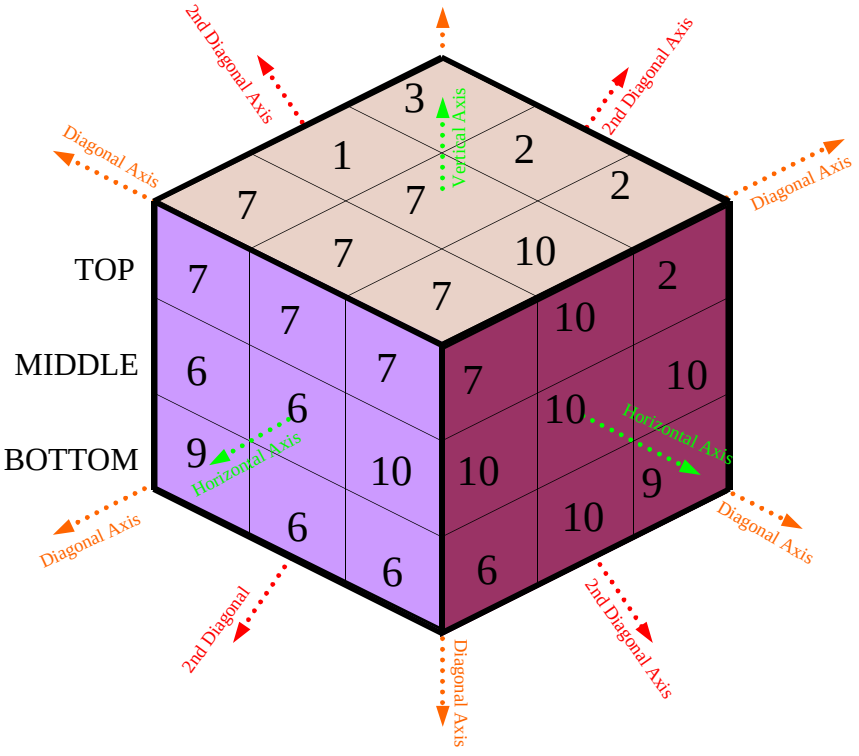
Lesson Two
Critical Thinking



3	2	2
1	7	10
7	7	7

TOP

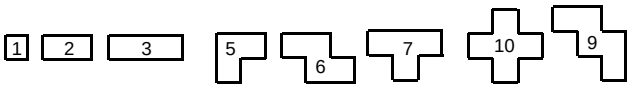
3	5	10
5	5	10
6	6	10

MIDDLE

3	9	9
9	9	10
9	6	6

BOTTOM

Use the pieces shown below to make the 3x3x3 cub puzzle shown above.
Record the piece locations in their respective grid locations.
(Note: There is more than one solution.)



Class Setting:

To help the Students have fun with this exercise, we will continue to have them pretend that they are all computer engineers working on a research program to understand the placement of computer chips on the motherboard within a new micro-computer. Space is still extremely limited and getting the pieces to all fit on may be difficult… Except this time there is a new twist. (Introduce the twist in the second hour.) What they didn't know was…, that when they were given specific pieces to sketch in the last lesson, we are now going to pretend that those were the chips that they had created/designed. When the computer is complete the manufacturer wants to have a glass opening so everyone can see two or three squares in the middle of the motherboard. If their piece is located where it can be seen, it would get their name in front of everyone and that could mean fame and fortune. Again, the JENZAC™ puzzles pieces will represent the computer chips and the solution grids will serve as the motherboard, only now each student has an interest as to the placement of certain pieces. If the project is to be successful, the students will have to use Critical Thinking to provide good non-bios conclusions.

Overview of Critical Thinking:

Students need to know that the way we think is as important as the things we are thinking about. This applies to the way we look at science; the way we interact with our friends and family, and the way we view the world. In the lesson on **The Scientific Approach** we focused on a systematic way of analyzing a problem. This lesson will not only use those systematic ways of solving a problem; but also, look at Critical Thinking, the way we think as we work through understand a problem.

This exercise is intended to introduce them to the concept of being a critical thinker. Provide them with a wealth of new terminology and try to have them challenge themselves and each other to see if their thought process is logical and with out bias. In addition, it will also continue to help them familiarize themselves with the JENZAC™ puzzles pieces and deepen their understanding of how it works.

The following review is also very technical. We only want to convey the concept to the students and pick out a few words or phrases you think they can understand. Work with those, the other is just for your review. Remember, it's the concept we're trying to help them realize.

Critical thinking consists of a mental process of analyzing or evaluating information, particularly statements or propositions that people have offered as true. It forms a process of reflecting upon the meaning of statements, examining the offered evidence and reasoning, and forming judgments about the facts.

Critical thinkers can gather such information from observation, experience, reasoning, and/or communication. Critical thinking has its basis in intellectual values that go beyond subject-matter divisions and which include: clarity, accuracy, precision, evidence, thoroughness and fairness.

Our problem will be a simple exercise in determining the alternate placement of the JENZAC™ puzzle pieces. Here we want the students to recognize the multiple combinations available to solving their puzzle problem and investigate the possible combinations to see which is the best solution given different constraints. We want them to do this while staying true to the principals of a Critical Thinker.

The following summary of critical thinking was taken from The Critical Thinking Community (www.criticalthing.org) and should provide an overview of Critical Thinking. Again, as the teacher you will have to pick out phrases and terms you feel are appropriate for your class. The concept of consciously trying to think in intellectual and scientific manner is what we are trying to install.

Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. In its exemplary form, it is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness.

It entails the examination of those structures or elements of thought implicit in all reasoning: purpose, problem, or question-at-issue; assumptions; concepts; empirical grounding; reasoning leading to conclusions; implications and consequences; objections from alternative viewpoints; and frame of reference. Critical thinking - in being responsive to variable subject matter, issues, and purposes - is incorporated in a family of interwoven modes of thinking, among them: scientific thinking, mathematical thinking, historical thinking, anthropological thinking, economic thinking, moral thinking, and philosophical thinking.

Critical thinking can be seen as having two components: 1) a set of information and belief generating and processing skills, and 2) the habit, based on intellectual commitment, of using those skills to guide behavior. It is thus to be contrasted with: 1) the mere acquisition and retention of information alone, because it involves a particular way in which information is sought and treated; 2) the mere possession of a set of skills, because it involves the continual use of them; and 3) the mere use of those skills ("as an exercise") without acceptance of their results.

Critical thinking varies according to the motivation underlying it. When grounded in selfish motives, it is often manifested in the skillful manipulation of ideas in service of one's own, or one's groups', vested interest. As such it is typically intellectually flawed, however pragmatically successful it might be. When grounded in fairmindedness and intellectual integrity, it is typically of a higher order intellectually, though subject to the charge of "idealism" by those habituated to its selfish use.

Critical thinking of any kind is never universal in any individual; everyone is subject to episodes of undisciplined or irrational thought. Its quality is therefore typically a matter of degree and dependent on , among other things, the quality and depth of experience in a given domain of thinking or with respect to a particular class of questions. No one is a critical thinker through-and-through, but only to such-and-such a degree, with such-and-such insights and blind spots, subject to such-and-such tendencies towards self-delusion. For this reason, the development of critical thinking skills and dispositions is a life-long endeavor.

Why Focus on Critical Thinking?

The Problem:

Everyone thinks; it is our nature to do so. But much of our thinking, left to itself, is biased, distorted, partial, uninformed or down-right prejudiced. Yet the quality of our life and that of what we produce, make, or build depends precisely on the quality of our thought. Shoddy thinking is costly, both in money and in quality of life. Excellence in thought, however, must be systematically cultivated.

A Definition:

Critical thinking is that mode of thinking - about any subject, content, or problem - in which the thinker improves the quality of his or her thinking by skillfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them.

The Result:

A well cultivated critical thinker:

- raises vital questions and problems, formulating them clearly and precisely;
- gathers and assesses relevant information, using abstract ideas to interpret it effectively comes to well-reasoned conclusions and solutions, testing them against relevant criteria and standards;
- thinks openmindedly within alternative systems of thought, recognizing and assessing, as need be, their assumptions, implications, and practical consequences; and
- communicates effectively with others in figuring out solutions to complex problems.

Critical thinking is, in short, self-directed, self-disciplined, self-monitored, and self-corrective thinking. It presupposes assent to rigorous standards of excellence and mindful command of their use. It entails effective communication and problem solving abilities and a commitment to overcome our native egocentrism and sociocentrism.

List of Materials Needed:

- 1 set of JENZAC™ pieces per group (team) of students
- Paper or Notebook (1 per student)
- Pens/Pencils

Activity Time Frame:

- Two hours or two one hour time blocks.

Environmental Setting:

- A classroom with semi-large tables with space enough to work as a group.

PASS Objectives:

The student will:

- Expand their vocabulary.
- Understand the concept of Critical Thinking.

