Assessment task

Year level	7
Learning area	Mathematics
Content Strand	Measurement and Geometry
Title of task	Transformations and Design

Task details

Description of task	Students will identify, describe and produce designs involving transformations of translation, reflection and rotations of multiples of 90˚ using the Cartesian plane.
Type of assessment	Summative
Purpose of assessment	To inform moderation practices
Assessment strategy	Written
Evidence to be collected	Responses to tasks
Suggested time	Part A: Approximately 45 minutes Part B: Approximately 45 minutes

Content description

Content from the Western Australian Curriculum	Describe translations, reflections in an axis and rotations of multiples of 90˚ on the Cartesian plane using coordinates. Identify line and rotational symmetries			
Proficiencies	Understanding	Fluency	Problem solving	Reasoning
	✓	✓	✓	✓

Task preparation

Prior learning	Students will have experience in identifying and locating points on the Cartesian plane and understand the language and notation associated with the Cartesian plane. They are familiar with the interpretation, representation and language of transformations of translation, reflection and rotation on the Cartesian Plane, including where multi-step transformations are involved.
Prior Learning Resources	The Cartesian plane and plotting points : http://amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_2a.html#student Understanding Transformations on the Cartesian plane https://www.resolve.edu.au/transformations-frieze-patterns http://amsi.org.au/ESA_middle_years/Year7/Year7_md/Year7_2d.html Combining Transformations: https://www.bbc.com/bitesize/guides/zw3rwxs/revision/9

Assessment task

Assessment conditions	This is a two-part individual assessment. Both Part A and B are assessed separately in class.
Resources	Separate student booklets for Parts A and B

Instructions for teacher

These assessment tasks involve students responding to a series of activities which require them to construct and interpret transformations. They will be describing or creating multiple transformations involving translation, reflection and/or rotation. Throughout the tasks, students are required to explain decisions or conclusions.

During previous teaching it should have been pointed out and modelled that explanations are not necessarily given only in words, but should incorporate diagrams, mathematical calculations and/or results, where appropriate. Such comprehensive explanations are a true sign of increasingly sophisticated understanding.

It would be helpful for students to use different colours when completing Part B as this will assist with visualisation of the resulting patterns.

It is suggested that teachers print off the solutions to the tasks in colour, to see the transformations in the marking scheme.

Instructions to students

This assessment task is in two parts which should both be completed independently.

Part A:
Students will perform a series of rotations and describe the resulting transformations using the language of the Cartesian plane, including coordinates, and transformation.

Part B:
It is recommended that students use as many different colours as required to help fully describe different transformations in questions 2 and 3 of this section.

Student Booklet – Mathematics

Task title	Transformations and Design
Student name	
School	
Year level	7
Date	

Part A: Robot

A robot is positioned at the origin of a Cartesian plane. You have programmed the robot to start by facing the positive vertical (y) axis and then move according to the following set of commands.

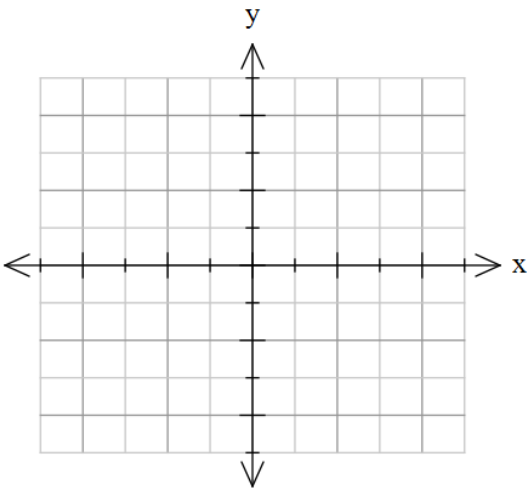
A: Walk one pace **forward** and then turn 90˚ to the right.
B: Walk two paces then turn 90˚to the right.
C: Walk three paces then turn 90˚to the right.

The commands A: B: C are to be repeated until the robot arrives back at its starting point.

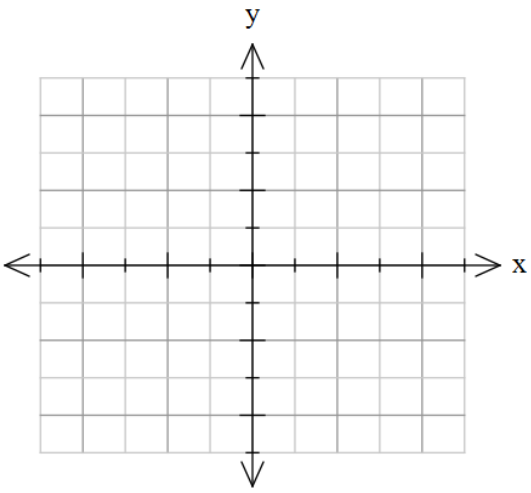
Question 1

a) Complete this series of commands on CARTESIAN PLANE 1 below and label the shape formed 'Q'.

