Autumn Scheme of Learning

Year 5

#MathsEveryoneCan

2020-21

White Rose Maths

New for 2020/21

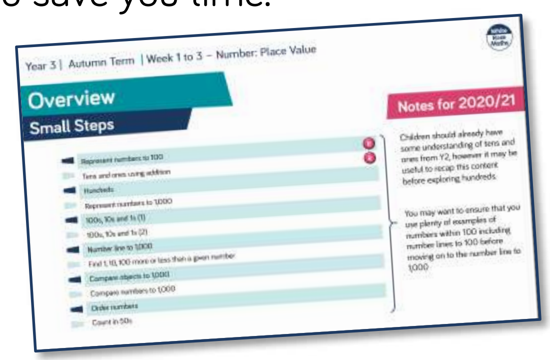
2020 will go down in history. The world has changed for all of us.

We want to do as much as we can to support children, teachers, parents and carers in these very uncertain times.

We have amended our schemes for 2020/21 to:

- ★ highlight key teaching points
- ★ recap essential content that children may have forgotten
- ★ flag any content that you might not have covered during the school closures period.

We hope these changes will add further value to the schemes and save you time.



Lesson-by-lesson overviews

We've always been reluctant to produce lesson-by-lesson overviews as every class is individual and has different needs. However, many of you have said that if blended learning becomes a key feature of school life next year, a weekly plan with linked content and videos could be really useful.

As always, we've listened! We've now produced a complete lesson-by-lesson overview for Y1 to Y9 that schools can use or adapt as they choose. Each lesson will be linked to a free-to-use home learning video, and for premium subscribers, a worksheet. This means that you can easily assign work to your class, whether they are working at home or in school.

Inevitably, this lesson-by-lesson structure won't suit everyone, but if it works for you, then please do make use of this resource as much as you wish.

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.

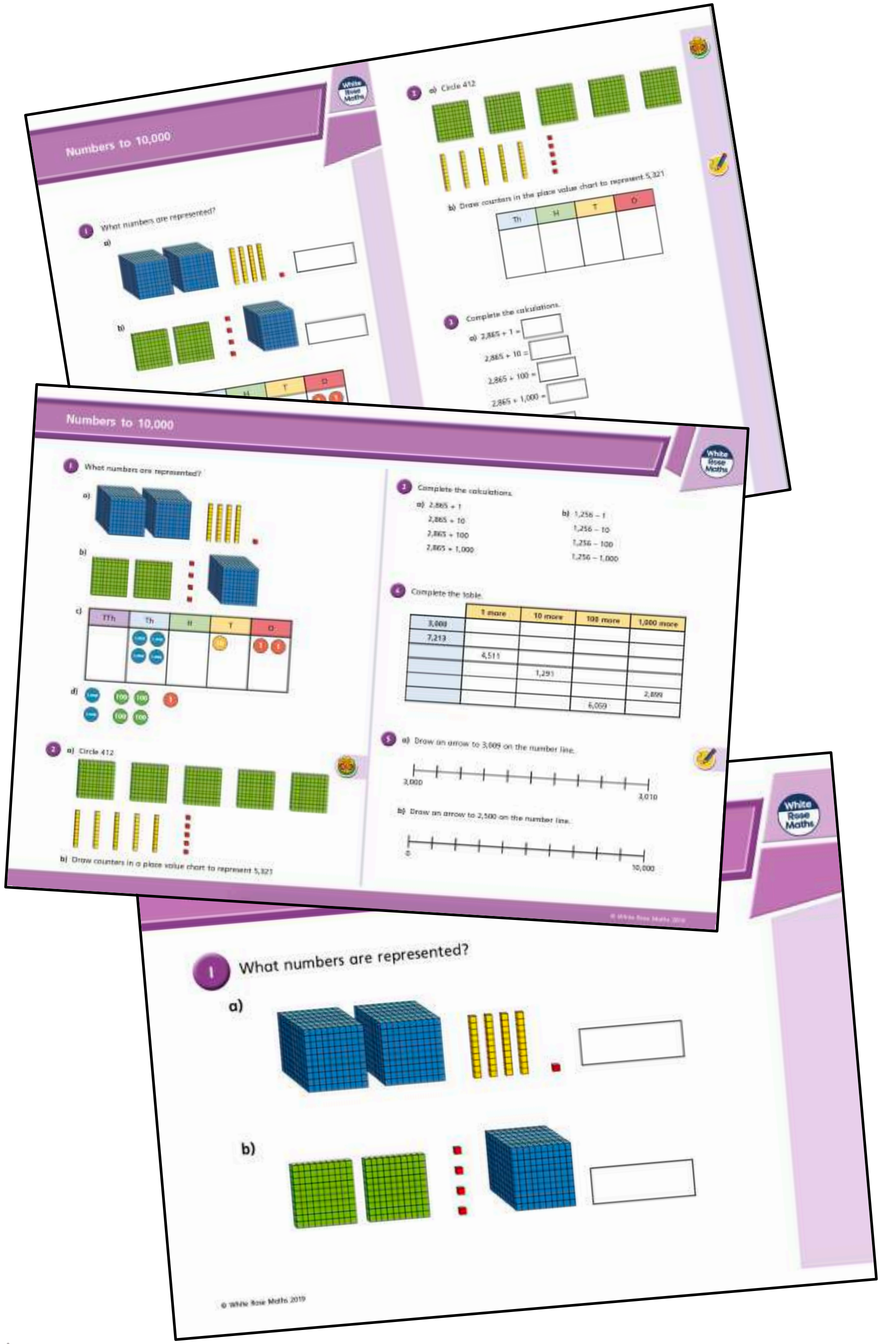
Need some CPD to develop this approach? Visit www.whiterosemaths.com for find a course right for you.

Supporting resources

We have produced supporting resources for every small step from Year 1 to Year 11.

The worksheets are provided in three different formats:

- Write on worksheet – ideal for children to use the ready made models, images and stem sentences.
- Display version – great for schools who want to cut down on photocopying.
- PowerPoint version – one question per slide. Perfect for whole class teaching or mixing questions to make your own bespoke lesson.

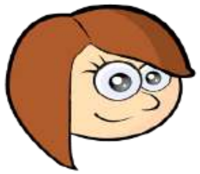


For more information visit our online training and resources centre resources.whiterosemaths.com or email us directly at support@whiterosemaths.com

Meet the Characters

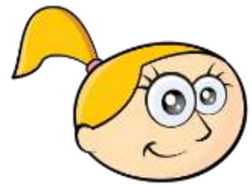
Children love to learn with characters and our team within the scheme will be sure to get them talking and reasoning about mathematical concepts and ideas. Who's your favourite?

Teddy



Rosie

Mo



Eva

Alex

Jack

Whitney

Amir

Dora

Tommy

Dexter

Ron

Annie

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

Autumn - Block 1

Place Value

Overview

Small Steps

- 1000s, 100s, 10s and 1s R
- Numbers to 10,000
- Rounding to the nearest 10 R
- Rounding to the nearest 100 R
- Round to nearest 10, 100 and 1,000
- Numbers to 100,000
- Compare and order numbers to 100,000
- Round numbers within 100,000
- Numbers to a million
- Counting in 10s, 100s, 1,000s, 10,000s, and 100,000s
- Compare and order numbers to one million
- Round numbers to one million
- Negative numbers
- Roman Numerals to 1,000

Notes for 2020/21

Before exploring numbers to 10,000 ensure that children are secure with 1000s, 100s, 10 and 1s.

You may also find it useful to recap rounding to the nearest 10 and 100 separately before expecting children to round to either 10, 100 and 1,000

Work on Roman Numerals has been moved to the end of the block as we believe it is important for children to be secure with our own number system before exploring another.

1,000s, 100s, 10s and 1s

Notes and Guidance

Children represent numbers to 9,999, using concrete resources on a place value grid. They understand that a four-digit number is made up of 1,000s, 100s, 10s and 1s.

Moving on from Base 10 blocks, children start to partition by using place value counters and digits.

Mathematical Talk

Can you represent the number on a place value grid?
How many thousands/hundreds/tens/ones are there?

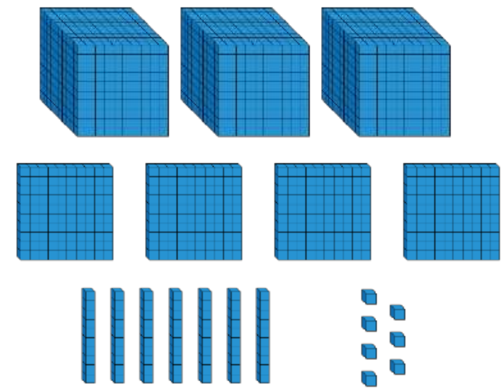
How do you know you have formed the number correctly? What could you use to help you?

How is the value of zero represented on a place value grid or in a number?

Varied Fluency

R

- Complete the sentences.

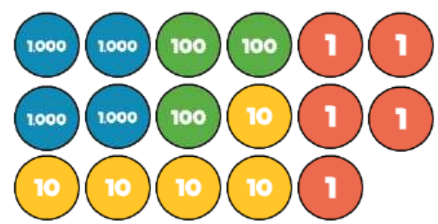


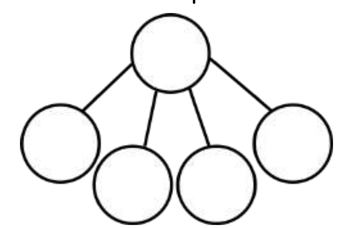
There are ______ thousands, ______ hundreds, ______ tens and ______ ones.

The number is ______ .

___ + ___ + ___ + ___ = ___

- Complete the part-whole model for the number represented.





- What is the value of the underlined digit in each number?

6,9$\underline{8}$3 | $\underline{9}$,021 | $\underline{7}$89 | 6,57$\underline{0}$

Represent each of the numbers on a place value grid.

1,000s, 100s, 10s and 1s

Reasoning and Problem Solving

Create four 4-digit numbers to fit the following rules: • The tens digit is 3 • The hundreds digit is two more than the ones digit • The four digits have a total of 12	Possible answers: 3,432 5,331 1,533 7,230

Use the clues to find the missing digits. $\square\ \square\ \square\ \square$ The thousands and tens digit multiply together to make 36 The hundreds and tens digit have a digit total of 9 The ones digit is double the thousands digit. The whole number has a digit total of 21	4,098

Numbers to 10,000

Notes and Guidance

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

Within this step, children must revise adding and subtracting 10, 100 and 1,000

They discuss what is happening to the place value columns, when carrying out each addition or subtraction.

Mathematical Talk

Can you show me 8,045 (any number) in three different ways?

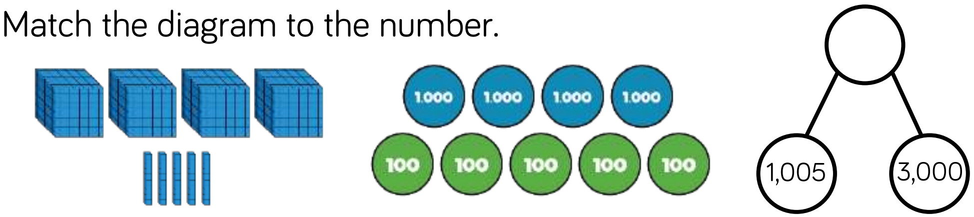
Which representation is the odd one out? Explain your reasoning.

What number could the arrow be pointing to?

Which column(s) change when adding 10, 100, 1,000 to 2,506?

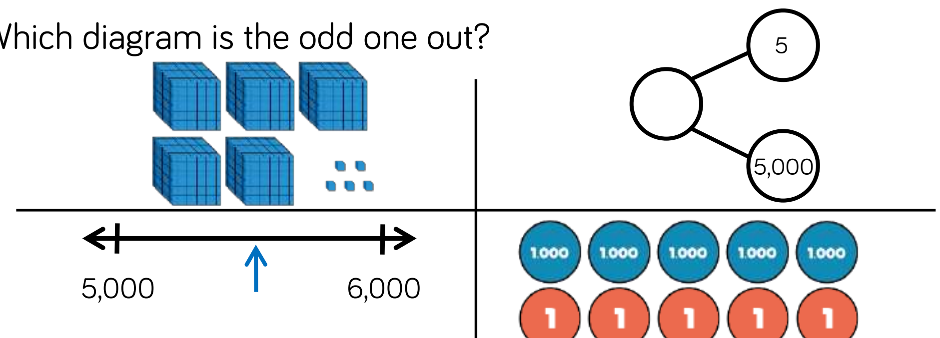
Varied Fluency

Match the diagram to the number.



4,005 4,500 4,050

Which diagram is the odd one out?



Complete the table.

	Add 10	Add 100	Add 1,000
2,506			
7,999			
		6,070	

Numbers to 10,000

Reasoning and Problem Solving

Dora has made five numbers, using the digits 1, 2, 3 and 4 She has changed each number into a letter. Her numbers are aabcd acdbc dcaba cdadc bdaab Here are three clues to work out her numbers: • The first number in her list is the greatest number. • The digits in the fourth number total 12 • The third number in the list is the smallest number.	44,213 43,123 13,424 31,413 21,442

Tommy says he can order the following numbers by only looking at the first three digits. 12,516 12,832 12,679 12,538 12,794 Is he correct? Explain your answer.	He is incorrect because two of the numbers start with twelve thousand, five hundred therefore you need to look at the tens to compare and order.

Round to the Nearest 10

Notes and Guidance

Children start to look at the position of a 2-digit number on a number line. They then apply their understanding to 3-digit numbers, focusing on the number of ones and rounding up or not.

Children must understand the importance of 5 and the idea that although it is in the middle of 0 and 10, that by convention any number ending in 5 is always rounded up, to the nearest 10

Mathematical Talk

What is a multiple of 10?

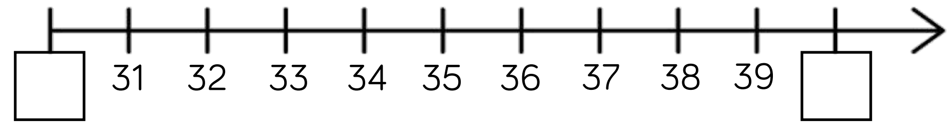
Which multiples of 10 does ____ sit between?

Which column do we look at when rounding to the nearest 10? What do we do if the number in that column is a 5?

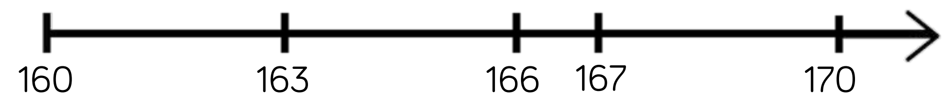
Which number is being represented? Will we round it up or not? Why?

Varied Fluency

- Which multiples of 10 do the numbers sit between?

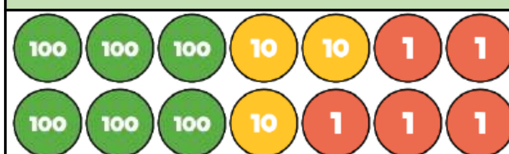


- Say whether each number on the number line is closer to 160 or 170?



Round 163, 166 and 167 to the nearest 10

- Complete the table:

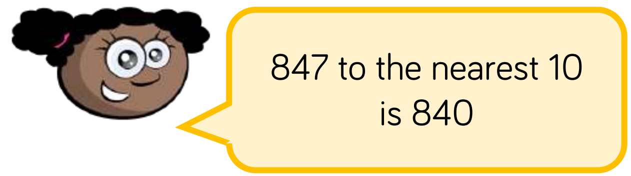
Start number	Rounded to the nearest 10
	
851	
XCVIII	

Round to the Nearest 10

Reasoning and Problem Solving

R

A whole number is rounded to 370 What could the number be? Write down all the possible answers. 370	365 366 367 368 369 370 371 372 373 374
Two different two-digit numbers both round to 40 when rounded to the nearest 10 The sum of the two numbers is 79 What could the two numbers be? Is there more than one possibility?	35 + 44 = 79 36 + 43 = 79 37 + 42 = 79 38 + 41 = 79 39 + 40 = 79

Whitney says:  Do you agree with Whitney? Explain why.	I don't agree with Whitney because 847 rounded to the nearest 10 is 850. I know this because ones ending in 5, 6, 7, 8 and 9 round up.

Round to the Nearest 100

Notes and Guidance

Children compare rounding to the nearest 10 (looking at the ones column) to rounding to the nearest 100 (looking at the tens column.)

Children use their knowledge of multiples of 100, to understand which two multiples of 100 a number sits between. This will help them to round 3-digit numbers to the nearest 100

Mathematical Talk

What's the same/different about rounding to the nearest 10 and nearest 100? Which column do we need to look at when rounding to the nearest 100?

Why do numbers up to 49 round down to the nearest 100 and numbers 50 to 99 round up?

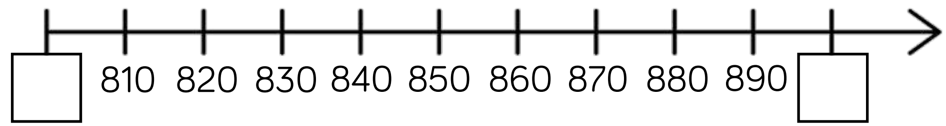
What would 49 round to, to the nearest 100?

Can the answer be 0 when rounding?

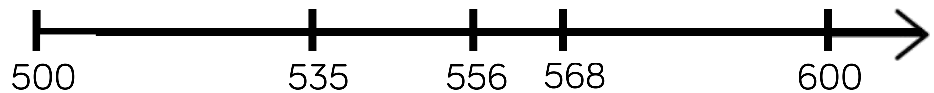
Varied Fluency

R

- Which multiples of 100 do the numbers sit between?



- Say whether each number on the number line is closer to 500 or 600.



Round 535, 556 and 568 to the nearest 100
Use the stem sentence: _____ rounded to the nearest 100 is _____ .

- Complete the table:

Start number	Rounded to the nearest 100
400 50 7	
994	
XLV	

Round to the Nearest 100

Reasoning and Problem Solving

Always, Sometimes, Never Explain your reasons for each statement. • A number with a five in the tens column rounds up to the nearest hundred. • A number with a five in the ones column rounds up to the nearest hundred. • A number with a five in the hundreds column rounds up to the nearest hundred.	Always – a number with five in the tens column will be 50 or above so will always round up. Sometimes – a number with five in the ones column might have 0 to 4 in the tens column (do not round up) or 5 to 9 (round up). Sometimes –a number with five in the hundreds column will also round up or down dependent on the number in the tens column.

When a whole number is rounded to the nearest 100, the answer is 200 When the same number is rounded to the nearest 10, the answer is 250 What could the number be? Is there more than one possibility?	245, 246, 247, 248 and 249 are all possible answers.
Using the digit cards 0 to 9, can you make whole numbers that fit the following rules? You can only use each digit once. 1. When rounded to the nearest 10, I round to 20 2. When rounded to the nearest 10, I round to 10 3. When rounded to the nearest 100, I round to 700	To 20, it could be 15 to 24 To 10, it could be 5 to 14 To 700, it could be 650 to 749 Use each digit once: 5, 24, 679 or 9, 17, 653 etc.

Round to 10, 100 and 1,000

Notes and Guidance

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

Children must understand that the column from the question and the column to the right of it are used e.g. when rounding 1,450 to the nearest hundred – look at the hundreds and tens columns. Number lines are a useful support.

Mathematical Talk

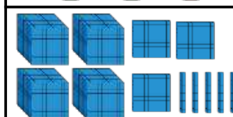
Which place value column do we need to look at when we round to the nearest 1,000?

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

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

Varied Fluency

Complete the table.

Start Number	Rounded to the nearest 10	Rounded to the nearest 100	Rounded to the nearest 1,000
			
			
DCCLXIX			

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

300 10,000 8,900

Complete the table.

Start Number	Nearest 10	Nearest 100	Nearest 1,000
365			
1,242			
	4,770		

Rounding to 10, 100 and 1,000

Reasoning and Problem Solving

My number rounded to the nearest 10 is 1,150
Rounded to the nearest 100 it is 1,200
Rounded to the nearest 1,000 it is 1,000

Jack

What could Jack's number be?

Can you find all of the possibilities?

1,150
1,151
1,152
1,153
1,154

2,567 to the nearest 100 is 2,500

Whitney

Do you agree with Whitney? Explain why.

I do not agree with Whitney because 2,567 rounded to the nearest 100 is 2,600. I know this because if the tens digit is 5, 6, 7, 8 or 9 we round up to the next hundred.

Teddy

4,725 to the nearest 1,000 is 5,025

Explain the mistake Teddy has made.

Teddy has correctly changed four thousand to five thousand but has added the tens and the ones back on. When rounding to the nearest thousand, the answer is always a multiple of 1,000

White Rose Maths

Numbers to 100,000

Notes and Guidance

Children focus on numbers up to 100,000
They represent numbers on a place value grid, read and write numbers and place them on a number line to 100,000

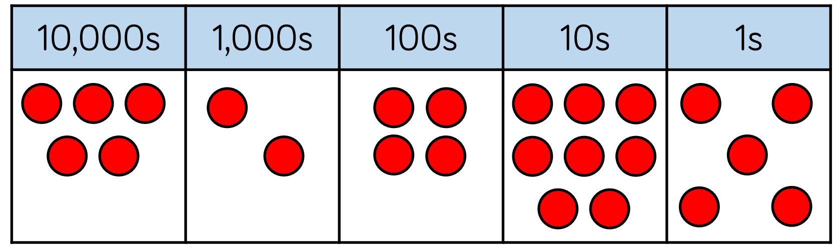
Using a number line, they find numbers between two points, place a number and estimate where larger numbers will be.

Mathematical Talk

How can the place value grid help you to add 10, 100 or 1,000 to any number?
How many digits change when you add 10, 100 or 1,000? Is it always the same number of digits that change?
How can we represent 65,048 on a number line?
How can we estimate a number on a number line if there are no divisions?
Do you need to count forwards and backwards to find out if a number is in a number sequence? Explain.

Varied Fluency

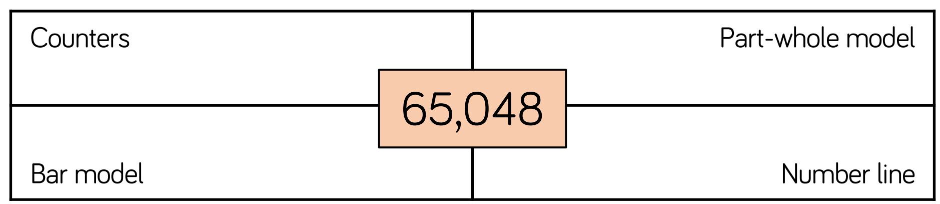
- A number is shown in the place value grid.



Write the number in figures and in words.
- Alex adds 10 to this number
- Tommy adds 100 to this number
- Eva adds 1,000 to this number

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

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



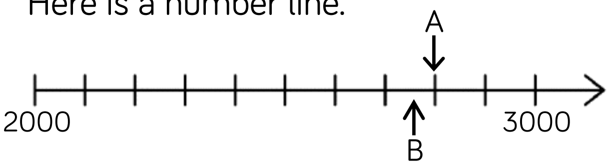
- Complete the missing numbers.

59,000 = 50,000 + ______
______ = 30,000 + 1,700 + 230
75,480 = ______ + 300 + ______

Numbers to 100,000

Reasoning and Problem Solving

Here is a number line.



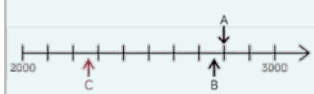
What is the value of A?

B is 40 less than A.
What is the value of B?

C is 500 less than B.
Add C to the number line.

A = 2,800

B = 2,760



Here are three ways of partitioning 27,650

27 thousands and 650 ones
27 thousands, 5 hundreds and 150 ones
27 thousands and 65 tens

Write three more ways

Possible answers:

2 ten thousands, 6 hundreds and 5 tens

20 thousands, 7 thousands and 650 ones

Rosie counts forwards and backwards in 10s from 317

Circle the numbers Rosie will count.

427	997	−7
1,666	3,210	5,627
−23	7	−3

Explain why Rosie will not say the other numbers.

427
997
5,627
7
−3
−23

Any positive number will have to end in a 7

Any negative number will have to end in a 3

Compare and Order

Notes and Guidance

Children will compare and order numbers up to 100,000 by applying their understanding from Year 4 and how numbers can be represented in different ways.

Children should be able to compare and order numbers presented in a variety of ways, e.g. using place value counters, part-whole models, Roman numerals etc.

Mathematical Talk

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

What is the value of each digit in the number 63,320?

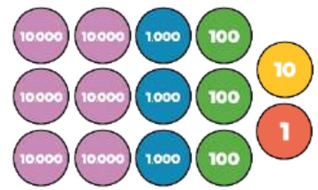
What is the value of ______ in this number?

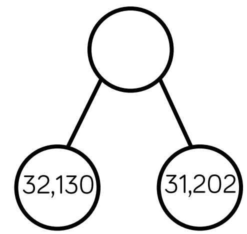
What is the value of the whole? Can you suggest other parts that make the whole?

