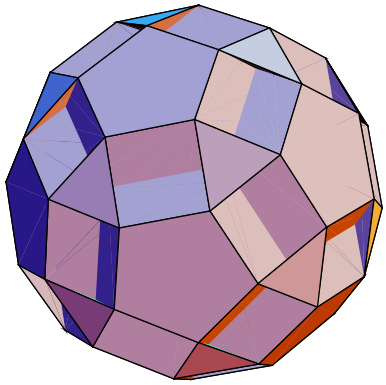


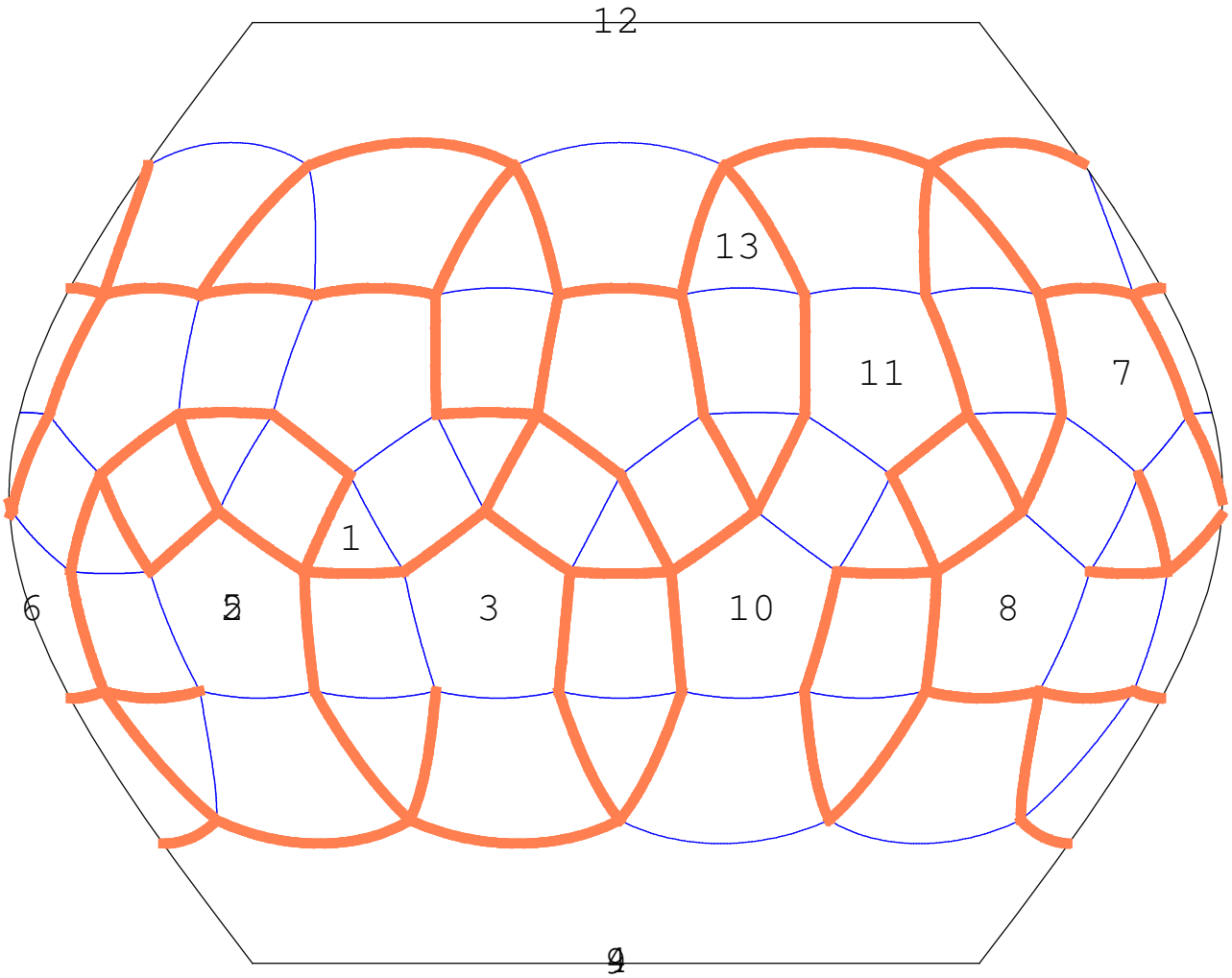


33.

