

Christchurch '74

Purpose:

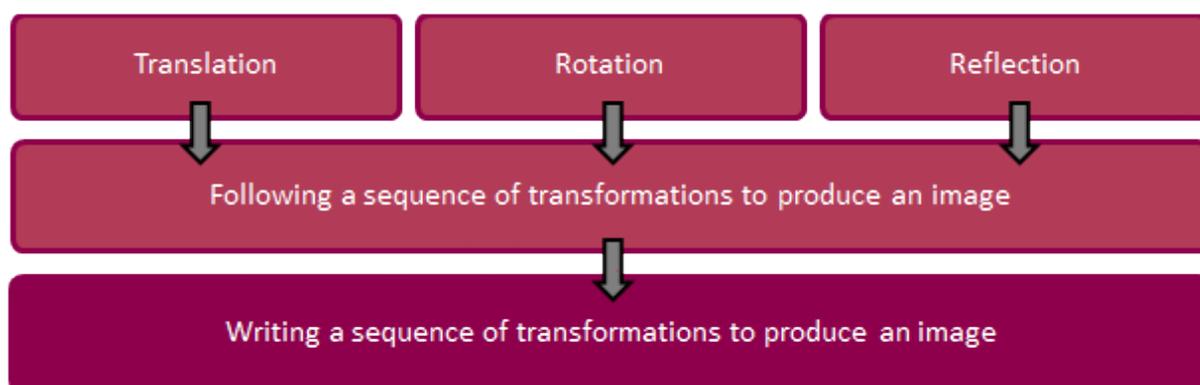
The purpose of this activity is to provide students with the opportunity to explore the invariant properties of a shape under transformations, in order to complete a given design and to communicate the transformations necessary to achieve this design.

Achievement Objectives:

GM4-8: Use the invariant properties of figures and objects under transformations (reflection, rotation, translation, or enlargement).

Description of mathematics:

The background knowledge and skills that need to be established before and/or during this task are outlined in the diagram below:



Translation

Translate the shape below, 1 cm up and 2 cm to the right.



Rotation

Rotate the shape below, 90° anticlockwise about x.



Reflection

Reflect the shape below in the dotted mirror line.



Following a sequence of transformations to produce an image

Reflect the J in the mirror line, then translate J and J' 3 cm to the right. Rotate the image under translation, 180° about the centre of the image.



Writing a sequence of transformations to produce an image

Write a sequence of transformations that would map the black object onto the blue image below.



This activity may be carried out with step by step guidance, or by allowing the student to follow their own method of solution. The approach should be chosen in sympathy with students' skills and depth of understanding.

Activity:

The 1974 Commonwealth Games logo can be constructed from a series of transformations on a single N.

Give a set of instructions that take the upper left hand blue N, that would:

1. Create the upper left hand N.
2. Use the upper left hand N to build the remainder of the logo.



The procedural approach

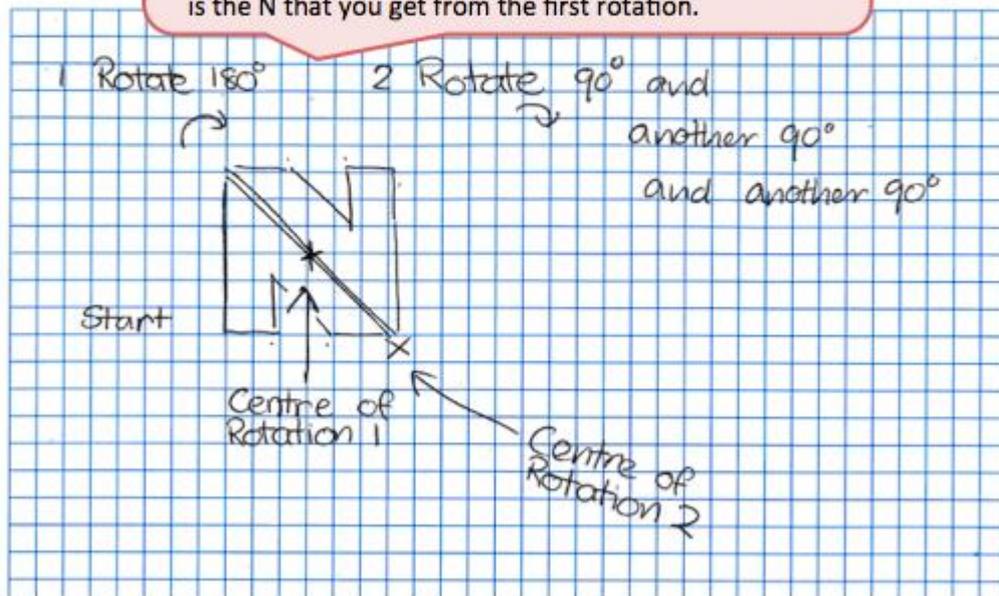
The student is able to find and describe the transformations necessary to build the given design from a specified starting shape.

Prompts from the teacher could be:

1. Draw or cut out the starting shape (blue 7).
2. Investigate various transformations until you have one, or a sequence of several, that lead to the position and orientation of the red 7 to complete the upper left N.
3. Draw or use a cut out of the upper left N.
4. Investigate various transformations until you have one, or a sequence of several, that lead to the position and orientation of the upper left N to complete the upper right Z.
5. Repeat this process (4) until you have completed the design.
6. Write the sequence of steps that take you from just the first blue 7 to the full design.

T: Your instructions are clearly written here, but what do the numbers 1 and 2 refer to?

S: Well 1 is just the blue 7 that we started with and then 2 is the N that you get from the first rotation.



The conceptual approach

The student is able to find and describe the transformations necessary to build the given design from a specified starting shape.

Prompts from the teacher could be:

1. Consider various transformations that could map the blue 7 to the red one. Could this be done in just one step?
2. Investigate various transformations that lead to the position and orientation of the upper left N to complete the upper right Z. Could this be done in just one step?
3. Repeat this process (2) until you have completed the design.
4. Write the sequence of steps that take you from just the first blue 7 to the full design.

1. Reflect along long edge
Then Rotate 180°

2. Rotate 90° from bottom right corner
to the right.
Rotate the same point 2 more times $\neq 90^\circ$ to the right.

The image shows handwritten notes on a grid background. Step 1 includes a diagram of a blue '7' being reflected across its long edge and then rotated 180 degrees. Step 2 includes a diagram of a blue '7' being rotated 90 degrees clockwise around its bottom-right corner, and a note to repeat this rotation two more times.

T: Your diagrams and reflection instructions are clear to follow, but I'm not sure about the rotation. Where is the centre of rotation?

S: Oh, in the middle. I didn't say cause that's where we usually rotate...like for counting order of symmetry and stuff.