Project Objectives:

The students will:

- Improve their ability to set up a scientific notebook, record their findings and convey their conclusions while focusing on the importance of Critical Thinking.
- Expand their scientific vocabulary.
- Improve team building skills.
- Improve fine motor skills.
- Reinforce an understanding of basic geometric shapes and their manipulation.
- Reinforce their understanding of multiplication, square and square root functions.
- Become familiar with the JENZAC™ puzzle pieces. This is important for future lessons.

Vocabulary Terms

There will be many new vocabulary terms used through out this exercise for your students. Highlight a few that you feel your class will grasp and focus on them. You may also have them let you know when you're using words they don't know. Below are a few definitions you may also choose to use:

- **Evaluation** - the systematic determination of merit, worth, and significance of something or someone. Evaluation often is used to characterize and appraise subjects of interest in a wide range of human enterprises, including the Arts, business, computer science, criminal justice, education, engineering, foundations and non-profit organizations, government, health care, and other human services.
- **Reasoning** - The act of using reason to derive a conclusion from certain premises using a given methodology.
- **Intelligence** - a property of mind that encompasses many related mental abilities, such as the capacities to reason, plan, solve problems, think abstractly, comprehend ideas and language, and learn.
- **Accuracy** - is the degree of conformity of a measured or calculated quantity to its actual (true) value. Accuracy

Background Knowledge:

Recording in Their Scientific Notebook – In addition to the date, time and who's on the team, each experiment should go from asking a question to finding an answer. Notebook records should:

 Make a guess. - **Hypothesis**.

 Take a look. - **Observations**.

 Write it down. - **Data**.

 Make it a picture. – **Graphs or Sketches**.

 Decide what it means. - **Conclusions**.

Additional Comment: Even at a young age, students understand the concept of things being correct and true, sometimes even better that we do. They are beginning to understand that this truth can be determined through analysis and a good logical approach to understand the question. Few, have entertained the notion that someone's bios could influence them to the point of them making an incorrect or false conclusion. Science is littered with false conclusion as a result of a bios approach. Think of (look up miths etc.) Have the students look up the xxx on the internet… these all started with a bios approach to understanding a puzzle.

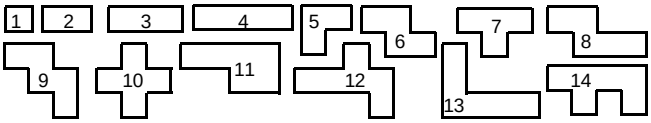
Activity Procedures

Hour One: Give each team of students a JENZAC™ set. Explain their role as computer engineers (Save the twist for the second hour)… Teach the students the definition of Critical Thinking. The main question they need to answer is: "Will the single cube go anywhere on a given grid and the other pieces fit also?"

- Pass out the Student 2x2 and 3x3 grid sheets (Sheet A).
- Have the students solve the 2x2 grid (this is said as a "2 by 2" grid…) with the pieces shown below the grid and answer the question "Can the single cube piece be placed in any one of the four locations. After they have made their conclusion "yes… it can", have them repeat the procedure with the 3x3 grid ask the same question. Have the whole class agree to the conclusion regarding the single "chip". (Re: Sheet D) *(This is intended to be FUN and have lots of energy.)*
- Check their Notebooks and make sure their making good notes etc. Hand out a grid sheet (Sheet B) and take this time to use the grid to explain multiplication in a practical approach. (i.e. How many spots are there for the single "chip" in a 3x3 grid, how many in a 5x5 or a 6x10). Have them note that when someone says that a room in a house is a 10 by 10 room… they are saying a 10x10 or when you see in a furniture magazine that a table top is 48"x24", they are saying that it is 48 inches by 24 inches etc. *(This is intended to calm them down, work their basic math skills and look for patterns or trends with the puzzle.)*
- If you feel the class is up to it, take time to talk about the mathematical function of square and square root. (Re: Sheet xx)
- For classes or students that seem to be solving the puzzle easily, skip the 4x4 grid and have them also repeat the question above for the 5x5 grid (Sheet F) and work through the solutions. They should discover that it will work in all 25 locations. (Re: Sheet H) If they seem to struggle (and this is typically dependent on their age…), just skip the 5x5 and proceed with this step.
- Had out the 4x4 grid (Sheet C). Before trying to solve the puzzle, have the students' hypothesis about the 4x4 grid … "Do they think, with out trying to solve it 16 times, that the single cube will go in any of the 16 different grid locations? Some may think that just because the three (or two if you skipped the 5x5) previous exercises would work, that the 4x4 would work. (Re: Sheet E) Discuss the pitfalls of assuming… Have them discuss why the others would work and the 4x4 would not. *(This is intended to provide self discovery regarding quick assumptions and how that might apply to other analytical areas.)*
- If your students seem to be solving the puzzle easily, have them consider which pieces they could exchange (if any) and have the 4x4 grid solve with the single cube in any of the 16 possible locations. Have them explain how they could know which pieces they could trade out and why they would choose to use those pieces verses the ones already selected.
- Review vocabulary words to make sure no one is left behind. Maker sure they understand that quick assumptions lead to bad critical thinking. *(This is intended to make sure everyone is on the same page and focused on the importance of critical thinking.)*

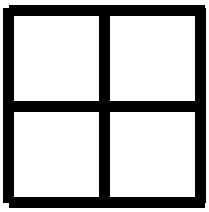
Hour Two: Give each team of students a **JENZAC™** set. Review the concept of Critical Thinking. Now it's time to reveal the twist to their experiment. Now they are not only solving the puzzle; but, solving it with the understanding that the placement of the pieces could make a difference to them personally. With that in mind, "How should they set up their experiment?" "Do they solve the puzzle taking turns with each person's piece in the middle or do they solve it to see if the single cube can be placed anywhere and just note where the other pieces are located?" "Can the single cube be place anywhere?" "Does that matter?"

- Remember each team divided the **JENZAC™** set into groups of pieces to allow each person on the team to have a group of pieces. The following divisions were used:

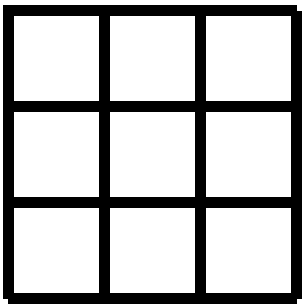


  - Team of 2 – Use pieces (1, 3, 5, 7, 9, 11, 13) and (2, 6, 8, 10, 12, 14)
  - Team of 3 – Use pieces (1, 4, 7, 10, 13), (2, 5, 8, 11, 14), and (3, 6, 9, 12)
  - Team of 4 – Use pieces (1, 5, 9, 13), (2, 6, 10, 14), (3, 7, 11) and (4, 8, 12)
  - Team of 5 – Use pieces (1, 6, 12), (2, 7, 13), (3, 8, 14), (4, 9, 11) and (5, 10)

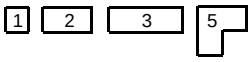
- Assign each team either the 5x5, 6x6, or 7x7 grid depending on how easily they did the first hour's exercise (Sheets G, I, K). Have each team pick a method of determining what pieces can go in the middle of the puzzle. Try to get the teams to pick different methods; but, limit the number of methods to two or three. The middle is defined by the shaded area on their respective grid. It's different for the three grids. *(This intended to give them a little independent thinking and have fun.)*
- Have each team evaluate which piece or pieces should be given the special spot. As a part of this exercise have the students determine how many solutions they would have to solve to determine that all possible solutions have been looked at. Remind them of the use of not only flipping and rotating the pieces; but, the whole puzzle. You may need to work each team individually to help them see the time savings to understanding flipping and rotating the puzzle to see other solutions(Re: Sheets H, J, L). *(This is intended to push their minds, improve communication, reinforce the scientific method and improve team work.)*
- Have each team collaborate and compare notes with the other teams to confirm their finding. Talk about how difficult it is to keep a non-bios approach to an experiment. Explain how this is the most important task to Critical Think. *(This is intended to focus on the importance of communication, collaboration, and Critical Thinking.)*
- As a bonus exercise for the students that are having good success in solving the puzzles and understanding the concepts, have them solve the 3x3x3 cube and determine if the single cube can be place anywhere with in the grid (Sheet M). Use this opportunity to expand their understanding into three dimensions (Re: Sheet N).
- If they seem to be knocking it out of the park, then introduce the concept and nomenclature of a Matrix. (Re: Sheet xx)

