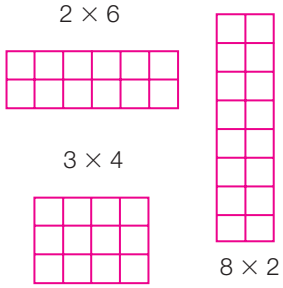
Does not focus on ‘rows of’ or ‘columns of’, but only sees an array as a collection of ones.

Opportunity for: reasoning about numbers

Resources

- Counters
- 2 cm squared paper
- Paper grids made from 2 cm squared paper for the following arrays: 1×12, 3×4, 2×6, 2×8, 1×16, 4×4, 8×2 (others created as required)
- Mini whiteboards and pens



Key vocabulary

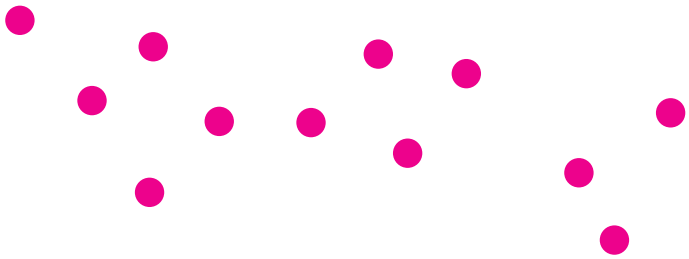
rows
columns
array
arranged
count how many
multiplied by
pattern
groups of

Teaching activity

Time 15–20 minutes

Explain to the child that this activity is going to help them to learn about using rows and columns to help them count more easily.

Spread twelve counters, all the same colour, on the table so that they are not arranged as an array (and cover them so the child does not count them), for example:



Reveal the counters and then hide them again.

? **Roughly how many counters do you think there are?**

? **How did you decide?**

Invite the child to check the actual number of counters.

If the child does not arrange the counters in a row to assist their checking, encourage them to do this on a 1 × 12 array (i.e. 1 row × 12 columns, or 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 = 12, or 12 groups of 1, or 1 multiplied by 12) squared paper strip, using the vocabulary of ‘row’ to describe the arrangement.

If the child does arrange the counters in a row, move them onto a paper grid.

Establish that there are twelve counters and that counting in ones is not the quickest way to count.

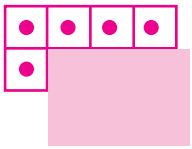
? **Are there other ways in which you could arrange the counters to make the counting quicker and more efficient?**

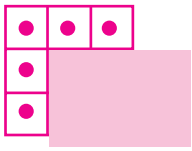
If the child does not choose to arrange the counters in a rectangular array, provide paper grids for other possible arrays, such as 2 × 6 (2 rows by 6 columns, or 2 + 2 + 2 + 2 + 2 + 2 = 12) and 3 × 4 (3 rows by 4 columns, or 3 + 3 + 3 + 3 = 12), and support the child in moving the counters onto each of the paper grids to establish that other rectangular arrays are possible using twelve counters.

Guide the child to count in twos up to twelve (for 2 × 6 grid) and/or in threes up to twelve (for 3 × 4 grid) to illustrate the support that arranging in rectangular arrays can provide.

Repeat the activity with sixteen counters and suitable paper grids to support the process.

Make two or three arrays up to 6 × 6 using counters of a single colour in each array. Use the corner of a piece of paper to mask all but the far left column and the top row of each array, for example:





? **How many rows are under the paper? How many rows altogether?**

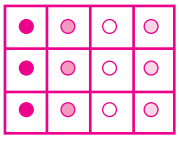
? **How many columns are under the paper? How many columns altogether?**

Repeat for two or three arrays.

If the child has difficulty with larger arrays, repeat the activity with arrays for smaller numbers.

Within arrays, different colours of counters are now going to be used to highlight rows and columns and to emphasise ways of describing arrays.

Arrange a 3 × 4 rectangular array on a 3 × 4 paper grid, using four different colours to indicate the four columns.



? **How many counters are there altogether?**

? **How many are there of each colour?**

? **How many threes are there?**

Support the child to count in threes up to twelve as the columns of the array are indicated.

? **Can you record on your whiteboard a way of writing a calculation to show this pattern?**

Support the child to record this array as: 3 + 3 + 3 + 3 = 12

(and, if appropriate, 12 = 3 + 3 + 3 + 3 and four columns of three showing four groups of three).

Repeat this activity using coloured counters to represent columns on previously prepared grids to encourage the child's fluency in:

- counting in steps of the column size;
- describing arrays as repeated addition;
- describing arrays as multiples of the column size.

? **Tell me something you learnt today.**

? **Did you learn any new words? What were they?**

Spotlight 1

Does not focus on 'rows of' or 'columns of', but only sees an array as a collection of ones

Opportunity for: solving problems

Toppling towers

Time 10–20 minutes

Resources

- Interlocking cubes (approximately 2 cm edge length)

Key vocabulary

rows
columns
array
arranged
count how many
multiplied by
pattern
groups of
towers

Teaching activity

Explain to the child that this activity is going to help them to learn about using rows and columns to help them count more easily.

