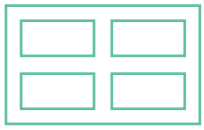
Is muddled about the correspondence between multiplication and division facts, recording, for example: 3 × 5 = 15, so 5 ÷ 15 = 3

Opportunity for: recognising relationships

Resources

- Board with space for four number sentences
- Four sets of number and symbol cards (Resource sheets 1, 2 and 8)
- Cubes or counters
- Number lines



Key vocabulary

multiplied by
divided by
array
groups of
hops of
steps of
change around
undoes
rows
columns

Teaching activity

Time 10–15 minutes

Explain to the child that today's activity will help them to find out more about the ways in which multiplication and division are linked.

? **Can you tell me what you think it means if I say that multiplication and division are linked? Choose from the things on the table to show me what you mean.**

Follow on from what the child says, noting their idea of the link between multiplication and division.

Try to establish that one undoes the other. For example, if you multiply four by five you get twenty and if you divide twenty by five you get four.

? **Can you draw something to show four multiplied by five that also shows twenty divided by five?**

Children might draw a number line or groups or an array. Follow on from what they draw to talk about the different calculations which their drawing shows.

If the child is confused, help them to lay out an array of twenty cubes or counters arranged as four multiplied by five: five columns of four cubes.

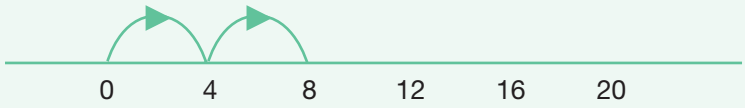
Four multiplied by five
4 × 5 = 20

? **Can you show this same multiplication on a number line?**

If the child is unsure, draw a line for them.

? **Can you tell me how big we need to make the hops along the line to show four multiplied by five?**

Clarify that it is the four that is the number that is being multiplied, so the steps are four and there are five of them.



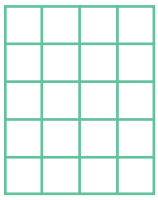
Help the child to draw the hops of four.

Clarify that this shows 4 + 4 + 4 + 4 + 4 or 4 × 5.

? **Which other number sentences can we make with 4 × 5 = 20?**

Talk the child through how you can look at the array the other way around and make five multiplied by four. (You can just rotate the array a quarter turn or move yourself to see it the other way around.)

'Five multiplied by four looks like this.
We are looking at it the other way around.'



? **Can you write a division number sentence that shows 4 × 5 = 20 or 5 × 4 = 20?**

If the child is confused or records this incorrectly, use the array or the number line, or both if you have time, to model the divisions.

'We can start from 20 and hop back in hops of four. We will need five hops of four to get to zero.'

20 – 4 – 4 – 4 – 4 – 4 = 0

'So there are five groups of four in twenty. We needed to take five hops of four.'

? **What if we do it the other way and make hops of five? How many hops will we need?**

'Let's record all the number sentences.'

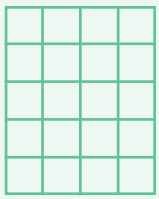
Put the four number sentences on the board, demonstrating how you use just three different number cards and you need four cards of each number, two × cards and two ÷ cards and four = cards.

4 × 5 = 20	5 × 4 = 20
20 ÷ 5 = 4	20 ÷ 4 = 5

(You might find it helpful to take the board back to class to remind the child in odd moments about what it shows.)

If the child seems confused, ask them to look at the columns in the array.

Explain that we can divide this array into fives. Ask the child to move one column of five at a time.



? **How many fives in twenty?** *(20 ÷ 5 = 4. There are four groups of five in twenty.)*

? **Can you show me those four groups of five in the array?**

? **What have you learned today?**

? **What did you find hard today?**

? **Are there any words we used today that you are unsure about?**

Spotlight 1

Is muddled about the correspondence between multiplication and division facts, recording, for example: 3 × 5 = 15, so 5 ÷ 15 = 3

Opportunity for: communicating with words and symbols

Three-card magic

Time 10–20 minutes

(*Note:* This Spotlight includes an optional activity about sharing apples, to use if the child needs further reinforcement. Additional time would be required.)