What number does MMXVII represent?

Varied Fluency

- Put these numbers in ascending order.



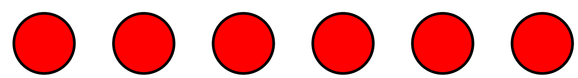


10,000s	1,000s	100s	10s	1s
6	3	3	2	0

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

MMXVII

- Use six counters to make five different 5-digit numbers.



10,000s	1,000s	100s	10s	1s

Order your numbers from greatest to smallest.

Compare and Order

Reasoning and Problem Solving

Place the digits cards 0 to 9 face down and select five of them. Make the greatest number possible and the smallest number possible. How do you know which is the greatest or smallest?	Dependent on numbers chosen. e.g. 4, 9, 1, 3, 2 Smallest: 12,349 Greatest: 94,321 I know this is the greatest number because the digit cards with the larger numbers are in the place value columns with the greater values.	Using the digit cards 0 to 9, create three different 5-digit numbers that fit the following clues: • The digit in the hundreds column and the ones column have a difference of 2 • The digit in the hundreds column and the ten thousands column has a difference of 2 • The sum of all the digits totals 19	Possible answers include: 47,260 56,341 18,325 20,476

Round within 100,000

Notes and Guidance

Children continue to work on rounding, now using numbers up to 100,000
Children use their knowledge of multiples of 10, 100, 1,000 and 10,000 to work out which two numbers the number they are rounding sits between. A number line is a good way to visualise which multiple is the nearest. Children may need reminding of the convention of rounding up if numbers are exactly halfway.

Mathematical Talk

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

Why would we round these distances to the nearest 1,000 miles?

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

Varied Fluency

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

Round the distances to the nearest 1,000 miles.

Destination	Miles from Manchester airport	Miles to the nearest 1,000
New York	3,334	
Sydney	10,562	
Hong Kong	5,979	
New Zealand	11,550	

Complete the table.

Rounded to the nearest 100	Start Number	Rounded to the nearest 1,000
	15,999	
	28,632	
	55,555	

Round within 100,000

Reasoning and Problem Solving

Round 59,996 to the nearest 1,000 Round 59,996 to the nearest 10,000 What do you notice about the answers? Can you think of three more numbers where the same thing could happen?	Both numbers round to 60,000 Other examples: 19,721 to the nearest 1,000 and 10,000 697 to the nearest 10 and 100 22,982 to the nearest 100 and 1,000

Two 5-digit numbers have a difference of five. When they are both rounded to the nearest thousand, the difference is 1,000 What could the numbers be?	Two numbers with a difference of five where the last three digits are between 495 and 504 e.g. 52,498 and 52,503

Numbers to One Million

Notes and Guidance

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

They will recognise large numbers represented in a part-whole model, when they are partitioned in unfamiliar ways.

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

Mathematical Talk

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

Show me 800,500 represented in three different ways.
Can 575,400 be partitioned into 4 parts in a different way?

Where do the commas go in the numbers?
How does the place value grid help you to represent large numbers?
Which columns will change in value when Eva adds 4 counters to the hundreds column?

Varied Fluency

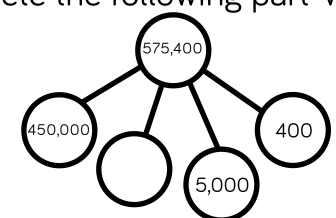
Thousands			Ones		
H	T	O	H	T	O

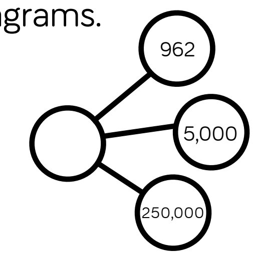
Use counters to make these numbers on the place value chart.

32,651 456,301 50,030

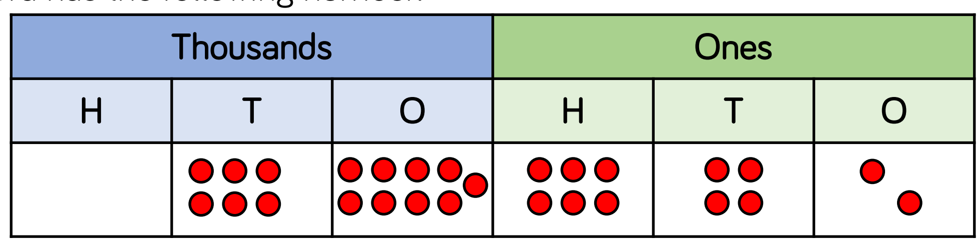
Can you say the numbers out loud?

Complete the following part-whole diagrams.





Eva has the following number.



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

Numbers to One Million

Reasoning and Problem Solving

Describe the value of the digit 7 in each of the following numbers. How do you know?

407,338

700,491

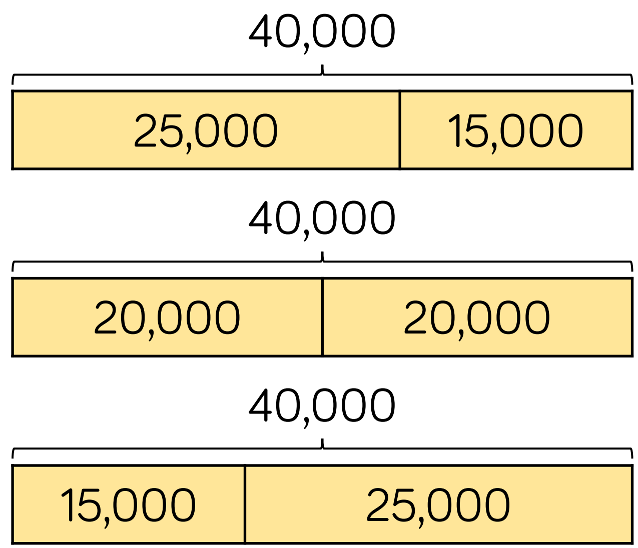
25,571

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

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

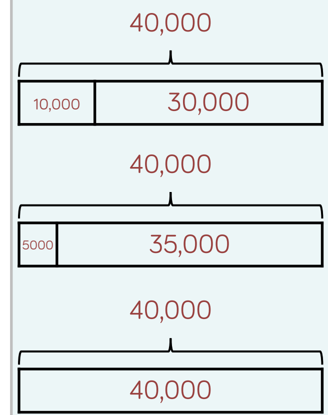
25,571: the value is 7 tens. It is one column to the left of the ones column.

The bar models are showing a pattern.



Draw the next three.

Create your own pattern of bar models for a partner to continue.



Counting in Powers of 10

Notes and Guidance

Children complete number sequences and can describe the term-to-term rule e.g. add ten each time. It is important to include sequences that go down as well as those that go up.

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

Mathematical Talk

Will there be any negative numbers in this sequence?

What pattern do you begin to see with the positive and negative numbers in the sequence?

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

Can you create a rule for the sequence?

Varied Fluency

Complete the sequence.

____ , ____ , 2 , ____ , 22 , ____ , 42 , ____ , ____ , 72

The rule for the sequence is ______________.

Circle and correct the mistake in each sequence.

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

Here is a Gattegno chart showing 32,450

1	2	3	4	5	6	7	8	9
10	20	30	40	50	60	70	80	90
100	200	300	400	500	600	700	800	900
1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000
10,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	90,000

Cards

+10	−10
+100	−100
+1,000	−1,000
+10,000	−10,000

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

Counting in Powers of 10

Reasoning and Problem Solving

Amir writes the first five numbers of a sequence.

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

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

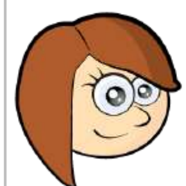
Amir

Is he correct?
Explain why.

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

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

Mo



Rosie

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

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

Jack

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

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

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

Compare and Order

Notes and Guidance

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

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

Mathematical Talk

What do we need to know to be able to compare and order large numbers?
Why can't we just look at the thousands columns when we are ordering these five numbers?
What is the value of each digit?
What is the value of ____ in this number?

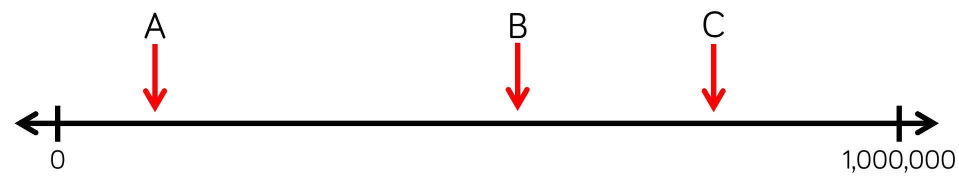
What is the value of the whole? Can you suggest other parts that make the whole?
Can you write a story to support your part-whole model?

Varied Fluency

- Put the number cards in order of size.

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

- Estimate the values of A, B and C.



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

Halifax	88,134
Brighouse	32,360
Leeds	720,492
Huddersfield	146,234
Wakefield	76,886
Bradford	531,200

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

The population of Halifax ◯ the population of Wakefield.

Double the population of Brighouse ◯ the population of Halifax.

Compare and Order

Reasoning and Problem Solving

The missing number is an odd number.

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

The sum of the digits is 23

475,000	?	407,500
Greatest		Smallest

What could the number be?

Can you find three possibilities?

Possible answers include:

444,812
435,812
439,502

Here are four number cards.

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

Four children take one each and say a clue.

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

Mo

Rosie

My number has exactly three hundreds in it

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

Jack

Dora

My number is exactly 100 less then 57,063

Which card did each child have?

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

Round within a Million

Notes and Guidance

Children use numbers with up to six digits, to recap previous rounding, and learn the new skill of rounding to the nearest 100,000

They look at cases when rounding a number for a purpose, including certain contexts where you round up when you wouldn't expect two e.g. to pack 53 items in boxes of 10 you would need 6 boxes.

Mathematical Talk

How many digits does one million have?
Why are we rounding these populations to the nearest 100,000?
Can you partition the number _______ in different ways?

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

How do you know which has the greatest value? Show me.

Varied Fluency

- Round these populations to the nearest 100,000

City	Population	Rounded to the nearest 100,000
Leeds	720,492	
Durham	87,559	
Sheffield	512,827	
Birmingham	992,000	

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

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

  How many batches should the organisers buy?

Round within a Million

Reasoning and Problem Solving

The difference between two 3-digit numbers is two. When each number is rounded to the nearest 1,000 the difference between them is 1,000 What could the two numbers be?	499 and 501 498 and 500

When the difference between A and B is rounded to the nearest 100, the answer is 700 When the difference between B and C is rounded to the nearest 100, the answer is 400 A, B and C are not multiples of 10 What could A, B and C be?	A – B is between 650 to 749 B has to be greater than 400 to complete B – C = 400 Possible answer: A = 1,241 B = 506 C = 59

Negative Numbers

Notes and Guidance

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

They need to see and use negative numbers in context, such as temperature, to be able to count back through zero. They may need to be reminded to call them negative numbers e.g. "negative four" rather than "minus four".

Mathematical Talk

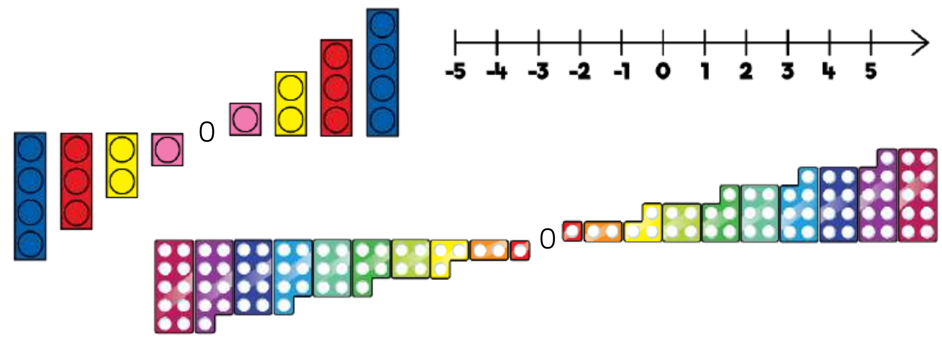
Do we include zero when counting backwards?

Which is the coldest/warmest temperature?
How can we estimate where a number goes on this number line?
Does it help to estimate where zero goes first? Why?

What was the temperature increase/decrease?.
Can you show how you know the increase/decrease on a number line?

Varied Fluency

- Here are three representations for negative numbers.



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

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

- Whitney visits a zoo.
The rainforest room has a temperature of 32°C
The Arctic room has a temperature of −24°C
Show the difference in room temperatures on a number line.

Negative Numbers

Reasoning and Problem Solving

True or False? • The temperature outside is −5 degrees, the temperature inside is 25 degrees. The difference is 20 degrees. • Four less than negative six is negative two. • 15 more than −2 is 13 Explain how you know each statement is true or false.	False: the difference is 30 degrees because it is 5 degrees from −5 to 0. Added to 25 totals 30. False: it is negative 10 because the steps are going further away from zero. True Children may use concrete or pictorial resources to explain.

Put these statements in order so that the answers are from smallest to greatest. • The difference between −24 and −76 • The even number that is less than −18 but greater than −22 • The number that is half way between 40 and −50 • The difference between −6 and 7	52 −20 −5 13 Ordered: −20, −5, 13, 52

Roman Numerals

Notes and Guidance

Building on their knowledge of Roman Numerals to 100, from Year 4, children explore Roman Numerals to 1,000

They explore what is the same and what is different about the number systems, for example there is no zero in the Roman system.

Writing the date in Roman Numerals could be introduced and so this concept can be revisited every day.

Mathematical Talk

Why is there no zero in Roman Numerals?

Do you notice any patterns in the Roman number system?

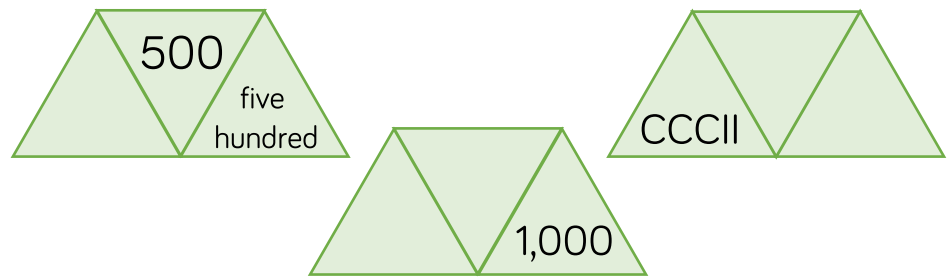
How can you check you have represented the Roman Numeral correctly?

Can you use numbers you know, such as 1, 10 and 100 to help you?

Varied Fluency

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

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



  Complete the diagrams.

- Complete the function machines.

CCC	→	+ 10	→	
	→	− 1	→	DCLXXV

Roman Numerals

Reasoning and Problem Solving

Solve

CCCL + CL =

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

Possible answers:

CD + C
M ÷ II
C + CC + CC
C × V

Here is part of a Roman Numerals hundred square.

Complete the missing values.

XLIV	XLV		XLVII
		LVI	LVII
LXIV		LXVI	LXVII

What patterns do you notice?

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

- XLVI
- LIV
- LV
- LXV

Autumn - Block 2

Addition & Subtraction

Overview

Small Steps

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

Notes for 2020/21

We feel it is important that children have a secure understanding of the column method for addition and subtraction, so we've suggested extra time on these key concepts.

It may be something that children have forgotten.

Add Two 4-digit Numbers (2)

Notes and Guidance

Children add two 4-digit numbers with one exchange. They use a place value grid to support understanding alongside column addition.

They explore exchanges as they occur in different place value columns and look for similarities/differences.

Mathematical Talk

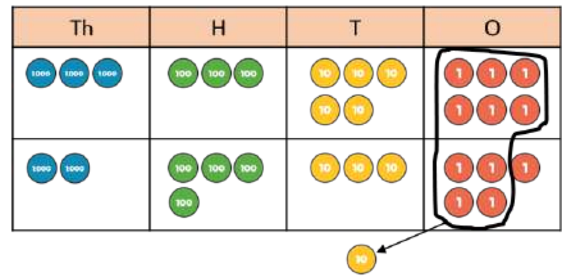
How many ones do we have altogether? Can we make an exchange? Why? How many ones do we exchange for one ten? Do we have any ones remaining? (Repeat for other columns.)

Why is it important to line up the digits in the correct column when adding numbers with different amounts of digits?

Which columns are affected if there are more than ten tens altogether?

Varied Fluency

- Rosie uses counters to find the total of 3,356 and 2,435



	Th	H	T	O
	3	3	5	6
+	2	4	3	5
	5	7	9	1
			1	

Use Rosie's method to calculate:
3,356 + 2,437 3,356 + 2,473 3,356 + 2,743

- Dexter buys a laptop costing £1,265 and a mobile phone costing £492
How much do the laptop and the mobile phone cost altogether?

- Complete the bar models.

1,185	405

3,535	2,634

3,264	1,655

Add Two 4-digit Numbers (2)

Reasoning and Problem Solving

What is the missing 4-digit number?

	Th	H	T	O
	___	___	___	___
+	6	3	9	5
	8	9	4	9

2,554

Annie, Mo and Alex are working out the solution to the calculation 6,374 + 2,823

Annie's Strategy

6,000 + 2,000 = 8,000
300 + 800 = 110
70 + 20 = 90
4 + 3 = 7
8,000 + 110 + 90 + 7 = 8,207

Mo's Strategy

	6	3	7	4
+	2	8	2	3
	8	1	9	7

Alex's Strategy

	6	3	7	4
+	2	8	2	3
				7
			9	0
	1	1	0	0
	8	0	0	0
	9	1	9	7

Who is correct?

Alex is correct with 9,197

Annie has miscalculated 300 + 800, forgetting to exchange a ten hundreds to make a thousand (showing 11 tens instead of 11 hundreds).

Mo has forgotten both to show and to add on the exchanged thousand.

Add Two 4-digit Numbers (3)

Notes and Guidance

Building on adding two 4-digit numbers with one exchange, children explore multiple exchanges within an addition.

Ensure children continue to use equipment alongside the written method to help secure understanding of why exchanges take place and how we record them.

Mathematical Talk

How many ones do we have altogether? Can we make an exchange? Why? How many ones do we exchange for one ten? How many ones are remaining? (Repeat for each column.)

Why do you have to add the digits from the right to the left, starting with the smallest place value column? Would the answer be the same if you went left to right?

What is different about the total of 4,844 and 2,156? Can you think of two other numbers where this would happen?

Varied Fluency R

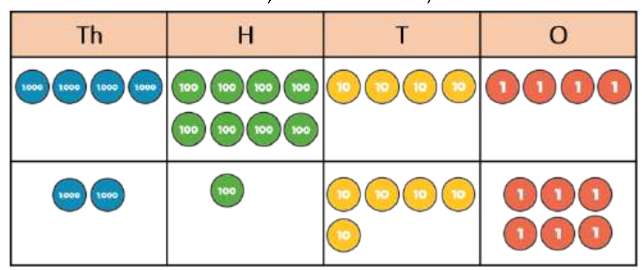
Use counters and a place value grid to calculate:

	5	9	3	4
+	2	2	4	6

	3	2	7	5
+	6	1	5	6

	1	7	7	2
+	2	2	5	0

Find the total of 4,844 and 2,156



	4	8	4	4
+	2	1	5	6

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

3,456 + 789	◯	1,810 + 2,436
2,829 + 1,901	◯	2,312 + 2,418
7,542 + 1,858	◯	902 + 8,496
1,818 + 1,999	◯	3,110 + 707

Add Two 4-digit Numbers (3)

Reasoning and Problem Solving

Jack says,

When I add two numbers together I will only ever make up to one exchange in each column.

Do you agree?
Explain your reasoning.

Jack is correct. When adding any two numbers together, the maximum value in any given column will be 18 (e.g. 18 ones, 18 tens, 18 hundreds). This means that only one exchange can occur in each place value column.
Children may explore what happens when more than two numbers are added together.

Complete:

	Th	H	T	O
	6	?	?	8
+	?	?	8	?
	9	3	2	5

Mo says that there is more than one possible answer for the missing numbers in the hundreds column.
Is he correct?
Explain your answer.

The solution shows the missing numbers for the ones, tens and thousands columns.

6,__38 + 2,__87

Mo is correct. The missing numbers in the hundreds column must total 1,200 (the additional 100 has been exchanged).

Possible answers include:
6,338 + 2,987
6,438 + 2,887

Add More than 4-digits

Notes and Guidance

Children will build upon previous learning of column addition. They will now look at numbers with more than four digits and use their place value knowledge to line the numbers up accurately.
Children use a range of manipulatives to demonstrate their understanding and use pictorial representations to support their problem solving.

Mathematical Talk

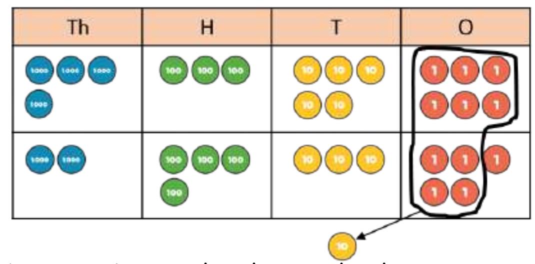
Will you have to exchange? How do you know which columns will be affected?

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

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

Varied Fluency

Ron uses place value counters to calculate 4,356 + 2,435



	Th	H	T	O
	4	3	5	6
+	2	4	3	5
	6	7	9	1
			1	

Use Ron's method to calculate:

	3	2	4	6	1
+		4	3	5	2

	4	8	2	7	6
+		5	6	1	3

Jack, Rosie and Eva are playing a computer game. Jack has 3,452 points, Rosie has 4,039 points and Eva has 10,989 points.

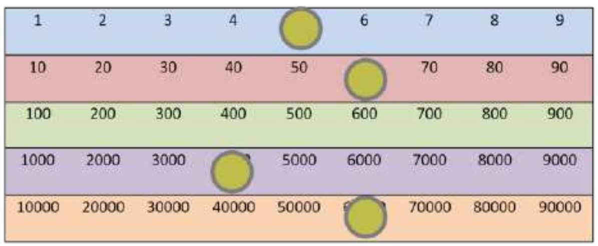
How many points do Jack and Rosie have altogether?
How many points do Rosie and Eva have altogether?
How many points do Jack and Eva have altogether?
How many points do Jack, Rosie and Eva have altogether?

Add More than 4-digits

Reasoning and Problem Solving

Amir is discovering numbers on a Gattegno chart.

He makes this number.



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

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

Which counter did he move?

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

Work out the missing numbers.

	?	4	?	3	?
+	2	?	5	?	2
	7	8	5	2	9

54,937 + 23,592 = 78,529

Subtract Two 4-digit Numbers (2)

Notes and Guidance

Building on their experiences in Year 3, children use their knowledge of subtracting using the formal column method to subtract two 4-digit numbers.

Children explore subtractions where there is one exchange. They use place value counters to model the exchange and match this with the written column method.

Mathematical Talk

When do we need to exchange in a subtraction?
How do we indicate the exchange on the written method?

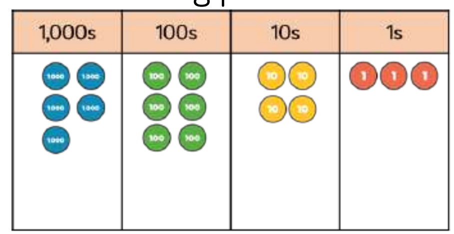
How many bars are you going to use in your bar model?
Can you find out how many tokens Mo has?
Can you find out how many tokens they have altogether?

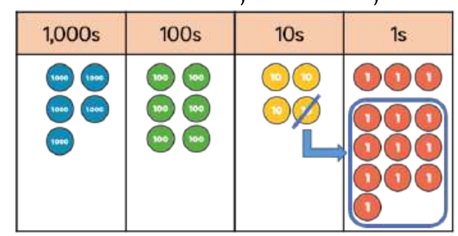
Can you create your own scenario for a friend to represent?

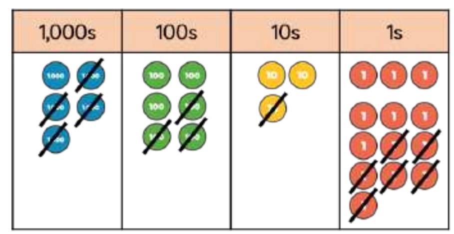
Varied Fluency

R

- Dexter is using place value counters to calculate 5,643 – 4,316







	Th	H	T	O
	5	6	$^{3}\cancel{4}$	$^{1}3$
–	4	3	1	6
	1	3	2	7

Use Dexter's method to calculate:
4,721 – 3,605 =   4,721 – 3,650 =   4,172 – 3,650 =

- Dora and Mo are collecting book tokens.
Dora has collected 1,452 tokens.
Mo has collected 621 tokens fewer than Dora.

Represent this scenario on a bar model.
What can you find out?

