reSolve Fruit Shop

Y2

Summary of learning goals

- Students learn to use the array to determine how many are in a collection, using strategies such as skip counting, repeated addition and partitioning the array into smaller parts.
- Students recognise that some numbers can be represented as an array in different ways. They also see that some numbers cannot be represented as an array with two or more in each row and column.

Australian Curriculum: Mathematics (Year 2)

ACMNA031: Recognise and represent multiplication as repeated addition, groups and arrays.

ACMNA032: Recognise and represent division as grouping into equal sets and solve simple problems using these representations.

Summary of lessons

Who is this sequence for?

- This sequence is designed to introduce the array as a multiplicative structure. It is assumed that students will have had experience skip counting collections using different counts such as 2, 5 and 3.
- Students should also be able to create equal groups in a collection and be familiar with the concept of equal groups as representing multiplication.

Lesson 1: Working with Arrays

Students are presented with a picture of the reSolve Fruit Shop and are asked to find examples of how multiplication can be used to find 'how many?' or 'how much?'. Students explore how multiplication can be used to efficiently calculate how many pieces of fruit are in an array.

Lesson 2: Lemon Arrays

Students arrange lemons into different arrays for display in the reSolve Fruit Shop. They explore arrays that can be made using 24 and 12 lemons, then work out all the ways the lemons can be arranged in arrays when split into two unequal groups.

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

Reflection on this sequence

Rationale

Arrays allow students to see the structure of multiplication in the context of equal groups. It also allows for the visualisation of multiplicative properties such as commutativity and distribution. However, the array is often first presented to students abstractly and removed from a context (e.g. as a rectangular arrangement of counters or dots) and, as such, it holds little meaning for many children. It is important that students build meaning for the construct through real-world examples. They need to be provided the opportunity to use the array as a model of a real situation and, through this interaction, progressively abstract it for themselves so that it becomes a model for mathematical reasoning.

reSolve mathematics is purposeful

- This sequence introduces the array through a context that is easily imagined by students.
- Students explore multiplicative properties, including commutativity and distribution.

reSolve tasks are inclusive and challenging

- The tasks allow students to use strategies that they know and understand to solve the problems.
- The context provides access, as students can use the picture to count and solve the problems.

reSolve classrooms have a knowledge-building culture

- Discussion plays an important role in these tasks; the collective knowledge of the class is built as students share their thinking and the strategies they used.

LESSON 1

reSolve Fruit Shop

Working with Arrays

Y2

About this lesson

Students are presented with a picture of the reSolve Fruit Shop and are asked to find examples of how multiplication can be used to find 'how many?' or 'how much?'. Students explore how multiplication can be used to efficiently calculate how many pieces of fruit are in an array.

Australian Curriculum: Mathematics (Year 2)

ACMNA031: Recognise and represent multiplication as repeated addition, groups and arrays.

ACMNA032: Recognise and represent division as grouping into equal sets and solve simple problems using these representations.

Mathematical purpose

- Students use arrays to explore the concept of equivalence through commutativity and participate in early investigations of the distributive property. They learn to determine how many are in an array using strategies such as skip counting, repeated addition, and partitioning the array into smaller parts.

Learning intention

- To explore multiplication in a picture of the reSolve Fruit Shop.

Time

A lesson of approximately 1 hour.

Vocabulary

- array
- how many?
- how much?
- multiplication

Resources

- reSolve PowerPoint *1a reSolve Fruit Shop* (for display)
- reSolve PowerPoint *1b reSolve Fruit Shop Picture* (for printing, one colour or black and white copy per student)
- Student Sheet 1 – Similar and Different (one copy per student)
- Student Sheet 2 – Exploring Arrays (one copy per student)

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Finding multiplication

Resources: Show the students slide 1 from reSolve PowerPoint *1a reSolve Fruit Shop*.

Pose the question: *What multiplication do you see?*

Provide students with their own copy of the picture and allow them time to explore the details of the picture.

How many and how much?

Students examine the picture of the reSolve Fruit Shop and identify examples of multiplication, then use the multiplication to work out 'how many?' or 'how much?'.

Possible student responses:

- There are many examples of arrays in the picture. Students will use different strategies to work out 'how many' pieces of fruit are in each array. Encourage students to move from counting all, to strategies such as skip counting, repeated addition and multiplication.
- Multiplication also can be used to work out the cost of items; for example, the watermelon, multiple punnets of strawberries and blueberries, or more than one bag of lemons.

