



Developing **number**

Optional Skills Assessment Materials

Mosaics



Optional Skills Assessment Materials

Developing number

Audience	Teachers at Key Stage 2, in particular those with Year 5 classes; local authorities; tutors in initial teacher training; and others with an interest in education.
Overview	These new materials support learning, teaching and assessment of learners' skills in Year 5. They are designed to assist schools in implementing the revised school curriculum and its frameworks.
Action required	Schools' senior managers and local authority advisers are requested to raise awareness of these new materials within their schools, and to encourage teachers to use the materials to support their focus on developing learners' skills.
Further information	Enquiries about this document should be directed to: Curriculum and Assessment Division Department for Children, Education, Lifelong Learning and Skills Welsh Assembly Government Cathays Park Cardiff CF10 3NQ Tel: 0800 083 6003 e-mail: C&A3-14.C&A3-14@wales.gsi.gov.uk
Additional copies	Can be obtained from: Tel: 0845 603 1108 (English medium) 0870 242 3206 (Welsh medium) Fax: 01767 375920 e-mail: dcells1@prolog.uk.com Or by visiting the Welsh Assembly Government's website www.wales.gov.uk/educationandskills
Related documents	<i>Optional Skills Assessment Materials for Year 5 – An overview;</i> <i>Optional Skills Assessment Materials: Developing communication;</i> <i>Optional Skills Assessment Materials: Developing thinking</i> (Welsh Assembly Government, 2009)

These materials are also available in Welsh.

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Overview

Three related activities based around a theme of mosaic patterns are provided:

- **Activity 1: Mosaic patterns**
- **Activity 2: Designing tiles**
- **Activity 3: Making mosaics**

In Activity 1, learners consider a range of mosaic patterns, identifying similarities and differences in their construction. Learners then have the opportunity to produce their own mosaics using the dedicated computer software, **Mosaic designer**.

In Activity 2, learners identify similarities and differences in a collection of tiles that are constructed on a 4 x 4 grid. Learners then design similar tiles of their own, before using **Mosaic designer** to produce further tiles designed to meet specific criteria.

In Activity 3, learners discuss ways in which the patterns on a number of given tiles could have been constructed. Learners then consider ways in which the tiles can be used to produce mosaic patterns. Finally, learners copy or design their own tile, before using this tile to produce a repeating pattern using **Mosaic designer**.

These activities are not timed assessment tasks, so you should feel free to adapt the materials provided to suit the needs of your learners.

The timings given at the beginning of each activity are suggestions. Some activities may take less time, while others may take considerably more. This will depend on the routes learners take and their interest in the activity itself.



Learner groupings

To promote collaborative learning, most activities are best undertaken by groups or pairs of learners who should be encouraged to share and discuss their ideas. At appropriate times, these groups could come together to present and compare their findings and the methods they use.

At other times, you may wish learners to work individually to provide evidence of their knowledge and skills. Consequently, the worksheets that accompany the activities can be used with groups, pairs or individuals as you consider appropriate.

Links to the skills framework

As learners engage with these materials they will generate evidence that contributes to their individual skills profile.

The 'Developing number across the curriculum' section of the skills framework has three main elements: **Use mathematical information**, **Calculate** and **Interpret and present findings**, with each of these sub-divided into a further two or three strands. These strands are referred to as 'principles' in the skills framework and are shown below.

Use mathematical information

- Using numbers
- Measuring
- Gathering information

Calculate

- Using the number system
- Using a variety of methods

Interpret and present findings

- Talking about and explaining work
- Comparing data
- Recording and interpreting data and presenting findings

Each principle contains six cells that correspond to stages in the development of the related skill. For example, the six cells identified in the **Using numbers** principle are shown below.

Use numbers in games and role play.	Use whole numbers in practical situations; use fractions in the context of simple shape. Recognise and use coins of different values.	Use decimals in the context of money and measures; use negative numbers in the context of temperature; use fractions and percentages to estimate, describe and compare proportions of a whole in practical contexts.	Use ratio and proportion in practical contexts, including currency exchange rates, value for money and scale drawings.	Use whole numbers, decimals, fractions, percentages, negative numbers, ratio and proportion in a variety of ways in practical contexts, including scale drawings, maps and plans.	Read and understand ways of writing very small and very large numbers.
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Evidence generated by the activities can be linked with cells to provide an indication of an individual learner's progress in the related skill area.

However, when doing this you should bear in mind the following points:

- The evidence generated by the activities will be a small part of the overall evidence that is available to you.
- Much evidence will be generated during other day-to-day learning and teaching; significant elements of this should also contribute to the learner's skills profile.
- The evidence generated by any activity is likely to contribute to a variety of principles and cells.

This final point is of particular importance when you review the **What to look for** section included with each of the activities.

These sections are designed to make evidence gathering more manageable by deliberately focusing on just two or three of the eight principles. However, this means that only some of the evidence that emerges is being considered.

As your familiarity with each of the activities increases, you may find that you are able to incorporate more of the available evidence into a variety of other principles and/or cells.

Links to the curriculum

English (Oracy)

Skills:

3. communicate clearly and confidently, expressing opinions, adapting talk to audience and purpose, using appropriate gesture, intonation and register in order to engage the listener
4. develop their awareness of the social conventions of conversation and discussion

ICT

Skills: Create and communicate information

1. create and communicate information in the form of text, images and sound, using a range of ICT hardware and software

Mathematics

Range: Number

2. Calculate in a variety of ways

- use fractions and percentages to estimate, describe and compare proportions of a whole; calculate fractions and percentages of quantities

Mathematics

Range: Shape, position and movement

1. Understand and use the properties of shapes

- make 2-D and 3-D shapes and patterns with increasing accuracy

2. Understand and use the properties of position and movement

- recognise reflective and rotational symmetries of 2-D shapes

Art and design

Skills: Understanding

1. describe and make comparisons between their own work and that of others
3. evaluate the methods and results of their own work and that of their fellow pupils through discussion, reading, writing and reflection

Art and design

Skills: Making

1. explore, experiment with and apply the elements of the visual, tactile and sensory language of art, craft and design which include line
2. design and make two-dimensional images; three-dimensional objects and artefacts using a range of various materials for a variety of purposes

Activity 1: Mosaic patterns



Links to the skills framework

In order to make evidence gathering more manageable, it is suggested that you concentrate initially on each of the principles shown as a main focus in the table below.

Use mathematical information

- Using numbers
- Measuring
- Gathering information

Calculate

- Using the number system
- Using a variety of methods

Interpret and present findings

- Talking about and explaining work
- Comparing data
- Recording and interpreting data and presenting findings

Key

- Main focus ● Incidental focus
- No intentional focus

Context

This activity is in two parts. Consequently, you may wish to spread it over two or more sessions.

In the first part of the activity, learners consider a collection of mosaic patterns, identifying similarities and differences in their design.

In the second part of the activity, learners are introduced to the computer software **Mosaic designer**, before using this software to produce their own mosaic patterns. Learners then display and discuss the patterns they have made.

Resources

For the first part of the activity, each group of learners will need a copy of the resource sheet provided.

