Scheme of Learning

Year 6

#MathsEveryoneCan

White Rose Maths

Contents

Welcome

Welcome to the White Rose Maths' new, more detailed schemes of learning for 2017-18.

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, 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 get in touch. 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
@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.

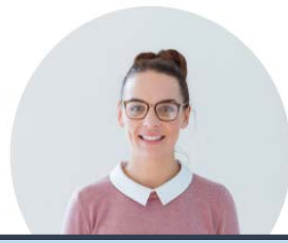
Caroline Hamilton

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 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.

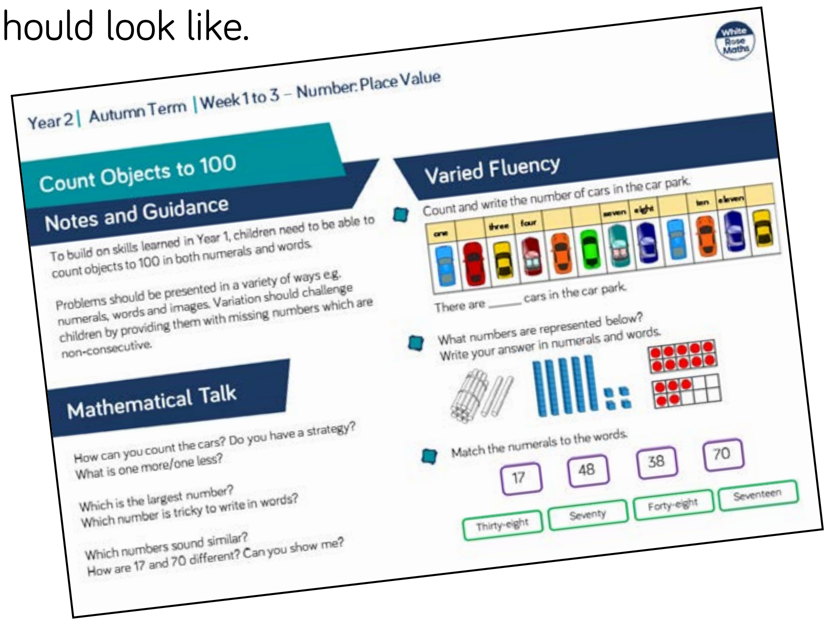
We know that breaking the curriculum down into small manageable steps should help children understand concepts better. Too often, we have noticed that teachers will try and cover too many concepts at once and this can lead to cognitive overload. In our opinion, it is better to follow a small steps approach.

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.



Assessments

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

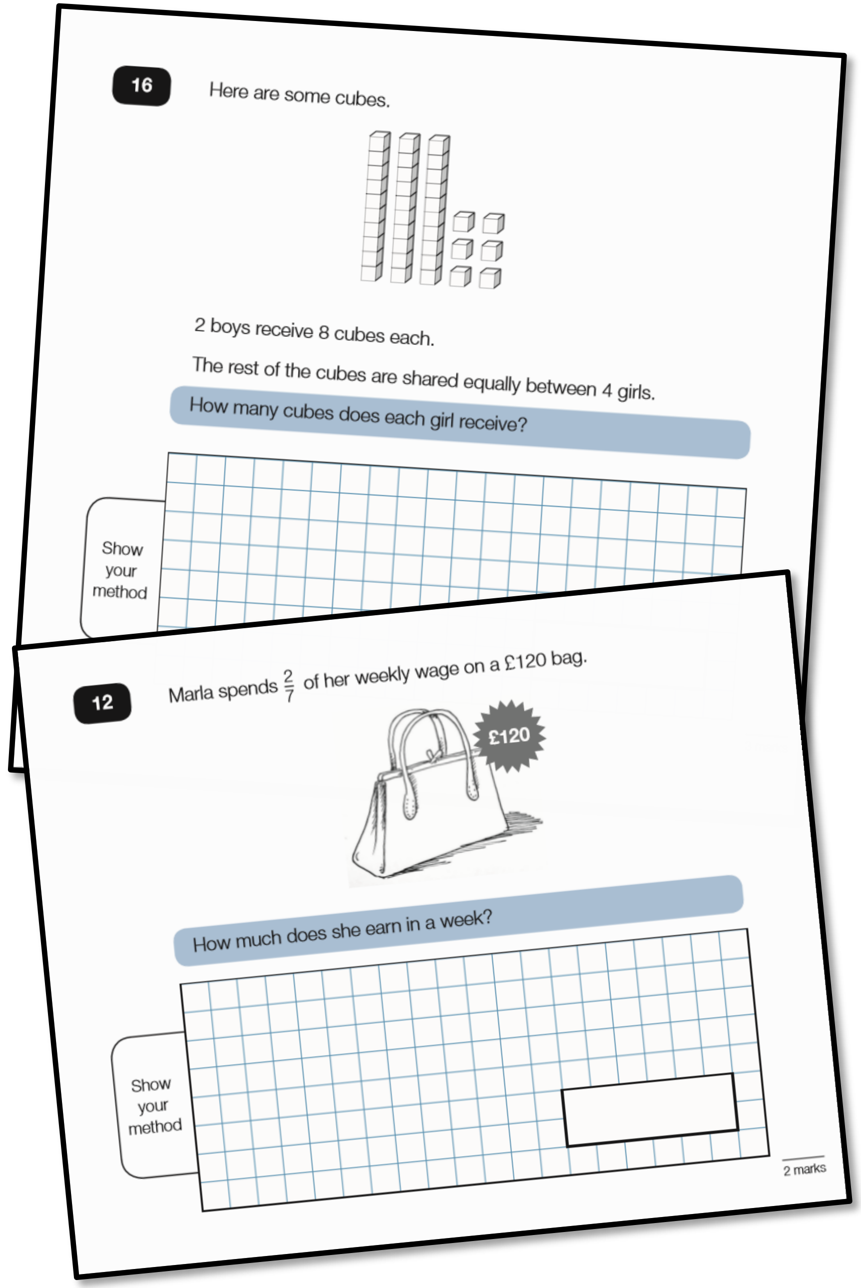
Part 1: Fluency based arithmetic practice

Part 2: Reasoning and problem solving based questions

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

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

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



Teaching for Mastery

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

The overviews:

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

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

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

Concrete - Pictorial - Abstract

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

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

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

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

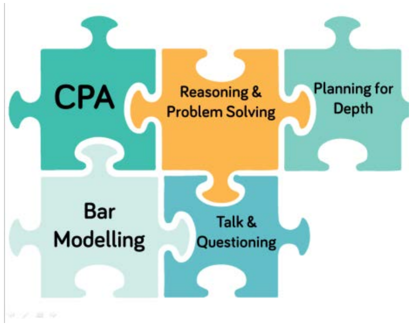
Need some CPD to develop this approach? Visit www.whiterosemaths.com for find a course right for you.

Training

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

Our popular JIGSAW package consists of five key elements:

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



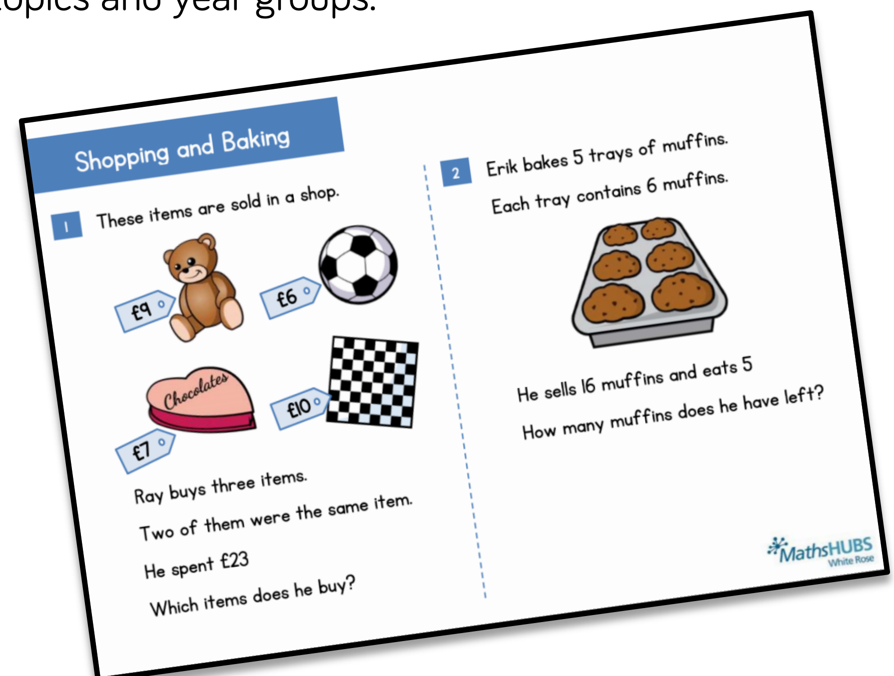
For more information and to book visit our website www.whiterosemaths.com or email us directly at support@whiterosemaths.com

Additional Materials

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

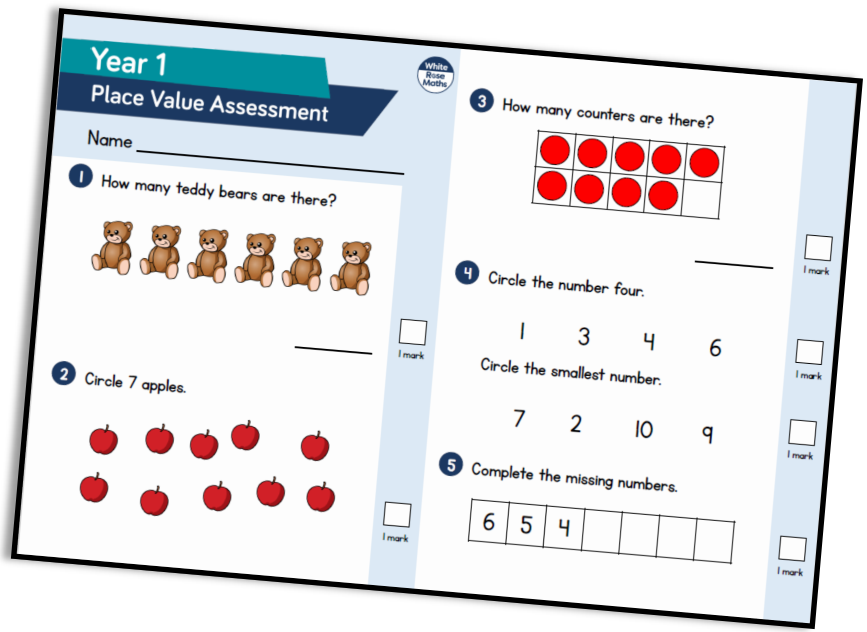
KS1 and KS2 Problem Solving Questions

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?

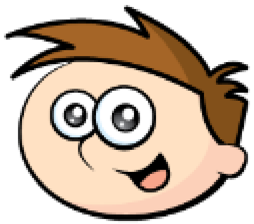
The questions are designed to be used by the teacher to help them understand the key teaching points that need to be covered. They should be used as inspiration and ideas to help teachers plan carefully structured lessons.

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

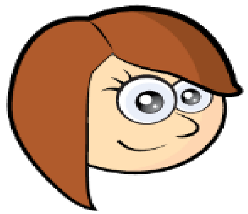
The scheme has been designed to give sufficient time for teachers to explore concepts in depth, however we also interleave prior content in new concepts. E.g. when children look at measurement we recommend that there are lots of questions that practice the four operations and fractions. This helps children 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?

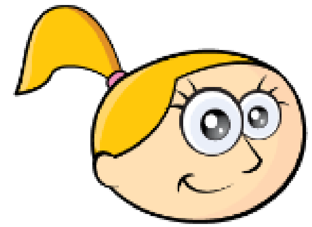


Teddy



Rosie

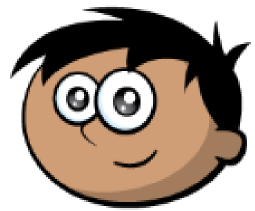
Mo



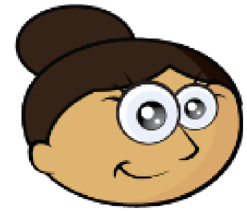
Eva

Jack

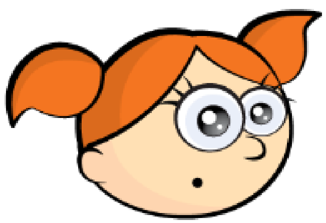
Whitney



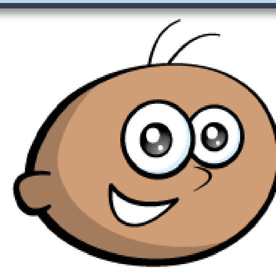
Amir



Dora



Alex



Tommy

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

Autumn - Block 1

Place Value

Overview

Small Steps

- Numbers to ten millions
- Compare and order any number
- Round any number
- Negative numbers

NC Objectives

Read, write, order and compare numbers up to 10,000,000 and determine the value of each digit.

Round any whole number to a required degree of accuracy.

Use negative numbers in context, and calculate intervals across zero.

Solve number and practical problems that involve all of the above.

Numbers to Ten Million

Notes and Guidance

Children need to read, write and represent numbers to ten million in different ways.
Numbers do not always have to be in the millions – they should see a mixture of smaller and larger numbers.

Mathematical Talk

What does a zero in a number represent?

What strategy do you use to work out the divisions on a number line?

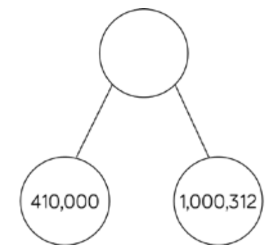
How many ways can you complete the partitioned number?

Varied Fluency

- Match the representations to the numbers in digits.

One million, four hundred and one thousand, three hundred and twelve.