small dodecicosidodecahedron $\{10, \frac{3}{2}, 10, 5\}$

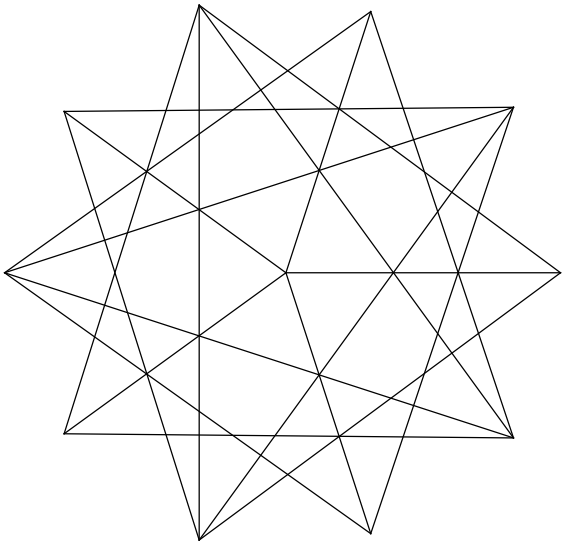


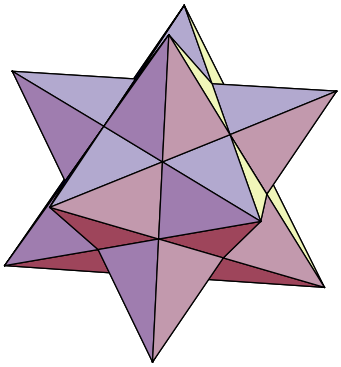


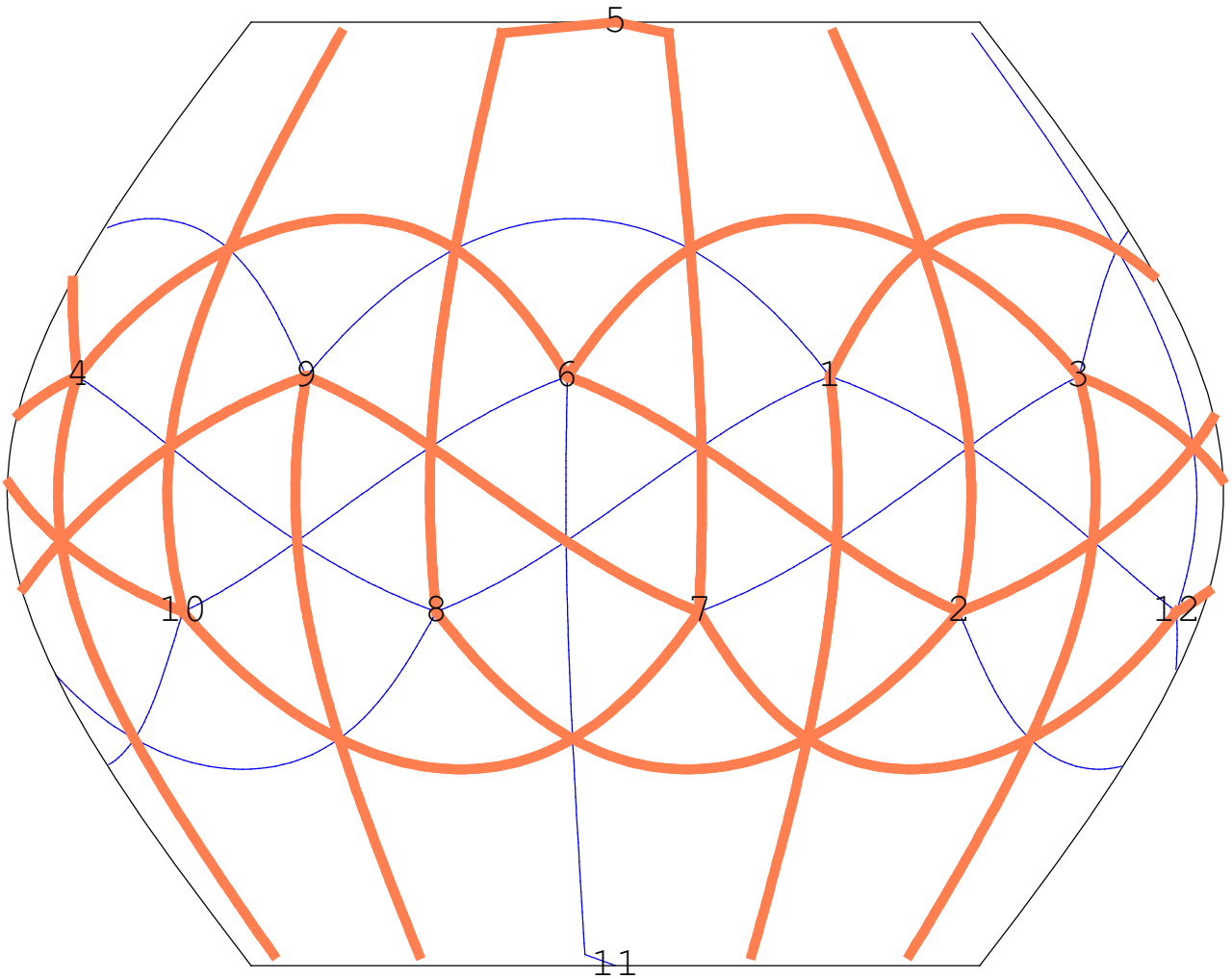


34.