CARTESIAN PLANE 1



CARTESIAN PLANE 2



b) Describe the shape formed. In your description, include references to Cartesian coordinates and transformation(s) that you think are involved.

c) The robot was now programmed to turn **left** instead of right for commands A: B: C. Draw the new shape formed on CARTESIAN PLANE 2 above.

d) Describe the change in the shape from CARTESIAN PLANE 1 to CARTESIAN PLANE 2 referring to Cartesian coordinates and transformations.

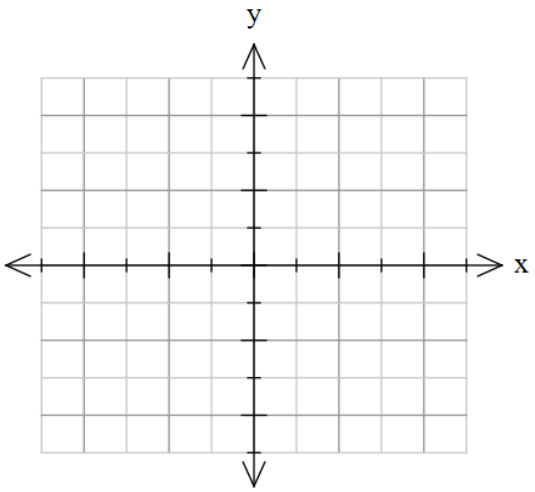
Question 2

a) Reproduce shape 'Q' starting at the origin, on CARTESIAN PLANE 3 below.

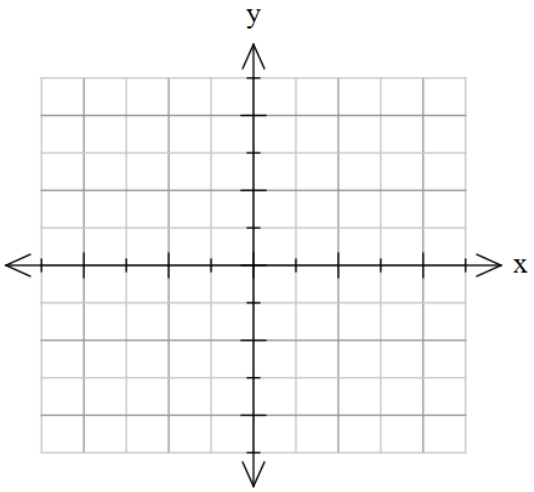
b) Draw a new shape formed by the robot on CARTESIAN PLANE 4, where the order of the commands has been changed from A: B: C to B: C: A. That is, starting at the origin and facing toward the positive vertical (y) axis:

B: Walk **two** paces **forward** then turn 90˚ to the right.
C: Walk **three** paces then turn 90˚to the right.
A: Walk **one** pace then turn 90˚to the right.

CARTESIAN PLANE 3



CARTESIAN PLANE 4



c) Describe the change in the shape from CARTESIAN PLANE 3 to CARTESIAN PLANE 4 referring to Cartesian coordinates and transformations.

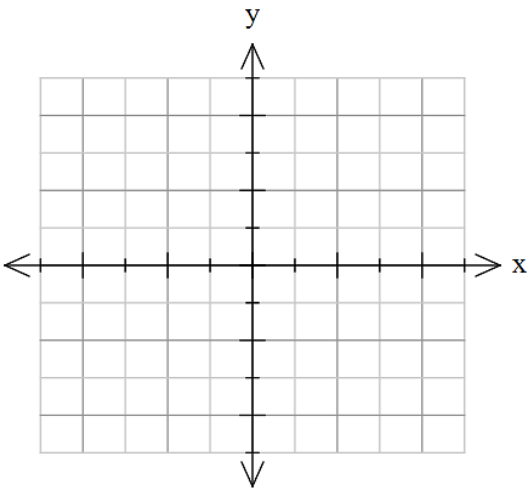
Question 3

a) Reproduce shape 'Q' on CARTESIAN PLANE 5 below.

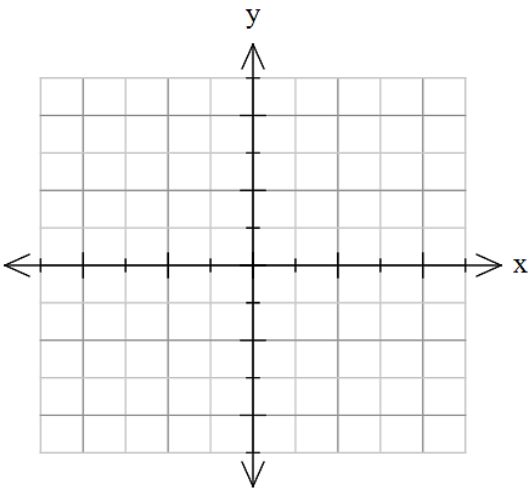
b) Draw a new shape formed by the robot on CARTESIAN PLANE 6, where the order of the commands has been changed from A: B: C to B: C: A *and* the direction is left instead of right. That is, starting at the origin and facing toward the positive vertical (y) axis:

B: Walk **two** paces **forward** then turn 90˚ to the **left.**
C: Walk **three** paces then turn 90˚to the **left.**
A: Walk **one** pace then turn 90˚to the **left.**

CARTESIAN PLANE 5



CARTESIAN PLANE 6



c) Describe the change in the shape from CARTESIAN PLANE 5 to CARTESIAN PLANE 6 referring to Cartesian coordinates and transformations.

