Scheme of Learning

Year 5

#MathsEveryoneCan

White Rose Maths

Contents

Welcome

Welcome to the White Rose Maths' new, more detailed schemes of learning for 2018-19.

We have listened to all the feedback over the last 2 years and as a result of this, we have made some changes to our primary schemes. *They are bigger, bolder and more detailed than before.*

The new schemes still have the *same look and feel* as the old ones, but we have tried to provide more detailed guidance. We have worked with enthusiastic and passionate teachers from up and down the country, who are experts in their particular year group, to bring you additional guidance. *These schemes have been written for teachers, by teachers.*

We all believe that every child can succeed in mathematics. Thank you to everyone who has contributed to the work of White Rose Maths. It is only with your help that we can make a difference.

We hope that you find the new schemes of learning helpful. As always, get in touch if you or your school want support with any aspect of teaching maths.

If you have any feedback on any part of our work, do not hesitate to contact us. Follow us on Twitter and Facebook to keep up-to-date with all our latest announcements.

White Rose Maths Team

#MathsEveryoneCan

White Rose Maths contact details

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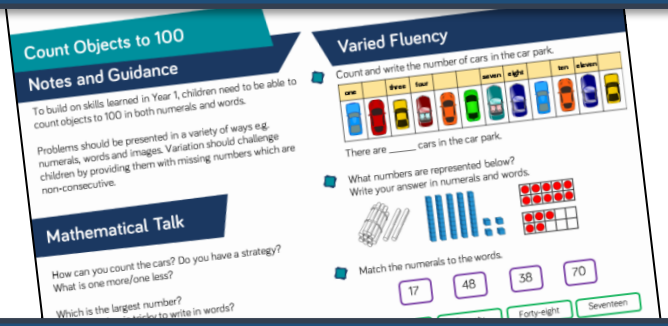
White Rose Maths

What's included?

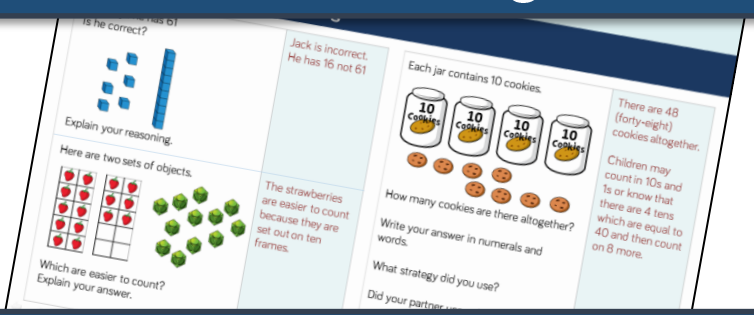
Our schemes include:

- Small steps progression. These show our blocks broken down into smaller steps.
- Small steps guidance. For each small step we provide some brief guidance to help teachers understand the key discussion and teaching points. This guidance has been written for teachers, by teachers.
- A more integrated approach to fluency, reasoning and problem solving.
- Answers to all the problems in our new scheme.
- We have also worked with Diagnostic Questions to provide questions for every single objective of the National Curriculum.

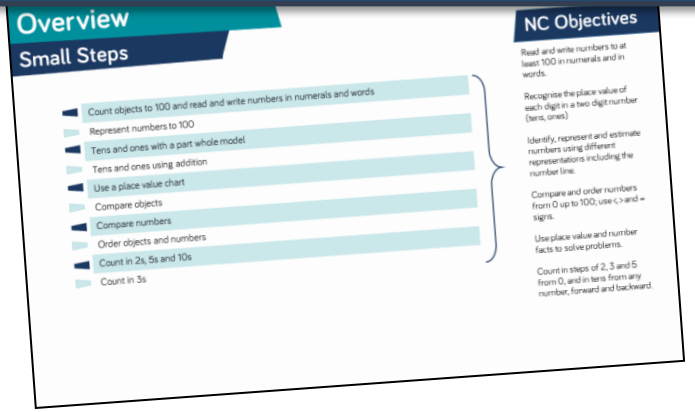
Teaching Notes and Examples



Answers to Reasoning Questions



Small Steps Guidance



Meet the Team

The schemes have been developed by a wide group of passionate and enthusiastic classroom practitioners.

Caroline Hamilton

Beth Smith

Kelsey Brown

Mary-Kate Connolly

James Clegg

Jane Brown

Sam Shutkever

Kate Henshall

Special Thanks

The White Rose Maths team would also like to say a huge thank you to the following people who came from all over the country to contribute their ideas and experience. We could not have done it without you.

Year 2 Team

Chris Gordon
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Year 5 Team

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Helen Eddie
Chris Dunn
Rebecca Gascoigne

Year 6 Team

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Kayleigh Parkes
Shahir Khan
Sarah Howlett

How to use the small steps

We were regularly asked how it is possible to spend so long on particular blocks of content and National Curriculum objectives.