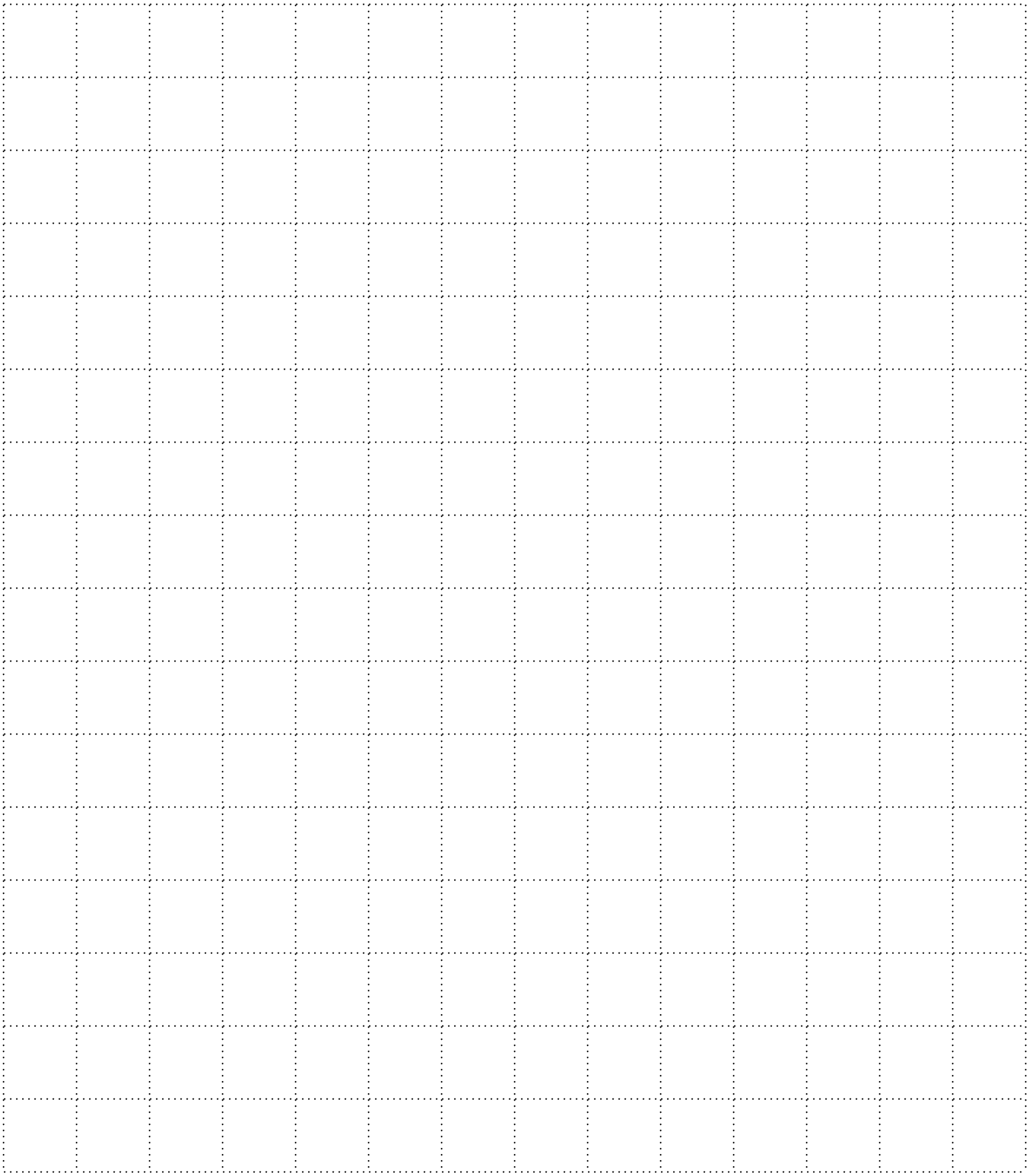


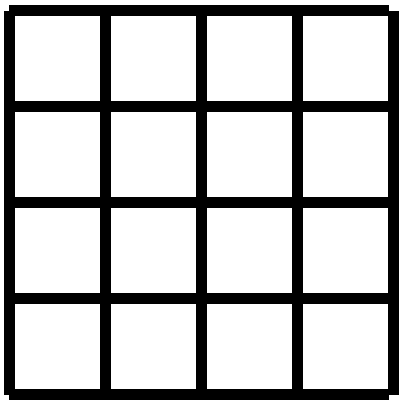
Use the pieces shown below to make
the 2x2 square puzzle shown above:
(Note: There is more than one solution.)



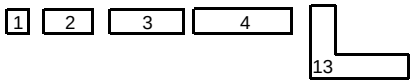
Use the pieces shown below to make
the 3x3 square puzzle shown above:
(Note: There is more than one solution.)

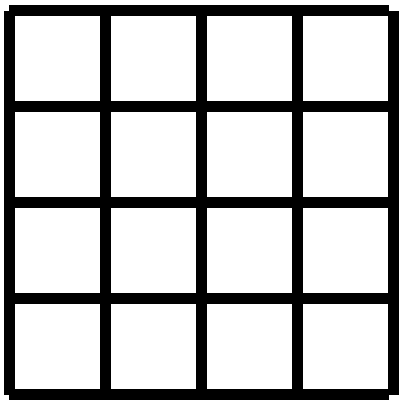




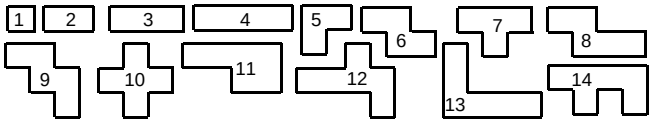


Use the pieces shown below to make
the 4x4 square puzzle shown above:
(Note: There is more than one solution.)



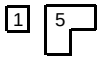


Select from the pieces shown below to
make the 4x4 square puzzle shown above:
(Note: There is more than one solution.)



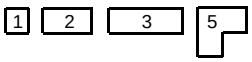
1	5
5	5

Use the pieces shown below to make
the 2x2 square puzzle shown above:
(Note: There is more than one solution.)



1	5	3
5	5	3
2	2	3

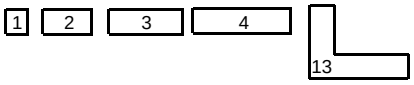
Use the pieces shown below to make
the 3x3 square puzzle shown above:
(Note: There is more than one solution.)



There is no solution where the single cube piece can be located in either of the four corners if the 1, 2, 3, 4 and 13 pieces are used. However, you can solve the puzzle with the single cube piece located in all the other locations. This would give you 12 solutions for this grid.

13	3	1	4
13	3	2	4
13	3	2	4
13	13	13	4

Use the pieces shown below to make the 4x4 square puzzle shown above: (Note: There is more than one solution.)



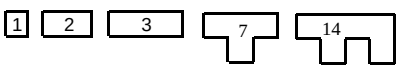
Note: with the one solution shown, the other 7 solutions could be re-solved by **rotating or flipping the puzzle**. With each rotation of 90 degrees the single cube will be in another position, giving you a total of four solutions. Then the puzzle can be flipped and rotated to give the four remaining solution highlighted.

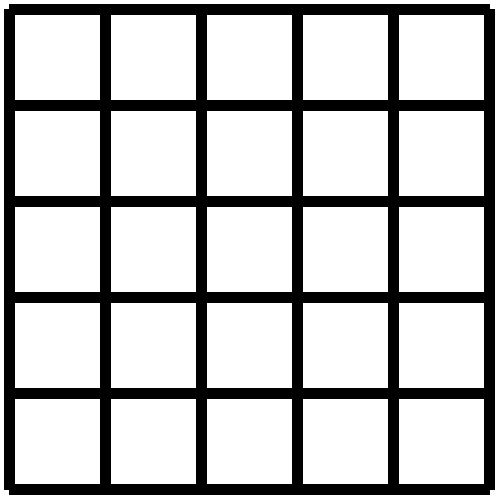
Solve the puzzle with the single cube located in any one of the 4 center locations shown and the other three can be solved by rotating the puzzle in 90 degree intervals.

The single cube **can** be solved located in any location if the 1, 2, 3, 7 and 14 pieces are used. The reason this group of pieces will solve with the single cube in any of the 16 locations is because the combination of peaces above had to many pieces that were four cubes long. With a grid that was 4x4 the four cube long pieces had to be placed covering up the corners. Simply removing the four cube four long piece (No. 4) and replacing it with a shorter four cube piece (No. 7) while also replacing the six cube (No. 13) piece with a more interlocking six cube piece (No. 14) the puzzle can be solve with the single cube in any location.

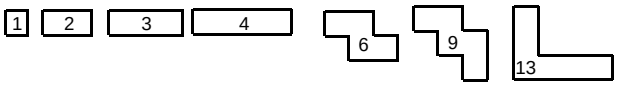
14	14	2	3
14	1	2	3
14	14	7	3
14	7	7	7

Use the pieces shown below to make the 4x4 square puzzle shown above: (Note: There is more than one solution.)