Part B: Tile design

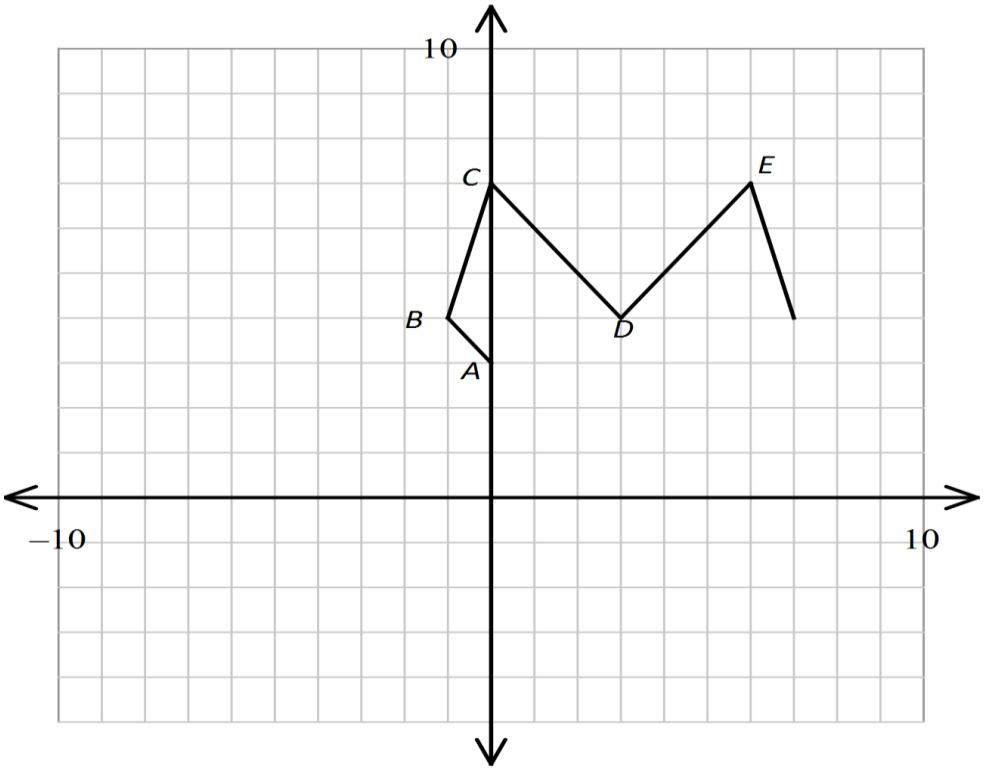
Transformations are used in designing tiles.

Question 1

(a) Use the Cartesian plane below to complete the following instructions.

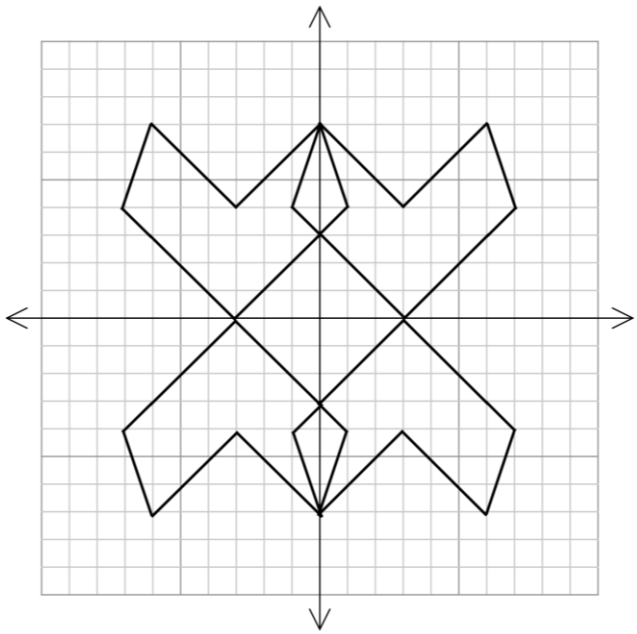
(i) Translate line segments CD and DE 4 units down.
(ii) Translate point B, 8 units to the right, label it B' and write the coordinate next to it.
(iii) Translate point A, 6 units to the right, label it A' and write the coordinate next to it.
(iv) Connect points A' and B'.

(b) Is the shape formed symmetrical? Explain your thinking.