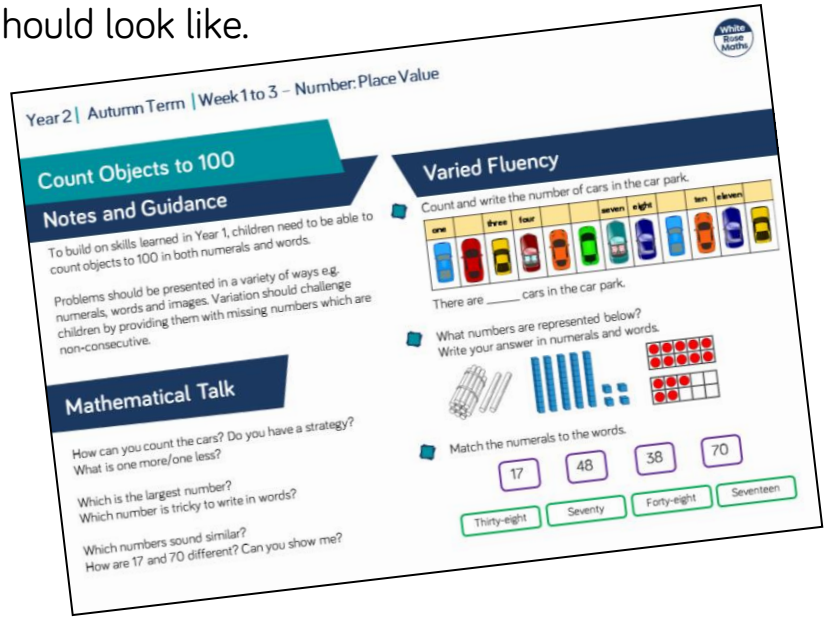
We know that breaking the curriculum down into small manageable steps should help children understand concepts better. Too often, we have noticed that teachers will try and cover too many concepts at once and this can lead to cognitive overload. In our opinion, it is better to follow a small steps approach.

As a result, for each block of content we have provided a "Small Step" breakdown. We recommend that the steps are taught separately and would encourage teachers to spend more time on particular steps if they feel it is necessary. Flexibility has been built into the scheme to allow this to happen.

Teaching notes

Alongside the small steps breakdown, we have provided teachers with some brief notes and guidance to help enhance their teaching of the topic. The "Mathematical Talk" section provides questions to encourage mathematical thinking and reasoning, to dig deeper into concepts.

We have also continued to provide guidance on what varied fluency, reasoning and problem solving should look like.


Year 2 | Autumn Term | Week 1 to 3 – Number: Place Value

Count Objects to 100

Notes and Guidance

To build on skills learned in Year 1, children need to be able to count objects to 100 in both numerals and words.

Problems should be presented in a variety of ways e.g. numerals, words and images. Variation should challenge children by providing them with missing numbers which are non-consecutive.

Mathematical Talk

How can you count the cars? Do you have a strategy? What is one more/one less?

Which is the largest number? Which number is tricky to write in words?

Which numbers sound similar? How are 17 and 70 different? Can you show me?

Varied Fluency

Count and write the number of cars in the car park.

There are ____ cars in the car park.

What numbers are represented below? Write your answer in numerals and words.

Match the numerals to the words.

17 48 38 70

Thirty-eight Seventy Forty-eight Seventeen

Assessments

Alongside these overviews, our aim is to provide an assessment for each term's plan. Each assessment will be made up of two parts:

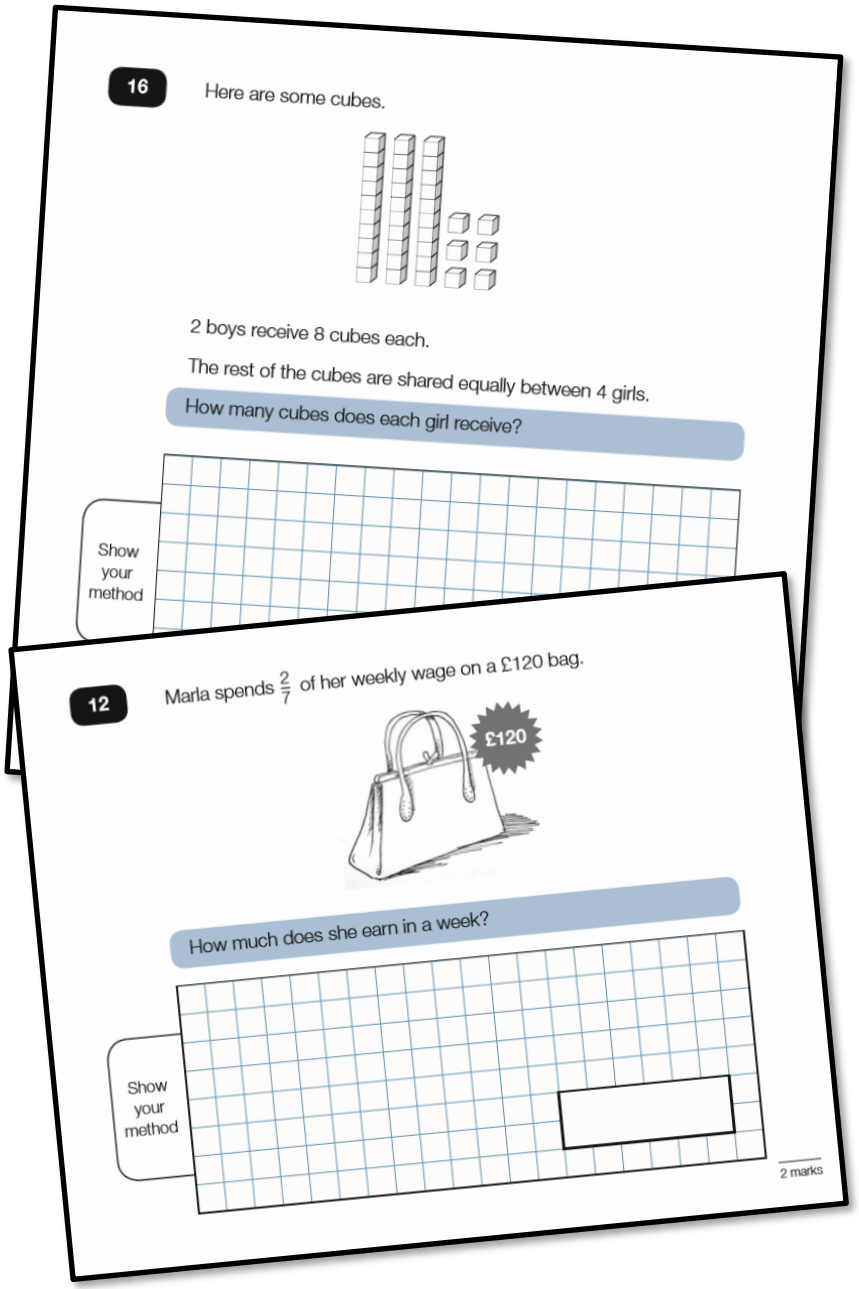
Part 1: Fluency based arithmetic practice

Part 2: Reasoning and problem solving based questions

Teachers can use these assessments to determine gaps in children's knowledge and use them to plan support and intervention strategies.

The assessments have been designed with new KS1 and KS2 SATs in mind.

For each assessment we provide a summary spread sheet so that schools can analyse their own data. We hope to develop a system to allow schools to make comparisons against other schools. Keep a look out for information next year.



Teaching for Mastery

These overviews are designed to support a mastery approach to teaching and learning and have been designed to support the aims and objectives of the new National Curriculum.

The overviews:

- have number at their heart. A large proportion of time is spent reinforcing number to build competency
- ensure teachers stay in the required key stage and support the ideal of depth before breadth
- ensure students have the opportunity to stay together as they work through the schemes as a whole group
- provide plenty of opportunities to build reasoning and problem solving elements into the curriculum

For more guidance on teaching for mastery, visit the NCETM website:

https://www.ncetm.org.uk/resources/47230

Concrete - Pictorial - Abstract

We believe that all children, when introduced to a new concept, should have the opportunity to build competency by taking this approach.

Concrete – children should have the opportunity to use concrete objects and manipulatives to help them understand what they are doing.

Pictorial – alongside this children should use pictorial representations. These representations can then be used to help reason and solve problems.

Abstract – both concrete and pictorial representations should support children's understanding of abstract methods.

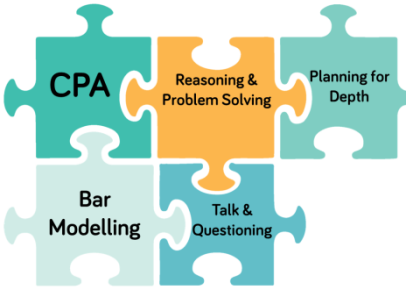
Need some CPD to develop this approach? Visit www.whiterosemaths.com for find a course right for you.

Training

White Rose Maths offer a plethora of training courses to help you embed teaching for mastery at your school.

Our popular JIGSAW package consists of five key elements:

- CPA
- Bar Modelling
- Mathematical Talk & Questioning
- Planning for Depth
- Reasoning & Problem Solving