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

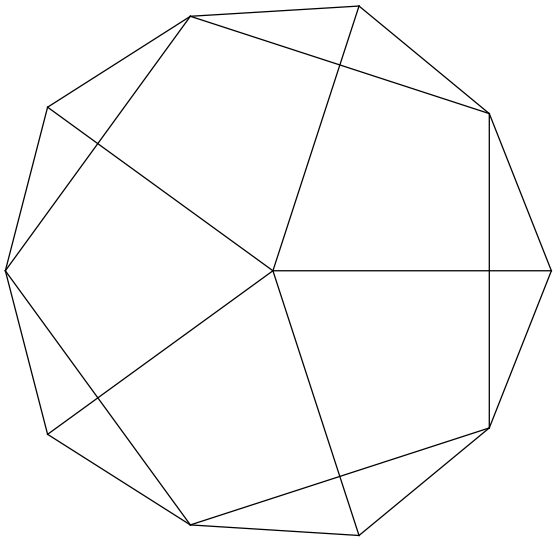


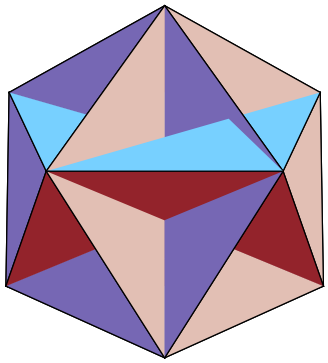


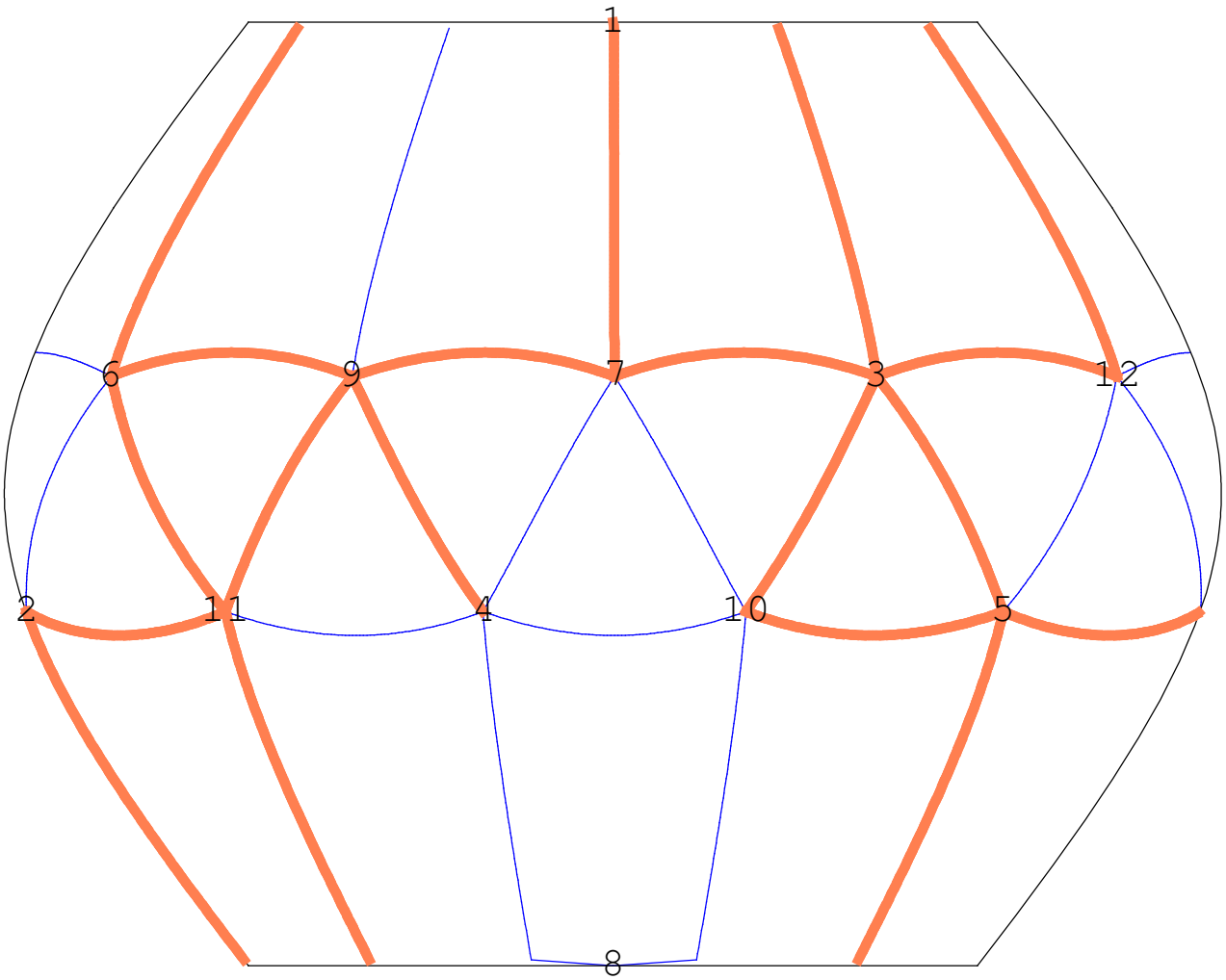


35.

