

Pensieve header: Drawing a permutohedron. Continues pensieve://2009-10/.

```
In[*]:= SetDirectory["C:\\drorbn\\AcademicPensieve\\Classes\\23-FastComputations\\KH4Knots"]
```

```
Out[*]=
```

```
C:\\drorbn\\AcademicPensieve\\Classes\\23-FastComputations\\KH4Knots
```

```
In[*]:= pts4 = Point @@@ Permutations[Range[4]]
```

```
Out[*]=
```

```
{Point[1, 2, 3, 4], Point[1, 2, 4, 3], Point[1, 3, 2, 4], Point[1, 3, 4, 2], Point[1, 4, 2, 3],
Point[1, 4, 3, 2], Point[2, 1, 3, 4], Point[2, 1, 4, 3], Point[2, 3, 1, 4], Point[2, 3, 4, 1],
Point[2, 4, 1, 3], Point[2, 4, 3, 1], Point[3, 1, 2, 4], Point[3, 1, 4, 2], Point[3, 2, 1, 4],
Point[3, 2, 4, 1], Point[3, 4, 1, 2], Point[3, 4, 2, 1], Point[4, 1, 2, 3], Point[4, 1, 3, 2],
Point[4, 2, 1, 3], Point[4, 2, 3, 1], Point[4, 3, 1, 2], Point[4, 3, 2, 1]}
```

```
In[*]:= mat = {{1, -1, 0, 0}, {0, 1, -1, 0}, {0, 0, 1, -1}};
```

```
mat = Drop[Orthogonalize[{{1, 1, 1, 1}, {1, -1, 0, 0}, {0, 1, -1, 0}, {0, 0, 1, -1}}, 1]
```

```
Out[*]=
```

$$\left\{ \left\{ \frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}}, 0, 0 \right\}, \left\{ \frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}, -\sqrt{\frac{2}{3}}, 0 \right\}, \left\{ \frac{1}{2\sqrt{3}}, \frac{1}{2\sqrt{3}}, \frac{1}{2\sqrt{3}}, -\frac{\sqrt{3}}{2} \right\} \right\}$$

```
In[ ]:= pts3 = pts4 /. Point[xs_] => Point @@ (
  mat.{xs}
)
```

```
Out[ ]:=
```

$$\left\{ \text{Point} \left[ \frac{1}{\sqrt{2}} - \sqrt{2}, \sqrt{\frac{2}{3}} + \frac{1}{\sqrt{6}} - \sqrt{6}, -\sqrt{3} \right], \text{Point} \left[ \frac{1}{\sqrt{2}} - \sqrt{2}, \frac{1}{\sqrt{6}} - \sqrt{6}, \frac{7}{2\sqrt{3}} - \frac{3\sqrt{3}}{2} \right], \right.$$

$$\text{Point} \left[ -\sqrt{2}, -2\sqrt{\frac{2}{3}} + \sqrt{\frac{3}{2}} + \frac{1}{\sqrt{6}}, -\sqrt{3} \right], \text{Point} \left[ -\sqrt{2}, -4\sqrt{\frac{2}{3}} + \sqrt{\frac{3}{2}} + \frac{1}{\sqrt{6}}, \frac{5}{2\sqrt{3}} - \frac{\sqrt{3}}{2} \right],$$

$$\text{Point} \left[ \frac{1}{\sqrt{2}} - 2\sqrt{2}, \frac{1}{\sqrt{6}}, \frac{7}{2\sqrt{3}} - \frac{3\sqrt{3}}{2} \right], \text{Point} \left[ \frac{1}{\sqrt{2}} - 2\sqrt{2}, 2\sqrt{\frac{2}{3}} + \frac{1}{\sqrt{6}} - \sqrt{6}, \frac{5}{2\sqrt{3}} - \frac{\sqrt{3}}{2} \right],$$

$$\text{Point} \left[ -\frac{1}{\sqrt{2}} + \sqrt{2}, \sqrt{\frac{2}{3}} + \frac{1}{\sqrt{6}} - \sqrt{6}, -\sqrt{3} \right], \text{Point} \left[ -\frac{1}{\sqrt{2}} + \sqrt{2}, \frac{1}{\sqrt{6}} - \sqrt{6}, \frac{7}{2\sqrt{3}} - \frac{3\sqrt{3}}{2} \right],$$

$$\text{Point} \left[ -\frac{3}{\sqrt{2}} + \sqrt{2}, \sqrt{\frac{3}{2}}, -\sqrt{3} \right], \text{Point} \left[ -\frac{3}{\sqrt{2}} + \sqrt{2}, \sqrt{\frac{3}{2}} - \sqrt{6}, \sqrt{3} \right],$$