M	HTh	TTh	Th	H	T	O
●		●●●●	●	●●●	●	●●



1,401,312 1,041,312 1,410,312

- Complete the missing numbers.

6,305,400 = ________ + 300,000 + ________ + 400

7,001,001 = 7,000,000 + ________ + ________

42,550 = ________ + ________ + ________ + 50

- Teddy's number is 306,042
He adds 5,000 to his number.
What is his new number?

Numbers to Ten Million

Reasoning and Problem Solving

Put a digit in the missing spaces to make the statement correct. 4,62 __ ,645 < 4,623,64 __ Is there more than one option? Can you find them all?	The first digit can be 0, 1, 2 or 3 When the first digit is 0, 1 or 2, the second digit can be any number. When the first digit is 3, the second digit can be 6 or above.
Dora has the number 824,650 She takes forty thousand away. Her answer is 820,650 Is she correct? Explain how you know.	Dora is incorrect because she has taken away 4,000 not 40,000 Her answer should be 784,650

Use the digit cards and statements to work out my number. 0 3 3 5 5 6 7 • The ten thousands and hundreds have the same digit. • The hundred thousand digit is double the tens digit. • It is a six-digit number. • It is less than six hundred and fifty-five thousand. Is this the only possible solution?	Possible solutions: 653,530 653,537 650,537 650,533

Compare and Order

Notes and Guidance

Children will compare and order numbers up to ten million using numbers presented in different formats.
They should use correct mathematical vocabulary (greater than/less than) alongside inequality symbols.

Mathematical Talk

What is the value of each digit?

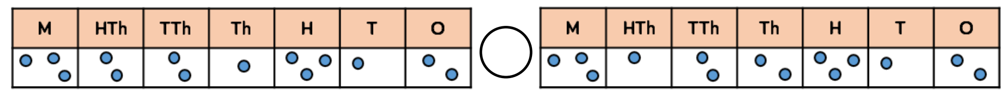
What is the value of ______ in this number?

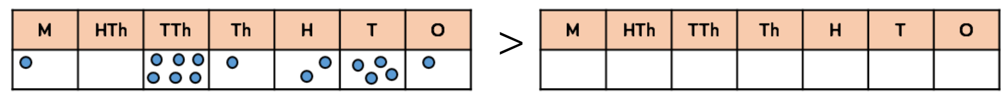
What is the value of the whole? Can you suggest other parts that make the whole?

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

Varied Fluency

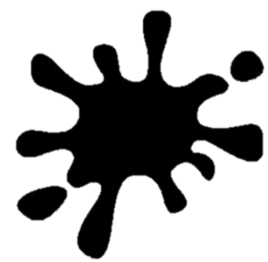
- Complete the statements to make them true.

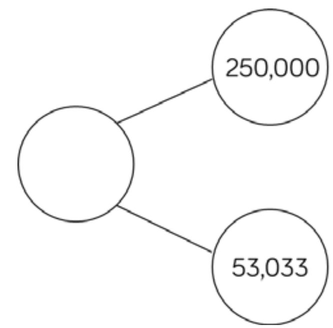




- What number could the splat be covering?

Three hundred and thirteen thousand and thirty-three





Greatest → **Smallest**

- A house costs £250,000
A motorised home costs £100,000
A bungalow is priced half way between the two.
Work out the price of the bungalow.

Compare and Order

Reasoning and Problem Solving

Eva has ordered eight 6-digit numbers.

The smallest number is 345,900

The greatest number is 347,000

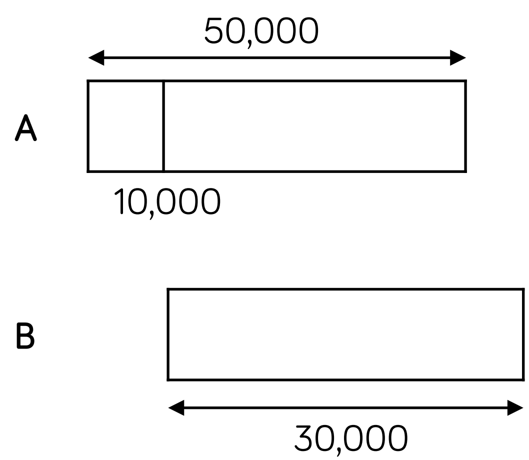
All the other numbers have digit total of 20 and have no repeating digits.

What are the other six numbers?

Can you place all eight numbers in ascending order?

The other six numbers have to have a digit total of 20 and so must start with 346,_ _ _ because anything between 345,900 and 346,000 has a larger digit total. The final three digits have to add up to 7 so the answer is:
345,900
346,025
346,052
346,205
346,250
346,502
346,520
347,000

Jack draws bar model A.
His teacher asks him to draw another where the total is 30,000



Explain how you know bar B is inaccurate.

Bar B is inaccurate because it starts at 10,000 and finishes after 50,000 therefore it is longer than 40,000

Round within Ten Million

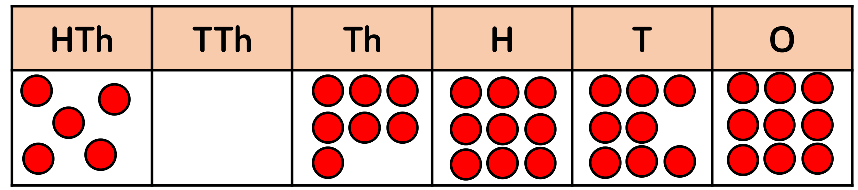
Notes and Guidance

Children build on their prior knowledge of rounding. They will learn to round any number within ten million.
They use their knowledge of multiples to work out which two numbers the number they are rounding sits between.

Mathematical Talk

Why do we round up if the following digit is 5 or above?
Which place value column do we need to look at when we round to the nearest 100,000?
What is the purpose of rounding?
When is it best to round to 1,000? 10,000?
Can you justify your reasoning?

Varied Fluency



Round the number in the place value chart to:

- The nearest 10,000
- The nearest 100,000
- The nearest 1,000,000

Write five numbers that round to the following numbers when rounded to the nearest hundred thousand.

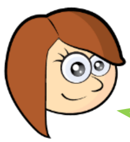
200,000 600,000 1,900,000

Complete the missing digits so that each number rounds to one hundred and thirty thousand when rounded to the nearest ten thousand.

12 __ ,657 1 __ 1,999 13 __ ,001

Round within Ten Million

Reasoning and Problem Solving

My number is 1,350 when rounded to the nearest 10  Mo  Rosie My number is 1,400 when rounded to the nearest 100 Both numbers are whole numbers. What is the greatest possible difference between the two numbers?	The greatest possible difference is 104
Kiera rounded 2,215,678 to the nearest million and wrote 2,215,000 Can you explain to Kiera what mistake she has made?	She has rounded it to the nearest million, but all other columns should be zero.

Miss Grogan gives out four number cards. 15,987 15,813 15,101 16,101 Four children each have a card and give a clue to what their number is. Tommy says, "My number rounds to 16,000 to the nearest 1,000" Alex says, "My number has one hundred." Jack says, " My number is 15,990 when rounded to the nearest 10" Dora says, "My number is 15,000 when rounded to the nearest 1,000" Can you work out which child has which card?	Tommy has 15,813 Alex has 16,101 Jack has 15,987 Dora has 15,101

Negative Numbers

Notes and Guidance

Children continue their work on negative numbers from year 5 by counting forwards and backwards through zero.
They extend their learning by finding intervals across zero.
Children need to see negative numbers in context.

Mathematical Talk

Are negative numbers whole numbers?

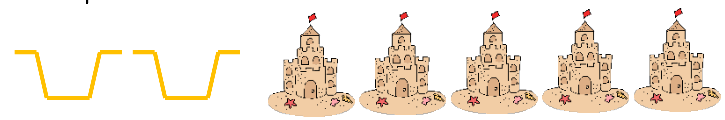
Why do the numbers on a number line mirror each other from 0?

Why does positive one add negative one equal zero?

Draw me a picture to show 5 subtract 8

Varied Fluency

- Use sandcastles (+1) and holes (−1) to calculate.
  Here is an example.

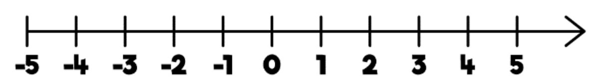
  $-2 + 5 =$ 

  Two sandcastles will fill two holes. There are three sandcastles left, therefore negative two add five is equal to three.

  Use this method to solve:

  $3 - 6$ $\qquad$ $-7 + 8$ $\qquad$ $5 - 9$

- Use the number line to answer the questions.

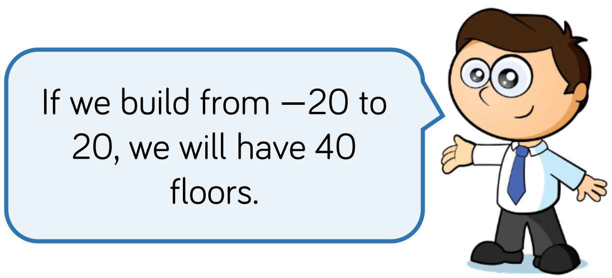
  - What is 6 less than 4?
  - What is 5 more than −2?
  - What is the difference between 3 and −3?

- Mo has £17.50 in his bank account. He pays for a jumper which costs £30. How much does he have in his bank account now?

Negative Numbers

Reasoning and Problem Solving

A company decided to build offices over ground and underground.



Do you agree? Explain why.

No, there would be 41 floors because you need to count floor 0

When counting forwards in tens from any positive one-digit number, the last digit never changes.

When counting backwards in tens from any positive one-digit number, the last digit does change.

Can you find examples to show this?

Explain why this happens.

Possible examples:

9, 19, 29, 39 etc.

9, −1, −11, −21

This happens because when you cross 0, the numbers mirror the positive side of the number line. Therefore, the final digit in the number changes and will make the number bond to 10

Autumn - Block 2

Four Operations

Overview

Small Steps

- Add and subtract whole numbers
- Multiply up to a 4-digit number by 1-digit
- Short division
- Division using factors
- Long division (1)
- Long division (2)
- Long division (3)
- Long division (4)
- Common factors
- Common multiples
- Primes
- Squares and cubes
- Order of operations
- Mental calculations and estimation
- Reason from known facts

NC Objectives

Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Multiply multi-digit number up to 4 digits by a 2-digit number using the formal written method of long multiplication.

Divide numbers up to 4 digits by a 2-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding as appropriate for the context.

Divide numbers up to 4 digits by a 2-digit number using the formal written method of short division, interpreting remainders according to the context.

Perform mental calculations, including with mixed operations and large numbers.

Identify common factors, common multiples and prime numbers.

Use their knowledge of the order of operations to carry out calculations involving the four operations.

Solve problems involving addition, subtraction, multiplication and division.

Use estimation to check answers to calculations and determine in the context of a problem, an appropriate degree of accuracy.

Add & Subtract Integers

Notes and Guidance

Children consolidate their knowledge of column addition and subtraction.
They use these skills to solve multi step problems in a range of contexts.

Mathematical Talk

What happens when there is more than 10 in a place value column?

Can you make an exchange between columns?
How can we find the missing digits? Can we use the inverse?

Is column method always the best method?

When should we use our mental methods?

Varied Fluency

- Calculate.

	3	4	6	2	1
+	2	5	7	3	4

	4	7	6	1	3	2	5
–		9	3	8	0	5	2

67,832 + 5,258

834,501 – 193,642

- A four bedroom house costs £450,000
A three bedroom house costs £199,000 less.
How much does the three bedroom house cost?
What method did you use to find the answer?

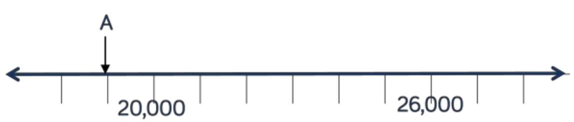
- Calculate the missing digits. What do you notice?

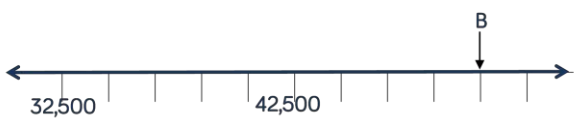
	5	2	2	4	7	?
+	3	?	5	9	0	4
	9	0	?	3	?	2

Add & Subtract Integers

Reasoning and Problem Solving

Find the difference between A and B.





A = 19,000

B = 50,500

The difference is 31,500

Here is a bar model.

A	B
631,255	

A is an odd number which rounds to 100,000 to the nearest ten thousand.
It has a digit total of 30

B is an even number which rounds to 500,000 to the nearest hundred thousand.
It has a digit total of 10

A and B are both multiples of 5 but end in different digits.

What are possible values of A and B?

Possible answer:

A = 99,255

B = 532,000

Multiply 4-digits by 2-digits

Notes and Guidance

Children consolidate their knowledge of column multiplication, multiplying numbers with up to 4 digits by a 2-digit number. They use these skills to solve multi step problems in a range of contexts.

Mathematical Talk

What is important to remember as we begin multiplying by the tens number?

How would you draw the calculation?

Can the inverse operation be used?

Is there a different strategy that you could use?

Varied Fluency

Calculate.

	4	2	6	7
×			3	4

	3	0	4	6
×			7	3

5,734 × 26

Lauren made cookies for a bake sale.
She made 345 cookies.
The recipe stated that she should have 17 chocolate chips in each cookie.

How many chocolate chips did she use altogether?

Work out the missing number.

$6 \times 35 = \_\_\_\_ \times 5$

Multiply 4-digits by 2-digits

Reasoning and Problem Solving

True or False?

