

MathBase5

Operating Instructions

Introduction

MathBase5 is a collection of six programs that deal with shape and space.

1. Matching Shapes
2. Move a Square
3. Centimetre Squares
4. Rectangles and Squares
5. Squares and Triangles
6. Right-Angled Triangles

All six programs have many operational features in common. Most of these are considered in the instructions for Program 1 'Matching Shapes'. Cell enlargement and protect are discussed in Appendix 1.

Pupils can begin to use these programs in Reception and continue through Key Stages 1 and 2. The material will also support many students with Special Educational Needs in Primary, Secondary and Further Education.

Program 1: **Matching Shapes**

When Program 1 starts, there are two matrices of cells. Each cell contains a shape made of yellow squares. Each matrix contains the same shapes but in different positions.

Basic program operation involves selecting a cell on the left (using a left-mouse click) and matching it with a cell on the right. If the match is correct, both cells disappear. A correct match also generates a 'rewarding' sound; there are several sounds to choose from using the blue button **Zz1**. The aim is to match all the cells.

A selected cell on the left has a red border. When the border is clicked, the cell enlarges. If clicked again, the cell is reduced back to its original size. Cells in the right matrix can also be enlarged [see Appendix 1].

Using the purple buttons below the program title, the number of cells in each matrix can be selected as **4**, **9**, **16** or **25**.

If the player's selection on the right is incorrect, the cell is given a red border and the player is treated to a comical 'booby' sound. A fault is also scored and is indicated

by the yellow **Fault** counter above the left matrix. The player is then free to select a different cell on the right.

A maximum of five faults are allowed. On the sixth fault, the game is stopped and the words 'GAME OVER, Click here to continue' appear – which will start a fresh game.

The button **Man**, indicating manual operation, becomes **Auto** indicating automatic when clicked. In automatic mode, cells on the left are automatically selected after a correct match – which can help speed up the matching process. This is useful when pupils are pressed for time while trying to beat the clock.

The red **1min** button allows player to compete against the clock. When clicked, a red disc begins to form and will take 1 minute to complete. The aim is to match as many cells as possible before completion.

Right-clicking the timer button can change the length of time allowed. When using an interactive whiteboard, the player can simply tap to the immediate right of this button to change the length of time. (Tapping the button itself simply causes the clock to start and stop). Note, programs cannot be exited while the timer is active – to exit, first click the timer off.

It will be seen that the patterns within each cell are confined to a 3 by 3 grid. This corresponds to the orange **3 by 3** button at the top of the screen and is one of four possible choices. These buttons create increasingly large/complex patterns and are common to all six programs.

At the bottom left of the screen are 3 square tabs that control visual elements within the cells. These tabs are common to all six programs; placing the mouse pointer over each will show a short description:

1. The first controls the internal 'mesh' of each shape. It can be black, green or invisible.
2. The second tab shows/hides the cells background grid.
3. The third tab makes subtle changes to the background colour.

At the bottom of the screen, information about the number of matches made is recorded. This is intended to help teachers monitor pupil activity. When a pupil exits and restarts a program, most settings for that program are reset but the readings at the bottom of the screen are cumulative while MathBase5 is running.

By clicking **Ctrl** and **L** on the keyboard, the word 'Locked' appears in red at the bottom right of the screen. This locks some program options and prevents the pupil from exiting. There are a variety of situations where this may be useful; click **Ctrl** and **L** again to release the lock.

Note that the whole MathBase screen can be reduced to the taskbar by clicking **Esc** on the Keyboard.

The buttons numbered **1** to **9** above the left matrix are unique to Program 1. Initially, button **1** is selected and means that shapes have simply been copied (i.e. translated to the right matrix). Each of the buttons **2** to **8** causes a specific type of transformation. Clicking on buttons a second time shows a description of the transformation. For example, button **2** produces reflections in the vertical.

Program 1 'Matching Shapes' is mainly aimed at developing direct, intuitive recognition of sameness – in fact, pupils are simply matching 'congruent' shapes. Pupils from reception upwards should find this fun and stimulating.

Older or more advanced pupils need to recognise and classify the relations between congruent shapes as reflections or rotations. This program should be useful for these pupils also. Transformations produced by buttons **1** to **9** are as follows:

1. Translations
2. Reflections in the vertical
3. Reflections in the horizontal
4. Reflections in the 'rising' (positive) diagonal
5. Reflections on the 'falling' (negative) diagonal
6. Quarter turn rotations clockwise.
7. Quarter turn rotations anticlockwise
8. Half turn rotations
9. A mixture of transformations.

However, again, as far as younger pupils (or pupils with degrees of SEN) are concerned, they are simply matching shapes.