Subtract Two 4-digit Numbers (2)

Reasoning and Problem Solving

1,235 people go on a school trip.

There are 1,179 children and 27 teachers. The rest are parents.

How many parents are there?

Explain your method to a friend.

Add children and teachers together first.

1,179 + 27 = 1,206

Subtract this from total number of people.

1,235 – 1,206 = 29

29 parents.

Find the missing numbers that could go into the spaces.

Give reasons for your answers.

____ – 1,345 = 4_6

What is the greatest number that could go in the first space?

What is the smallest?

How many possible answers could you have?

What is the pattern between the numbers?

What method did you use?

Possible answers:

1,751 and 0
1,761 and 10
1,771 and 20
1,781 and 30
1,791 and 40
1,801 and 50
1,811 and 60
1,821 and 70
1,831 and 80
1,841 and 90
1,841 is the greatest
1,751 is the smallest.

There are 10 possible answers. Both numbers increase by 10

Subtract Two 4-digit Numbers (3)

Notes and Guidance

Children explore what happens when a subtraction has more than one exchange. They can continue to use manipulatives to support their understanding. Some children may feel confident calculating with a written method.

Encourage children to continue to explain their working to ensure they have a secure understanding of exchange within 4-digits numbers

Mathematical Talk

When do we need to exchange within a column subtraction?

What happens if there is a zero in the next column? How do we exchange?

Can you use place value counters or Base 10 to support your understanding?

How can you find the missing 4-digit number? Are you going to add or subtract?

Varied Fluency

R

- Use place value counters and the column method to calculate:

5,783 – 844 6,737 – 759 8,252 – 6,560

1,205 – 398 2,037 – 889 2,037 – 1,589

- A shop has 8,435 magazines.
367 are sold in the morning and 579 are sold in the afternoon.

How many magazines are left?

8,435		
367	579	?

There are ____ magazines left.

- Find the missing 4-digit number.

	Th	H	T	O
	?	?	?	?
+	4	6	7	8
	7	4	3	1

Subtract Two 4-digit Numbers (3)

Reasoning and Problem Solving

R

Amir and Tommy solve a problem.

When I subtract 546 from 3,232 my answer is 2,714

Amir

Tommy

When I subtract 546 from 3,232 my answer is 2,686

Who is correct?
Explain your reasoning.
Why is one of the answers wrong?

Tommy is correct.

Amir is incorrect because he did not exchange, he just found the difference between the numbers in the columns instead.

There were 2,114 visitors to the museum on Saturday.
650 more people visited the museum on Saturday than on Sunday.

Altogether how many people visited the museum over the two days?

What do you need to do first to solve this problem?

First you need to find the number of visitors on Sunday which is
2,114 – 650 = 1,464

Then you need to add Saturday's visitors to that number to solve the problem.
1,464 + 2,114 = 3,578

White Rose Maths

Subtract More than 4-digits

Notes and Guidance

Building on Year 4 experience, children use their knowledge of subtracting using the formal column method to subtract numbers with more than four digits. Children will be focusing on exchange and will be concentrating on the correct place value.

It is important that children know when an exchange is and isn't needed. Children need to experience '0' as a place holder.

Mathematical Talk

Why is it important that we start subtracting the smallest place value first?

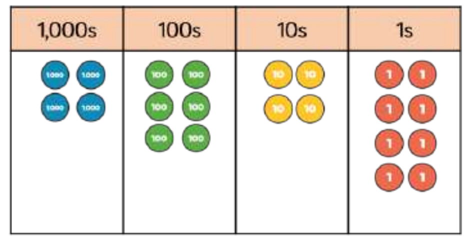
Does it matter which number goes on top? Why? Will you have to exchange? How do you know which columns will be affected?

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

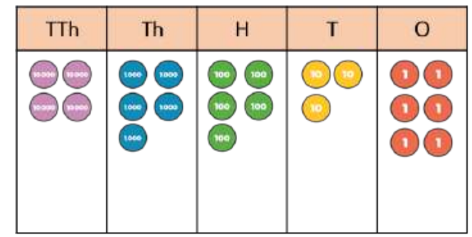
Varied Fluency

- Calculate:

4,648 – 2,347



45,536 – 8,426



- Represent each problem as a bar model, and solve them.

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

Tommy earns £37,506 pounds a year.
Dora earns £22,819 a year.
How much more money does Tommy earn than Dora?

There are 83,065 fans at a football match.
45,927 fans are male. How many fans are female?

Subtract More than 4-digits

Reasoning and Problem Solving

Eva makes a 5-digit number. Mo makes a 4-digit number. The difference between their numbers is 3,465 What could their numbers be?	Possible answers: 9,658 and 14,023 12,654 and 8,289 5,635 and 10,000 Etc.	Rosie completes this subtraction incorrectly. $\begin{array}{r} 28701 \\ -\ \ 7621 \\ \hline 21180 \\ \hline \end{array}$ Explain the mistake to Rosie and correct it for her.	Rosie did not write down the exchange she made when she exchanged 1 hundred for 10 tens. This means she still had 7 hundreds subtract 6 hundreds when she should have 6 hundreds subtract 6 hundreds. The correct answer is 21,080

Estimate and Approximate

Notes and Guidance

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

Encourage children to consider the most appropriate number to round to e.g. the nearest ten, hundred or thousand. Reinforce the idea that an estimate should be performed quickly by choosing much easier numbers.

Mathematical Talk

Which numbers shall I round to?

Why should I round to this number?

Why should an estimate be quick?

When, in real life, would we use an estimate?

Varied Fluency

- Which is best to estimate the total of 22,223 and 5,687?

  22,300 + 5,700

  22,200 + 5,700

  22,200 + 5,600

- Here are the attendances from the last 3 months at a rugby club.

Month	Attendance
February	18,655
March	31,402
April	27,092

What is the approximate total of February and March?
What is the approximate difference between March and April?
What is the approximate total of the three months?

April and May had an approximate total of 50,000
Estimate the attendance in May.

Estimate and Approximate

Reasoning and Problem Solving

True or False?

49,999 – 19,999 = 50,000 – 20,000

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

Dora

Can you explain why Dora's method work?

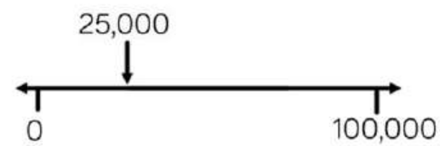
Can you think of another example where this method could be used?

True

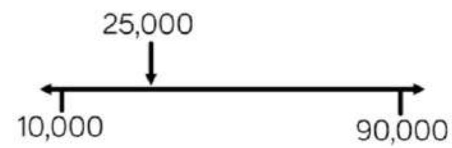
Dora has used her related number facts. Both numbers on the right have increased by 1 therefore whatever the difference is, it will remain the same as the left hand side.

Which estimate is inaccurate?

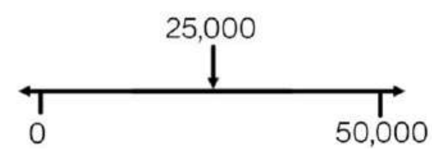
a)



b)



c)



Explain how you know.

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

Inverse Operations

Notes and Guidance

In this small step, children will use their knowledge of addition and subtraction to check their workings to ensure accuracy.

They use the commutative law to see that addition can be done in any order but subtraction cannot.

Mathematical Talk

How can you tell if your answer is sensible?

What is the inverse of addition?

What is the inverse of subtraction?

Varied Fluency

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

  8,947 + 8,631 = 17,468

  8,947 + 8,521 = 17,468

  8,251 + 8,947 = 17,468

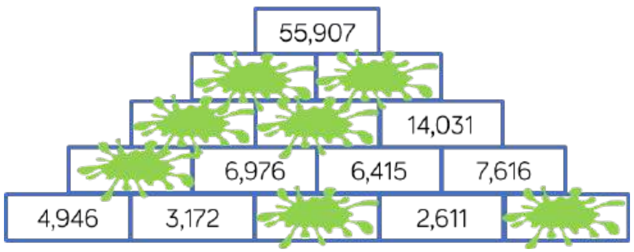
- I'm thinking of a number.
  After I add 5,241 and subtract 352, my number is 9,485
  What was my original number?

- Eva and Dexter are playing a computer game.
  Eva's high score is 8,524
  Dexter's high score is greater than Eva's.
  The total of both of their scores is 19,384
  What is Dexter's high score?

Inverse Operations

Reasoning and Problem Solving

Complete the pyramid using addition and subtraction.



From left to right:

Bottom row: 3,804, 5,005

Second row: 8,118

Third row: 15,094, 13,391

Fourth row: 28,485, 27,422

Mo, Whitney, Teddy and Eva collect marbles.

Mo: I have 1,648 marbles.

Whitney: I have double the amount of marbles Mo has.

Teddy: I have half the amount of marbles Mo has.

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

Eva has 2,756 marbles.

Multi-step Problems

Notes and Guidance

In this small step children will be using their knowledge of addition and subtraction to solve multi-step problems.

The problems will appear in different contexts and in different forms i.e. bar models and word problems.

Mathematical Talk

What is the key vocabulary in the question?

What are the key bits of information?

Can we put this information into a model?

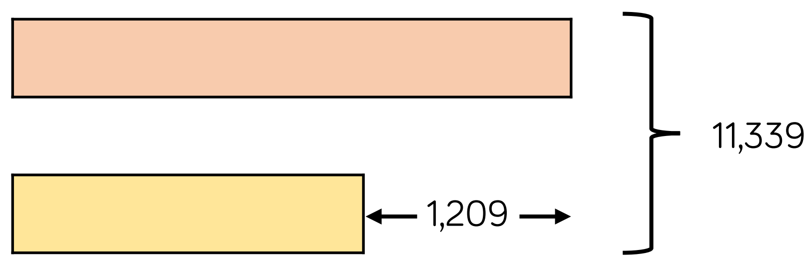
Which operations do we need to use?

Varied Fluency

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

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

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



Multi-step Problems

Reasoning and Problem Solving

A milkman has 250 bottles of milk.

He collects another 160 from the dairy, and delivers 375 during the day.

How many does he have left?

Tommy

My method:

375 – 250 = 125

125 + 160 = 285

Do you agree with Tommy?
Explain why.

Tommy is wrong. He should have added 250 and 160, then subtracted 375 from the answer.

There are 35 bottles of milk remaining.

On Monday, Whitney was paid £114

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

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

How much was Whitney paid in total?

How many calculations did you do?

Is there a more efficient method?

£342

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

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

White Rose Maths

Autumn - Block 3

Statistics

Overview

Small Steps

- Interpret charts R
- Comparison, sum and difference R
- Introduce line graphs R
- Read and interpret line graphs
- Draw line graphs
- Use line graphs to solve problems
- Read and interpret tables
- Two-way tables
- Timetables

Notes for 2020/21

Children may have missed learning on statistics in Year 4.

We have included a recap on some of the trickier aspects of the topic such as interpreting charts and comparing results.

Interpret Charts

Notes and Guidance

Children revisit how to use bar charts, pictograms and tables to interpret and present discrete data.
They decide which scale will be the most appropriate when drawing their own bar charts.
Children gather their own data using tally charts and then present the information in a bar chart. Questions about the data they have gathered should also be explored so the focus is on interpreting rather than drawing.

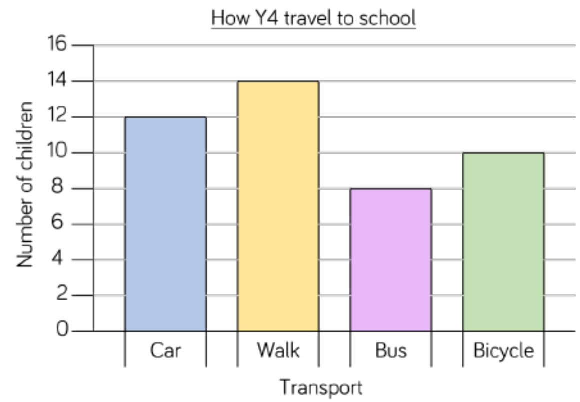
Mathematical Talk

What are the different ways to present data?
What do you notice about the different axes?
What do you notice about the scale of the bar chart?
What other way could you present the data shown in the bar chart?
What else does the data tell us?
What is the same and what is different about the way in which the data is presented?
What scale will you use for your own bar chart? Why?

Varied Fluency

R

- Complete the table using the information in the bar chart.

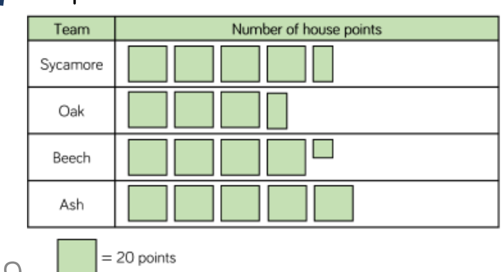


Transport	Number of children
Car	
Walk	
Bus	
Bicycle	

What is the most/least popular way to get to school?
How many children walk to school?

- Produce your own table, bar chart or pictogram showing how the children in your class travel to school.

- Represent the data in each table as a bar chart.



Day	Number of tickets sold
Monday	55
Tuesday	30
Wednesday	45
Thursday	75
Friday	85

Interpret Charts

Reasoning and Problem Solving

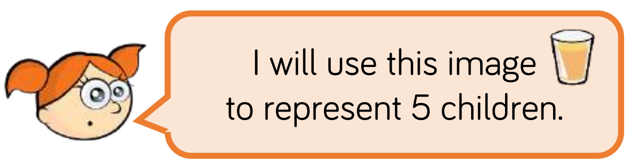
Halifax City Football Club sold the following number of season tickets:

- Male adults – 6,382
- Female adults – 5,850
- Boys – 3,209
- Girls – 5,057

Would you use a bar chart, table or pictogram to represent this data? Explain why.

Possible answer:
I would represent the data in a table because it would be difficult to show the exact numbers accurately in a pictogram or bar chart.

Alex wants to use a pictogram to represent the favourite drinks of everyone in her class.



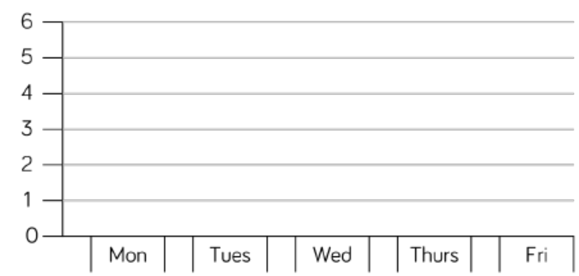
Explain why this is not a good idea.

It is not a good idea, because it would be difficult to show amounts which are not multiples of 5

Here is some information about the number of tickets sold for a concert.

Day	Number of tickets sold
Monday	55
Tuesday	30
Wednesday	45
Thursday	75
Friday	85

Jack starts to create a bar chart to represent the number of concert tickets sold during the week.



What advice would you give Jack about the scale he has chosen?
What would be a better scale to use?
Is there anything else missing from the bar chart?

Possible response:
I would tell Jack to use a different scale for his bar chart because the numbers in the table are quite large.
The scale could go up in 5s because the numbers are all multiples of 5
Jack needs to record the title and he needs to label the axes.

Comparison, Sum & Difference

Notes and Guidance

Children solve comparison, sum and difference problems using discrete data with a range of scales.
They use addition and subtraction to answer questions accurately and ask their own questions about the data in pictograms, bar charts and tables.
Although examples of data are given, children should have the opportunity to ask and answer questions relating to data they have collected themselves.

Mathematical Talk

What does a full circle represent in the pictogram?

What does a half/quarter/three quarters of the circle represent?

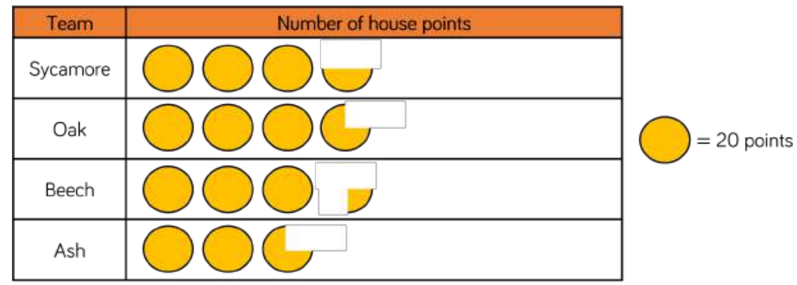
What other questions could we ask about the pictogram?

What other questions could we ask about the table?

What data could we collect as a class?

What questions could we ask about the data?

Varied Fluency



How many more points does the Sycamore team have than the Ash team?
How many points do Beech and Oak teams have altogether?
How many more points do Ash need to be equal to Oak?

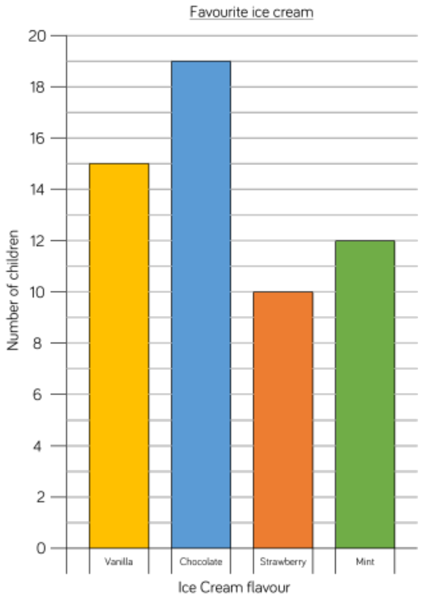
Activity	Number of votes
Bowling	9
Cinema	10
Swimming	7
Ice-skating	14

How many people voted in total?
$\frac{1}{4}$ of the votes were for ________.
7 more people voted for __________ than ___________.

As a class, decide on some data that you would like to collect, for example: favourite books, films, food.
Collect and record the data in a table.
Choose a pictogram or a bar chart to represent your data, giving reasons for your choices.
What questions can you ask about the data?

Comparison, Sum & Difference

Reasoning and Problem Solving



Rosie says,

Can you spot Rosie's mistake? How many people were asked altogether?

Rosie has read the bar chart incorrectly.
15 people chose vanilla, 19 people chose chocolate, 10 chose strawberry and 12 chose mint.
That means 56 people were asked altogether.

Attraction	Number of visitors on Saturday	Number of visitors on Sunday
Animal World Zoo	1,282	2,564
Maltings Castle	2,045	1,820
Primrose Park	1,952	1,325
Film Land Cinema	2,054	1,595

True or false?

- The same number of people visited Maltings Castle as Film Land Cinema on Saturday.
- Double the number of people visited Animal World Zoo on Sunday than Saturday.
- The least popular attraction of the weekend was Primrose Park.

- False
  The Film Land Cinema had 9 more visitors that Maltings Castle
- True
  1,282 doubled is 2,564
- True
  Animal World Zoo - 3,846
  Maltings Castle - 3,865
  Primrose Park - 3,277
  Film Land Cinema - 3,649

Introducing Line Graphs

Notes and Guidance

Children are introduced to line graphs in the context of time. They use their knowledge of scales to read a time graph accurately and create their own graphs to represent continuous data.
It is important that children understand that continuous data can be measured (for example time, temperature and height) but as values are changing all the time, the values we read off between actual measurements are only estimates.

Mathematical Talk

How is the line graph different to a bar chart?

Which is the x and y axis? What do they represent?

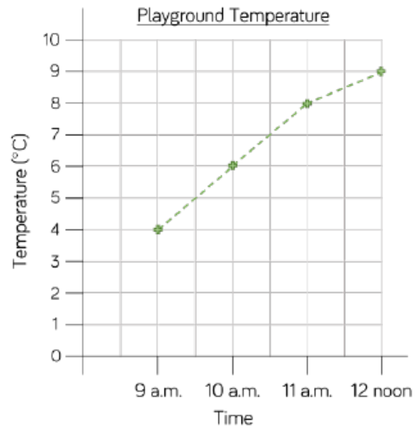
How would you estimate the temperature at 9:30 a.m.?

How would you estimate the time it was when the temperature was 7 degrees?

Varied Fluency

R

The graph shows the temperature in the playground during a morning in April.



The temperature at 9 a.m. is _______ degrees.

The warmest time of the morning is _________.

Class 4 grew a plant. They measured the height of the plant every week for 6 weeks.
The table shows the height of the plant each week.

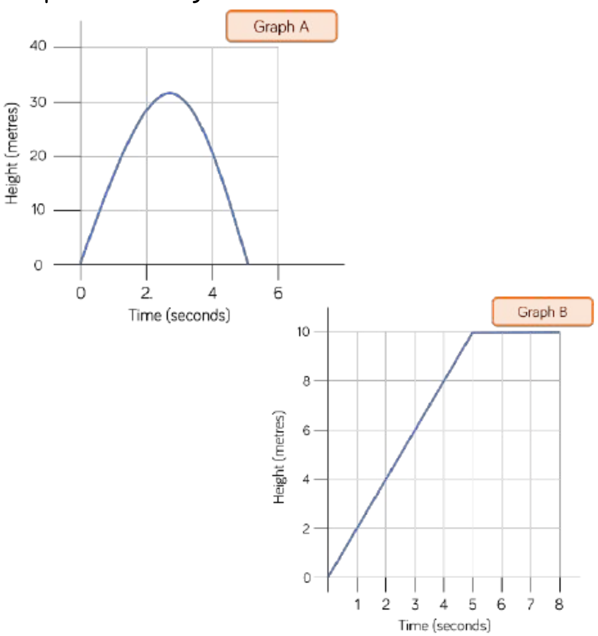
Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
4 cm	7 cm	9 cm	12 cm	14 cm	17 cm

Create a line graph to represent this information.
What scale would you use on the x and y axes?
Between which two weeks did the plant reach a height of 10 cm?

Introducing Line Graphs

Reasoning and Problem Solving

Jack launched a toy rocket into the sky.
After 5 seconds the rocket fell to the ground.
Which graph shows this?
Explain how you know.

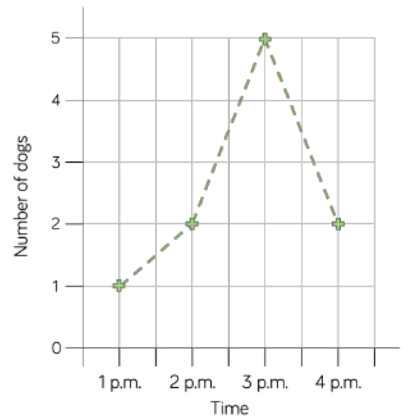


Make up your own story for the other graph.

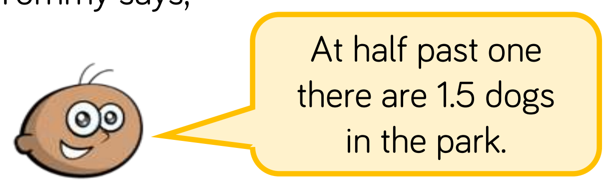
Graph A
The height of the rocket increases then decreases quickly again, returning to a height of 0 at 5 seconds.

Example story:
A bird flew up from the ground. It continued to fly upwards for 5 seconds then flew at the same height for another 3 seconds.

Tommy created a line graph to show the number of dogs walking in the park one afternoon.



Tommy says,



Why is Tommy incorrect?

What would be a better way of presenting this data?

Tommy is incorrect because you cannot have 1.5 dogs.

A better way of presenting this data would be using a bar chart, pictogram or table because the data is discrete.

Read & Interpret Line Graphs

Notes and Guidance

Children read and interpret line graphs. They make links back to using number lines when reading the horizontal and vertical axes. Children can draw vertical and horizontal lines to read the points accurately.
Encourage children to label all the intervals on the axes to support them in reading the line graphs accurately. When reading between intervals on a line graph, children can give an estimate of the value that is represented.

Mathematical Talk

How can we use a ruler to support us to read values from a line graph?

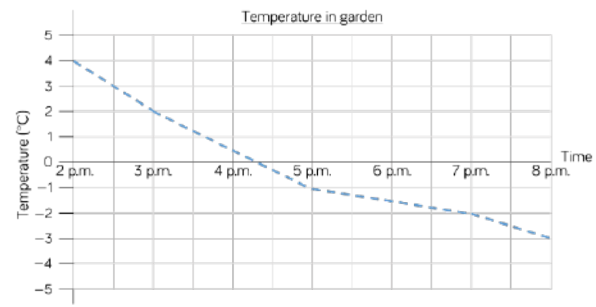
Where do we see examples of line graphs in real life?

How is the line graph different to a bar chart? How is it the same?

How can we estimate the value between intervals? Does it matter if we are not perfectly accurate? Why?

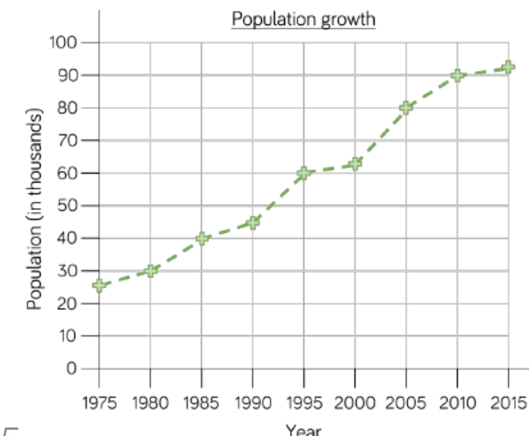
Varied Fluency

- Here is a line graph showing the temperature in a garden.