- $5,463 \times 18 = 18 \times 5,463$
- I can find the answer to $1,100 \times 28$ by doing $1,100 \times 30$ and subtracting 2 lots of 1,100
- $70 \times 10 = 700 \times 100$

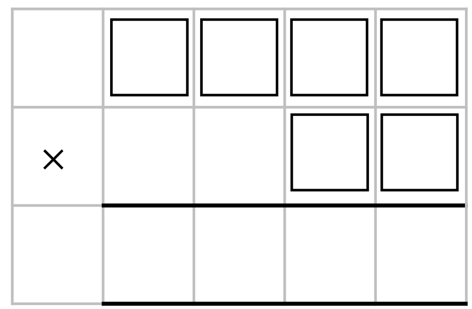
True

True

False

2 3 4 5 7 8

Place the digits in the boxes to make the largest product.



$$\begin{array}{r} 8432 \\ \times \quad 75 \\ \hline 632000 \\ \hline \end{array}$$

Short Division

Notes and Guidance

Children build on their understanding of dividing up to 4-digits by 1-digit by now dividing by up to 2-digits. They use the short division method and focus on division as grouping.

Teachers may encourage children to list the multiples of the number to help them solve the division more easily.

Mathematical Talk

What is different between dividing by 1 digit and 2 digits?

If the number does not divide into the ones, what do we do?

Do we need to round our remainders up or down? Why does the context affect whether we round up or down?

Varied Fluency

- Calculate using short division.

5	7	2	5

3	1	9	3	8

12	6	0	3	6

$3{,}612 \div 14$

List the multiples of the numbers to help you calculate.

- A limousine company allows 14 people per limousine.

  How many limousines are needed for 230 people?

- Year 6 has 2,356 pencil crayons for the year.

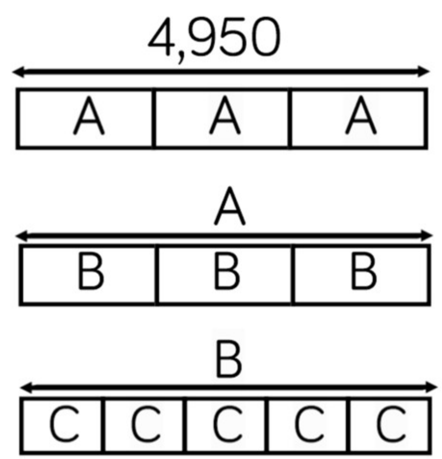
  They put them in bundles, with 12 in each bundle.

  How many complete bundles can be made?

Short Division

Reasoning and Problem Solving

Find the missing digits. 0 4 1 □ r3 4 ⟌ 1 □ 5 9	0 4 1 4 r3 4 ⟌ 1 6 5 9
Here are two calculation cards. $A = 396 \div 11$ $B = 832 \div 13$ Find the difference between A and B.	$396 \div 11 = 36$ $832 \div 13 = 64$ $64 - 36 = 28$

Work out the value of C. (The bar models are not drawn to scale)  	$4{,}950 \div 3 =$ $1{,}650$ $1{,}650 \div 3 = 550$ $550 \div 5 = 110$

Division using Factors

Notes and Guidance

Children need to use their number sense, specifically their knowledge of factors to be able to see relationships between the divisor and dividend. Beginning with multiples of 10 and moving on will allow the children to see the relationship before progressing forward.

Mathematical Talk

What is a factor?
How does using factor pairs help us to answer division questions?
Do you notice any patterns?
Does using factor pairs always work?
Is there more than one way to solve a calculation using factor pairs?
What methods can be used to check your working out?

Varied Fluency

- Calculate $780 \div 20$

  Now calculate $780 \div 10 \div 2$

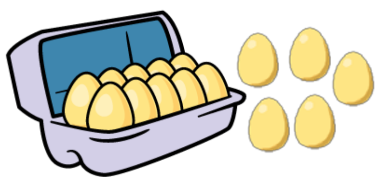
  What do you notice? Why does this work?

  Use the same method to calculate $480 \div 60$

- Use factors to help you calculate.

$$4{,}320 \div 15$$

- Eggs are put into boxes.
  Each box holds a dozen eggs.
  A farmer has 648 eggs that need to go in boxes.

  How many boxes will he fill?

Division using Factors

Reasoning and Problem Solving

Calculate: • 1,248 ÷ 48 • 1,248 ÷ 24 • 1,248 ÷ 12 What did you do each time? What was your strategy? What do you notice? Why?	26 52 104 Children should recognise that when dividing by half of the amount the answer is doubled.
Tommy says,  To work out 4,320 ÷ 15 I will first divide 4,320 by 5 then divide the answer by 10 Do you agree? Explain why.	Tommy is wrong because he has partitioned 15 when he should have used factor pairs. The correct answer is 288

Class 6 are calculating 7,848 ÷ 24 The children decide which factor pairs to use. Here are some of their suggestions: • 2 and 12 • 4 and 6 • 10 and 14 Which will not give them the correct answer? Why? Use the two correct factor pairs to calculate the answer. Is it the same each time?	10 and 14 is incorrect because this is partitioned, they are not factors of 24 The correct answer should be 327 Children should get the same answer using both methods.

White Rose Maths

Long Division (1)

Notes and Guidance

Children are introduced to long division as a different method of dividing by a 2-digit number. They divide 3-digit numbers by a 2-digit number without remainders moving from a more expanded method with multiples shown to the more formal long division method.

Mathematical Talk

How can we use our multiples to help us divide by a 2-digit number?

Why are we subtracting the totals from the starting number (seeing division as repeated subtraction)?

In long division, what does the arrow represent? (The movement of the next digit coming down to be divided)

Varied Fluency

		3	6	
12	4	3	2	
–	3	6	0	(×10)
		7	2	
–		7	2	(×6)
			0	

<u>Multiples to help</u>
$12 \times 1 = 12$
$12 \times 2 = 24$
$12 \times 5 = 60$
$12 \times 10 = 120$

Use this method to calculate:

$765 \div 17$ $450 \div 15$ $702 \div 18$

	0	3	6
12	4	3	2
–	3	6	↓
		7	2
–		7	2
			0

Use the long division method to calculate:

$836 \div 11$ $798 \div 14$ $608 \div 19$

One has been done for you.

Long Division (1)

Reasoning and Problem Solving

Odd One Out

Which is the odd one out?
Explain your answer.

$512 \div 16$

$672 \div 21$

$792 \div 24$

$792 \div 24 = 33$ so this is the odd one out as the other two give an answer of 32

Spot the Mistake

$746 \div 16 =$

$$
\begin{array}{r l}
41 & \\
16\overline{)746} & \\
-\ 64\downarrow & (\times 4) \\
\hline
106 & \\
-\ 106 & (\times 10) \\
\hline
0 &
\end{array}
$$

They mistakenly thought that 106 divided by 16 was 10

White Rose Maths

Long Division (2)

Notes and Guidance

Building on using long division with 3-digit numbers, children divide four-digit numbers by 2-digits using the long division method.
They use their knowledge of multiples and multiplying and dividing by 10 and 100 to calculate more efficiently.

Mathematical Talk

How can we use our multiples to help us divide by a 2-digit number?

Why are we subtracting the totals from the beginning number? (Seeing division as repeated subtraction)

In long division, what does the arrow represent? (The movement of the next digit coming down to be divided)

Varied Fluency

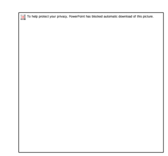
Here is a division method.

	0	4	8	9	
15	7	3	3	5	
−	6	0	0	0	(×400)
	1	3	3	5	
−	1	2	0	0	(×80)
		1	3	5	
−		1	3	5	(×9)
				0	

Use this method to calculate:

2,208 ÷ 16 1,755 ÷ 45 1,536 ÷ 16

There are 2,028 footballers in a tournament.
Each team has 11 players and 2 substitutes.
How many teams are there in the tournament?



White Rose Maths

Long Division (2)

Reasoning and Problem Solving

Which question is harder? $1{,}950 \div 13$ $1{,}950 \div 15$ Explain why.	Dividing by 13 is harder as 13 is prime so we can't divide it in smaller parts, and the 13 times table is harder than the 15 times table.
$6{,}823 \div 19 = 359$ r2 $8{,}259 \div$ ★ $= 359$ r2 ★ is a prime number. Find the value of ★	23

Long Division (3)

Notes and Guidance

Children now divide using long division where their answers have remainders. After dividing, they check that their remainder is smaller than their divisor.

Children start to understand when rounding is appropriate to use for interpreting the remainder and when the context means that this is not applicable.

Mathematical Talk

How can we use our multiples to help us divide?

What happens if we cannot divide our ones exactly by our divisor? How do we show what we have left over?

Why are we subtracting the totals from the starting number? (Seeing division as repeated subtraction)

Does the remainder need to be rounded up or down?

Varied Fluency

Elijah uses this method to calculate 372 divided by 15
He has used his knowledge of multiples to help.

		2	4	r	12
15	3	7	2		
–	3	0	0		
		7	2		
–		6	0		
		1	2		

$1 \times 15 = 15$
$2 \times 15 = 30$
$3 \times 15 = 45$
$4 \times 15 = 60$
$5 \times 15 = 75$
$10 \times 15 = 150$

Use this method to calculate:

$271 \div 17$ $623 \div 21$ $842 \div 32$

A school needs to buy 380 biscuits for parents' evening. They come in packs of 12

How many packets will the school need to buy?

Long Division (3)

Reasoning and Problem Solving

Here are two calculation cards.

A = 396 ÷ 11

B = 832 ÷ 11

Sana think there won't be a remainder in either calculation because 396 and 832 are both multiples of 11

Eve disagrees, she has done the written calculations and says **one** of them has a remainder.

Who is correct? Explain your answer.

Eve is correct because 832 isn't a multiple of 11

The answers are 36 and 75r7

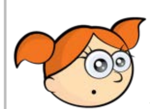
420 children and 32 adults need transport for a school trip.
A coach holds 55 people.

We need 7 coaches.

Dora

We need 8 coaches.

Eva



We need 9 coaches.

Alex

Who is correct? Explain.

Alex is correct because there are 452 people altogether, 452 divided by 55 is 8r12, so 9 coaches are needed.

Long Division (4)

Notes and Guidance

Children now divide four-digit numbers using long division where their answers have remainders. After dividing, they check that their remainder is smaller than their divisor.

Children start to understand when rounding is appropriate to use for interpreting the remainder and when the context means that it is not applicable.

Mathematical Talk

How can we use our multiples to help us divide?
What happens if we cannot divide our ones exactly by our divisor?
How do we show what we have left over?
Why are we subtracting the totals from the starting amount? (Seeing division as repeated subtraction)
Does the remainder need to be rounded up or down?

Varied Fluency

Simon used this method to calculate 1,426 divided by 13

		1	0	9	r	9	
13	1	4	2	6			
–	1	3	0	0			(× 100)
		1	2	6			
–		1	1	7			(×9)
				9			

Use this method to calculate:

2,637 ÷ 16 4,321 ÷ 22 4,203 ÷ 18

There are 7,849 people going to a concert via coach. Each coach holds 64 people.

How many coaches are needed to transport all the people?

Long Division (4)

Reasoning and Problem Solving

Class 6 are calculating three thousand, six hundred and thirty-three divided by twelve. Whitney says that she knows there will be a remainder without calculating. Is she correct? Explain your answer.	Whitney is correct because 3,633 is odd and 12 is even.

Using the number 4,236, how many numbers up to 20 does it divide by without a remainder? Is there are pattern?	1, 2, 3, 4, 6, 12 They are all factors of 12

Common Factors

Notes and Guidance

Children find the common factors of two numbers. Some children may still need to use arrays and other representations at this stage but mental methods and knowledge of multiples should be encouraged.
They can show their results using Venn diagrams and tables.

Mathematical Talk

How do you know you have found all the factors of a given number?
Have you used a system?
Can you explain your system to a partner?
How does a Venn diagram show common factors?
Where are the common factors?

Varied Fluency

- Find the common factors of each pair of numbers.

  24 and 36

  20 and 30

  28 and 45

- Which number is the odd one out?

  12, 30, 54, 42, 32, 48

  Can you explain why?

- Two numbers have common factors of 4 and 9
  What could the numbers be?

Common Factors

Reasoning and Problem Solving

There are 49 pears and 56 oranges.

They need to be put into baskets with an equal number in each basket.

Amir says,

There will be 8 pieces of fruit in each basket.

Jack says,

There will be 7 pieces of fruit in each basket.

Who is correct? Explain how you know.

Jack is correct. There will be seven pieces of fruit in each basket because 7 is a common factor of 49 and 56

Tom has two pieces of string.

One is 160 cm long and the other is 200 cm long.

He cuts them into pieces of equal length.

What are the possible lengths the pieces of string could be?

2, 4, 5, 8, 10, 20 and 40 cm are the possible lengths.

Tahil has 32 football cards that he is giving away to his friends.

He shares them equally.

How many friends could Tahil have?

1, 2, 4, 8, 16 or 32

Common Multiples

Notes and Guidance

Building on knowledge of multiples, children find common multiples of numbers. They should continue to use a visual representation to support their thinking.
They also use more abstract methods to calculate the multiples and use numbers outside of times table facts.

Mathematical Talk

Is the lowest common multiple of a pair of numbers always the product of them?

Can you think of any strategies to work out the lowest common multiples of different numbers?

When do numbers have common multiples that are lower than their product?

Varied Fluency

- On a 100 square, shade the first 5 multiples of 7 and then the first 8 multiples of 5

  What do you notice?

  Choose 2 other times tables which you think will have more than 3 common multiples.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

- List 5 common multiples of 4 and 3

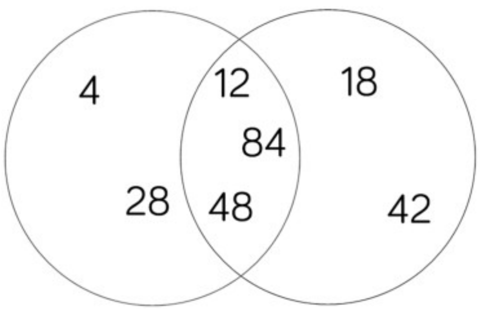
- Jim and Nancy play football at the same local football pitches. Jim plays once every 4 days and Nancy plays once every 6 days.