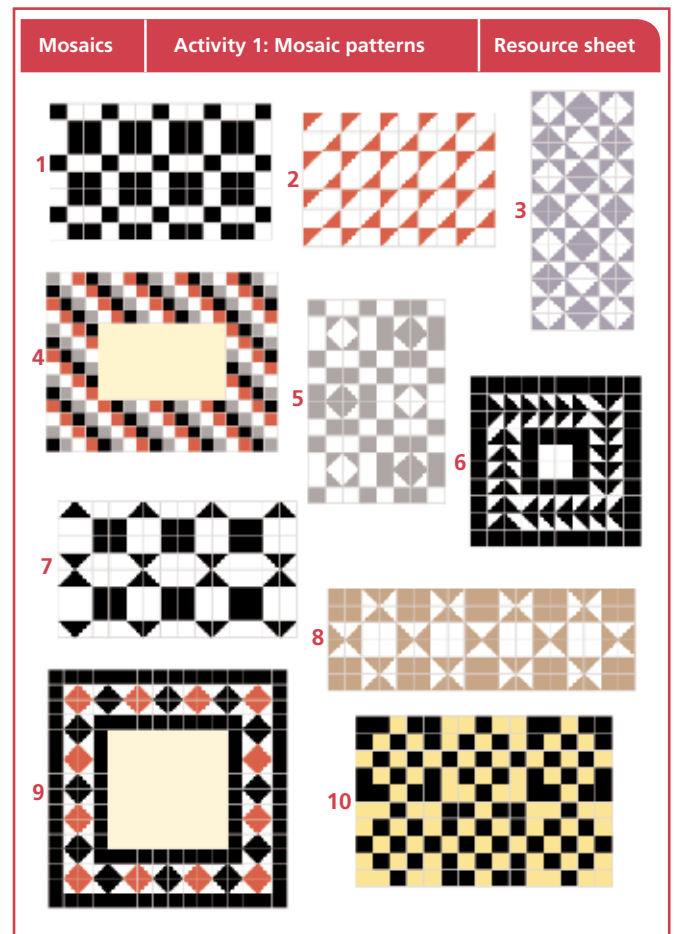
In the second part of the activity, learners need access to the computer software **Mosaic designer** that is provided on the CD.

The **What to look for** section at the end of this activity provides an indication of some of the evidence that you might expect and the cells with which this evidence might be matched. However, it is important to appreciate that a range of other evidence may also be generated and that this may be more validly associated with other principles and/or cells.

Activity 1 | Mosaic patterns

Developing the activity (part 1)

- Display the resource sheet on the whiteboard and/or distribute a copy to each group of learners.
- Stimulate whole-class discussion and thinking by asking questions such as:
 - What do you think the resource sheet shows?
 - Where have you seen patterns like these before?
 - Where else might you see similar patterns?
 - What do you think this activity might be about?
- As learners provide feedback, encourage other learners to comment and/or ask further questions.
- After the general introduction, ask learners to work in groups identifying similarities and differences in the patterns.
- To provide some structure, each learner could take a turn selecting two patterns and stating one way in which the patterns are similar and/or one way in which they are different, e.g. 'Patterns 1 and 7 are similar because they are both black and white, but different because Pattern 1 is made using only squares'.
- Careful observation of learners as they work will provide opportunities for gathering evidence relating to thinking, communication and number skills.
- Allow adequate time for groups to discuss the patterns, before bringing them together to share and compare their ideas.
- Selecting particular learners to report back will provide further opportunities for you to gather specific evidence about individuals.



An example of classroom practice

After a general introduction, each pair of learners was given a copy of the resource sheet and asked to identify similarities and differences in the patterns shown. After a while, the teacher asked the pairs to form into groups and share the facts that had been identified.

Although most pairs had initially considered factors such as colour, shape and number of squares or triangles, some had considered

properties such as area, perimeter and symmetry. Consequently, the sharing of ideas in this way initiated a further round of group discussion, with some learners very keen to compare perimeters and areas of all the mosaics.

Before moving on, the teacher brought the groups together to report their findings, which she recorded on the whiteboard.

Mosaics
Activity 1: Mosaic patterns
Resource sheet

1. 8×8 checkerboard, $P=42$, 104 squares

2. 10×7 checkerboard, $P=34$

3. 6×4 vertical stripes, $P=40$

4. 18×14 checkerboard, $P=64$

5. 8×12 checkerboard, $P=40$

6. 10×10 square with concentric borders, $P=40$

7. 14×8 checkerboard, $P=44$

8. 18×6 checkerboard, $P=48$

9. 16×16 square with concentric borders, $P=64$

10. 15×10 checkerboard, $P=50$

Similarities & Differences

- 8 patterns have 2 colours
- Pattern 4 has 5 colours
- Pattern 9 has 4 colours
- All made up of little squares either shaded or $\frac{1}{2}$ shaded. (2,5,6,7,8+9) combination
- shapes - square, rectangle, triangle, right-angled Δ , isosceles Δ , diamond
- Patterns are all rectangular even numbers $6+9$ because a square is a special rectangle
- Patterns 1, 4 and 10 are all made shading in whole squares.
- Pattern 3 is made by only shading $\frac{1}{2}$ squares.

Handwritten Notes:

- 4 + 9 look like picture frames.
- 3 patterns are black and white.
- They are repeated patterns
- Pattern 10 is half and half made up of 2 opposite patterns like 6 tiles - 3 of each
- Many of the patterns are symmetrical
- Pattern 9 has the largest area
- Patterns 9 + have the largest perimeter.

Activity 1 | Mosaic patterns

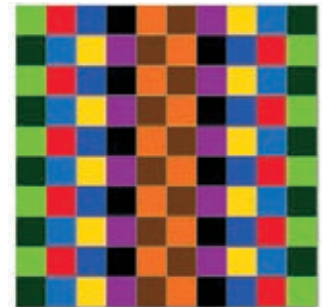
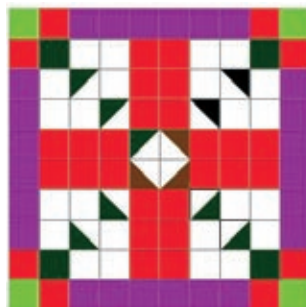
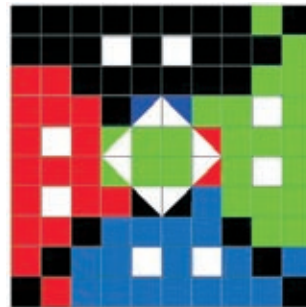
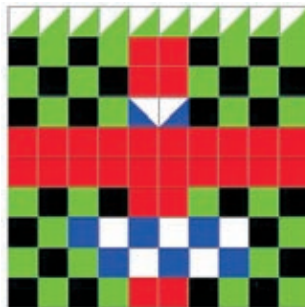
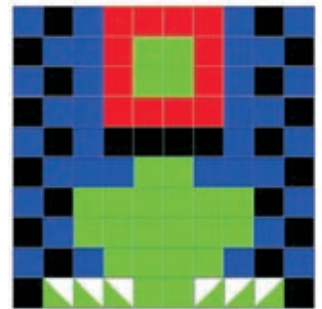
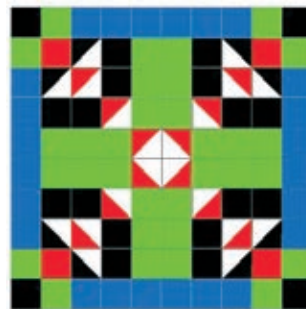
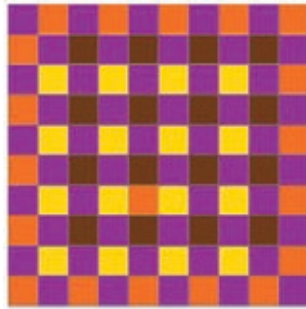
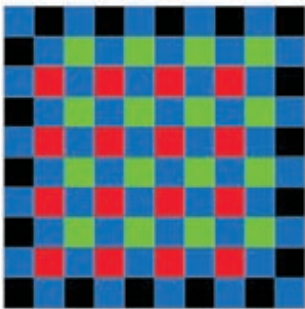
Developing the activity (part 2)

- Provide learners with a demonstration of the computer software **Mosaic designer**.
- Open the computer software **Mosaic designer**. A title screen is displayed and the program moves on automatically to the 'Home' page.
- To demonstrate the program, choose to create a new mosaic.
- Choose any grid size (in this case 16 x 16) and the screen shown below is displayed.
- Only tiles shown on the right of the screen can be reproduced on the grid. This means that it is not possible to overlay a half red tile and a half blue tile to produce a red and blue square on the grid.
- Computer mosaics can be printed (learners can enter their own names to identify their work) or saved (learners will need to enter a file name) by clicking onto the appropriate icons on the 'Options' panel.