What was the temperature at 5 p.m.?
What was the difference in temperature between 3 p.m. and 7 p.m.?
When was the temperature 4°C?
Estimate the time when the temperature was 0°C.
Estimate the temperature at 6 p.m.

- This line graph shows the population growth of a town.



What was the population in 1985?

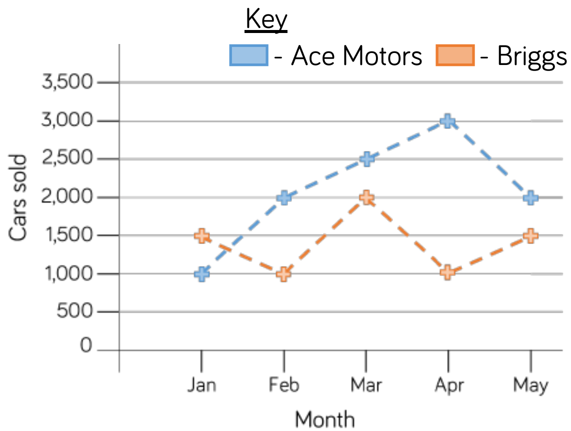
How much did the population grow between 1990 and 2010?

When was the population double the population of 1985?

Read & Interpret Line Graphs

Reasoning and Problem Solving

The graph shows the number of cars sold by two different companies.



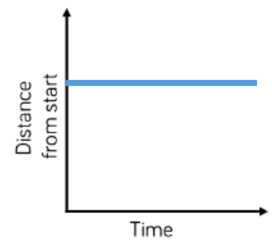
- How many more cars did Ace Motors sell than Briggs in April?
- From January to March, how many cars did each company sell? Who sold more? How many more did they sell?
- Crooks Motors sold 250 more cars than Briggs each month.
  Plot Crooks Motors' sales on the graph.

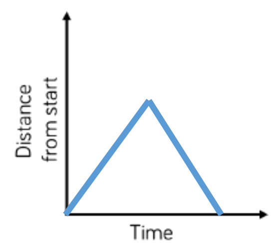
2,000

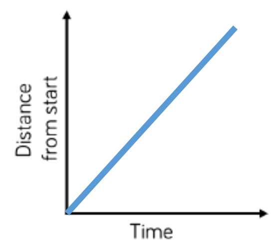
Ace 5,500
Briggs 4,500
Difference of 1,000
Ace sold more.

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

Match the graph to the activity.







A car travels at constant speed on the motorway.

A car is parked outside a house.

A car drives to the end of the road and back.

The first graph matches with the second statement.

Second graph with the third statement.

Third graph with the first statement.

Draw Line Graphs

Notes and Guidance

Children use their knowledge of scales and coordinates to represent data in a line graph. Drawing line graphs is a Year 5 Science objective and has been included here to support this learning and link to reading and interpreting graphs.
Children draw axes with different scales depending on the data they are representing. Encourage children to collect their own data to present in line graphs focusing on accurately plotting the points.

Mathematical Talk

On the rainfall graph, if the vertical axis went up in intervals of 5 mm, would the graph be more or less accurate? Why?

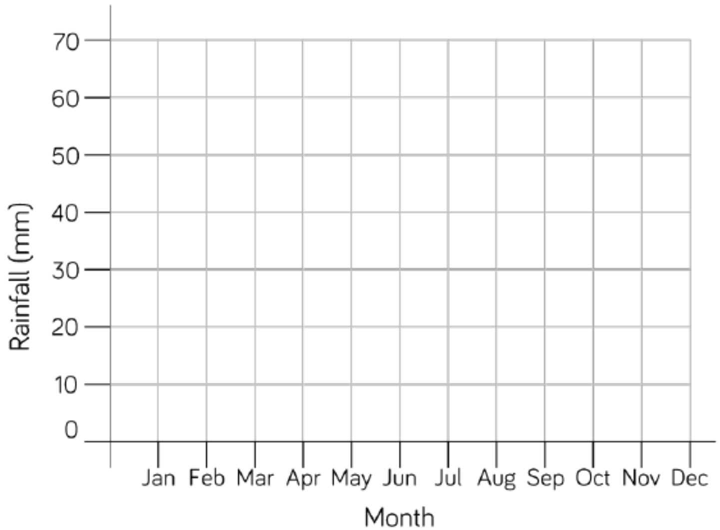
What scale will you use for the rupees on the conversion graph?

Which axis will you use for the pounds on the conversion graph? Explain why you have chosen this axis.

How can we use multiples to support our choice of intervals on the vertical axis?

Varied Fluency

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



Month	Rainfall (mm)
Jan	54
Feb	40
Mar	38
Apr	38
May	48
Jun	46
Jul	58
Aug	60
Sep	50
Oct	57
Nov	65
Dec	50

Here is a table showing the conversion between pounds and rupees. Present the information as a line graph.

Pounds	1	2	3	4	5	6	7	8	9	10
Rupees	80	160	240	320	400	480	560	640	720	800

Draw Line Graphs

Reasoning and Problem Solving

Encourage the children to collect their own data and present it as a line graph. As this objective is taken from the science curriculum, it would be a good idea to link it to investigations.
Possible investigations could be:

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

Children will present a range of line graphs over the year.

Here is a table of data.

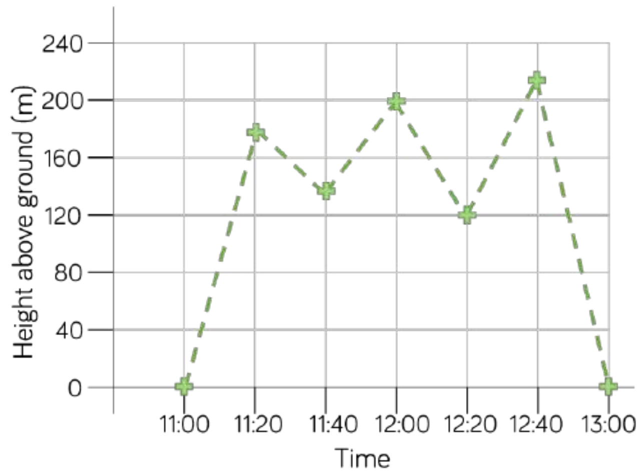
Time (min)	15	30	45	60	75
Distance (km)	25	46	67	72	98

Which intervals would be the most appropriate for the vertical axis of the line graph?
Explain your answer.

Children may give different answers but should give clear reasons. Intervals may range from 2s up to 10s. The most appropriate scale may be in 5s.

Rosie has used the data in the table to plot the line graph.

Time	11:00	11:20	11:40	12:00	12:20	12:40	13:00
Height above ground (m)	0	180	150	200	210	120	0



What mistakes has Rosie made?
Can you draw the line graph correctly?

Rosie has plotted the time for 11:40 inaccurately, it should be closer to 160 than 120
She has mixed up the points for 12:20 and 12:40 and plotted them the other way round.

Problems with Line Graphs

Notes and Guidance

Children use line graphs to solve problems. They use prepared graphs or graphs which they have drawn themselves, and make links to other subjects, particularly Science.

Children solve comparison, sum and difference problems. They can also generate their own questions for others to solve by reading and interpreting the line graphs.

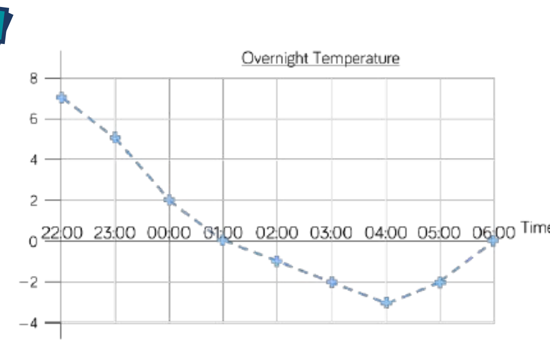
Mathematical Talk

How does drawing vertical and horizontal lines support me in reading the line graph?

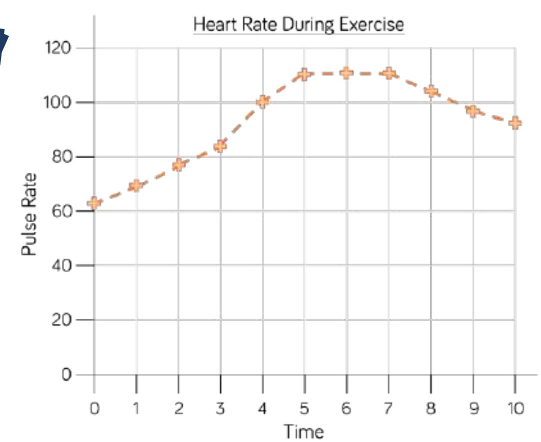
How will you plan out your own heart rate experiment? What information will you need to gather? What unit will you measure in? How will you label your axes?

Can we measure the temperature in our classroom? How could we gather the data? How could we present the data?

Varied Fluency



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



How long did it take for the pulse rate to reach the highest level? Explain your answer, using the graph to. help.
What could have happened at 5 minutes?
What could have happened at 7 minutes?

Estimate what the pulse rate was after 2 and a half minutes. How did you get an accurate estimate?

Problems with Line Graphs

Reasoning and Problem Solving

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

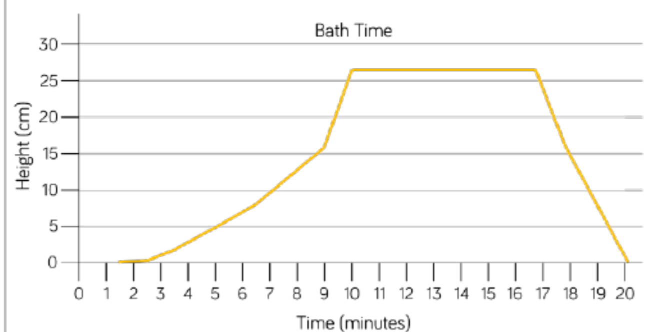
Can you make a set of questions for a friend to answer about your graph?

Can you put the information into a table?

Various answers.

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

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



How long did it take to fill the bath?

How long did it take to empty?

The bath doesn't fill at a constant rate. Why might that be?

Discussions around what happens to the water level when someone gets in the bath would be useful.

Approximately 9 and a half mins to fill the bath.

Approximately 3 and a half mins to empty.

One or two taps could be used to fill.

Read & Interpret Tables

Notes and Guidance

Children read tables to extract information and answer questions. There are many opportunities to link this learning to topic work within class and in other subject areas.

Encourage children to generate their own questions about information in a table. They will get many opportunities to apply their addition and subtraction skills when solving sum and difference problems.

Mathematical Talk

Why are column and row headings important in a table?

If I am finding the difference, what operation do I need to use?

Can you think of your own questions to ask about the information in the table?

Why is it important to put units of measure in the table?

Varied Fluency

Here is a table with information about planets. Use the table to answer the questions.

Planet	Time for Revolution	Diameter (km)	Time for Rotation
Mercury	88 days	4,878	59 days
Venus	225 days	12,104	243 days
Earth	365 days	12,756	24 hours
Mars	687 days	6,794	25 hours
Jupiter	12 years	142,984	10 hours
Saturn	29 years	120,536	11 hours
Uranus	84 years	51,118	17 hours
Neptune	165 years	49,500	17 hours

How many planets take more than one day to rotate?
Which planets take more than one year to make one revolution?
Write the diameter of Jupiter in words.
What is the difference between the diameter of Mars and Earth?
What is the difference between the time for rotation between Mercury and Venus?

Use the table to answer the questions.

City	Leeds	Wakefield	Bradford	Liverpool	Coventry
Population	720,000	316,000	467,000	440,000	305,000

What is the difference between the highest and lowest population?
Which two cities have a combined population of 621,000?
How much larger is the population of Liverpool than Coventry?

Read & Interpret Tables

Reasoning and Problem Solving

	100 m sprint (s)	Shot put (m)	50 m Sack race (s)	Javelin (m)
Amir	15.5	6.5	18.9	11.2
Dora	16.2	7.5	20.1	13.3
Teddy	15.8	6.9	19.3	13.9
Rosie	15.6	7.2	18.7	14.1
Ron	17.9	6.3	18.7	13.3

Ron thinks that he won the 100 m sprint because he has the biggest number.

Do you agree?
Explain your answer.

Ron's number is the biggest but this means he was the slowest therefore he did not win the 100 m sprint.

This table shows the 10 largest stadiums in Europe.

Stadium	City	Country	Capacity
Camp Nou	Barcelona	Spain	99,365
Wembley	London	England	90,000
Signal Iduna Park	Dortmund	Germany	81,359
Santiago Bernabeu	Madrid	Spain	81,044
San Siro	Milan	Italy	80,018
Stade de France	Paris	France	80,000
Luzhniki Stadium	Moscow	Russia	78,300
Ataturk Olimpiyat Stadium	Istanbul	Turkey	76,092
Old Trafford	Manchester	England	75,811
Allianz Arena	Munich	Germany	75,000

True or False?

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

Two-way Tables

Notes and Guidance

Children read a range of two-way tables. These tables show two different sets of data which are displayed horizontally and vertically.

Children answer questions by interpreting the information in the tables. They complete two-way tables, using their addition and subtraction skills. Encourage children to create their own questions about the two-way tables.

Mathematical Talk

Which column do I need to look in to find the information?
Which row do I need to look in to find the information?

How can I calculate the total of a row/column?
If I know the total, how can I calculate any missing information?

Can you create your own two-way table using information about your class?

Varied Fluency

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

	Male	Female	Total
Constable	55	24	79
Sergeant	8	5	13
Inspector	2	4	6
Chief Inspector	1	1	2
Total	66	34	100

- How many female inspectors are there?
- How many male sergeants are there?
- How many constables are there altogether?
- How many people work at Liverpool police station?
- How many male inspectors and female constables are there altogether?

Complete the table.

	Man United	Liverpool	Chelsea	TOTAL
Lost	36	42	29	
Won	174	76	126	
TOTAL				

Write questions about the information for a friend to solve.

Two-way Tables

Reasoning and Problem Solving

This table shows how many children own dogs and cats.

Fill in the missing gaps and answer the questions below.

	Boys	Girls	Total
Dogs		44	
Cats	38		
Total	125		245

- How many more boys have dogs than girls?
- How many more girls have cats than dogs?
- How many more children have dogs than cats?

Completed table:

	Boys	Girls	Total
Dogs	87	44	131
Cats	38	76	114
Total	125	120	245

43

32

17

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

Use this information to create a two-way table.

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

You can choose to give children a blank template.

Children may not know where to put the 120, or realise its importance.

Children will need to work systematically in order to get all of the information.

As a teacher, you could choose not to give the children the complete total and let them find other possible answers.

Timetables

Notes and Guidance

Children read timetables to extract information. Gather local timetables for the children to interpret to make the learning more relevant to the children's lives, this could include online timetables.

Revisit children's previous learning on digital time to support them in reading timetables more accurately. Consider looking at online apps for timetables to make links with ICT.

Mathematical Talk

Where do you see timetables and why are they useful?

What information is displayed in a row when you read across the timetable?

What information is displayed in a column when you read down the timetable?

Why is it important to use 24-hour clock or a.m./p.m. on a timetable?

Varied Fluency

Use the timetable to answer the questions.

	Bus Timetable				
Halifax	06:05	06:35	07:10	07:43	08:15
Shelf	06:15	06:45		07:59	08:31
Shelf Village	06:16	06:46	07:23	08:00	08:32
Woodside	06:21	06:50	07:28		
Odsal	06:26	06:55	07:33	08:15	08:45
Bradford	06:40	07:10	07:48	08:30	09:00

On the 06:35 bus, how long does it take to get from Shelf to Bradford?
Can you travel to Woodside on the 07:43 bus from Halifax?
Which journey takes the longest time between Shelf Village and Bradford?
If you needed to travel from Halifax to Odsal and had to arrive by 08:20, which would be the best bus to catch? Explain your answer.
Which bus takes the longest time from Halifax to Bradford?
Amir travels on the 06:35 bus from Halifax to Woodside, how many minutes is he on the bus?
The 08:15 bus is running 12 minutes late, what time does it arrive at Odsal?

Timetables

Reasoning and Problem Solving

NatureWatch		NatureWatch +1		QuizTime		Cookery Channel	
5 p.m.	News	5 p.m.	Puppy Playtime	5 p.m.	Talk the Talk	5 p.m.	Cheese Please
5:30 p.m.	Weather	6 p.m.	News	5:30 p.m.	Quizdom	6 p.m.	Cook with Lydia
5:45 p.m.	Deep Blue	6:30 p.m.	Weather	6 p.m.	What's the Q?	6:30 p.m.	Pizza Pasta Pietro
6 p.m.	Pampered Pets	6:45 p.m.	Deep Blue	6:30 p.m.	aMAZEment	6:45 p.m.	5 Minute Menu
7 p.m.	Safari	7 p.m.	Pampered Pets	7:30 p.m.	Buzzed Out	7 p.m.	Budget Baker
8:15 p.m.	Animal Antics	8 p.m.	Safari	8 p.m.	Guess the Noise	8 p.m.	Lots of Lollies
9:15 p.m.	Worldly Wonders	9:15 p.m.	Animal Antics	9 p.m.	Dance & Decide	9:15 p.m.	Biscuit Bites

Ron wants to watch the following TV programmes: Cheese Please, What's the Q, aMAZEment, Budget Baker, Safari, Dance & Decide.

Will Ron be able to watch all the shows he has chosen?

No, Budget Baker is on at the same time as aMAZEment. Safari also overlpas with Dance & Decide by 15 minutes.

It is 18:45. How long is it until 'Guess the Noise' is on?

Guess the Noise is on in 1 hour and 15 minutes.

Here is Rosie's weekly timetable from secondary school.

Y7CM	Daily Assembly (09:00 – 09:15)	1 09:15 - 09:55	2 09:55 - 10:45	Break (10:45 – 11:05)	3 11:05 - 11:55	4 11:55 - 12:45	Lunchtime (12:45 – 13:45)	5 13:45 - 14:35	6 14:35 - 15:25
Monday		Literacy	English		Maths	I.C.T.		P.S.H.C.E.	Geography
Tuesday		English	Art		French	Science		D.T.	
Wednesday		Literacy	D.T.		Art	Drama		I.C.T.	Science
Thursday		P.E.	Maths		R.E.	English		History	P.S.H.C.E.
Friday		Literacy	Maths		Art	Science		P.E.	

True or False?

- Rosie has 2 hours and 20 minutes of PE in a week.
- Rosie has 130 minutes of literacy in a week.
- Rosie does Art for the same length of time as Maths each week.
- Rosie does Art for the same length of time as English each week.

True

False, 120 mins (2 hours)

True

False (150 mins of Art, 140 mins of English)

White Rose Maths

Autumn - Block 4

Multiplication & Division

Overview

Small Steps

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

Notes for 2020/21

Multiplying and dividing by 10, 100 and 1,000 can be a difficult topic for children. We have therefore added in recap on this to ensure enough time is devoted to it.

This is an essential skill to master to enable children to be successful later.

Multiples

Notes and Guidance

Building on their times tables knowledge, children will find multiples of whole numbers. Children build multiples of a number using concrete and pictorial representations e.g. an array. Children understand that a multiple of a number is the product of the number and another whole number.

Multiplying decimal numbers by 10, 100 and 1,000 forms part of Year 5 Summer block 1 .

Mathematical Talk

What do you notice about the multiples of 5? What is the same about each of them, what is different?

Look at multiples of other numbers, is there a pattern that links them to each other?

Are all multiples of 8 multiples of 4?

Are all multiples of 4 multiples of 8?

Varied Fluency

- Circle the multiples of 5

  25 32 54 175 554 3000

  What do you notice about the multiples of 5?

- 7,135 is a multiple of 5. Explain how you know.

- Roll 2 dice (1-6), and multiply the numbers the you roll.
  List all the numbers that this number is a multiple of.
  Repeat the dice roll.
  Use a table to show your results.
  Multiply the numbers you roll to complete the table.

Multiples

Reasoning and Problem Solving

Use 0 – 9 digit cards. Choose 2 cards and multiply the digits shown.

What is your number a multiple of?

Is it a multiple of more than one number?

Find all the numbers you can make using the digit cards.

Use the table below to help.

	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

Always, Sometimes, Never

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

Always - all integers are multiples of 1, which is an odd number.

Never - Two odd numbers multiplied together are always a multiple of an odd number.

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

She is younger than 40

How old is Eva?

Eva is 21 years old.

Factors

Notes and Guidance

Children understand the relationship between multiplication and division and use arrays to show the relationship between them. Children learn that factors of a number multiply together to give that number, meaning that factors come in pairs. Factors are the whole numbers that you multiply together to get another whole number (factor × factor = product).

Mathematical Talk

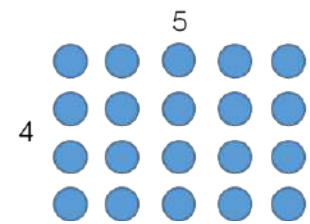
How can you work in a systematic way to prove you have found all the factors?

Do factors always come in pairs?

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

Varied Fluency

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



How many factors of twenty have you found by arranging your counters in different arrays?

- Circle the factors of 60

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

Which factors of 60 are not shown?

- Fill in the missing factors of 24

1 × ____ ____ × 12

3 × ____ ____ × ____

What do you notice about the order of the factors?
Use this method to find the factors of 42

Factors

Reasoning and Problem Solving

Here is Annie's method for finding factor pairs of 36

1	36
2	18
3	12
4	9
5	X
6	6

When do you put a cross next to a number?

How many factors does 36 have?

Use Annie's method to find all the factors of 64

If it is not a factor, put a cross.

36 has 9 factors.

Factors of 64:

1	64
2	32
3	X
4	16
5	X
6	X
7	X
8	8

Always, Sometimes, Never

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

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

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

True or False?

The bigger the number, the more factors it has.

False. For example, 12 has 6 factors but 13 only has 2

Common Factors

Notes and Guidance

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

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

Mathematical Talk

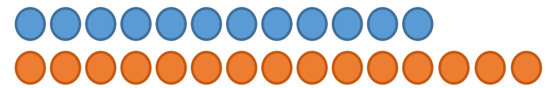
How can we find the common factors systematically?

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

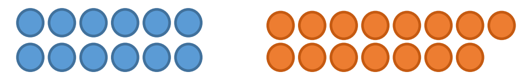
How does a Venn diagram help to show common factors? Where are the common factors?

Varied Fluency

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

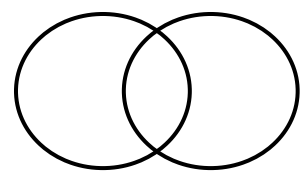


Yes- so they have a common factor of one.
Can we arrange each number in counters in two equal rows?



We can for 12, so 2 is a factor of 12, but we can't for 15, so 2 is not a factor of 15, meaning 2 is not a common factor of 12 and 15
Continue to work through the factors systematically until you find all the common factors.

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



Where are the common factors of 20 and 24?
Use a Venn diagram to show the common factors of 9 and 15

Common Factors

Reasoning and Problem Solving

True or False? • 1 is a factor of every number. • 1 is a multiple of every number. • 0 is a factor of every number. • 0 is a multiple of every number.	 True False False True
I am thinking of two 2-digit numbers. Both of the numbers have a digit total of six. Their common factors are: 1, 2, 3, 4, 6, and 12 What are the numbers?	24 and 60

Prime Numbers

Notes and Guidance

Using their knowledge of factors, children see that some numbers only have two factors. They are taught that these are numbers called prime numbers, and that non-primes are called composite numbers. Children can recall primes up to 19 and are able to establish whether a number is prime up to 100. Using primes, they break a number down into its prime factors. Children learn that 1 is not a prime number because it does not have exactly two factors (it only has 1 factor).

Mathematical Talk

How many factors does each number have?

How many other numbers can you find that have this number of factors?

What is a prime number?

What is a composite number?

How many factors does a prime number have?

Varied Fluency

- Use counters to find the factors of the following numbers.

  5, 13, 17, 23

  What do you notice about the arrays?

- A prime number has exactly 2 factors, one and itself. A composite number can be divided by numbers other than 1 and itself to give a whole number answer.
  Sort the numbers into the table.

  2 3 5 9 15 24 29 30

	Prime	Composite
Exactly 2 factors (1 and itself)		
More than 2 factors		

Put two of your own numbers into the table.
Why are two of the boxes empty?
Would 1 be able to go in the tablet? Why or why not?

Prime Numbers

Reasoning and Problem Solving

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

End in a 1	End in a 3	End in a 7	End in a 9

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

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

End in a 1	End in a 3
11, 31, 41, 61, 71,	13, 23, 43, 53, 73
End in a 7	**End in a 9**
17, 37, 47, 67, 97	19, 29, 59, 79, 89

Because all two-digit even numbers have more than 2 factors.