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

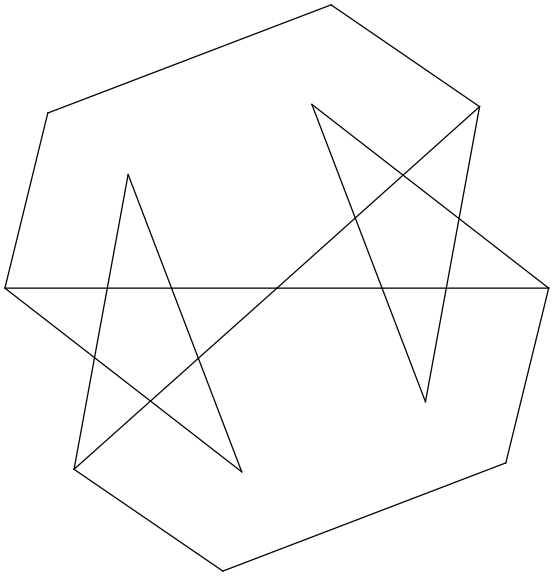


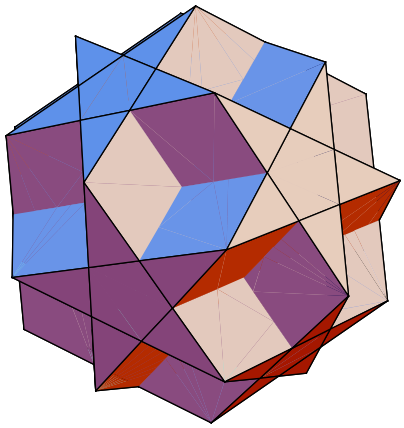


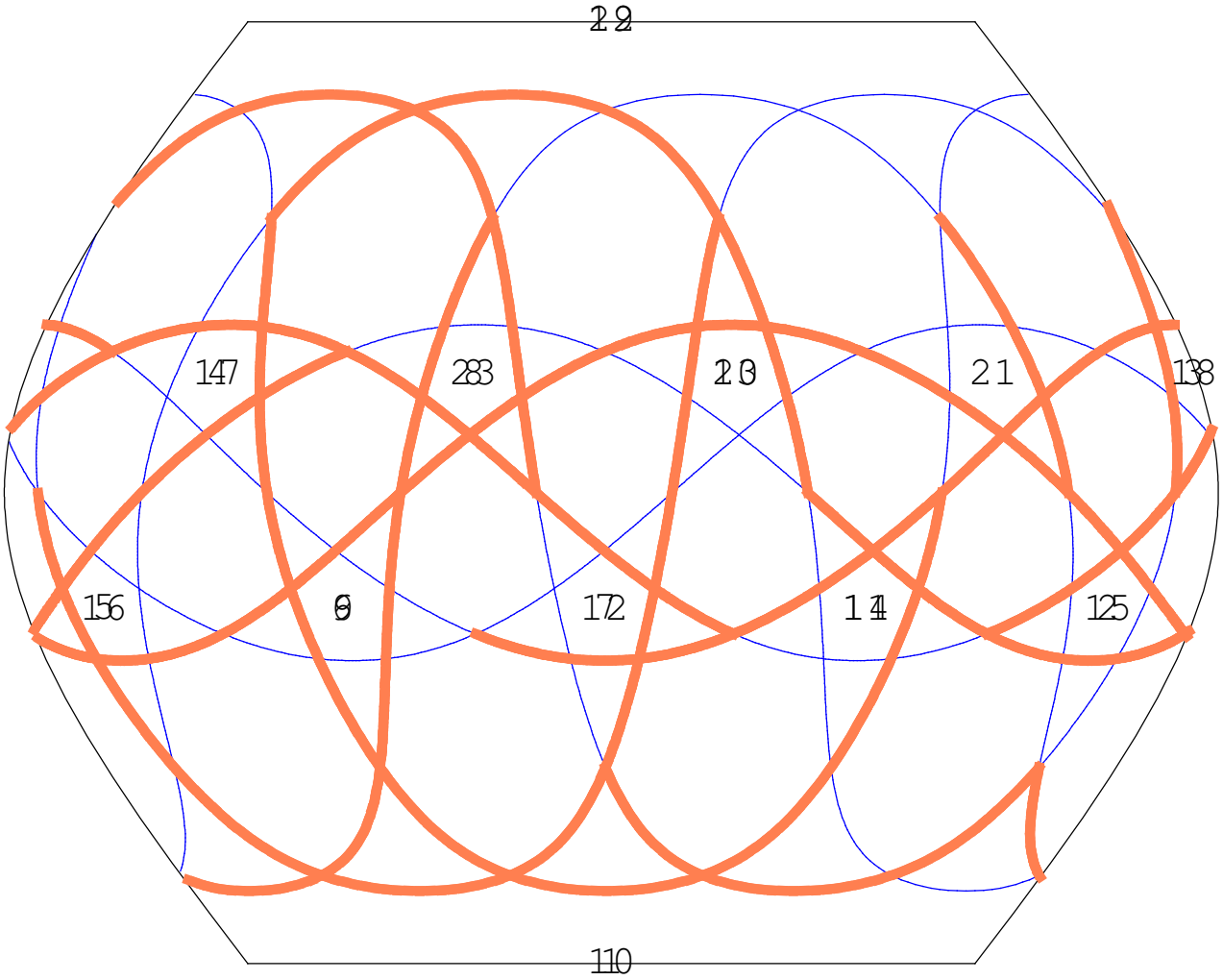


36.

