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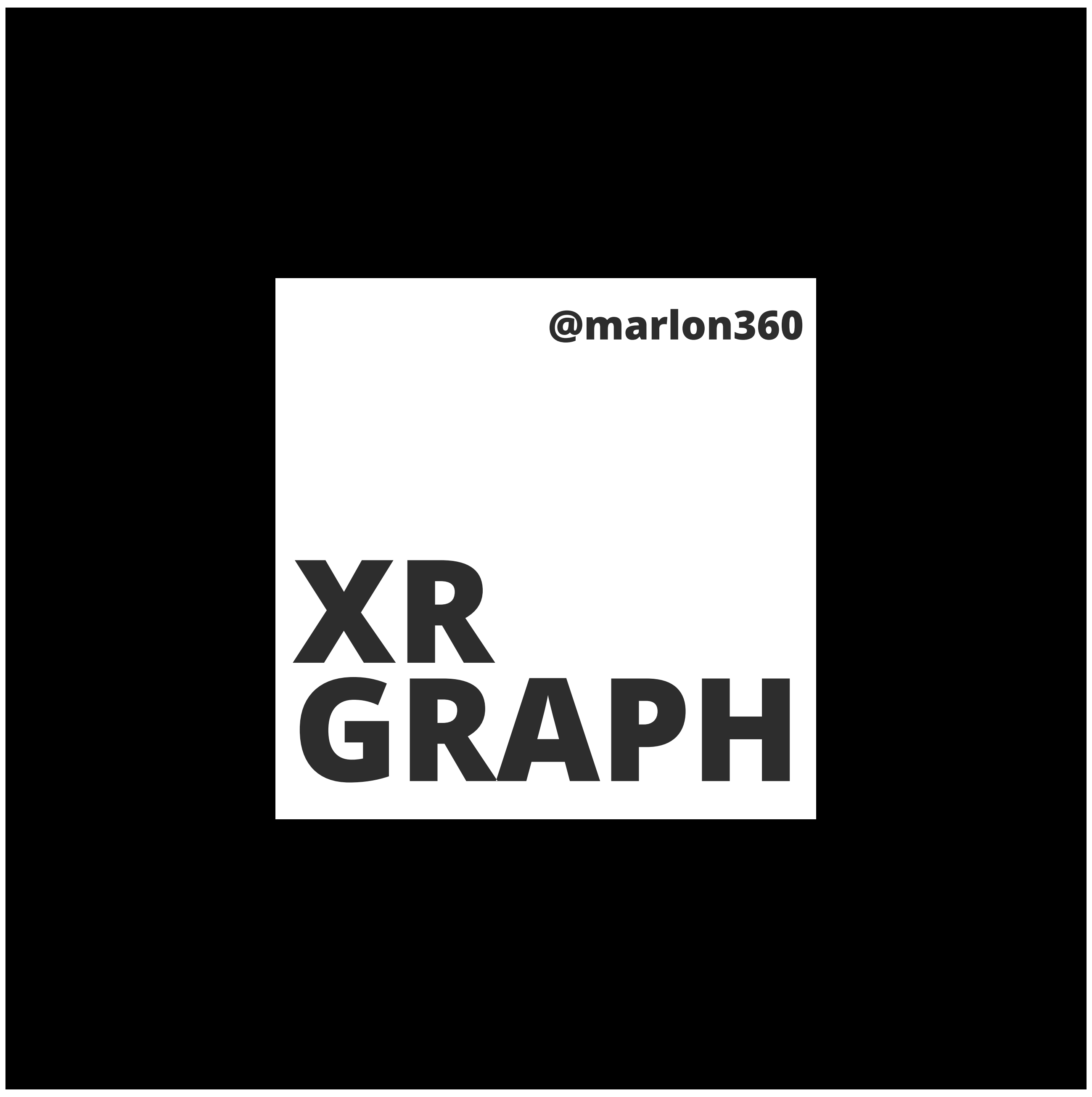
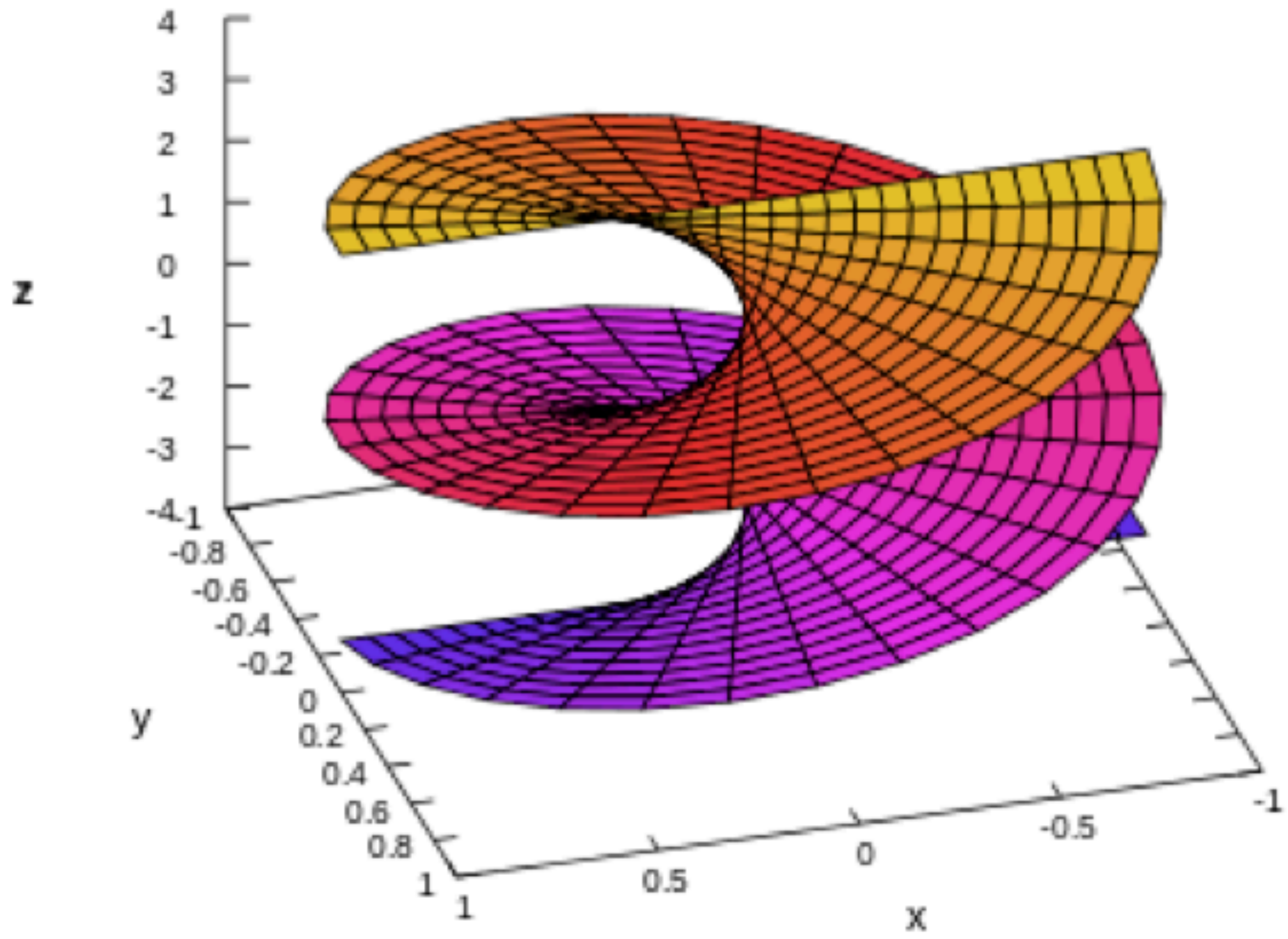
Helicoid