Ask students to create a poster to record their thinking. Conduct a class gallery walk to look at the different examples of multiplication found.

Looking at the arrays

Resources: Have students complete Student Sheet 1 – Similar and Different and Student Sheet 2 – Exploring Arrays.

- How are the boxes of mangos and apples similar and different?
  - There are two boxes of apples and two boxes of mangos. Both boxes of apples and both boxes of mangos are arranged in the same structure. This means that the total number of each can be calculated by working out how many in one box and then doubling to find the quantity for two boxes.
  - The apples and mangos are both arranged into three rows in each box or six rows together. There are two mangos in each row and four apples in each row. The total number of apples can be calculated by doubling the number of mangos.
- How are the two boxes of oranges similar and different?
  - This is an example of commutativity. The arrays have the same number in each but their orientation has been altered.
  - The top box of oranges has five rows of three and the bottom box has three rows of five.

- How could you use the number of mangos in one box to help you work out the number of blueberry punnets?
  - ◊ There are three rows of mangos in one box and two mangos in each row. There are three rows of blueberry punnets with three punnets in each row. This means that the number of blueberry punnets is equal to three more than the number of mangos in one box.
- How could you use the number of apricots to help you work out the number of strawberry punnets?
  - ◊ The number of strawberries is half the number of apricots.
- What other connections can you see?

Reflection

Look at the strategies that students used to solve the problem. In particular, explore the strategies that utilise skip counting and arrays. Discuss why these strategies are more efficient.

Continue the reSolve PowerPoint *1a reSolve Fruit Shop* and discuss the connections between the arrays.

Similar and Different

Name: _____

In what ways are the boxes of mangos and apples similar and different?	In what ways are the two boxes of oranges similar and different?

Exploring Arrays

Name: _____

How could you use the number of mangos in one box to help you work out the number of blueberry punnets?	How could you use the number of apricots to help you work out the number of strawberry punnets?
Can you make any other connections between the arrays?	

LESSON 2

re(Solve) MATHS BY INQUIRY

reSolve Fruit Shop

Lemon Arrays

Y2

About this lesson

Students arrange lemons into different arrays for display in the reSolve Fruit Shop. They explore arrays that can be made using 24 and 12 lemons, then work out all the ways the lemons can be arranged in arrays when split into two unequal groups.

Australian Curriculum: Mathematics (Year 2)

ACMNA031: Recognise and represent multiplication as repeated addition, groups and arrays.

ACMNA032: Recognise and represent division as grouping into equal sets and solve simple problems using these representations.

Mathematical purpose

- Students see that it is possible to make multiple arrays for some numbers. They learn that it is not possible to arrange some numbers into arrays with more than two in each row or column.

Learning intention

- To create different arrays for the reSolve Fruit Shop.

Time

A lesson of approximately 1 hour.

Vocabulary

- array
- how many?
- how much?
- multiplication

Resources

- reSolve PowerPoint *1a reSolve Fruit Shop*
- Student Sheet 1 – One Array (one copy per student)
- Student Sheet 2 – Different Arrays (one copy per student)

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One array of lemons

Resources: Show students slide 1 from reSolve PowerPoint *1a reSolve Fruit Shop*.
Provide students with Student Sheet 1 – One Array.

Explain: *There are four bags of lemons. The owner of the fruit shop wishes to take the lemons out of the bags and arrange them in a box like the oranges, apples, peaches, apricots and mangos. She wants more than one lemon in each row and column.*

Pose the question: *How could the owner arrange all the lemons in just one array? Can you find more than one way?*

Provide students with counters to explore the different ways that the lemons might be arranged. Students should record the solutions they find for each scenario.

Enabling prompt:

- Use 12 lemons instead of 24. In the class reflection, the connection between 12 and 24 can be discussed.

Arranging the lemons in one array

As there needs to be more than one lemon in each row and column, there are six possible ways to arrange 24 lemons:

- 2 rows of 12 and 12 rows of 2
- 3 rows of 8 and 8 rows of 3
- 4 rows of 6 and 6 rows of 4.

Ask: *How do you know you have found them all? Can you see similarities between the arrays?*

Two arrays of lemons

Resources: Provide students with Student Sheet 2 – Different Arrays.