Make five towers, each of four cubes, each tower a different colour. Stand the towers upright as a vertical 4 × 5 array, and then lay the first two towers flat to form an array 4 × 2 on the table in front of the child.

? **How many cubes are there in each of these towers?**

? **How many cubes are there altogether in the two towers that have fallen over?**

With the child, rehearse 'four and another four so that makes eight altogether'. Get the child to repeat the description you have just given and emphasise the usefulness of this way of looking at the towers to find a quicker way of counting the total number of cubes.

If the child finds counting in fours too challenging, change the size of the towers to work on the same activity with towers two cubes high, making arrays 2 × 2, 2 × 3, etc. Count in twos to find the total number of cubes in 2 × 2, 2 × 3, etc.

Explain that you are going to try out this way of counting more efficiently using more of the towers. Add another tower to the array already laid on the table to make an array 4 × 3.

? **What is a quick way for you to find how many cubes there are altogether in the three towers?**

Support the child in counting four and another four makes eight and another four makes twelve.

Repeat the activity, increasing the size of the array by adding one more tower of four cubes each time.

? **Tell me something you know about rows and columns.**

Spotlight 2

Does not focus on 'rows of' or 'columns of', but only sees an array as a collection of ones

Opportunity for: developing mental images

Egg boxes

Time 10–20 minutes

Resources

- Empty egg boxes with lids (that have contained four, six, ten, twelve eggs)
- Marbles (as large as possible)

Key vocabulary

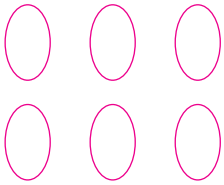
rows	arranged
columns	count how many
array	multiplied by
pattern	groups of

Teaching activity

Explain to the child that this activity is going to help them to learn about using rows and columns to help them count more easily.

Give the child one of the empty egg boxes which would have held six eggs, keeping the lid closed.

? **How many eggs would this box hold, do you think?**



Still with the lid closed, ask the child to show how the eggs would be arranged inside the box.

? **How many in each column?** *(2)*

? **How many in each row?** *(3)*

If the child cannot imagine the layout of the eggs inside the box, turn over the box and show them the humps in the base of the box as a hint. Repeat the questions about numbers of rows and columns.

Open the lid of the box and give the child the number of marbles which represent the number of eggs that they expected the box to contain. Guide the child to place the marbles in the indentations in the box, column by column, checking their original prediction. Emphasise the column structure. Repeat with their row prediction, emphasising the row structure.

If the child's expectation of total number (or column or row size) was incorrect, encourage them to correct themselves, using the marbles to support their thinking.

As time allows, repeat the activity with different sizes of egg box.

? **What shall we write about rows and columns that you think is important?**

Spotlight 3

Does not focus on 'rows of' or 'columns of', but only sees an array as a collection of ones

Opportunity for: relating pictures to symbols

Footprints

Time 10–20 minutes

Resources

- Mixture of objects which include arrays, e.g. plastic minibeasts, such as insects, centipedes and spiders, and/or building bricks
- Play dough or small sand tray or paint-on sponge
- Counters
- Mini whiteboard and pen

Key vocabulary

rows	arranged
columns	count how many
array	multiplied by
pattern	groups of

Teaching activity

Explain to the child that this activity is going to help them to learn about using rows and columns to help them count more easily.

Choose an item such as a plastic ant (or other insect) and ask the child to look carefully at the arrangement of the legs and 'feet', when the ant is viewed from underneath.

? **How many pairs of feet has it got?**

? **How many feet on each side?**

? **How many feet has this ant (insect) got altogether?**

Make an imprint of the creature's feet in play dough, sand, paint or any other convenient medium.

Ask the child to recreate the arrangement of footprints that they see as an array made from counters.

? **Tell me about the counter pattern you can see.**

Encourage the child to observe the column and row sizes and match these to pairs of feet and numbers of feet on either side of the body respectively. With the child, count in twos to the total number of feet, highlighting two and two more and two more makes six feet altogether.

? **Show me a calculation to add up the pairs of feet.**

Support the child to record 2 + 2 + 2 and 3 pairs of feet/counters. Demonstrate the match between the numbers in the calculation and the counter pairs, imprint pairs and feet pairs.

If the child has not inserted an equals sign in their recording, ask:

? **How can you complete the number sentences to show the total number of legs on the insect?**

Support the child to complete the calculations they have started as: 2 + 2 + 2 = 6

3 sets of 2 = 6, etc.

With the child, count in threes the total number of feet.

? **Three on one side and three on the other makes how many altogether?**

? **Show me a calculation to add up the legs on either side of the body.**

Support the child to record 3 + 3 and 2 sets of feet/counters, with a record of the total count. Demonstrate the match between the numbers in the calculation and the counter positions, imprint positions and feet positions.

