

Combined Transformations part 2

Whether you are a parent, teacher or home school educator, we've compiled examples of activities, games and puzzles which can be used to support the learning of shape and space.

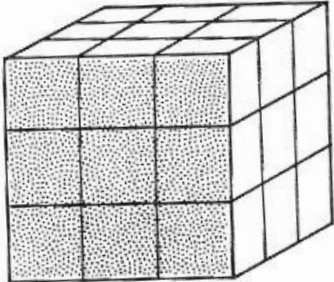
These examples are taken from the 'Combined Transformations' packs found in our SMILE resource collection. The mathematical demand increases as you work through the packs. There are lots more ideas in the complete packs, which can be downloaded at <https://www.stem.org.uk/rxzf8>

Answers to cards can be found at <https://www.stem.org.uk/rxxo5>

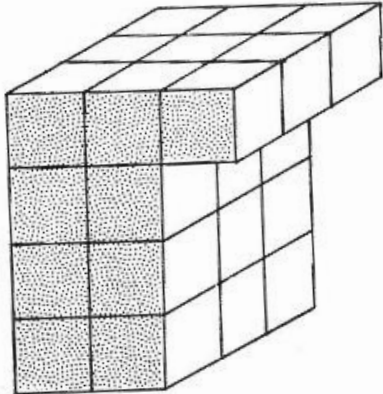
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You will need: Cubes

Cube Cuts



Problem: Cut the cube with a saw into centimetre cubes.
How many cuts are needed?



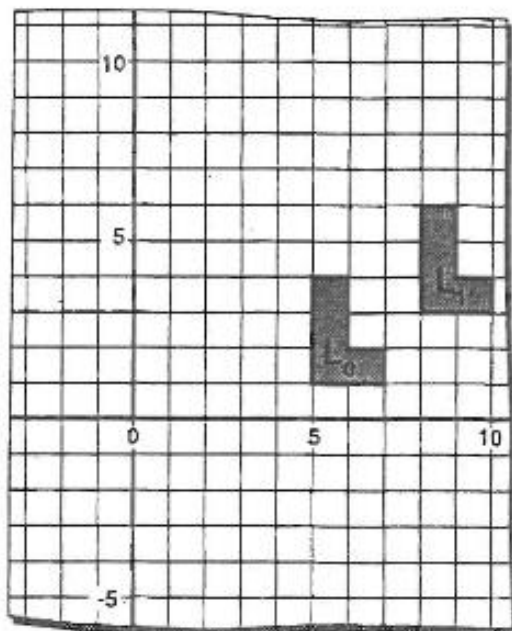
If you may re-arrange the pieces after each cut, can you do it with fewer cuts?

Try a 4 by 4 by 4 cube
Try other cuboids.

Combining Transformations

- Draw a grid with x -axis from -7 to 14 and y -axis from -7 to 10.
Plot the points (5, 1), (7, 1), (7, 2), (6, 2), (6, 4), (5, 4), (5, 1) and join them in order.
Shade the 'L' shape and label it L_0 .
- Draw the resulting 'L' shapes for the transformations in the table below.
The first transformed 'L' shape L_1 has been completed for you.

Starting Shape	Transformation	Label of new shape
L_0	translate $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$	L_1
L_1	translate $\begin{pmatrix} 4 \\ 3 \end{pmatrix}$	L_2
L_0	reflect in x -axis	L_3
L_3	reflect in y -axis	L_4
L_0	reflect in $y = x$	L_5
L_5	rotate 180° about (0,0) anticlockwise	L_6
L_0	rotate 90° about (0, 0) anticlockwise	L_7
L_7	rotate 180° about (0, 0)	L_8
L_0	reflect in $x = 3$	L_9
L_9	reflect in $x = -2$	L_{10}



- Describe the single transformation to map:

- L_2 on to L_0
- L_4 on to L_0
- L_6 on to L_0
- L_8 on to L_0
- L_{10} on to L_0

Cross Stitch

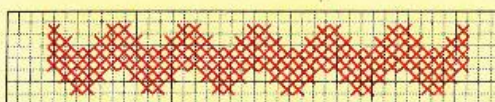
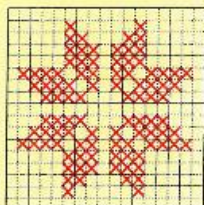
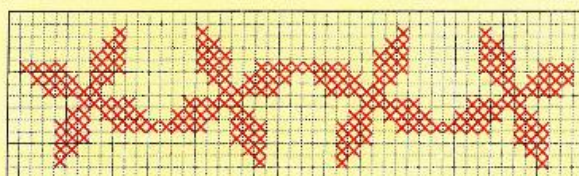
You will need 5mm square paper.