The **helicoid**, after the plane and the catenoid, is the third minimal surface to be known.





A helicoid with $\alpha = 1$, $-1 \leq \rho \leq 1$ and $-\pi \leq \theta \leq \pi$.

Description

It was described by Euler in 1774 and by Jean Baptiste Meusnier in 1776. Its name derives from its similarity to the helix: for every point on the helicoid, there is a helix contained in the helicoid which passes through that point. Since it is considered that the planar range extends through negative and positive infinity, close observation shows the appearance of two parallel or mirror planes in the sense that if the slope of one plane is traced, the co-plane can be seen to be bypassed or skipped, though in actuality the co-plane is also traced from the opposite perspective.

The helicoid is also a ruled surface (and a right conoid), meaning that it is a trace of a line. Alternatively, for any point on the surface, there is a line on the surface passing through it. Indeed, Catalan proved in 1842 that the helicoid and the plane were the only ruled minimal surfaces.[1].

A helicoid is also a translation surface in the sense of differential geometry.

The helicoid and the catenoid are parts of a family of helicoid-catenoid minimal surfaces.

The helicoid is shaped like Archimedes screw, but extends infinitely in all directions. It can be described by the following parametric equations in Cartesian coordinates:

$$x = \rho \cos(\alpha\theta),$$
$$y = \rho \sin(\alpha\theta),$$
$$z = \theta,$$