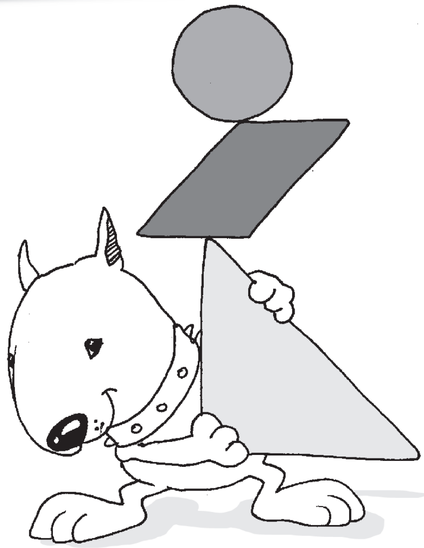
Shape and Fraction Set

Product code 061440



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.

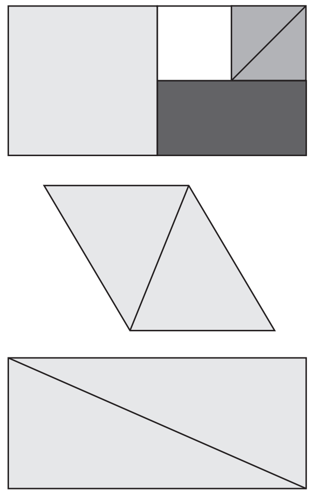
Picture This!

It is important to realise that the uses of the fraction pieces are not limited to fractions. In fact, they are not even limited to mathematics. To familiarise children with the fraction pieces, and to avoid the universal "Maths? Yuk!" reaction, allow the children to engage in free play with the pieces. Ask them to make pictures. Perhaps ask them to make something beginning with "A". After playing, ask them what they discovered about the pieces. Can they identify relationships between the pieces?

Name the Shapes

Fraction pieces include squares, circles, rectangles, parallelograms, and two types of triangle. Hold up a shape in front of the class and ask the children to name it. If the children are advanced enough, point out that one triangle is known as an isosceles triangle - this triangle has two equal sides, the other is known as a scalene triangle - it has sides of all different lengths. Can the children think of another type of triangle? (Equilateral - all sides of the same length) Point out that there are two sizes of each shape in the fraction pieces. We can call one large and one small but they are still the same shape. This means that these two shapes are similar. Ask the children to name things they have seen that are the same shape as the fraction pieces.

Twice as much fun!



Use the large rectangles and large squares to demonstrate the concept of a half. By placing two large squares on top of one large rectangle the children will see that the two squares together neatly cover the rectangle. Ask the children to do the same themselves. Can they find which fraction piece is half of the large square? (The small rectangle) What about half of this shape? (The small square) Is there a piece that is half of this shape again? (The small isosceles triangle). This exercise shows the children a concrete example of what we mean by a half - one part of two equal parts. It helps them to see that we have half a square or half a rectangle, not just "a half". Advanced students can be asked to trace the large rectangle onto a piece of paper and continue halving it - they will see that no matter how many times we halve something, we will always end up with something, however small that thing is.

Different halves of the same thing

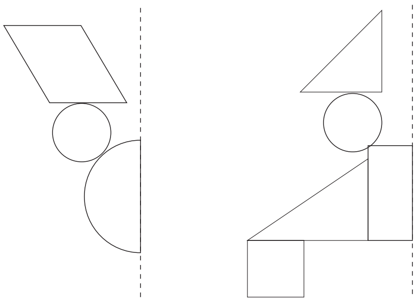
Once again, use the large rectangle and two large squares to demonstrate that the squares are half the size of the rectangle. Now show the children that two large scalene triangles are also half the size of the large rectangle. Some shapes can be divided into two equal halves in many different ways. Can the children find two different shapes that are half the size of the small

Different halves of the same thing

rectangle? What about the large square? Ask the children to trace around the large circle and cut the shape out. How many different ways can they find to fold the circle in half? The children will see that there are an infinite number of ways to divide the circle in half. As long as a straight line is used and it passes through the centre of the circle, then the line cuts the circle into two equal halves.