Resources

- Four sets of number and symbol cards (Resource sheets 1, 2 and 8)
- Cubes or counters
- Board with space for four number sentences

Key vocabulary

multiplied by
divided by
array
hops of
steps of
change around
undoes
rows
columns

Teaching activity

'Today we are going to think about the two multiplication number sentences and the two division sentences that we can make with fifteen cubes.'

? **How could you put out these fifteen cubes to make an array?**

The array could be three rows of five cubes or five rows of three cubes. (It could also be one row of fifteen or fifteen rows of one.)

? **Which two multiplication sentences can we make with this pattern?**

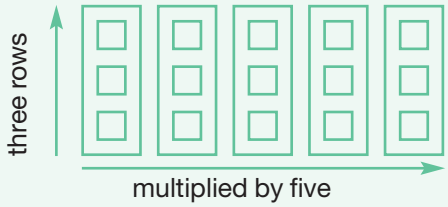
? **Which number cards do you need to make your sentences?**

Help the child to record with cards:

$3 \times 5 = 15$
$5 \times 3 = 15$

Show how the numbers arise from the array.

If the child needs support in knowing which way around the array needs to be for these two multiplications, you can show the rows and columns like this:



$3 \times 5 = 15$

? **Which is the division card?**

? **Which division number sentences can we make?**

? **How can you make these cubes show a division sentence?**

If the child needs help with this, show how the array can break down into fifteen divided into three groups of five (5 + 5 + 5) or fifteen divided into five groups of three (3 + 3 + 3 + 3 + 3).

Help the child to record and read:

15 ÷ 5 = 3 'Fifteen divided by five is three groups of five.'

and

15 ÷ 3 = 5 'Fifteen divided by three is five groups of three.'

grouping model

? **What if I move your cards around to make this number sentence?** 3 ÷ 15 = 5

? **Can you read that number sentence to me?**

? **If we put the five after the equals would the number sentence be correct? Why not?**

Establish that this sentence is three divided between fifteen.
This might be three pens divided between fifteen children!
That would not even be enough for one pen each, let alone five!

sharing model

Sharing apples

If the child finds this challenging, try another real-life context.

? **If we had fifteen apples to divide between three of us, how many would we have each?**

Establish that you would have five each.

? **If we had three apples and we had to divide them between fifteen people, would everyone get at least one whole apple, or would we have to cut them up?**

sharing model

Establish that each person would only have a small piece of apple.

'So if we write 3 ÷ 15 = 5

we end up with an answer of less than one, and that doesn't fit with our cubes.'

Focus on the cubes again.

'We start with fifteen cubes. Let's put that first.' 15 ÷ 3 = 5

sharing model

Help the child to talk you through the words of this number sentence.

? **How many threes in fifteen, or fifteen divided by three, or how many groups of three are there in fifteen?**

(Keep away from the phrase 'goes into' because this can cause confusion.)

If there is time, repeat the activity by looking at what happens if you try to divide five apples between fifteen people.

? **What did you learn today using these number cards?**

Establish that you had to keep using the same three numbers to make the three-card magic work.

? **If we are doing some three-card magic and one of the numbers is twelve, what could the other numbers be?** *(Could be 3 × 4 = 12, or 12 × 2 = 24, or 12 × 100 = 1200, or ...)*

Spotlight 2

Is muddled about the correspondence between multiplication and division facts, recording, for example: $3 \times 5 = 15$, so $5 \div 15 = 3$

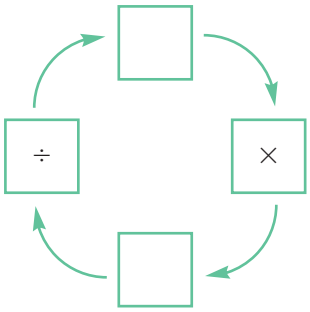
Opportunity for: recognising relationships