Question 2

The shape made in Question 1, was used to produce the following design.



a) Trace over the shape made in Question 1 in the design above.

b) Fully describe how this shape has been used to make the total design.
- Use the language of transformations and coordinates in your description.
- Use coloured pencils to assist in your explanations.

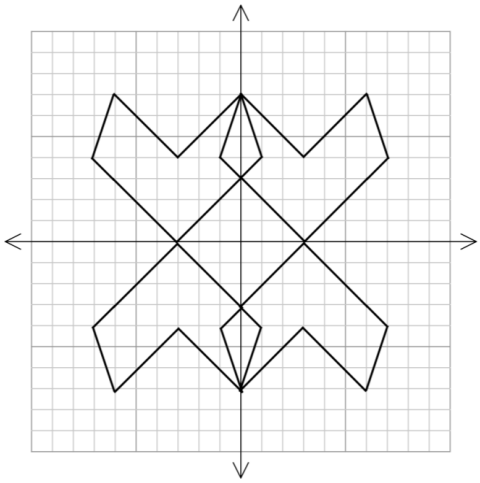
DESCRIPTION

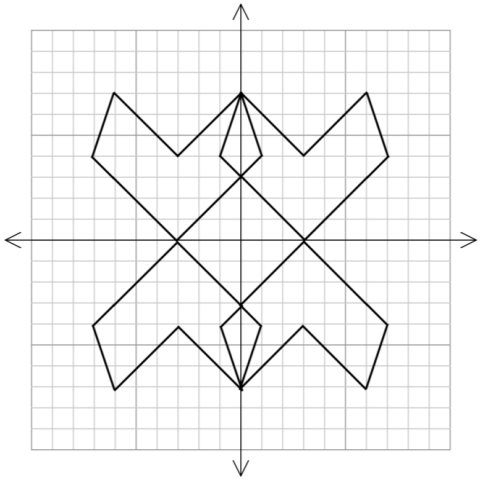
Question 3

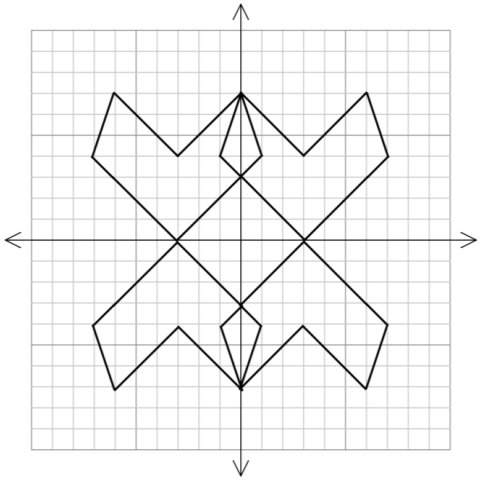
Fully describe any other multi-step transformations that could be used to produce the final design from the original shape made in Question 1.

- Try to use all of the types of transformations in your descriptions.
- Reference must be made to coordinates in some of your descriptions.
- Use coloured pencils to assist in your descriptions.

DESIGN **DESCRIPTION**



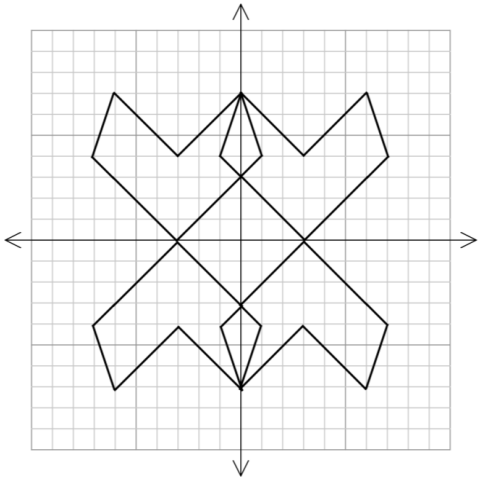


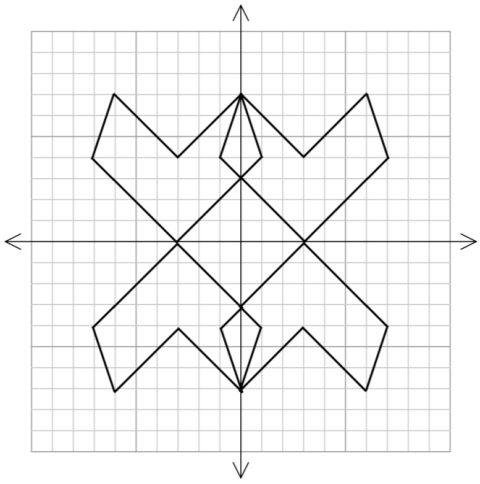


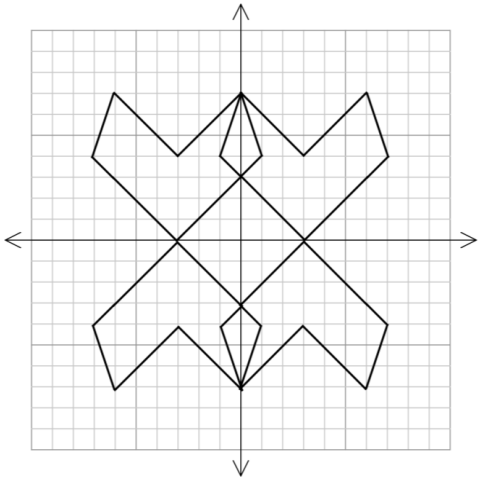
Extra grids are available on the next page if you need.