Because all two-digit numbers ending in 5 are divisible by 5 as well as 1 and itself, so have more than 2 factors.

Dora says all prime numbers have to be odd.

Her friend Amir says that means all odd numbers are prime, so 9, 27 and 45 are prime numbers.

Explain Amir's and Dora's mistakes and correct them.

Dora is incorrect because 2 is a prime number (it has exactly 2 factors).

Amir thinks all odd numbers are prime but he is incorrect because most odd numbers have more than 2 factors.

E.g.
Factors of 9:
1, 3 and 9

Factors of 27:
1, 3, 9 and 27

Square Numbers

Notes and Guidance

Children will need to be able to find factors of numbers. Square numbers have an odd number of factors and are the result of multiplying a whole number by itself.

Children learn the notation for squared is ^{2}

Mathematical Talk

Why are square numbers called ‘square’ numbers?

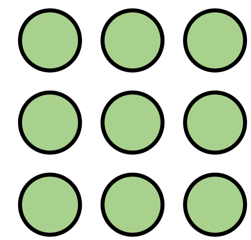
Are there any patterns in the sequence of square numbers?

Are the squares of even numbers always even?

Are the squares of odd numbers always odd?

Varied Fluency

- What does this array show you?
  Why is this array square?



- How many ways are there of arranging 36 counters in an array?
  What is the same about each array?
  What is different?

- Find the first 12 square numbers.
  Show why they are square numbers.
  How many different squares can you make using counters?
  What do you notice?
  Are there any patterns?

Square Numbers

Reasoning and Problem Solving

Teddy says,  Factors come in pairs so all numbers must have an even number of factors. Do you agree? Explain your reasoning.	No. Square numbers have an odd number of factors (e.g. the factors of 25 are 1, 25 and 5).
How many square numbers can you make by adding prime numbers together? Here's one to get you started: $2 + 2 = 4$	Solutions include: $2 + 2 = 4$ $2 + 7 = 9$ $11 + 5 = 16$ $23 + 2 = 25$ $29 + 7 = 36$

Whitney thinks that 4^2 is equal to 16 Do you agree? Convince me. Amir thinks that 6^2 is equal to 12 Do you agree? Explain what you have noticed.	Children may use concrete materials or draw pictures to prove it. Children should spot that 6 has been multiplied by 2 They may create the array to prove that $6^2 = 36$ and $6 \times 2 = 12$
Always, Sometimes, Never A square number has an even number of factors.	Never. Square numbers have an odd number of factors because one of their factors does not have a pair.

Cube Numbers

Notes and Guidance

Children learn that a cube number is the result of multiplying a whole number by itself three times e.g. $6 \times 6 \times 6$

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

Children learn the notation for cubed is ^{3}

Mathematical Talk

Why are cube numbers called 'cube' numbers?

How are squared and cubed numbers similar?

How are they different?

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

Varied Fluency

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

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

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

- Complete the table.

		8
3^3	$3 \times 3 \times 3$	27
4^3		
5^3	$5 \times 5 \times 5$	
	$6 \times 6 \times 6$	

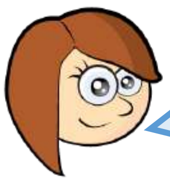
- Calculate:

$4^3 =$ ____ $5^3 =$ ____

3 cubed = ____ 6 cubed = ____

Cube Numbers

Reasoning and Problem Solving

Rosie says,  5^3 is equal to 15 Do you agree? Explain your answer.	Rosie is wrong, she has multiplied 5 by 3 rather than by itself 3 times. $5^3 = 5 \times 5 \times 5$ $5 \times 5 \times 5 = 125$
Here are 3 cards A B C On each card there is a cube number. Use these calculations to find each number. $A \times A = B$ $B + B - 3 = C$ Digit total of $C = A$	$A = 8$ $B = 64$ $C = 125$

Dora is thinking of a two-digit number that is both a square and a cube number. What number is she thinking of?	64
Teddy's age is a cube number. Next year his age will be a square number. How old is he now?	8 years old
The sum of a cube number and a square number is 150 What are the two numbers?	125 and 25

Multiply by 10

Notes and Guidance

Children need to be able to visualise and understand making a number ten times bigger and that 'ten times bigger' is the same as 'multiply by 10'

The language of 'ten lots of' is vital to use in this step. The understanding of the commutative law is essential because children need to see calculations such as 10 × 3 and 3 × 10 as equal.

Mathematical Talk

Can you represent these calculations with concrete objects or a drawing?

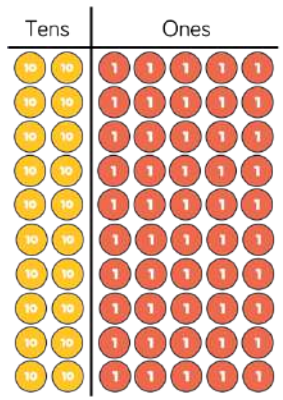
Can you explain what you did to a partner?

What do you notice when multiplying by 10? Does it always work?

What's the same and what's different about 5 buses with 10 passengers on each and 10 buses with 5 passengers on each?

Varied Fluency

R



Write the calculation shown by the place value counters.

Each row has ____ tens and ____ ones.

Each row has a value of ____.

There are ____ rows.

The calculation is ____ × ____ = ____.

Use place value counters to calculate:

10 × 3 4 × 10 12 × 10

Match each statement to the correct bar model.

5 buses have ten passengers.

8 pots each have ten pencils.

10 chickens lay 5 eggs each.

10	10	10	10	10

5	5	5	5	5	5	5	5	5	5

10	10	10	10	10	10	10	10

Multiply by 10

Reasoning and Problem Solving

Always, Sometimes, Never If you write a whole number in a place value grid and multiply it by 10, all the digits move one column to the left.	Always. Discuss the need for a placeholder after the new rightmost digit.
Annie has multiplied a whole number by 10 Her answer is between 440 and 540 What could her original calculation be? How many possibilities can you find?	45×10 46×10 47×10 48×10 49×10 50×10 51×10 52×10 53×10 (or the above calculations written as 10×45 etc.).

Multiply by 100

Notes and Guidance

Children build on multiplying by 10 and see links between multiplying by 10 and multiplying by 100

Use place value counters and Base 10 to explore what is happening to the value of the digits in the calculation and encourage children to see a rule so they can begin to move away from concrete representations.

Mathematical Talk

How do the Base 10 help us to show multiplying by 100?

Can you think of a time when you would need to multiply by 100?

Will you produce a greater number if you multiply by 100 rather than 10? Why?

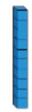
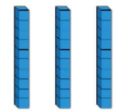
Can you use multiplying by 10 to help you multiply by 100? Explain why.

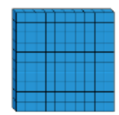
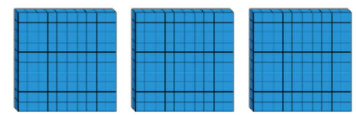
Varied Fluency

R

- 3 ×  =  = 3 ones = 3

  Complete:

  3 ×  =  = ____ tens = ____

  3 ×  =  = ____ hundreds = ____

- Use a place value grid and counters to calculate:

7 × 10	63 × 10	80 × 10
7 × 100	63 × 100	80 × 100

  What's the same and what's different comparing multiplying by 10 and 100? Write an explanation of what you notice.

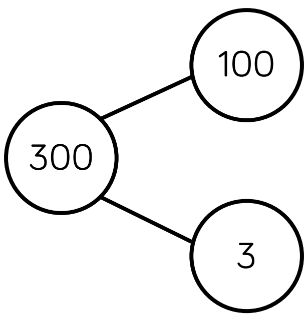
- Use <, > or = to make the statements correct.

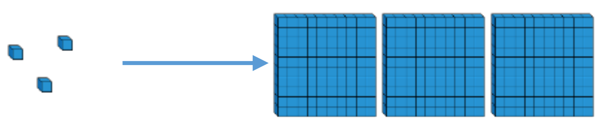
75 × 100	◯	75 × 10
39 × 100	◯	39 × 10 × 10
460 × 10	◯	100 × 47

Multiply by 100

Reasoning and Problem Solving

Which representation does **not** show multiplying by 100?
Explain your answer.





The part-whole model does not represent multiplying by 100

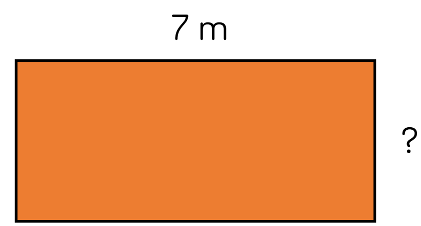
Part-whole models show addition (the aggregation structure) and subtraction (the partitioning structure), so if the whole is 300 and there are two parts, the parts added together should total 300 (e.g. 100 and 200, or 297 and 3). If the parts are 100 and 3, the whole should be 103.

To show multiplying 3 by 100 as a part-whole model, there would need to be 100 parts each with 3 in.

The perimeter of the rectangle is 26 m.

Find the length of the missing side.

Give your answer in cm.



The missing side length is 6 m so in cm it will be:

$6 \times 100 = 600$

The missing length is 600 cm.

Multiply by 10, 100 and 1,000

Notes and Guidance

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

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

Mathematical Talk

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

How many places do you move to the left?

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

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

Varied Fluency

- Make 234 on a place value grid using counters.

HTh	TTh	Th	H	T	O

When I multiply 234 by 10, where will I move my counters?
Is this always the case when multiplying by 10?

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

$234 \times 100 =$ ____   ____ $= 324 \times 100$

$100 \times 36 =$ ____ $1{,}000 \times 207 =$ ____

$45{,}020 \times 10 =$ ____   ____ $= 3{,}406 \times 1{,}000$

- Use <, > or = to complete the statements.

$71 \times 1{,}000$ ○ 71×100

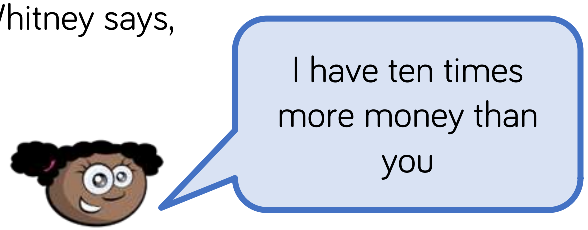
100×32 ○ $16 \times 1{,}000$

48×100 ○ $48 \times 10 \times 10 \times 10$

Multiply by 10, 100 and 1,000

Reasoning and Problem Solving

Rosie has £300 in her bank account. Tommy has 100 times more than Rosie in his bank account. How much more money does Tommy have than Rosie?	Tommy has £30,000 Tommy has £29,700 more than Rosie.
Whitney has £1,020 in her bank account. Tommy has £120 in his bank account. Whitney says,	Whitney is incorrect, she would need to have £1,200 if this were the case (Or Tommy would need to be £102).



Is Whitney correct? Explain your reasoning.

Jack is thinking of a 3-digit number. When he multiplies his number by 100, the ten thousands and hundreds digit are the same. The sum of the digits is 10 What number could Jack be thinking of?	181 262 343 424 505

Divide by 10

Notes and Guidance

Exploring questions with whole number answers only, children divide by 10
They should use concrete manipulatives and place value charts to see the link between dividing by 10 and the position of the digits before and after the calculation.
Using concrete resources, children should begin to understand the relationship between multiplying and dividing by 10 as the inverse of the other.

Mathematical Talk

What has happened to the value of the digits?

Can you represent the calculation using manipulatives?
Why do we need to exchange tens for ones?

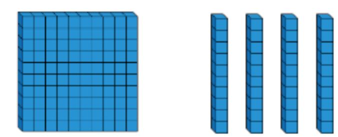
When dividing using a place value chart, in which direction do the digits move?

Varied Fluency

- Use place value counters to show the steps to divide 30 by 10

Can you use the same steps to divide a 3-digit number like 210 by 10?

- Use Base 10 to divide 140 by 10
Explain what you have done.



- Ten friends empty a money box. They share the money equally between them. How much would they have each if the box contained:
  - 20 £1 coins?
  - £120
  - £24?

After emptying the box and sharing the contents equally, each friend has 90 p.
How much money was in the box?

Divide by 10

Reasoning and Problem Solving

R

Four children are in a race. The numbers on their vests are:

350	35
3,500	53

Use the clues to match each vest number to a child.

- Jack's number is ten times smaller than Mo's.
- Alex's number is not ten times smaller than Jack's or Dora's or Mo's.
- Dora's number is ten times smaller than Jack's.

Alex – 53

Jack – 350

Dora – 35

Mo – 3,500

While in Wonderland, Alice drank a potion and everything shrank. All the items around her became ten times smaller! Are these measurements correct?

Item	Original measurement	After shrinking
Height of a door	220 cm	2,200 cm
Her height	160 cm	16 cm
Length of a book	340 mm	43 mm
Height of a mug	220 mm	?

Can you fill in the missing measurement?

Can you explain what Alice did wrong?

Write a calculation to help you explain each item.

Height of a door
Incorrect – Alice has multiplied by 10.

Her height
Correct

Length of a book
Incorrect – Alice has swapped the order of the digits. When dividing by 10 the order of the digits never changes.

Height of a mug
22 mm.

Divide by 100

Notes and Guidance

Children divide by 100 with whole number answers.

Money and measure is a good real-life context for this, as coins can be used for the concrete stage.

Mathematical Talk

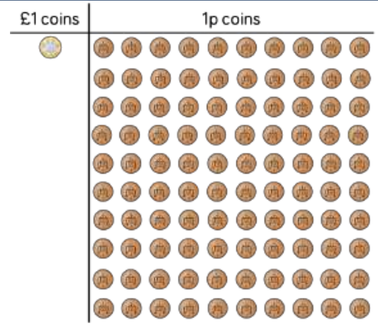
How can you use dividing by 10 to help you divide by 100?

How are multiplying and dividing by 100 related?

Write a multiplication and division fact family using 100 as one of the numbers.

Varied Fluency

- Is it possible for £1 to be shared equally between 100 people?
  How does this picture explain it?
  Can £2 be shared equally between 100 people?
  How much would each person receive?



- Match the calculation with the correct answer.

4,200 ÷ 10	420
4,200 ÷ 100	42
420 ÷ 10	

- Use <, > or = to make each statement correct.

3,600 ÷ 10 ◯ 3,600 ÷ 100

2,700 ÷ 100 ◯ 270 ÷ 10

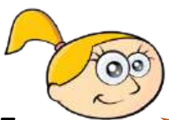
4,200 ÷ 100 ◯ 430 ÷ 10

Divide by 100

Reasoning and Problem Solving

Eva and Whitney are dividing numbers by 10 and 100
They both start with the same 4-digit number.

They give some clues about their answer.



Eva

My answer has 8 ones and 2 tens.

My answer has 2 hundreds, 8 tens and 0 ones.

Whitney

What number did they both start with?
Who divided by what?

They started with 2,800

Whitney divided by 10 to get 280 and Eva divided by 100 to get 28

Use the digit cards to fill in the missing digits.

1	2	3	4	5	6	7	8	9

$170 \div 10 = \_\_\ \_\_$

$\_\_20 \times 10 = 3,\_\_00$

$1,8\_\_0 \div 10 = 1\_\_6$

$\_\_9 \times 100 = 5,\_\_00$

$6\_\_ = 6,400 \div 100$

$170 \div 10 = \underline{17}$

$\underline{3}20 \times 10 = 3,\underline{2}00$

$1,8\underline{6}0 \div 10 = 1\underline{8}6$

$\underline{5}9 \times 100 = 5,\underline{9}00$

$6\underline{4} = 6,400 \div 100$

Divide by 10, 100 and 1,000

Notes and Guidance

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

They use counters and digits to learn that the digits move to the right when dividing by powers of ten. They develop understanding of how many places to the right to move the counters to the right.

Mathematical Talk

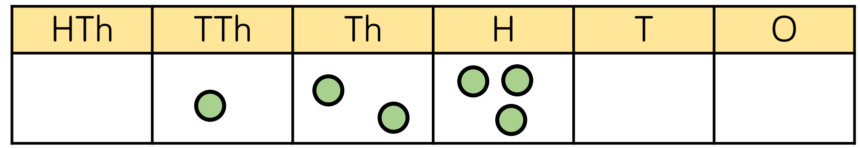
What happens to the digits?

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

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

What does 'inverse' mean?

Varied Fluency



What number is represented in the place value grid?
Divide the number by 100
Which direction do the counters move?
How many columns do they move? How do you know how many columns to move?
What number do we have now?

Complete the following using a place value grid.

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

Divide these numbers by 10, 100 and 1,000

80,000 300,000 547,000

Calculate 45,000 ÷ 10 ÷ 10
How else could you calculate this?

Divide by 10, 100 and 1,000

Reasoning and Problem Solving

Mo has £357,000 in his bank. He divides the amount by 1,000 and takes that much money out of the bank. Using the money he has taken out, he buys some furniture costing two hundred and sixty-nine pounds. How much money does Mo have left from the money he took out? Show your working out.	$357{,}000 \div 1{,}000 = 357$ If you subtract £269, he is left with £88

Here are the answers to some problems: 5,700 405 397 6,203 Can you write at least two questions for each answer involving dividing by 10, 100 or 1,000?	Possible solutions: $3{,}970 \div 10 = 397$ $57{,}000 \div 10 = 5{,}700$ $397{,}000 \div 1{,}000 = 397$ $40{,}500 \div 100 = 405$ $620{,}300 \div 100 = 6{,}203$

Multiples of 10, 100 and 1,000

Notes and Guidance

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

They now use knowledge of other multiples of 10, 100 and 1,000 to answer related questions.

Mathematical Talk

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

How does using multiplication and division as the inverse of the other help us to use known facts?

Varied Fluency

$36 \times 5 = 180$
Use this fact to solve the following questions:

$36 \times 50 =$ ____ $500 \times 36 =$ ____
$5 \times 360 =$ ____ $360 \times 500 =$ ____

Here are two methods to solve 24×20

Method 1	Method 2
$24 \times 10 \times 2$ $= 240 \times 2$ $= 480$	$24 \times 2 \times 10$ $= 48 \times 10$ $= 480$

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

The division diagram shows $7{,}200 \div 200 = 36$
Use the diagram to solve:

$$7{,}200 \xrightarrow{\div 100} 72 \xrightarrow{\div 2} 36$$

$3{,}600 \div 200 = \square$

$18{,}000 \div 200 = \square$

$5{,}400 \div \square = 27$

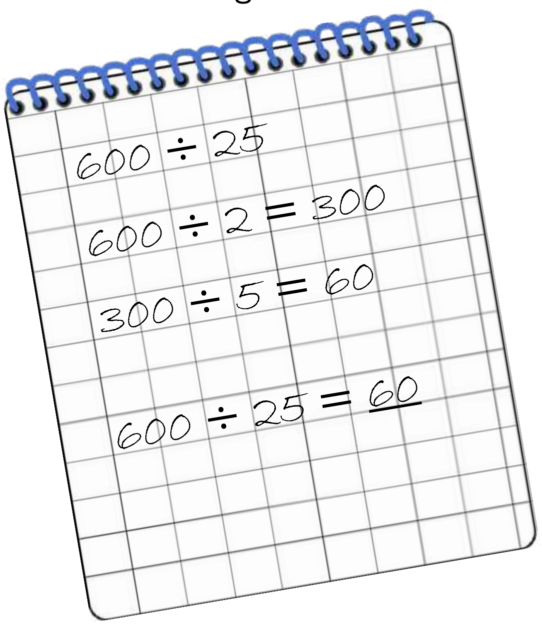
$\square = 6{,}600 \div 200$

Multiples of 10, 100 and 1,000

Reasoning and Problem Solving

Tommy has answered a question.

Here is his working out.



Is he correct?

Explain your answer.

Tommy is not correct as he has partitioned 25 incorrectly.

He could have divided by 5 twice.

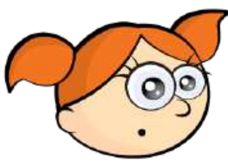
The correct answer should be 24

$$6 \times 7 = 42$$

Alex uses this multiplication fact to solve

$$420 \div 70 = \_\_\_$$

Alex says,



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

Do you agree with Alex?

Explain your answer.

Alex is wrong; both numbers (the dividend and divisor) are 10 times bigger than the numbers in the multiplication so the answer is 6.

$6 \times 70 = 420$, therefore $420 \div 70 = 6$

White Rose Maths

Autumn - Block 5

Perimeter & Area

Overview

Small Steps

- Measure perimeter
- Perimeter on a grid R
- Perimeter of rectangles R
- Perimeter of rectilinear shapes R
- Calculate perimeter
- Counting squares R
- Area of rectangles
- Area of compound shapes
- Area of irregular shapes

Notes for 2020/21

A recap of key learning from Year 4 may be useful here.

It is important that children understand perimeter and area on a grid before moving on to shapes with just side lengths marked.

Measure Perimeter

Notes and Guidance

Children measure the perimeter of rectilinear shapes from diagrams without grids.
They will recap measurement skills and recognise that they need to use their ruler accurately in order to get the correct answer.
They could consider alternative methods when dealing with rectangles e.g. l + w + l + w or (l × w) × 2

Mathematical Talk

What is perimeter of a shape?

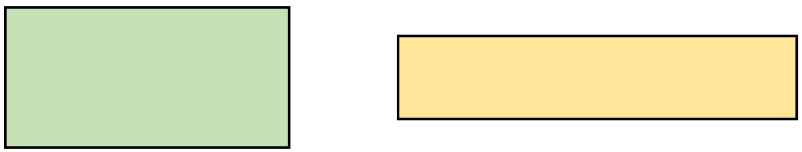
What's the same/different about these shapes?

Do we need to measure every side?

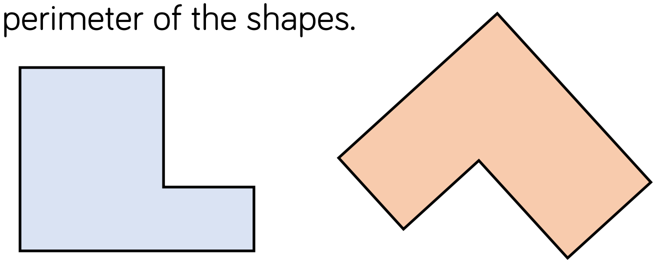
Once we have measured each side, how do we calculate the perimeter?

Varied Fluency

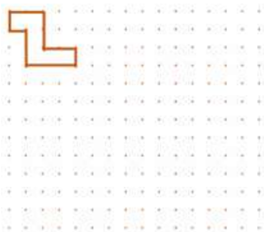
- Measure the perimeter of the rectangles.



- Measure the perimeter of the shapes.



- Make this shape double the size using dot paper.



Measure the perimeter of both shapes.

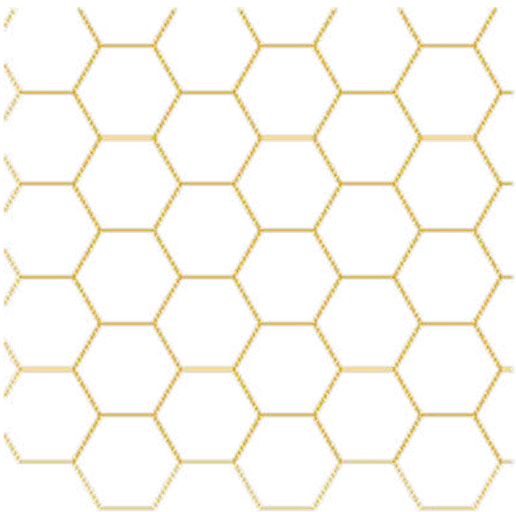
What do you notice about the perimeter of the larger one? Why?

Measure Perimeter

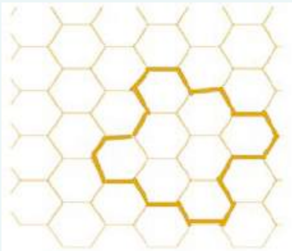
Reasoning and Problem Solving

Each regular hexagon has a side length of 2 cm

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



Possible answer:



Discuss how many sides the shape must have with the children. Encourage their reasoning that there must be 22 2 cm sides to make a total perimeter of 44 cm.

Activity

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

Perimeter on a Grid

Notes and Guidance

Children calculate the perimeter of rectilinear shapes by counting squares on a grid. Rectilinear shapes are shapes where all the sides meet at right angles.

Encourage children to label the length of each side and to mark off each side as they add the lengths together. Ensure that children are given centimetre squared paper to draw the shapes on to support their calculation of the perimeter.