- To create a mosaic, click on a tile on the right-hand side and then onto the grid to copy the tile on to the selected square.
- Click onto further grid squares to copy similar tiles.
- To change to a different tile, click onto a different tile and repeat.
- To remove a tile that has been incorrectly coloured, click onto the 'wipe' tile. Alternatively, tiles can be overwritten by selecting a new tile.
- To create a new mosaic, choose the 'New' icon from the 'Options' panel. Please note: Unless the current mosaic has been saved, it will be lost.
- A saved mosaic can be loaded back onto the screen by returning to the 'Home' page and choosing the appropriate option. Learners will, of course, need to enter the relevant file name.
- Rather than try to cover all of the above points with learners, it is better to give a brief introduction and then allow them to experiment with the software by creating, saving and printing their own mosaics.

- Some examples of the patterns produced by learners during their first session using **Mosaic designer** are shown below.
- Once all learners have had sufficient time to use the software, bring them back together to share and compare the mosaic patterns they have made.
- This should provide a rich variety of opportunities for learners to demonstrate their thinking, communication and number skills.



Activity 1 | Mosaic patterns

What to look for

Using numbers

When discussing the patterns shown on the resource sheet, creating their own patterns and/or reporting back, are learners able to:

- use numbers, e.g. by counting the number of squares or triangles in a particular row or column of a given pattern (Cell 1)
- use simple fractions, e.g. by identifying the proportion of a given row or pattern that has been shaded (Cell 2)
- use fractions or percentages to describe and compare patterns as appropriate (Cell 3)?

Comparing data

When discussing the patterns shown on the resource sheet and/or reporting back, are learners able to:

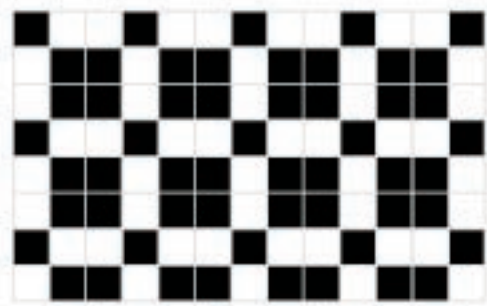
- sort the patterns according to a given criterion, e.g. identify those patterns that are made using only two colours (Cell 1)
- sort the patterns using one or more of their own criteria, e.g. identify those patterns that are not square and are made using only black and white tiles (Cell 2)?

Talking about and explaining work

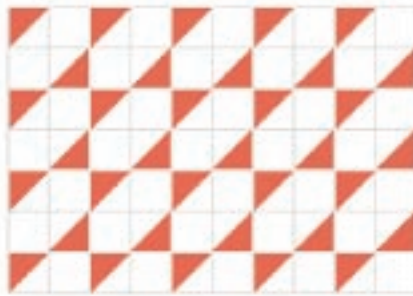
When discussing the patterns shown on the resource sheet, creating their own patterns and/or reporting back, are learners able to:

- talk about what they have done, referring to the number of shaded squares and/or triangles in a particular design (Cell 1)
- use the language of number and shape, e.g. by comparing patterns and describing 2-D shapes (Cell 2)
- use the language of position, movement and measurement, e.g. explain that parts of a particular pattern are repeated or reflected, identify lines of symmetry in a particular pattern or state the perimeter of a particular grid (Cell 3)?

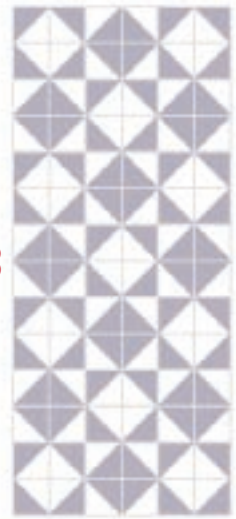
1



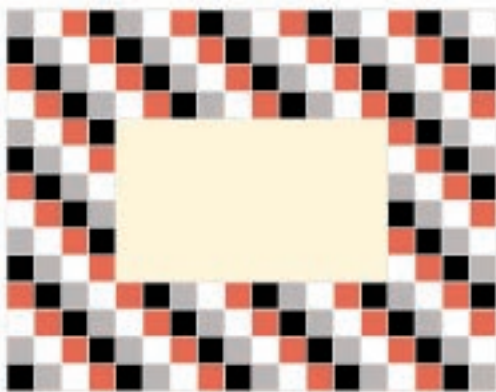
2



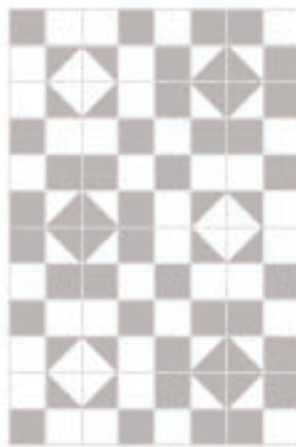
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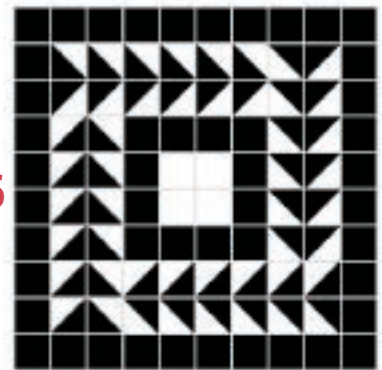
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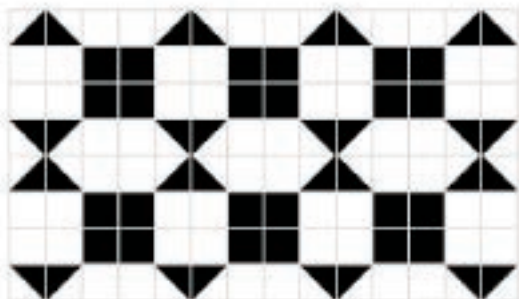
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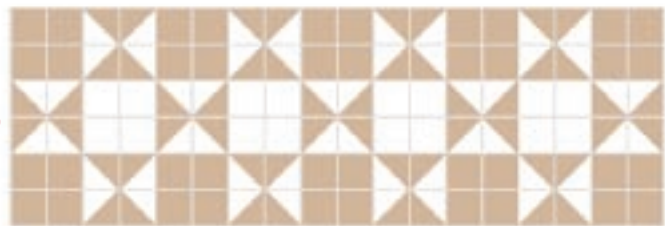
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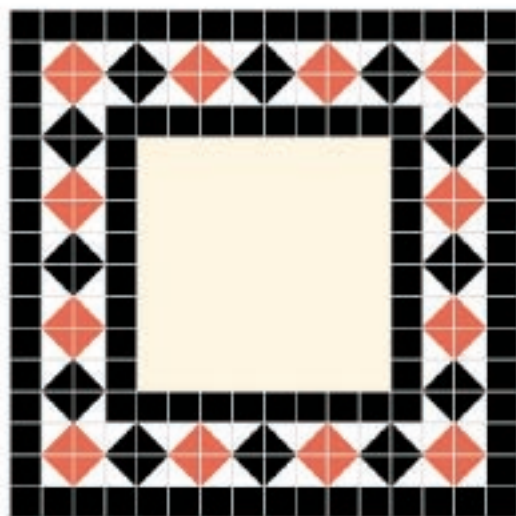
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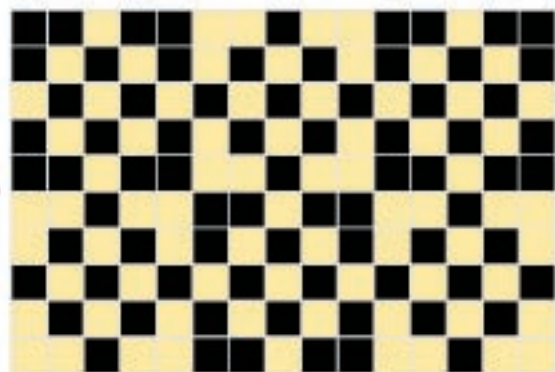
8



9



10



Activity 2: Designing tiles



Links to the skills framework

In order to make evidence gathering more manageable, it is suggested that you concentrate initially on each of the principles shown as a main focus in the table below.