Simple motifs, using cross stitch, can be used to create elaborate patterns by using transformations including reflections, rotations and translations.

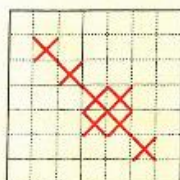
The patterns below have been created by transforming this motif.



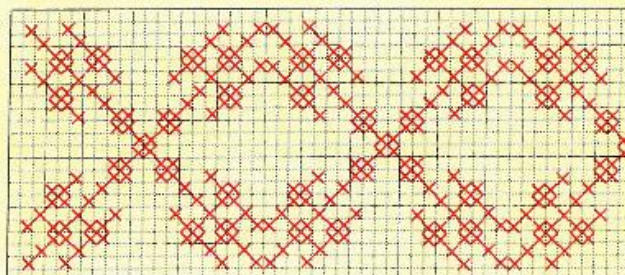
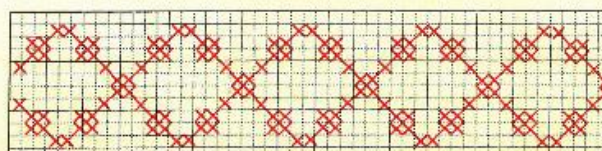
- ✗ Analyse and describe each pattern in terms of transformations used.



Here is another motif.



- ✗ Analyse and describe the patterns created.



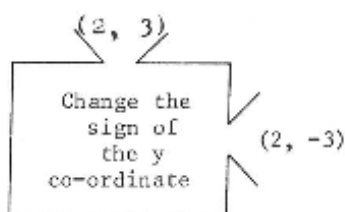
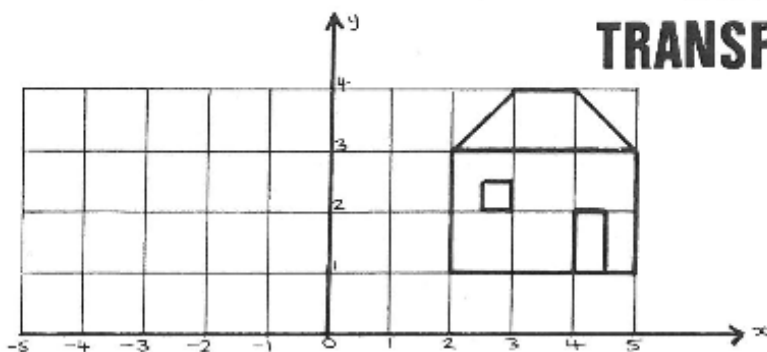
- ✗ Using 5mm square paper to represent the cloth, design a motif of your own and create patterns, describing them in terms of reflections, rotations and translations.
- ✗ Take one of your patterns and make it into a rectangular border keeping the design continuous and making right-angled bends in the appropriate places. You may find a mirror helpful to plan the corners.

You might like to choose one of your patterns and using cross stitch embroider it.

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SMILE

MATRICES AND TRANSFORMATIONS



This machine changes the point $(2, 3)$ to $(2, -3)$

- (1) Copy and complete, for the corners of the house:

$(2, 3) \longrightarrow (2, -3)$	$(5, 3) \longrightarrow (\blacksquare, \blacksquare)$
$(3, 4) \longrightarrow (\blacksquare, \blacksquare)$	$(5, 1) \longrightarrow (\blacksquare, \blacksquare)$
$(4, 4) \longrightarrow (\blacksquare, \blacksquare)$	$(2, 1) \longrightarrow (\blacksquare, \blacksquare)$

- (2) On squared paper draw both the original house, and the house after it has been through the machine.

Describe what has happened to the house?

- (3) Repeat (1) and (2) for each of the following machines, drawing just the new house in each case.