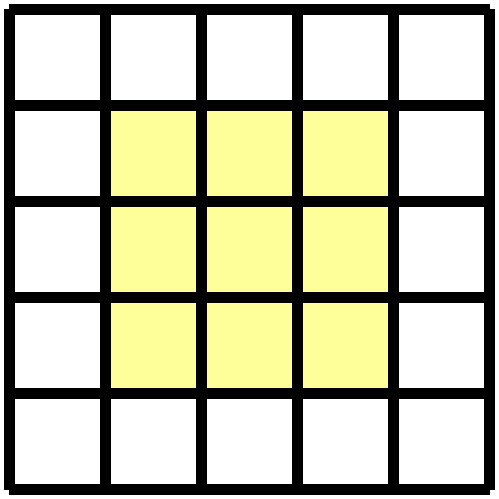




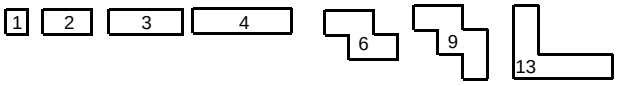
Use the pieces shown below to make
the 5x5 square puzzle shown above:
(Note: There is more than one solution.)



The shaded area in the center of the puzzle grid is your window of opportunity. The pieces located within this window area will have show the world who designed and made them. This opportunity could lead to fame and fortune.



Use the pieces shown below to make the 5x5 square puzzle shown above:
(Note: There is more than one solution.)

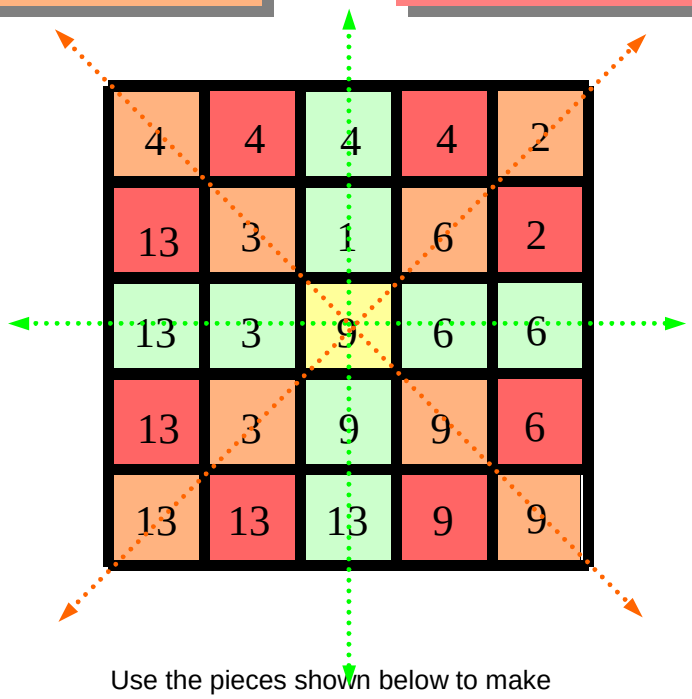


The single cube can be located in all 25 different grid location with the pieces chosen. Note how a solution with the single cube located on one of the grid location along a horizontal, vertical or diagonal axis will yield four solutions by rotation. A solution with the single cube not located on any axis will yield eight solutions by rotation and flipping.

Solutions with the single cube located on a diagonal axis will yield four solutions by rotation.

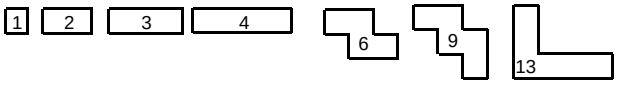
No axis goes through these grid locations. By solving the puzzle in one of these locations you can flip and rotate the puzzle to solve the other 7.

With the 5x5 grid, there is a unique grid location in the center of the grid. The solution for the single cube located in this position will not yield any other solutions. Rotating or flipping will not change the location of the single cube. All axis go through this point.

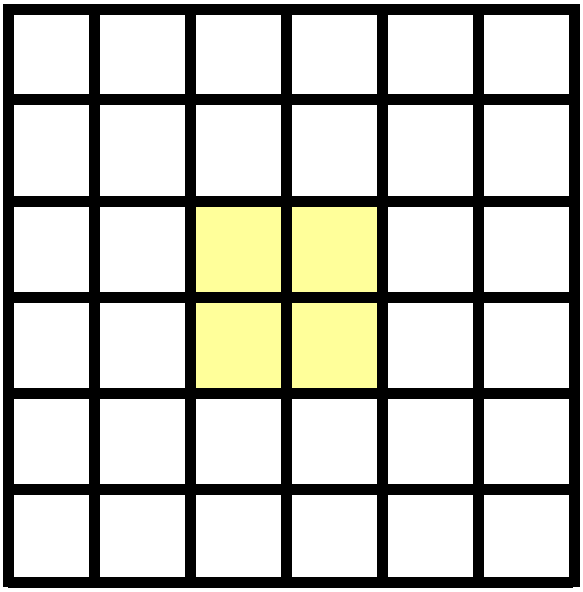


Solutions with the single cube located on a horizontal or vertical axis will yield four solutions by rotating the puzzle in 90 degree intervals.

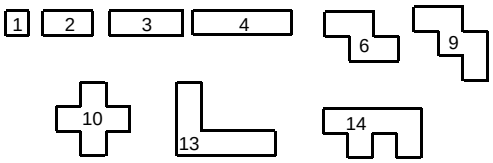
Use the pieces shown below to make the 5x5 square puzzle shown above:
(Note: There is more than one solution.)



The shaded area in the center of the puzzle grid is your window of opportunity. The pieces located within this window area will have show the world who designed and made them. This opportunity could lead to fame and fortune.



Use the pieces shown below to make the 6x6 square puzzle shown above:
(Note: There is more than one solution.)



The single cube can be located in all 36 different grid location with the pieces chosen. Note how a solution with the single cube located on one of the grid location along a horizontal, vertical or diagonal axis will yield four solutions by rotation. A solution with the single cube not located on any axis will yield eight solutions by rotation and flipping.

Solutions with the single cube located on a diagonal axis will yield four solutions by rotation.

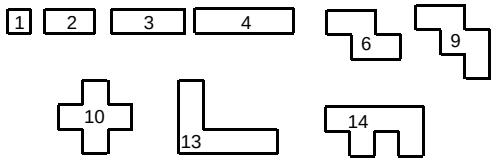
No axis goes through these grid locations. By solving the puzzle in one of these locations you can flip and rotate the puzzle to solve the other 7.

With the 6x6 grid, there is not a unique grid location in the center of the grid. The four grid locations in the center are all on the horizontal and diagonal axis. Solve for a solution in any one of the four locations and the other three can be resolved by rotating the puzzle 90 degrees.

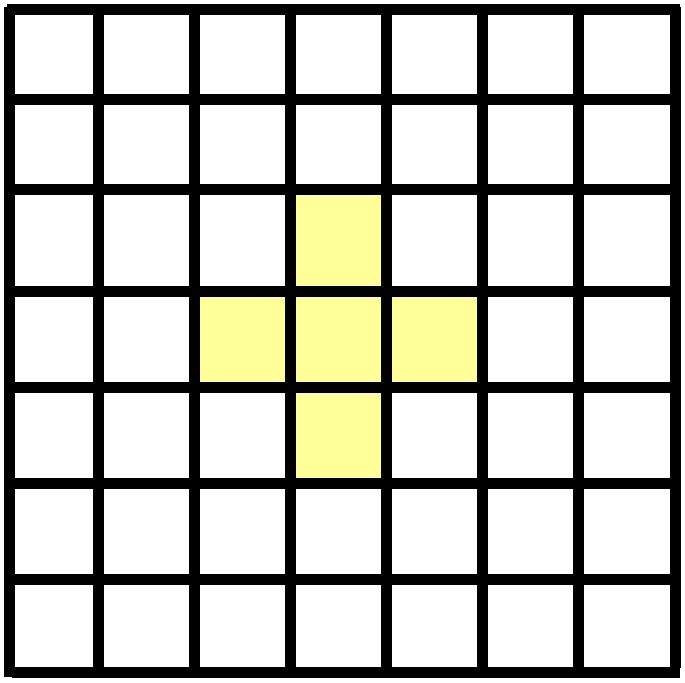
6	4	4	4	4	2
6	6	3	3	3	2
13	6	9	9	1	14
13	9	9	10	14	14
13	9	10	10	10	14
13	13	13	10	14	14

Solutions with the single cube located on a horizontal or vertical axis will yield four solutions by rotating the puzzle in 90 degree intervals.

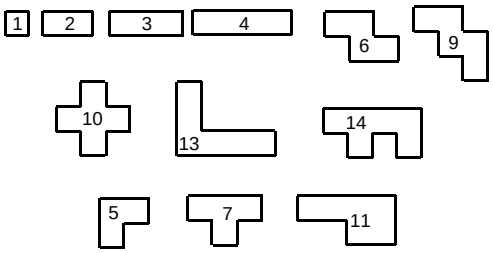
Use the pieces shown below to make the 6x6 square puzzle shown above:
(Note: There is more than one solution.)



