Patterns in a Circle

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Summary of learning goals

- Students explore the various possibilities for constructing a circular three-pattern using two different colours. They discover that, although the three-patterns may at first look different, they form identical circular patterns.
- Students then create different circular four-patterns and identify similarities and differences between these patterns.

Australian Curriculum: Mathematics (Foundation)

ACMNA005: Sort and classify familiar objects and explain the basis for these classifications. Copy, continue and create patterns with objects and drawings.

Summary of lessons

Who is this sequence for?

- Foundation students with experience in copying, continuing and creating repeated patterns.
- Students should be familiar with describing patterns and naming them based on the number of elements in the pattern.

Lesson 1: Three Pompoms

The task uses the context of decorating party hats to explore patterns forming a circle. Students look at different arrangements of three pompoms and what patterns are produced when the three pompoms are repeated to make a circle. Students create their own patterns using two green pompoms and one blue, and discover that all possible arrangements look the same when repeated in a circle.

Lesson 2: What About Four?

Students look at the ways four pompoms can be arranged to form a repeating pattern around the base of a party hat. Students recognise the similarities and differences between the various circular patterns.

reSolve: Mathematics by Inquiry is funded by the Australian Government and is managed by the Australian Academy of Science.

Reflection on this sequence

Rationale

Children have an intuitive sense of pattern and enjoy creating and exploring patterns of all kinds. The regularity of patterns allows students to explore the structure in mathematics, particularly structure related to number. Understanding pattern is essential to developing concepts related to skip counting, unitising, multiplication and division, and is the foundation of algebraic reasoning.

This resource explores repeating patterns that are constructed using colour. Students are asked to explore the different three- and four-patterns that can be made with a given number of colours, and to identify similarities in the patterns by repeating arrangements around a circle.

reSolve mathematics is purposeful

- Repeating patterns are an important part of early algebraic reasoning.
- Students draw on a context for patterns that can be easily imagined.

reSolve tasks are inclusive and challenging

- The context of a party hat is familiar to students and can be easily imagined and constructed.
- Students use counters to explore possible patterns, enabling them to experiment with different combinations and changing their working as needed.
- Students are challenged to consider the underlying structure of patterns to identify how they are similar and different. They are challenged to find all possible patterns using three or four colours arranged in a circle.

reSolve classrooms have a knowledge-building culture

- Different students will construct different patterns. The collective work of the class allows for a comparison of similarities and differences between the patterns.

LESSON 1

re(Solve) MATHS BY INQUIRY Patterns in a Circle

Three Pompoms

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About this lesson

The task uses the context of decorating party hats to explore patterns forming a circle. Students look at different arrangements of three pompoms and what patterns are produced when the three pompoms are repeated to make a circle. Students create their own patterns using two green pompoms and one blue, and discover that all possible arrangements look the same when repeated in a circle.

Australian Curriculum: Mathematics (Foundation)

ACMNA005: Sort and classify familiar objects and explain the basis for these classifications. Copy, continue and create patterns with objects and drawings.

Mathematical purpose

- Students work systematically to explore the various possibilities for constructing a circular three-pattern using two or three different colours.
- Students find that all the different arrangements of two green pompoms and one blue create identical circular patterns.

Learning intention

- To make and compare patterns in a circle using three pompoms.

Time

A lesson of approximately 1 hour.

Vocabulary

- circular pattern
- element
- pattern
- repeating pattern

Resources

- reSolve PowerPoint *1a Three Pompoms* (for display)
- Student Sheet 1 – Circle Pattern (one copy per student)
- Student Sheet 2 – Carlo's Pattern (one copy per student)
- Red, yellow, green and blue counters
  - Note: Templates are sized for 2.5 cm counters. If using larger counters, you may need to print the student sheets at A3 size.

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Decorating party hats

Resources: Show the reSolve PowerPoint *1a Three Pompoms*.

This introduces the context of decorating party hats with pompoms and repeating an arrangement to create a circular pattern.

Resources: Provide the students with red, yellow and blue counters and copies of Student Sheet 1 – Circle Pattern.

Teacher note:

- If students have had limited experience with patterns, ask them to use the counters to make their own pattern and ensure that they understand the repeated nature of a pattern.

Ask students to copy Jack's pattern by placing counters onto the template and then repeating the pattern around the circle. Repeat for Charlotte's pattern.