Mathematical Talk

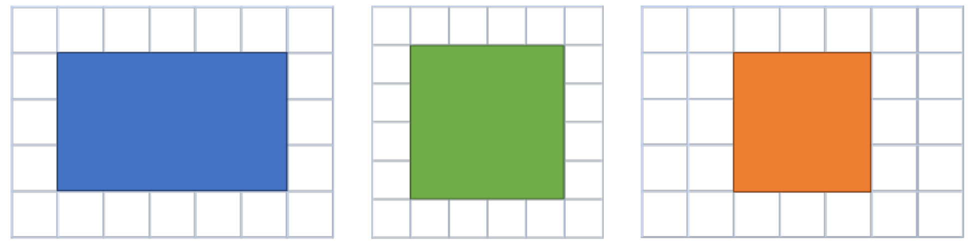
What is perimeter? How can we find the perimeter of a shape?

What do you think rectilinear means? Which part of the word sounds familiar?

If a rectangle has a perimeter of 16 cm, could one of the sides measure 14 cm? 8 cm? 7 cm?

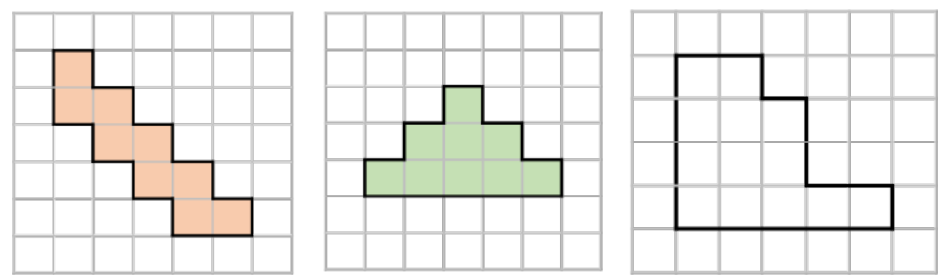
Varied Fluency

- Calculate the perimeter of the shapes.



- Using squared paper, draw two rectilinear shapes, each with a perimeter of 28 cm.
  What is the longest side in each shape? What is the shortest side in each shape?

- Draw each shape on centimetre square paper.

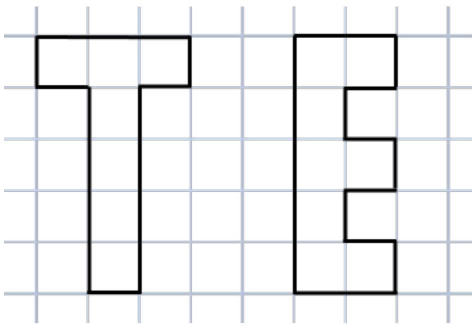


Order the shapes from smallest to largest perimeter.

Perimeter on a Grid

Reasoning and Problem Solving

Which of these shapes has the longest perimeter?



Explore other letters which could be drawn as rectilinear shapes.

Put them in order of shortest to longest perimeter.

Can you make a word?

E has a greater perimeter, it is 18 compared to 16 for T.

Open ended.

Letters which could be drawn include:

B C D F I J L O P

Letters with diagonal lines would be omitted.

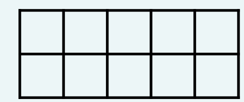
If heights of letters are kept the same, I or L could be the shortest.

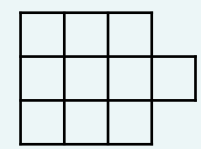
You have 10 paving stones to design a patio. The stones are one metre square.

The stones must be joined to each other so that at least one edge is joined corner to corner.

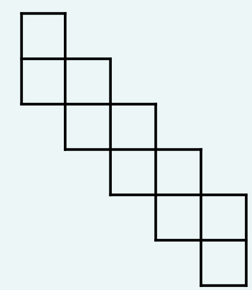
Use squared paper to show which design would give the longest perimeter and which would give the shortest.

The shortest perimeter would be 14 m in a 2 × 5 arrangement or 3 × 3 square with one added on.





The longest would be 22 m.



Perimeter of a Rectangle

Notes and Guidance

Children calculate the perimeter of rectangles (including squares) that are not on a squared grid. When given the length and width, children explore different approaches of finding the perimeter: adding all the sides together, and adding the length and width together then multiplying by 2
Children use their understanding of perimeter to calculate missing lengths and to investigate the possible perimeters of squares and rectangles.

Mathematical Talk

If I know the length and width of a rectangle, how can I calculate the perimeter? Can you tell me 2 different ways? Which way do you find the most efficient?

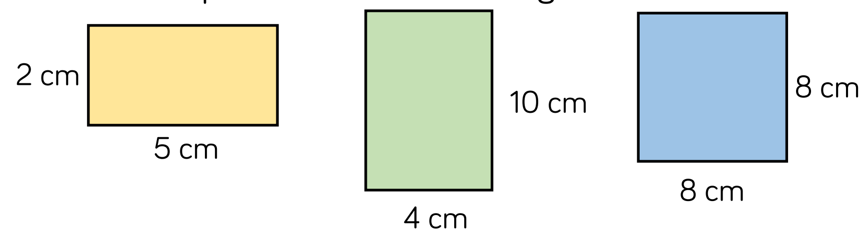
If I know the perimeter of a shape and the length of one of the sides, how can I calculate the length of the missing side?

Can a rectangle where the length and width are integers, ever have an odd perimeter? Why?

Varied Fluency

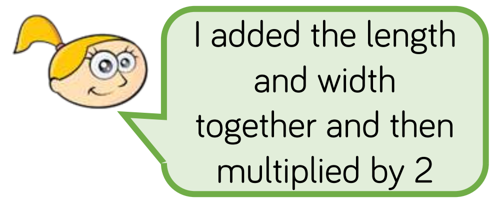
R

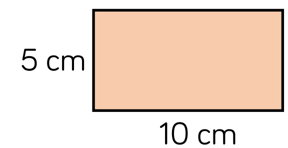
- Calculate the perimeter of the rectangles.



___ cm + ___ cm + ___ cm + ___ cm = ___ cm

- Eva is finding the perimeter of the rectangle.

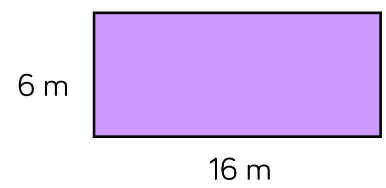


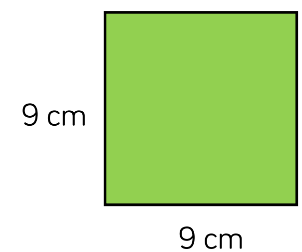


5 cm + 10 cm = 15 cm

15 cm × 2 = 30 cm

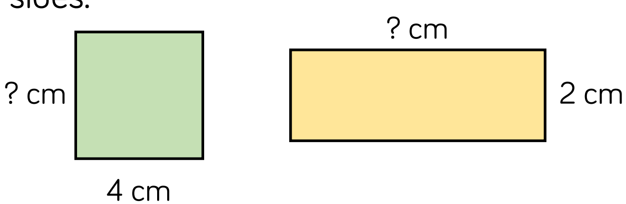
Use Eva's method to find the perimeter of the rectangles.

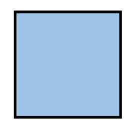




Perimeter of a Rectangle

Reasoning and Problem Solving

The width of a rectangle is 2 metres less than the length. The perimeter of the rectangle is between 20 m and 30 m. What could the dimensions of the rectangle be? Draw all the rectangles that fit these rules. Use 1 cm = 1 m.	If the perimeter is: 20 m Length = 6 m Width = 4 m 24 m Length = 7 m Width = 5 m 28 m Length = 8 m Width = 6 m
Each of the shapes have a perimeter of 16 cm. Calculate the lengths of the missing sides. 	4 cm 6 cm

Always, Sometimes, Never When all the sides of a rectangle are odd numbers, the perimeter is even. Prove it.	Always because when adding an odd and an odd they always equal an even number.
Here is a square. Each of the sides is a whole number of metres.  Which of these lengths could be the perimeter of the shape? 24 m, 34 m, 44 m, 54 m, 64 m, 74 m Why could the other values not be the perimeter?	24 cm Sides = 6 cm 44 cm Sides = 11 cm 64 cm Sides = 16 cm They are not divisible by 4

Perimeter of Rectilinear Shapes

Notes and Guidance

Children will begin to calculate perimeter of rectilinear shapes without using squared paper. They use addition and subtraction to calculate the missing sides. Teachers may use part-whole models to support the understanding of how to calculate missing sides.
Encourage children to continue to label each side of the shape and to mark off each side as they calculate the whole perimeter.

Mathematical Talk

Why are opposite sides important when calculating the perimeter of rectilinear shapes?

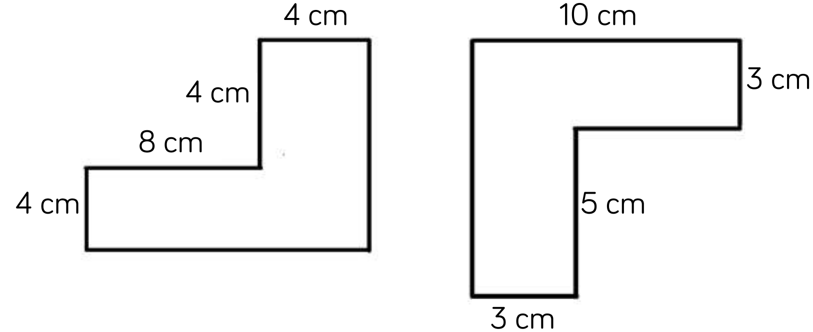
If one side is 10 cm long, and the opposite side is made up of two lengths, one of which is 3 cm, how do you know what the missing length is? Can you show this on a part-whole model?

If a rectilinear shape has a perimeter of 24 cm, what is the greatest number of sides it could have? What is the least number of sides it could have?

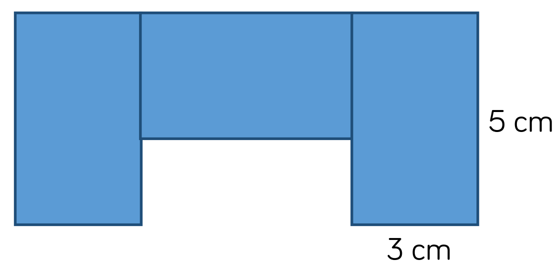
Varied Fluency

R

- Find the perimeter of the shapes.



- The shape is made from 3 identical rectangles. Calculate the perimeter of the shape.

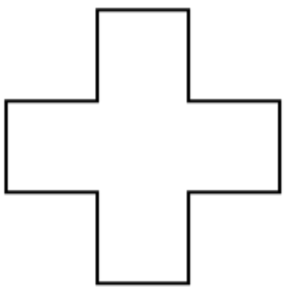


- How many different rectilinear shapes can you draw with a perimeter of 24 cm? How many sides do they each have? What is the longest side? What is the shortest side?

Perimeter of Rectilinear Shapes

Reasoning and Problem Solving

Here is a rectilinear shape. All the sides are the same length and are a whole number of centimetres.



Which of these lengths could be the perimeter of the shape?

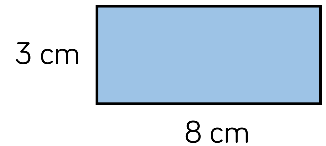
48 cm, 36 cm, 80 cm, 120 cm, 66 cm

Can you think of any other answers which could be correct?

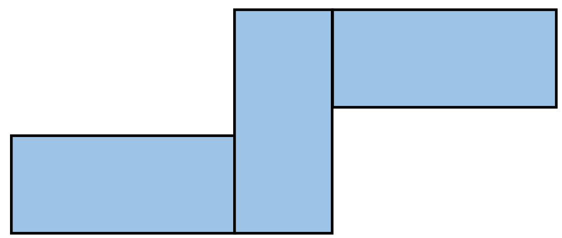
48 cm, 36 cm or 120 cm as there are 12 sides and these numbers are all multiples of 12

Any other answers suggested are correct if they are a multiple of 12

Amir has some rectangles all the same size.

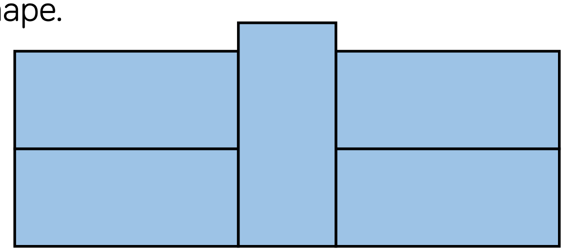


He makes this shape using his rectangles. What is the perimeter?



54 cm

He makes another shape using the same rectangles. Calculate the perimeter of this shape.



54 cm

Calculate Perimeter

Notes and Guidance

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

They find the perimeter of shapes with and without grids.

When calculating perimeter of shapes, encourage children to mark off the sides as they add them up to prevent repetition of counting/omission of sides.

Mathematical Talk

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

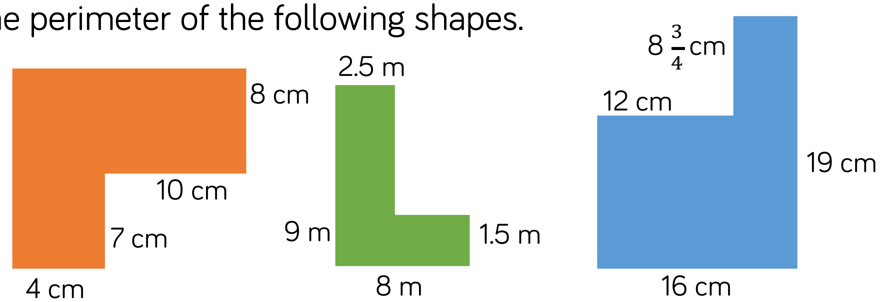
How can you use the labelled sides to find the length of the unknown sides?

What strategies can you use to calculate the total perimeter?

What does regular mean? Why are rectangles irregular?

Varied Fluency

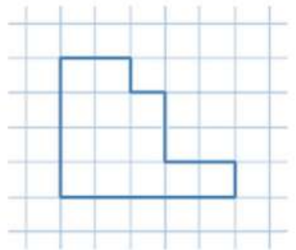
- Find the perimeter of the following shapes.



- Each square has an area of 4 square cm.

  What is the length of each square?

  What is the perimeter of the whole shape?



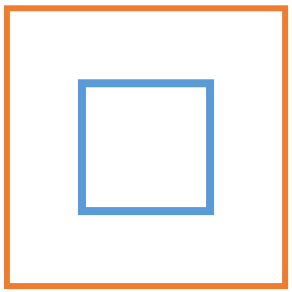
- How many ______ can you draw with a perimeter of ____ cm? e.g. rectangles, other rectilinear shapes.

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

Calculate Perimeter

Reasoning and Problem Solving

Here is a square inside another square.



The perimeter of the inner square is 16 cm

The outer square's perimeter is four times the size of the inner square.

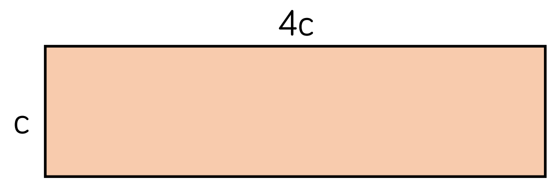
What is the length of one side of the outer square?

How do you know? What do you notice?

Small square = 16 cm

Large square = 64 cm

Length of one of the outer sides is 8 cm, because 64 is a square number.

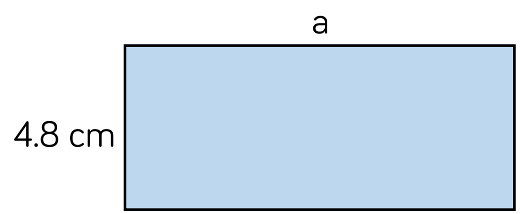


The value of c is 14 m.

What is the total perimeter of the shape?

4c + 4c + c + c = 10c

10 × 14 = 140 m



The blue rectangle has a perimeter of 38 cm.

What is the value of a?

Total perimeter = 38 cm

38 – (4.8 + 4.8) = 28.4

So 28.4 divided by 2 = 14.2 cm

Counting Squares

Notes and Guidance

Once children understand that area is measured in squares, they use the strategy of counting the number of squares in a shape to measure and compare the areas of rectilinear shapes.
They explore the most efficient method of counting squares and link this to their understanding of squares and rectangles.

Mathematical Talk

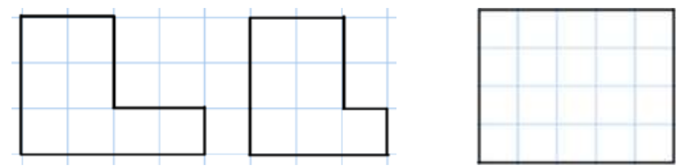
What strategy can you use to ensure you don't count a square twice?

Which colour covers the largest area of the quilt?
Which colour covers the smallest area of the quilt?

Will Jack's method work for every rectilinear shape?

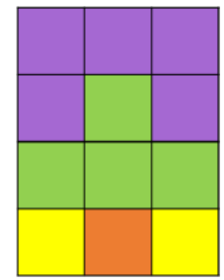
Varied Fluency

Complete the sentences for each shape.



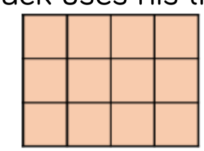
The area of the shape is ____ squares.

Here is a patchwork quilt.
It is made from different coloured squares.
Find the area of each colour.



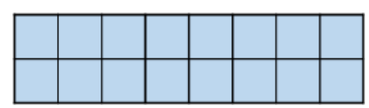
Purple = ___ squares   Green = ___ squares
Yellow = ___ squares   Orange = ___ squares

Jack uses his times-tables to count the squares more efficiently.



There are 4 squares in 1 row.
There are 3 rows altogether.
3 rows of 4 squares = 12 squares

Use Jack's method to find the area of this rectangle.

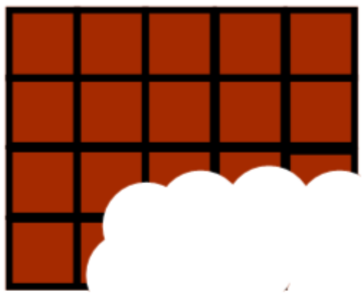


Counting Squares

Reasoning and Problem Solving

R

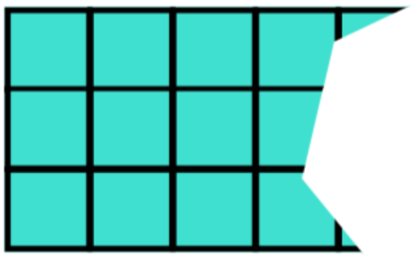
Dexter has taken a bite of the chocolate bar.



The chocolate bar was a rectangle.
Can you work out how many squares of chocolate there were to start with?

There were 20 squares. You know this because two sides of the rectangle are shown.

This rectangle has been ripped.



What is the smallest possible area of the original rectangle?

What is the largest possible area if the length of the rectangle is less than 10 squares?

Smallest area – 15 squares.

Largest area – 30 squares.

Area of Rectangles

Notes and Guidance

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

Is a square a rectangle? This would be a good discussion point when the children are finding different rectangles with a given area. For example, a rectangle with an area of 36 cm^2 could have four equal sides of 6 cm.

Mathematical Talk

What properties of these shapes do you need to know to help you work this out?

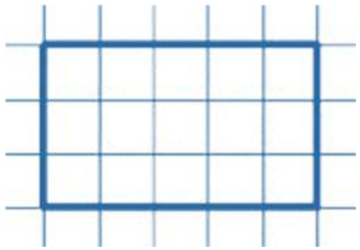
What can you tell me about the sides of a square/rectangle? How does this help you work out this question?

Will the formula 'Area = length × width' work for any shape, or only squares and rectangles?

Varied Fluency

- How many rectangles can you draw with an area of ____ cm^2?

- What is the area of this shape if:
  - each square is 2 cm in length?
  - each square is 3.5 cm in length?



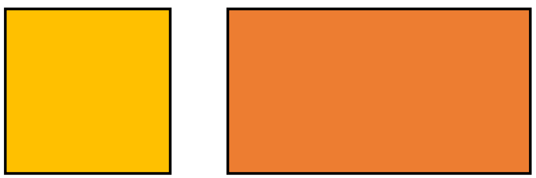
- Mo buys a house with a small back garden, which has an area of 12 m^2.
His house lies in a row of terraces, all identical.
If there are 15 terraced houses altogether, what is the total area of the garden space?

Area of Rectangles

Reasoning and Problem Solving

Investigate how many ways you can make different squares and rectangles with the same area of 84 cm^2

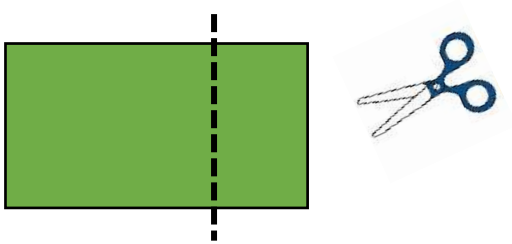
What strategy did you use?



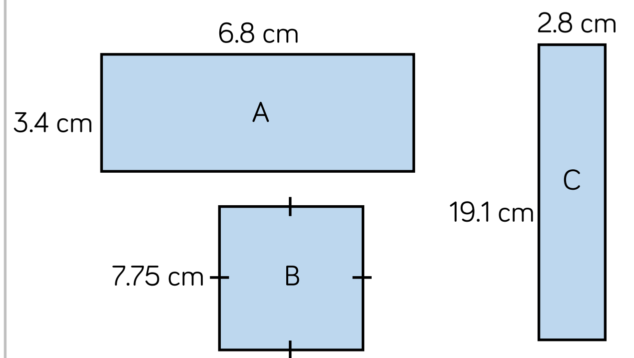
True or False?

If you cut off a piece from a shape, you reduce its area and perimeter.

Draw 2 examples to prove your thinking.



True



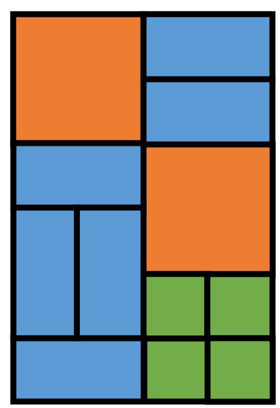
Estimate the area of each shape and then order from largest to smallest.

Answer: A = 3cm × 7cm = 21cm^2

B = 8cm × 8cm = 64cm

C = 3cm × 19cm = 57cm^2

Order: B, C, A



Each orange square has an area of 24 cm^2.

Calculate the total orange area.

Calculate the blue area.

Calculate the green area.

What is the total area of the whole shape?

Answer:

Orange = 48 cm^2

Blue = 72 cm^2

Green = 24 cm^2

Total = 144 cm^2

Area of Compound Shapes

Notes and Guidance

Children learn to calculate area of compound shapes. They need to be careful when splitting shapes up to make sure they know which lengths correspond to the whole shape, and which to the smaller shapes they have created. They will discover that the area remains the same no matter how you split up the shapes.
Children need to have experience of drawing their own shapes in this step.

Mathematical Talk

What formula do we use to find the area of a rectangle?

Can you see any rectangles within the compound shapes?

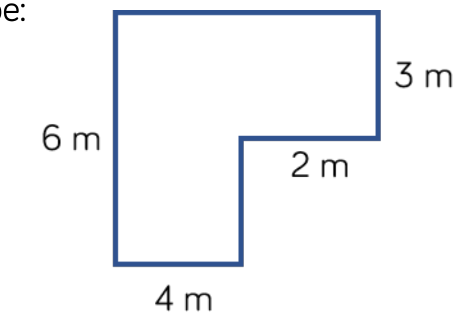
How can we split the compound shape?

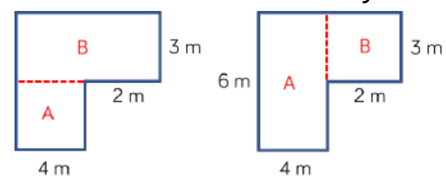
Is there more than one way?

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

Varied Fluency

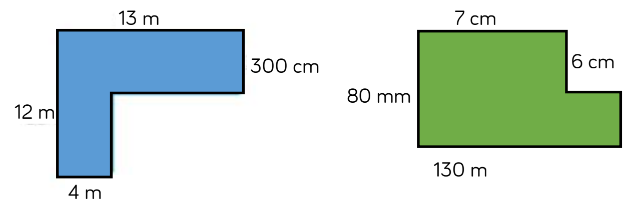
- Find the area of the compound shape:
  How many ways can we split the compound shape?
  Is there more than one way?



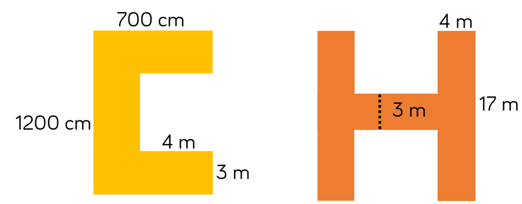


  Could we multiply 6 m × 6 m and then subtract 2 m × 3 m?

- Calculate the area.



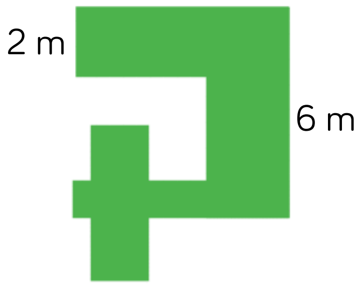
- Calculate the area of these symmetrical shapes.



