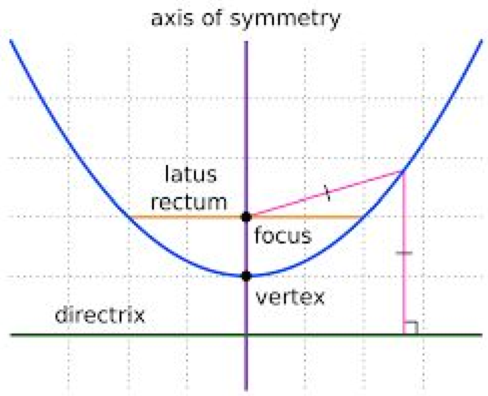
QUADRATIC FUNCTION

In this lesson you are going to learn:

- DEFINITION AND ELEMENTS OF THE PARABOLA
- HOW CAN WE GET THE EQUATION OF A PARABOLA?
- QUADRATIC EQUATION: COMPLETE, PURE, SPURIOUS AND MONOMIAL
- DISCRIMINANT: DELTA
- PARABOLIC MOTION

DEFINITION AND ELEMENTS OF THE PARABOLA

The parabola is the Locus of the points which have the same distance from a fixed point called FOCUS and a fixed line called the DIRECTRIX.



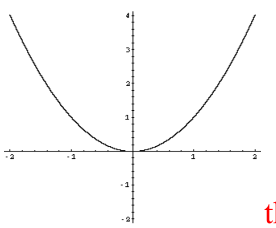
- **the axis of symmetry** of the parabola is the line that **divides** it into **two congruent parts**

- the **vertex** of the parabola is the point of **intersection** between the **parabola** and the **axis of symmetry** and also the **lowest/higher point** of the parabola.

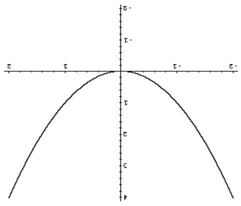
The parabola is the grafical rappresentation **of a quadratic function**, and is strictly related to the quadratic equation. The **two solution of a quadratic equation**, if they are real, represent the intersection points of the curve with the x**-axis.**

- The standard formula of the parabola is : $y= ax^2+bx+c$

❖ **a** is the coefficent of x^2, if **a=0**, the equation becomes linear (first grade), and in the graph represents a straight line.

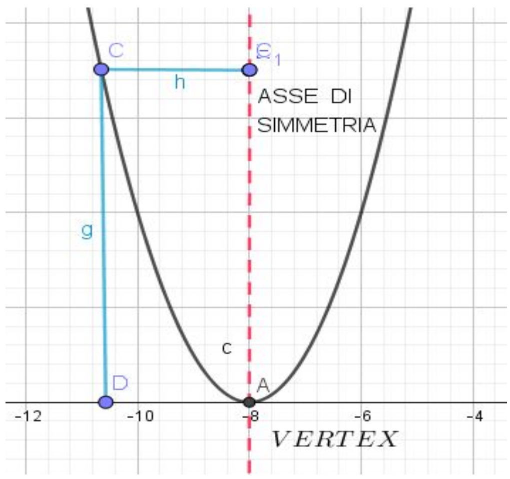


❖ If **a>0** the parabola opens upwards

❖ If **a<0**  the parabola opens downwards

HOW CAN WE GET THE EQUATION OF A PARABOLA?

- To draw a parabola, given the equation **$y = ax^2 + bx + c$**, you have to calculate:
- **the vertex**, is the lowest point if a> 0, the highest point if a <0, which has coordinates **V (-b/2a; -Δ/4a)**;
- **the axis of symmetry** having equation **y = -b/2a**;
- **find two or more** points for example the intersection points with the x and y-axis.



QUADRATIC EQUATION: COMPLETE, PURE, SPURIOUS AND MONOMIAL

- Complete equation, when none of the coefficients is equal to zero:

$$\mathbf{ax^2+bx+c=0}$$

with a, b, c real number and a≠0
example: $4x^2+5x-6=0$ is a complete equation, with coefficients a=4, b=5, c=−6

- **Pure equation**, if b=0 and c≠0. The equation then becomes:

$$\mathbf{ax^2+c=0}$$

example: $2x^2+4=0$ is a pure equation, with coefficients a=2, b=0, c=4

- **Spurious equation**, if b≠0 and c=0. The equation then becomes:

$$\mathbf{ax^2+bx=0}$$

example: $2x^2+6x=0$ is a spurious equation, with coefficients a=2, b=6, c=0

- **Monomial equation**, if b=0 and c=0. The equation then becomes:

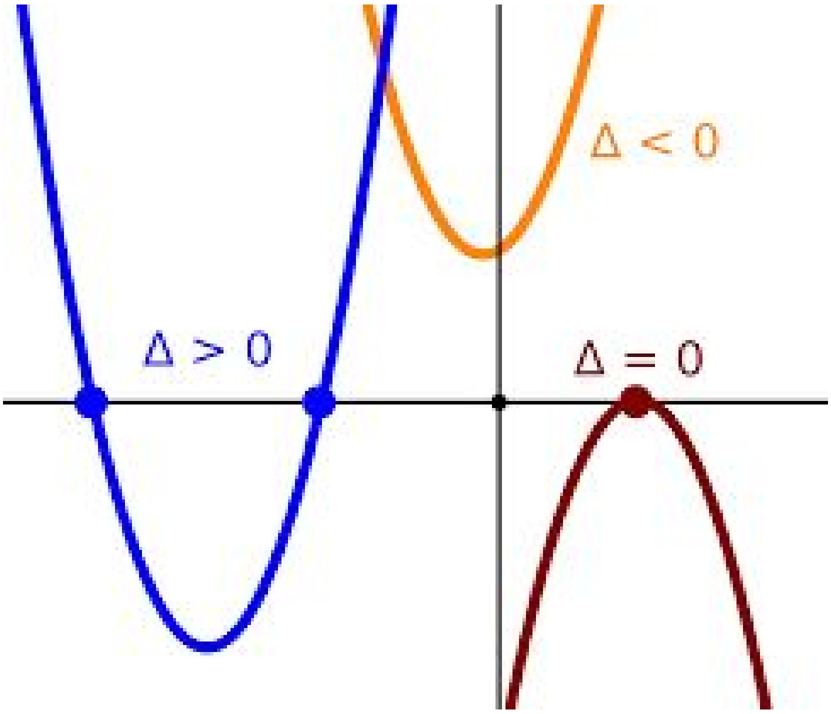
$$ax^2=0$$

example: $x^2=0$ is a monomial equation, with coefficients a=1, b=0, c=0

DISCRIMINANT: DELTA

Delta is called the discriminant of the equation: $\Delta = b^2 - 4ac$

- if Δ >0 there are two different real solutions and the parabola crosses two times the x-axis
- if Δ =0, there are two coincident solutions and the parabola crosses on time the x-axis
- if Δ <0, the equation loses its meaning and becomes impossible and the parabola has any intersection poits with the x-axis.

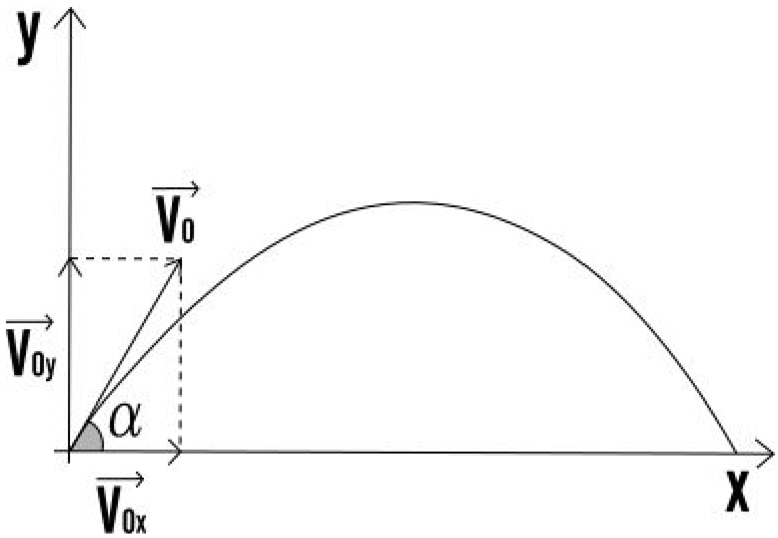


PARABOLIC MOTION

- The parabolic motion is a practical application of the parabola.
- An example is the motion of the ball being kicked: the parable that it performs can be expressed in an equation.
- This can be linked to physics, especially to the parabolic motion formulas

$$\begin{cases} x = x_0 + v_{0x}t \\ y = -\frac{1}{2}gt^2 + v_{0y}t + y_0 \end{cases}$$

- In physics the parabolic motion is defined as that movement underwent only to the force of gravity and the bodies involved are defined as “projectiles”.



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