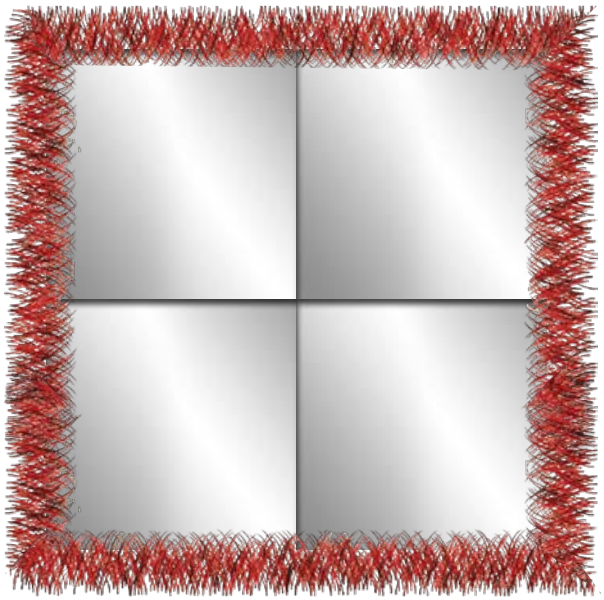
Reasoning in the classroom

Mirror and tinsel



Support materials for teachers

Year 6

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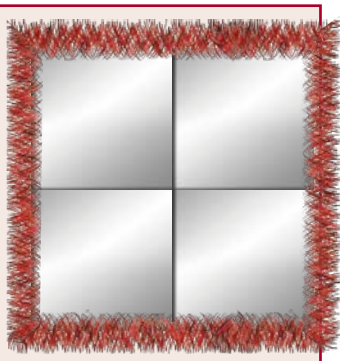
Welsh Government

Year 6 Reasoning in the classroom – Mirror and tinsel

These Year 6 activities start with an item that was included in the 2014 National Numeracy Tests (Reasoning). They continue with a second activity that uses the same context of area and perimeter.



Activity 1

Mirror and tinsel

Learners use information to calculate the perimeter of a rectangle.

Includes:

- Mirror and tinsel question
- Markscheme

Activity 2

Same or different?

They create different shapes with the same area, then explore the implications in terms of the perimeters.

Includes:

- Explain and question – instructions for teachers
- Whiteboard – Rectangle
- Teachers' sheet – Solutions

Reasoning skills required

Identify	Communicate	Review
Learners decide on their methods and find different solutions.	They explain their reasoning and create a report showing their findings.	They check their work.

Procedural skills

- **Perimeter (rectangle)**
- **Area (rectangle, hexagon, octagon, decagon)**

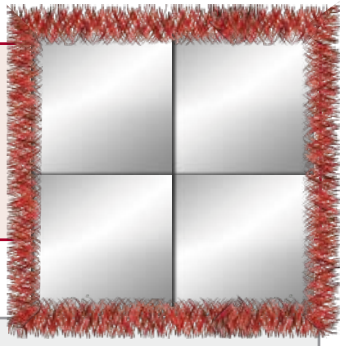
Numerical language

- **Perimeter**
- **Area**
- **Hexagon**
- **Octagon**
- **Decagon**
- **Regular (shape)**

Activity 1

Mirror and tinsel

Activity 1 – Mirror and tinsel



Outline

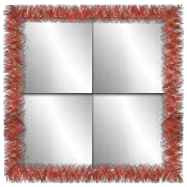
In this Year 6 activity, learners use their understanding of perimeter to work out how much tinsel is needed to go around the border of a mirror.

You will need

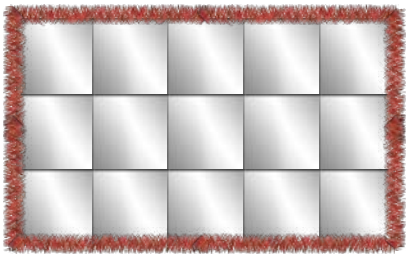
Mirror and tinsel question
One page for each learner

Markscheme

Anna uses red tinsel to decorate square mirror tiles.

 is made from **4** tiles.

