Scheme of Learning

Year 5

#MathsEveryoneCan
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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

✉️ [support@whiterosemaths.com](mailto:support@whiterosemaths.com)

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

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.
- This year there will also be updated assessments.
- We are also working 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.

Caroline Hamilton  
Beth Smith  
Kelsey Brown  
Julie Matthews  
Faye Hirst  
Emma Davison  
Mary-Kate Connolly  
Kate Henshall  
Sam Shutkever  
Rachel Otterwell  
Jenny Lewis  
Stephen Monaghan
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
- Beth Prottey
- Rachel Wademan
- Emma Hawkins
- Scott Smith
- Valda Varadineck-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.
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 spreadsheet 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 a 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.

**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 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
Jack  Whitney  Amir  Dora
Alex  Tommy
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<th>Week 1</th>
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**Consolidation:**
Overview

Small Steps

- Numbers to 10,000
- Roman Numerals to 1,000
- Round to nearest 10, 100 and 1,000
- Number to 100,000
- Compare and order numbers to 100,000
- Round numbers within 100,000
- Numbers to a million
- Counting in 10s, 100s, 1,000s, 10,000s, and 100,000s
- Compare and order numbers to one million
- Round numbers to one million
- Negative numbers

NC Objectives

- Read, write, order and compare numbers to at least 1,000,000 and determine the value of each digit.
- Count forwards or backwards in steps of powers of 10 for any given number up to 1,000,000.
- Interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers including through zero.
- Round any number up to 1,000,000 to the nearest 10, 100, 1,000, 10,000 and 100,000.
- Solve number problems and practical problems that involve all of the above.
- Read Roman numerals up to 1,000 (M) and recognise years written in Roman numerals.
**Numbers to 10,000**

**Notes and Guidance**

Children use concrete manipulatives and pictorial diagrams to recap representing numbers up to 10,000.

Within this step, ensure children revise adding and subtracting 10, 100 and 1,000, and discuss what is happening to the place value columns.

**Mathematical Talk**

Show me 8,045 in three different ways.

Do you prefer to use concrete objects or draw an image pictorially? Why?

Make 1,500 and explain why you choose to make it in this way (use this to see what concrete objects children choose to use).

**Varied Fluency**

- **Match the diagram to the number.**
  - 4,005
  - 4,500
  - 4,050
  - 1,005
  - 3,000

- **Which diagram is the odd one out?**
  - 5,000
  - 6,000

- **Complete the table.**
<table>
<thead>
<tr>
<th></th>
<th>Add 10</th>
<th>Add 100</th>
<th>Add 1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,506</td>
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<td>7,999</td>
<td></td>
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<td>6,070</td>
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</tbody>
</table>
Numbers to 10,000

Reasoning and Problem Solving

Harriet has made five numbers, using the digits 1, 2, 3 and 4.
She has changed each number into a letter.
Her numbers are:
- aabcd
- acdbc
- dcaba
- cdaad
- bdaab

Here are three clues to work out her numbers:
- The first number in her list is the greatest number.
- The digits in the fourth number total 12.
- The third number in the list is the smallest number.

Simon says he can order the following numbers by only looking at the first three digits.

He is incorrect because two of the numbers start with twelve thousand, five hundred therefore you need to look at the tens to compare and order.

Is he correct?

Explain your answer.
Roman Numerals

Notes and Guidance

Building on their Year 4 knowledge of Roman Numerals to 100, children explore Roman Numerals to 1,000. They explore what is the same and what is different between the number systems, for example there is no zero.

Teachers could introduce writing the date in Roman Numerals to revise the concept on a daily basis.

Mathematical Talk

Why is there no zero in Roman Numerals? What might it look like?

Do you notice any patterns? Look at 30 and 300

How can you check you have represented the Roman Numeral correctly?

Varied Fluency

Lollipop stick activity. The teacher shouts out a number and the children make it with lollipop sticks. Children could also do this in pairs or groups, or for a bit of fun they could test the teacher!

Each diagram shows a number in digits, words and Roman Numerals.

Complete the diagrams.

Complete the function machines.

\[ \text{CCC} \rightarrow +10 \rightarrow \text{DCLXXV} \]
Roman Numerals

Reasoning and Problem Solving

**Solve**

CCCL + CL =

How many calculations, using Roman Numerals, can you write to get the same total?

**Possible answers:**

CD + C
M ÷ II
C + CC + CC
C × V

Here is part of a Roman Numerals hundred square.

Complete the missing values.

<table>
<thead>
<tr>
<th>XLIV</th>
<th>XLV</th>
<th>XLVII</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LVI</td>
<td>LVII</td>
</tr>
<tr>
<td>LXIV</td>
<td>LXVI</td>
<td>LXVII</td>
</tr>
</tbody>
</table>

What patterns do you notice?

**Missing Roman Numerals from the top row and left to right:**

- XLVI
- LIV
- LV
- LXV
Round to 10, 100 and 1,000

Notes and Guidance

Children build on their Year 4 knowledge of rounding to 10, 100, and 1,000. They need to experience rounding up to and within 10,000.

They need to understand that the column form the question and the column to the right of it are used e.g. round 1,450 to the nearest hundred – look at the hundreds and tens columns.

Mathematical Talk

Which place value column do we need to look at when we round to the nearest 1,000?

When is it best to round to 10? 100? 1,000?
Can you give an example of this?
Can you justify your reasoning?

Is there more than one solution?
Will the answers to the nearest 100 and 1,000 be the same or different for the different start numbers?

Varied Fluency

Complete the table.

<table>
<thead>
<tr>
<th>Start Number</th>
<th>Rounded to the nearest 10</th>
<th>Rounded to the nearest 100</th>
<th>Rounded to the nearest 1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,100</td>
<td>10</td>
<td>100</td>
<td>1,000</td>
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<tr>
<td>DCCLXIX</td>
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</table>

For each number, find five numbers that round to it when rounding to the nearest 100:

- 300, 10,000, 8,900

Complete the table.

<table>
<thead>
<tr>
<th>Start Number</th>
<th>Nearest 10</th>
<th>Nearest 100</th>
<th>Nearest 1,000</th>
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### Rounding to 10, 100 and 1,000

#### Reasoning and Problem Solving

| My number rounded to the nearest 10 is 1,150  
  Rounded to the nearest 100 it is 1,200  
  Rounded to the nearest 1,000 it is 1,000 | 1,150  
  1,151  
  1,152  
  1,153  
  1,154 | I do not agree with Whitney because 2,567 rounded to the nearest 100 is 2,600. I know this because if the tens digit is 5, 6, 7, 8 or 9 we round up to the next hundred. |
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<tr>
<td>What could Jack's number be?</td>
<td>2,567 to the nearest 100 is 2,500</td>
<td>Teddy has correctly changed four thousand to five thousand but has added the tens and the ones back on. When rounded to the nearest thousand the hundreds tens and ones will be zeros.</td>
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<td>Can you find all of the possibilities?</td>
<td>Do you agree with Whitney? Explain why.</td>
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Children focus on numbers up to 100,000. They represent numbers on a place value grid, read and write numbers and place them on a number line to 100,000.

Varied Fluency

A number is shown in the place value grid.

<table>
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<th>10,000s</th>
<th>1,000s</th>
<th>100s</th>
<th>10s</th>
<th>1s</th>
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<td>🍎🍎🍎🍎</td>
<td>🍎🍎🍎🍎</td>
<td>🍎🍎🍎🍎</td>
</tr>
</tbody>
</table>

Write the number in figures and in words.
- Ashy adds 10 to this number
- Zack adds 100 to this number
- Isobel adds 1,000 to this number

Write each of their new numbers in figures and in words.

Complete the grid to show the same number in different ways.

<table>
<thead>
<tr>
<th>Counters</th>
<th>Part-whole model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar model</td>
<td>65,048</td>
</tr>
<tr>
<td>Number line</td>
<td></td>
</tr>
</tbody>
</table>

Complete the missing numbers.
- \( 59,000 = 50,000 + \) _____
- _____ = 30,000 + 1,700 + 230
- 75,480 = _____ + 300 + _____

How can we estimate a number on a number line if there are no divisions?

How many digits change when you add 10,100 or 1,000?

Do you need to count forwards and backwards to find out if a number is in a number sequence? Explain.
Numbers to 100,000

Reasoning and Problem Solving

Here is a number line.

A = 2,800
B = 2,760
C is 500 less than B.
Add C to the number line.

Jennie counts forwards and backwards in 10s from 317

Circle the numbers Jennie will count.

Possible answers:
2 ten thousands, 6 hundreds and 5 tens
20 thousands, 7 thousands and 650 ones

Any positive number will have to end in a 7
Any negative number will have to end in a 3

427
997
5,627
507
7
−3
−23

428x194
Compare and Order

Notes and Guidance

Building on their learning from Year 4, children will compare and order numbers up to 100,000

Children should be able to do this with numbers presented in a variety of ways.