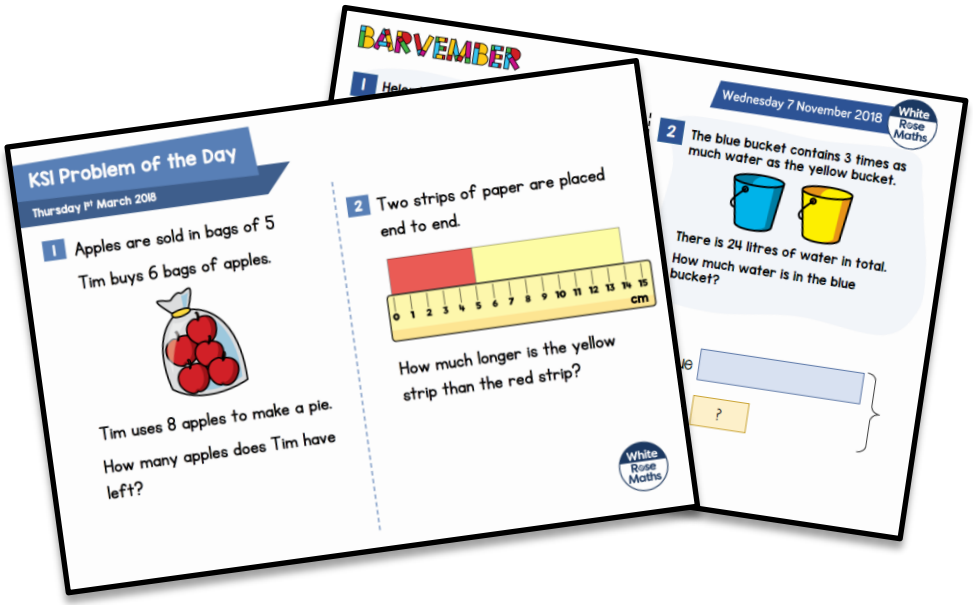
For more information and to book visit our website www.whiterosemaths.com or email us directly at support@whiterosemaths.com

Additional Materials

In addition to our schemes and assessments we have a range of other materials that you may find useful.

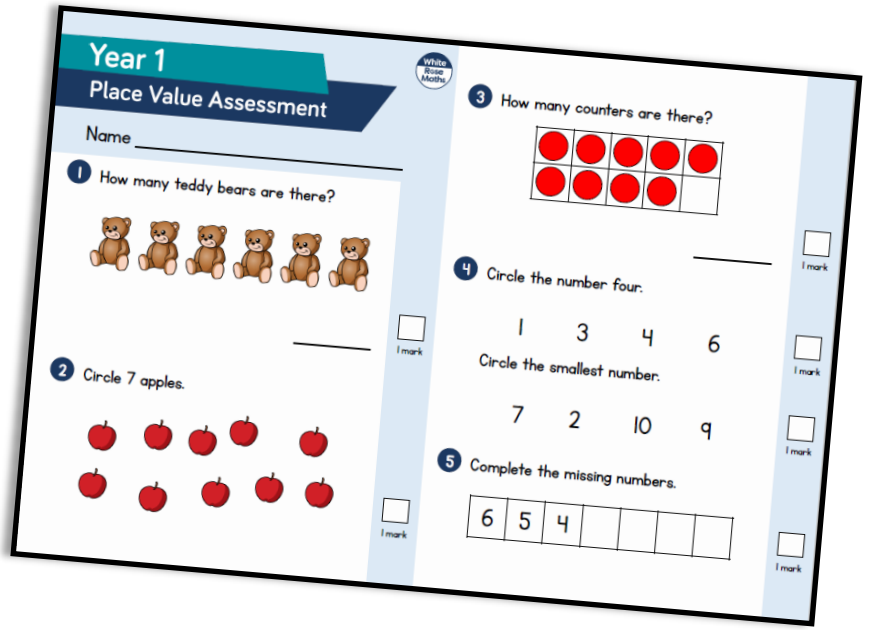
KS1 and KS2 Problem Solving Questions

For the last three years, we have provided a range of KS1 and KS2 problem solving questions in the run up to SATs. There are over 200 questions on a variety of different topics and year groups. You will also find more questions from our Barvember campaign.



End of Block Assessments

New for 2018 we are providing short end of block assessments for each year group. The assessments help identify any gaps in learning earlier and check that children have grasped concepts at an appropriate level of depth.



FAQs

If we spend so much time on number work, how can we cover the rest of the curriculum?

Children who have an excellent grasp of number make better mathematicians. Spending longer on mastering key topics will build a child's confidence and help secure understanding. This should mean that less time will need to be spent on other topics.

In addition, schools that have been using these schemes already have used other subjects and topic time to teach and consolidate other areas of the mathematics curriculum.

Should I teach one small step per lesson?

Each small step should be seen as a separate concept that needs teaching. You may find that you need to spend more time on particular concepts. Flexibility has been built into the curriculum model to allow this to happen. This may involve spending more or less than one lesson on a small step, depending on your class' understanding.

How do I use the fluency, reasoning and problem solving questions?

The questions are designed to be used by the teacher to help them understand the key teaching points that need to be covered. They should be used as inspiration and ideas to help teachers plan carefully structured lessons.

How do I reinforce what children already know if I don't teach a concept again?

The scheme has been designed to give sufficient time for teachers to explore concepts in depth, however we also interleave prior content in new concepts. E.g. when children look at measurement we recommend that there are lots of questions that practice the four operations and fractions. This helps children make links between topics and understand them more deeply. We also recommend that schools look to reinforce number fluency through mental and oral starters or in additional maths time during the day.