$$\text{Point} \left[ -\sqrt{2}, 2\sqrt{\frac{2}{3}}, \frac{7}{2\sqrt{3}} - \frac{3\sqrt{3}}{2} \right], \text{Point} \left[ -\sqrt{2}, 0, \sqrt{3} \right],$$

$$\text{Point} \left[ \sqrt{2}, -2\sqrt{\frac{2}{3}} + \sqrt{\frac{3}{2}} + \frac{1}{\sqrt{6}}, -\sqrt{3} \right], \text{Point} \left[ \sqrt{2}, -4\sqrt{\frac{2}{3}} + \sqrt{\frac{3}{2}} + \frac{1}{\sqrt{6}}, \frac{5}{2\sqrt{3}} - \frac{\sqrt{3}}{2} \right],$$

$$\text{Point} \left[ \frac{3}{\sqrt{2}} - \sqrt{2}, \sqrt{\frac{3}{2}}, -\sqrt{3} \right], \text{Point} \left[ \frac{3}{\sqrt{2}} - \sqrt{2}, \sqrt{\frac{3}{2}} - \sqrt{6}, \sqrt{3} \right],$$

$$\text{Point} \left[ \frac{3}{\sqrt{2}} - 2\sqrt{2}, \sqrt{\frac{2}{3}} + \sqrt{\frac{3}{2}}, \frac{5}{2\sqrt{3}} - \frac{\sqrt{3}}{2} \right], \text{Point} \left[ \frac{3}{\sqrt{2}} - 2\sqrt{2}, \sqrt{\frac{3}{2}}, \sqrt{3} \right],$$

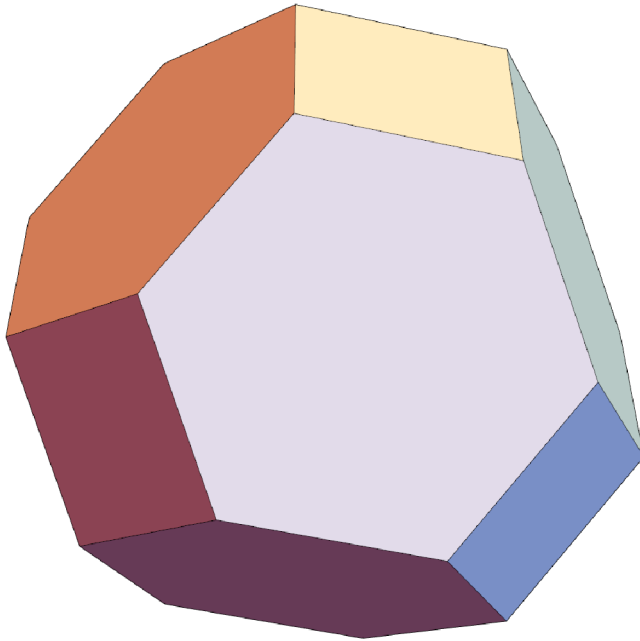
$$\text{Point} \left[ -\frac{1}{\sqrt{2}} + 2\sqrt{2}, \frac{1}{\sqrt{6}}, \frac{7}{2\sqrt{3}} - \frac{3\sqrt{3}}{2} \right], \text{Point} \left[ -\frac{1}{\sqrt{2}} + 2\sqrt{2}, 2\sqrt{\frac{2}{3}} + \frac{1}{\sqrt{6}} - \sqrt{6}, \frac{5}{2\sqrt{3}} - \frac{\sqrt{3}}{2} \right],$$

$$\text{Point} \left[ \sqrt{2}, 2\sqrt{\frac{2}{3}}, \frac{7}{2\sqrt{3}} - \frac{3\sqrt{3}}{2} \right], \text{Point} \left[ \sqrt{2}, 0, \sqrt{3} \right],$$

$$\text{Point} \left[ -\frac{3}{\sqrt{2}} + 2\sqrt{2}, \sqrt{\frac{2}{3}} + \sqrt{\frac{3}{2}}, \frac{5}{2\sqrt{3}} - \frac{\sqrt{3}}{2} \right], \text{Point} \left[ -\frac{3}{\sqrt{2}} + 2\sqrt{2}, \sqrt{\frac{3}{2}}, \sqrt{3} \right] \left. \right\}$$

```
In[ ]:= Permutohedron = Rasterize@Graphics3D[ConvexHullMesh[pts3 /. Point -> List],  
      {Boxed -> False, ImageSize -> {359.635, 357.951}, ImageSizeRaw -> Automatic, ViewPoint ->  
      {2.76216, 1.27727, 1.47954}, ViewVertical -> {0.0144266, 0.597172, 0.801984}}]
```

Out[ ]=



```
In[ ]:= Export["Permutohedron.png", ImageCrop@Permutohedron]
```

Out[ ]=

Permutohedron.png