As time allows, select other objects to repeat the process of:

- identifying the array;
- reflecting on its structure;
- copying the structure in counters;
- counting to the total number in step size equal to the column size;
- describing the structure as numbers in rows and columns with associated repeated addition and multiplication calculations.

? **Can you draw an array that is three rows of five? What size are the columns?**

? **What would you like more help with?**

Spotlight 4

Does not focus on 'rows of' or 'columns of', but only sees an array as a collection of ones

Opportunity for: reasoning about numbers

Jigsaws

Time 15–20 minutes

Resources

- 2 cm squared paper
- Paper grids made from 2 cm squared paper for the following arrays: 3 × 4, 2 × 6, 2 × 8, 1 × 16, 4 × 4, 8 × 2 (for this activity, each will need to be cut into two parts)

Key vocabulary

rows	arranged
columns	count how many
array	multiplied by
pattern	groups of

Teaching activity

Explain to the child that this activity is going to help them to learn about using rows and columns to help them count more easily.

Use a 3 × 4 grid cut into two parts, with heavy lines along the outside edges of the grid, for example:

Give the child one of the two parts (exactly as illustrated, without rotating it), explaining that you have another part to the grid and that you want them to work out what size it could be. Explain that the heavy lines show the outside edge of the shape.

? **How many rows do you think the missing piece has?** *(three)*

? **How many squares in each row?** *(three or more, or two or more, depending on piece selected)*

? **How do you know?**

Lay the part you have shown the child on a piece of 2 cm squared paper aligning the grid with the lines on the paper. Ask them to sketch the answers they have given you. Hide their sketch, just allowing them to see the piece you presented originally.

? **How many columns do you think it has?**

? **How many squares in each column?**

? **How do you know?**

Ask the child to check their sketch and make sure it still fits with their expected grid.

? **Could this be a piece from any other rectangular grid?**

If the child thinks other grids are possible, ask about these, encouraging the child to describe their ideas in terms of numbers of squares in the columns and number of columns. Then reveal the missing grid piece.

If the child is not sure about the range of possible grids, reveal the other part of the grid you have been discussing and ask the child to check its match with their idea. If their choice was not the piece that you revealed but nevertheless perfectly feasible, ensure that this is acknowledged and understood.

Support the child to show the 'family' of grids to which the piece could belong, emphasising the increasing number of columns.

Either repeat this activity with a part of another grid or provide a collection of grid pieces from four grids, each cut into two parts. Ask the child to recreate the four grids, explaining how they know they are correct. Ensure a continuing focus on the number in each column and the number of columns. If it seems appropriate, this could be an activity that the child takes home to try out.

Spotlight 5: a learning check

Does not focus on 'rows of' or 'columns of', but only sees an array as a collection of ones

Opportunity for: recognising relationships between numbers

Chocolate bars

Time 10–20 minutes

Resources

- Interlocking cubes (approximately 2 cm edge length)
- Bar of chocolate
- Scraps of paper to cover parts of rectangular arrays made from interlocking cubes
- Counters

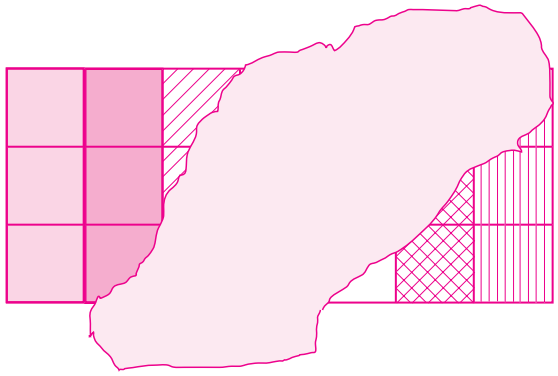
Check: does the child use key vocabulary?

rows
columns
array
pattern
arranged
count how many
multiplied by
groups of

Teaching activity

Explain to the child that this activity is going to help them to learn about using rows and columns to help them count more easily.

Make a rectangular array, for example 3 × 7, from interlocking cubes, with each column a different colour from the adjacent columns. Cover part of the array with an irregular scrap of paper to hide parts of every row and two or three columns, for example:



? How many cubes are there in each column?

? How many cubes in each row?

Ask the child to show the pattern that they see, using counters to build up the array column by column.

Repeat the activity, making up other grids from assorted colours of cubes so the child does not have the cue of individually colour-coded columns. Use various sizes of paper scraps to cover parts of the arrays. Each time ensure that the child can recreate the array using counters.

Finish the activity by using a real chocolate bar, marked in squares!

Learning outcomes

By the end of this set of activities children should be able to:

- tackle related learning tasks with increased motivation and confidence;
- use and understand connected mathematical vocabulary;
- recognise the rows and columns of an array;
- understand the organisation of objects into an array to support counting.