Scheme of Learning

Year 5

#MathsEveryoneCan
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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🐦 [@WhiteRoseMaths](https://twitter.com/WhiteRoseMaths)

倌 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.
Meet the Team

The schemes have been developed by a wide group of passionate and enthusiastic classroom practitioners.
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
- Beth Prottey
- Rachel Wademan
- Emma Hawkins
- Scott Smith
- Valda Varadinek-Skelton
- Chloe Hall
- Charlotte James
- Joanne Stuart
- Michelle Cornwell

**Year 3 Team**
- Becky Stanley
- Nicola Butler
- Laura Collis
- Richard Miller
- Claire Bennett
- Chris Conway

**Year 4 Team**
- Terrie Litherland
- Susanne White
- Hannah Kirkman
- Daniel Ballard
- Isobel Gabanski
- Laura Stubbs

**Year 5 Team**
- Lynne Armstrong
- Laura Heath
- Clare Bolton
- Helen Eddie
- Chris Dunn
- Rebecca Gascoigne

**Year 6 Team**
- Lindsay Coates
- 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.
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
Notes and Guidance

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.
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.
Notes and Guidance

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
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<tr>
<th>Week 1</th>
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<td>Number: Place Value</td>
<td>Number: Addition and Subtraction</td>
<td>Statistics</td>
<td>Number: Multiplication and Division</td>
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Overview

Small Steps

- Multiply 4-digits by 1-digit
- Multiply 2-digits (area model)
- Multiply 2-digits by 2-digits
- Multiply 3-digits by 2-digits
- Multiply 4-digits by 2-digits
- Divide 4-digits by 1-digit
- 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.
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.

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?
Multiply 4-digits by 1-digit

Reasoning and Problem Solving

Alex calculated $1,432 \times 4$

Here is her answer.

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<td>12</td>
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</tbody>
</table>

$1,432 \times 4 = 416,128$

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.

$2,345 \times 5 = 11,725$
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.

**Notes and Guidance**

**Varied Fluency**

Whitney uses Base 10 to calculate $23 \times 22$

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

- $32 \times 24$
- $25 \times 32$
- $35 \times 32$

Rosie adapts the Base 10 method to calculate $44 \times 32$

Compare using place value counters and a grid to calculate:

- $45 \times 42$
- $52 \times 24$
- $34 \times 43$
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.

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

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<tr>
<th>x</th>
<th>40</th>
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Eva’s calculation does not include 20 × 7 and 50 × 3.
Children can show this with concrete or pictorial representations.

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.
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 $38 \times 12$ is equal to, how else could we work out $39 \times 12$?

### What’s the same? What’s different?

Use this method to calculate:

- $34 \times 26$
- $58 \times 15$
- $72 \times 35$

Use this method to calculate:

- $27 \times 39$
- $46 \times 55$
- $94 \times 49$

Calculate:

- $38 \times 12$
- $39 \times 12$
- $38 \times 11$
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 \(27 \times 37\) is equal to 999.

Amir has multiplied 47 by 36

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</table>

Alex says,

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

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

Who is correct? What mistake has been made?
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.

**Complete:**

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Use this method to calculate:

- \((132 \times 4)\)
- \(264 \times 14\)
- \(264 \times 28\)

What do you notice about your answers?

**Calculate:**

- \(637 \times 24\)
- \(573 \times 28\)
- \(573 \times 82\)

A playground is 128 yards by 73 yards.

Calculate the area of the playground.
Multiply 3-digits by 2-digits

Reasoning and Problem Solving

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

What do you think the answer to $25 \times 111$ will be?

What do you notice?

Does this always work?

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?

Here are examples of Dexter’s maths work.

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.
The final answer should have been $25,272$

Correct each calculation.

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

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?

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It should have been $987 \times 76 = 75,012$

In the second calculation, Dexter has not included his final exchanges.
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 $2,456 \times 34$

\[
\begin{array}{cccc}
3 & 2 & 5 & 0 \\
\times & & & 2 & 6 \\
\hline
1 & 9 & 5 & 0 \\
6 & 5 & 0 & 0 \\
8 & 4 & 5 & 0 \\
\hline
3,250 & 6 \\
3,250 & 20 \\
\end{array}
\]

Calculate

$3,282 \times 32$  
$7,132 \times 21$  
$9,708 \times 38$

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

$4,458 \times 56$ $<$ $4,523 \times 54$

$4,458 \times 55$ $<$ $4,523 \times 54$

$4,458 \times 55$ $<$ $4,522 \times 54$
Spot the Mistakes

Can you spot and correct the errors in the calculation?

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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 6 9
×  2
```
```
  2 6 5
2 9 5
```
```
  1 5 7 1 3 0
```
```
  1 0 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.

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
Jack is calculating $2,240 \div 7$

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.

There is no exchanging between columns within the calculation. The final answer should have been 3,138
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?
### Divide with Remainders

#### Reasoning and Problem Solving

I am thinking of a 3-digit number.

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<tr>
<th>When it is divided by 9, the remainder is 3</th>
<th>Possible answers:</th>
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<td>849</td>
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<tr>
<th>When it is divided by 2, the remainder is 1</th>
<th>Possible answers:</th>
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<td>399</td>
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<td>759</td>
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| When it is divided by 5, the remainder is 4 | Encourage children to think about the properties of numbers that work for each individual statement. This will help decide the best starting point. |

What is my number?

### 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 ÷ 4 = 191 remainder 1

How many possible examples can you find?

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<th>Sometimes</th>
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<tbody>
<tr>
<td>Possible answers:</td>
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<tr>
<td>432 ÷ 1 = 432 r 0</td>
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<td>543 ÷ 2 = 271 r 1</td>
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<td>654 ÷ 3 = 218 r 0</td>
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<tr>
<td>765 ÷ 4 = 191 r 1</td>
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<tr>
<td>876 ÷ 5 = 175 r 1</td>
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<tr>
<td>987 ÷ 6 = 164 r 3</td>
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