Mathematical Talk

In order to compare numbers, what do we need to know?

What is the value of each digit?

What is the value of _____ in this number?

What is the value of the whole? Can you suggest other parts that make the whole?

Can you write a story to support your part-whole model?

Varied Fluency

Order the following.

<table>
<thead>
<tr>
<th>10,000s</th>
<th>1,000s</th>
<th>100s</th>
<th>10s</th>
<th>1s</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Add the symbol <, > or = to make the statement correct.

Use six counters to make five different 5 digit numbers.

<table>
<thead>
<tr>
<th>10,000s</th>
<th>1,000s</th>
<th>100s</th>
<th>10s</th>
<th>1s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Order your numbers from greatest to smallest.
Compare and Order

Reasoning and Problem Solving

Place the digits cards 0 to 9 face down and select five of them.

Make the greatest number possible and the smallest number possible.

How do you know this is the greatest or smallest?

Dependent on numbers chosen. e.g. 4, 9, 1, 3, 2

Smallest: 12,349
Greatest: 94,321

I know this is the greatest number because the digit cards with the larger numbers are in the place value columns with the greater values.

Using the digit cards 0 to 9, create three different five digit numbers that fit the following clues:

- The digit in the hundreds column and the ones column have a difference of 2
- The digit in the hundreds column and the ten thousands column has a difference of 2
- The sum of all the digits totals 19

Possible answers:
47,260
56,341
18,325
20,476
Round within 100,000

Notes and Guidance

Children continue with work on rounding, now using numbers up to 100,000. They round to the nearest 10, 100, 1,000 and 10,000.

Children use their knowledge of multiples to work out which two numbers the number they are rounding sits between.

Mathematical Talk

Which place value column do we need to look at when we round to the nearest 1,000?

When is it best to round to 10? 100? 1,000?
Can you give an example of this?
Can you justify your reasoning?

Varied Fluency

Round 85,617
- To the nearest 10
- To the nearest 100
- To the nearest 1,000
- To the nearest 10,000

Round the distances to the nearest 1,000 miles.

<table>
<thead>
<tr>
<th>Destination</th>
<th>Miles from Manchester airport</th>
<th>Miles to the nearest 1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>3,334</td>
<td></td>
</tr>
<tr>
<td>Sydney</td>
<td>10,562</td>
<td></td>
</tr>
<tr>
<td>Hong Kong</td>
<td>5,979</td>
<td></td>
</tr>
<tr>
<td>New Zealand</td>
<td>11,550</td>
<td></td>
</tr>
</tbody>
</table>

Complete the table.

<table>
<thead>
<tr>
<th>Rounded to the nearest 100</th>
<th>Start Number</th>
<th>Rounded to the nearest 1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>15,999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26,392</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55,555</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Round within 100,000

#### Reasoning and Problem Solving

<table>
<thead>
<tr>
<th>Round 59,996 to the nearest 1,000</th>
<th>Both numbers round to 60,000</th>
<th>Two five digit numbers have a difference of 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round 59,996 to the nearest 10,000</td>
<td>Other examples:</td>
<td>When they are both rounded to the nearest thousand, the difference is 1,000</td>
</tr>
<tr>
<td>What do you notice about the answers?</td>
<td>19,721 to the nearest 1,000 and 10,000</td>
<td>What could the numbers be?</td>
</tr>
<tr>
<td>Can you think of three more numbers where the same thing could happen</td>
<td>697 to the nearest 10 and 100</td>
<td>Two numbers with a difference of five where the last three digits are between 495 and 504</td>
</tr>
<tr>
<td></td>
<td>22,982 to the nearest 100 and 1,000</td>
<td>e.g. 52,498 and 52,503</td>
</tr>
</tbody>
</table>
Numbers to One Million

Notes and Guidance

Children read, write and represent numbers to 1,000,000

Children need to see numbers represented with counters on a place value grid, as well as drawing the counters.

Mathematical Talk

If one million is the whole, what could the parts be?

Show me 800,500 in three different ways.

Where do the commas go in the numbers? How does the place value grid help?

How else can the numbers be represented?

Varied Fluency

<table>
<thead>
<tr>
<th>Thousands</th>
<th>Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>T</td>
</tr>
</tbody>
</table>

Use counters to make these numbers on the place value chart.

32,651 456,301 50,030

Can you say the numbers out loud?

Complete the following part-whole diagrams.

Katya has the following number.

<table>
<thead>
<tr>
<th>Thousands</th>
<th>Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>T</td>
</tr>
</tbody>
</table>

She adds 4 counters to the hundreds column. What is her new number?
Numbers to One Million

Reasoning and Problem Solving

Show the value of the digit 7 in each of the following numbers.

407,338: the value is 7 thousand. It is to the left of the hundreds column.

700,491: the value is 7 hundred thousand. It is a 6-digit number and there are 5 other numbers in place value columns to the right of this number.

25,571: the value is 7 tens. It is one column to the left of the ones column.

The bar models are showing a pattern.

<table>
<thead>
<tr>
<th>40,000</th>
<th>25,000</th>
<th>15,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>40,000</td>
<td>20,000</td>
<td>20,000</td>
</tr>
<tr>
<td>40,000</td>
<td>15,000</td>
<td>25,000</td>
</tr>
</tbody>
</table>

Draw the next three.

Create your own pattern of bar models for a partner to continue.
Counting in Powers of 10

Notes and Guidance

Children complete number sequences and can describe the term to term rule e.g. add ten each time.

They count forwards and backwards in powers of ten up to 1,000,000

Mathematical Talk

What happens to the pattern when you move into negatives?

What patterns do you notice when you compare sequences increasing or decreasing in 10s, 100s, 1,000s etc.?

Can you create a rule for the sequence?

Varied Fluency

Complete the sequence.

___, ___, 2, ___, 22, ___, 42, ___, ___, 72

The rule for the sequence is:

Circle and correct the mistake in each sequence.

7,875, 8,875, 9,875, 11,875, 12,875, 13,875, ...
864,664, 764,664, 664,664, 554,664, 444,664, ...

Here is a Gattegno chart showing 32,450

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>100</td>
<td>200</td>
<td>300</td>
<td>400</td>
<td>500</td>
<td>600</td>
<td>700</td>
<td>800</td>
<td>900</td>
</tr>
<tr>
<td>1000</td>
<td>2000</td>
<td>3000</td>
<td>4000</td>
<td>5000</td>
<td>6000</td>
<td>7000</td>
<td>8000</td>
<td>9000</td>
</tr>
<tr>
<td>10000</td>
<td>20000</td>
<td>30000</td>
<td>40000</td>
<td>50000</td>
<td>60000</td>
<td>70000</td>
<td>80000</td>
<td>90000</td>
</tr>
</tbody>
</table>

Give children a target number to make then let them choose a card. Children then need to adjust their number on the chart.
Counting in Powers of 10

Reasoning and Problem Solving

Amir writes the first five numbers of a sequence.

They are 3,666, 4,666, 5,666, 6,666, 7,666

The 10th term will be 15,322 because I will double the 5th term.

Is he correct? Explain why.

The 10th term is 12,666 because Amir is adding 1,000 each time. He should have added 5,000 not doubled the 5th term.

I am counting up in 10s from 184
I will include 224

Mo

I am counting up in 100s from 604
I will include 1,040

Rosie

I am counting up in 1,000s from 13
I will include 130,000

Jack

Who has made a mistake? Identify anyone who has made a mistake and explain how you know.

Rosie has made a mistake. She is counting in 100s; therefore the ones column should never change.

Henry has also made a mistake as he is counting in 1,000s, so the tens and ones columns won’t change.
Compare and Order

Notes and Guidance

Children compare and order numbers up to 1,000,000 using comparison vocabulary and symbols.

They use a number line to compare numbers, and look at the importance of focusing on the column with the highest place value when comparing numbers.

Mathematical Talk

In order to compare, what do we need to know?

What is the value of each digit?

What is the value of ____ in this number?

What is the value of the whole? Can you suggest other parts that make the whole?

Can you write a story to support your part-whole model?

Varied Fluency

Put the number cards in order of size.

13,010  13,100  13,011  13,110  13,111

Estimate the values of A, B and C.

A  B  C

Here is a table showing the population in areas of Yorkshire.

<table>
<thead>
<tr>
<th>Area</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halifax</td>
<td>88,134</td>
</tr>
<tr>
<td>Brighouse</td>
<td>32,360</td>
</tr>
<tr>
<td>Leeds</td>
<td>720,492</td>
</tr>
<tr>
<td>Huddersfield</td>
<td>146,234</td>
</tr>
<tr>
<td>Wakefield</td>
<td>76,886</td>
</tr>
<tr>
<td>Bradford</td>
<td>531,200</td>
</tr>
</tbody>
</table>

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

The population of Halifax ____ the population of Wakefield.
Double the population of Brighouse ____ the population of Halifax.
The missing number is an odd number.