Lines of Symmetry

When a line divides something in half so that one half is the mirror image of the other, it is called a line of symmetry. When the children tried to find how many ways a circle can be divided in half, they were creating many lines of symmetry. Ask the children to find how many lines of symmetry the large square has by tracing its shape onto a piece of paper, cutting it out and trying to fold it so that one half covers the other.

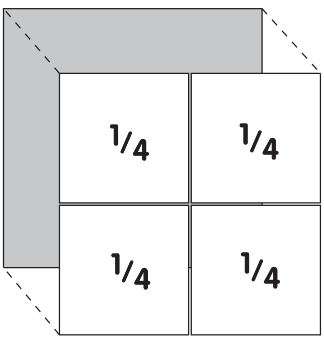


A square has 4 lines of symmetry. Ask the children to complete the exercise for the other shapes. They will find that a rectangle has two lines of symmetry, the isosceles triangle has only one while the parallelogram and the scalene triangle don't have any at all. Try drawing diagrams like the ones above with shapes placed together in a pattern and a dotted line to signify the line of symmetry. Ask the children to complete the other half of the picture.

Fractions of Fractions

First, take a large square and show that it can be divided into two equal halves by small rectangles. Explain that we write this as "$1/2$ of the large square is one small rectangle". The 2 in $1/2$ is the number of equal pieces we are dividing the whole into. It is known as the denominator, literally "the thing that numbers".

Ask the children to find "$1/2$ of the small rectangle". They should find that one small square fits this description.



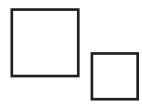
Now ask them to see how many small squares fit on top of the large square. They should find that four small squares make up one large square. Explain that this can be written as "$1/4$ of the large square is one small square" because we are dividing the large square into 4 equal pieces.

Now ask them to find "$2/4$ of the large square". This is equivalent to 2 small squares. Point out that 2 small squares makes a shape of the same size as one small rectangle.

We can see now that $1/2$ of the large square is the same as $2/4$ of the large square. $1/2$ and $2/4$ are equivalent fractions - they are different ways of expressing the same thing. Simple additions and subtractions can now be attempted with the fraction pieces using the large square as a base and placing small squares and rectangles onto it to make calculations. Start with the same denominator sums $1/4 + 1/4$, $1/4 + 2/4$, $3/2 - 2/4$ and move on to simple sums with different denominators $1/4 + 1/2$, $3/4 - 1/2$.

Sorting & Classifying

Construct a diagram like the one below (known as a Carroll Diagram after Lewis Carroll) and ask the children to sort the shapes according to various criteria. For example, "square/not square and yellow/not yellow" or "four-sided/not four-sided" and "red/not red". Insisting that the children distinguish between scalene and isosceles triangles can increase the complexity of the task.

	Yellow	Not Yellow
Square		
Not Square		

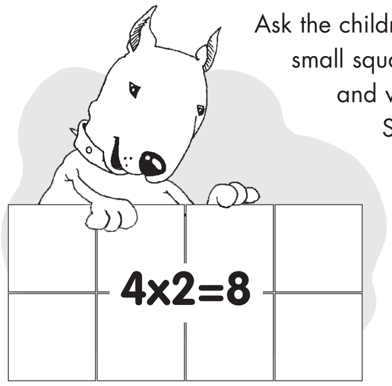
Area of a Square & Rectangle

Use the small square as a unit of measurement to relate the concept of area to children.

Four small squares can be used to completely cover one large square. We say that the large square has an area of 4 square units. Point out that the area can be calculated by multiplying the length of the two sides together; $2 \times 2 = 4$.

Ask them to confirm this for themselves by tracing the large rectangle onto a sheet of paper and then tracing the outline of the small square onto the large rectangle as in the diagram below. Then ask them to count the number of small squares that make up one large rectangle.

