

Have you ever wondered about the U-shaped curves found in many architectures such as bridges, arches, cables or even hanging chains? Most people would think these U-shaped curves are parabolas, just like the path traced out by a projectile and so do I. Genius scientist Galileo also thought the curve of a hanging chain was a parabola and he later found out this was a wrong idea. Joachim Jungius later proved that the curve found in a hanging chain is not a parabola mathematically.

In fact, this kind of curve is called a catenary which is the shape of a chain or cable with its own weight supported by the two ends under normal gravitational assumption. On the other hand, a projectile has no external supports of its weight and just falls freely under the effect of the gravity and probably its initial speed. Graphically, if we put a parabola and a catenary together, we can see that the catenary grows more slowly at the lowest point comparing with the parabola and the growth rate at other points of the catenary is much bigger than the same corresponding points on the parabola. Mathematically, the equation

of a typical catenary is $y = a \cosh\left(\frac{x}{a}\right) + b$ where a is the distance of the lowest point from the x -axis while the equation of a typical parabola is $y = ax^2 + bx + c$.