



YOUMAGINE

Cube Puzzle Quartet

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Located at: <http://www.youmagine.com/designs/cube-puzzle-quartet>

Short description:

Four tricky Cube Puzzles - can you get the pieces into the box?

Description:

This year at Maker Faire Bay Area, Ultimaker is offering a challenge: Solve one of our 3D-printed Cube Puzzles and you get to keep it! **Level 1: Easy** The *Soma Cube* has 240 different solutions, so it's easier to solve than the other puzzles. This puzzle was very popular in the 1960's, and people enjoy assembling the pieces into many other pleasing shapes like stairs or pyramids. **Level 2: Medium** The *Hoffmann Cube* is the earliest known 3x3x3 Cube Puzzle, created in 1893. This puzzle has only six types of solutions, up to symmetry. One interesting thing about the Hoffmann Cube is that all of its pieces are flat! **Level 3 = Hard** The *Coffin Cube* has only one solution and it is also known as the Half Hour Puzzle, created by Stewart Coffin. All four of the puzzle patterns used in our Cube Puzzle Challenge are from Stewart Coffin's excellent book *Geometric Puzzle Design*. **Level 4 = Diabolical** The *Nob Cube* also has only one solution and it is notoriously difficult to solve. Some puzzle makers craft this puzzle out of wood and it is said that the puzzle is so difficult that solvers sometimes resort to examining the grain of the wood to figure out how the pieces fit together. Are you up to the challenge? The 3D-printed pieces of each Cube Puzzle, as well as the container box, can be printed without supports, rafts, or brims. These prints are optimized to print on Ultimaker Fast settings, at .15mm layer height, with an 0.4mm nozzle. For other printers, resolutions, or nozzle sizes, you may need the pieces to have different clearances; feel free to message me if you have a need for such a modification. **PROJECT: Design Your Own Cube Puzzle!** Have students use their favorite 3D design software to create their own Cube Puzzles. This project can be adapted for many different educational subject areas and at a variety of levels: **Beginner:** Use Tinkercad or Morphi to place boxes together to construct puzzle pieces that fit together into a 3x3x3 cube. How do you know they will all fit together into the cube? Print out your puzzle and have fellow students try it out to rate its difficulty. **Intermediate:** Use Blender, Fusion 360, or AutoCAD to create puzzle pieces, and use fillets and offsets so that the pieces are pleasant to hold and fit together nicely. Create a container box that will hold the assembled Cube Puzzle. Who can make the most difficult puzzle? **Fundraising:** Print out students' Cube Puzzles and create a solving event where parents and faculty try to solve the puzzles. Raise money for your school or classroom by charging per solving minute, having solving championships, or selling the Cube Puzzles themselves. You can inscribe one of the puzzle pieces in each Cube with text to personalize it for your school or event. **Designing with Code:** Use OpenSCAD or BlocksCAD to create pieces for a Cube Puzzle by translating and arranging cubes. Add code that creates clearance for where pieces will touch each other. Make this clearance customizable so that it can be easily changed for printing on different 3D printers or with different settings. **Exploring Mathematics:** Which other 3D shapes could be used in this type of puzzle? What types of polyhedra can fill space, and which of those can be used to create a puzzle whose pieces can slide together? As a starting point, think about 2D space-filling shapes and puzzles by exploring tessellations and tangrams. **Advanced:** Use the software BurrTools to construct a Cube Puzzle, analyze it for constructability, and test how many solutions it has. Can you find a new 3x3x3 Cube puzzle that has only one solution? You can also try your hand at more advanced puzzles like interlocking Burr Puzzles or puzzles with unit shapes other than cubes.

If you can, please use the online documentation found at <http://www.youmagine.com/designs/cube-puzzle-quartet> because those may have been updated. Also, there you can interact and provide praise and/or feedback.