The shaded area in the center of the puzzle grid is your window of opportunity. The pieces located within this window area will have show the world who designed and made them. This opportunity could lead to fame and fortune.



Use the pieces shown below to make the 7x7 square puzzle shown above:
(Note: There is more than one solution.)

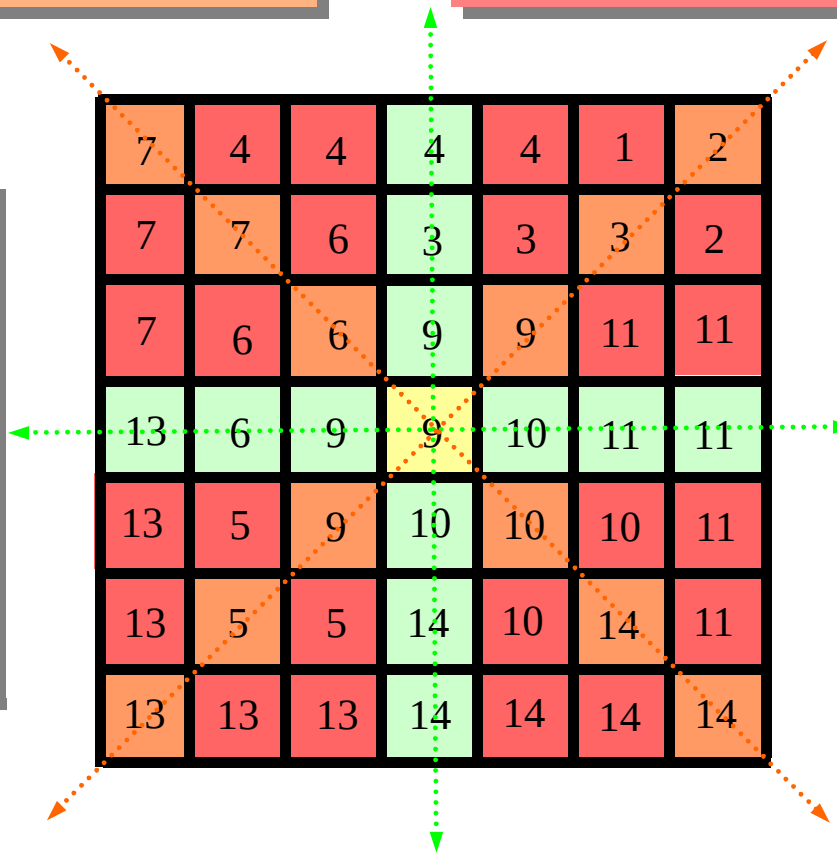


The single cube can be located in all 49 different grid location with the pieces chosen. Note how a solution with the single cube located on one of the grid location along a horizontal, vertical or diagonal axis will yield four solutions by rotation. A solution with the single cube not located on any axis will yield eight solutions by rotation and flipping.

Solutions with the single cube located on a diagonal axis will yield four solutions by rotation.

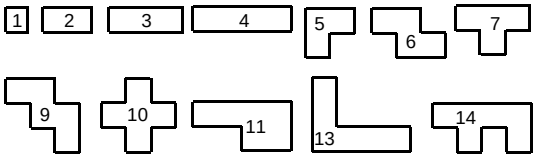
No axis goes through these grid locations. By solving the puzzle in one of these locations you can flip and rotate the puzzle to solve the other 7.

With the 7x7 grid, there is a unique grid location in the center of the grid. The solution for the single cube located in this position will not yield any other solutions. Rotating or flipping will not change the location of the single cube. All axis go through this point.

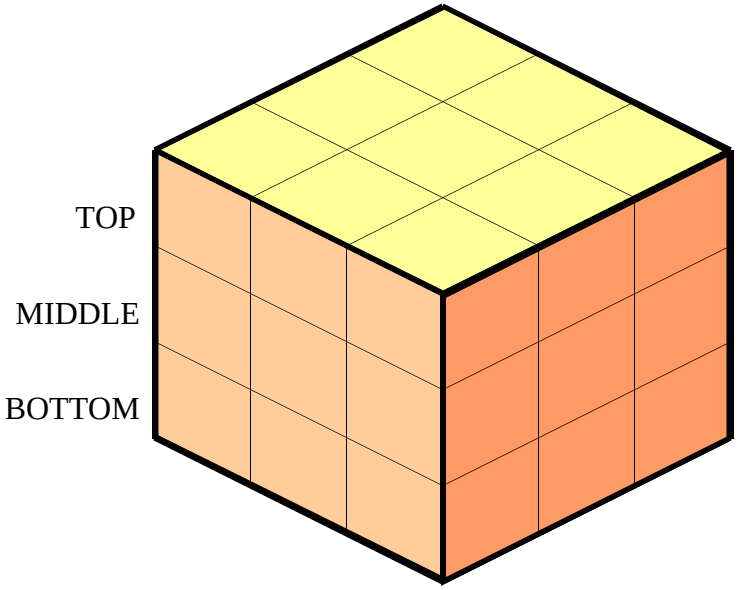


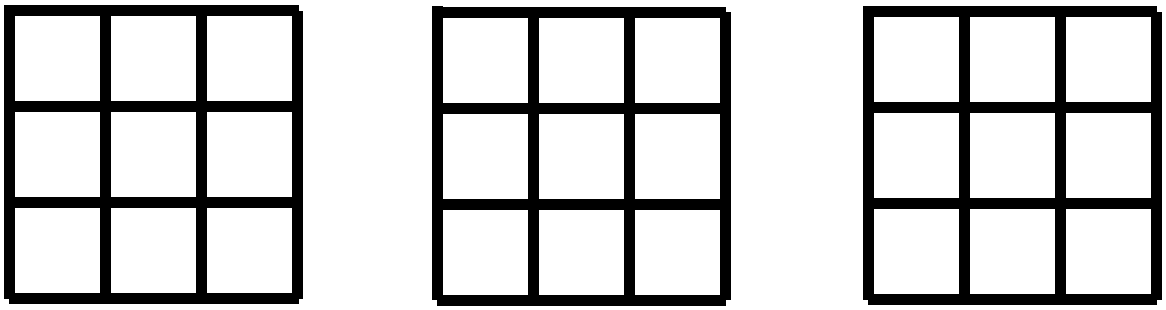
Solutions with the single cube located on a horizontal or vertical axis will yield four solutions by rotating the puzzle in 90 degree intervals.

Use the pieces shown below to make the 7x7 square puzzle shown above: (Note: There is more than one solution.)

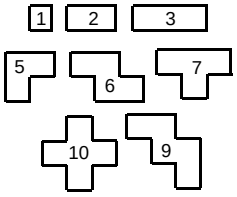


Note symmetry of a square grid. The axis form lines of symmetry. Also note that the horizontal and vertical axis divide the grid into four quadrants. Each quadrant symmetrical to the others. Any solution found for one quadrant can be flipped or rotated to solve the other. Quadrants are use in a verity of math and science applications. Most notably the number



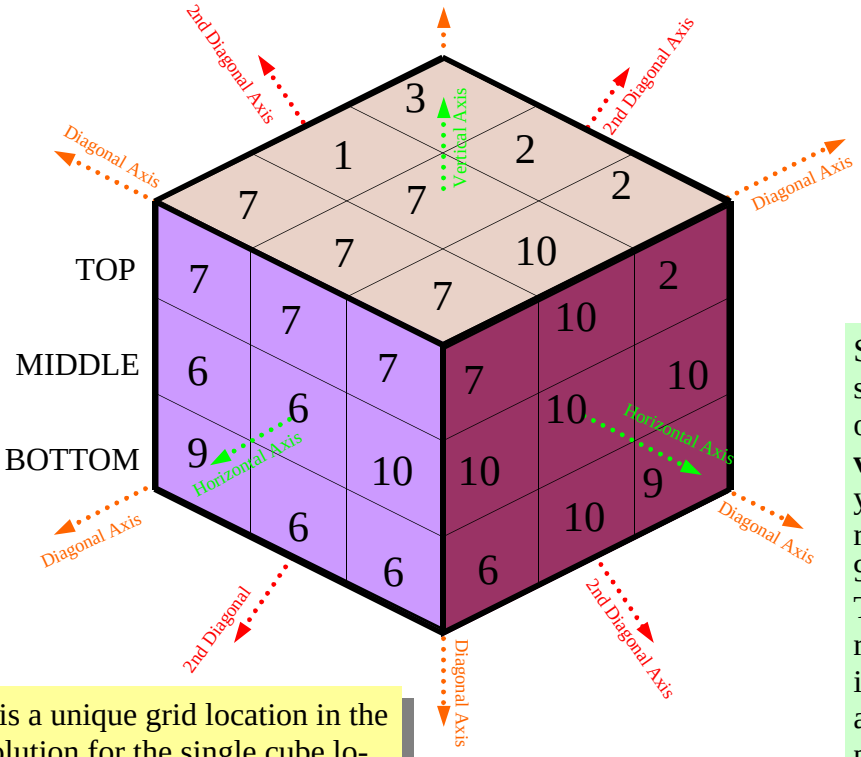


Use the pieces shown below to make the 3x3x3 cub puzzle shown above.
Record the piece locations in their respective grid locations.
(Note: There is more than one solution.)