Area of Compound Shapes

Reasoning and Problem Solving

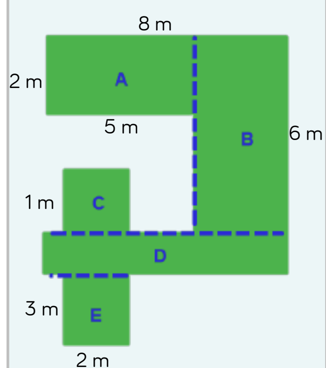
How many different ways can you split this shape to find the area?



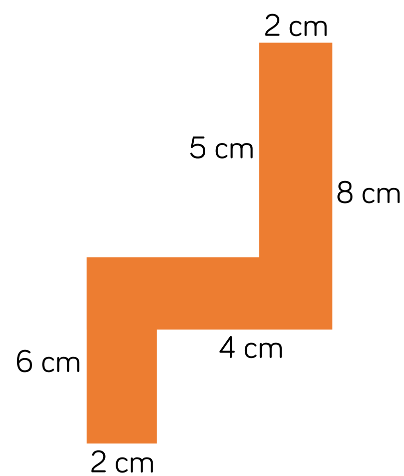
Add more values and work out the area.

Possible solution:

A = 2 m × 5 m
= 10 m^2
B = 6 m × 3 m
= 18 m^2
C = 1 m × 2 m
= 2 m^2
D = 1 m × 8 m
= 8 m^2
E = 3 m × 2 m
= 6m^2
Total area = 36m^2



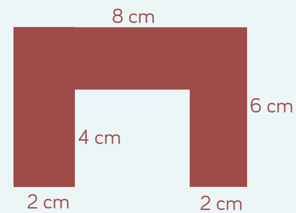
Jack says this shape has an area of 34 cm^2.



Show that Jack is correct.

Find three more possible compound shapes that have an area of 34 cm^2.

Possible solution:



Area of Irregular Shapes

Notes and Guidance

Children use their knowledge of counting squares to estimate the areas of shapes that are not rectilinear. They use their knowledge of fractions to estimate how much of a square is covered and combine different part-covered squares to give an overall approximate area.

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

Mathematical Talk

How many whole squares can you see?

How many part squares can you see?

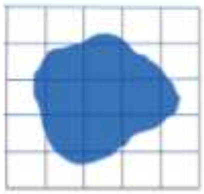
Can you find any part squares that you could be put together to make a full square?

What will we do with the parts?

What does approximate mean?

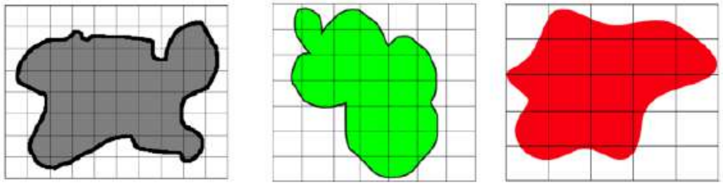
Varied Fluency

- Estimate the area of the pond.
  Each square = 1 m^2

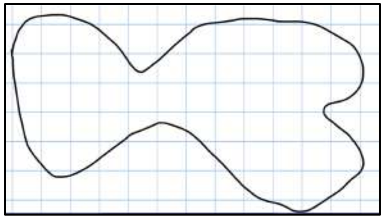
  Ron's answer is 4 whole squares and 11 parts.
  Is this an acceptable answer?
  What can we do with the parts to find an approximate answer?

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

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

- Each square is ____ m^2
  Work out the approximate area of the shape.

Area of Irregular Shapes

Reasoning and Problem Solving

Draw a circle on 1 cm^2 paper. What is the estimated area?

Can you draw a circle that has area approximately 20 cm^2?

If each square represents 3 m^2, what is the approximate area of:

- The lake
- The bunkers
- The fairway
- The rough
- Tree/forest area

Can you construct a 'Pirate Island' to be used as part of a treasure map for a new game? Each square represents 4 m^2.

The island must include the following features and be of the given approximate measure:

- Circular Island 180 m^2
- Oval Lake 58 m^2
- Forests with a total area of 63 m^2 (can be split over more than one space)
- Beaches with a total area of 92 m^2 (can be split over more than one space)
- Mountains with a total area of 57 m^2
- Rocky coastline with total area of 25 m^2

Spring Scheme of Learning

Year 5

#MathsEveryoneCan

2020-21

White Rose Maths

New for 2020/21

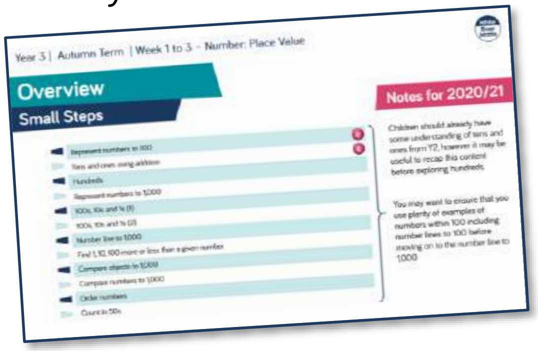
2020 will go down in history. The world has changed for all of us.

We want to do as much as we can to support children, teachers, parents and carers in these very uncertain times.

We have amended our schemes for 2020/21 to:

- ★ highlight key teaching points
- ★ recap essential content that children may have forgotten
- ★ flag any content that you might not have covered during the school closures period.

We hope these changes will add further value to the schemes and save you time.



Lesson-by-lesson overviews

We've always been reluctant to produce lesson-by-lesson overviews as every class is individual and has different needs. However, many of you have said that if blended learning becomes a key feature of school life next year, a weekly plan with linked content and videos could be really useful.

As always, we've listened! We've now produced a complete lesson-by-lesson overview for Y1 to Y9 that schools can use or adapt as they choose. Each lesson will be linked to a free-to-use home learning video, and for premium subscribers, a worksheet. This means that you can easily assign work to your class, whether they are working at home or in school.

Inevitably, this lesson-by-lesson structure won't suit everyone, but if it works for you, then please do make use of this resource as much as you wish.

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.

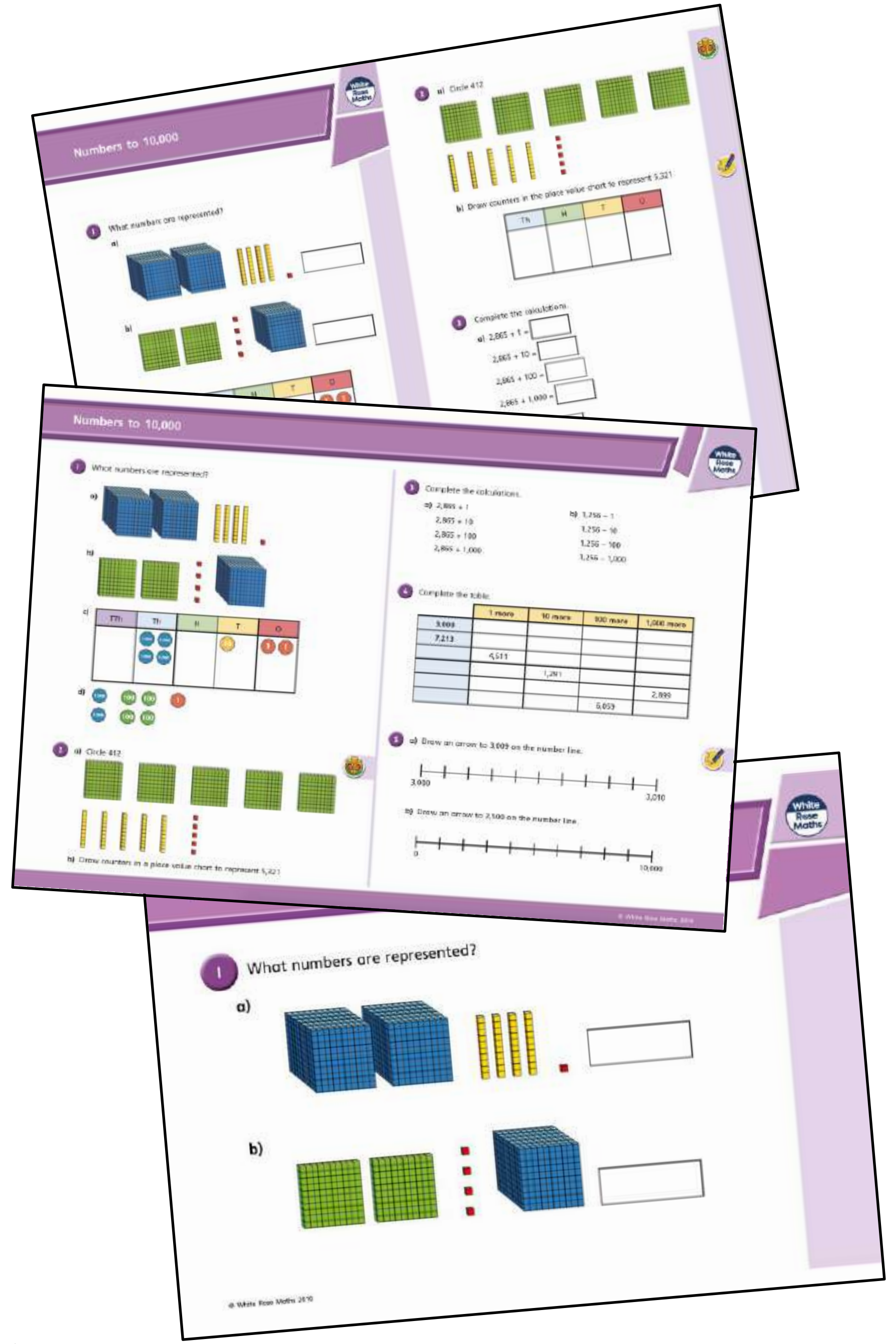
Supporting resources

We have produced supporting resources for every small step from Year 1 to Year 11.

The worksheets are provided in three different formats:

- Write on worksheet – ideal for children to use the ready made models, images and stem sentences.
- Display version – great for schools who want to cut down on photocopying.
- PowerPoint version – one question per slide. Perfect for whole class teaching or mixing questions to make your own bespoke lesson.

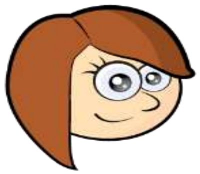
For more information visit our online training and resources centre resources.whiterosemaths.com or email us directly at support@whiterosemaths.com



Meet the Characters

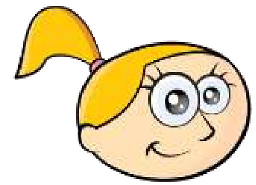
Children love to learn with characters and our team within the scheme will be sure to get them talking and reasoning about mathematical concepts and ideas. Who’s your favourite?

Teddy

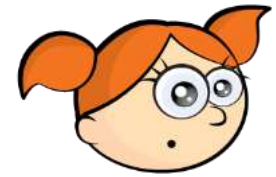


Rosie

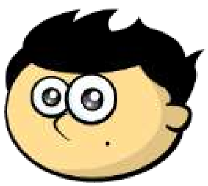
Mo



Eva

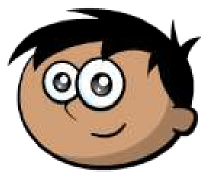


Alex

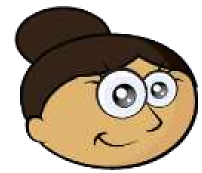


Jack

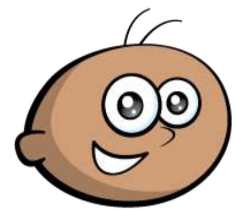
Whitney



Amir

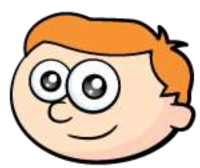


Dora



Tommy

Dexter



Ron

Annie

White Rose Maths

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

White Rose Maths

Spring - Block 1

Multiplication & Division

Overview

Small Steps

- Multiply 2-digits by 1-digit (R)
- Multiply 3-digits by 1-digit (R)
- Multiply 4-digits by 1-digit
- Multiply 2-digits (area model)
- Multiply 2-digits by 2-digits
- Multiply 3-digits by 2-digits
- Multiply 4-digits by 2-digits
- Divide 2-digits by 1-digit (1) (R)
- Divide 2-digits by 1-digit (2) (R)
- Divide 3-digits by 1-digit (R)
- Divide 4-digits by 1-digit
- Divide with remainders

Notes for 2020/21

Before moving on to 4-digit multiplication, children may need to work with place value counters to support their understanding, of multiplying by 2- and 3-digit numbers.

The division steps may look similar but this is a difficult concept and children need to spend time exploring partitioning and dividing 2- and 3-digit numbers before working with larger numbers.
In the recap steps they will cover division with remainders using place value counters.

Multiply 2-digits by 1-digit

Notes and Guidance

Children build on their understanding of formal multiplication from Year 3 to move to the formal short multiplication method.
Children use their knowledge of exchanging ten ones for one ten in addition and apply this to multiplication, including exchanging multiple groups of tens. They use place value counters to support their understanding.

Mathematical Talk

Which column should we start with, the ones or the tens?

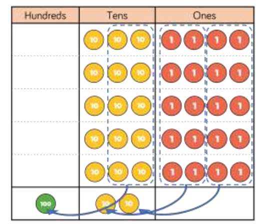
How are Ron and Whitney's methods the same?
How are they different?

Can we write a list of key things to remember when multiplying using the column method?

Varied Fluency

R

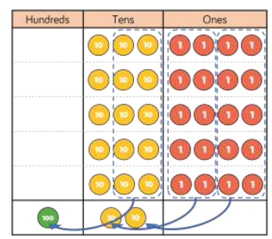
Whitney uses place value counters to calculate 5×34



	H	T	O		
		3	4		
×			5		
		2	0	(5 × 4)	
+	1	5	0	(5 × 30)	
	1	7	0		

Use Whitney's method to solve
5×42
23×6
48×3

Ron also uses place value counters to calculate 5×34



	H	T	O		
		3	4		
×			5		
	1	7	0		
	1	2			

Use Ron's method to complete:

	T	O
	4	3
×		3

	T	O
	3	6
×		4

	T	O
	7	4
×		5

Multiply 2-digits by 1-digit

Reasoning and Problem Solving

Here are three incorrect multiplications.

	T	O
	6	1
×		5
	3	5

	T	O
	7	4
×		7
4	9	8

	T	O
	2	6
×		4
8	2	4

Correct the multiplications.

	T	O
	6	1
×		5
3	0	5
3		

	T	O
	7	4
×		7
5	1	8
	2	

	T	O
	2	6
×		4
1	0	4
	2	

Always, sometimes, never

- When multiplying a two-digit number by a one-digit number, the product has 3 digits.
- When multiplying a two-digit number by 8 the product is odd.
- When multiplying a two-digit number by 7 you need to exchange.

Prove it.

Sometimes: 12 × 2 has only two-digits; 23 × 5 has three digits.

Never: all multiples of 8 are even.

Sometimes: most two-digit numbers need exchanging, but not 10 or 11

Multiply 3-digits by 1-digit

Notes and Guidance

Children build on previous steps to represent a three-digit number multiplied by a one-digit number with concrete manipulatives.
Teachers should be aware of misconceptions arising from 0 in the tens or ones column.
Children continue to exchange groups of ten ones for tens and record this in a written method.

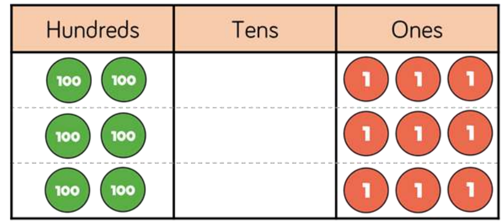
Mathematical Talk

How is multiplying a three-digit number by one-digit similar to multiplying a two-digit number by one-digit?

Would you use counters to represent 84 multiplied by 8? Why?

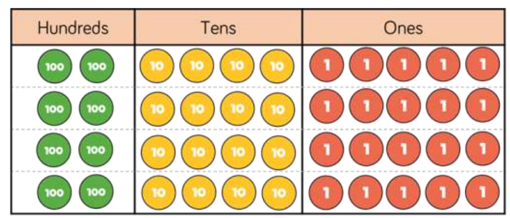
Varied Fluency

- Complete the calculation.



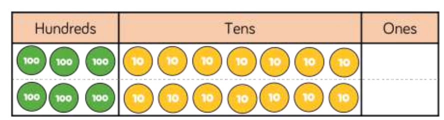
	H	T	O
	2	0	3
×			3

- A school has 4 house teams.
There are 245 children in each house team.
How many children are there altogether?



	H	T	O
	2	4	5
×			4

- Write the multiplication represented by the counters and calculate the answer using the formal written method.



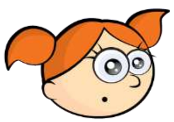
Multiply 3-digits by 1-digit

Reasoning and Problem Solving

R

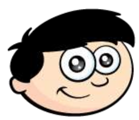
Spot the mistake

Alex and Dexter have both completed the same multiplication.



Alex

	H	T	O
	2	3	4
×			6
1	2	0	4
	2	2	



Dexter

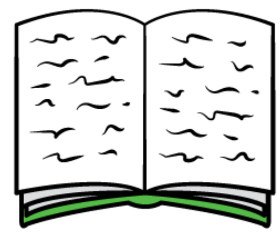
	H	T	O
	2	3	4
×			6
1	4	0	4
	2	2	

Who has the correct answer?
What mistake has been made by one of the children?

Dexter has the correct answer.

Alex has forgotten to add the two hundreds she exchanged from the tens column.

Teddy and his mum were having a reading competition.
In one month, Teddy read 814 pages.



His mum read 4 times as many pages as Teddy.
How many pages did they read altogether?
How many fewer pages did Teddy read?
Use the bar model to help.

Teddy	814			
Mum	814	814	814	814

$814 \times 5 = 4{,}070$

They read 4,070 pages altogether.

$814 \times 3 = 2{,}442$

Teddy read 2,442 fewer pages than his mum.

Multiply 4-digits by 1-digit

Notes and Guidance

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

Mathematical Talk

Why is it important to set out multiplication using columns?

Explain the value of each digit in your calculation.

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

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

Which part of the multiplication is the product?

Varied Fluency

- Complete the calculation.

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

	Th	H	T	O
	1	0	2	3
×				3

- Write the multiplication calculation represented and find the answer.

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

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

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

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

	Th	H	T	O
	1	3	2	5
×				4

Multiply 4-digits by 1-digit

Reasoning and Problem Solving

Alex calculated 1,432 × 4

Here is her answer.

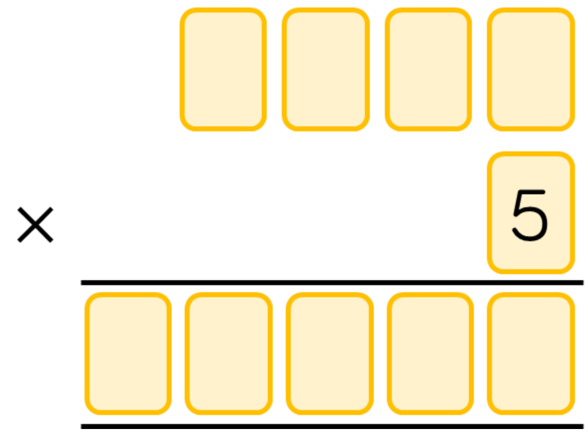
	Th	H	T	O
	1	4	3	2
×				4
	4	16	12	8

1,432 × 4 = 416,128

Can you explain what Alex has done wrong?

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

Can you work out the missing numbers using the clues?



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

2,345 × 5 = 11,725

Multiply 2-digits (Area Model)

Notes and Guidance

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

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

Mathematical Talk

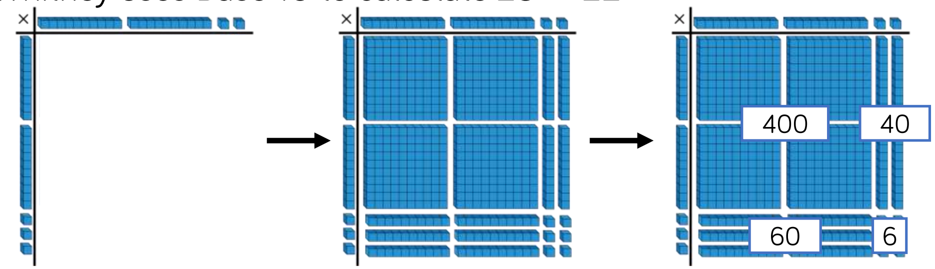
What are we multiplying?
How can we partition these numbers?

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

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

Varied Fluency

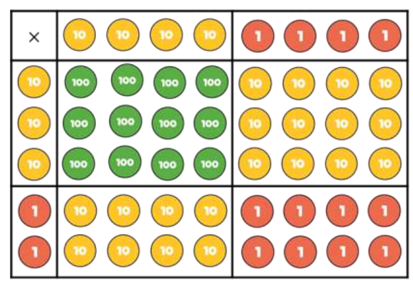
Whitney uses Base 10 to calculate 23 × 22



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

32 × 24   25 × 32   35 × 32

Rosie adapts the Base 10 method to calculate 44 × 32



×	40	4
30	1,200	120
2	80	8

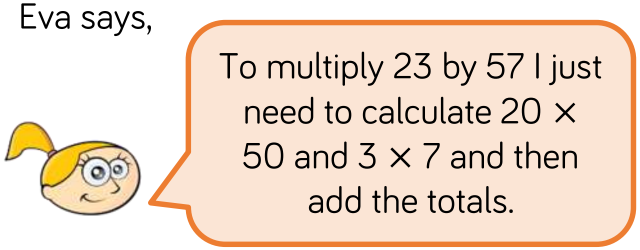
Compare using place value counters and a grid to calculate:

45 × 42   52 × 24   34 × 43

Multiply 2-digits (Area Model)

Reasoning and Problem Solving

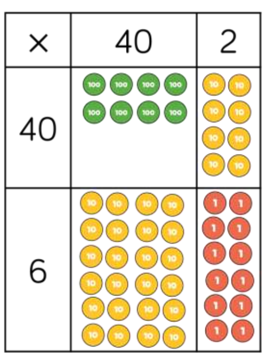
Eva says,



What mistake has Eva made?
Explain your answer.

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

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



Amir needs 8 more hundreds, $40 \times 40 = 1,600$ and he only has 800

His calculation is $42 \times 46 = 1,932$

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

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

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

Do you agree? Prove it.

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

White Rose Maths

Multiply 2-digits by 2-digits

Notes and Guidance

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

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

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

Mathematical Talk

Why is the zero important?

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

When do we need to make an exchange?

What can we exchange if the product is 42 ones?

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

Varied Fluency

Complete the calculation to work out 23 × 14

		2	3	
×		1	4	
		9	2	(23 × 4)
		1		
	2	3	0	(23 × 10)

Use this method to calculate:

34 × 26   58 × 15   72 × 35

Complete to solve the calculation.

		4	6	
×		2	7	
	3	2	2	(__ × __)
		4		
	9	2	0	(__ × __)
	1			

Use this method to calculate:

27 × 39   46 × 55   94 × 49

Calculate:

38 × 12   39 × 12   38 × 11

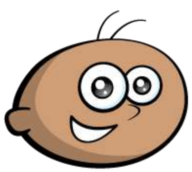
What's the same? What's different?

Multiply 2-digits by 2-digits

Reasoning and Problem Solving

Tommy says,

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



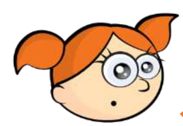
Do you agree?
Explain your answer.

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

Amir has multiplied 47 by 36

		4	7
×		3	6
	2	8 $_{4}$	2
	1	4 $_{2}$	1
	3	2	3

Alex says,



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

Who is correct?
What mistake has been made?

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

Multiply 3-digits by 2-digits

Notes and Guidance

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

Mathematical Talk

Why is the zero important?

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

When do we need to make an exchange?

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

Varied Fluency

Complete:

		1	3	2	
×			1	4	
		5	2_1	8	(132 × 4)
	1	3	2	0	(132 × 10)

Use this method to calculate:

264 × 14 264 × 28

What do you notice about your answers?

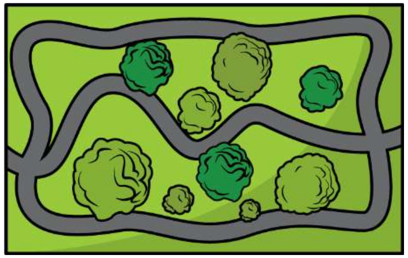
Calculate:

637 × 24

573 × 28

573 × 82

A playground is 128 yards by 73 yards.



Calculate the area of the playground.

Multiply 3-digits by 2-digits

Reasoning and Problem Solving

$22 \times 111 = 2442$

$23 \times 111 = 2553$

$24 \times 111 = 2664$

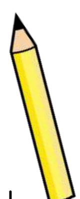
What do you think the answer to 25×111 will be?