Pose the question: *The owner splits the lemons into two equal-sized groups. How could she arrange these groups of lemons into two arrays? Can you find more than one way?*

Arranging the lemons in two equal arrays

There will be 12 lemons in each group. There are four possible ways to arrange 12 lemons:

- 2 rows of 6 and 6 rows of 2
- 3 rows of 4 and 4 rows of 3.

Ask: *What is similar and different about the different ways that 12 lemons can be arranged?*

Pose the question: *The owner uses all the lemons to make two arrays. There are not the same number of lemons in each group. What might these arrays look like? Is there more than one answer?*

Arranging the lemons in two unequal arrays

There are five possible ways to split the lemons into two unequal groups and still be able to make arrays with more than one lemon in each row and column:

- a group of 4 and a group of 20
- a group of 6 and a group of 18
- a group of 8 and a group of 16
- a group of 9 and a group of 15
- a group of 10 and a group of 14.

Ask:

- *Can you find more than one way to arrange the lemons?*
- *Choose one of the combinations. What are all the different ways that the lemons can be arranged for this combination?*
- *What is interesting about the way lemons can be arranged in groups of 9 and 16?*

Extending prompt:

- Can you find all the ways that the owner could make two arrays with an unequal number of lemons in each group?

Reflection

Conduct a class gallery walk to look at the solutions presented.

Look at the different arrangements that were found for arranging 24 as an array. How do we know if we have found them all? Discuss working systematically to find all possibilities:

- One cannot be used for the array.
- Two in each row creates a 2×12 array.
- Three in each row creates a 3×8 array.
- Four in each row creates a 4×6 array.
- Five in each row does not create an array.
- Six in each row creates a 6×4 array.
- Seven in each row does not create an array.
- Eight in each row creates an 8×3 array, and so on.

Each of these numbers is a factor of 24. Students may note that the arrays flip around at six and so subsequent numbers do not need to be checked. Discuss how this is because of the commutative property of multiplication.

Ask the students to consider: *Which arrangement do you think will work best in the fruit shop? Why?*

There is no right answer for this question, but students should consider the different shapes and sizes of the arrays.

Exploring two unequal arrays further

There are only five ways to split the lemons into two unequal groups and still make arrays without any lemons left over. Why can't arrays be made for every way to split 24 into two unequal groups, such as 13 and 11?

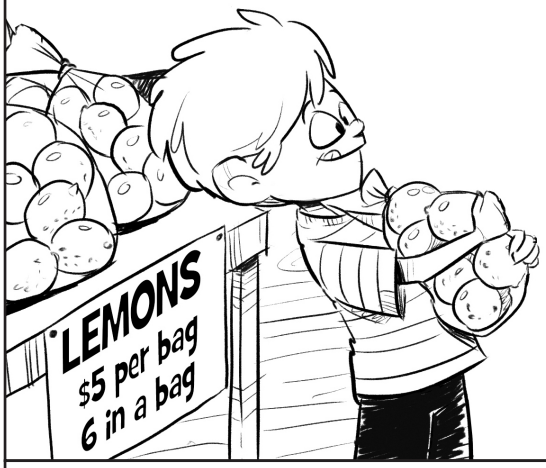
- Using 13 and 11 as an example: with 13 lemons it is possible to make arrays of only 1×13 or 13×1. This is also true for 11. Because the owner wanted two or more lemons in each row or column, some numbers (prime numbers) will not form appropriate arrays.

How many different arrays were you able to make for 9?

- There is only one way that 9 can be arranged into an array with more than one lemon in each row and column. Explain it is a **square** number as it creates a **square array**. Ask the students to identify the other square number in the third scenario. It is interesting to note that 16 can be made into a square array and a non-square array.

One Array

Name: _____



There are four bags of lemons.

The owner of the fruit shop wishes to take the lemons out of the bags and arrange them in a box like the oranges, apples, peaches, apricots and mangos.

She wants more than one lemon in each row and column.

In what way might she arrange all the lemons in an array? Can you find more than one way?

Different Arrays

Name: _____

The owner splits the lemons into two equal-sized groups. In what way could she arrange these groups of lemons into two arrays? Can you find more than one way?

The owner uses all the lemons to make two arrays. There are not the same number of lemons in each group. What might these arrays look like? Is there more than one answer?