She puts **80cm** of red tinsel around the perimeter.

 is made from **15** tiles.

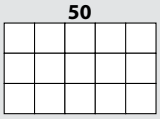
How many centimetres of red tinsel does she put around the perimeter?

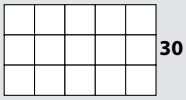
cm

3m

Activity 1 – Mirror and tinsel – Markscheme

Marks	Answer
3m	**160**cm
Or 2m	Clearly links **50** to the width of the larger mirror Or **30** to the height of the larger mirror Or Shows working that would lead to 160 if calculated correctly, e.g. • 80 ÷ 8, then the answer is × 16 • 80 + 80
Or 1m	Clearly links **20** to any side of the smaller mirror Or **10** to any side of one tile Or Shows the value **16** Or Gives the answer **120**

◀ 

◀ 

◀

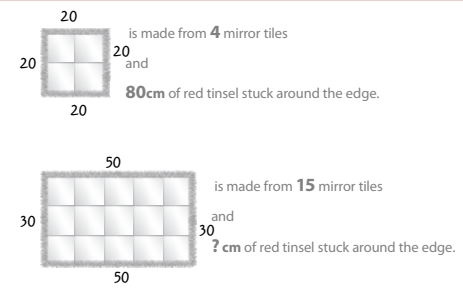
◀

◀ **Number of mirror edges**

Common error

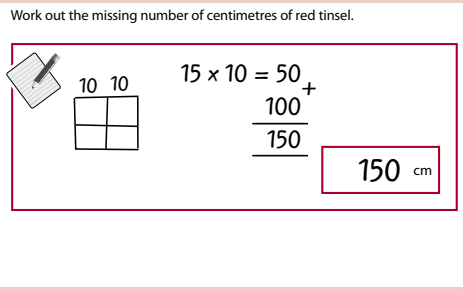
◀ **This comes from finding 10 or 20, then counting only the number of squares around the border of the shape (see exemplar)**

Activity 1 – Mirror and tinsel – Exemplars



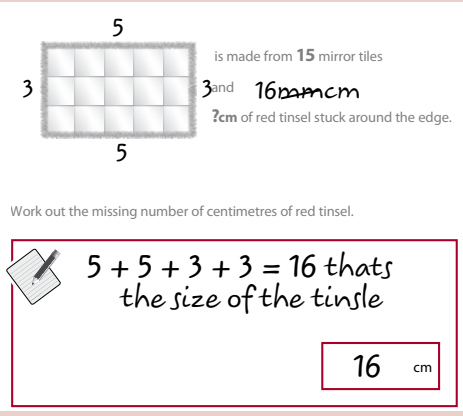
Correct; **3 marks**

- The answer is clearly 160, so it doesn't matter that it is not in the answer box.
- Annotating the diagram is effective mathematical communication.



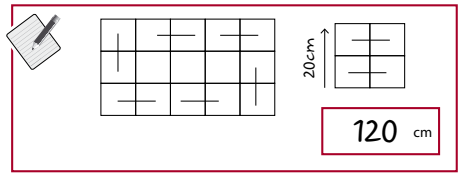
10 linked to one side of the tile; **1 mark**

- This learner has worked out the side length of one tile but then has miscounted or worked with the total number of tiles.
- Although 50 is shown, it is not linked to the width of the larger mirror, so cannot be given 2 marks.



Shows the value 16; **1 mark**

- Although this learner shows understanding of perimeter, they have not taken into account the side length of each tile.



Answer 120 (or 20 linked to one side of the tile); **1 mark**

Common error

This learner has done 6 × 20 (or 12 × 10) from counting the number of squares around the border of the rectangle (when teaching, be careful to say 'count the number of edges', not 'count the number of squares').

Answer 300; **0 marks**

Common error

This is a common error. The learner assumes that one tile is 20 (80 ÷ 4) so 15 tiles are 300 (20 × 15). It shows a lack of understanding of perimeter and, possibly, confusion with area.