Use mathematical information

- Using numbers
- Measuring
- Gathering information

Calculate

- Using the number system
- Using a variety of methods

Interpret and present findings

- Talking about and explaining work
- Comparing data
- Recording and interpreting data and presenting findings

Key

- Main focus ● Incidental focus
- No intentional focus

Context

This activity is in two parts. Consequently, you may wish to spread it over two or more sessions.

In the first part of the activity, learners consider the patterns shown on four tiles, identifying similarities and differences in their design. Learners then design four 'similar' tiles using their own criteria, before comparing and discussing the patterns produced.

In the second part of the activity, learners are challenged to produce further tiles according to their own or prescribed success criteria.

Resources

For the first part of the activity, each pair of learners will need a copy of the worksheet provided. Learners will also need coloured pencils or crayons.

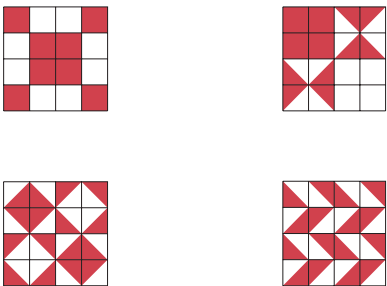
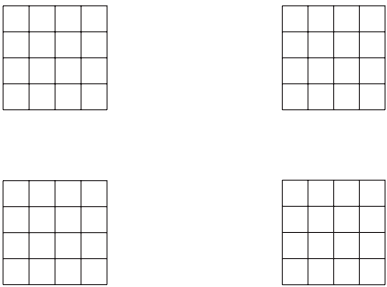
In the second part of the activity, learners need access to the computer software **Mosaic designer** that is provided on the CD. Alternatively, if computers are not available, learners can produce their tiles on squared paper.

The **What to look for** section at the end of this activity provides an indication of some of the evidence that you might expect and the cells with which this evidence might be matched. However, it is important to appreciate that a range of other evidence may also be generated and that this may be more validly associated with other principles and/or cells.

Activity 2 | Designing tiles

Developing the activity (part 1)

- Display a copy of the worksheet on the whiteboard and/or distribute a copy to each pair of learners.
- Stimulate whole-class discussion and thinking by asking questions such as:
 - How are these tiles similar?
 - How are they different?
 - Which patterns do you prefer? Why?
 - What things could you change to make similar tiles?
 - What things could you change to make different tiles?
- As learners provide feedback, encourage other learners to comment and/or ask further questions.
- After the general introduction, ask learners to work in pairs, designing similar tiles.
- As they plan their tiles, encourage learners to think about what 'similar' means. For example, does it mean:
 - similar to the earlier tiles?
 - similar to one another (but not the earlier tiles)?
 - similar because just two colours will be used?
 - similar because each tile will have the same fraction coloured?
 - similar because they will be on a 4 x 4 grid?
- Allow learners to decide upon the criteria they will use. You may wish to provide further copies of the worksheet so that individual learners can produce their own tiles.
- Explain that when they have completed their tiles, they should make a note of any interesting facts and/or the criteria they have used.
- Allow adequate time for the learners to engage with the task before bringing them back together to share and compare their results.

Mosaics	Activity 2: Designing tiles	Worksheet
Name(s):		
• Look at these tiles.		
		
Discuss ways in which the tiles are similar. Discuss ways in which the tiles are different.		
• Design some similar tiles and show them below.		
		

An example of classroom practice

For this session, the learners were sat in mixed-ability groups of threes and fours. To begin with, the teacher provided each group with just one copy of the worksheet, which she also displayed on the interactive whiteboard. Learners were then asked to identify similarities and differences in the four tiles shown. The suggestions offered included:

'All the tiles are red and white.'

'They are all the same size.'

'Some of the tiles have whole squares coloured and some have only halves.'

'On some of the tiles, you can see red triangles.'

'On the first tile, there are eight little red squares, but on the second only four.'

'Some of the tiles are symmetrical.'

Where appropriate, the teacher followed up these suggestions with further questions, leading to more thinking and ideas from the learners. For example:

'What do you mean by the same size?' prompted suggestions relating to the size of the tiles ('16 small squares', 'four rows and four columns', '4 x 4 grid'; 'They all have an area of 16 small squares', 'They all have a perimeter of 16 units').

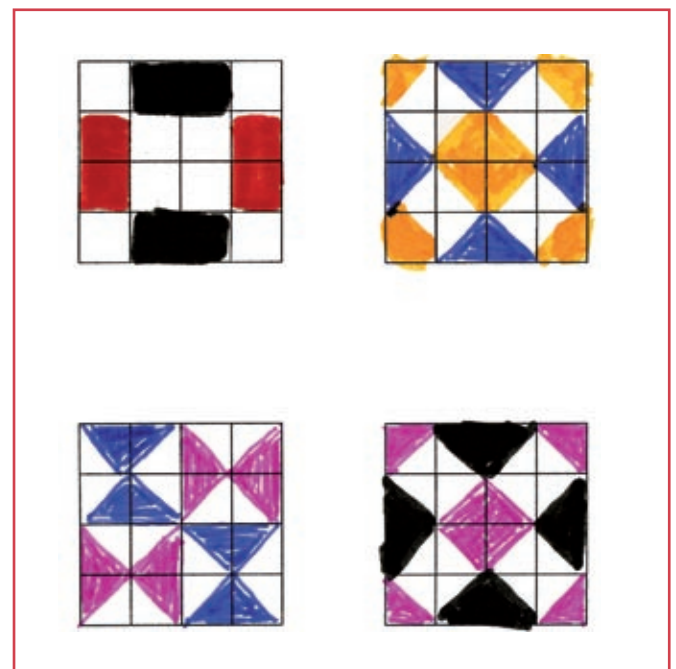
'If there are eight little red squares on the first tile, how many squares are not red? What fraction of the first tile is red? What about the other tiles?' prompted a discussion of fractions and the recognition that all tiles are coloured half red and half white.

'How can you tell if the tile is symmetrical?' prompted a variety of suggestions ('Use a mirror', 'Use tracing paper', 'Imagine a line and match up the pieces', 'You could cut the tile out and fold it over') and a lot of discussion relating to the position of various shapes on the tiles.

Following this introduction, the teacher asked the learners to discuss in their groups ways in which they might design their own tiles. She said that when designing their tiles, learners should think about how the tiles were going to be similar and how they were going to be different. The teacher then provided further copies of the worksheet so that each learner could produce their own tiles according to the criteria they set for themselves.