  They both played football today.

  In a fortnight, how many times will they have played football on the same day?

Common Multiples

Reasoning and Problem Solving

Work out the headings for the Venn diagram.  Add in one more number to each section. Can you find a square number that will go in the middle of the Venn diagram?	Multiples of 4 Multiples of 6 144 is a square number that can go in the middle.
Nancy is double her sister's age. They are both older than 20 but younger than 50 Their ages are both multiples of 7 Work out their ages.	Nancy is 42 and her sister is 21
A train starts running from Leeds to York at 7am. The last train leaves at midnight. Platform 1 has a train leaving from it every 12 minutes. Platform 2 has one leaving from it every 5 minutes. How many times in the day would there be a train leaving from both platforms at the same time?	18 times

Primes to 100

Notes and Guidance

Building on their learning in year 5, children should know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers.
They should be able to use their understanding of prime numbers to work out whether or not numbers up to 100 are prime. Using primes, they break a number down into its prime factors.

Mathematical Talk

What is a prime number?
What is a composite number?
How many factors does a prime number have?
Are all prime numbers odd?
Why is 1 not a prime number?
Why is 2 a prime number?

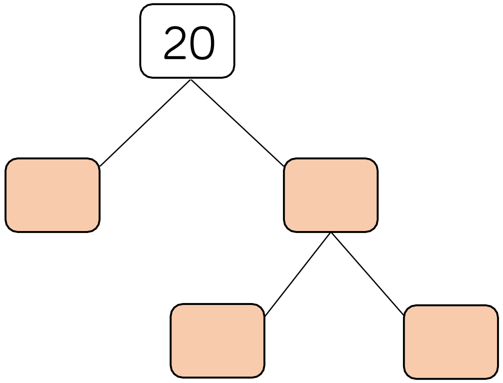
Varied Fluency

- List all of the prime numbers between 10 and 30

- The sum of two prime numbers is 36

  What are the numbers?

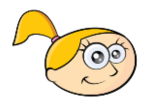
- All numbers can be broken down into prime factors.
  A prime factor tree can help us find them.
  Complete the prime factor tree for 20



Primes to 100

Reasoning and Problem Solving

Use the clues to work out the number. • It is greater than 10 • It is an odd number • It is not a prime number • It is less than 25 • It is a factor of 60	15

Shade in the multiples of 6 on a 100 square. What do you notice about the numbers either side of every multiple of 6?	Both numbers are always odd.
Eva says,  I noticed there is always a prime number next to a multiple of 6 Is she correct? Explore this.	Yes, Eva is correct because at least one of the numbers either side of a multiple of 6 is always prime.

Square & Cube Numbers

Notes and Guidance

Children have identified square and cube numbers previously and now need to explore the relationship between them and solve problems involving these numbers.
They need to experience sorting the numbers into different diagrams and look for patterns and relationships. They need to explore general statements.
This step is a good opportunity to practice efficient mental methods of calculation.

Mathematical Talk

What do you notice about the sequence of square numbers?

What do you notice about the sequence of cube numbers?

Explore the pattern of the difference between the numbers.

Varied Fluency

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

3 cubed ◯ 6 squared

8 squared ◯ 4 cubed

11 squared ◯ 5 cubed

This table shows square and cube numbers. Complete the table. Explain the relationships you can see between the numbers.

	3×3		3^3		27
		25	5^3		
6^2				$6 \times 6 \times 6$	
	4×4		4^3		
					8
9^2					

____ + 35 = 99

210 – ____ = 41

Which square numbers are missing from the calculations?

Square & Cube Numbers

Reasoning and Problem Solving

Place 5 odd and 5 even numbers in the table.

	Not Cubed	Cubed
Over 100		
100 or less		

Possible cube numbers to use:

8, 27, 64, 125, 216, 343, 512, 729, 1,000

Shade in all the square numbers on a 100 square.

Now shade in multiples of 4

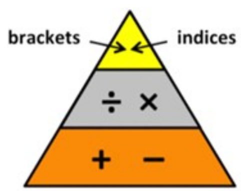
What do you notice?

Square numbers are always either a multiple of 4 or 1 more than a multiple of 4

Order of Operations

Notes and Guidance

Children will look at different operations within a calculation and consider how the order of operations affects the answer.
The following image is useful when referring to the order of operations.



Mathematical Talk

Does it make a difference if you change the order in a mixed operation calculation?

What would happen if we did not use the brackets?

Would the answer be correct?

Why?

Varied Fluency

- Sarah has 7 bags with 5 sweets in each bag.
  She adds one more sweet to each bag.
  Which calculation will work out how many sweets she now has in total? Explain your answer.

$$7 \times (5 + 1)$$

$$7 \times 5 + 1$$

- Daniel has completed the calculation and got an answer of 96

$$2(30 \div 5) + 14 = 96$$

  Can you explain what he did and where he made the mistake?

- Add brackets and missing numbers to make the calculations correct.

$$3 + \_\_\_ \times 5 = 25$$

$$25 - 6 \times \_\_\_ = 38$$

Order of Operations

Reasoning and Problem Solving

Countdown

Big numbers: 25, 50, 75, 100

Small numbers: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Children randomly select 6 numbers.

Reveal a target number.

Children aim to make the target number ensuring they can write it as a single calculation using order of operations.

Write different number sentences using the digits 3, 4, 5 and 8 before the equals sign that use:

- One operation
- Two operations with no brackets
- Two operations with brackets

Possible solutions:

$58 - 34 = 14$

$58 + 3 \times 4 = 70$

$5(8 - 3) + 4 = 29$

Mental Calculations

Notes and Guidance

We have included this small step separately to ensure that teachers emphasise this important skill. Discussions around efficient mental calculations and sensible estimations need to run through all steps.
Sometimes children are too quick to move to computational methods, when changing the order leads to quick mental methods and solutions.

Mathematical Talk

Is there an easy and quick way to do this?

Can you use known facts to answer the problem?

Can you use rounding?

Does the solution need an exact answer?

How does knowing the approximate answer help with the calculation?

Varied Fluency

How could you change the order of these calculations to be able to perform them mentally?

$50 \times 16 \times 2$

$30 \times 12 \times 2$

$25 \times 17 \times 4$

Jamie buys a t-shirt for £9.99, socks for £1.49 and a belt for £8.99
He was charged £23.47
How could he quickly check if he was overcharged?

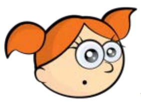
What do you estimate B represents when:
- A = 0 and C = 1,000
- A = 30 and C = 150
- A = −7 and C = 17
- A = 0 and C = 1,000
- A = 1,000 and C = 100,000

Mental Calculations

Reasoning and Problem Solving

Class 6 are trying to find the total of 3,912 and 3,888

Alex



We just need to double 3,900

Is Alex correct? Explain.

Alex is correct because 3,912 is 12 more than 3,900 and 3,888 is 12 less than 3,900

2,000 – 1,287

Dora

I used the column method.

Tommy

I used my number bonds from 87 to 100 then from 1,300 to 2,000

Jack

I subtracted one from each number and then used the column method.

Whose method is most efficient?

Children share their ideas. Discuss how Dora's method is inefficient for this question because the multiple exchanges make it difficult.

Reason from Known Facts

Notes and Guidance

Children should use their understanding of known facts from one calculation to work out the answer of another similar calculation without starting afresh.
They should use reasoning and apply their knowledge of commutativity and inverse operations.

Mathematical Talk

What is the inverse?

When do you use the inverse?

How can we use multiplication/division facts to help us answer similar questions?

Varied Fluency

Complete.

$70 \div \_\_\_ = 3.5$	$\_\_\_ \times 3.5 = 7$
$70 \div \_\_\_ = 7$	$3.5 \times 20 = \_\_\_$
$\_\_\_ \div 2 = 35$	$70 \div \_\_\_ = 3.5$

Make a similar set of calculations using $90 \div 2 = 45$

$5,138 \div 14 = 367$

Use this to calculate 15×367

$14 \times 8 = 112$

Use this to calculate:

- 1.4×8
- 140×8

Reason from Known Facts

Reasoning and Problem Solving

$$3{,}565 + 2{,}250 = 5{,}815$$

True or False?

$4{,}565 + 1{,}250 = 5{,}815$

$5{,}815 - 2{,}250 = 3{,}565$

$4{,}815 - 2{,}565 = 2{,}250$

$4{,}065 + 2{,}750 = 6{,}315$

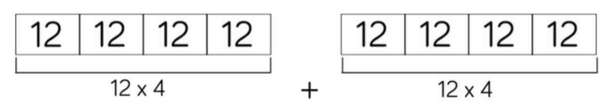
True
True
True
False

Which calculations will give an answer that is the same as the product of 12 and 8?

$3 \times 4 \times 8$

$12 \times 4 \times 2$

$2 \times 10 \times 8$



All apart from the third one will give the same answer (96)

White Rose Maths

Autumn - Block 3

Fractions

White Rose Maths

Overview

Small Steps

- Simplify fractions
- Fractions on a number line
- Compare and order (denominator)
- Compare and order (numerator)
- Add and subtract fractions (1)
- Add and subtract fractions (2)
- Add fractions
- Subtract fractions
- Mixed addition and subtraction
- Multiply fractions by integers
- Multiply fractions by fractions
- Divide fractions by integers (1)
- Divide fractions by integers (2)
- Four rules with fractions
- Fraction of an amount
- Fraction of an amount – find the whole

NC Objectives

Use common factors to simplify fractions; use common multiples to express fractions in the same denomination.

Compare and order fractions, including fractions > 1

Generate and describe linear number sequences (with fractions)

Add and subtract fractions with different denominations and mixed numbers, using the concept of equivalent fractions.
Multiply simple pairs of proper fractions, writing the answer in its simplest form [for example $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$]

Divide proper fractions by whole numbers [for example $\frac{1}{3} \div 2 = \frac{1}{6}$]
Associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example $\frac{1}{8}$]

Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.

Simplify Fractions

Notes and Guidance

Children build on their knowledge of factors to help them simplify fractions. They must choose which method is most efficient. Is it identifying if the denominator is a multiple of the numerator, or is it finding a highest common factor?

Mathematical Talk

In order to make a simpler fraction, which direction do you move on the fraction wall? Up or down?

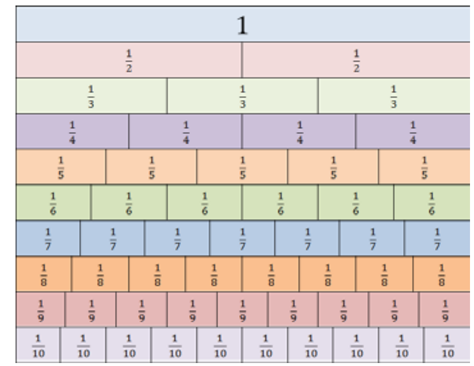
Is the most efficient method dividing by two? Explain your reasoning.

What is the highest common factor of the numerator and the denominator? How does this help you when simplifying?

Varied Fluency

- Use the fraction wall to simplify:

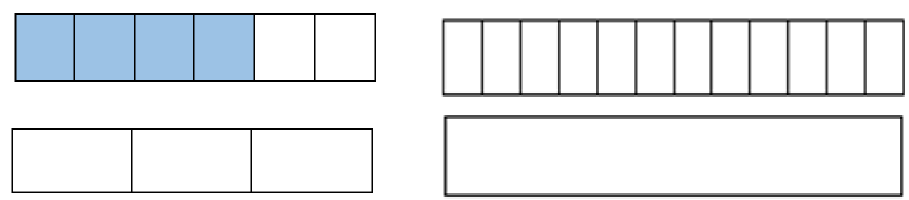
  $\frac{2}{8}$ $\frac{3}{9}$ $\frac{4}{10}$

  Which direction did you move on the fraction wall?

  What have the numerator and denominator been divided by?

- Use bar models to simplify the fractions.
  Make sure your bar model has fewer parts than the original fraction.

  $\frac{4}{6} = \frac{\square}{3}$ $\frac{8}{12} = \frac{\square}{\square}$

Simplify Fractions

Reasoning and Problem Solving

Sam has simplified $\frac{6}{12}$ $\frac{6}{12} \quad \frac{3}{6}$ What method has he used? Is this the most efficient method? Explain.	He has just halved the numerator and denominator. This is not the most efficient method as it isn't yet fully simplified. If he'd have just divided by 6 he would have got straight to the answer $\frac{1}{2}$
Hassan thinks that $\frac{2}{5}$ in its simplest form is $\frac{1}{2.5}$ Do you agree? Convince me.	No because $\frac{2}{5}$ is simplified as it has two prime numbers and you don't have decimal numbers in a fraction.

Always, sometimes, never. To simplify a fraction you divide by 2 until you can't divide by 2 anymore.	Sometimes

Fractions on a Number Line

Notes and Guidance

Children use their knowledge of equivalent fractions and ordering fractions to place fractions on a number line. They can draw their own divisions to help them place the fractions more accurately.

Mathematical Talk

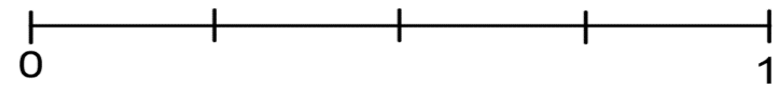
How are the number lines similar and different?

Are there any other fractions we can place on the number line? Which fractions can't be placed on the number line?

Which method have you used to help you place improper fractions on a number line?