Discuss how Jack and Charlotte's patterns are similar and different.

Possible student responses:

- The patterns are similar because they are both patterns with three elements.
- Jack's pattern uses three colours. We can call it an A-B-C pattern. Charlotte's pattern uses two colours and is an A-A-B pattern.

Making Carlo's pattern

Provide students with green and blue counters. Ask students to make the start of their own pattern using one blue and two green counters. What different arrangements can they make?

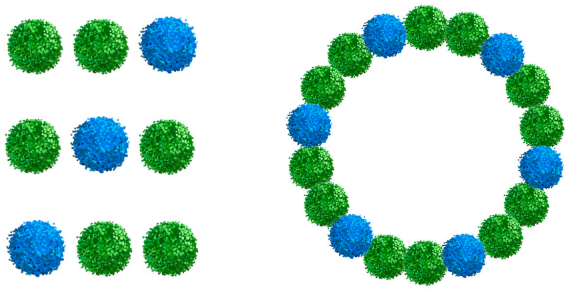
Provide the students with Student Sheet 2 – Carlo's Pattern. Have students choose one arrangement and record it by colouring in the three circles in the bottom right corner of the sheet. Students repeat the pattern around the circle, either using counters and then colouring the circles or by simply colouring the circles.

Teacher note:

- Some students are likely to choose a green–blue–green three-pattern and then repeat the pattern as green, blue, green, blue... You might need to explore the pattern in a linear format and then move these linear patterns to the circle.

Possible student response:

- Three different arrangements can be made with one blue and two green counters. When repeated in a circle, all three patterns look the same.



Reflection

Select students who used different initial arrangements to show their finished circle to the class. Observe that each pattern looks the same in a circle. Discuss why this happens.

Further activities

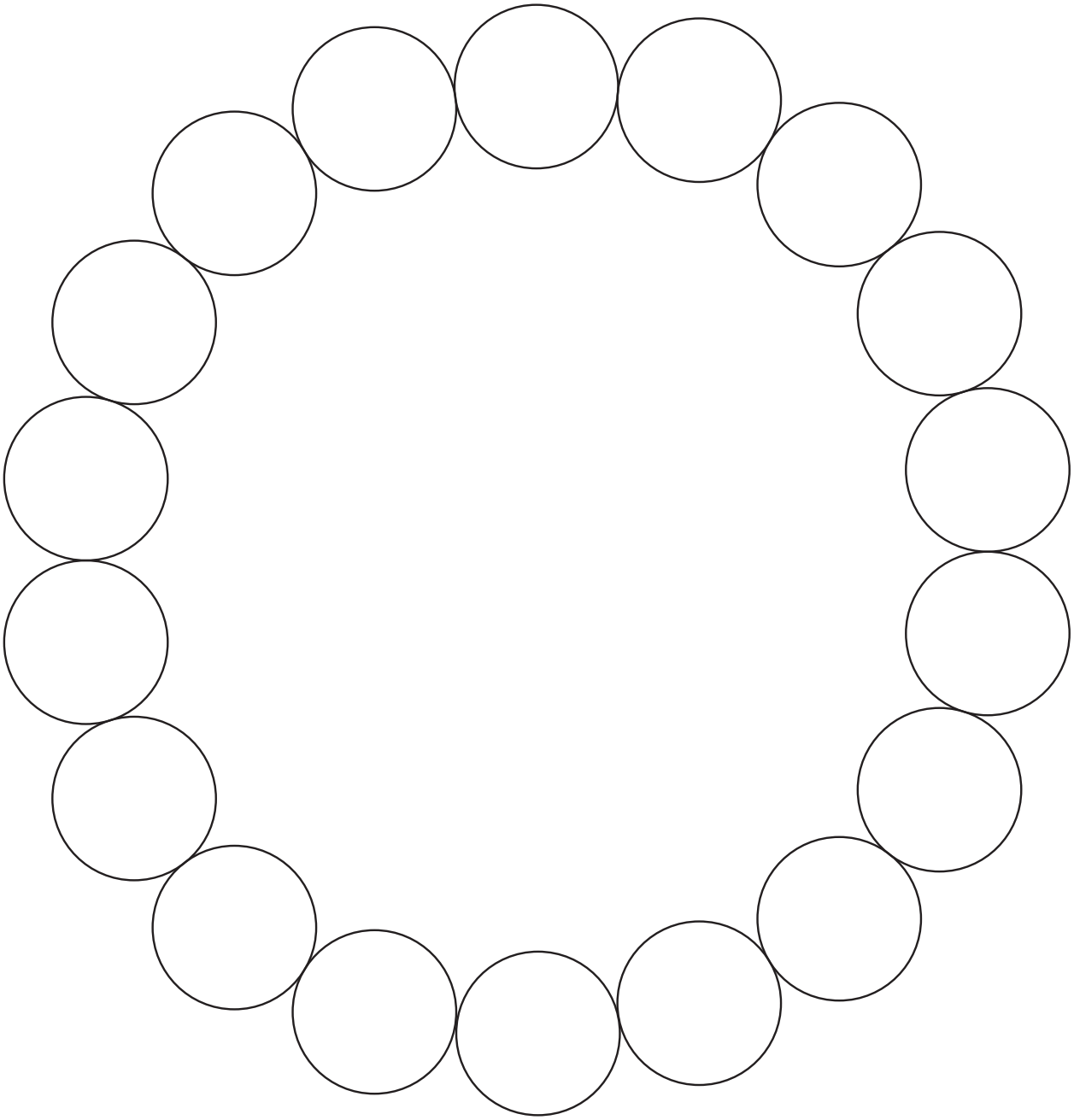
Explore how many different circular patterns can be made using three pompoms with three different colours.

