

Roman Arch Set

Item code 40500

Description:

This set of hardwood blocks is precision-cut in the shape of a catenary arch. It needs no support because it is the ideal shape to hold its own weight. The forces acting on the arch cause it to take the shape of a curve naturally.

Introduction:

A catenary arch is the curve which is formed by a heavy, perfectly flexible cord, cable or chain, hanging from two fixed points not in the same vertical line, and acted on by gravity. It comes from the word **catenarius** which is Latin for relating to a chain.

The equation of this "chain-curve" was obtained by Leibniz, Huygens and Johann Bernoulli in 1691, who were responding to a challenge put out by Jacob Bernoulli to see if this could be done. The equation can be described as follows:

$$y = a \cosh (x/a)$$

Preceding this challenge, the catenary had been under discussion in the scholarly world for some years. Huygens was the first to use the term "catenary" in a letter to Leibniz in 1690. In the same year, David Gregory wrote a treatise on the catenary. Jungius (in 1669) disproved Galileo's claim that the curve of a chain hanging under gravity would be a parabola.

In mathematical terms, the catenary is the locus of the focus of a parabola rolling along a straight line and is the evolute of the tractrix. It is the locus of the midpoint of the vertical line segment between the curves e^x and e^{-x} . Euler showed in 1744 that a catenary revolved about its asymptote generates the only minimal surface of revolution.

How To Use:

Use the picture overleaf to help you construct the arch. You do not need further support, as with a scaffold, if each block is carefully placed in order. We suggest you build up two legs simultaneously. You can cup one hand around each end while also dropping in

the top blocks. If desired, you can build the arch on a panel such as a board or cardboard and then try to raise the arch and leave it standing. If the arch falls, it probably means the blocks were not carefully assembled according to the picture. Make sure all blocks are mated to the adjoining blocks with no over-lapping corners.

You might wish to number each block if you plan to have many students reassemble the arch.