DESIGN

DESCRIPTION





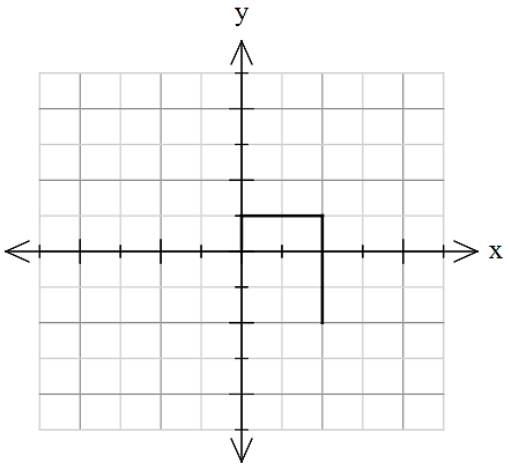


Marking key

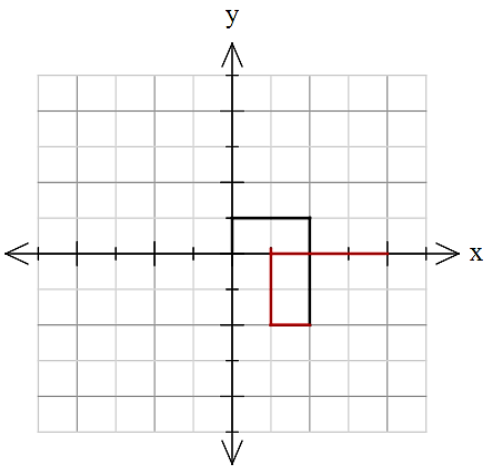
Part A: Robot

Question 1 (a) on Cartesian Plane 1

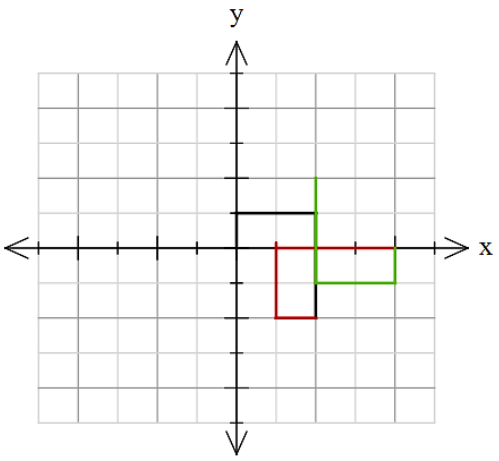
Sequence 1



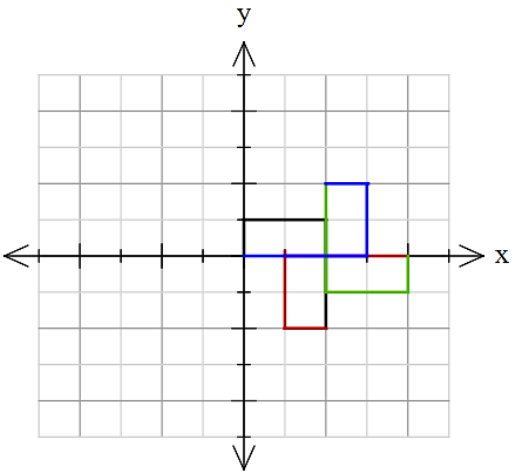
Sequence 2



Sequence 3



Sequence 4



Specific behaviours	Marks
Correctly applies distance commands	1
Completes one sequence one correctly	1
Completes at least 2 sequences correctly	1
Shows that the fourth sequence finishes at the starting point	1
Subtotal	**4**

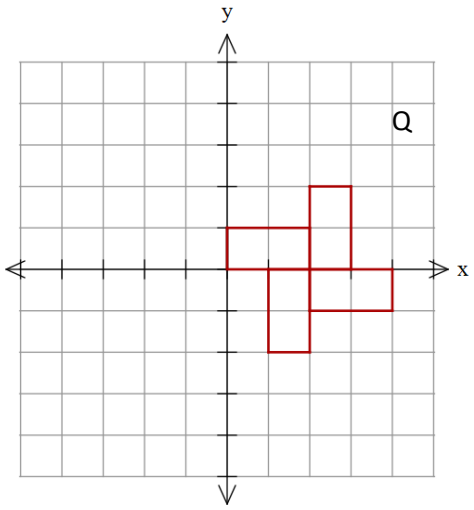
Question 1 (b)	
States that 4 sequences complete one whole pattern involving rectangles	1
Refers to rotational symmetry in observation	1
Identifies order of rotational symmetry of 4	1
Correctly identifies the centre of rotation of complete pattern as being (2, 0)	1
Subtotal	**4**

