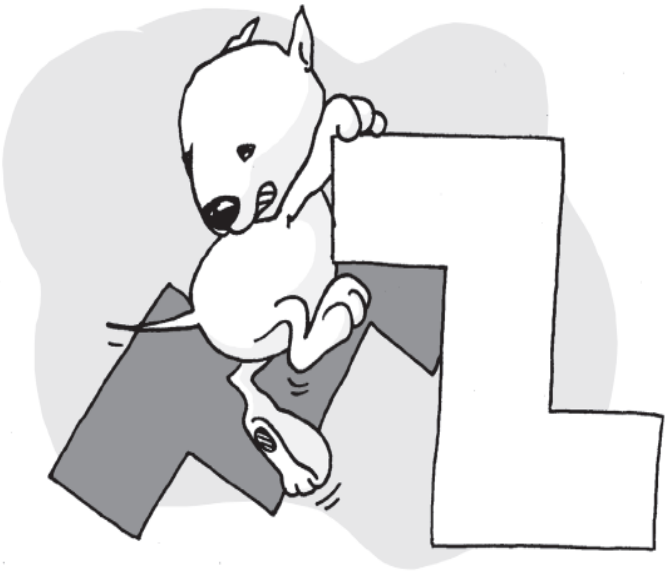
Pentominoes

Product code 061168



An Introduction to Manipulatives

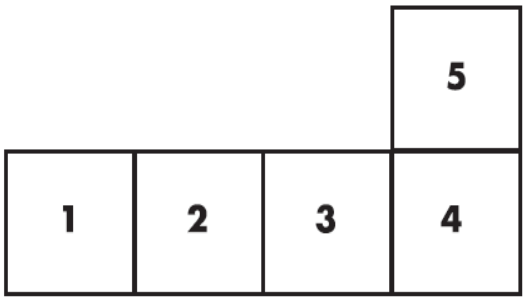
A manipulative is any object that aids children in visualising mathematical processes. Our range of manipulatives includes Tangrams, Geoboards, Fraction Pieces, Fraction Circles, Fraction Bars, Linking Cubes, Pentominoes and Pattern Blocks. However a manipulative can be as simple as a piece of string or a tin can.

Manipulatives are invaluable in the classroom because, as modern research tells us, children retain information gained from hands-on experiences better than information they gain from memorisation. They learn in a physical way - with their hands as well as their minds. As a physical learning aid, manipulatives encourage this natural learning process by adding a concrete element to ordinarily abstract concepts.

Above all else, children enjoy working with concrete materials - in the hands of young children manipulatives will excite their natural curiosity and motivate them to take responsibility for their own learning. Children will become flexible thinkers with a knowledge of mathematics that can be applied to a wide variety of situations - instead of being taught seemingly unrelated rules, they will learn to be problem solvers.

Introductory Activities

- What are pentomines? A pentomino may be defined as a shape that consists of five unit squares joined together so that each square shares at least one whole side with another square. There are 12 possibilities. Draw an example on the board such as the diagram below.



  Have the children work in pairs. Ask the class to put away their pentominos and attempt to draw the other 11 based on the definition given above. Alternatively give each pair 5 square tiles ask them to make as many different shapes as they can. Remind them that the edges of each square must match exactly. Also explain rotation and flipping so that the children recognise that a shape they create may be the same as another except that it has been flipped or rotated. As a new shape is discovered, it is traced on graph paper. When one group has discovered all 12, share them with the class.

- Allow the children to engage in free play with the pentominoes. Gradually introduce various fun activities. Familiarity with the pentominoes will help activities go smoother and hopefully reduce the fear of numbers that sometimes develops with traditional maths classes.
- Ask the students to simply fit all the pentominoes together in any shape but make sure that every pentomino touches another pentomino on at least one whole side. This means that each pentomino has at least one unit length in common with another pentomino. Point out that even though everyone will come up with a different shape, they will all have the same area.