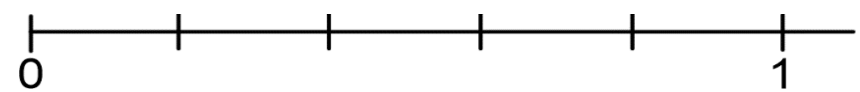
Varied Fluency

- On the number line place $\frac{2}{8}, \frac{4}{8}, \frac{1}{8}, \frac{4}{4}, \frac{7}{8}$ and $\frac{3}{16}$



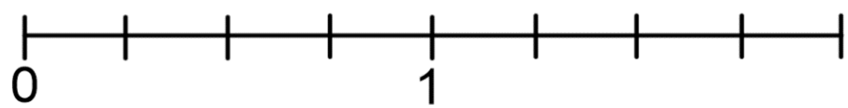
Which other fractions, with different denominators can be placed on the number line?

- On the number line place $\frac{2}{5}, \frac{3}{10}, \frac{6}{15}, \frac{10}{15}$ and $\frac{4}{5}$



What other fractions can you place on this number line?

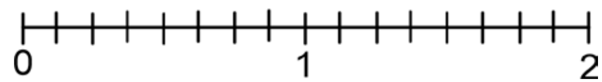
- On the number line place $\frac{10}{20}, \frac{1}{4}, \frac{6}{4}, 1\frac{3}{8}, \frac{15}{8}$ and $1\frac{7}{8}$



Fractions on a Number Line

Reasoning and Problem Solving

What would you split your number line into to plot the fractions? $$\frac{1}{3}, \frac{11}{12}, \frac{5}{6}$$ Explain your answer. Is this the only answer?	You can split the number line into twelfths because you would be able to plot all three fractions on this. You could also split it into any multiple of 12

How many ways can you show a difference of one quarter on the number line? 	Various answers available.

Compare & Order (Denominator)

Notes and Guidance

Children build on their equivalent fraction and common multiple knowledge to compare and order fractions where the denominators are not always multiples of the same number.

Mathematical Talk

What has happened to the original fractions?

What do you notice about the original denominators and the new denominator? Explain what has happened.

What do you notice?
How do you find a common denominator?
What else could the common denominator be?

Varied Fluency

- Use the bar models to show $\frac{1}{4}$ and $\frac{2}{3}$ then complete the sentences.

____ is larger than ____ ____ is smaller than ____

____ < ____

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

$\frac{3}{5} \bigcirc \frac{4}{7}$ $\frac{2}{6} \bigcirc \frac{1}{4}$ $2\frac{1}{5} \bigcirc 2\frac{3}{8}$

$\frac{7}{8} \bigcirc \frac{4}{6} \bigcirc \frac{3}{4}$

- Jen read $\frac{3}{4}$ of her book, Emma read $\frac{3}{10}$ of her book and Amy read $\frac{4}{5}$ of her book.
Put them in order starting with the person who has read the most of their book.

Compare & Order (Denominator)

Reasoning and Problem Solving

Use the digit cards to complete the statements.

5 6 3 4

$$\frac{\square}{\square} > \frac{\square}{\square} \qquad \frac{\square}{4} < \frac{6}{\square}$$

Find three examples of ways you could complete the statement.

$$\frac{\square}{\square} < \frac{\square}{\square}$$

Can one of your ways include an improper fraction?

Multiple answers.

E.g. $\frac{4}{6} > \frac{3}{5}$ for the first one, and $\frac{3}{4} < \frac{6}{5}$ for the second one.

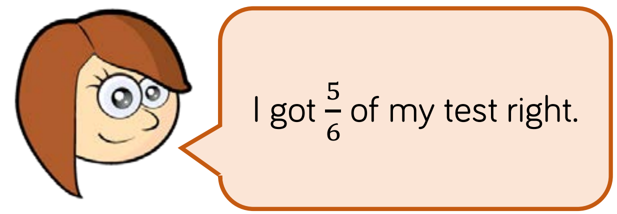
$\frac{3}{5} < \frac{6}{4}$

$\frac{3}{4} < \frac{6}{5}$

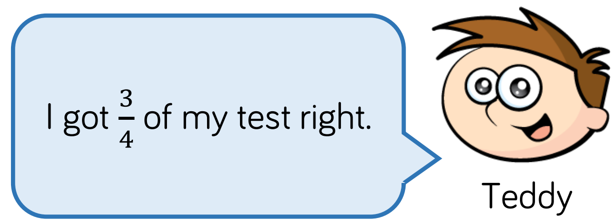
$\frac{4}{5} < \frac{6}{3}$

More answers available.

Rosie and Teddy sat the same maths test.



Rosie



Teddy

Who did better on the test? Explain how you know.

Rosie did better because $\frac{5}{6}$ is greater than $\frac{3}{4}$

Compare & Order (Numerator)

Notes and Guidance

To build on finding common denominators, children explore how finding a common numerator can be effective too.

It's important for children to develop number sense and discover which is the most effective strategy for a range of questions.

Mathematical Talk

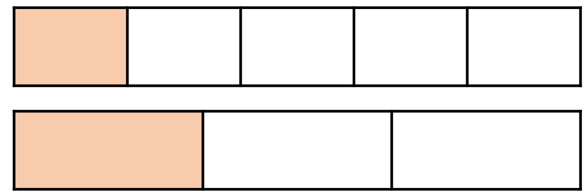
What's the same and what's different about the fractions on the bar model? Can we create a rule? How is this different to when the denominators are the same?

Can you find a common numerator to help you compare? How will you do this?

Why is finding a common numerator the most efficient method? What do you notice about all the denominators? How can we find a common numerator?

Varied Fluency

- Compare the fractions.



One third is ________________ one fifth.

$\frac{\square}{\square} \bigcirc \frac{\square}{\square}$

What is the rule when comparing fractions with the same numerator?

- The fractions are in order from greatest to smallest. What faction could go in the space?

$\frac{4}{7}$ ____ $\frac{4}{11}$

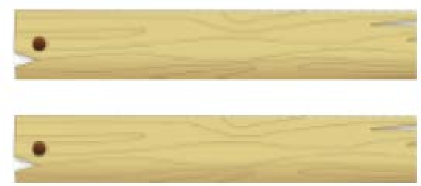
- Use <, > or = to make the statements correct.

$\frac{8}{11} \bigcirc \frac{8}{19}$ $1\frac{2}{7} \bigcirc 1\frac{4}{5}$ 2 fifths $\bigcirc$ 4 sevenths

Compare & Order (Numerator)

Reasoning and Problem Solving

Bob is comparing the fractions $\frac{3}{7}$ and $\frac{6}{11}$ He wants to find a common denominator. Explain whether you think this is the most effective strategy.	This is not the most effective strategy because both denominators are prime. He could find a common numerator by changing $\frac{3}{7}$ into $\frac{6}{14}$ and comparing them by using the rule 'when the numerator is the same, the smaller the denominator, the bigger the fraction' $\frac{6}{11}$ is bigger.

Here are two fractions of two pieces of wood.  $\frac{5}{6}$ $\frac{3}{4}$ Which piece of wood is the longest? Explain your answer. Can you explain your method?	The second piece is longer because $\frac{1}{4}$ is bigger than $\frac{1}{6}$ so if the missing pieces were added on the second piece would be longer. Could discuss why $\frac{3}{4}$ is bigger in this compared to previous small step.

White Rose Maths

Add & Subtract Fractions (1)

Notes and Guidance

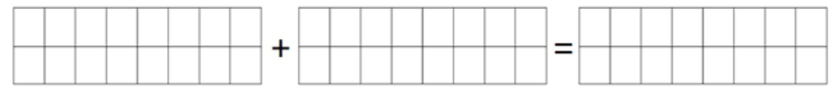
Building on their skills of finding common denominators, children will add fractions when the answer is less than 1. They will work with fractions with different denominators where one is a multiple of the other and where they are not. It is important that children find the lowest common denominator not just any common denominator.

Mathematical Talk

What must we do if our denominator is different?
Could your answer be simplified?
How will you make a whole one?
Are there any other ways? What do you notice about the denominators.
Explain your method.

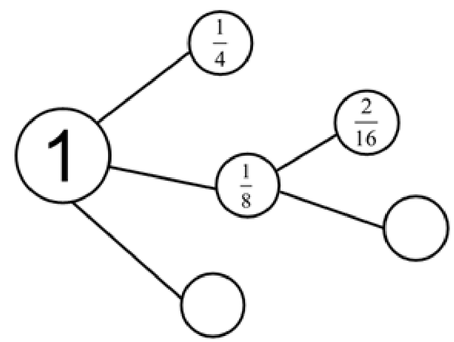
Varied Fluency

- Shade in the diagram to show that $\frac{5}{8} + \frac{3}{16} = \frac{13}{16}$



Draw your own diagram to show that $\frac{1}{3} + \frac{2}{9} = \frac{5}{9}$

- Complete the part-whole model.



- Emma uses $\frac{1}{3}$ of her tin of paint on Friday, $\frac{1}{21}$ on Saturday and on Sunday she uses $\frac{2}{7}$.
How much paint does she have left?

Add & Subtract Fractions (1)

Reasoning and Problem Solving

Can you complete the calculation using the same digit? $\frac{\boxed{}}{\boxed{5}} + \frac{\boxed{1}}{\boxed{}} = \frac{\boxed{9}}{\boxed{10}}$	$\frac{2}{5} + \frac{1}{2} = \frac{9}{10}$
Shelden subtracted $\frac{3}{5}$ from a fraction and his answer was $\frac{8}{45}$ What was the original question?	$\frac{35}{45} - \frac{27}{45} = \frac{8}{45}$ So the original question could have been $\frac{7}{9} - \frac{3}{5} = \frac{8}{45}$

Amy answered the following calculation: $\frac{3}{6} + \frac{1}{15} = \frac{4}{21}$ Do you agree with her? Explain your answer. If you don't agree with Amy, what should the answer be?	Amy is wrong because she has just added the numerators and the denominators rather than finding a common denominator. It should be $\frac{15}{30} + \frac{2}{30} = \frac{17}{30}$

Add & Subtract Fractions (2)

Notes and Guidance

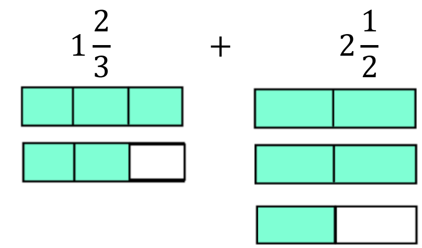
Children are to build on their knowledge of adding and subtracting fractions within 1, finding common denominators and applying it to mixed numbers.
At this stage children may choose to deal with the whole numbers and fractions separately, or convert the mixed numbers to improper fractions. Can they prove and explain why both methods work in this case? When might it not work?

Mathematical Talk

What do you notice about your answer? Can you convert it back into a mixed number?
How might we approach this question? Do we need to convert the mixed number into an improper fraction? Explain why.
Which is the most efficient method.
Could you show me how you might use a number line to answer this question? Can you explain how you might solve this mentally?

Varied Fluency

- Can you split the bar models so each fraction has the same denominator?

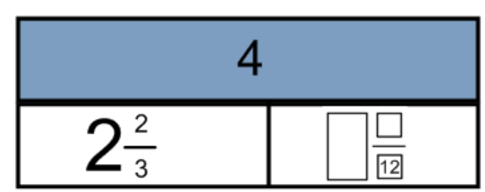


How can you use this information to solve the original calculation?

- Complete the calculation.

$$\square\frac{\square}{\square} = 3\frac{1}{2} + 1\frac{1}{4}$$

- Complete the bar model.



Add & Subtract Fractions (2)

Reasoning and Problem Solving

Fill in the blank boxes.

$2\frac{1}{4}$	$\square\frac{\square}{8}$	$\frac{1}{2}$	$= 3\frac{7}{8}$
$\frac{1}{\square}$			
$3\frac{1}{12}$			
$\parallel$			
$5\frac{1}{2}$			

$2\frac{1}{4}$	$1\frac{1}{8}$	$\frac{1}{2}$
$\frac{1}{6}$		
$3\frac{1}{12}$		

$a = d - 7$

$c + c = 2$

$3 \times 4 = d$

$b = a - 3$

Use this information to complete the following calculation and find the value of e.

$$a\frac{c}{b} - 3\frac{c}{d} = e\frac{a}{d}$$

$$5\frac{1}{2} - 3\frac{1}{12} = 2\frac{5}{12}$$

$e = 2$

Add Fractions

Notes and Guidance

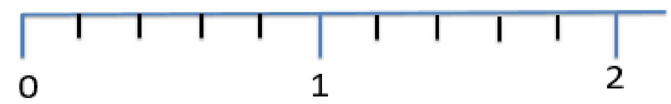
To build on knowledge of adding fractions, children now add fractions that give a total greater than one.
It is important that children are exposed to a range of examples e.g. adding improper fractions and mixed numbers.

Mathematical Talk

How can we represent $\frac{2}{5}$ and $\frac{4}{5}$ on a number line?
When adding two fractions with sixths, how will we split our number line?
What do you notice is happening when you add fractions with the same denominator?
What can we do if our denominators are different?

Varied Fluency

Use the number line to solve $\frac{2}{5} + \frac{4}{5}$

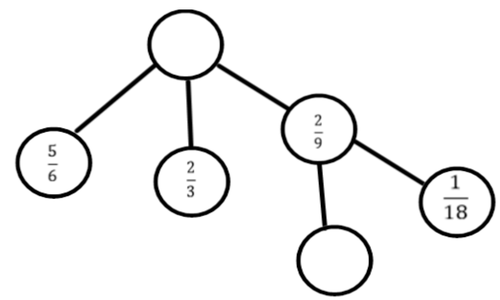


Use a number line to solve
- 3 sixths plus 5 sixths
- $\frac{11}{7} + \frac{5}{7}$

Find the sum of:

$\frac{13}{4}$ and $\frac{5}{6}$ $\frac{26}{7}$ and $\frac{2}{3}$

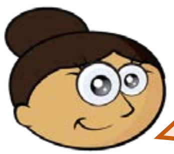
Complete the part-whole model.