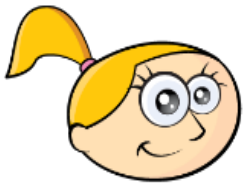
Meet the Characters

Children love to learn with characters and our team within the scheme will be sure to get them talking and reasoning about mathematical concepts and ideas. Who's your favourite?


Teddy


Rosie


Mo


Eva


Alex


Jack


Whitney


Amir


Dora


Tommy


Dexter


Ron


Annie

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Number: Place Value			Number: Addition and Subtraction		Statistics		Number: Multiplication and Division		Measurement: Perimeter and Area		Consolidation
Spring	Number: Multiplication and Division			Number: Fractions						Number: Decimals and Percentages		Consolidation
Summer	Number: Decimals				Geometry: Properties of Shape			Geometry: Position and Direction	Measurement: Converting Units		Measurement: Volume	Consolidation

White Rose Maths

Spring - Block 1

Multiplication & Division

Overview

Small Steps

1. Multiply 4-digits by 1-digit
2. Multiply 2-digits (area model)
3. Multiply 2-digits by 2-digits
4. Multiply 3-digits by 2-digits
5. Multiply 4-digits by 2-digits
6. Divide 4-digits by 1-digit
7. Divide with remainders

NC Objectives

Multiply and divide numbers mentally drawing upon known facts.

Multiply numbers up to 4 digits by a one or two digit number using a formal written method, including long multiplication for 2-digit numbers.

Divide numbers up to 4 digits by a 1-digit number using the formal written method of short division and interpret remainders appropriately for the context.

Solve problems involving addition and subtraction, multiplication and division and a combination of these, including understanding the use of the equals sign.

Multiply 4-digits by 1-digit

Notes and Guidance

Children build on previous steps to represent a 4-digit number multiplied by a 1-digit number using concrete manipulatives.
Teachers should be aware of misconceptions arising from using 0 as a place holder in the hundreds, tens or ones column.
Children then move on to explore multiplication with exchange in one, and then more than one column.

Mathematical Talk

Why is it important to set out multiplication using columns?

Explain the value of each digit in your calculation.

How do we show there is nothing in a place value column?

What do we do if there are ten or more counters in a place value column?

Which part of the multiplication is the product?

Varied Fluency

- Complete the calculation.

Thousands	Hundreds	Tens	Ones
1000		10 10	1 1 1
1000		10 10	1 1 1
1000		10 10	1 1 1

	Th	H	T	O
	1	0	2	3
×				3

- Write the multiplication calculation represented and find the answer.

Thousands	Hundreds	Tens	Ones
1000 1000	100		1 1 1 1 1 1
1000 1000	100		1 1 1 1 1 1

Remember if there are ten or more counters in a column, you need to make an exchange.

- Annie earns £1,325 per week.
How much would he earn in 4 weeks?

Thousands	Hundreds	Tens	Ones
1000	100 100 100	10 10	1 1 1 1 1
1000	100 100 100	10 10	1 1 1 1 1
1000	100 100 100	10 10	1 1 1 1 1
1000	100 100 100	10 10	1 1 1 1 1

	Th	H	T	O
	1	3	2	5
×				4

Multiply 4-digits by 1-digit

Reasoning and Problem Solving

Alex calculated 1,432 × 4

Here is her answer.

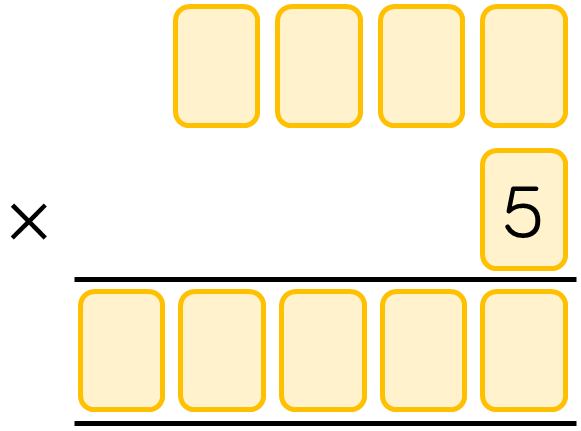
	Th	H	T	O
	1	4	3	2
×				4
	4	16	12	8

1,432 × 4 = 416,128

Can you explain what Alex has done wrong?

Alex has not exchanged when she has got 10 or more in the tens and hundreds columns.

Can you work out the missing numbers using the clues?



- The 4 digits being multiplied by 5 are consecutive numbers.
- The first 2 digits of the product are the same.
- The fourth and fifth digits of the answer add to make the third.

2,345 × 5 = 11,725

Multiply 2-digits (Area Model)

Notes and Guidance

Children use Base 10 to represent the area model of multiplication, which will enable them to see the size and scale linked to multiplying.