When rounded to the nearest 10,000 it is 440,000

The sum of the digits is 23

475,000   ?   407,500

Greatest   Smallest

What could the number be?

Can you find three possibilities?

Possible answers:
444,812
435,812
439,502

Here are four number cards.

42,350   43,385
56,995   56,963

Four children take one each and say a clue.

Mo: 56,995
Rosie: 42,350
Jack: 43,385
Kyra: 56,963

My number is 57,000 when rounded to the nearest 100

My number has exactly three hundreds in it

My number is 43,000 when rounded to the nearest thousand

My number is exactly 100 less than 57,063

Which card did each child have?
Round within a Million

Notes and Guidance

Children use up to 6-digit numbers to recap previous rounding and learn the new skill of rounding to the nearest 100,000.

They look at cases when rounding a number for a purpose, and in certain contexts, goes against the general rules of rounding.

Varied Fluency

Round these populations to the nearest 100,000

<table>
<thead>
<tr>
<th>City</th>
<th>Population</th>
<th>Rounded to the nearest 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leeds</td>
<td>720,492</td>
<td></td>
</tr>
<tr>
<td>Durham</td>
<td>87,559</td>
<td></td>
</tr>
<tr>
<td>Sheffield</td>
<td>512,827</td>
<td></td>
</tr>
<tr>
<td>Birmingham</td>
<td>992,000</td>
<td></td>
</tr>
</tbody>
</table>

Round 450,985 to the nearest
- 10
- 100
- 1,000
- 10,000
- 100,000

At a festival, 218,712 people attend across the weekend. Tickets come in batches of 100,000.

How many batches should the organisers buy? Explain why this goes against the rounding rule.

Mathematical Talk

How many digits does one million have?

Partition these numbers. Show me.

Which digits do you need to look at when rounding to the nearest 10? 100? 1,000? 10,000? 100,000?

How do you know which is the greatestt value? Show me.
Round within a Million

Reasoning and Problem Solving

The difference between two 3-digit numbers is two.

When each number is rounded to the nearest 1,000 the difference between them is 1,000

What could the two numbers be?

499 and 501
498 and 500

When the difference between A and B is rounded to the nearest 100, the answer is 700

When the difference between B and C is rounded to the nearest 100, the answer is 400

A, B and C are not multiples of 10

What could A, B and C be?

A = 1,240
B = 506
C = 59

A − B = in the range of and including 650 to 749

B has to be greater than 400 to complete

B − C = 400

Possible answer:
Negative Numbers

Notes and Guidance

Children continue to explore negative numbers and their position on a number line.

They need to see and use negative numbers in context, and be able to count back through zero.

Mathematical Talk

Do we include zero when counting backwards?

Which is the coldest? Warmest?

What was the temperature increase? Decrease?

Varied Fluency

Here are three representations for negative numbers.

What is the same and what is different about each representation?

Estimate and label where 0, −12 and −20 will be on the number line.

Jane visits a zoo.

The rainforest room has a temperature of 32°C
The Arctic room has a temperature of −24°C
Show the difference in room temperatures on a number line.
### True or False?

- The temperature outside is $-5$ degrees, the temperature inside is 25 degrees.  
  The difference is 20 degrees.  
- Four less than negative six is minus two.  
- $15$ more than $-2$ is $13$

Explain how you know each statement is true or false.

<table>
<thead>
<tr>
<th>False: the difference is 30 degrees because it is 5 degrees from $-5$ to 0. Added to 25 totals 30.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>False: it is negative 10 because the steps are going further away from zero.</td>
<td></td>
</tr>
<tr>
<td>True</td>
<td></td>
</tr>
<tr>
<td>Children may use concrete or pictorial resources to explain.</td>
<td></td>
</tr>
</tbody>
</table>

Put these statements in order so that the answers are from smallest to greatest.

- The difference between $-24$ and $-76$
- The even number that is less than $-18$ but greater than $-22$  
- The number that is half way between 40 and $-50$  
- The difference between $-6$ and 7

Ordered: $-20, -5, 13, 52$
Overview
Small Steps

- Add whole numbers with more than 4 digits (column method)
- Subtract whole numbers with more than 4 digits (column method)
- Round to estimate and approximate
- Inverse operations (addition and subtraction)
- Multi-step addition and subtraction problems

NC Objectives

Add and subtract numbers mentally with increasingly large numbers.

Add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction). Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy.

Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.
Add More than 4-digits

Notes and Guidance

Children will build upon previous learning of column addition. They will now look at numbers with more than four digits and use their place value knowledge to line the numbers up accurately. Children will learn that when there are more than ten thousands in the thousands column these can be exchanged for ten thousands.

Mathematical Talk

Will you have to exchange? How do you know which columns will be affected?

Does it matter that the two numbers don’t have the same amount of digits?

Which number goes on top in the calculation? Does it affect the answer?

Varied Fluency

Use a place value grid and counters to calculate 4,434 + 3,325.

Show the column method alongside.

How does the column method represent the concrete?

Calculate.

<table>
<thead>
<tr>
<th>Th</th>
<th>H</th>
<th>T</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4</th>
<th>8</th>
<th>2</th>
<th>7</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>5</td>
<td>6</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Can you think of a sensible story to represent each calculation?

Use the column method to calculate:

54,311 + 425 + 3,501

35,622 + 24,316 + 743

3,942 + 14,356 + 88
Add More than 4-digits

Reasoning and Problem Solving

Sam is discovering numbers on a Gattegno chart.

He makes this number.

He moved the counter on the thousands row, he moved it from 4,000 to 7,000

Sam moves one counter three spaces on a horizontal line to create a new number.

When he adds this to his original number he gets 131,130

Which counter did he move?

Work out the missing numbers.

\[ 54,937 + 23,592 = 78,529 \]

\[
\begin{array}{cccc}
? & 4 & ? & 3 \\
2 & ? & 5 & ?
\end{array}
\]

\[
\begin{array}{cccc}
7 & 8 & 5 & 2 \end{array}
\]
Subtract More than 4-digits

Notes and Guidance

Building on Year 4, children use their knowledge of subtracting using the formal column method to subtract more than four digit numbers. Children will be focusing on exchange and will be concentrating on the correct place value. It is important that children know when an exchange is and isn’t needed. Children need to experience ‘0’ as a place holder.

Mathematical Talk

Why is it important that we start subtracting the ones first? What could happen if we didn’t? Does it matter which number goes on top? Why? Will you have to exchange? How do you know which columns will be affected? Does it matter that the two numbers don’t have the same amount of digits?

Varied Fluency

A plane is flying at 29,456 feet.
During the flight the plane descends 8,896 feet.
It then descends another 989 feet.
What height is the plane now flying at?

Using column subtraction answer:
Adam earns £37,506 pounds a year.
Sarah earns £22,819 a year.
How much more money does Adam earn than Sarah?

Calculate:

\[4,648 - 2,347\]

\[45,536 - 8,426\]
Subtract More than 4-digits

Reasoning and Problem Solving

Gina makes a 5-digit number.
Mike makes a 4-digit number.
The difference between their numbers is 3,465
What could their numbers be?

Possible answers:
9,658 and 14,023
12,654 and 8,289
5,635 and 10,000
Etc.

Holly completes this subtraction incorrectly.

```
28701
- 7621
---
21180
```

Explain the mistake to Holly and correct it for her.

Holly did not write down the exchange she made when she exchanged 1 hundred for 10 tens. This means she still had 7 hundreds subtract 6 hundreds when she should have 6 hundreds subtract 6 hundreds. The correct answer is 21,080.
Estimate and Approximate

Notes and Guidance

Children build on their understanding of estimating and rounding to estimate answers for calculations and problems. The term approximate is used throughout.

Varied Fluency

Which is the best question to estimate the total of 22,223 and 5,687?
- \(2220 + 5690\)
- \(22230 + 5690\)
- \(22220 + 5680\)

The children from West Pool Junior School all go on a whole school trip to a museum. There are 30 children in each year group and all 4 year groups go. The cost for each child is as follows:

<table>
<thead>
<tr>
<th>Cost</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of ticket</td>
<td>9.95</td>
</tr>
<tr>
<td>Cost of coach</td>
<td>7.63</td>
</tr>
<tr>
<td>Cost of lunch</td>
<td>3.32</td>
</tr>
</tbody>
</table>

What is the approximate cost for each individual child?