Add Fractions

Reasoning and Problem Solving

Dora has worked out the answer to a question.



The answer is $1\frac{1}{5}$

What could the question have been?

Lots of answers available.

Possible answers:

$$\frac{4}{5} + \frac{2}{5}$$

$$\frac{4}{10} + \frac{16}{20}$$

Etc.

Fill in the boxes to make the calculation correct.

$$\boxed{1}\frac{\boxed{}}{\boxed{10}} = \frac{\boxed{3}}{\boxed{}} + \frac{\boxed{}}{\boxed{10}}$$

Various answers available. E.g.

$$\boxed{1}\frac{\boxed{1}}{\boxed{10}} = \frac{\boxed{3}}{\boxed{5}} + \frac{\boxed{5}}{\boxed{10}}$$

Subtract Fractions

Notes and Guidance

Children build on their knowledge of subtracting fractions. This small step encourages children to use one of their wholes to create a new mixed number fraction so they can complete the calculation.

It is vital that children know that fractions such as $3\frac{1}{4}$ and $2\frac{5}{4}$ are equal.

Mathematical Talk

Which fraction is greatest? How do you know? We must look at the whole numbers to help us.

Have we still got the same fraction? How do you know?

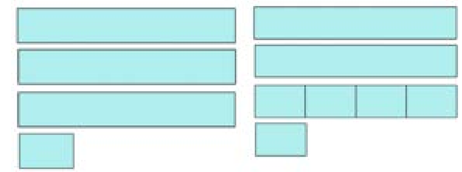
What are the five wholes made up of? How do you know? Can you use one of these wholes to help you complete the calculation?

What calculation will we complete to solve the problem?

Varied Fluency

- Calculate $3\frac{1}{4} - 1\frac{3}{4}$

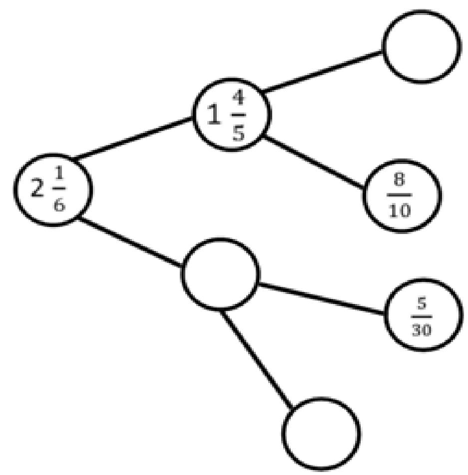
  $3\frac{1}{4}$ can become $2\frac{5}{4}$



  How can you use the equivalent fraction of $2\frac{5}{4}$ to complete the calculation?

- Tina has $3\frac{2}{3}$ bags left of bird feed. She uses $1\frac{4}{6}$
  How much will she have left?

- Complete the part-whole model.



Subtract Fractions

Reasoning and Problem Solving

Tina has 5 bags of sweets.

On Monday she eats $\frac{2}{3}$ of a bag and gives $\frac{4}{5}$ of a bag to her friend.

On Tuesday she eats $1\frac{1}{3}$ bags and gives $\frac{2}{5}$ of a bag to her friend.

What fraction of her sweets does she have left?

$\frac{2}{3} + \frac{4}{5} = 1\frac{7}{15}$

$5 - 1\frac{7}{15} = 3\frac{8}{15}$

$1\frac{1}{3} + \frac{2}{5} = 1\frac{11}{15}$

$3\frac{8}{15} - 1\frac{11}{15}$

$= 1\frac{12}{15}$

Tina has $1\frac{12}{15}$ of her sweets left. Can be simplified to $1\frac{4}{5}$

Fill in the boxes to make the calculation correct.

$$\boxed{1}\frac{\boxed{}}{\boxed{2}} = \boxed{3}\frac{\boxed{1}}{\boxed{}} - \boxed{1}\frac{\boxed{}}{\boxed{10}}$$

$$\boxed{1}\frac{\boxed{1}}{\boxed{2}} = \boxed{3}\frac{\boxed{1}}{\boxed{5}} - \boxed{1}\frac{\boxed{7}}{\boxed{10}}$$

Mixed Addition & Subtraction

Notes and Guidance

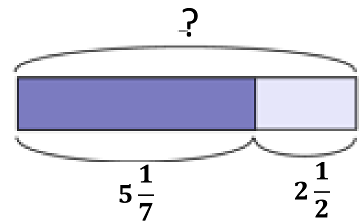
Children are given the opportunity to consolidate adding and subtracting fractions.
The examples provided encourage the use of the bar model, part-whole models and word problems which include mixed numbers and improper fractions.

Mathematical Talk

What other calculations could you write using the bar model?
Can you draw a bar model to show the second calculation? Where would the '?' go?
Explain how you know the fraction can be simplified.
How many different ways can you show $6\frac{7}{30}$?
How might these different representations help you solve the calculation?

Varied Fluency

- Complete the bar model and use it to answer the following calculations



$2\frac{1}{2} + 5\frac{1}{7} = \boxed{}$

$\boxed{} - 2\frac{1}{2} = 5\frac{1}{7}$

Can you rewrite the calculations as improper fractions?

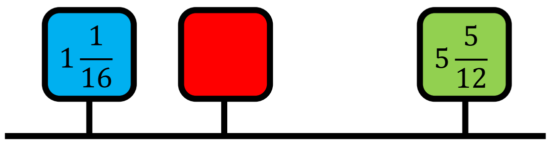
- Fill in the blank. Give your answer in the simplest form:

$$\frac{4}{15} + \frac{1}{5} + \boxed{} = 1$$

- Lizzie and Marie each had an ice cream sundae. Lizzie only ate $\frac{3}{4}$ of hers and Marie left $\frac{2}{5}$ of her sundae. How much ice cream was left over? Who ate the largest fraction of their sundae? By how much?

Mixed Addition & Subtraction

Reasoning and Problem Solving



The green box is $3\frac{2}{3}$ more than the red box.

The red box is $\square\frac{\square}{\square}$

The red box is $\frac{\square}{\square}$ greater than the blue box.

$$5\frac{5}{12} - 3\frac{2}{3}$$
$$= 1\frac{9}{12}$$

The red box is $1\frac{3}{4}$

$$1\frac{3}{4} - 1\frac{1}{16} = \frac{11}{16}$$

The red box is $\frac{11}{16}$ greater than the blue box.

Fill in the boxes to make the calculation correct.

$\frac{1}{3}$ $\frac{2}{6}$ $\frac{1}{9}$ $\frac{15}{27}$ $\frac{12}{13}$ $\frac{6}{108}$

$$\square + \square + \square = \frac{1}{2} = \square - \square$$

$$\frac{1}{3} + \frac{1}{9} + \frac{6}{108}$$
$$= \frac{1}{2}$$
$$= \frac{15}{27} - \frac{6}{108}$$

Multiply Fractions by Integers

Notes and Guidance

Children will use their understanding of fractions to multiply whole numbers and fractions together.
It is important that they experience varied representations of fractions. They must also be able to multiply whole numbers and mixed numbers.

Mathematical Talk

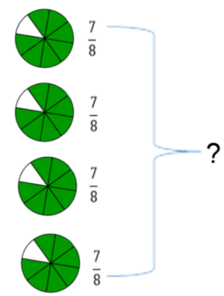
How could you represent this fraction?
What is the denominator? How do you know?
How many whole pieces do we have?
What is multiplying fractions similar to? (repeated addition)
Why have you chosen to represent the fraction in this way?
How many wholes are there?
How many parts are there?

Varied Fluency

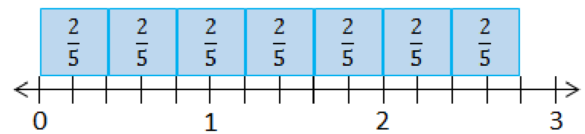
- Complete:

$3 \times \frac{2}{3}$

$4 \times \frac{7}{8}$



$\frac{2}{5} \times 7$



- Sally and 3 of her friends have $1\frac{2}{3}$ of a chocolate bar each. How much chocolate do they have altogether?

- Complete and then order:

  - $6 \times \frac{5}{7}$ $\quad$ $\frac{5}{6} \times 5$ $\quad$ $4 \times \frac{7}{8}$
  - $4 \times 2\frac{3}{5}$ $\quad$ $3\frac{4}{9} \times 3$ $\quad$ $5 \times 2\frac{3}{7}$

White Rose Maths

Multiply Fractions by Integers

Reasoning and Problem Solving

There are 9 lamp posts on a road. There is $4\frac{3}{8}$ of a metre between each lamp post.

What is the distance between the first and last lamp post?

$8 \times 4\frac{3}{8} = 8 \times \frac{35}{8}$

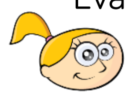
$= \frac{280}{8} = 35$

The distance between the first and last lamp post is 35 metres.

Children may think they need to multiply by 9, encourage them to draw a picture to see otherwise.

Eva and Amir both work on a homework project.

Eva



I spent $4\frac{1}{4}$ hours a week for 4 weeks doing my project.

I spent $2\frac{3}{4}$ hours a week for 5 weeks doing my project.

Amir

Who spent the most time on their project?

Explain your reasoning.

$4 \times 4\frac{1}{4} = \frac{68}{4}$

$= 17$ hours

$5 \times 2\frac{3}{4} = \frac{55}{4}$

$= 13\frac{3}{4}$ hours

Eva spent longer on her project than Amir did by $3\frac{1}{4}$ hours.

Multiply Fractions by Fractions

Notes and Guidance

Children will use their understanding of multiplying fractions by an integer and find the link between multiplying fractions by fractions.
It is important that children see the link between multiplying fractions by whole numbers and fractions by fractions.

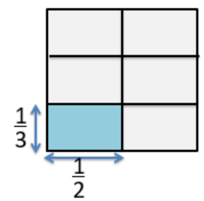
Mathematical Talk

Using a piece of paper/drawing:
Show me a whole, show me thirds, now split each third in half.
Shade one section.
What fraction do you have?
What do you notice about the numerators and denominators when they are multiplied?

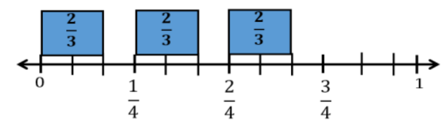
Varied Fluency

Calculate:

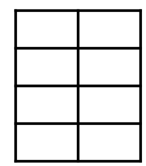
$\frac{1}{3} \times \frac{1}{2}$



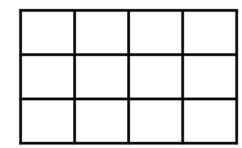
$\frac{2}{3}$ of $\frac{3}{4}$



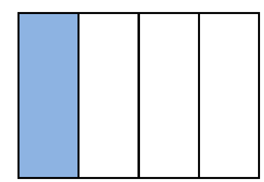
$\frac{1}{4} \times \frac{1}{2}$



$\frac{2}{3}$ of $\frac{1}{4}$



Use the diagram to work out $\frac{1}{3} \times \frac{1}{4}$



Work out:

$\frac{1}{4} \times \frac{1}{2}$

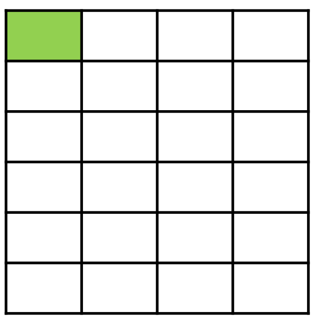
$\square \times \frac{1}{2} = 1$

Multiply Fractions by Fractions

Reasoning and Problem Solving

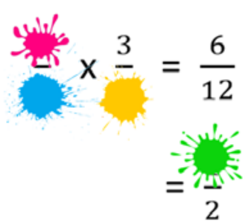
The shaded square in the grid below is the answer to a multiplying fractions question.

What was the question?



$$\frac{1}{6} \times \frac{1}{4}$$

How many ways can you answer the following?

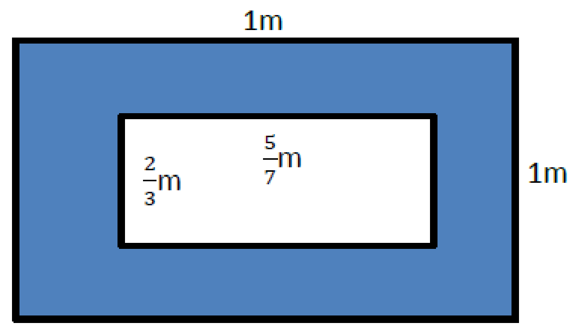


Possible answers:

$$\frac{2}{3} \times \frac{3}{4} = \frac{6}{12} = \frac{1}{2}$$

$$\frac{2}{2} \times \frac{3}{6} = \frac{6}{12} = \frac{1}{2}$$

Find the area of the shaded part of the shape.



$$1 \times 1 = 1$$

$$\frac{2}{3} \times \frac{5}{7} = \frac{10}{21}$$

$$1 - \frac{10}{21} = \frac{11}{21}$$

The shaded area is $\frac{11}{21}m^2$

Divide Fractions by Integers (1)

Notes and Guidance

Children will use their understanding of fractions to divide fractions by whole numbers.
In this small step they will focus on examples where the numerator is directly divisible by the divisor.
It is important that they experience varied representations of fractions in different contexts.

Mathematical Talk

How could you represent this fraction?
How many parts of the whole are there? How do you know?

How do you know how many parts to shade?
Is the numerator divisible by the whole number?