The single cube can be located in all 27 different grid location with the pieces chosen. Note how the axis are now in three dimensions. A solution with the single cube located on one of the grid location along a horizontal, vertical or diagonal axis will yield additional solutions by rotation and flipping. Every location in a 3x3x3 grid in on an axis of symmetry.

Note: There is a 2nd type of Diagonal. The grid locations on the center edge of the top and bottom of the cube are on an axis that runs diagonal across and parallel to a plane created from the horizontal and vertical axis. These single cube locations will yield **eight** solutions by rotating and flipping.



Solutions with the single cube located on a **diagonal** axis will yield **twelve** solutions by rotation and flipping.

Solutions with the single cube located on a **horizontal or vertical** axis will yield **six** solutions by rotating the puzzle in 90 degree intervals. Then flipping it and rotating it 90 degree intervals again. With a three dimensional puzzle, flipping is just rotating about another axis.

With the 3x3 cube, there is a unique grid location in the center of the grid. The solution for the single cube located in this position will not yield any other solutions. Rotating or flipping will not change the location of the single cube. All axis go through this point.

3	2	2
1	7	10
7	7	7

TOP

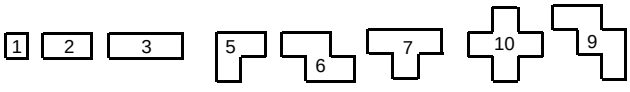
3	5	10
5	5	10
6	6	10

MIDDLE

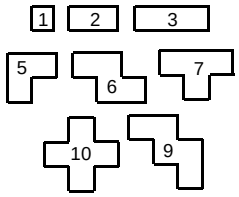
3	9	9
9	9	10
9	6	6

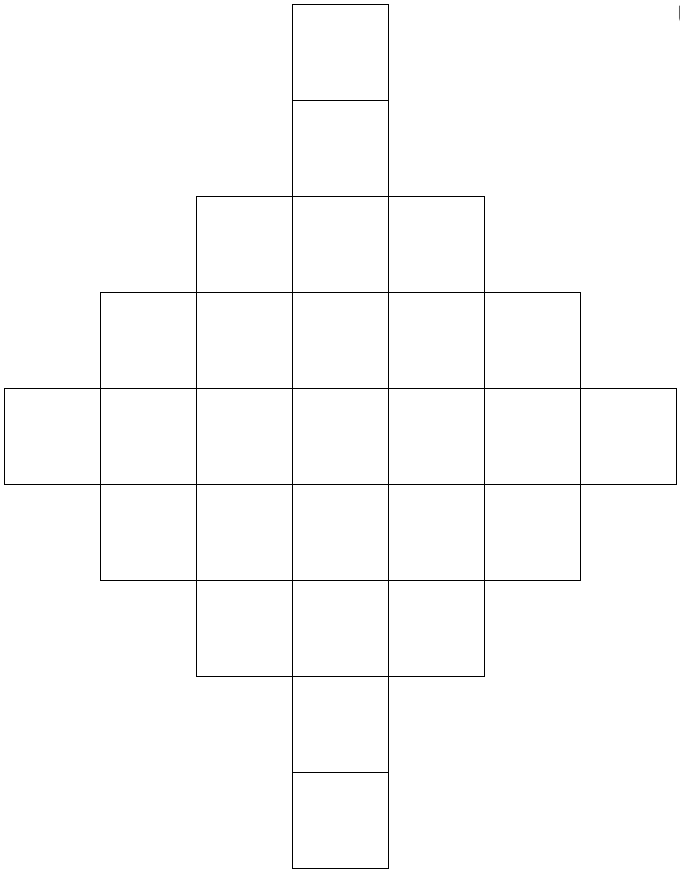
BOTTOM

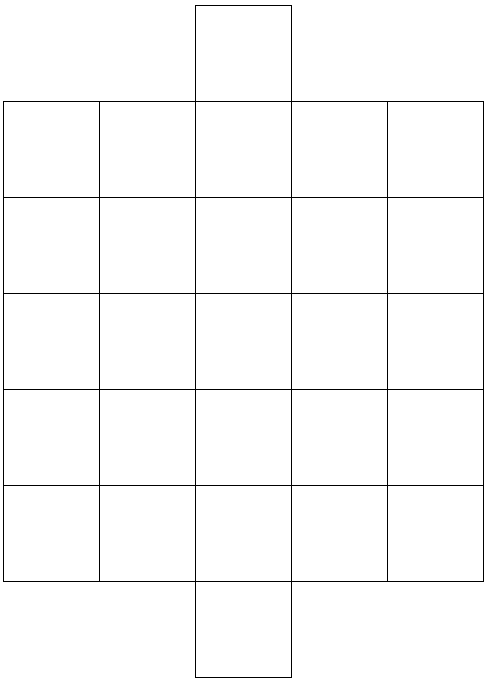
Use the pieces shown below to make the 3x3x3 cub puzzle shown above. Record the piece locations in their respective grid locations.

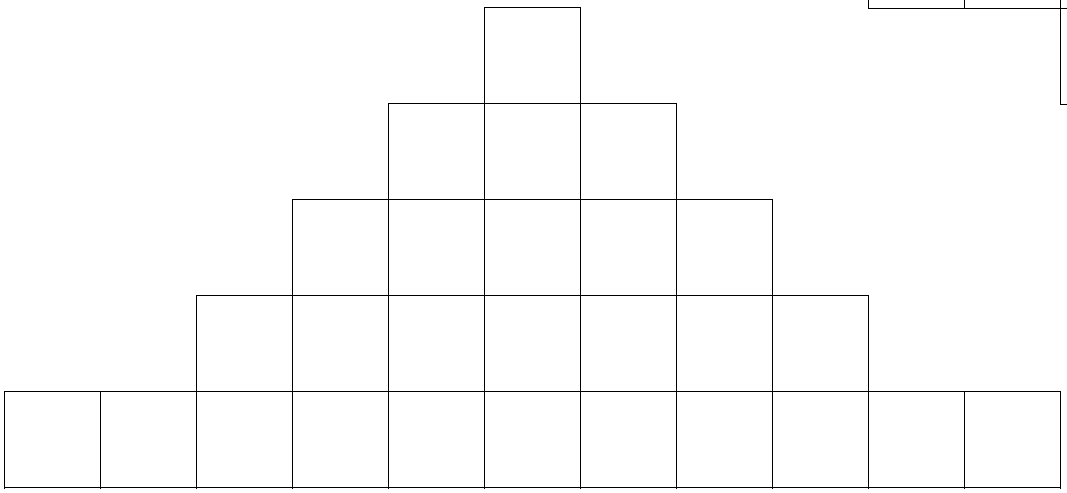


Use the pieces shown below to make the three different two-dimensional shapes shown on this page. Record the piece locations in their respective grid locations. (Note: There is more than one solution.)





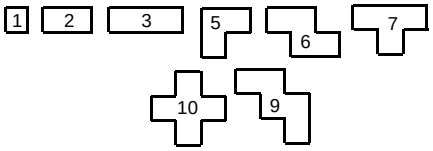


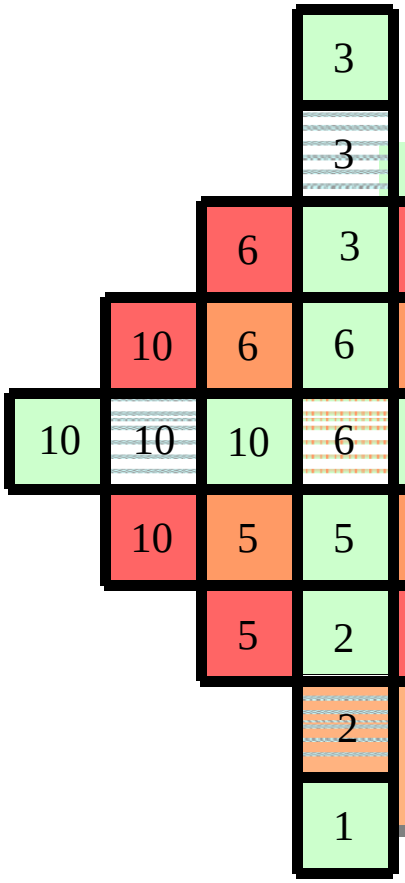


With these puzzles the single cube can not be located in all 27 different grid location. Also, note how the axis rotations and flips will yield a different number of solutions for a different puzzle.