Here are the total costs for the whole school trip:

<table>
<thead>
<tr>
<th>Cost</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost of tickets</td>
<td>1,194</td>
</tr>
<tr>
<td>Total cost of coach</td>
<td>915.60</td>
</tr>
<tr>
<td>Total cost of lunches</td>
<td>398.49</td>
</tr>
</tbody>
</table>

What is the approximate total cost of the trip?

Mathematical Talk

Which numbers shall I round to?
Why should I round to this number?
Why should an estimate be quick?
When, in real life, would we use an estimate?
Estimate and Approximate

Reasoning and Problem Solving

True or False?

49,999 – 19,999 = 50,000 – 20,000

True

Dora has used her related number facts. Both numbers on the right have decreased by 1 therefore whatever the difference is, it will remain the same as the left hand side.

How could Dora have worked this out?

I did not need to use a written method to work this out.

Which estimate is inaccurate?

a)  

b)  

c)  

B is inaccurate. The arrow is about a quarter of the way along the number line so it should be 30,000

Explain how you know.
Inverse Operations

Notes and Guidance

In this small step, children will use their knowledge of addition and subtraction to check their workings to ensure accuracy. They use the commutative law to see that addition can be done in any order but subtraction cannot.

Mathematical Talk

How can you tell if your answer is sensible?
What is the inverse of addition?
What is the inverse of subtraction?

Varied Fluency

When calculating 17,468 - 8,947, which answer gives the corresponding addition question?

- 8,947 + 8,631 = 17,468
- 8,947 + 8,521 = 17,468
- 8,251 + 8,947 = 17,468

I'm thinking of a number.
After I add 5,241 and subtract 352, my number is 9,485
What was my original number?

Amy and Matthew are playing their favourite computer game.
Amy’s current high score is 8,524
Matthew’s high score is bigger than Amy’s.
The total of both of their scores is 19,384

What is Matthew’s high score?
Inverse Operations

Reasoning and Problem Solving

Complete the pyramid using addition and subtraction.

<table>
<thead>
<tr>
<th>4,946</th>
<th>3,172</th>
<th>2,611</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,976</td>
<td>6,415</td>
<td>7,616</td>
</tr>
<tr>
<td>14,031</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55,907</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From left to right:

- Bottom row: 3,804, 5,005
- Second row: 8,118
- Third row: 15,094, 13,391
- Fourth row: 28,485, 27,422

Mo, Whitney, Teddy and Eva collect marbles.

- Mo: I have 1,648 marbles.
- Whitney: I have double the amount of marbles Mo has.
- Teddy: I have half the amount of marbles Mo has.

In total they have 8,524 marbles between them. How many does Eva have?

Eva has 2,756 marbles.
Multi-step Problems

Notes and Guidance

In this small step children will be using their knowledge of addition and subtraction to solve multi-step problems. The problems will appear in different contexts and in different forms, i.e. bar models and word problems.

Varied Fluency

- When Claire opened her book, she saw two numbered pages. The sum of these two pages was 317. What would the next page number be?

- Adam is twice as old as Barry. Charlie is 3 years younger than Barry. The sum of all their ages is 53. How old is Barry?

- The sum of two numbers is 11,339. The difference between the same two numbers is 1,209. Use the bar model to help you find the numbers.

Mathematical Talk

What is the key vocabulary in the question?

What are the key bits of information?

Can we put this information into a model?

Which operations do we need to use?
Multi-step Problems

Reasoning and Problem Solving

A milkman has 250 bottles of milk. He collects another 160 from the dairy, and delivers 375 during the day. How many does he have left?

My method:

375 − 250 = 125
125 + 160 = 285

Tommy is wrong. He should have added 250 and 160, then subtracted 375 from the answer. There are 35 bottles of milk remaining.

On Monday, Dupree was paid £114.

On Tuesday, he was paid £27 more than on Monday.

On Wednesday, he was paid £27 less than on Monday.

How much was Dupree paid in total?

How many calculations did you do?

Is there a more efficient method?

£342

Children might add 114 and 27, subtract 27 from 114 and then add their numbers.

A more efficient method is to recognise that the ‘£27 more’ and ‘£27 less’ cancel out so they can just multiply £114 by three.

Do you agree with Tommy? Explain why.
### Overview

#### Small Steps

- Read and interpret line graphs
- Draw line graphs
- Use line graphs to solve problems
- Read and interpret tables
- Two-way tables
- Timetables

### NC Objectives

Solve comparison, sum and difference problems using information presented in a line graph.

Complete, read and interpret information in tables including timetables.
Read & Interpret Line Graphs

Notes and Guidance

Children are introduced to line graphs. They use their knowledge of scales to read information accurately. They look at effective ways to read a line graph and answer questions relating to the graphs.

Children use data in different real life contexts.

Mathematical Talk

What do you notice about the scale on the vertical axis?

What would happen if you used a different scale?

Can you think of two questions to ask each other about your graph?

Where have you seen information presented in line graphs? Is it clear?

Varied Fluency

- What was the lowest temperature record on the graph?
- What was the time when freezing point was reached?
- Can you estimate what the temperature was at 6pm?
- The temperature was below 0°C for ___ hours.

This line graph shows the population growth of a town. What was the population of the town in 1985?

- In what year did the population reach double the population of 1985?
- By how much had the population grown between 1990 and 2010?
The graph shows how many cars were sold by two different companies in the first 5 months of 2017. Blue represents Ace Motors and red represents Briggs.

2,000
Ace 5,500
Briggs 4,500
Difference of 1,000
Ace sold more.

Points on graph are all half an interval up from Briggs.

- How many more cars did Ace Motors sell than Briggs in April?
- For the first 3 months of the year compare the total sales for each company. Who sold more and by how many?
- Crooks Motors sold 250 more cars than Briggs each month. Plot their sales on the graph.

Match the graph to the activity.

A car travels at constant speed on the motorway.
A car is parked outside a house.
A car drives to the end of the road and back.

The first graph matches with the second statement.
Second graph with the third statement.
Third graph with the first statement.
Draw Line Graphs

Notes and Guidance

Children use their knowledge of scales and coordinates to represent data as a line graph. Drawing line graphs is a Year 5 Science objective and has been included here to support this learning and link to reading and interpreting graphs. Children draw axis with different scales depending on the data they are representing.

Mathematical Talk

What intervals will you use? What will each square represent? What does the x-axis represent? What does the y-axis represent? Why are line graphs useful? What makes them different to other types of graphs? What data could we collect?

Varied Fluency

The table shows average rainfall in Leicester over a year. Complete the graph below using the information from the table.

<table>
<thead>
<tr>
<th>Month</th>
<th>Rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>54</td>
</tr>
<tr>
<td>February</td>
<td>40</td>
</tr>
<tr>
<td>March</td>
<td>38</td>
</tr>
<tr>
<td>April</td>
<td>38</td>
</tr>
<tr>
<td>May</td>
<td>48</td>
</tr>
<tr>
<td>June</td>
<td>46</td>
</tr>
<tr>
<td>July</td>
<td>58</td>
</tr>
<tr>
<td>August</td>
<td>60</td>
</tr>
<tr>
<td>September</td>
<td>50</td>
</tr>
<tr>
<td>October</td>
<td>57</td>
</tr>
<tr>
<td>November</td>
<td>65</td>
</tr>
<tr>
<td>December</td>
<td>50</td>
</tr>
</tbody>
</table>

Here is a table showing the conversion between pounds and rupees. Put the information into a line graph.

<table>
<thead>
<tr>
<th>Pounds</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rupees</td>
<td>80</td>
<td>160</td>
<td>240</td>
<td>320</td>
<td>400</td>
<td>480</td>
<td>560</td>
<td>640</td>
<td>720</td>
<td>800</td>
</tr>
</tbody>
</table>
Draw Line Graphs

Reasoning and Problem Solving

Activity

This would be a good opportunity to collect your own data and draw a line graph to display the results. As this objective is taken from the science curriculum, it would be a good idea to link it to this or PE.

- Measuring shadows over time
- Melting and dissolving substances
- Plant growth

Here is a line graph showing the effect that exercise had on Jimmy's heart during Monday's PE lesson.

What was Jimmy's heart rate at 1 min 15 secs?

At what time was Jimmy's heart rate 130 beats per minute?

70 bpm

Approximately 3 mins 30 secs and 5 mins 45 secs
Problems with Line Graphs

Notes and Guidance

Children will use line graphs to solve problems. They may use prepared graphs and also graphs which they have drawn themselves, and will make links to other subjects, particularly science.

They need to consider comparison, sum and difference problems.

Mathematical Talk

How is the information organised?

Is it clear?

What else does this graph tell you?

What does it not tell you?

Varied Fluency

What was the highest/lowest temperature?
What time did they occur?
What is the difference between the highest and lowest temperature?
How long did the temperature stay at freezing point or less?