Activity 2

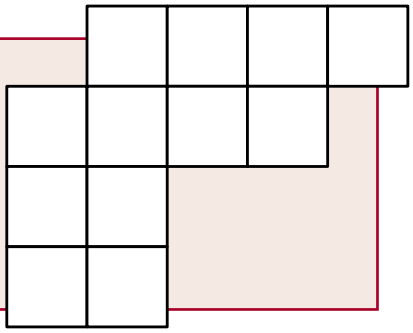
Same or different?

Activity 2 – Same or different?

or

Outline

This Year 6 activity continues the theme of area and perimeter presented in **Activity 1 – Mirror and tinsel**. Learners find different ways to manipulate and change a shape while retaining its original area. They then explore whether the perimeter also remains the same.



You will need

WB **Whiteboard – Rectangle**

T **Teachers' sheet – Solutions**

Activity 2 – Same or different?

Explain

Show **Rectangle** on the whiteboard and ask what shape it is and why. If the side length of each square within the rectangle is one centimetre, what is the area of the rectangle? *(12cm²)* Discuss, then ask, if you were to cut this large rectangle in half vertically *(creating two 2 by 3 rectangles)*, then move one half vertically above the other, what would the new shape be and would the area change or be the same? (*A 2 by 6 rectangle, area still 12cm²)* Draw on the whiteboard and discuss. Does the new shape have more sides than the original? *(No – it is a rectangle, so also has four sides.)*

Is it possible to keep the same area but make a shape that has more than four sides? Ask learners what we call a six-sided shape *(hexagon)*. Can they make a hexagon that has the same area as the rectangle – 12cm²? Give each pair squared paper, pencils, an eraser and ruler. They may also find it useful to use scissors to cut the shapes, or use multilink cubes. Let them choose, but whatever their method of working, they need to record their shapes, as they are going to produce a report later on.