Children will then move on to representing multiplication more abstractly with place value counters and then numbers.

Mathematical Talk

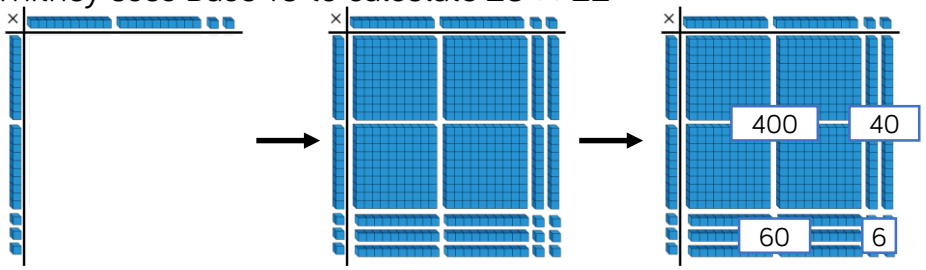
What are we multiplying?
How can we partition these numbers?

Where can we see 20 × 20?
What does the 40 represent?

What's the same and what's different between the three representations (Base 10, place value counters, grid)?

Varied Fluency

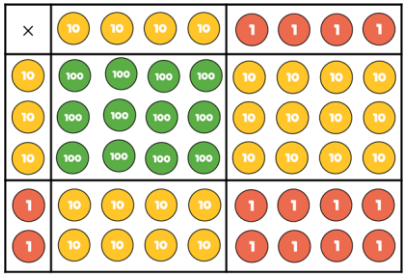
Whitney uses Base 10 to calculate 23 × 22



How could you adapt your Base 10 model to calculate these:

32 × 24 25 × 32 35 × 32

Rosie adapts the Base 10 method to calculate 44 × 32



×	40	4
30	1,200	120
2	80	8

Compare using place value counters and a grid to calculate:

45 × 42 52 × 24 34 × 43

Multiply 2-digits (Area Model)

Reasoning and Problem Solving

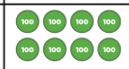
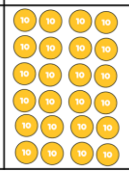
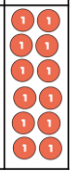
Eva says,

To multiply 23 by 57 I just need to calculate 20 × 50 and 3 × 7 and then add the totals.

What mistake has Eva made?
Explain your answer.

Eva's calculation does not include 20 × 7 and 50 × 3
Children can show this with concrete or pictorial representations.

Amir hasn't finished his calculation.
Complete the missing information and record the calculation with an answer.

×	40	2
40		
6		

Amir needs 8 more hundreds, 40 × 40 = 1,600 and he only has 800

His calculation is 42 × 46 = 1,932

Farmer Ron has a field that measures 53 m long and 25 m wide.

Farmer Annie has a field that measures 52 m long and 26 m wide.

Dora thinks that they will have the same area because the numbers have only changed by one digit each.

Do you agree? Prove it.

Dora is wrong. Children may prove this with concrete or pictorial representations.

Multiply 2-digits by 2-digits

Notes and Guidance

Children will move on from the area model and work towards more formal multiplication methods.

They will start by exploring the role of the zero in the column method and understand its importance.

Children should understand what is happening within each step of the calculation process.

Mathematical Talk

Why is the zero important?

What numbers are being multiplied in the first line and in the second line?

When do we need to make an exchange?

What can we exchange if the product is 42 ones?

If we know what 38 × 12 is equal to, how else could we work out 39 × 12?

Varied Fluency

Complete the calculation to work out 23 × 14

		2	3
×		1	4
		9 (1)	2
	2	3	0

(23 × 4)

(23 × 10)

Use this method to calculate:

34 × 26 58 × 15 72 × 35

Complete to solve the calculation.

		4	6
×		2	7
	3	2 (4)	2
	9 (1)	2	0

(___ × ___)

(___ × ___)

Use this method to calculate:

27 × 39 46 × 55 94 × 49

Calculate:

38 × 12 39 × 12 38 × 11

What's the same? What's different?

Multiply 2-digits by 2-digits

Reasoning and Problem Solving

Tommy says,

It is not possible to make 999 by multiplying two 2-digit numbers.

Do you agree?
Explain your answer.

Children may use a trial and error approach during which they'll further develop their multiplication skills.
They will find that Tommy is wrong because 27 × 37 is equal to 999

Amir has multiplied 47 by 36

		4	7
×		3	6
	2	8	2
	1	4	1
	3	2	3

4
2

Alex says,

Amir is wrong because the answer should be 1,692 not 323

Who is correct?
What mistake has been made?

Alex is correct. Amir has forgotten to use zero as a place holder when multiplying by 3 tens.

Multiply 3-digits by 2-digits

Notes and Guidance

Children will extend their multiplication skills to multiplying 3-digit numbers by 2-digit numbers. They will use multiplication to find area and solve multi-step problems.
Methods previously explored are still useful e.g. using an area model.