With the top two puzzles, note the center of the grid. This single cube position will not yield any other solutions. Rotating or flipping will not change the location of the single cube. All axis go through this point.

Use the pieces shown below to make the three different two-dimensional shapes shown on this page. Record the piece locations in their respective grid locations. (Note: There is more than one solution.)

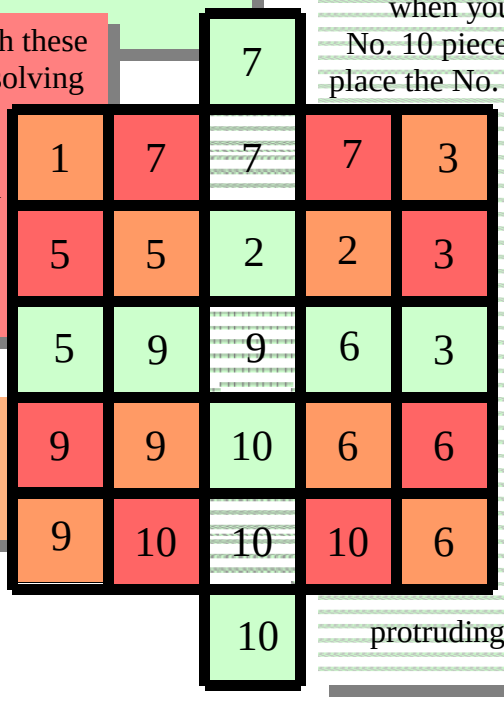




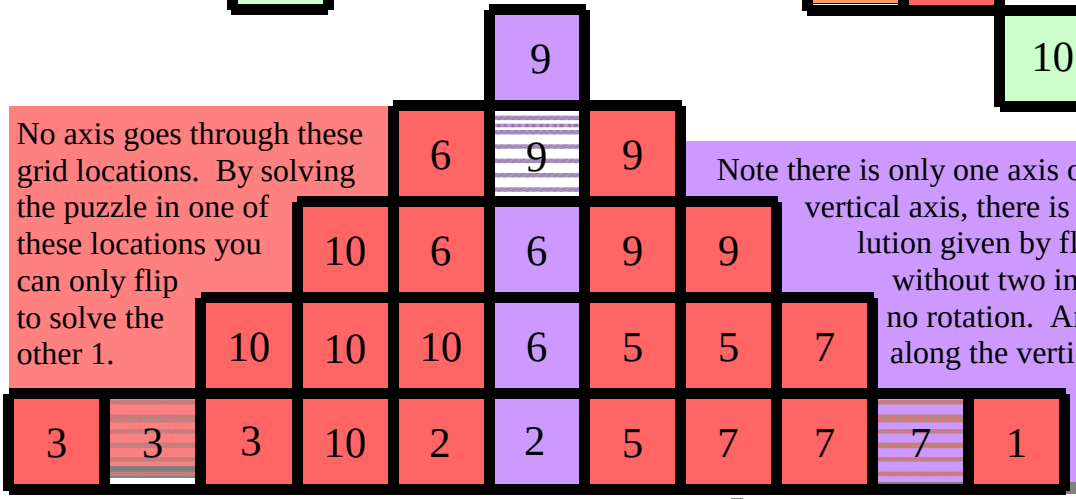
Solutions with the single cube located on a horizontal or vertical axis will yield four solutions by rotating the puzzle in 90 degree intervals.

No axis goes through these grid locations. By solving the puzzle in one of these locations you can flip and rotate the puzzle to solve the other 7.

Solutions with the single cube located on a diagonal axis will yield four solutions by rotation.



There are locations the single cube can not be placed. In the center, when you place the No. 10 piece you can't place the No. 9 with out covering the center. Also, you would have to have a second single cube if you placed it just inside the single protruding grid loca-

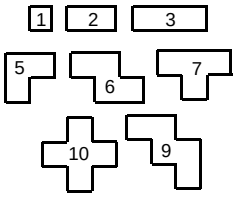


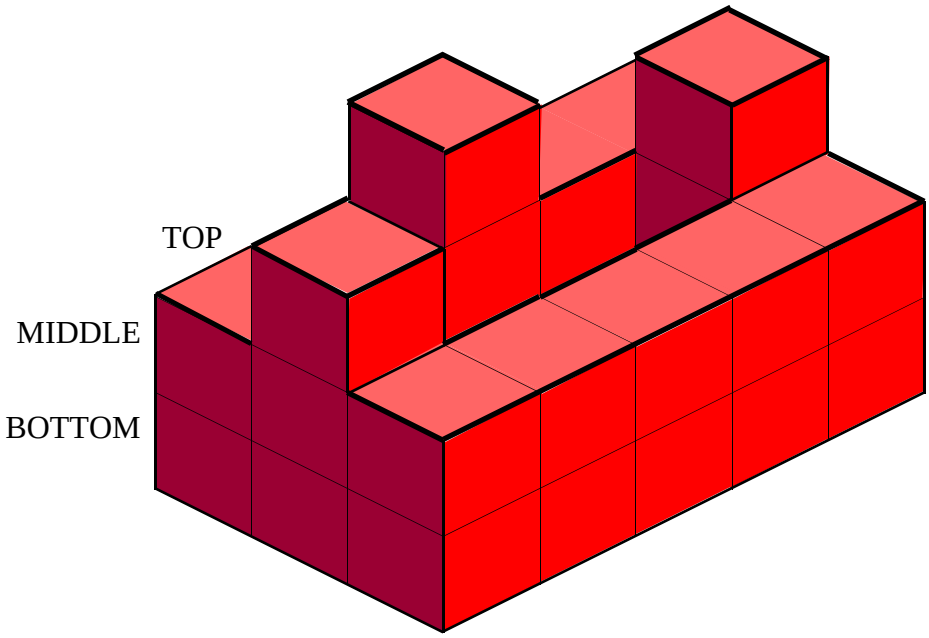
No axis goes through these grid locations. By solving the puzzle in one of these locations you can only flip to solve the other 1.

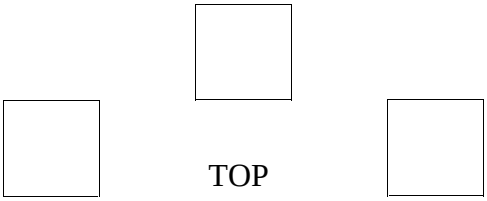
Note there is only one axis of symmetry. With this vertical axis, there is only one additional solution given by flipping. Also note, that without two intersecting axis, there is no rotation. And that all the locations along the vertical only have one solution spot. Like the center locations in the

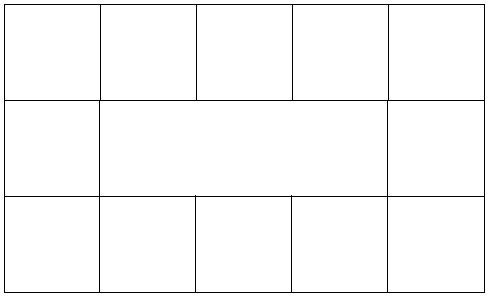
~~The 1 piece will not work in the shaded grid locations.~~

Use the pieces shown below to make the two-dimensional and three-dimensional shapes shown on this page. Record the piece locations in their respective grid locations.
(Note: There is more than one solution.)