Where to next?

Lesson 2: What About Four? extends the concepts in this lesson to working with four-patterns.

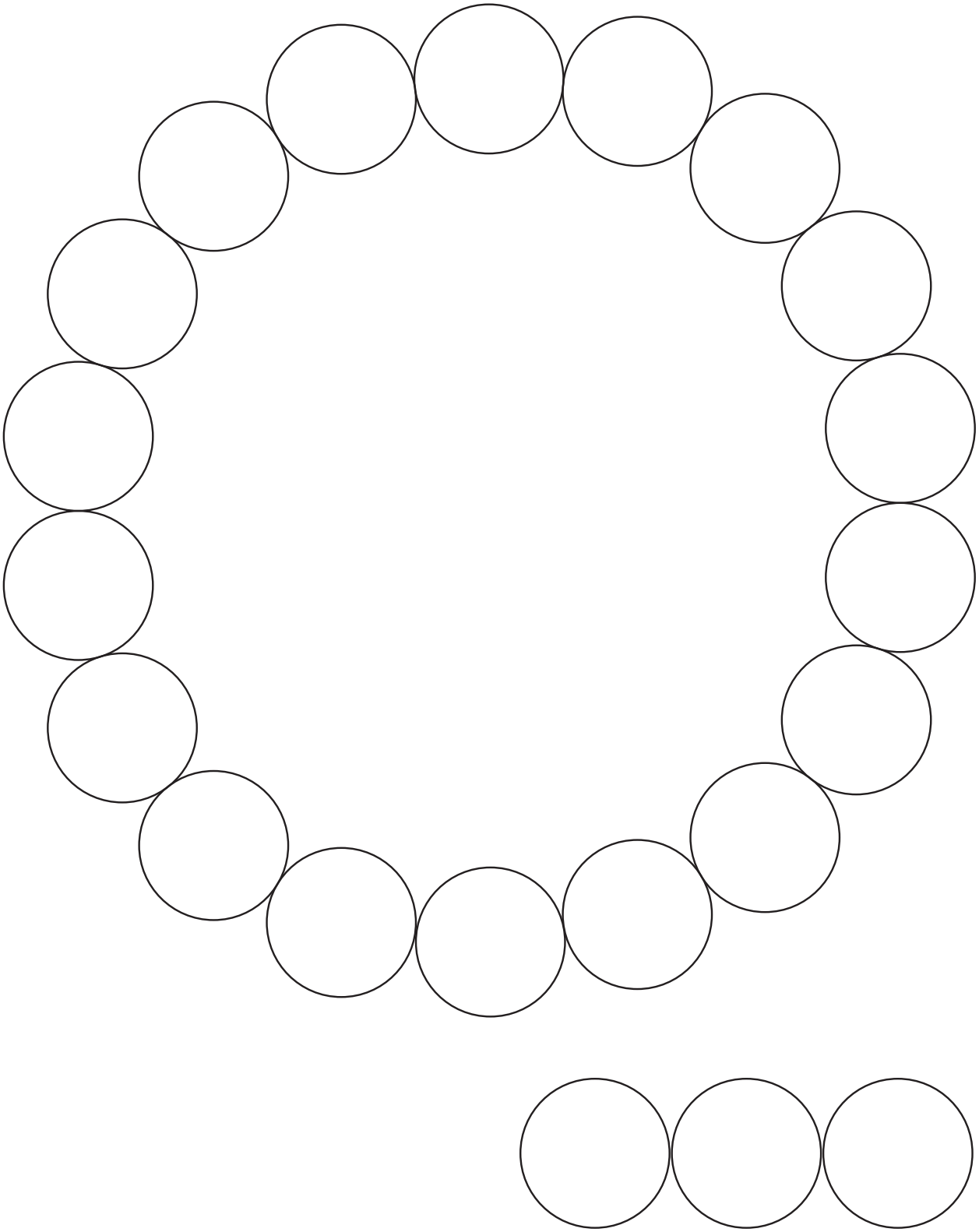
Circle Pattern

Name: _____



Carlo's Pattern

Name: _____



LESSON 2

reSolve MATHS BY INQUIRY Patterns in a Circle

What About Four?

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About this lesson

Students look at the ways four pompoms can be arranged to form a repeating pattern around the base of a party hat. Students recognise the similarities and differences between the various circular patterns.

Australian Curriculum: Mathematics (Foundation)

ACMNA005: Sort and classify familiar objects and explain the basis for these classifications. Copy, continue and create patterns with objects and drawings.

Mathematical purpose

- Students work systematically to create and compare different four-patterns around a circle.

Learning intention

- To make and compare patterns in a circle using four pompoms.

Time

A lesson of approximately 1 hour.

Vocabulary

- circular pattern
- element
- pattern
- repeating pattern

Resources

- reSolve PowerPoint *2a What About Four?* (for display)
- Student Sheet 1 – Jenny's Hat (one copy per student)
- Red, yellow, green and blue counters
  - ◊ Note: Templates are sized for 2.5 cm counters. If using larger counters, you may need to print the student sheets at A3 size.

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Jenny's hat

Resources: Use the reSolve PowerPoint *2a What About Four?* to introduce the problem. At this stage DO NOT show the last slide. Provide students with counters to represent the pompoms and allow them to explore the different ways they can arrange one red, one green and two blue counters.

A pattern in a circle

Review the discovery from Lesson 1. No matter how we started the pattern on Carlo's hat, the same circular pattern was made.

Ask the students to look at the different arrangements that they have made to start the pattern for Jenny's hat.