Left matrix	Right matrix	Comments
Shape	Shape	Matched by shape (Orientation unimportant)

Program 2: **Move a Square**

In this program, pairs of shapes appearing in the right and left matrices differ by the position of a single square. The player has to modify shapes in the left matrix to match shapes in the right matrix by moving one (or more) squares.

The player selects a shape in the left matrix to work with. Clicking one of the constituent yellow squares makes it grey. Clicking a vacant space can then move the square. The player has to recreate one of the shapes (with correct orientation) found in the right matrix that can then be matched.

Left matrix	Right matrix	Comments
Shape to be altered	Shape	Matched by shape and Orientation

Program 3: Centimetre Squares

Cells of each matrix can show three kinds of content: shapes made of squares, values for area and values for perimeter. These options appear above each matrix. To aid counting, mouse-clicks highlight squares and perimeter segments. When enlarged, measurements are approximately cm. Examples of matching are given below.

Left matrix	Right matrix	Comments
Shape	Shape	Matched by area
Shape	Area in sq cm	Squares can be highlighted
Shape	Perimeter in cm	Perimeter segments can be highlighted

Program 4: Squares and Rectangles

Cells of each matrix can show five kinds of content: Squares and rectangles, values for area, calculations for area, values for perimeter, and calculations for perimeter. All these options are found above each matrix and are obtained by clicking. Examples of matching are given below. Rectangle side measurements can be displayed using the special 'number' control below the program title.

Left matrix	Right matrix	Comments
Squares/Rectangles	Squares/Rectangles	Matched by area
Squares/Rectangles	Area in sq cm	Squares can be highlighted
Squares/Rectangles	Area Calculations	e.g. 3×4
Squares/Rectangles	Perimeter in cm	Perimeter segments can be highlighted
Squares/Rectangles	Perimeter Calculations	e.g. $2 \times 5 + 2 \times 3$ or 4×2

Program 5: Squares and Triangles

This program is concerned with shapes made from squares and half squares made by cutting a square diagonally. When matching shapes, both shape and orientation are important (these shapes are not matched by area).

Constituent squares and triangles can be identified and counted separately. Area values involve the possible use of 0.5 cm.

On a shape's perimeter, square sides and diagonal sides can be identified separately and counted. It should be apparent, that the diagonal of a square is quite a bit longer than its side. We approximate the length of a diagonal as 1.4 cm and base perimeter values on this to 1 decimal place. The options can be selected by clicking above each matrix. Examples of possible matching are shown below.

Left matrix	Right matrix	Comments
Shapes	Shapes	Matched by shape and orientation
Shapes	Number of squares	Squares can be highlighted
Shapes	Number of triangles	Triangles can be highlighted
Shapes	Area in sq cm	Area may involve 0.5 cm
Shapes	Number of 1cm segments	Perimeter segments can be highlighted
Shapes	Number of 1.4cm segments	Perimeter segments can be highlighted
Shapes	Perimeter in cm	Perimeter is given to 1 decimal place

Program 6: Right-Angled Triangles

Each matrix can show five kinds of cell: Right-angled triangles, values for area, calculations for area, values for perimeter, and calculations for perimeter. Examples of matching are given below.

Left matrix	Right matrix	Comments
Triangle	Triangle	Triangles matched by area
Triangle	Area in sq cm	
Triangle	Area Calculations	e.g. $3 \times 4 / 2$
Triangle	Perimeter in cm	
Triangle	Perimeter Calculations	e.g. $4 + 2 + 4.5$

There are four special controls under the program title. The first places the right angle in different positions. The second shows/hides the rectangle underlying the triangle. The third shows/hides the right angle. The fourth shows/hides the three side measurements.

Appendix 1: **Auto-Enlarge and Cell Protection**

On the program selection screen, to the bottom left of the MathBase logo, there are three check boxes.

1. Left Enlarge Tab This places a small tab by the left matrix of each program. When selected (made yellow) the tab causes cells in the left matrix to enlarge automatically when clicked. Clicking the tab again or clicking the cell's border reduces the cell. Use of the enlarge facility is essential in circumstances where detailed information within a cell is too small to be seen comfortably.

2. Right Enlarge Tab This places a small tab by the right matrix of each program. When selected (made yellow) this will causes cells in the right matrix to enlarge automatically when clicked. The cell is reduced again by clicking the tab or clicking the cell's border.

When the 'Auto-Enlarge' tab is yellow, the cell is 'protected' – a small red square will appear in the bottom right of the cell to allow the cell to be selected and matched.

3. Right Protect Tab This places another small tab by the right matrix of each program. When selected (made blue) this will cause cells in the right matrix to be protected - cells maintain their original size. Protecting cells in this way allows the player to manipulate the contents of a cell without selecting it – if the player decides to select that cell s/he can click the small red square that will appear within the cell.

Use of Auto-Enlarge and Protection tabs is not always necessary; using the above check boxes on the program selection screen can hide them.

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