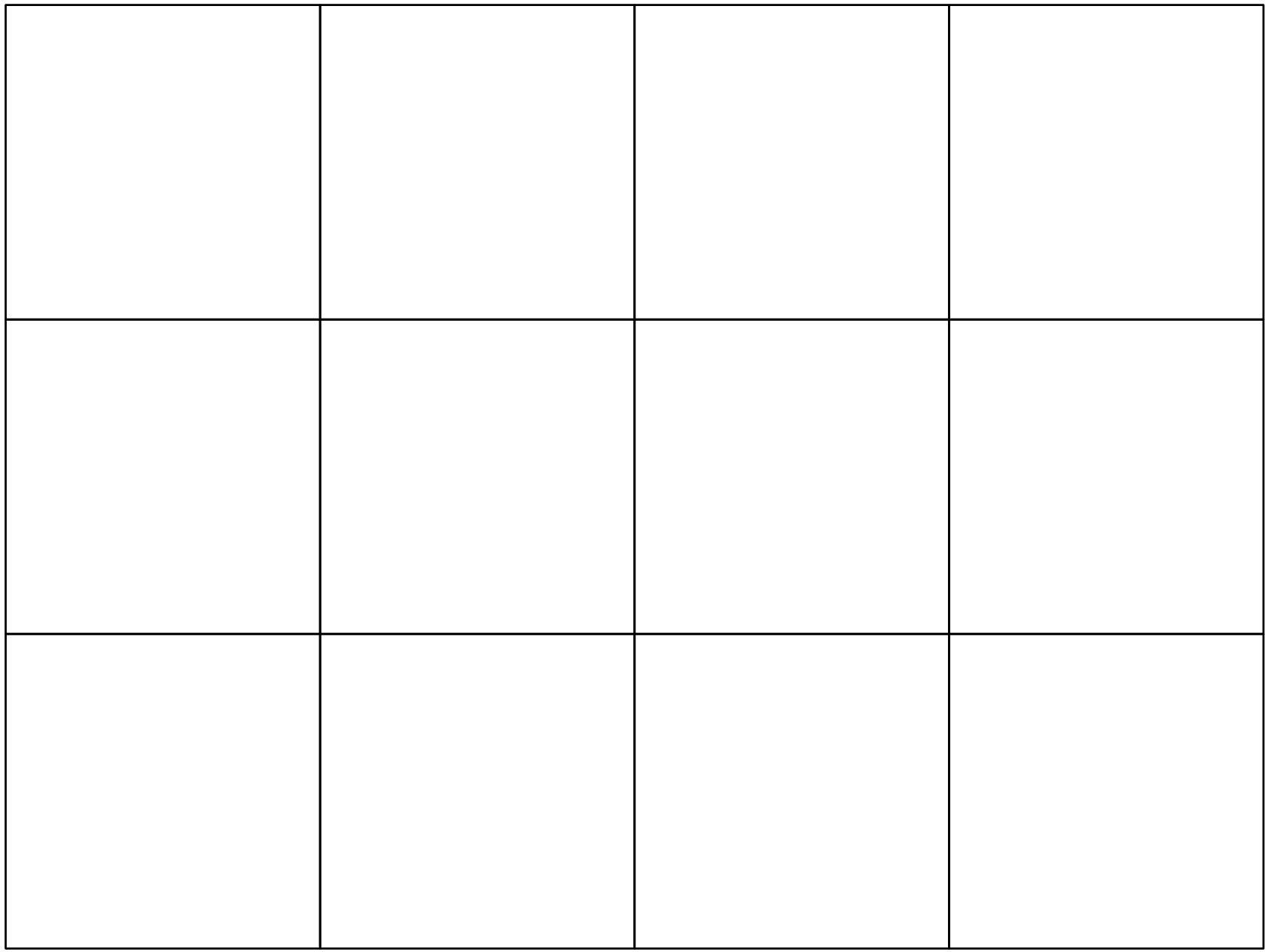
Once they have found a hexagon, ask them to make an eight-sided shape *(octagon)* and a 10-sided shape *(decagon)*. When they have achieved all three, ask them to prove to you that the area is the same for each shape. *(Encourage them to use numerical language – e.g. the area of the rectangle is 12cm² and it is made up of 12 centimetre squares. Our hexagon has six sides and also has 12 centimetre squares, so the area is the same. Examples of solutions are provided in the teachers' sheet* **Solutions***.)*

Bring the class back together and discuss their findings, exploring how many different shapes they have found. Then ask – if the areas of these shapes are the same, what about the perimeters? Will they be the same? Ask them to look at the shapes they have created and find out. Then discuss and help them to see why the perimeters are different *(the perimeter depends on the number of edges that are on the 'outside' of the shape – the edges inside are not included)*. Groups then decide how to bring their findings together and present them in a report/display for the classroom.

Question

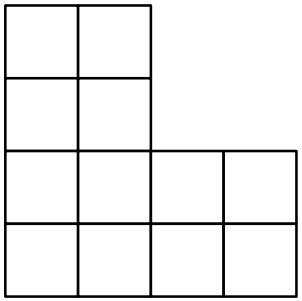
- What shape is this? How do you know it is a rectangle? Is a square a rectangle? *(Yes, as it meets the requirement for a rectangle to have two sides parallel and four right angles.)*
- How many sides does a hexagon have? Do they need to be the same length? *(No. A hexagon is any six-sided shape. A regular hexagon has six equal sides.)*
- How are you going to find your shape? What is the simplest way of making sure you keep the same area? *(Use centimetre squares and make sure you use 12 of them.)*
- Have you checked your new shape to make sure it is a hexagon and has the correct area? How? *(Count the sides and the centimetre squares.)*
- Is there just one way of making a decagon with the area 12cm²? How do you know? Do you think there will be other ways? *(There are many ways.)*
- What is the difference between perimeter and area? We use cm as the unit for perimeter. What unit is it for area? *(cm²)* Why is it important to have both perimeter and area? Can you think of when perimeter might be important? *(For example, working out how much tinsel you need to put round the mirror)* And area? *(Finding how much paint you need to paint a wall)*