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

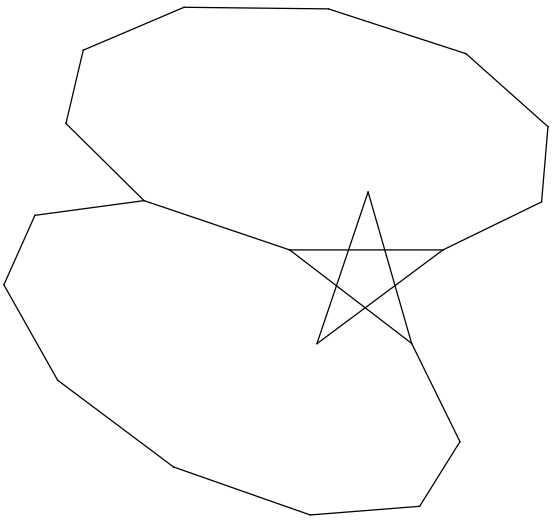


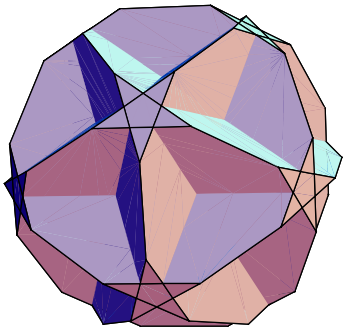


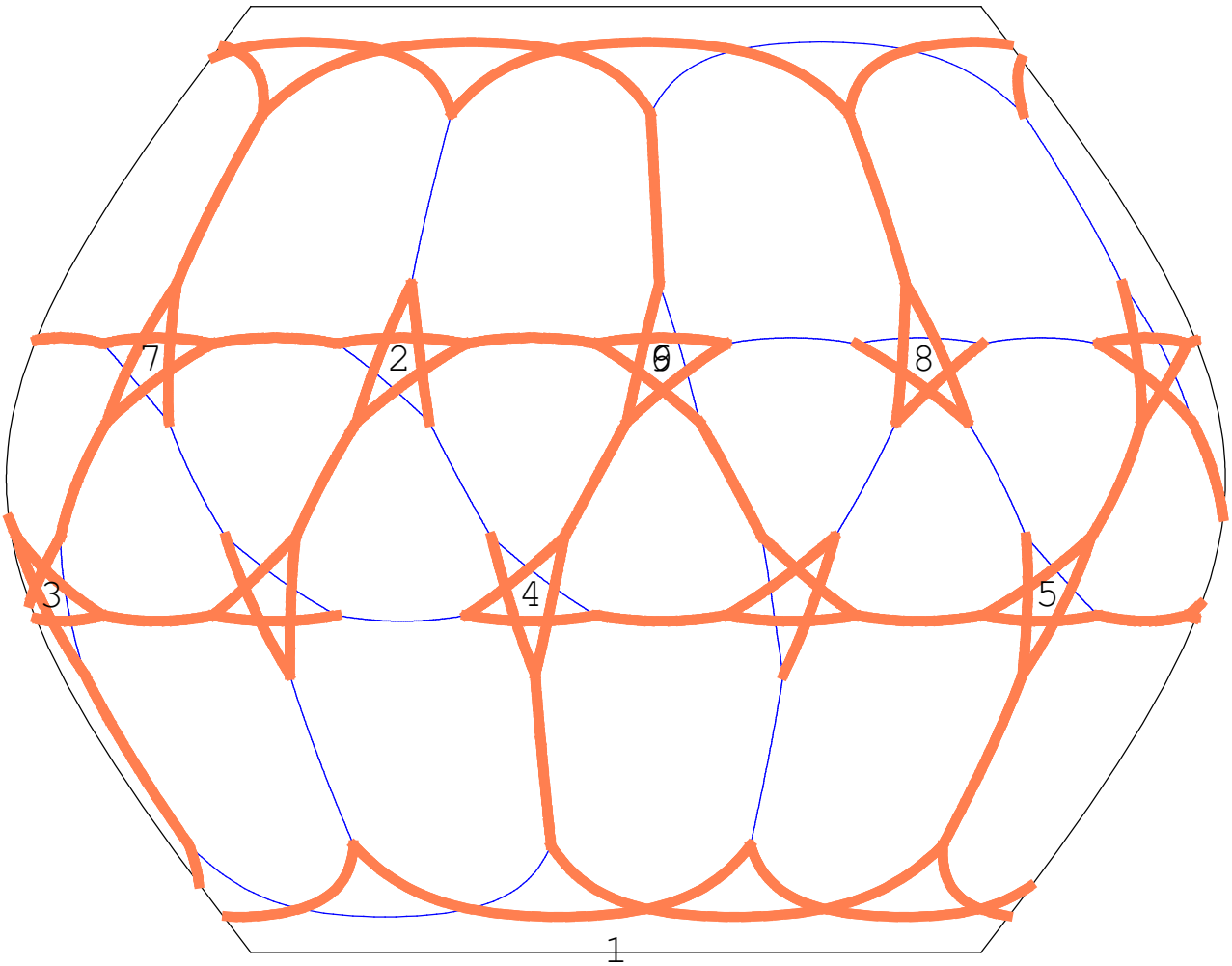


37.