What could have happened at 5 minutes?
What could have happened at 7 minutes?
Estimate what the pulse rate was after 2 and a half minutes. How did you get an accurate estimate?
Problems with Line Graphs
Reasoning and Problem Solving

Carry out your own exercise experiment and record your heart rate on a graph like the one shown in the section above. How does it compare?

Can you make a set of questions for a friend to answer about your graph?

Can you put the information into a table?

Open ended answers.
Children can be supported by being given part-drawn line graphs.

Here is a line graph showing a bath time. Can you write a story to explain what is happening in the graph?

How long did it take to fill the bath?
How long did it take to empty?
The bath doesn't fill at a constant rate. Why might that be?

Discussions around what happens to the water level when someone gets in the bath would be useful.
9 and a half mins to fill the bath
5 mins to empty
One or two taps could be used to fill.
Read & Interpret Tables

Notes and Guidance

Children will extract information from tables and apply previously learned skills to manipulate information.

There are many opportunities to link this to the local area or topics being studied by the class.

This step provides good opportunities to add and subtract larger numbers in meaningful contexts.

Mathematical Talk

Can you find the information on the table?

Can you make up your own question to ask about the table?

Varied Fluency

Use the table to answer the questions.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Time for Revolution</th>
<th>Diameter (km)</th>
<th>Time for Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>88 days</td>
<td>4,878</td>
<td>59 days</td>
</tr>
<tr>
<td>Venus</td>
<td>226 days</td>
<td>12,104</td>
<td>243 days</td>
</tr>
<tr>
<td>Earth</td>
<td>365 days</td>
<td>12,756</td>
<td>24 hours</td>
</tr>
<tr>
<td>Mars</td>
<td>667 days</td>
<td>6,794</td>
<td>25 hours</td>
</tr>
<tr>
<td>Jupiter</td>
<td>12 years</td>
<td>142,984</td>
<td>10 hours</td>
</tr>
<tr>
<td>Saturn</td>
<td>29 years</td>
<td>120,536</td>
<td>11 hours</td>
</tr>
<tr>
<td>Uranus</td>
<td>84 years</td>
<td>51,118</td>
<td>17 hours</td>
</tr>
<tr>
<td>Neptune</td>
<td>165 years</td>
<td>49,500</td>
<td>17 hours</td>
</tr>
</tbody>
</table>

- How many planets take more than one day to rotate?
- Which planets take more than one year to make one revolution?
- Write the diameter of Jupiter in words.
- Make up some questions for a friend to answer

Answer the questions using information from the table.

<table>
<thead>
<tr>
<th>City</th>
<th>Leeds</th>
<th>Wakefield</th>
<th>Bradford</th>
<th>Liverpool</th>
<th>Coventry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>720,000</td>
<td>316,000</td>
<td>467,000</td>
<td>440,000</td>
<td>305,000</td>
</tr>
</tbody>
</table>

- What is the difference between the highest and lowest population?
- Which two cities have a combined population of 621,000?
Read & Interpret Tables

Reasoning and Problem Solving

<table>
<thead>
<tr>
<th>100 m sprint (s)</th>
<th>Shot put (m)</th>
<th>50 m Sack Race (s)</th>
<th>Javelin (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stephen</td>
<td>15.5</td>
<td>6.5</td>
<td>18.9</td>
</tr>
<tr>
<td>Julie</td>
<td>16.2</td>
<td>7.5</td>
<td>20.1</td>
</tr>
<tr>
<td>Fred</td>
<td>15.8</td>
<td>6.9</td>
<td>19.3</td>
</tr>
<tr>
<td>Chris</td>
<td>15.6</td>
<td>7.2</td>
<td>18.7</td>
</tr>
<tr>
<td>Dora</td>
<td>17.9</td>
<td>6.3</td>
<td>18.7</td>
</tr>
</tbody>
</table>

Dora’s number is the biggest but this means she was the slowest therefore she did not win the 100 m sprint.

Dora thinks that she won the 100 m sprint because she has the biggest number.

Do you agree?

Explain your answer.

This table shows the 10 largest stadiums in Europe.

<table>
<thead>
<tr>
<th>Stadium</th>
<th>City</th>
<th>Country</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camp Nou</td>
<td>Barcelona</td>
<td>Spain</td>
<td>99,365</td>
</tr>
<tr>
<td>Wembley Stadium</td>
<td>London</td>
<td>England</td>
<td>80,000</td>
</tr>
<tr>
<td>Signal Iduna Park</td>
<td>Dortmund</td>
<td>Germany</td>
<td>81,359</td>
</tr>
<tr>
<td>Estadio Santiago Bernabeu</td>
<td>Madrid</td>
<td>Spain</td>
<td>81,044</td>
</tr>
<tr>
<td>San Siro</td>
<td>Milan</td>
<td>Italy</td>
<td>80,000</td>
</tr>
<tr>
<td>Stade de France</td>
<td>Paris</td>
<td>France</td>
<td>80,000</td>
</tr>
<tr>
<td>Luzhniki Stadium</td>
<td>Moscow</td>
<td>Russia</td>
<td>78,300</td>
</tr>
<tr>
<td>Ataturk Olimpiyat Stadium</td>
<td>Istanbul</td>
<td>Turkey</td>
<td>75,052</td>
</tr>
<tr>
<td>Old Trafford</td>
<td>Manchester</td>
<td>England</td>
<td>75,811</td>
</tr>
<tr>
<td>Allianz Arena</td>
<td>Munich</td>
<td>Germany</td>
<td>75,000</td>
</tr>
</tbody>
</table>

True or false?

- The fourth largest stadium is The San Siro.
- There are 6 stadiums with a capacity of more than 80,000.
- Three of the largest stadiums are in England.
Two-way Tables

Notes and Guidance

Children read a range of two-way tables where the data is represented in various ways.

These tables show two different sets of data which are displayed horizontally and vertically.

Children show they can interpret a two-way table by creating questions themselves.

Mathematical Talk

What does the table show?

What information is missing?

How can we calculate the missing information?

How else could this data be represented?

Varied Fluency

This two way table shows the staff at Liverpool police station.

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constable</td>
<td>55</td>
<td>24</td>
<td>79</td>
</tr>
<tr>
<td>Sergeant</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Inspector</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Chief Inspector</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>66</td>
<td>34</td>
<td>100</td>
</tr>
</tbody>
</table>

• How many female inspectors work there?
• How many male sergeants work there?
• How many constables are there altogether?
• How many people work at Liverpool police station?
• How many male inspectors and female constables are there altogether?
• How many people in total are ranked below inspector?

This table shows how many football games teams have won and lost. Fill in the totals and write your own questions to interpret the information.

<table>
<thead>
<tr>
<th></th>
<th>Man United</th>
<th>Liverpool</th>
<th>Chelsea</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost</td>
<td>36</td>
<td>42</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Won</td>
<td>174</td>
<td>76</td>
<td>126</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1</strong></td>
<td><strong>1</strong></td>
<td><strong>1</strong></td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>
Two-way Tables

Reasoning and Problem Solving

This table shows how many children own dogs and cats.

Fill in the missing gaps and answer the questions below.

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogs</td>
<td></td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Cats</td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>125</td>
<td></td>
<td>245</td>
</tr>
</tbody>
</table>

**Completed table:**

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogs</td>
<td>87</td>
<td>44</td>
<td>131</td>
</tr>
<tr>
<td>Cats</td>
<td>38</td>
<td>76</td>
<td>114</td>
</tr>
<tr>
<td>Total</td>
<td>125</td>
<td>120</td>
<td>245</td>
</tr>
</tbody>
</table>

120 people were asked where they went on holiday during the summer months of last year.

Use this information to create a two way table.

In June, 6 people went to France and 18 went to Spain.
In July, 10 people went to France and 19 went to Italy.
In August, 15 people went to Spain.
35 people went to France altogether.
39 people went to Italy altogether.
35 people went away in June.
43 people went on holiday in August.

You can choose to give children a blank template. Children may not know where to put the 120, or realise its importance. Children will need to work systematically in order to get all of the information. As a teacher, you could choose not to give the children the complete total and let them find other possible answers.
Children need to extract information from timetables. Where possible it is useful to look at real timetables of public transport in the local area.

Allow children plenty of time to examine the timetables and ask each other questions about the information.

**Mathematical Talk**

How often does a bus leave ____ station?
How many buses leave each hour?
Where do you see timetables and why are they useful?
What information is displayed in a row when you read across the timetable?
What information is displayed in a column when you read down the timetable?