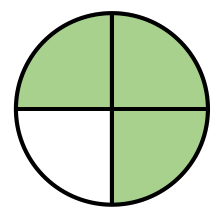
Why doesn't the denominator change?
What have you chosen to represent the fraction in this way?

Varied Fluency

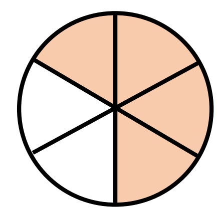
- Lee has $\frac{2}{5}$ of a chocolate bar. He shares it with his friend. What fraction of the chocolate bar do they each get?

- Use the diagrams to help you calculate.

$\frac{3}{4} \div 3$



$\frac{4}{6} \div 2$



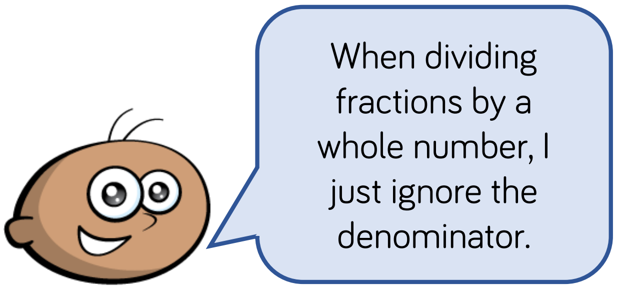
- Calculate.

$\frac{6}{8} \div 2$ $\qquad$ $\frac{10}{13} \div 5$ $\qquad$ $\frac{6}{7} \div 3$

Divide Fractions by Integers (1)

Reasoning and Problem Solving

Tommy says,



Do you agree?
Explain why.

Tommy's method will only work when the numerator is a multiple of the divisor, and even then you can't 'ignore' the denominator. It is still there.

Becky's mum ordered a pizza for her and her friends.

By the time they arrived home there was only $\frac{3}{4}$ of it left.
When she shared it among her friends they each got $\frac{1}{4}$
How many friends did Becky have with her?

Becky had three friends:

$\frac{3}{4} \div 3 = \frac{1}{4}$

Divide Fractions by Integers (2)

Notes and Guidance

Children will continue to divide fractions by integers, this time including fractions where the numerator isn't directly divisible by the integer.
They should learn how to represent the fractions and divide it visually.
They may find an alternative strategy for dividing fractions during this process.

Mathematical Talk

How could you represent this fraction?
Which parts should you shade?
What would happen if we divided each eighth into two? How many pieces would we have in total?
How many sub-parts would you divide each section into?
What is the value of the denominator?
What is the value of the numerator?
Can it be simplified?

Varied Fluency

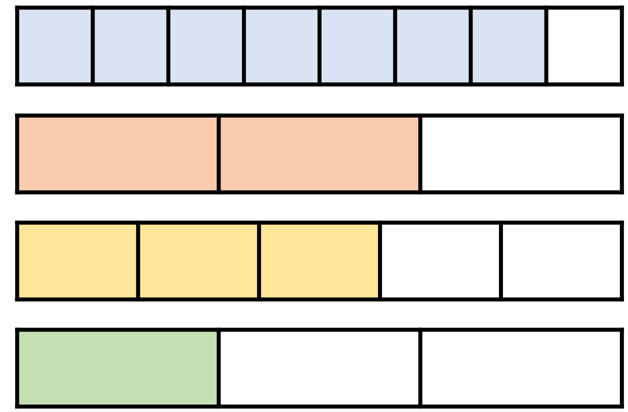
Calculate:

$\frac{7}{8} \div 2$

$\frac{2}{3} \div 2$

$\frac{3}{5} \div 2$

$\frac{1}{3} \div 3$



What do you notice?
Is there another strategy you could use to solve these calculations?

Calculate:

$\frac{3}{7} \div 4$ $\quad$ $\frac{7}{9} \div 3$ $\quad$ $\frac{3}{8} \div 5$

White Rose Maths

Divide Fractions by Integers (2)

Reasoning and Problem Solving

Alex says,

I can only divide a fraction by an integer if the numerator is a multiple of the divisor.

Do you agree?
Explain why.

Alex is wrong, we can divide any fraction by an integer.

Solve

$$\square \div 4 = \frac{7}{36}$$

$$\frac{6}{29} \div \square = \frac{6}{58}$$

$$\square \div \square = \frac{9}{65}$$

Have you found all of the possibilities?

There are various possibilities:

1. $\frac{7}{9}$

2. 2

3. $\frac{9}{13} \div 5$ or $\frac{9}{65} \div 1$

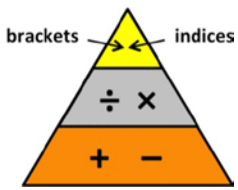
(denominators and whole numbers can swap)

White Rose Maths

Four Rules with Fractions

Notes and Guidance

During this small step children will apply the rules of the four operations when working with fractions.
They may need to be reminded of which operations to use first.

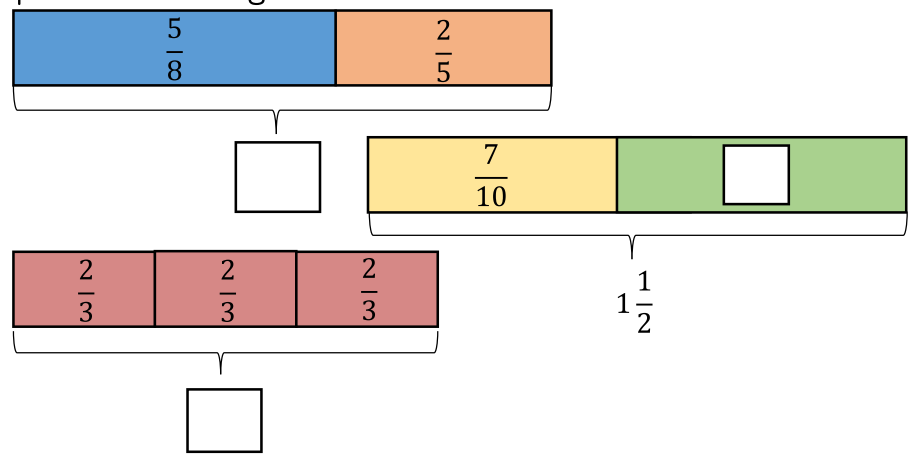


Mathematical Talk

What does it mean when we have a number or a fraction in front of the bracket?
Which operation should we use first? Why?
Is there another way we could answer this?
What would happen if we did not use the brackets? Would the answer be correct? Why?

Varied Fluency

- Complete the missing boxes.



- Jack had one quarter of a bag of sweets and Harry had two thirds of the sweets. They shared their sweets with Sophie. What fraction of the sweets do they all receive?

- Match each calculation to the correct answer.

$(\frac{2}{3}+\frac{1}{5})\times 3$	$\frac{41}{70}$
$\frac{5}{9}-\frac{1}{3}\div 2$	$\frac{7}{18}$
$\frac{2}{5}\times 2-(\frac{3}{7}\div 2)$	$2\frac{3}{5}$

Four Rules with Fractions

Reasoning and Problem Solving

Add two sets of brackets to make the following calculation correct:

$$\frac{1}{2} + \frac{1}{4} \times 8 + \frac{1}{6} \div 3 = 6\frac{1}{18}$$

Explain where the brackets go and why.
Did you find any difficulties?

$(\frac{1}{2} + \frac{1}{4}) \times 8 + (\frac{1}{6} \div 3)$

Using the following cards and any operation find an answer of $\frac{33}{56}$

(	)	$\frac{3}{7}$
$\frac{5}{8}$	3	

$(\frac{5}{8} - \frac{3}{7}) \times 3 = \frac{33}{56}$

$\frac{35}{56} - \frac{24}{56} = \frac{11}{56}$

$\frac{11}{56} \times 3 = \frac{33}{56}$

Fraction of an Amount

Notes and Guidance

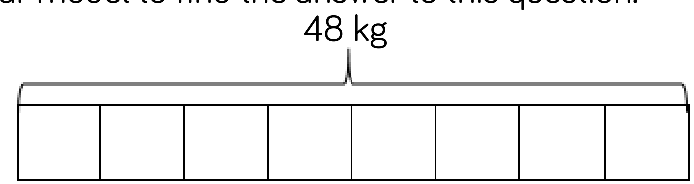
Chilldren will start to calculate fractions of an amount. They should recognise that the denominator is the number of parts the amount is being divided into, and the numerator is the amount of those parts we want.
A bar model will help children visualise and calculate fractions of an amount.

Mathematical Talk

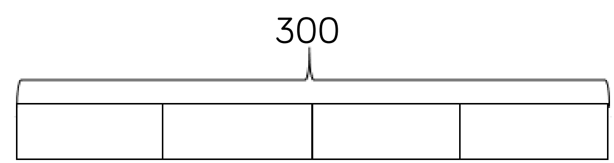
How can you represent the problem?
How many parts should the bar model be split into?
How many parts should you shade?
What is the value of the whole?
What is the value of the part?
How many parts are shaded?
So what is the value of the shaded bit?

Varied Fluency

- The school kitchen has 48 kg of potatoes. They use $\frac{5}{8}$ to make mash potato for lunch.
How much potato do they have left?
Use the bar model to find the answer to this question.



- A football team has 300 tickets to give away. They give $\frac{3}{4}$ of them to a local school and give $\frac{1}{3}$ of the remainder to a local business. How many tickets are left to give to friends and family?



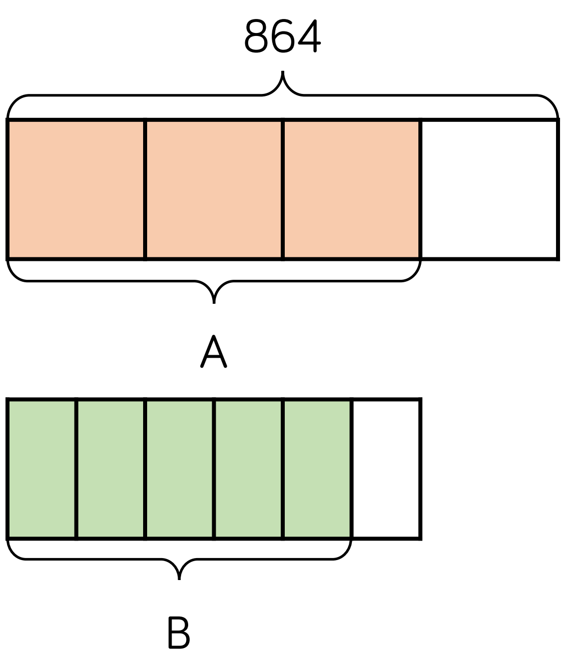
- Complete: $\frac{3}{8}$ of 40 = $\frac{?}{10}$ of 150

$\frac{1}{5}$ of 315 = $\frac{?}{8}$ of 72

Fraction of an Amount

Reasoning and Problem Solving

What is the value of A?
What is the value of B?



A = 648
B = 540

Two fashion designers receive $\frac{3}{8}$ of 208 metres of material.

One of them says:

Is she correct?
Explain your reasoning

She is incorrect because 26 is only one eighth of 208
She needs to multiply her answer by 3 so that they each get 78 m each.

Find the Whole

Notes and Guidance

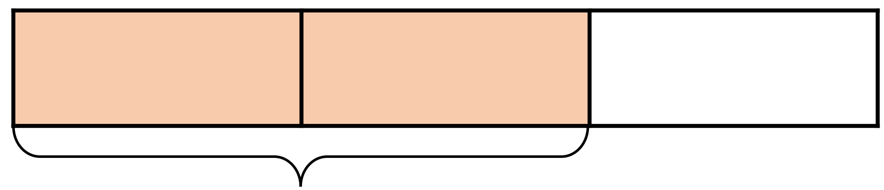
Children will learn how to find the whole amount from the known value of a fraction.
Children should use their knowledge of finding fractions of amounts and apply this when finding the whole amount.

Mathematical Talk

How could you represent this fraction?
Which parts should you shade?
What is the value of the shaded parts?
What is the value of one part?
What is the value of the whole?

Varied Fluency

- Sam has spent $\frac{2}{3}$ of his money.
  He spent £60, how much did he have to start with?

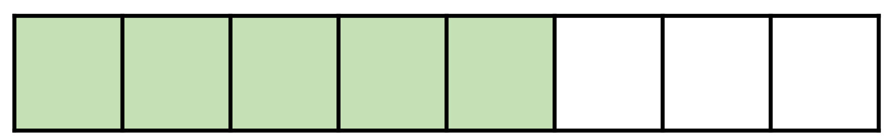


£60

- Jen eats $\frac{2}{5}$ of a packet of biscuits. She eats 10
  How many were in the original packet?

- $\frac{3}{8}$ of a town voted.
  If 120 people voted, how many people lived in the town?

- Write a problem which this bar model could represent.



Find the Whole

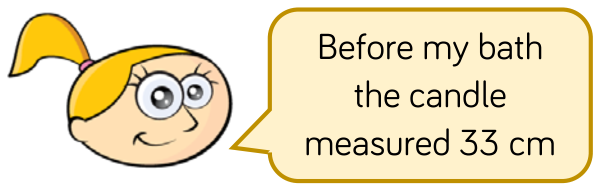
Reasoning and Problem Solving

Eva lit a candle while she had a bath.

After her bath, $\frac{2}{5}$ of the candle was left.

It measured 13 cm.

Eva says:



Is she correct?

Explain your reasoning.

She is incorrect.