Pentomino Perimeters

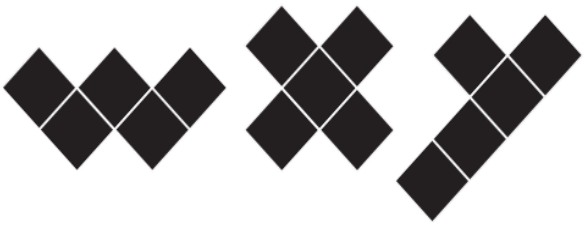
Ask the class to find the perimeter of each of the pentominoes using one side of a square as one unit. Which has the smallest perimeter? Which has the largest? (This is a trick question!) What is the most common perimeter? Point out that although the perimeter of the pentominoes may vary, all of the pentominoes have the same area.

Pentomino Words

Pentominoes are often identified by the letter they resemble most.

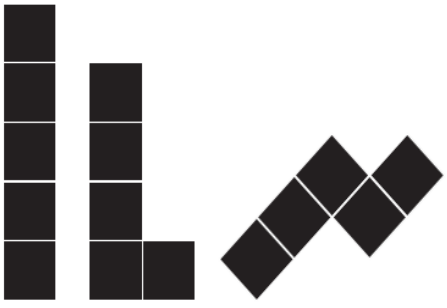
Challenge students to write down as many words as they can using the pentomino letters below. Did they find words like "flip" and "silt"? What about if you allow them to use letters more than once?

What is the longest word they can come up with?

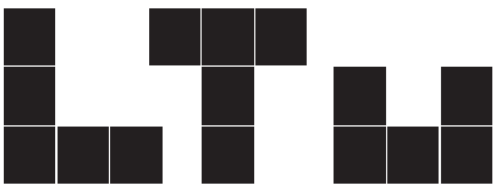


W X Y

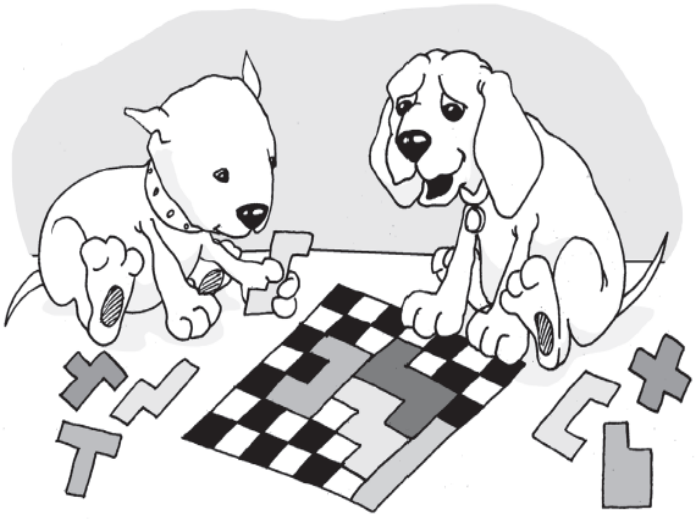
P Z F



I L N



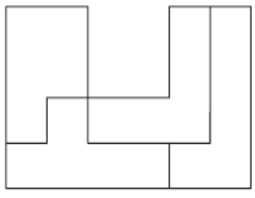
Checkerboard Challenge

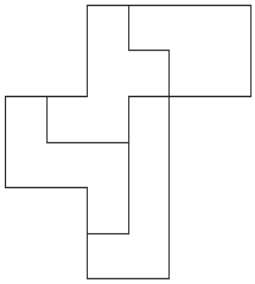


Using a checkerboard, pentominoes can be an exiting game of skill, played by two or three players. Players take turns choosing a piece and placing it on the board. The object of the game is to be the last player to place a pentomino piece on the board blocking the other player from placing their pieces on the board. Ask the students to identify the minimum number of moves that can be made. What is the maximum?