<table>
<thead>
<tr>
<th>Bus Timetable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halifax</td>
</tr>
<tr>
<td>Shelf</td>
</tr>
<tr>
<td>Shelf Village</td>
</tr>
<tr>
<td>Woodside</td>
</tr>
<tr>
<td>Odsal</td>
</tr>
<tr>
<td>Bradford</td>
</tr>
</tbody>
</table>

- On the 06:35 bus, how long does it take to get from Shelf Roundabout to Bradford Interchange?
- Can you travel to Woodside on the 07:43 bus?
- Which journey takes the longest time between Shelf Village and Bradford Interchange, the bus that leaves Shelf Village at 06:46 or the bus that leaves Shelf Village at 07:23?
- If you needed to travel from Halifax Bus Station to Odsal and had to arrive by 08:20, which would be the best bus to catch? Explain your answer.
- Which journey takes the longest time from Halifax Bus Station to Bradford Interchange?
Timetables
Reasoning and Problem Solving

Here is Becky’s weekly timetable from secondary school.

True or false?

- If Becky was 10 minutes late for her English lesson on Monday there would be 45 mins of the lesson left.
- Becky has 2 hours and 20 minutes of PE in a week.
- Becky has 130 minutes of literacy in a week.

No, Budget Baker clashes with aMAZEment.
False – Safari and Lab of Lollies are on for over an hour.

Simon scans the TV guide and plans his viewing for the evening. He chooses this sequence of TV shows:
Cheese Please, What’s the Q, aMAZEment, Budget Baker, Safari, Dance & Decide.
Will Simon be able to watch all the shows he has chosen?

True or False – Safari, Guess the Noise and Lots of Lollies are all on for 1 hour.

False, 40 mins
True
False, 120mins (2 hours)
### Overview

#### Small Steps

- Multiples
- Factors
- Common factors
- Prime numbers
- Square numbers
- Cube numbers
- Multiply by 10, 100 and 1,000
- Divide by 10, 100 and 1,000
- Multiples of 10, 100 and 1,000

#### NC Objectives

- Multiply and divide numbers mentally drawing upon known facts.
- Multiply and divide whole numbers by 10, 100 and 1000.
- Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.
- Recognise and use square numbers and cube numbers and the notation for squared (2) and cubed (3).
- Solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes.
- Know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.
- Establish whether a number up to 100 is prime and recall prime numbers up to 19.
Multiples

Notes and Guidance

Building on their times tables knowledge, children will find multiples of whole numbers. Children build multiples of a number using concrete and pictorial representations e.g. in an array.

Varied Fluency

- Circle the multiples of 5
  25  32  54  40  175  3000

  What do you notice about the multiples of 5?

- Write down all the multiples of 4 between 20 and 80

- Roll 2 dice (1-6), multiply the numbers. What is the number a multiple of?
  Is it a multiple of more than one number?

  How many different numbers can you make multiples of?
  Can you make multiples of all numbers up to 10?
  Can you make multiples of all numbers up to 20?

  Use a table to show your results.
  Multiply the numbers you roll to complete the table.

Mathematical Talk

What do you notice about the multiples of 2? What is the same about them, what is different?

Look at multiples of other numbers; is there a rule that links them?
### Multiples

**Reasoning and Problem Solving**

Use the digits 0 – 9. Choose 2 digits. Multiply them together.

**What is your number a multiple of?**

Is it a multiple of more than one number?

Can you find all the numbers you could make?

Use the table below to help.

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
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<td>7</td>
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<td>8</td>
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<tr>
<td>9</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Always, sometimes, never.

- The product of two even numbers is a multiple of an odd number.
- The product of two odd numbers is a multiple of an even number.

**Clare's age is a multiple of 7 and is 3 less than a multiple of 8**

She is younger than 40

How old is Clare?

- **Always - all multiples of 1**
- **Never - Two odd numbers multiplied together are always a multiple of an odd number.**

**Claire is 21 years old.**
Factors

Notes and Guidance

Children understand the relationship between multiplication and division and can use arrays to show the relationship between them. They know that division can involve either sharing or finding equal groups of amounts. Children learn that a factor of a number is the number you get when you divide a whole number by another whole number and that factors come in pairs. \((\text{factor} \times \text{factor} = \text{product})\).

Mathematical Talk

How can you work in a systematic way to prove you have found all the factors?

Do factors always come in pairs?

How can we use our multiplication and division facts to find factors?

Varied Fluency

If you have twenty counters, how many different ways of arranging them can you find?

5

How many factors of twenty have you found?

E.g. A pair of factors of 20 are 4 and 5

Circle the factors of 60

9, 6, 8, 4, 12, 5, 60, 15, 45

Which factors of 60 are not shown?

Fill in the missing factors of 24

\[1 \times \_ \_ \_ \quad \_ \_ \_ \times 12\]

\[3 \times \_ \_ \_ \quad \_ \_ \_ \times \_ \_ \_ \_\]

What do you notice about the order of the factors?

Use this method to find the factors of 42
### Factors

#### Reasoning and Problem Solving

Here is Kayla’s method for finding factor pairs:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>36</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>X</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

When do you put a cross next to a number?

How many factors does 36 have?

Use Kayla’s method to find all the factors of 64

If it is not a factor, put a cross.

36 has 9 factors.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>X</td>
</tr>
<tr>
<td>6</td>
<td>X</td>
</tr>
<tr>
<td>7</td>
<td>X</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

### Always, sometimes, never.

- An even number has an even amount of factors.
- An odd number has an odd amount of factors.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>X</td>
</tr>
<tr>
<td>7</td>
<td>X</td>
</tr>
<tr>
<td>8</td>
<td>X</td>
</tr>
</tbody>
</table>

### True or False?

The bigger the number, the more factors it has.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>X</td>
</tr>
<tr>
<td>7</td>
<td>X</td>
</tr>
<tr>
<td>8</td>
<td>X</td>
</tr>
</tbody>
</table>

Sometimes, e.g. 6 has four factors but 36 has nine.

Sometimes, e.g. 21 has four factors but 25 has three.

False. For example, 12 has 6 factors but 97 only has 2
Common Factors

Notes and Guidance

Using their knowledge of factors, children find the common factors of two numbers.

They use arrays to compare the factors of a number and use a Venn diagram to show their results.

Mathematical Talk

How can we find the common factors systematically?

Which number is a common factor of any pair of numbers?

How does a Venn diagram help to show common factors?

Where are the common factors?

Varied Fluency

Use arrays to find the common factors of 12 and 15
Can we arrange the counters in one row?

Yes- so they have a common factor of one.
Can we arrange the counters in two equal rows?

2 is a factor of 12 but not of 15 so 2 is not a common factor.
Continue to work through the factors systematically until you find all the common factors.

Fill in the Venn diagram to show the factors of 20 and 24

Where are the common factors of 20 and 24?
Can you use a Venn diagram to show the common factors of 9 and 15?
**Common Factors**

**Reasoning and Problem Solving**

### True or False?

1. **1 is a factor of every number.**  
   - **True**

2. **1 is a multiple of every number.**  
   - **False**

3. **0 is a factor of every number.**  
   - **False**

4. **0 is a multiple of every number.**  
   - **True**

---

I am thinking of two 2-digit numbers.  
Both of the numbers have a digit total of six.  
Their common factors are:  
1, 2, 3, 4, 6, & 12  
What are the numbers?  
**24 and 60**
Prime Numbers

Notes and Guidance

Using their knowledge of factors, children see that some numbers only have 2 factors and these are special numbers called Prime Numbers. They also learn that non-primes are called composite numbers. Children can recall primes up to 19 and are able to establish whether a number is prime up to 100. Using primes, they break a number down into its prime factors.

Mathematical Talk

How many factors does each number have?
How many other numbers can you find that have this number of factors?
What is a prime number?
What is a composite number?
How many factors does a prime number have?

Varied Fluency

Use counters to find the factors of the following numbers.

5, 13, 17, 23

What do you notice about the arrays?

A prime number has 2 factors, one and itself. A composite number can be divided by numbers other than 1 and itself. Sort the numbers into the table.

<table>
<thead>
<tr>
<th>5</th>
<th>15</th>
<th>9</th>
<th>12</th>
<th>3</th>
<th>27</th>
<th>24</th>
<th>30</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Prime</th>
<th>Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 factors (1 &amp; itself)</td>
<td></td>
</tr>
<tr>
<td>More than 2 factors</td>
<td></td>
</tr>
</tbody>
</table>

Put two of your own numbers into the table.
Why are two of the boxes empty?
Where would 1 go in the table? Would it fit in at all?
Prime Numbers

Reasoning and Problem Solving

Find all the prime numbers between 10 and 100, sort them in the table below.

<table>
<thead>
<tr>
<th>End in a 1</th>
<th>End in a 3</th>
<th>End in a 7</th>
<th>End in a 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>11, 31, 41, 61, 71,</td>
<td>13, 23, 43, 53, 73</td>
<td>17, 37, 47, 67, 97</td>
<td>19, 29, 59, 79, 89</td>
</tr>
</tbody>
</table>

Why do no two-digit prime numbers end in an even number?

Why do no two-digit prime numbers end in a 5?