Sample Description

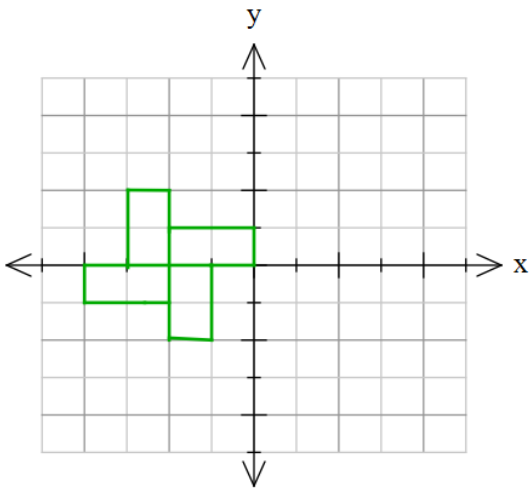
After four repeats of the three commands, a rectangular shape is formed. The rectangles in the shape can be rotated through 90˚about the centre of rotation (2, 0). The figure has a rotational symmetry of 4 when rotated 90˚ through (2, 0).

Question 1 (c)

CARTESIAN PLANE 1



CARTESIAN PLANE 2



Reproduces shape 'Q' on Cartesian Plane 1	1
Completes all 4 sequences turning left in the commands A: B: C to form the new shape on Cartesian Plane 2	2
Subtotal	**3**

Question 1 (d)

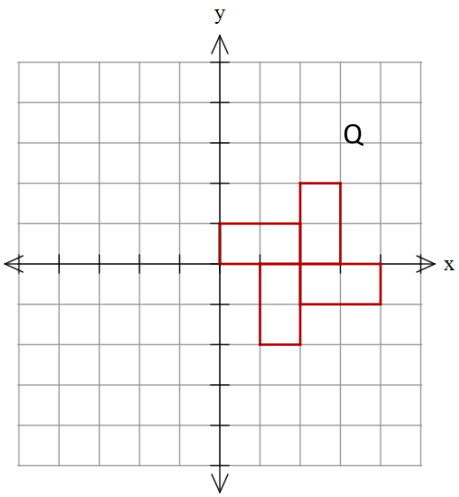
States that the shape has moved	1
Correctly identifies a transformation, such as reflection (or combination) to arrive at the new position of the shape	1
Makes reference to a line of symmetry	1
Correctly identifies the line of symmetry as being the vertical axis	1
Correctly identifies the new centre of rotation as being (-2, 0)	1
Subtotal	**5**

Sample Description

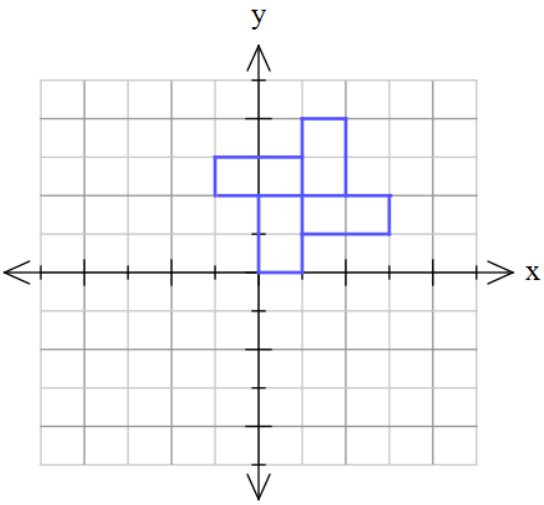
Shape 'Q' has been reflected about the vertical axis (y) into quadrant 2 to form the new shape on Cartesian Plane 2. The centre of rotation has been moved from (2, 0) for 'Q' to (-2, 0) for the new shape.

Question 2 (a) and (b)