Mathematical Talk

Why is the zero important?

What numbers are being multiplied in the first line and the second line?

When do we need to make an exchange?

What happens if there is an exchange in the last step of the calculation?

Varied Fluency

Complete:

		1	3	2
×			1	4
		5	2 (1)	8
	1	3	2	0

(132 × 4)
(132 × 10)

Use this method to calculate:

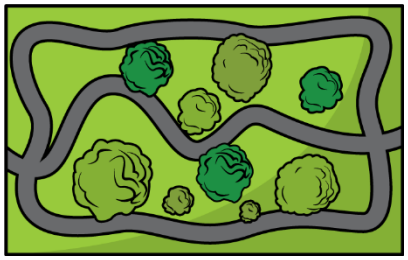
264 × 14 264 × 28

What do you notice about your answers?

Calculate:

637 × 24 573 × 28 573 × 82

A playground is 128 yards by 73 yards.



Calculate the area of the playground.

Multiply 3-digits by 2-digits

Reasoning and Problem Solving

$22 \times 111 = 2442$

$23 \times 111 = 2553$

$24 \times 111 = 2664$

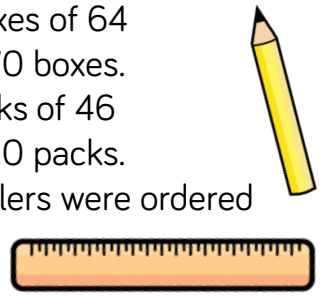
What do you think the answer to 25×111 will be?

What do you notice?

Does this always work?

The pattern stops at up to 28×111 because exchanges need to take place in the addition step.

Pencils come in boxes of 64
A school bought 270 boxes.
Rulers come in packs of 46
A school bought 720 packs.
How many more rulers were ordered than pencils?



15,840

Here are examples of Dexter's maths work.

			9	8	7
×				7	6
		5	59	42	2
		6	69	40	9
	1	12	8	13	1

			3	2	4
×				7	8
		2	15	39	2
	2	12	26	8	0
		3	2	7	2

He has made a mistake in each question.

Can you spot it and explain why it's wrong?

Correct each calculation.

In his first calculation, Dexter has forgotten to use a zero when multiplying by 7 tens.
It should have been $987 \times 76 = 75{,}012$

In the second calculation, Dexter has not included his final exchanges.
$324 \times 8 = \underline{2},592$
$324 \times 70 = \underline{2}2{,}680$
The final answer should have been 25,272

Multiply 4-digits by 2-digits

Notes and Guidance

Children will build on their understanding of multiplying a 3-digit number by a 2-digit number and apply this to multiplying 4-digit numbers by 2-digit numbers.

It is important that children understand the steps taken when using this multiplication method.

Methods previously explored are still useful e.g. grid.

Mathematical Talk

Explain the steps followed when using this multiplication method.

Look at the numbers in each question, can they help you estimate which answer will be the largest?

Explain why there is a 9 in the thousands column.

Why do we write the larger number above the smaller number?

What links can you see between these questions? How can you use these to support your answers?

Varied Fluency

- Use the method shown to calculate 2,456 × 34

		3	2	5	0	
×				2	6	
	1	9_{1}	5_{3}	0	0	(3,250 × 6)
	6	5_{1}	0	0	0	(3,250 × 20)
	8	4	5	0	0	

- Calculate

3,282 × 32 | 7,132 × 21 | 9,708 × 38

- Use <, > or = to make the statements correct.

4,458 × 56 ◯ 4,523 × 54

4,458 × 55 ◯ 4,523 × 54

4,458 × 55 ◯ 4,522 × 54

Multiply 4-digits by 2-digits

Reasoning and Problem Solving

Spot the Mistakes

Can you spot and correct the errors in the calculation?

		2	5	3	4
×				2	3
		$^{1}7$	5	$^{1}9$	2
		$_{1}5$	0	6	8
	1	2	$_{1}6$	$_{1}6$	0

There are 2 errors.
In the first line of working, the exchanged ten has not been added.
In the second line of working, the place holder is missing.
The correct answer should be 58,282

Teddy has spilt some paint on his calculation.

		2	[paint]	6	9
×				2	[paint]
	2	$^{6}2$	$^{5}9$	$^{7}5$	2
	$_{1}5$	$_{1}7$	$_{1}3$	[paint]	0
	[paint]	$_{1}0$	$_{1}3$	3	2

What are the missing digits?

What do you notice?

The missing digits are all 8

Divide 4-digits by 1-digit

Notes and Guidance

Children use their knowledge from Year 4 of dividing 3-digits numbers by a 1-digit number to divide up to 4-digit numbers by a 1-digit number.

They use place value counters to partition their number and then group to develop their understanding of the short division method.