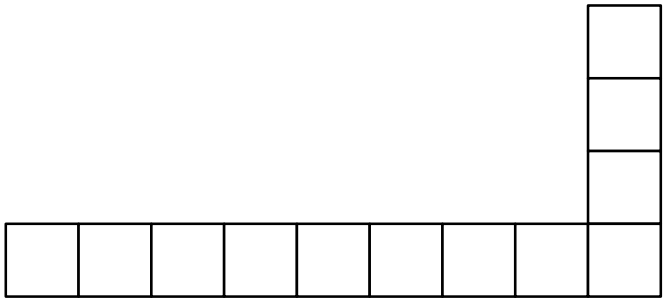
WB

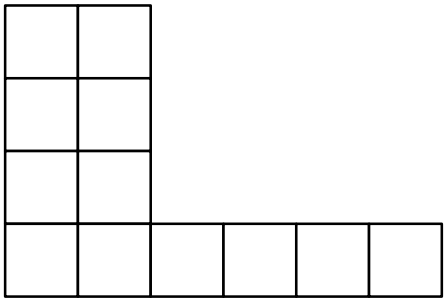


Please note that there are many ways of making each shape. The ones provided below are examples.
To avoid the perimeter including diagonals, which are not 1cm in length, each shape shown here consists of 12 complete squares.
If learners create shapes that include diagonals, they will need to use a ruler to measure the perimeter.

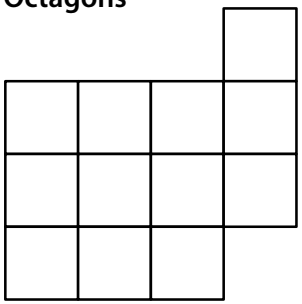
Hexagons

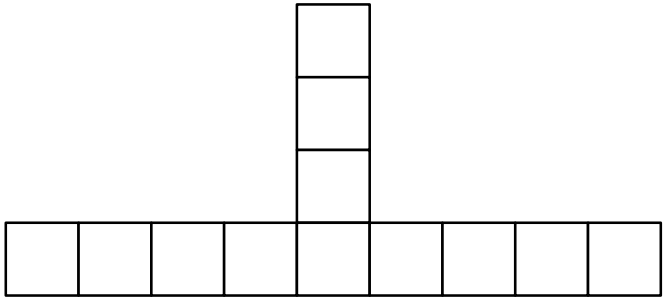


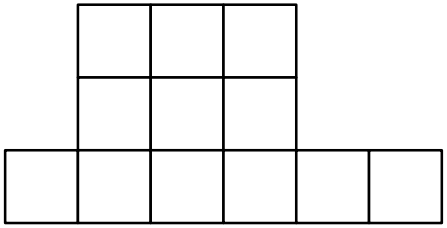
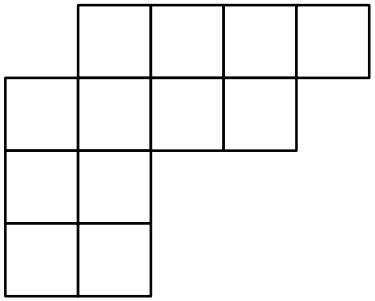
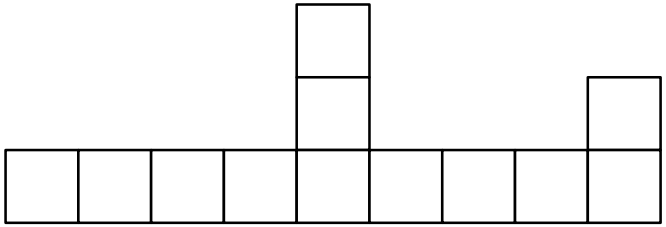
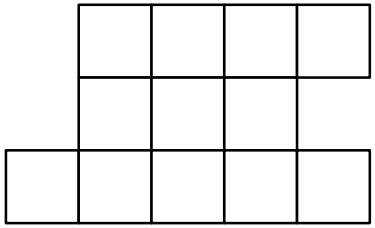




Octagons







Decagons