During the reporting back session, a wide range of examples were displayed by individual learners, who were each asked to state the criteria they had used for producing their tiles.

Cerys said her tiles (shown below) are similar because, 'They are all made using three colours. White is always a half and the other colours a quarter each. They are different because I've used different colours and coloured different squares'.



Activity 2 | Designing tiles

Developing the activity (part 2)

- Ask learners to use **Mosaic designer** to produce tiles according to a set of agreed design (success) criteria.

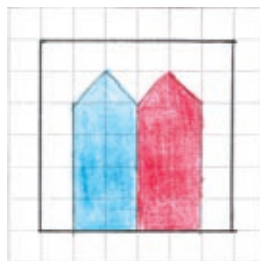
Some possible design criteria

Design a 6 x 6 tile in which a quarter of the tile is blue, a quarter red and the rest is white.

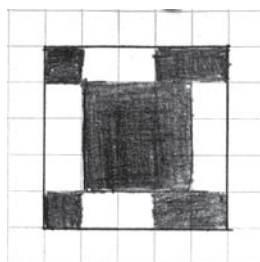
Design a 5 x 5 tile in which 40 per cent is white and 60 per cent is black.

- This is intended to be a more structured activity than the one undertaken in Activity 1, so learners should use the design criteria to evaluate the tiles that are produced.
- As groups of learners gain experience, they should be encouraged to set their own design (success) criteria against which to evaluate their tiles.
- Learners can then print their tiles and display them, along with the criteria that were set. These criteria should be written using conventional symbols and notation to assess learners' ability in these areas.
- To conclude the activity, bring groups back together to share and compare their results.
- Selecting particular learners to report back will provide further opportunities for you to gather specific evidence about individuals.
- Following the reporting back session, you may wish to allow further time for learners to follow up the ideas discussed.

- If **Mosaic designer** is not available, learners can produce their tiles on squared paper.



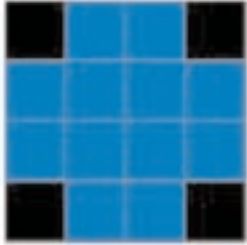
The size of my grid was
 $6 \times 6 = 36$ squares.
My fractions were a quarter
blue, a quarter red and the
rest white.



I have made a 5x5 grid.
I shaded 15 black and 10 white
So 40% are white and 60% are black.

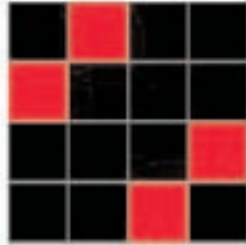
Some examples of learners' work

Design a 4 x 4 tile in two colours, with one colour covering three-quarters of the tile.



$$\text{black } \frac{1}{4} = 25\%$$

$$\text{blue } \frac{3}{4} = 75\%$$



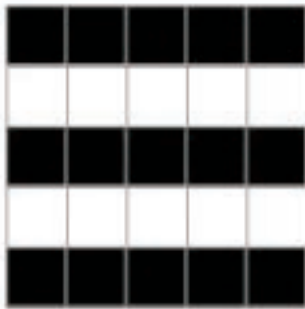
$$\frac{3}{4} \text{ black} = 75\%$$

$$\frac{1}{4} \text{ red} = 25\%$$



$$\begin{aligned} \text{White: Blue} \\ &= 12 \text{ squares} = 4 \text{ squares} \\ &= \frac{12}{16} = \frac{4}{16} = 25\% \\ &= 75\% \end{aligned}$$

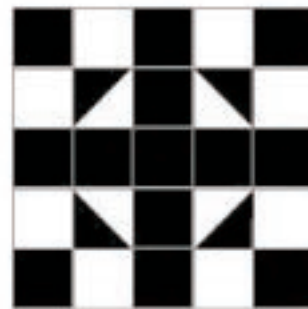
Design a 5 x 5 tile in two colours, with one colour covering forty per cent of the tile.



$$\begin{aligned} 40\% \text{ white } 10 \text{ squares} \\ 60\% \text{ black } 15 \text{ squares} \end{aligned}$$

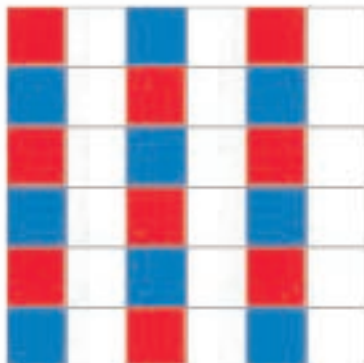


$$\begin{aligned} \text{white } 40\% = \text{white } 10 \text{ squares } \frac{4}{10} = \frac{2}{5} \\ 60\% = \text{black } 15 \text{ squares } \frac{6}{10} = \frac{3}{5} \end{aligned}$$



$$\begin{aligned} 40\% = \text{white } 10 \text{ squares } \frac{4}{10} = \frac{2}{5} \\ 60\% = \text{black } 15 \text{ squares } \frac{6}{10} = \frac{3}{5} \end{aligned}$$

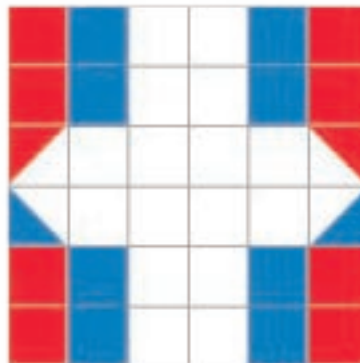
Design a 6 x 6 tile in three colours, with one colour covering half of the tile.



$$\frac{1}{4} \text{ blue } 9 \text{ squares } 25\%$$

$$\frac{1}{4} \text{ red } 9 \text{ squares } 25\%$$

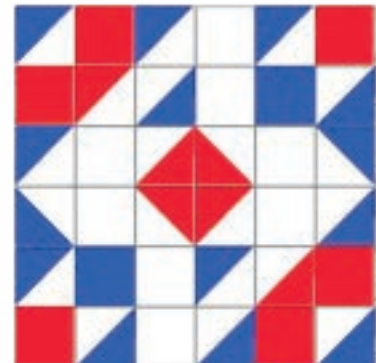
$$\frac{2}{4} \text{ white } 18 \text{ squares } 50\%$$



$$\frac{1}{4} \text{ blue} = 9 \text{ squares} = 25\%$$

$$\frac{1}{4} \text{ red} = 9 \text{ squares} = 25\%$$

$$\frac{1}{2} = \frac{2}{4} \text{ white} = 18 \text{ squares} = 50\%$$



$$\frac{1}{4} \text{ Blue} = 9 \text{ squares} = 25\%$$

$$\frac{1}{4} \text{ Red} = 9 \text{ squares} = 25\%$$

$$\frac{1}{2} \text{ white} = 18 \text{ squares} = 50\%$$

What to look for

Using numbers

When designing and producing their own tiles and/or when using **Mosaic designer**, are learners able to:

- use number as one of the design criteria they employ or count the number of squares and triangles used in a particular pattern (Cell 1)
- use simple fractions to identify the proportion of a tile that has been shaded and use number and proportion as some of the design criteria they employ (Cell 2)
- describe and compare the patterns they produce, using fractions and percentages as appropriate (Cell 3)?