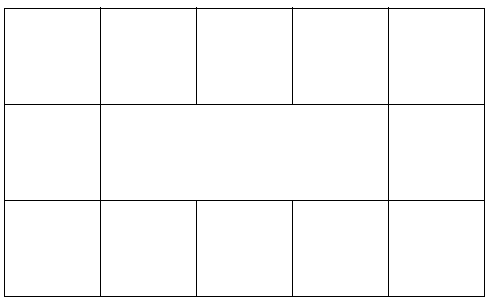








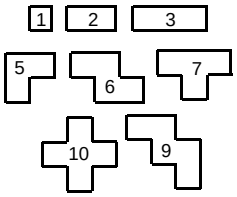
MIDDLE

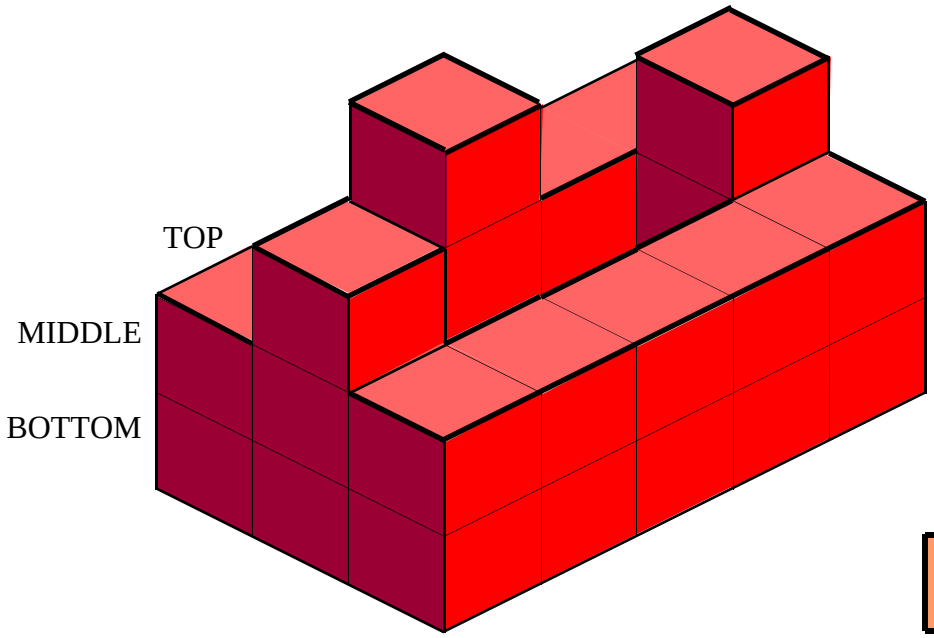


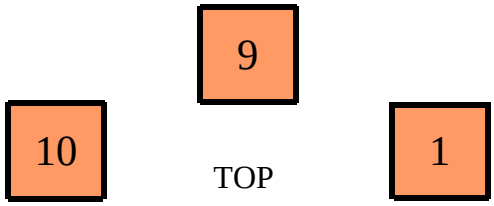
BOTTOM

5	5	3	3	3	10	9	9	1
5	6	6	7	10	10	10	9	9
6	6	7	7	7	10	2	2	9

Use the pieces shown below to make the two-dimensional and three-dimensional shapes shown on this page. Record the piece locations in their respective grid locations.
(Note: There is more than one solution.)





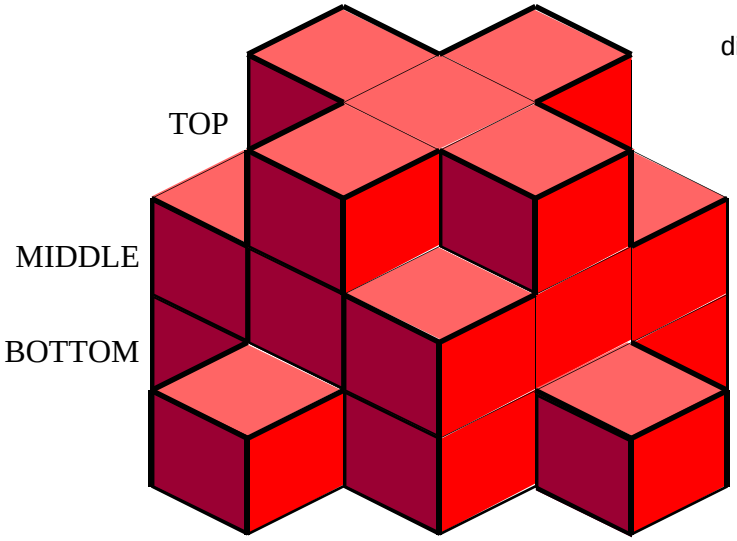


10	7	9	9	3
10				3
10	6	6	5	3

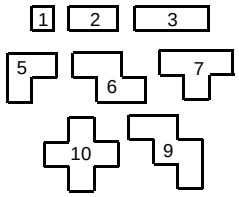
MIDDLE

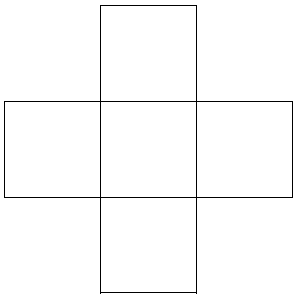
7	7	7	9	9
3				2
6	6	5	5	2

BOTTOM

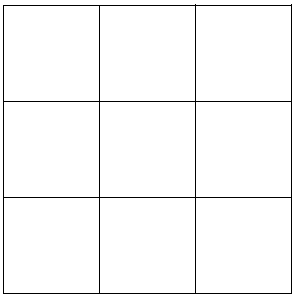


Use the pieces shown below to make the three-dimensional shape shown on this page. Record the piece locations in their respective grid locations. (Note: There is more than one solution.)

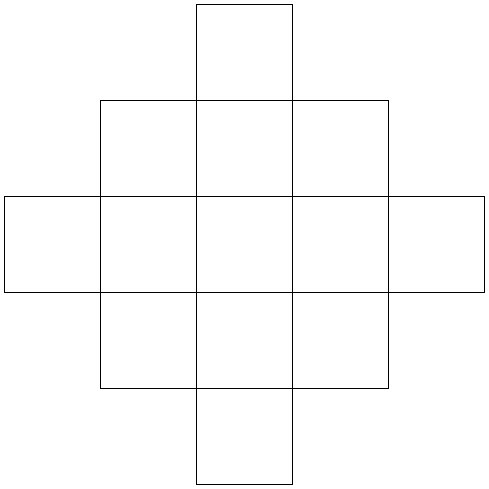




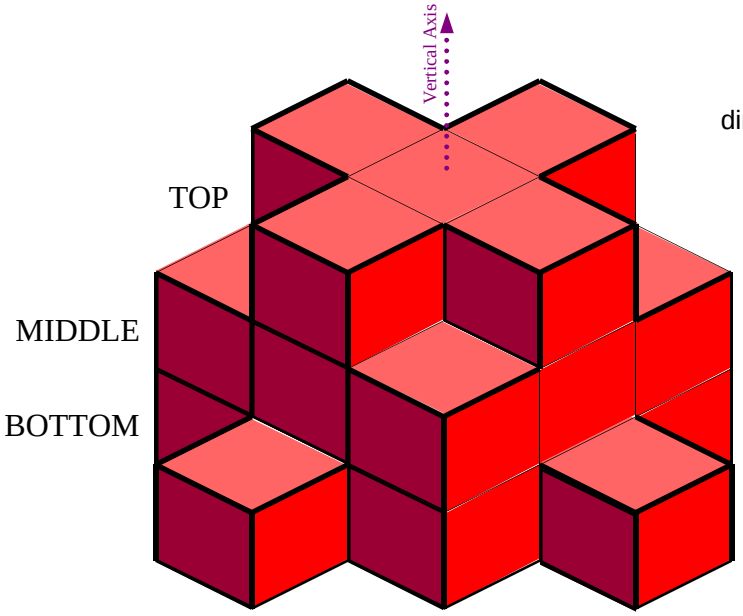
TOP



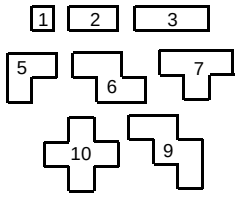
MIDDLE



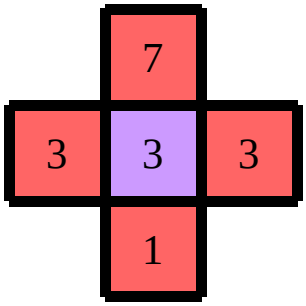
BOTTOM



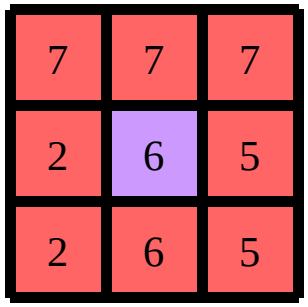
Use the pieces shown below to make the three-dimensional shape shown on this page. Record the piece locations in their respective grid locations. (Note: There is more than one solution.)



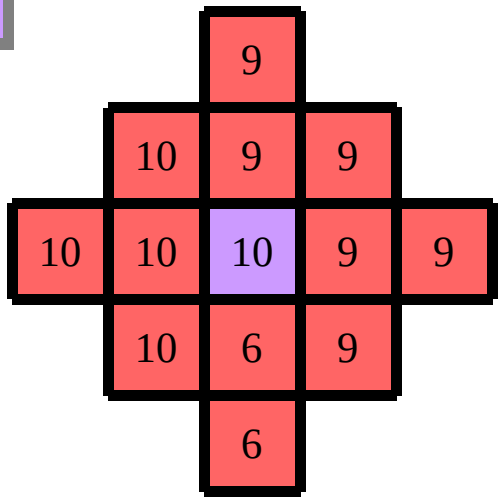
Note there is only one axis of symmetry. With this vertical axis, three additional solution are given by rotating the puzzle around the axis. Also note, that without two intersecting axis, there is no flipping the puzzle. And that all the locations along the vertical only have one solution spot.



TOP



MIDDLE



BOTTOM