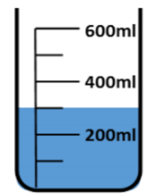
$13 \div 2 = 6.5$

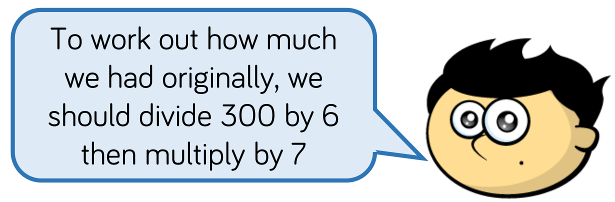
$6.5 \times 5 = 32.5\text{cm}$

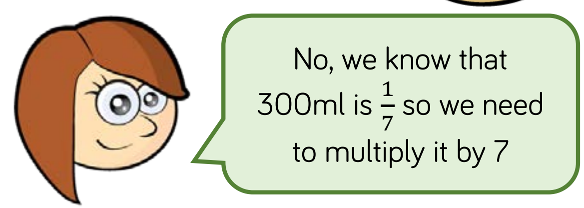
She either didn't half correctly or didn't multiply correctly

Rosie and Jack are making juice.

They use $\frac{6}{7}$ of the water in a jug and are left with this amount of water:







Who is correct?

Explain your reasoning.

Rosie is correct. Jack would only be correct if $\frac{6}{7}$ was **remaining** but $\frac{6}{7}$ is what was used. Rosie recognised that $\frac{1}{6}$ is left in the jug therefore multiplied it by 7 to correctly find the whole.

Autumn - Block 4

Position and Direction

Overview

Small Steps

- The first quadrant
- Four quadrants
- Translations
- Reflections

NC Objectives

Describe positions on the full coordinate grid (all four quadrants)

Draw and translate simple shapes on the coordinate plane, and reflect them in the axes.

The First Quadrant

Notes and Guidance

Children recap work from Year 4 and Year 5 by reading and plotting coordinates.

They draw shapes on a 2D grid from coordinates given and use their increasing understanding to write coordinates for shapes with no grid lines.

Mathematical Talk

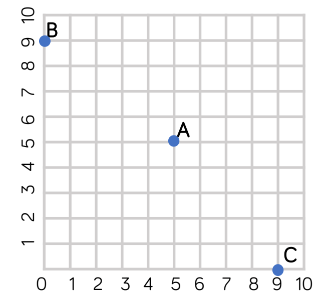
Which axis do we look at first?

Does joining up the vertices already given help you to draw the shape?

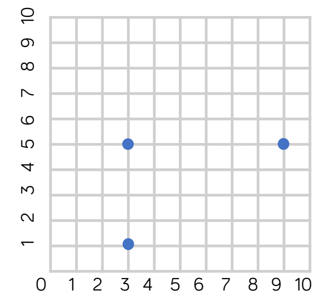
Can you draw a shape in the first quadrant and describe the coordinates of the vertices to a friend?

Varied Fluency

- Chris plots three coordinates. Write down the coordinates of points A, B and C.



- Amir is drawing a rectangle on a grid. Plot the final vertex of the rectangle. Write the coordinate of the final vertex.



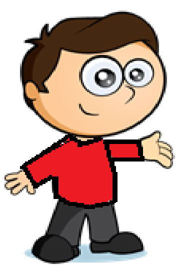
- Draw the vertices of the polygon with the coordinates (7, 1), (7, 4) and (10, 1)
  What type of polygon is the shape?

The First Quadrant

Reasoning and Problem Solving

Jamie is drawing a trapezium.
He wants his final shape to look like this:

Jamie uses the coordinates (2, 4), (4, 5), (1, 6) and (5, 6).
Will he draw a trapezium that looks correct?
If not, can you correct his coordinates?

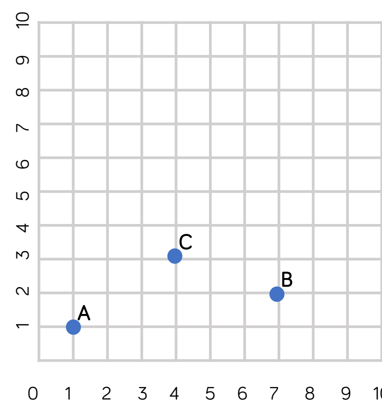


Jamie has plotted the coordinate (4, 5) incorrectly. This should be plotted at (4, 4) to make the trapezium that Jamie wanted to draw.

Marie has written the coordinates of point A, B and C.

A (1, 1) **B** (2, 7) **C** (3, 4)

Mark Marie's work and correct any mistakes.



A is correct but B & C have been plotted with the x & y coordinates the wrong way round.

Four Quadrants

Notes and Guidance

Children use knowledge of the first quadrant to read and plot coordinates in all four quadrants.
They draw shapes from coordinates given.
Children need to become fluent in deciding which part of the axis is positive or negative.

Mathematical Talk

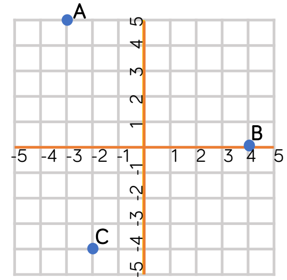
Which axis do we look at first?

If (0, 0) is the centre of the axis (the origin), which way do you move on the x axis to find negative coordinates?

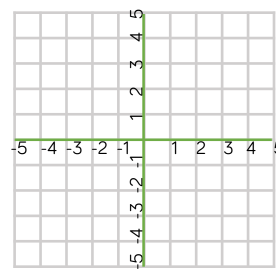
Which way do you move on the y axis to find negative coordinates?

Varied Fluency

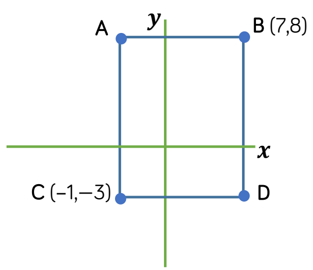
- Emily plotted three coordinates. Write down the coordinates of points A, B and C.



- Draw a shape using the coordinates (-2, 2), (-4, 2), (-2, -3) and (-4, -2). What kind of shape have you drawn?



- Work out the missing coordinates of the rectangle.



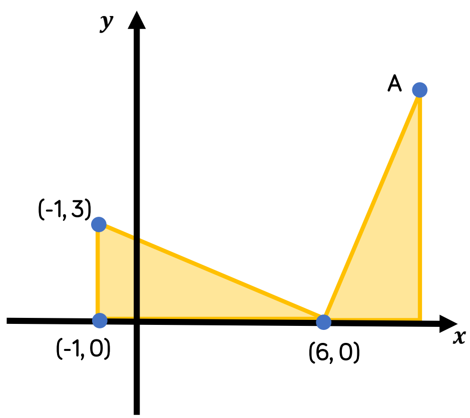
Four Quadrants

Reasoning and Problem Solving

The diagram shows two identical triangles.

The coordinates of three points are shown.

Find the coordinates of point A.



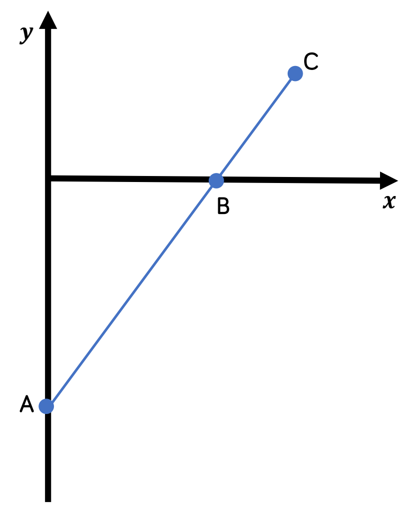
(9, 7)

A is the point (0, – 10)

B is the point (8, 0)

The distance from A to B is two thirds of the distance from A to C.

Find the coordinates of C.



(12, 5)

Translations

Notes and Guidance

Children use knowledge of coordinates and positional language to translate shapes in all four quadrants.
They describe translations using direction and use instructions to draw translated shapes.

Mathematical Talk

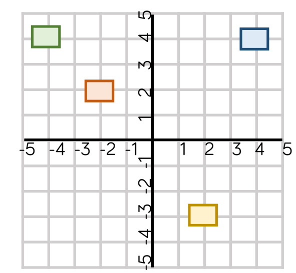
What does translation mean?

Which point are you going to look at when describing the translation?

Does each vertex translate in the same way?

Varied Fluency

Use the graph describe the translations.
One has been done for you.
From to translate **8** units to the **left**.

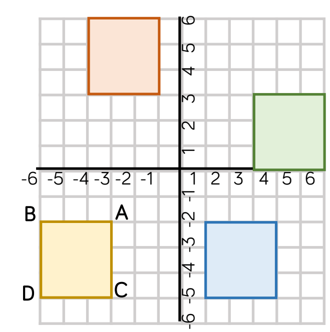


From to translate __ units to the left and __ units up.

From to translate 4 units to the _____ and 5 units _____.

From to translate __ units to the ____ and __ units ____.

Write the coordinates for A, B, C and D.
Describe the translation of ABCD to the blue square.



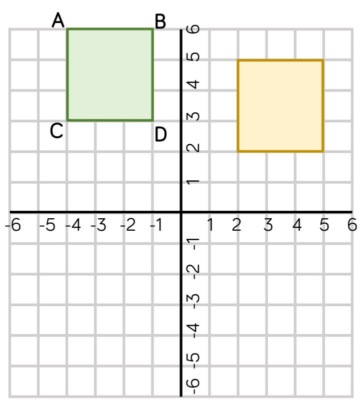
ABCD is moved 8 units up and 2 units to the right. Which colour square is it translated to?
Write the coordinates for A, B, C and D now it is translated.

Translations

Reasoning and Problem Solving

True or false?

Sam has translated the square ABCD 6 units down and 1 unit to the right to get to the yellow square.

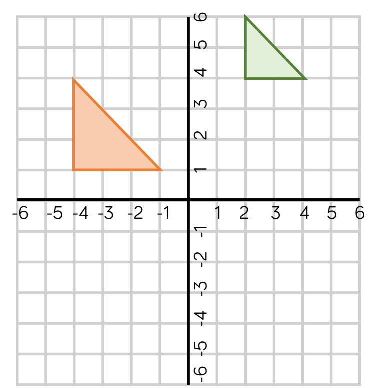


Explain your reasoning.

False.
The translation is 6 units to the right and 1 unit down.

Spot the mistake.

The green triangle has been translated 6 units to the left and 3 units down.



The triangle has changed size, when translating this should not happen.

Reflections

Notes and Guidance

Children extend their knowledge of reflection by reflecting shapes in four quadrants. They will reflect in both the x and the y-axis.

Children should use their knowledge of coordinates to ensure that shapes are correctly reflected.

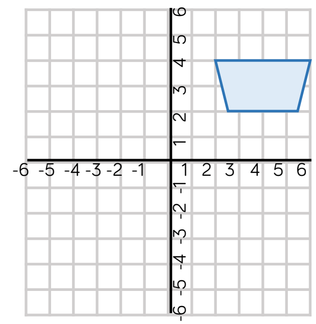
Mathematical Talk

How is reflecting different to translating?

Can you reflect one vertex at a time? Does this make it easier to reflect the shape?

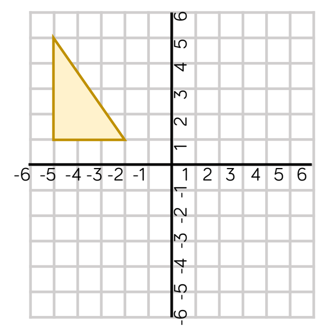
Varied Fluency

Reflect the trapezium in the x and the y axis.
Complete the table with the new coordinates of the shape.



	Reflected in the x axis	Reflected in the y axis
(3,4)		
(6,4)		
(7,7)		
(2,7)		

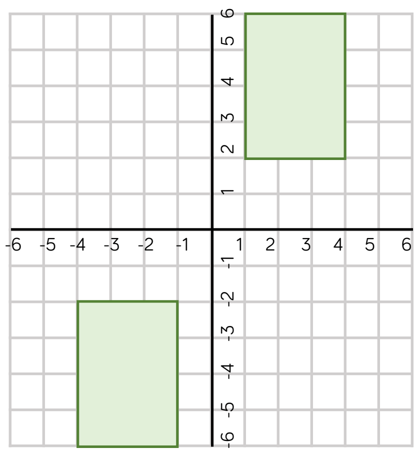
Translate the shape 4 units to the right.
Reflect the shape in the y axis.



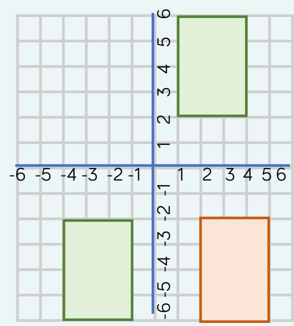
Reflections

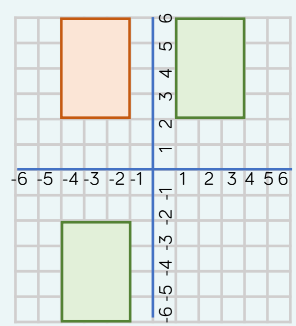
Reasoning and Problem Solving

A rectangle has been reflected in the x axis and the y axis.
Where could the starting rectangle have been? Is there more than one option?

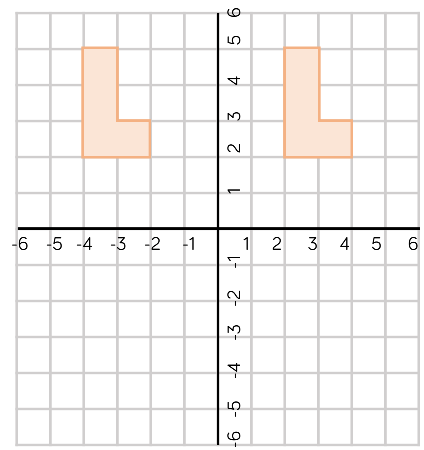


Two possible answers:





Tess has reflected the orange shape in the y axis.
Is her drawing correct?
If not explain why.



Tess has used the correct axis, but her shape has not been reflected. She has just drawn the shape again on the other side of the axis.