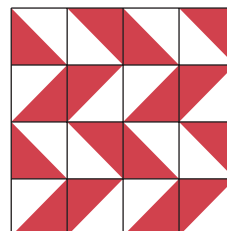
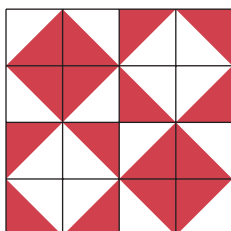
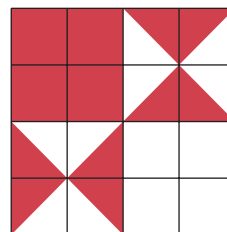
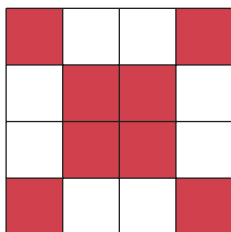
Talking about and explaining work

When discussing the given tiles, describing and recording their own design criteria, and/or when reporting back, are learners able to:

- talk about what they have done, referring to the number of shaded squares and/or triangles in a particular design (Cell 1)
- compare the various patterns, using the language of number and shape, e.g. compare the number of shaded squares and triangles used to make two different patterns (Cell 2)
- use the language of position, movement and measures, e.g. explain that parts of a pattern are reflections of others, identify the shaded area of a particular tile or give the perimeter of a particular grid (Cell 3)
- use correct mathematical language, symbols and notation, e.g. record design criteria using mathematical symbols and notation (Cell 4)?

Name(s):

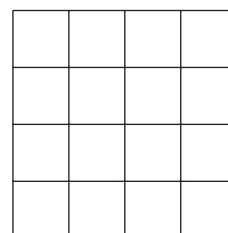
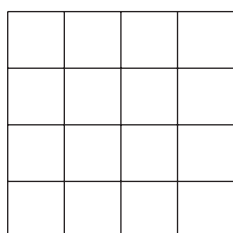
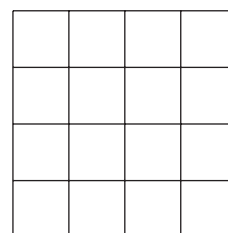
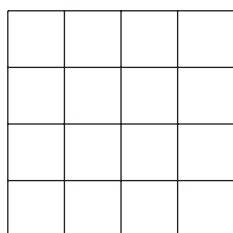
- Look at these tiles.



Discuss ways in which the tiles are similar.

Discuss ways in which the tiles are different.

- Design some similar tiles and show them below.



Activity 3: Making mosaics



Links to the skills framework

In order to make evidence gathering more manageable, it is suggested that you concentrate initially on each of the principles shown as a main focus in the table below.

Use mathematical information

- Using numbers
- Measuring
- Gathering information

Calculate

- Using the number system
- Using a variety of methods

Interpret and present findings

- Talking about and explaining work
- Comparing data
- Recording and interpreting data and presenting findings

Key

- Main focus ● Incidental focus
- No intentional focus

The **What to look for** section at the end of this activity provides an indication of some of the evidence that you might expect and the cells with which this evidence might be matched. However, it is important to appreciate that a range of other evidence may also be generated and that this may be more validly associated with other principles and/or cells.

Context

This activity is in two parts. Consequently, you may wish to spread it over two or more sessions.

In the first part of the activity, learners discuss ways in which patterns could have been constructed on a variety of given tiles, considering ways in which the tiles could be used to produce mosaics. As part of their deliberations, learners find the proportion of each tile that has been coloured and investigate ways in which these amounts vary as the tiles are combined into repeating patterns.

In the second part of the activity, learners design their own tiles and use these to make mosaic patterns using the computer software **Mosaic designer**.

Resources

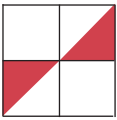
For the first part of the activity, each group of learners will need a copy of Discussion sheet 1. A second discussion sheet is also provided, but its use is optional.

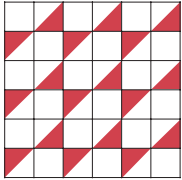
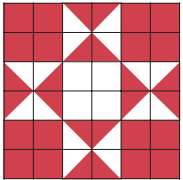
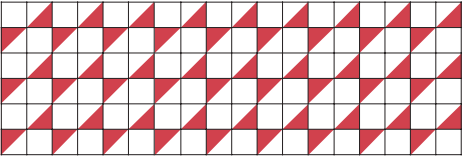
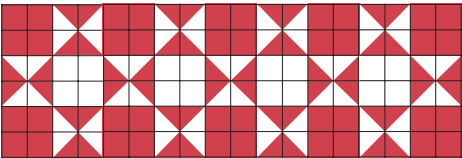
In the second part of the activity, learners need access to the computer software **Mosaic designer** that is provided on the CD. Alternatively, if computers are not available, learners can use coloured pencils or crayons to produce their mosaic patterns on the worksheet provided.

A sheet of cut-out tiles is also provided for optional use in the second part of the activity.

Activity 3 | Making mosaics

Developing the activity (part 1)

- Distribute a copy of Discussion sheet 1 to each group of learners and ask them to discuss ways in which the patterns shown on Tiles A and B could have been made.
- To help learners get started, you may need to give some direction to the discussion, e.g. the pattern on Tile A could have been made using smaller, 2 x 2 tiles. How many of these smaller tiles have been used? 
- Can learners suggest other ways in which the pattern could have been built up? For example, it could have been made using single tiles, or a series of horizontal (or vertical) strips, some of which may need to be rotated through 180°.
- Encourage learners to be as creative as possible and to identify a variety of different ways of making each of the patterns on the two tiles shown.
- Learners should also consider how much of each tile is coloured.

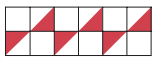
Mosaics	Activity 3: Making mosaics	Discussion sheet 1
• Look at the patterns on these two tiles.   Tile A Tile B Discuss ways in which the patterns could have been made. How much of each tile is coloured?		
• Look at these two mosaics.   Mosaic A Mosaic B Discuss ways in which the patterns could have been made. How much of each mosaic is coloured?		

Twenty-five per cent of Tile A is coloured.

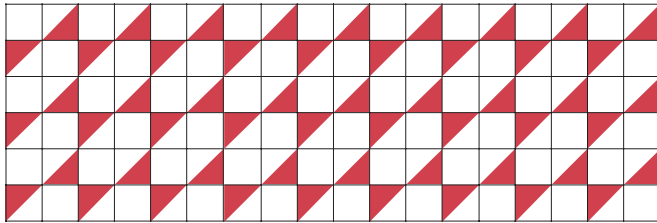
Two-thirds of Tile B is shaded.

On Tile A, there are 36 squares and only 18 halves are coloured.

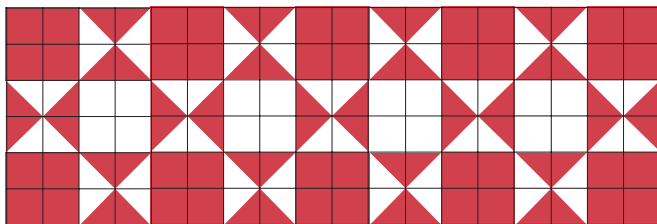
Some ways of making the pattern on Tile A

- 18 white tiles  and 18 red and white tiles 
- 3 strips like this 
- 6 strips like this 

- After the general introduction, ask learners to work in groups to consider the two mosaic patterns shown on Discussion sheet 1.



Mosaic A



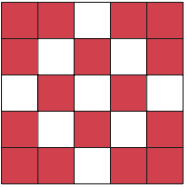
Mosaic B

- Can learners suggest ways in which the two patterns could have been made and can they work out how much of each pattern is coloured?
- In the case of Mosaic A, as well as the use of 2 x 2 tiles (as above) or horizontal and vertical strips, some learners may recognise that the pattern can be made by placing three copies of Tile A side by side.
- Similarly, some learners may recognise that Tile B can be used to make Mosaic B, but this time by overlapping four copies. Cut-out tiles are provided for those learners who may benefit from investigating these relationships practically.
- When considering how much of each mosaic is coloured, some learners may be surprised to find that, unlike Mosaic A, the fraction of Mosaic B coloured (eleven-eighteenths) is not the same as the corresponding tile (two-thirds).
- Learners could pursue this further by investigating what happens when copies of Tile B are placed side by side and/or when copies of Tile A are overlapped.

