

An Instrument That Has to Be in Tune

Ratio and proportion, measurement, and the physical relationship between string length and pitch.

AGE RANGE

3rd grade and up

TIME NEEDED

About 20 minutes per child

THE BIG IDEA

A stretched string only responds to two things: how long it is, and how tight it is. Shorten it to exactly half its length, and the pitch jumps up one full octave, every single time. This build lets you test that with your own hands and ears, about 20 minutes from start to finish.

WHAT YOU'LL NEED

- ☐ A sturdy shoebox or similar small box
- ☐ A wooden board or thick ruler to lay across the box opening
- ☐ Fishing line (an adult should handle tensioning and knots), or a couple of sturdy rubber bands for a younger builder as a safer, easier substitute
- ☐ A ruler
- ☐ Something to play a reference note: a piano, keyboard app on a phone, or another instrument in the house

**An adult should handle the string**

If you are using fishing line, tension and knot-tying should be done by an adult, not pulled taut around a child's fingers. Rubber bands are a fine, lower-tension substitute for younger kids and remove most of that concern.

BUILDING AND TESTING

1**Build the body (adult helps)**

Lay the board across the open top of the box so it spans the opening like a little bridge. This is what your string will stretch across.



PHOTO GOES HERE

Photo: box and board, ready for stringing

2

String it up

Stretch the fishing line or rubber band across the board and anchor both ends firmly. It should be snug but does not need to be perfectly tight yet.

3

Measure the full length

Measure the string between its two anchor points with a ruler. Write this number down, call it your “whole” length.

4

Tune the open string

Play a reference note on a piano, app, or other instrument, and adjust the tension of your string until plucking it roughly matches that note.

5

Guess, then test the halfway point

Before you measure, guess out loud: what do you think will happen if you press the string exactly in the middle? Then measure the halfway point, press there, and pluck. It should sound like the same note, just higher, an octave up.



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Photo: marking and testing the halfway point

6

Guess, then test the quarter point

Do the same thing at one quarter of the full length. It should jump up another octave from there.

TALK ABOUT IT

- Why do you think cutting the length in half changes the pitch by such a big, clean jump?
- What happens if you loosen the string instead of shortening it? Is that the same kind of change, or something different?