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

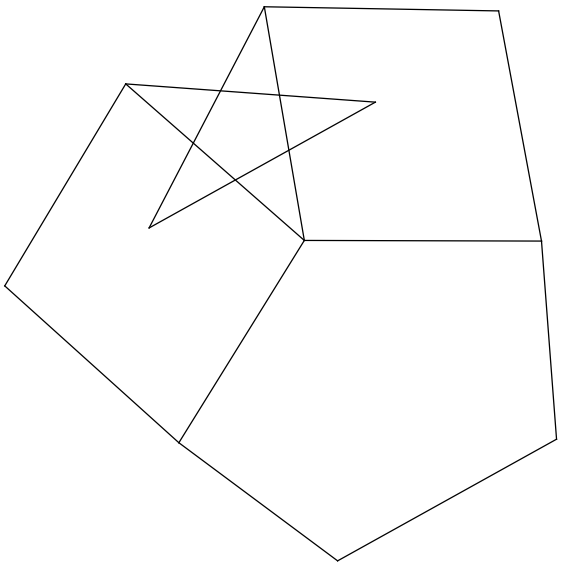


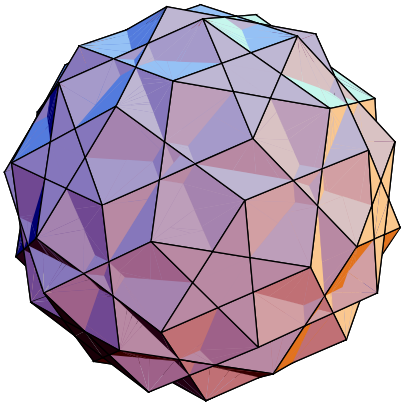


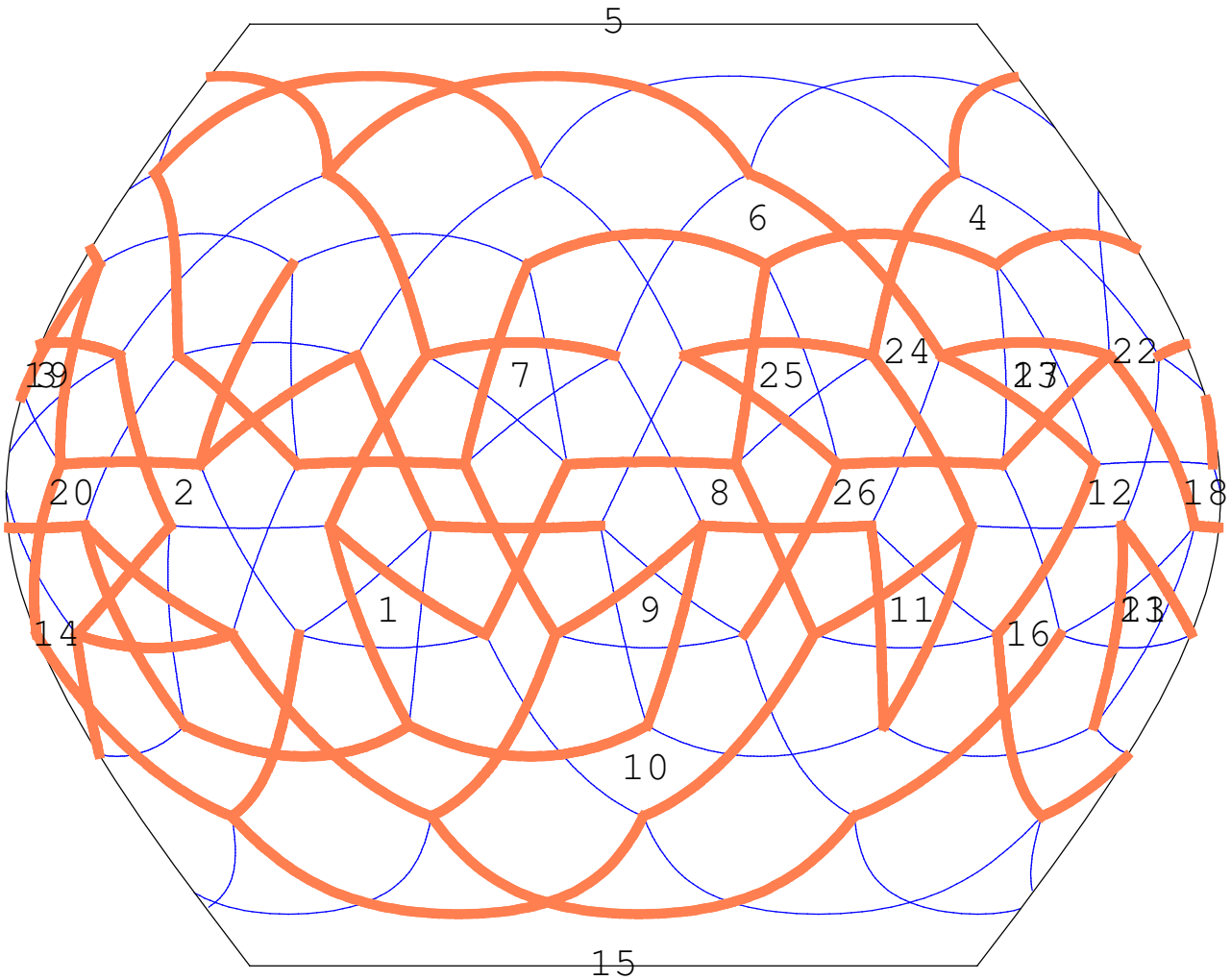


38.