No 2-digit primes end in an even number because 2-digit even numbers are divisible by 2. No 2-digit prime numbers end in a 5 because they are divisible by 5 as well as 1 and itself.

Dora says all prime numbers have to be odd.

Her friend Abdul says that means 9, 27 and 45 are prime numbers.

Explain Abdul and Dora’s mistakes and correct them.

2 is a prime number so Dora is wrong. Abdul thinks all odd numbers are prime but he is wrong as some have more than 2 factors. E.g.

Factors of 9: 1, 3 & 9

Factors of 27: 1, 3, 9 & 27

Etc.
Square Numbers

Notes and Guidance
Children will need to be able to find factors of whole numbers. Square numbers have an odd number of factors and are the result of multiplying a number by itself.
They learn the notation for squared is \( n^2 \).

Varied Fluency
- What does this array show you? Why is it square?
- How many ways are there of arranging 36 counters in an array? What is the same about each array? What is different?
- Find the first 12 square numbers. Prove that they are square numbers. How many different squares can you make using counters? What do you notice? Are there any patterns?

Mathematical Talk
- Why are square numbers called ‘square’ numbers?
- Is there a pattern between the numbers?
- True or False: The square of an even number is even and the square of an odd number is odd.
### Square Numbers

#### Reasoning and Problem Solving

<table>
<thead>
<tr>
<th>Teddy says,</th>
<th>Children will find that some numbers don’t have an even number of factors e.g. 25</th>
<th>Julian thinks that $4^2$ is equal to 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you agree? Explain your reasoning.</td>
<td>Square numbers have an odd number of factors.</td>
<td>Do you agree? Convince me.</td>
</tr>
<tr>
<td>How many square numbers can you make by adding prime numbers together? Here’s one to get you started:</td>
<td>Solutions include: $2 + 2 = 4$ $2 + 7 = 9$ $11 + 5 = 16$ $23 + 2 = 25$ $29 + 7 = 36$</td>
<td>He also thinks that $6^2$ is equal to 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Do you agree? Explain what you have noticed.</td>
</tr>
<tr>
<td></td>
<td>Always, sometimes, never.</td>
<td>Children may use concrete materials or draw pictures to prove it.</td>
</tr>
<tr>
<td></td>
<td>A square number has an even number of factors.</td>
<td>Children should spot that 6 has been multiplied by 2</td>
</tr>
<tr>
<td></td>
<td>Never. Square numbers have an odd number of factors.</td>
<td>They may create the array to prove that $6^2 = 36$ and $6 \times 2 = 12$</td>
</tr>
</tbody>
</table>
Cube Numbers

Notes and Guidance

Children learn that a cubed number is the product of three numbers which are the same.

If you multiply a number by itself, then itself again the result is a cubed number.

They learn the notation for cubed is ‘\( \times^3 \)’.

Mathematical Talk

Why are cube numbers called ‘cube’ numbers?

How are squared and cubed numbers similar?

How are they different?

True or False: Cubes of even numbers are even and cubes of odd numbers are odd.

Varied Fluency

Use multilink cubes and investigate how many are needed to make different sized cubes.

How many multilink cubes are required to make the first cube number? The second? Third?

Can you predict what the tenth cube number is going to be?

Complete the table.

<table>
<thead>
<tr>
<th>Number</th>
<th>Expression</th>
<th>Cube</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 3^3 )</td>
<td>( 3 \times 3 \times 3 )</td>
<td>27</td>
</tr>
<tr>
<td>( 5^3 )</td>
<td>( 5 \times 5 \times 5 )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( 6 \times 6 \times 6 )</td>
<td></td>
</tr>
<tr>
<td>( 4^3 )</td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

Calculate:

\( 4^3 = \) ____ \( 5^3 = \) ____

4 cubed = ____ \( 6 \text{ cubed} = \) ____
## Cube Numbers

### Reasoning and Problem Solving

<table>
<thead>
<tr>
<th>Rosie says,</th>
<th>Rosie is wrong, she has multiplied 5 by 3 rather than by itself 3 times.</th>
<th>Jenny is thinking of a two-digit number that is both a square and a cube number. What number is she thinking of?</th>
</tr>
</thead>
<tbody>
<tr>
<td>5³ is equal to 15</td>
<td>Do you agree? Explain your answer.</td>
<td>Caroline’s daughter has an age that is a cube number.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Next year her age will be a square number.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How old is she now?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The sum of a cube number and a square number is 150. What are the two numbers?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Here are 3 number cards</th>
<th>A = 8</th>
<th>Jenny is thinking of a two-digit number that is both a square and a cube number. What number is she thinking of?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B = 64</td>
<td>Caroline’s daughter has an age that is a cube number.</td>
</tr>
<tr>
<td>B</td>
<td>C = 125</td>
<td>Next year her age will be a square number.</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>How old is she now?</td>
</tr>
<tr>
<td>A × A = B</td>
<td></td>
<td>The sum of a cube number and a square number is 150. What are the two numbers?</td>
</tr>
<tr>
<td>B + B − 3 = C</td>
<td></td>
<td>64</td>
</tr>
<tr>
<td>Digit total of C = A</td>
<td></td>
<td>8 years old</td>
</tr>
<tr>
<td></td>
<td></td>
<td>125 &amp; 25</td>
</tr>
</tbody>
</table>
Multiply by 10, 100 & 1,000

Notes and Guidance

Children recap multiplying by 10 and 100 before moving on to multiplying by 1,000.

They look at numbers in a place value grid and discuss how many places to the left digits move when you multiply by different multiples of 10.

Mathematical Talk

Which direction do the digits move when you multiply by 10, 100 or 1,000?

How many places do you move to the left?

When we have an empty place value column to the right of our digits what number do we use as a place holder?

Can you use multiplying by 100 to help you multiply by 1,000? Explain why.

Varied Fluency

Make the number 234 on a place value grid using counters.

<table>
<thead>
<tr>
<th>HTh</th>
<th>TTh</th>
<th>Th</th>
<th>H</th>
<th>T</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When I multiply my number by 10, where will I move my counters?
Is this always the case?

Complete the following questions using counters and a place value grid.

234 \times 100 = ____
100 \times 36 = ____
45,020 \times 10 = ____
324 \times 100 = ____
1,000 \times 207 = ____
45,020 \times 10 = ____ = 3,456 \times 1,000

Use <, > or = to complete the statements.

62 \times 1,000 \hspace{1cm} 62 \times 100
100 \times 32 \hspace{1cm} 32 \times 100
48 \times 100 \hspace{1cm} 48 \times 10 \times 10 \times 10
## Multiply by 10, 100 & 1,000

### Reasoning and Problem Solving

<table>
<thead>
<tr>
<th>Rosie has £300 in her bank account. Louis has 100 times more than Rosie in his bank account. How much more money does Louis have than Rosie?</th>
<th>Rosie has £300 Louis has £30,000 Louis has £29,700 more than Rosie.</th>
<th>Emily is incorrect, she would have £1,200 if this was the case.</th>
<th>Jack is thinking of a 3-digit number. When he multiplies his number by 100, the ten thousands and hundreds digit are the same. The sum of the digits is 10 What number could Jack be thinking of?</th>
<th>181 262 343 424 505</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emily has £1,020 in her bank account. Philip has £120 in his bank account. Emily says, ‘I have ten times more money than you.’</td>
<td>Is Emily correct? Explain your reasoning.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

80
Divide by 10, 100 & 1,000

Notes and Guidance

Children look at dividing by 10, 100 and 1,000 using a place value chart.

They use counters and digits to learn that the digits move to the right when dividing by powers of ten.

Mathematical Talk

What happens to the digits?

How are dividing by 10, 100 and 1,000 related to each other?

How are dividing by 10, 100 and 1,000 linked to multiplying by 10, 100 and 1,000?

What does ‘inverse’ mean?

Varied Fluency

<table>
<thead>
<tr>
<th>HTh</th>
<th>TTh</th>
<th>Th</th>
<th>H</th>
<th>T</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

What number is represented in the place value grid?

Divide the number by 100

Which direction do the counters move?

How many columns do they move?

What number do we have now?

Complete the following using a place value grid.

- Divide 460 by 10
- Divide 5,300 by 100
- Divide 62,000 by 1,000

Divide these numbers by 10, 100 and 1,000

80,000 300,000 547,000

Calculate 45,000 ÷ 10 ÷ 10

How else could you write this?
Divide by 10, 100 & 1,000

Reasoning and Problem Solving

David has £357,000 in his bank.
He divides the amount by 1,000 and takes that much money out of the bank.
Using the money he has taken out, he buys some furniture costing two hundred and sixty-nine pounds.
How much money does David have left from the money he took out?
Show your working out.