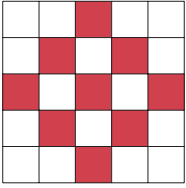
- When all groups have completed their deliberations, bring them back together to share and compare their findings.
- If you wish to reinforce the ideas introduced on Discussion sheet 1, a second optional sheet is provided.

Mosaics
Activity 3: Making mosaics
Discussion sheet 2

- Look at the patterns on these two tiles.



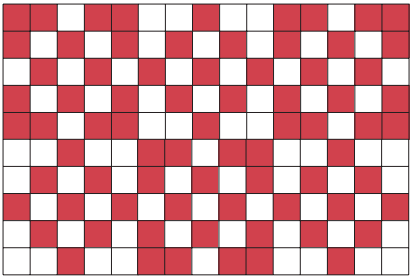
Tile C



Tile D

Discuss ways in which the patterns could have been made.
How much of each tile is coloured?

- Look at this mosaic.



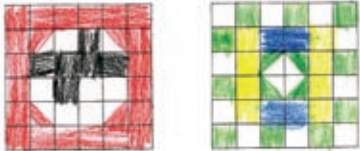
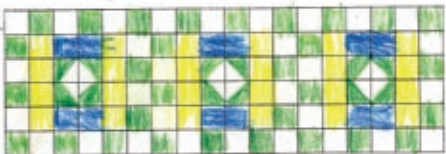
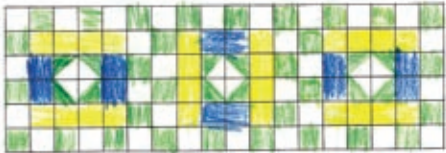
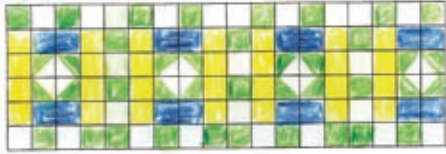
Discuss ways in which this pattern could have been made.
How much of the mosaic is coloured?

- Groups of learners can be asked to work through this sheet themselves, reflecting upon and developing the ideas discussed earlier. This will greatly enrich learners' experience and understanding.
- When all groups have completed their deliberations, bring them back together to share and compare their findings.
- Selecting particular learners to report back will provide further opportunities for you to gather specific evidence about individuals.

Activity 3 | Making mosaics

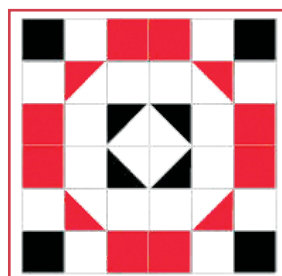
Developing the activity (part 2)

- Challenge learners to design their own tiles and then use these to make mosaic patterns.
- Learners can do this on screen using **Mosaic designer** or on the worksheet provided.
- Encouraging learners to design tiles before they are used to make mosaics will focus attention more closely on the repeating patterns involved.
- As learners work, ask them to explain the methods they are using to generate their patterns. As well as placing tiles side by side, can learners make mosaics by overlapping and/or combining two or more tiles?
- Ideally, learners will be thinking in terms of 'copying and pasting' parts of the tile to use as a building block within their repeating pattern.
- Although there is no 'copying and pasting' facility available within **Mosaic designer**, you may wish to exemplify this procedure by using the cut-out tiles provided.
- When learners have completed their mosaic patterns, bring them back together to compare and discuss their results.
- Following the reporting back session, you may wish to allow further time for learners to follow up the ideas discussed.

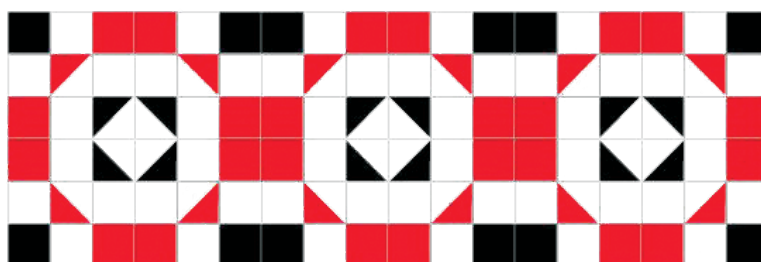
Mosaics	Activity 3: Making mosaics	Worksheet
Name(s): <u>Jonathan</u>		
Design your own 6 x 6 tiles below.		
		
Use one, or both, of your tiles to make some mosaics.		
18x6 grid 36 green 24 yellow 12 blue 36 white 		
I have rotated the 1st and 2nd tiles. 		
I have overlap tiles 		

An example of classroom practice

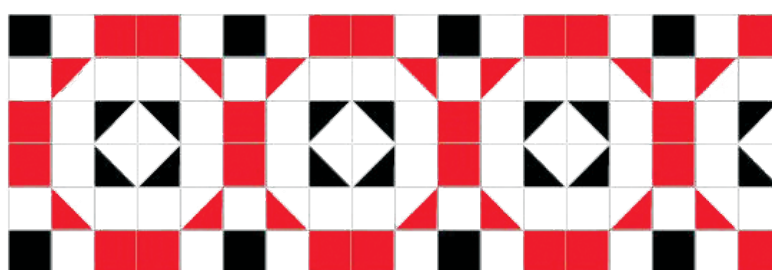
Learners worked in small groups, designing a 6 x 6 tile on screen using **Mosaic designer**. A typical example is shown below.



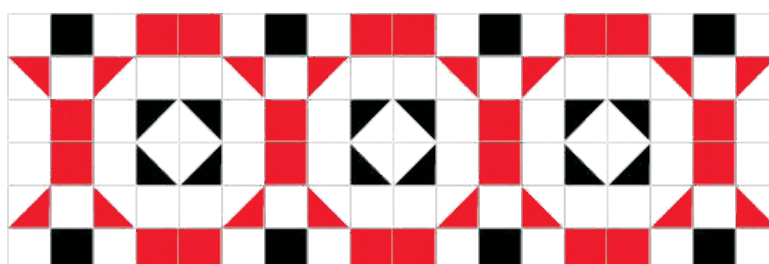
The teacher then asked learners to use their tile to make mosaic patterns on 6 x 18 grids. Initially, most learners made a pattern by repeating their tile three times.



However, some learners experimented by overlapping their tiles, for example:



During the reporting back session, it was noted that, 'The three tiles do not fit, because there are two extra columns'. Some learners thought that this 'spoiled the pattern', although in fact the pattern had been extended correctly. Following these observations, the learners re-worked their mosaic in a way they found more satisfying.



What to look for

Using numbers

When discussing the given patterns and/or making their own mosaics, are learners able to:

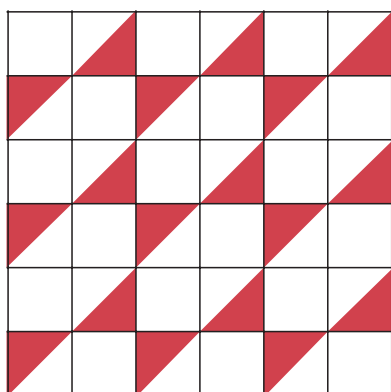
- use number to identify simple relationships, e.g. 'On Tile B, there are four butterfly shapes' (Cell 1)
- use whole numbers and simple fractions, e.g. by identifying that Tile A can be made using nine repeating 2 x 2 grids, each of which is one-quarter shaded (Cell 2)
- use fractions and percentages as appropriate (Cell 3)?