`rhombidodecadodecahedron` $\{4, \frac{5}{2}, 4, 5\}$

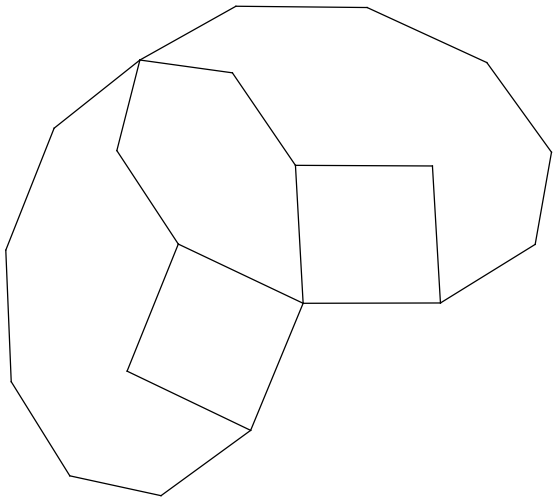


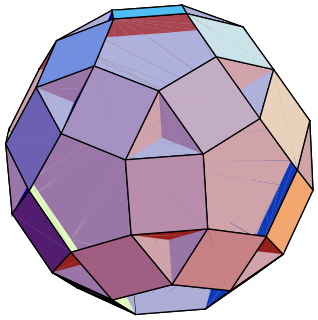


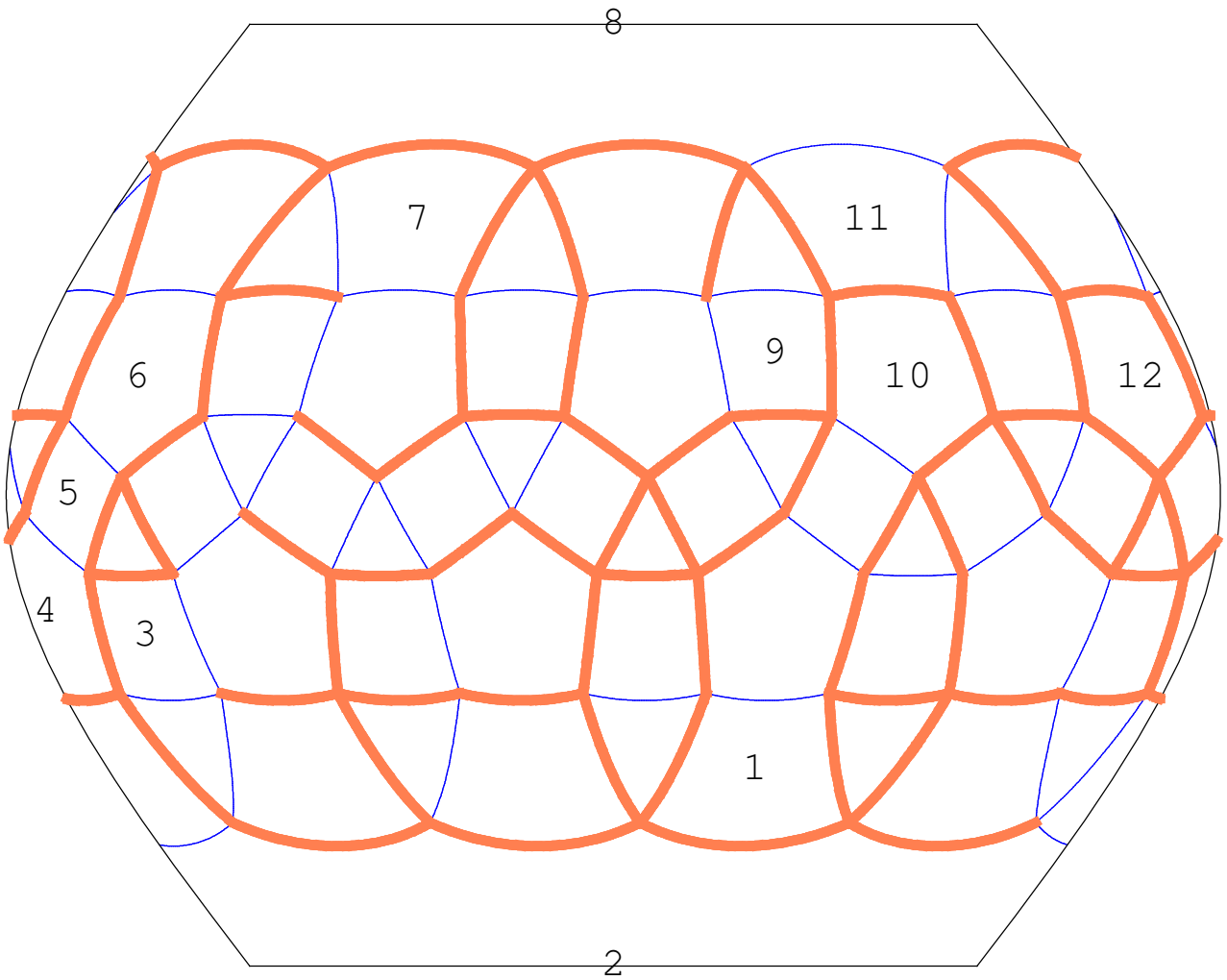


39.

`small rhombidodecahedron` $\{10, 4, \frac{10}{9}, \frac{4}{3}\}$







40.

snub dodecadodecahedron $\{3, 3, \frac{5}{2}, 3, 5\}$