PARABOLA, PARABOLOID IN ARCHITECTURE

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Parabola is defined as a set of points in a plane that are equidistant from both the line and the point.

The line *d* is called the ***directrix*** of the parabola while the point *F* is called the ***focus*** of the parabola.

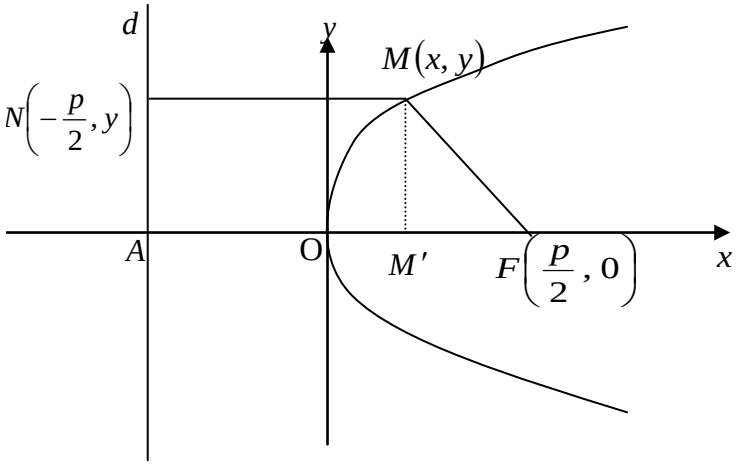


Fig. 1.

The parabola does not have a centre of symmetry but has an axis of symetry Ox. It is a plane curve.

Implicit Cartesian equations of the parabola: $y^2 = 2px$.

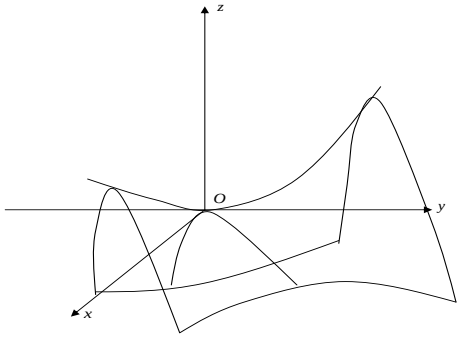
Note: When $x \le 0$, the implicit Cartesian equation will become $y^2 = -2px$.

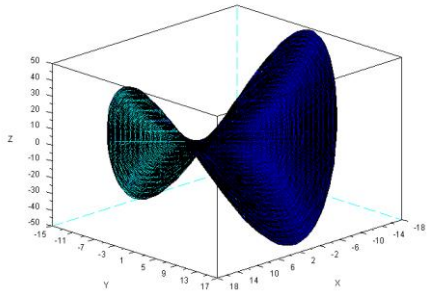
Explicit Cartesian equations of the parabola: $y = \pm\sqrt{2px}$, $x \ge 0$, p being a positive point called the *parameter of the parabola* which shows its shape.
The smaller *p* is, the closer *Oy* comes to the focus and directrix and the parabola gets closer to *Ox* axis (when $p \to 0$ then the parabola degenerates in *Ox* axis). The bigger *p* is, the farther the focus and directrix get from the *Oy* axis and the parabola comes closer to the *Oy* axis (when $p \to \infty$ then the parabola degenerates in the *Oy* axis).

Parametric equations of the parabola: $\begin{cases} x = \dfrac{t^2}{2p}; \quad t \in \Re \\ y = t \end{cases}$

Hyperbolic paraboloid is the locus of the points M(x,y) in the plane which satisfy the equation: $\frac{x^2}{a^2}-\frac{y^2}{b^2}=2z, a, b>0$

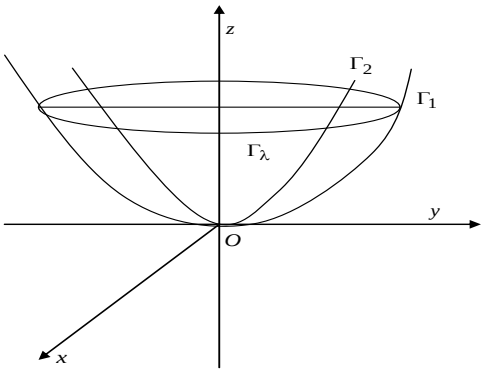
The hyperbolic paraboloid is a doubly ruled surface shaped like a saddle and i formed by doubly ruling a parabola that opens downward on a parabola that opens upward.

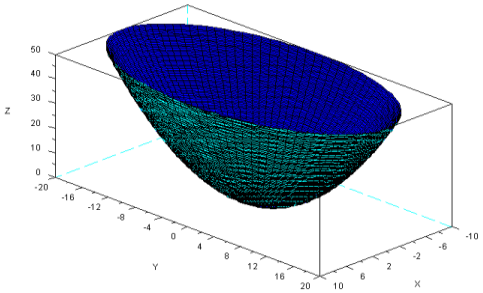




The hyperbolic paraboloid is used in industrial constructions as a roof pattern.

Elliptic paraboloid is the locus of the points M(x,y) in a plane which satisfy the equation: $\frac{x^2}{a^2}+\frac{y^2}{b^2}=2z, a, b>0$





Note: If a=b, then the elliptic paraboloid is circular around Oz, that means it can be generated through the rotation of a parabola of equation: $y^2=2a^2z$ around the axis Oz.

Parabolas and Paraboloids in architecture

Parabolic arches are often used in architecture and construction engineering because they ensure the equilibrium of forces and thus the construcions are much more stable.

Spring 24 in Olăneşti mountain resort

The Olympic Pool in Bacău

Hulme Arch Bridge, Manchester, England

Bibliography: ro.wikipedia.org