Pose the questions: *Do you think that the completed circle patterns will all look the same? Why or why not?*

Resources: Provide students with Student Sheet 1 – Jenny's Hat. Ask them to choose one of the patterns and repeat it around the circle. As in Lesson 1, they can repeat the pattern using counters and then colour in the circles.

Possible student responses:

- Three different circular patterns can be made:

Ask students to find someone else in the class who made the same circular pattern as them.

Teacher note:

- The first two patterns above are different because the hat cannot be flipped. If they were used to make a bracelet they would be considered identical.

Reflect: similar and different

Look at the different patterns created in the class and discuss how they are similar and different.

Possible student responses:

- In two circles the blue pompoms are placed next to each other. In the third circle the blue pompoms are separated.
- In the two circles with blue pompoms together, the order of the red and green pompoms is different.

Look at the last slide in the reSolve PowerPoint *2a What About Four?* Look at the pattern on Jenny's hat. Ask students to decide what arrangement Jenny might have used to create this pattern on her hat.

Further activities

Activity 1

Decorate party hats using a three- or four-pattern made with pompoms.

Teacher note:

- Finding the number of different arrangements of pompoms is part of a branch of mathematics dealing with combinatorics.
- There are six different patterns that can be made using all four colours in a four-pattern, or three if flipping is allowed.
- There are two different patterns that can be made using two colours in a four-pattern, but one of these is really a two-pattern.

Activity 2

Further explore three- and four-patterns forming a circle. Use other attributes, such as size, shape or texture, as the basis of a pattern. This emphasises the structure of the pattern rather than the specifics. Students might then classify patterns as A-B-A-B or A-A-B, etc.

Jenny's Hat

Name: _____