Round and rounds

Time 10–20 minutes

Resources

- 'Round and round' chart
- Number and symbol cards (Resource sheets 1, 2 and 8)



Key vocabulary

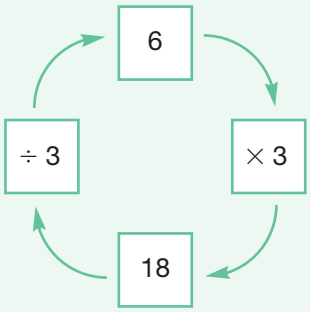
multiplied by	change around
divided by	undoes
array	rows
hops of	columns
steps of	reverse the numbers

Teaching activity

'Today we are going to do a bit more of the three-card magic that we did last time, and we are going to think about how division undoes multiplication.'

? **Remind me what we found out before about three number cards going together in a special way.**

If the child can't remember, remind them and see if they can find three cards which go together that you can use, for example 3, 6 and 18 (or another multiplication fact that the child finds hard to remember).



Demonstrate how to move around the chart saying the calculation, for example 'six multiplied by three is eighteen and eighteen divided by three gets you back to six'.

If the child isn't following this, talk it through once more, then ask the child to choose some other numbers for a multiplication fact they know, for example $2 \times 5 = 10$.

Help the child to 'read' the round and round chart and put in other numbers that go together.

? **Do you think it will work if we go the other way round?**

? **Can you write twenty divided by five as a calculation?**

If the child needs support for this, help them to write the calculation and do a few more examples, such as thirty divided by three and so on, each time starting with the 'round and round' chart.

What is the correct way to write fourteen divided by two? Is it 14 ÷ 2 or 2 ÷ 14? How do you know?

Can you read this: ? If it was about biscuits to divide between children, what might two divided by fourteen mean?

Use number cards to show that you can swap around multiplication calculations but you can't do that with division calculations.

4 x 5 = 20 and 5 x 4 = 20

20 ÷ 4 is very different from 4 ÷ 20. Stress that these two calculations have a different answer so the child must be careful not to swap the numbers around in divisions and expect the same answer.

Choose three more numbers and ask the child to put them on a 'round and round' chart and then write the two divisions that can be made from those numbers.

Can you tell me what you learned today about some calculations where you can reverse the numbers and some where you can't?

Support the child to give examples of where reversing the numbers will not work.

Spotlight 3

Is muddled about the correspondence between multiplication and division facts, recording, for example: 3 × 5 = 15, so 5 ÷ 15 = 3

Opportunity for: developing mental images

Make a picture

Time 10 minutes

Resources

- Board with space for four number sentences
- Number and symbol cards (Resource sheets 1, 2 and 8)
- Cubes
- Number lines
- Bead string

Key vocabulary

multiplied by, divided by, divided into, array, hops of, steps of, change around, undoes, rows, columns

Teaching activity

'Today we are going to think about some pictures that we can make to show divisions.'

What picture do you have in your head for twelve divided by two?

Can you write twelve divided by two?

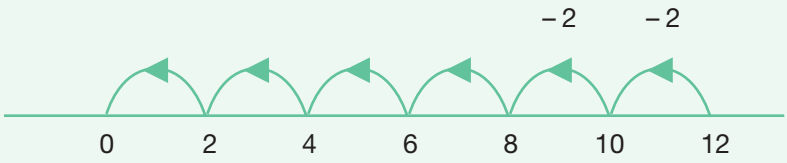
How would you work out twelve divided by two?

Encourage the child to tell you about their own mental images. If we suggest using cubes to help, we might be pushing a child into a method of working that isn't closely related to what they do in their head.

? **What is your favourite way of working out divisions?**

If the child clearly needs more guidance, ask them to choose any of the equipment on the table, or suggest that they draw some kind of picture to show how they work it out.

If they are still finding this difficult, suggest that they draw a number line.



'Twelve divided by two can be done by stepping back in twos on the number line from 12.'