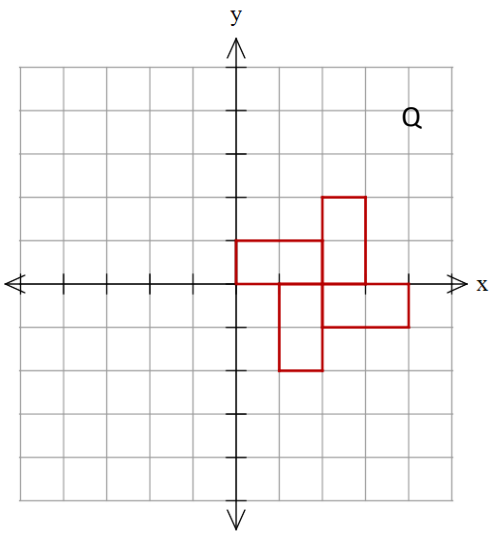
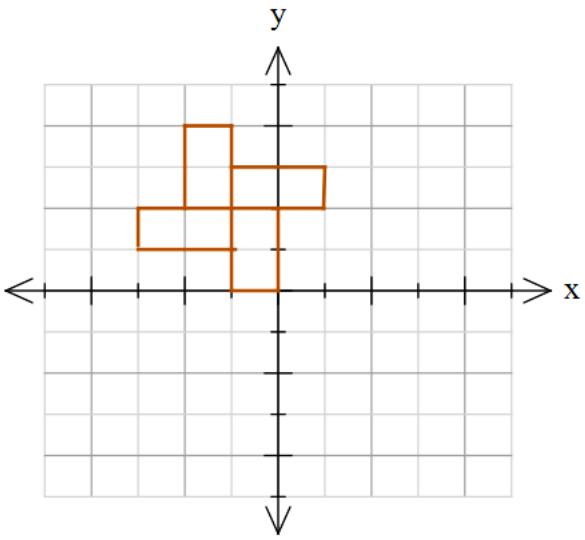
CARTESIAN PLANE 3



CARTESIAN PLANE 4



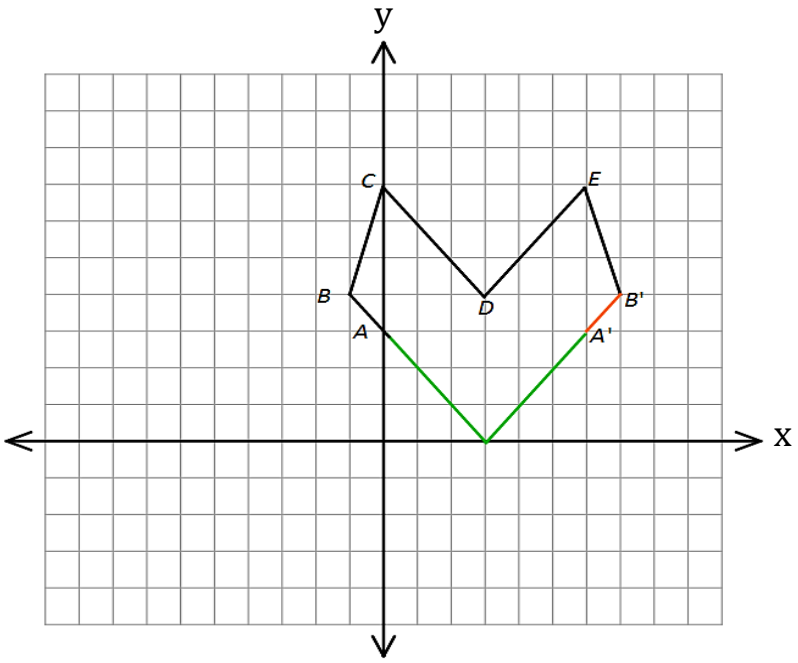
Specific behaviours	Marks
Reproduces 'Q' on Cartesian Plane 3	1
Completes all 4 sequences of B: C: A to form the new shape on Cartesian Plane 4	2
Subtotal	**3**
Question 2 (c)	
States that the shape has moved	1
Correctly identifies a transformation, such as translation (or combination) to arrive at the new position of the shape	1
Makes reference to the direction the shape has moved (e.g. left and up)	1
Makes correct reference to the distance the shape has moved (e.g. 1 left and 2 up)	1
Correctly identifies the new centre of rotation as being (1, 2)	1
Subtotal	**5**
Sample Description Shape 'Q' has been moved on Cartesian Plane 2 to form a new shape. The new shape has been translated 1 unit left and 2 units up from 'Q'. The centre of rotation has been moved from (2, 0) for 'Q' to (1, 2) for the new shape.	

Question 3 (a) and (b)	
CARTESIAN PLANE 5  CARTESIAN PLANE 6  	
Specific behaviours (this may vary, depending upon the order and combination of transformations chosen by the student)	**Marks**
Reproduces 'Q' on Cartesian plane	1
Completes all 4 sequences of B C A turning *left* to form the new shape	2
Subtotal	**3**
Question 3 (c)	
States that the shape has moved	1
Correctly identifies a **combination** of transformations, such as reflection and translation (or combination) to arrive at the new position of the shape	1
Correctly identifies reflection as one of the transformations	1
Correctly identifies that shape 'Q' is reflected over the vertical axis	1
Correctly identifies translation as one of the transformations	1
Correctly identifies the direction the shape has then moved (e.g. right and up)	1
Makes correct reference to the distance the shape has moved (e.g. 1 unit right and 2 up)	1
Correctly identifies the new centre of rotation as being (-1, 2)	1
Subtotal	**8**
Sample Description Shape 'Q' has been moved on the Cartesian plane to form the new shape. The new shape has been reflected around the vertical (or y) axis. It has then been translated 1 unit right and 2 units up. The centre of rotation has been moved from (2, 0) for 'Q' to (-1, 2) for the new shape.	
Total	**35**