Talking about and explaining work

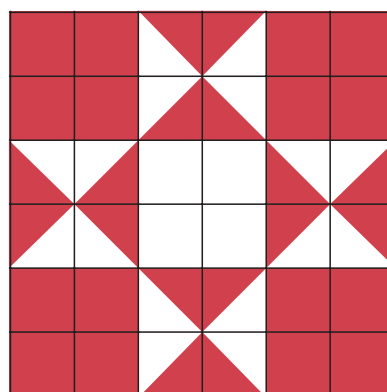
When discussing the given patterns, describing and recording their own mosaics, and/or when reporting back, are learners able to:

- talk about what they have done, e.g. by referring to the number of shaded squares and/or triangles in a particular tile or mosaic (Cell 1)
- compare the various patterns, using the language of number and shape, e.g. by comparing the number of shaded squares and triangles used to make two different patterns (Cell 2)
- use the language of position, movement and measures, e.g. by referring to parts of a pattern that are similar to, reflections of, or rotations of, other parts of the same pattern (Cell 3)?

- Look at the patterns on these two tiles.



Tile A

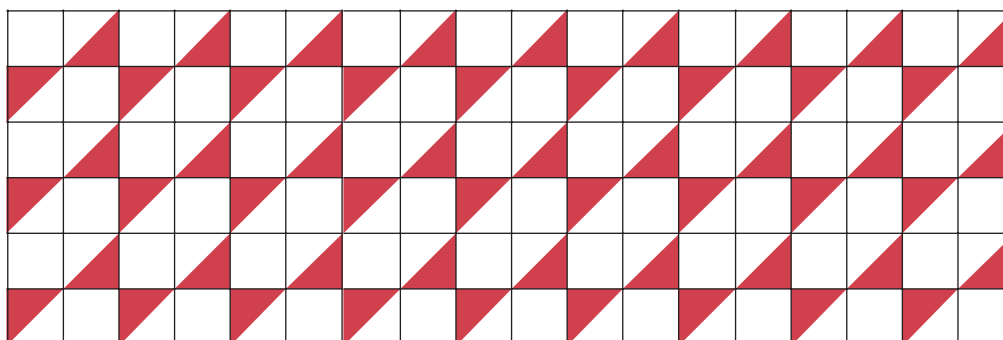


Tile B

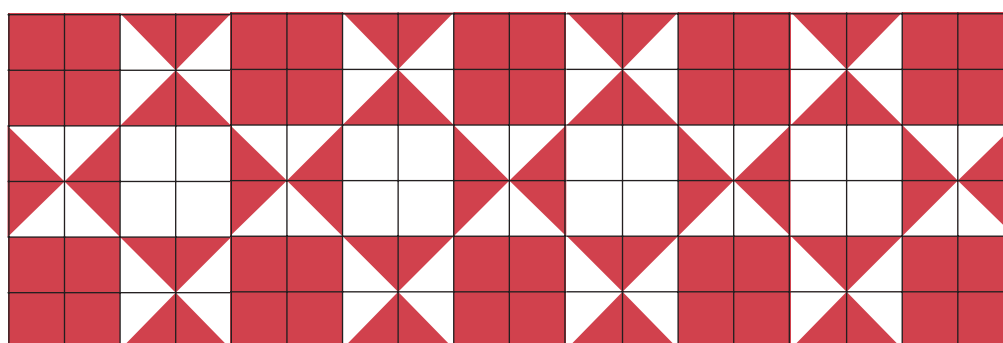
Discuss ways in which the patterns could have been made.

How much of each tile is coloured?

- Look at these two mosaics.



Mosaic A

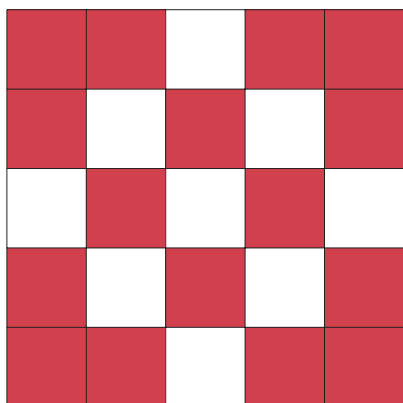


Mosaic B

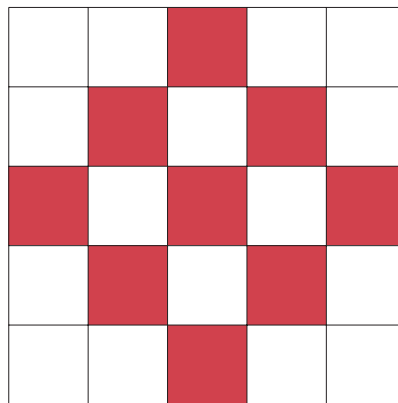
Discuss ways in which the patterns could have been made.

How much of each mosaic is coloured?

- Look at the patterns on these two tiles.



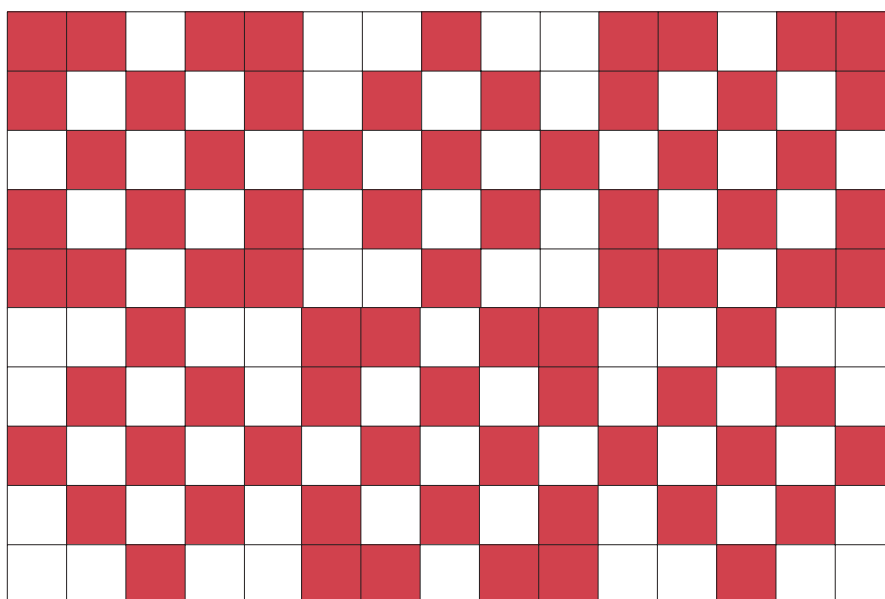
Tile C



Tile D

Discuss ways in which the patterns could have been made.
How much of each tile is coloured?

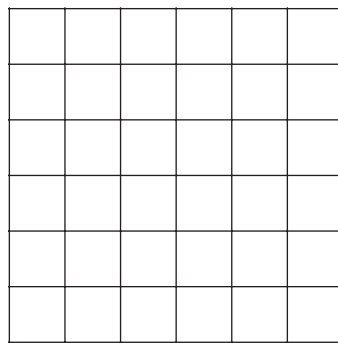
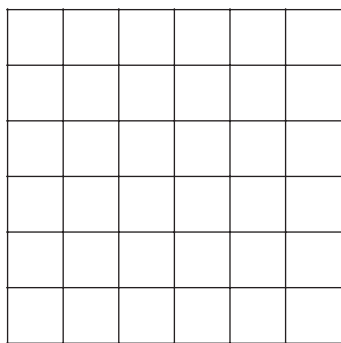
- Look at this mosaic.



Discuss ways in which this pattern could have been made.
How much of the mosaic is coloured?

Name(s):

Design your own 6 x 6 tiles below.



Use one, or both, of your tiles to make some mosaics.