? **Can you write in the numbers we land on when we step back in twos?**

? **How many steps of two did we need to take to get to zero?**

'We needed six steps of two to get to zero, so twelve divided by two is six. Or we could ask, how many twos in twelve? Or we could ask, how many twos make twelve?'

? **How many twos make twelve?**

? **So if we had twelve apples and we wanted to give two each to some children, how many children could have two each?**

Make the calculation with number cards and then record it with a pen. Keep it to refer to and keep some of the pictures.

12 ÷ 2 = 6

? **What happens if we write the division the other way around (2 ÷ 12)?**

? **Can you read that calculation? What picture does that make in your head?**

? **If we thought of it as apples, what would two apples divided into twelve look like?**

Make sure the child understands that this calculation gives a completely different answer. The two apples would be cut up into small pieces and the answer is definitely not six! It is less than one, so it is a fraction (about 0.167).

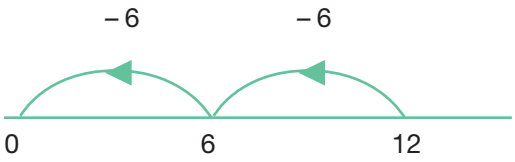
Working with the cards again, ask the child to rearrange the cards so that the calculation is correct and they are using use only those three numbers.

12	÷	6	=	2

? **Can you read this division to me?**

? **What pictures do you have in your head?**

You could either turn any array they have made a quarter turn, or suggest they draw a different number line with different steps.



? **What is special about these two number sentences?**
(They use the same three numbers. They go together.)

12	÷	2	=	6
12	÷	6	=	2

? **Does this division fit with the others? Tell me why it does or why it doesn't.**

2	÷	12

? **Show me what you have learned today.**

'If I tell you that four multiplied by six is twenty-four, can you write me two divisions that use just these three numbers?' Lay out the calculation with number cards.

Spotlight 4

Is muddled about the correspondence between multiplication and division facts, recording, for example: $3 \times 5 = 15$, so $5 \div 15 = 3$

Opportunity for: making connections

Multiplication square twos

Time 10 minutes

Resources

- Board with space for four number sentences
- Number and symbol cards (Resource sheets 1, 2 and 8)
- Cubes
- Number lines
- Sweets or counters
- Bead string
- Completed multiplication grid, for example, *Multiplication grid 1* (Resource sheet 35) or for Year 6 work use *Multiplication grid 2* (Resource sheet 36)

Key vocabulary

multiplied by
divided by
array
hops of
steps of
change around
undoes
rows
columns

Teaching activity

You need some number cards of multiplication facts which the child needs to practise, for example 24 (to go with 8 and 3), 18 (to go with 3 and 6), 21 (to go with 3 and 7).

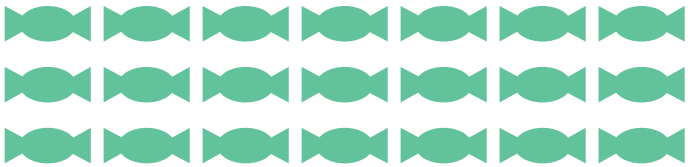
Lay the number cards out on the table, 21, 24, 18 and so on, disregarding the lower numbers.
'Today we are going to make some division calculations using these cards.'

'I want you to choose a number and show your division with that number using any of the equipment on the table, or you can draw a picture. We are also going to use these sweets – and I don't want to have to cut up any of the sweets! They are much too hard to cut so you must think carefully about the number you start with.'

? **Which number will you choose to start with?**

If the child needs help, suggest they start with twenty-one.

Help the child to count out twenty-one sweets and to put them in an array.



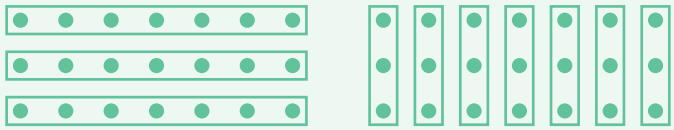
? **Can you tell me something about our array of sweets?**

Encourage the child to begin with the fact that there are twenty-one sweets.