Marking key

Part B: Tile design

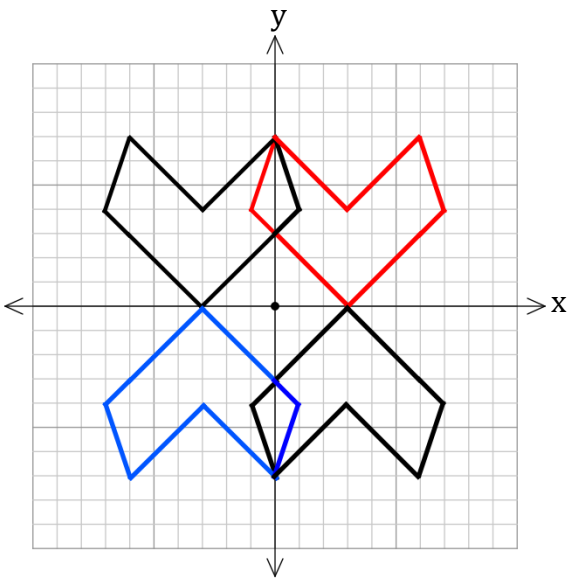
Question 1 (a)



Specific behaviours	Marks
Translates CD and DE a distance of 4 units down	2
Translates point B, 8 units to the right	1
Translates point A, 6 units to the right	1
Labels new points correctly as A' and B'	1
Correctly writes the coordinates for both A' (6, 3) and B' (7, 4)	2
Correctly produces the figure	1
Subtotal	**8**
Question 1 (b)	
States that there is a line of symmetry	1
Correctly indicates that the line of symmetry is vertical	1
Correctly states that the line of symmetry passes through D or the x axis at the point (3, 0)	1
Subtotal	**3**

Question 2

DESIGN



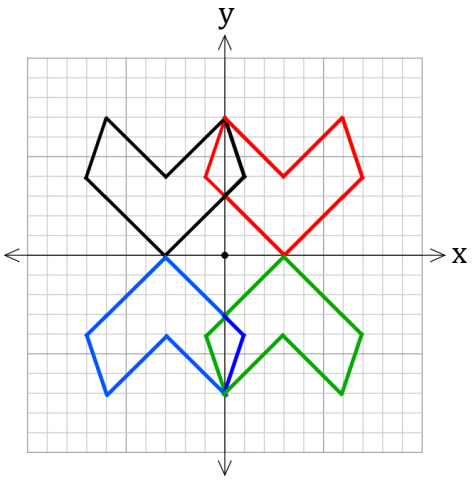
SAMPLE DESCRIPTION

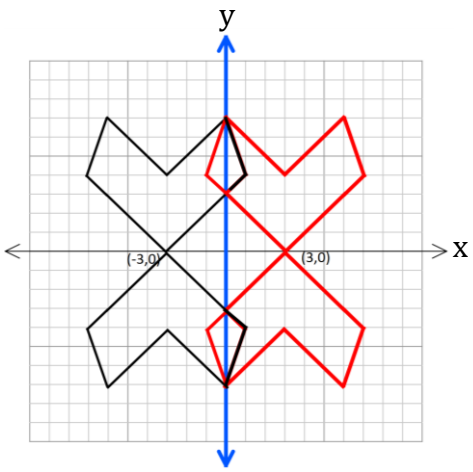
Rotation of original shape (in red) 180˚in clockwise (or anticlockwise) direction about the origin (0, 0) to make the blue shape. This is followed by the reflection of both the red and the blue shape through the vertical (or y) axis to form the black shapes.

Specific behaviours	Marks
Correctly traces the shape from Question 1	1
Correctly names the type of transformations required to make the final shape	2
Correctly uses the language of each of the multi-step transformations	4
Correctly refers to specific Cartesian coordinates in at least one of the transformation steps	1
Subtotal	**8**

Question 3	

DESIGN





SAMPLE DESCRIPTIONS

The original red shape is reflected in the horizontal axis followed by reflection of the green shape in the vertical axis followed by reflection of the blue shape in the horizontal axis to form the final black shape.

Reflects the original shape about the horizontal or x axis.
The whole of the red shape is then translated 6 units left so that the coordinate at the base of the original shape (3, 0) becomes (-3, 0) on the new shape.

Specific behaviours	Marks
Correctly traces the shape from Question 1 for each diagram	1
Correctly names a sequence of multi-step transformations using the **same** transformation (e.g. a series of reflections) in at least one description	2
Correctly names a sequence of multi-step transformations using **different** transformations (e.g. reflection followed by translation) in at least one description	4
Correctly uses the language of each of the transformations steps	4
Correctly refers to specific Cartesian coordinates in at least one of the descriptions	2
Subtotal	**13**
Total	**32**