Triplication

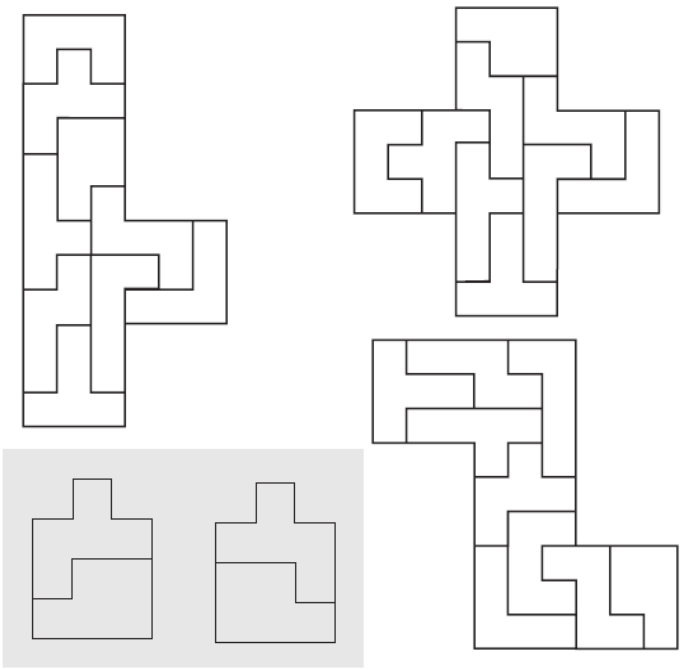
Ask the class to try making a replica of the "U" or "F" shape using four other shapes.





The resulting shape should have dimensions twice the length of the original. It can be said that the sides are in a 2:1 ratio. For more of a challenge, each individual piece can be modelled using nine of the others - the resulting shape is three times larger. This is called the triplication problem.There is more than one solution to the triplication problem for each of the letters. HINT: The trick is to decide which pentominoes to leave out. As a rule, leaving out the I, X and W works well.

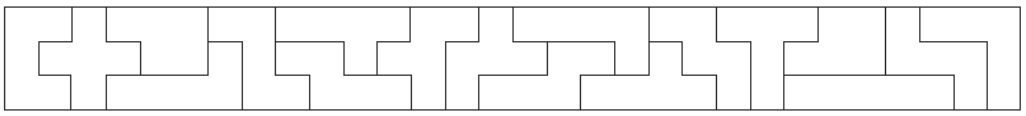
Triplication

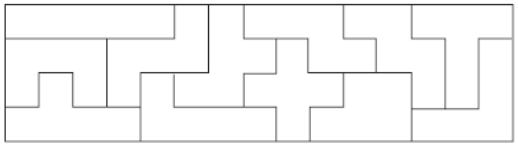


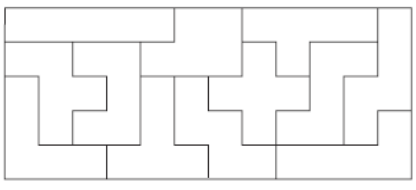
Once you have found one possibility, try finding other solutions. Remember that you don't have to start from scratch. As the diagram on the right illustrates, a few pentominoes can be moved to form a new, slightly different solution.

Advanced Exercises

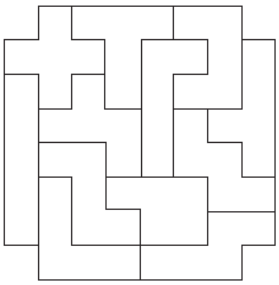
The traditional pentomino puzzle most people attempt is trying to create a 60 square rectangle. They won't fit into a 2 x 30 rectangle because several of the pieces are 3 tall and 3 wide. So try fitting the pieces into a 3 x 20, 4 x15, 5 x 12 or a 6 x 10 rectangle. Remember, it is harder than it looks!

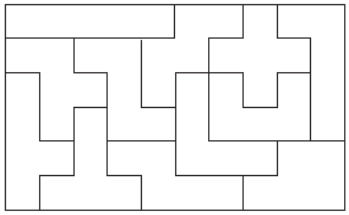






Other interesting shapes can be attempted. Try making an 8 x 8 square with each of the corners missing.





Tessellation

A tessellation is a way of covering a plane with shapes, leaving no gaps and in a repetitive pattern. Ask students to trace around one of the pentominoes several times to create a tessellation. Can they find two pentominoes that will tessellate together?