Support the child to talk about seven columns of three sweets, that is 3 + 3 + 3 + 3 + 3 + 3 + 3 or 3 multiplied by 7 or, if you look at it the other way around, 7 + 7 + 7 or 7 multiplied by 3.

? **Can you show me how we could use our array of twenty-one sweets to show a division?**

Help the child to divide the array into three rows of seven and into seven columns of three.



? **Which of these lower numbers could you choose to make a division calculation with twenty-one, making sure that we don't have to cut up the sweets?**

The child should select the 3 card and the 7 card.

If the child needs support, you can ask them to look at their multiplication grid.

? **Can you find 21 on the multiplication grid? Which two other numbers does it go with?**

Work towards placing cards to give:

21	÷	7	=	3	and	21	÷	3	=	7

? **Why did you start that division with twenty-one?**
Would it work if we put 3 ÷ 21 = 7?

? **Can you read this number sentence to me?**
How could we have three sweets divided by twenty-one?
(Or three divided by seven? Or seven divided by twenty-one?)

Then you could record the two divisions on the board with space for the four number sentences.

Move on to the other cards (24 and 18 or whatever you have chosen for the child to practise).

Spotlight 5: a learning check

Is muddled about the correspondence between multiplication and division facts, recording, for example: $3 \times 5 = 15$, so $5 \div 15 = 3$

Opportunity for: discussing and explaining

Thinking threes

Time 5–15 minutes

Resources

- Sets of number cards that go together, i.e. two numbers and their product, for example 3, 4 and 12 (Resource sheets 1, 2 and 3)
- At least one other child
- Cubes
- Number lines

Check: does the child use key vocabulary?

multiplied by	steps of
divided by	change around
go together	undoes
array	rows
hops of	columns

Teaching activity

'We are going to play a game called **Thinking threes**, and you will need to think very carefully to work out which three cards go together to make a trick.'

Lay the cards face up on the table (with the larger number cards together to make the choice of cards easier). Choose cards to suit the child. For a 5-minute game, you just need about eight tricks and a few odd cards.

Possible cards which you might use are:

2, 4, and 8	4, 4 and 16	5, 7 and 35
3, 4 and 12	4, 7 and 28	4, 8 and 32
3, 7 and 21	3, 9 and 27	

Include a few extra cards, such as a couple of 1s, a 10, another 12 and a 14.

How to play

1. Players take turns to choose three cards that go together, for example 10, 2 and 5.
2. Players explain why they chose those cards. For example, 'I chose those cards because ten divided by five is two.' (You can add that they must show their three numbers together on a number line or with an array or on a multiplication square.)
3. If everyone agrees that the three cards go together, the player wins that trick. If a player thinks the cards don't go together, they must say why. They can use any equipment to show why the cards don't go together and, if they are right, the player who tried to make the trick misses that go and the cards are put back on the table.
4. Play goes on like this until there are only a few cards left.
5. The winner is the player with the most tricks.

Variations

- Play with the larger-number cards in a bag. These cards are picked at random and the player must find the other two cards to make the trick.
- Play with a dice or spinner that makes one of the numbers, for example, a dice marked 2, 2, 3, 4, 5, 10.
- Play with one complete set of number cards 0 to 30.
- Play as a race. All the cards are put on the table, someone says 'Ready, steady, go' and the children race to make as many tricks as they can. (Don't play this with your best cards! Paper copies are fine.)

Scoring

Score 10 for every trick that is right.
Score negative 10 for any tricks that are wrong.

? **Can you explain to me how you knew those three numbers go together?**

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;
- make two correct multiplication and two correct division number sentences with the same three numbers;
- understand that multiplication calculations can be done the other way around, but division can't (that is, multiplication is commutative but division is not);
- explain or draw their mental images of multiplication and division and understand the connections between these images;
- begin to understand that a division such as 2 ÷ 12 would result in a number smaller than one.