

Catenary Arch

Build an arch that can stand up by itself.

Try this:

- Flip up the narrow wooden base.
- Place all the blocks carefully within the outlines, starting with number 1 and continuing in order. Make sure the black stripe is on the inside of the arch and the numbers point toward the top of the arch.
- Make sure all the blocks fit closely together before putting the last block, number 11, into place.
- Slowly and carefully raise the board until the arch is vertical. Gently lower the board back down to the table. The arch you built should stand by itself.
- Notice that if you touch the free-standing arch very gently, it will sway like a chain, but it will not fall down.

What's going on?

The arch you built is self-supporting because it has a special shape called a *catenary*. Every block in the arch is held in place by its neighboring blocks. The blocks don't slide off each other, even at the top, because the forces between the blocks are along the curve of the arch itself.

A catenary shape forms naturally when you suspend a rope or chain from two points. (The word “catenary” comes from the Latin *catena*, meaning “chain.”)

So what?

The 630-foot Gateway Arch in St. Louis, Missouri, was built in the shape of a catenary. Catenary arches are especially strong because they redirect the vertical force of gravity into compression forces that press along the curve of the arch.