Area of a Square & Rectangle



Area = length x width

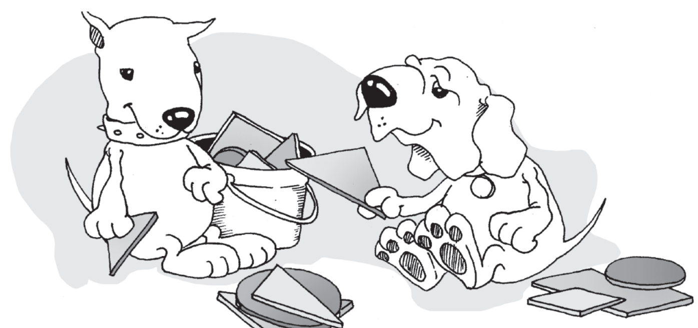
Ask the children to find out how many small squares make up the length and width of the large rectangle. Show them that they can calculate the area by multiplying 4 x 2 = 8 square units. So, the area of a rectangle or a square can be found by multiplying the length by the width.

Area of a Triangle

We already know that one large scalene triangle is exactly half the size of the large rectangle and we know that the area of the rectangle can be found by multiplying the length by the width. It follows that the area of the triangle is half the area of the rectangle; $^1/2$ x length x width. If we change length to "height" and width to "base" we can express the area of a triangle in the classic form "$^1/2$ the base times the height".

Pile 'em Up! Shape & Colour Recognition Game

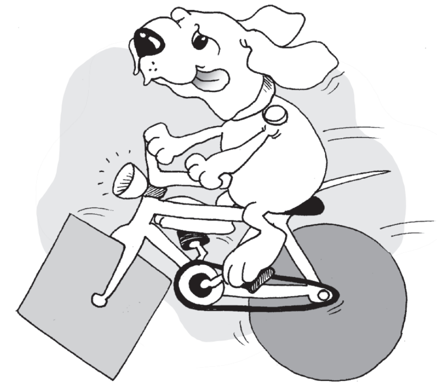
1 Place all the fraction pieces into the plastic bucket.
2 Ask 2 - 4 children to each take out 5 pieces at random from the bucket.
3 Then place one piece (again drawn at random) in the centre of the children.
4 Tell the children that the aim of the game is to get rid of all the pieces in their hands.
5 For simplicity play starts with the youngest child, with each child taking a turn trying to place a fraction piece onto the top of the pile in the centre. In order to put a piece down, the child must have a piece that matches the colour or shape of the last piece in the middle.
6 So, if a large yellow triangle is in the middle, the child must put down a triangle of any size or colour or any shape that is yellow. If the child cannot put down a piece they must pick another piece from the bucket at random. The play then moves on in a clockwise direction.



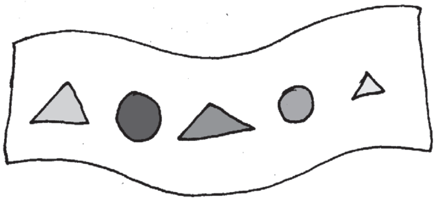
Remember that each piece should be placed on top of the last piece to keep it clear which piece is in play. If the pile gets too high or the bucket runs out of pieces, remove the top piece from the pile and put it back in the centre. Place the rest of the pile back into the bucket. (Or for even more fun, the child who knocks over the pile must pick up an extra piece from the bucket and clean up the mess!) Play continues until one child is declared the winner by placing the last of his or her pieces onto the pile.

Shape Cycle! Shape Recognition Game

This game requires the teacher to establish the cycle the children must follow. For example, the teacher may draw a diagram similar to the one below on a sheet of paper and place it in the middle of a group of two to four children. Alternatively, the diagram may contain the words for each shape rather than a drawing.



1 With all the fraction pieces that are in the cycle in the bucket, each child draws out 4 pieces at random.
2 Another piece is drawn at random and placed in the middle of the children to determine the start of the cycle.



3 Play starts with the youngest child this time placing the next shape in the cycle on the top of the pile. If they do not have the piece required to continue the cycle, he or she must pick up a piece at random from the bucket.
4 Play continues clockwise until one player runs out of pieces.

The teacher can determine the length and complexity of this game by modifying the rules.