$357,000 ÷ 1,000 = 357$
If you subtract £269, he is left with £88

Here are the answers to some problems:

Possible solutions could be:

1. $5,700 ÷ 10 = 570$
2. $405 ÷ 10 = 40$
3. $397 ÷ 1,000 = 0.397$
4. $620,300 ÷ 100 = 6,203$

Can you write at least two questions for each answer involving dividing by 10, 100 or 1,000?
Multiples of 10, 100 & 1,000

Notes and Guidance

Children have been taught how to multiply and divide by 10, 100 and 1,000

They now use knowledge of other multiples to calculate related questions.

Mathematical Talk

If we are multiplying by 20, can we break it down into two steps and use our knowledge of multiplying by 10?

How does using multiplication and division as inverses help us use known facts?

Varied Fluency

36 × 5 = 180

Use this fact to solve the following questions:

36 × 50 = ___  500 × 36 = ___
5 × 360 = ___  360 × 500 = ___

Here are two methods to solve 24 × 20

<table>
<thead>
<tr>
<th>Method 1</th>
<th>Method 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 × 10 × 2</td>
<td>24 × 2 × 10</td>
</tr>
<tr>
<td>= 240 × 2</td>
<td>= 48 × 10</td>
</tr>
<tr>
<td>= 480</td>
<td>= 480</td>
</tr>
</tbody>
</table>

What is the same about the methods, what is different?

Use the division diagram to help solve the calculations.

7,200 ÷ 200 = 36

3,600 ÷ 200 = □
18,000 ÷ 200 = □
5,400 ÷ □ = 27
□ = 6,600 ÷ 200
Multiples of 10, 100 & 1,000

Reasoning and Problem Solving

Tim has answered a question. Here is his working out.

600 ÷ 25
600 ÷ 2 = 300
300 ÷ 5 = 60
600 ÷ 25 = 60

Is he correct? Explain your answer.

Tim is not correct as he has partitioned 25 incorrectly.

He could have divided by 5 twice.

The correct answer should be 24

6 × 7 = 42
420 ÷ 70 = ___

Alex is wrong because
60 × 70 = 4200
6 × 70 = 420
So the answer should be 6

The answer is 60 because all of the numbers are 10 times bigger.

Do you agree with Alex? Explain your answer.
Autumn - Block 5

Perimeter & Area
Measure perimeter
Calculate perimeter
Area of rectangles
Area of compound shapes
Area of irregular shapes

NC Objectives

Measure and calculate the perimeter of composite rectilinear shapes in cm and m.

Calculate and compare the area of rectangles (including squares), and including using standard units, cm², m² estimate the area of irregular shapes.
Measure Perimeter

Notes and Guidance

Children measure the perimeter of rectilinear shapes from diagrams without grids. They will recap measurement skills and recognise that they need to use their ruler accurately in order to get the correct answer.

Mathematical Talk

What is perimeter?

Do we need to measure every side?

Once we have measured each side, how do we find the perimeter?

Varied Fluency

- Measure the perimeter of the shapes.

- Measure the perimeter of the shapes.

- Make this shape double the size using dot paper.

- Measure the perimeter of both shapes.

What do you notice about the perimeter of the larger one? Why?
Measure Perimeter

Reasoning and Problem Solving

Each regular hexagon has a side length of 2 cm

Can you construct a shape with a perimeter of 44 cm?

Possible answer:

Activity

Investigate different ways you can make composite rectilinear shapes with a perimeter of 54 cm.
Calculate Perimeter

Notes and Guidance

Children apply their knowledge of measuring and finding perimeter to find unknown lengths.

They find the perimeter of shapes with and without grids. When calculating perimeter of shapes, encourage children to mark off the sides as they add them up to prevent repetition of counting/omission of sides.

Varied Fluency

Find the perimeter of the following shapes.

- Each square has an area of 4 square cm. What is the perimeter of the whole shape?

Mathematical Talk

What can you tell me about the sides of a square/rectangle? How does this help you work out this question?

How many _____ can you draw with a perimeter of x cm? e.g. irregular shapes e.g. rectangles

How many regular shapes can you make with a perimeter of ____ cm?
Calculate Perimeter

Reasoning and Problem Solving

Here is a square inside another square.

Small square = 16 cm
Large square = 64 cm
Length of one of the outer sides is 16 cm, for one side of the square, because 16 is 4 times 4 cm.

The perimeter of the inner square is 16 cm
The outer square’s perimeter is four times the size of the inner square.
What is the length of one side of the outer square?
How do you know? What do you notice?

The value of c is 14 m.
What is the total perimeter of the shape?

4c + 4c + c + c = 10c
10 x 14 = 140 m

The blue rectangle has a perimeter of 38 cm.
What is the value of a?

Total perimeter = 38 cm
38 - (4.8 + 4.8) = 28.4
So 28.4 divided by 2 = 14.2 cm
Area of Rectangles

Notes and Guidance

Children build on previous knowledge in Year 4 by counting squares to find the area. They then move on to using a formula to find the area.

Varied Fluency

- How many rectangles can you draw with an area of ___ cm²?
- What is the area of this shape if:
  - each square is 2 cm in length?
  - each square is 3.5 cm in length?

Mathematical Talk

What properties of these shapes do you need to know to help you work this out?
What can you tell me about the sides of a square/rectangle?
How does this help you work out this question?
Show formula for area alongside examples:
Area = length × width

Simon buys a house with a small back garden, which has an area of 12 m².
His house lies in a row of terraces, all identical.
If there are 15 terraced houses altogether, what is the total area of the garden space?
Area of Rectangles

Reasoning and Problem Solving

Investigate how many ways you can make different squares and rectangles with the same area of 84 cm².
What strategy did you use?

True or False?
If you cut off a piece from a shape, you reduce its area and perimeter.
Draw 2 examples to prove your thinking.

Approximate the area of each shape and then order from largest to smallest.

Each orange square has an area of 24 cm².
Calculate the total orange area.
Calculate the blue area.
Calculate the green area.
What is the total area of the whole shape?

Answer: A = 3cm × 7cm = 21cm²
B = 8cm × 8cm = 64cm²
C = 3cm × 19cm = 57cm²
Order: B, C, A

Answer: Orange = 48cm²
Blue = 72cm²
Green = 24cm²
Total = 144cm²
Area of Compound Shapes

Notes and Guidance

Children learn to calculate area of compound shapes. They need to apply their previous knowledge of area and the formula used. Children need to have experience of drawing their own shapes in this step.

Mathematical Talk

What formula do we use to find the area?

How can we split the compound shape?

Is there more than one way?

Do we get a different answer if we split the shape differently?

Varied Fluency

Find the area of the compound shape: How many ways can we split the compound shape? Is there more than one way?

Could we multiply 6 m × 6 m and then subtract 2 m × 3 m?

Calculate the area.

Calculate the area of these symmetrical shapes.
Area of Compound Shapes

Reasoning and Problem Solving

How many different ways can you split this shape to find the area?

Possible solution:
A= 2m × 5m = 10m²
B= 6m × 3m = 18m²
C= 1m × 2m = 2m²
D=1m × 8m = 8m²
E= 3m × 2m = 6m²
Total area = 36m²

Add more values and work out the area.

Jack has a shape with an area of 34 cm².

Possible solution:

Find 3 possible compound shapes that have an area of 34 cm².
Area of Irregular Shapes

Notes and Guidance

Children use their knowledge of counting squares to estimate the areas of irregular shapes. They use their knowledge of fractions to estimate how much of a square is covered and combine different part covered squares to give an overall approximate area.

Children need to physically annotate to avoid repetition when counting the squares.

Mathematical Talk

How many whole squares can you see?
How many part squares can you see?
What will we do with the parts?
What does approximate mean?

Varied Fluency

Estimate the area of the pond.
Each square = 1 m²

The answer is 4 whole and 11 parts.
Is this an acceptable answer?
What can we do with the parts to find an approximate answer?

If all of the squares are 1cm in length, which shape has the greatest area?

Is the red shape the greatest because it fills more squares? Why?
Why not?
What is the same about each image? What is different about each image?

Each square is ____ m²
What is the approximate area?
Area of Irregular Shapes

Reasoning and Problem Solving

Draw a circle on 1 cm² paper. What is the estimated area?
Can you draw a circle that is approximately 20 cm²?

If each square represents 3 m², what is the approximate area of:
- The lake
- The bunkers
- The fairway
- The rough
- Tree/forest area

Can you construct a ‘Pirate Island’ to be used as part of a treasure map for a new game? Each square represents 4 m².

The island must include the following features and be of the given approximate measure:
- Circular Island 180 m²
- Oval Lake 58 m²
- Forests with a total area of 63 m² (can be split over more than one space)
- Beaches with a total area of 92 m² (can be split over more than one space)
- Mountains with a total area of 57 m²
- Rocky coastline with total area of 25 m²