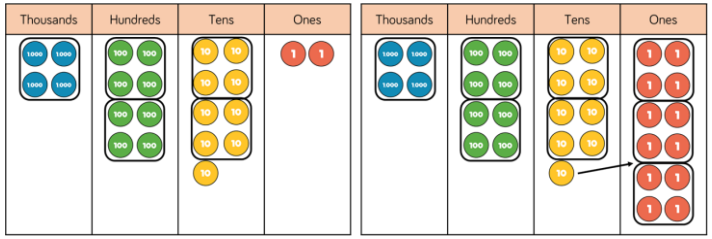
Mathematical Talk

How many groups of 4 thousands are there in 4 thousands?
How many groups of 4 hundreds are there in 8 hundreds?
How many groups of 4 tens are there in 9 tens?
What can we do with the remaining ten?
How many groups of 4 ones are there in 12 ones?

Do I need to solve both calculations to compare the divisions?

Varied Fluency

- Here is a method to calculate 4,892 divided by 4 using place value counters and short division.



	1	2	2	3
4	4	8	9	$^{1}2$

Use this method to calculate:

6,610 ÷ 5 2,472 ÷ 3 9,360 ÷ 4

- Mr Porter has saved £8,934
He shares it equally between his three grandchildren.
How much do they each receive?

- Use <, > or = to make the statements correct.

3,495 ÷ 5 ◯ 3,495 ÷ 3

8,064 ÷ 7 ◯ 9,198 ÷ 7

7,428 ÷ 4 ◯ 5,685 ÷ 5

Divide 4-digits by 1-digit

Reasoning and Problem Solving

Jack is calculating 2,240 ÷ 7

He says you can't do it because 7 is larger than all of the digits in the number.

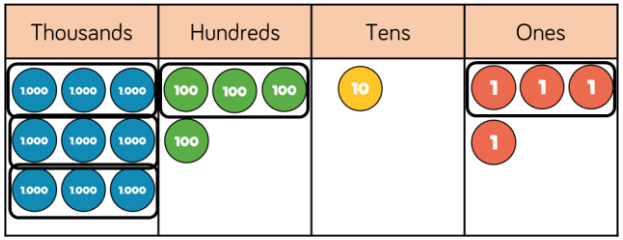
Do you agree with Jack?
Explain your answer.

Jack is incorrect.
You can exchange between columns.
You can't make a group of 7 thousands out of 2 thousand, but you can make groups of 7 hundreds out of 22 hundreds.

The answer is 320

Spot the Mistake

Explain and correct the working.



	3	1	0	1
3	9	4	1	4

There is no exchanging between columns within the calculation.
The final answer should have been 3,138

Divide with Remainders

Notes and Guidance

Children continue to use place value counters to partition and then group their number to further develop their understanding of the short division method.

They start to focus on remainders and build on their learning from Year 4 to understand remainders in context. They do not represent their remainder as a fraction at this point.

Mathematical Talk

If we can't make a group in this column, what do we do?

What happens if we can't group the ones equally?

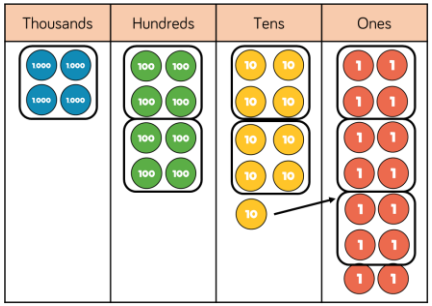
In this number story, what does the remainder mean?

When would we round the remainder up or down?

In which context would we just focus on the remainder?

Varied Fluency

- Here is a method to solve 4,894 divided by 4 using place value counters and short division.



	1	2	2	3		
4	4	8	9	1 4		r2

Use this method to calculate:

6,613 ÷ 5 2,471 ÷ 3 9,363 ÷ 4

- Muffins are packed in trays of 6 in a factory.
In one day, the factory makes 5,623 muffins.
How many trays do they need?
How many trays will be full?
Why are your answers different?

- For the calculation 8,035 ÷ 4
  - Write a number story where you round the remainder up.
  - Write a number story where you round the remainder down.
  - Write a number story where you have to find the remainder.

Divide with Remainders

Reasoning and Problem Solving

I am thinking of a 3-digit number.

When it is divided by 9, the remainder is 3

When it is divided by 2, the remainder is 1

When it is divided by 5, the remainder is 4

What is my number?

Possible answers:

129	219
309	399
489	579
669	759
849	939

Encourage children to think about the properties of numbers that work for each individual statement.
This will help decide the best starting point.

Always, Sometimes, Never?

A three-digit number made of consecutive descending digits divided by the next descending digit always has a remainder of 1

$765 \div 4 = 191$ remainder 1

How many possible examples can you find?

Sometimes

Possible answers:

$432 \div 1 = 432$ r 0
$543 \div 2 = 271$ r 1
$654 \div 3 = 218$ r 0
$765 \div 4 = 191$ r 1
$876 \div 5 = 175$ r 1
$987 \div 6 = 164$ r 3