What do you notice?

Does this always work?

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

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



15,840

Here are examples of Dexter's maths work.

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

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

He has made a mistake in each question.

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

Correct each calculation.

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

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

Multiply 4-digits by 2-digits

Notes and Guidance

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

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

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

Mathematical Talk

Explain the steps followed when using this multiplication method.

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

Explain why there is a 9 in the thousands column.

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

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

Varied Fluency

Use the method shown to calculate 2,456 × 34

		3	2	5	0	
×				2	6	
	1	9_1	5_3	0	0	(3,250 × 6)
	6	5_1	0	0	0	(3,250 × 20)
	8	4	5	0	0	

Calculate

3,282 × 32

7,132 × 21

9,708 × 38

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

4,458 × 56 ◯ 4,523 × 54

4,458 × 55 ◯ 4,523 × 54

4,458 × 55 ◯ 4,522 × 54

Multiply 4-digits by 2-digits

Reasoning and Problem Solving

Spot the Mistakes

Can you spot and correct the errors in the calculation?

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

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

Teddy has spilt some paint on his calculation.

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

What are the missing digits?

What do you notice?

The missing digits are all 8

Divide 2-digits by 1-digit (1)

Notes and Guidance

Children build on their knowledge of dividing a 2-digit number by a 1-digit number from Year 3 by sharing into equal groups.

Children use examples where the tens and the ones are divisible by the divisor, e.g. 96 divided by 3 and 84 divided by 4. They then move on to calculations where they exchange between tens and ones.

Mathematical Talk

How can we partition 84?
How many rows do we need to share equally between?

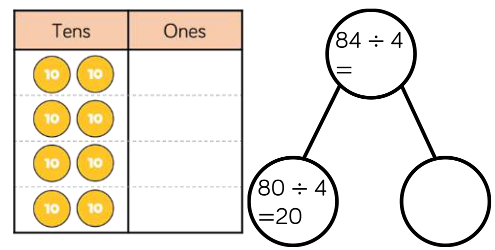
If I cannot share the tens equally, what do I need to do?
How many ones will I have after exchanging the tens?

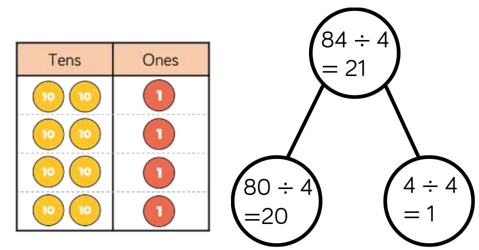
If we know 96 ÷ 4 = 24, what will 96 ÷ 8 be?
What will 96 ÷ 2 be? Can you spot a pattern?

Varied Fluency

Jack is dividing 84 by 4 using place value counters.

First, he divides the tens. Then, he divides the ones.

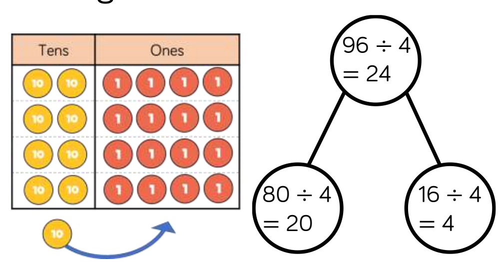




Use Jack's method to calculate:

69 ÷ 3 88 ÷ 4 96 ÷ 3

Rosie is calculating 96 divided by 4 using place value counters. First, she divides the tens. She has one ten remaining so she exchanges one ten for ten ones. Then, she divides the ones.



Use Rosie's method to solve
65 ÷ 5
75 ÷ 5
84 ÷ 6

Divide 2-digits by 1-digit (1)

Reasoning and Problem Solving

Dora is calculating $72 \div 3$ Before she starts, she says the calculation will involve an exchange. Do you agree? Explain why.	Dora is correct because 70 is not a multiple of 3 so when you divide 7 tens between 3 groups there will be one remaining which will be exchanged.
Use $<$, $>$ or $=$ to complete the statements. $69 \div 3$ ◯ $96 \div 3$ $96 \div 4$ ◯ $96 \div 3$ $91 \div 7$ ◯ $84 \div 6$	$<$ $<$ $<$

Eva has 96 sweets. She shares them into equal groups. She has no sweets left over. How many groups could Eva have shared her sweets into?	Possible answers $96 \div 1 = 96$ $96 \div 2 = 48$ $96 \div 3 = 32$ $96 \div 4 = 24$ $96 \div 6 = 16$ $96 \div 8 = 12$

Divide 2-digits by 1-digit (2)

Notes and Guidance

Children explore dividing 2-digit numbers by 1-digit numbers involving remainders.

They continue to use the place value counters to divide in order to explore why there are remainders. Teachers should highlight, through questioning, that the remainder can never be greater than the number you are dividing by.

Mathematical Talk

If we are dividing by 3, what is the highest remainder we can have?

If we are dividing by 4, what is the highest remainder we can have?

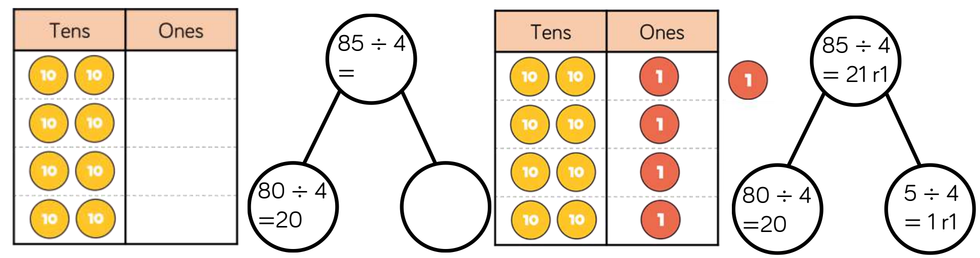
Can we make a general rule comparing our divisor (the number we are dividing by) to our remainder?

Varied Fluency

R

- Teddy is dividing 85 by 4 using place value counters.

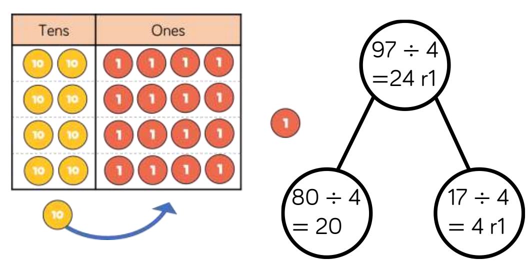
First, he divides the tens. Then, he divides the ones.



Use Teddy's method to calculate:

86 ÷ 4 87 ÷ 4 88 ÷ 4 97 ÷ 3 98 ÷ 3 99 ÷ 3

- Whitney uses the same method, but some of her calculations involve an exchange.



Use Whitney's method to solve
57 ÷ 4
58 ÷ 4
58 ÷ 3

Divide 2-digits by 1-digit (2)

Reasoning and Problem Solving

Rosie writes, 85 ÷ 3 = 28 r 1 She says 85 must be 1 away from a multiple of 3 Do you agree?	I agree, remainder 1 means there is 1 left over. 85 is one more than 84 which is a multiple of 3
37 sweets are shared between 4 friends. How many sweets are left over? Four children attempt to solve this problem. • Alex says it's 1 • Mo says it's 9 • Eva says it's 9 r 1 • Jack says it's 8 r 5 Can you explain who is correct and the mistakes other people have made?	Alex is correct as there will be one remaining sweet. Mo has found how many sweets each friend will receive. Eva has written the answer to the calculation. Jack has found a remainder that is larger than the divisor so is incorrect.

Whitney is thinking of a 2-digit number that is less than 50 When it is divided by 2, there is no remainder. When it is divided by 3, there is a remainder of 1 When it is divided by 5, there is a remainder of 3 What number is Whitney thinking of?	Whitney is thinking of 28

Divide 3-digits by 1-digit

Notes and Guidance

Children apply their previous knowledge of dividing 2-digit numbers to divide a 3-digit number by a 1-digit number.

They use place value counters and part-whole models to support their understanding.

Children divide numbers with and without remainders.

Mathematical Talk

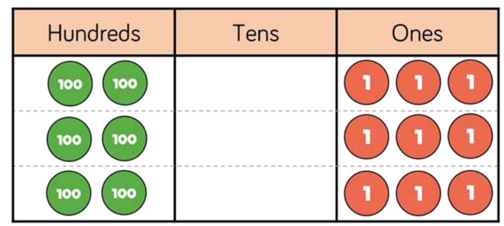
What is the same and what's different when we are dividing 3-digit number by a 1-digit number and a 2-digit number by a 1-digit number?

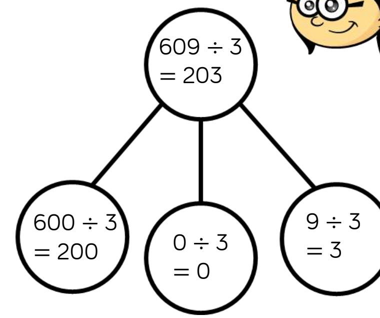
Do we need to partition 609 into three parts or could it just be partitioned into two parts?

Can we partition the number in more than one way to support dividing more efficiently?

Varied Fluency

- Annie is dividing 609 by 3 using place value counters.

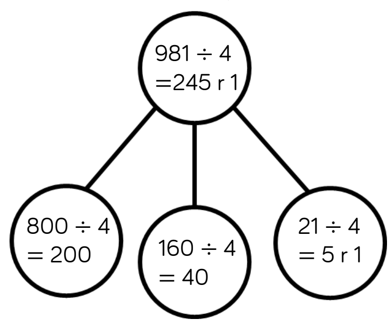




Use Annie's method to calculate the divisions.

906 ÷ 3   884 ÷ 4   884 ÷ 8   489 ÷ 2

- Rosie is using flexible partitioning to divide 3-digit numbers. She uses her place value counters to support her.

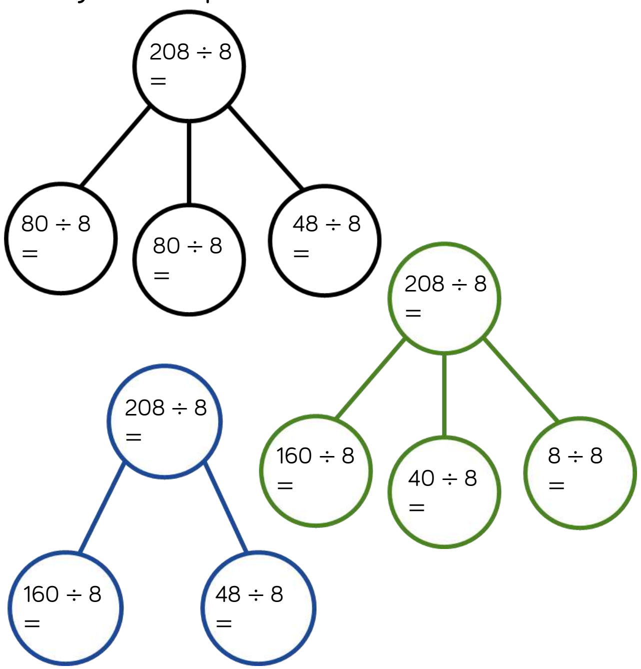


Use Rosie's method to solve:
726 ÷ 6
846 ÷ 6
846 ÷ 7

Divide 3-digits by 1-digit

Reasoning and Problem Solving

Dexter is calculating 208 ÷ 8 using part-whole models.
Can you complete each model?

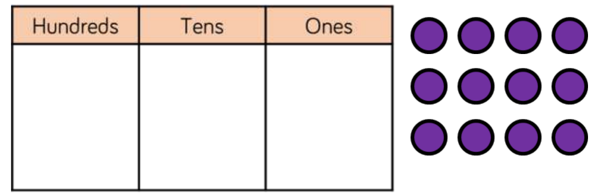


How many part-whole models can you make to calculate 132 ÷ 4?

208 ÷ 8 = 26
80 ÷ 8 = 10
48 ÷ 8 = 6
160 ÷ 8 = 20
40 ÷ 8 = 5
8 ÷ 8 = 1

Children can then make a range of part-whole models to calculate 132 ÷ 4
e.g.
100 ÷ 4 = 25
32 ÷ 4 = 8

You have 12 counters and the place value grid. You must use all 12 counters to complete the following.



Create a 3-digit number divisible by 2
Create a 3-digit number divisible by 3
Create a 3-digit number divisible by 4
Create a 3-digit number divisible by 5
Can you find a 3-digit number divisible by 6, 7, 8 or 9?

2: Any even number

3: Any 3-digit number (as the digits add up to 12, a multiple of 3)

4: A number where the last two digits are a multiple of 4

5: Any number with 0 or 5 in the ones column.

Possible answers

6: Any even number

7: 714, 8: 840

9: Impossible

Divide 4-digits by 1-digit

Notes and Guidance

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

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

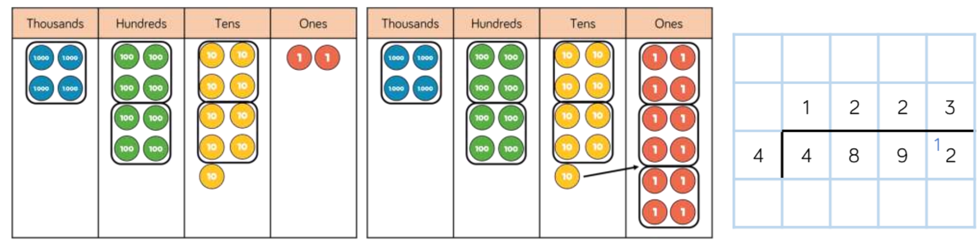
Mathematical Talk

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

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

Varied Fluency

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



Use this method to calculate:

6,610 ÷ 5   2,472 ÷ 3   9,360 ÷ 4

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

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

3,495 ÷ 5 ◯ 3,495 ÷ 3

8,064 ÷ 7 ◯ 9,198 ÷ 7

7,428 ÷ 4 ◯ 5,685 ÷ 5

Divide 4-digits by 1-digit

Reasoning and Problem Solving

Jack is calculating 2,240 ÷ 7

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

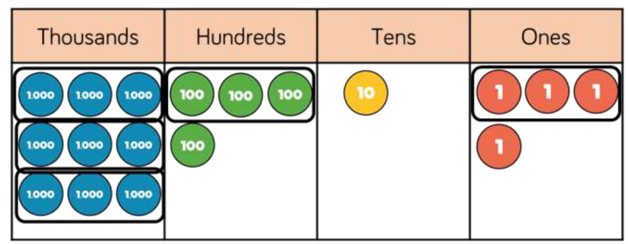
Do you agree with Jack?
Explain your answer.

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

The answer is 320

Spot the Mistake

Explain and correct the working.



	3	1	0	1
3	9	4	1	4

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

Divide with Remainders

Notes and Guidance

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

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

Mathematical Talk

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

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

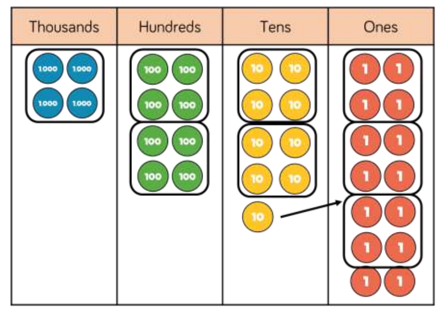
In this number story, what does the remainder mean?

When would we round the remainder up or down?

In which context would we just focus on the remainder?

Varied Fluency

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



	1	2	2	3		
4	4	8	9	¹4		r2

Use this method to calculate:

6,613 ÷ 5   2,471 ÷ 3   9,363 ÷ 4

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

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

White Rose Maths

Divide with Remainders

Reasoning and Problem Solving

I am thinking of a 3-digit number.

When it is divided by 9, the remainder is 3

When it is divided by 2, the remainder is 1

When it is divided by 5, the remainder is 4

What is my number?

Possible answers:

129	219
309	399
489	579
669	759
849	939

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

Always, Sometimes, Never?

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

$765 \div 4 = 191$ remainder 1

How many possible examples can you find?

Sometimes

Possible answers:

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

White Rose Maths

Spring - Block 2

Fractions

Overview

Small Steps

- What is a fraction? R
- Equivalent fractions (1) R
- Equivalent fractions
- Fractions greater than 1 R
- Improper fractions to mixed numbers
- Mixed numbers to improper fractions
- Number sequences
- Compare and order fractions less than 1
- Compare and order fractions greater than 1
- Add and subtract fractions
- Add fractions within 1
- Add 3 or more fractions
- Add fractions

Notes for 2020/21

Children will need to look at different representations of fractions to expose any misconceptions.

They can then move onto a practical exploration of equivalent fractions by folding paper before comparing fractions with drawings and diagrams in these first recap steps.

Year 5 is the first time children explore improper fractions in depth so we have added a recap step from Year 4 where children add fractions to a total greater than one whole.

Overview

Small Steps

- Add mixed numbers
- Subtract fractions
- Subtract mixed numbers
- Subtract – breaking the whole
- Subtract 2 mixed numbers
- Multiply unit fractions by an integer
- Multiply non-unit fractions by an integer
- Multiply mixed numbers by integers
- Calculate fractions of a quantity (R)
- Fraction of an amount
- Using fractions as operators

Notes for 2020/21

As children progress through the small steps they use different representations to support their understanding of the abstract.

Before exploring fractions of an amount it may be useful to recap the Year 4 content with practical equipment and pictorial representations to help them see the relationships between the fraction and the whole.

What is a Fraction?

Notes and Guidance

Children explore fractions in different representations, for example, fractions of shapes, quantities and fractions on a number line.

They explore and recap the meaning of numerator and denominator, non-unit and unit fractions.

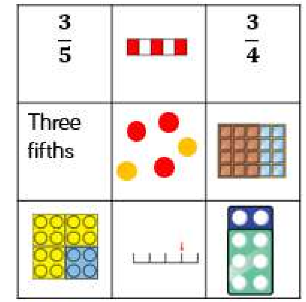
Mathematical Talk

How can we sort the fraction cards?
What fraction does each one represent?
Could some cards represent more than one fraction?
Is $\frac{1.5}{3}$ an example of a non-unit fraction? Why?
Using Cuisenaire, how many white rods are equal to an orange rod? How does this help us work out what fraction the white rod represents?

Varied Fluency

R

Here are 9 cards.
Sort the cards into different groups.
Can you explain how you made your decision?
Can you sort the cards in a different way?
Can you explain how your partner has sorted the cards?



Complete the Frayer model to describe a unit fraction.

Can you use the model to describe the following terms?

Non-unit fraction

Numerator

Denominator

Definition	Characteristics
unit fraction	
Examples	Non-examples

Use Cuisenaire rods.
If the orange rod is one whole, what fraction is represented by:
- The white rod
- The red rod
- The yellow rod
- The brown rod

Choose a different rod to represent one whole; what do the other rods represent now?

What is a Fraction?

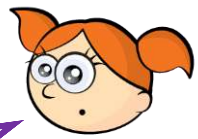
Reasoning and Problem Solving

R

Always, Sometimes, Never?

Alex says,

If I split a shape into 4 parts, I have split it into quarters.

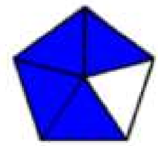


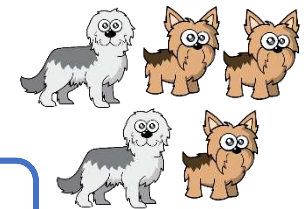
Explain your answer.

Sometimes

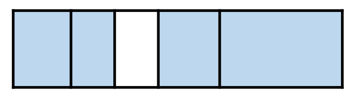
If the shape is not split equally, it will not be in quarters.

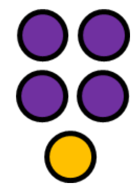
Which representations of $\frac{4}{5}$ are incorrect?





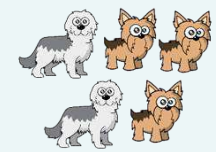
$\frac{4}{5}$



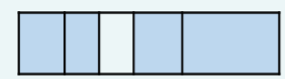


Explain how you know.

The image of the dogs could represent $\frac{2}{5}$ or $\frac{3}{5}$



The bar model is not divided into equal parts so this does not represent $\frac{4}{5}$



Equivalent Fractions (1)

Notes and Guidance

Children use strip diagrams to investigate and record equivalent fractions.

They start by comparing two fractions before moving on to finding more than one equivalent fraction on a fraction wall.

Mathematical Talk

Look at the equivalent fractions you have found.
What relationship can you see between the numerators and denominators? Are there any patterns?

Can a fraction have more than one equivalent fraction?

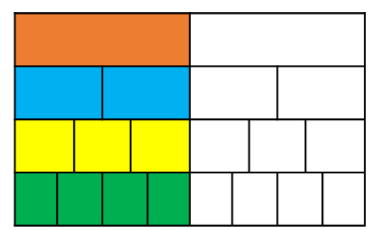
Can you use Cuisenaire rods or pattern blocks to investigate equivalent fractions?

Varied Fluency

- Use two strips of equal sized paper.
Fold one strip into quarters and the other into eighths.
Place the quarters on top of the eighths and lift up one quarter; how many eighths can you see?
How many eighths are equivalent to one quarter?
Which other equivalent fractions can you find?

- Using squared paper, investigate equivalent fractions using equal parts e.g. $\frac{2}{4} = \frac{?}{8}$
Start by drawing a bar 8 squares long.
Underneath, compare the same length bar split into four equal parts.

- How many fractions that are equivalent to one half can you see on the fraction wall?

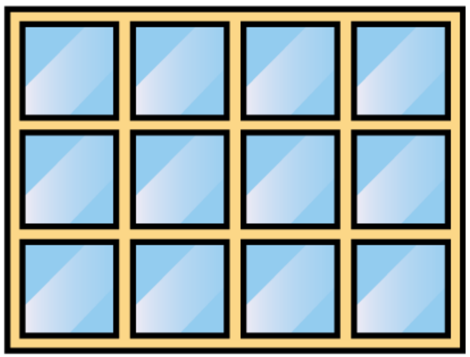


Draw extra rows to show other equivalent fractions.

Equivalent Fractions (1)

Reasoning and Problem Solving

How many equivalent fractions can you see in this picture?

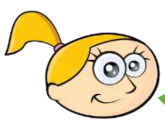


Children can give a variety of possibilities.
Examples:

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

$$\frac{1}{4} = \frac{3}{12}$$

Eva says,



> I know that $\frac{3}{4}$ is equivalent to $\frac{3}{8}$ because the numerators are the same.

Is Eva correct?
Explain why.

Eva is not correct.
$\frac{3}{4}$ is equivalent to $\frac{6}{8}$
When the numerators are the same, the larger the denominator, the smaller the fraction.

Ron has two strips of the same sized paper.
He folds the strips into different sized fractions.
He shades in three equal parts on one strip and six equal parts on the other strip.
The shaded areas are equal.

What fractions could he have folded his strips into?

Ron could have folded his strips into sixths and twelfths, quarters and eighths or any other fractions where one of the denominators is double the other.

Equivalent Fractions

Notes and Guidance

Children explore equivalent fractions using models and concrete representations.

They use models to make the link to multiplication and division. Children then apply the abstract method to find equivalent fractions.

It is important children have the conceptual understanding before moving on to just using an abstract method.

Mathematical Talk

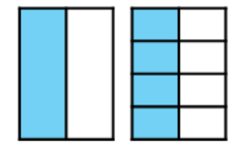
What equivalent fractions can we find by folding the paper? How can we record these?

What is the same and what is different about the numerators and denominators in the equivalent fractions?

How does multiplication and division help us find equivalent fractions? Where can we see this in our model?

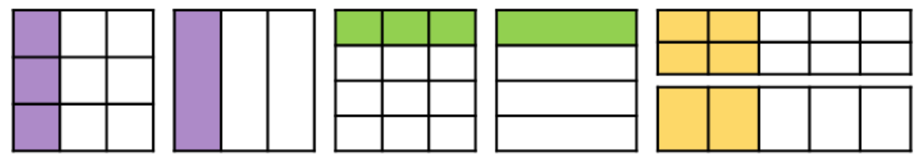
Varied Fluency

- Take two pieces of paper the same size.
  Fold one piece into two equal pieces.
  Fold the other into eight equal pieces.
  What equivalent fractions can you find?

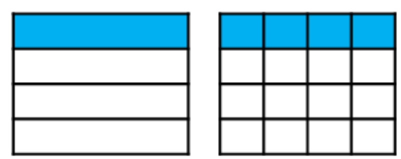


$\frac{1}{2} = \frac{4}{8}$

Use the models to write equivalent fractions.



- Eva uses the models and her multiplication and division skills to find equivalent fractions.



$\frac{1}{4} \overset{\times 4}{\underset{\times 4}{=}} \frac{4}{16}$

Use this method to find equivalent fractions to $\frac{2}{4}$, $\frac{3}{4}$ and $\frac{4}{4}$ where the denominator is 16

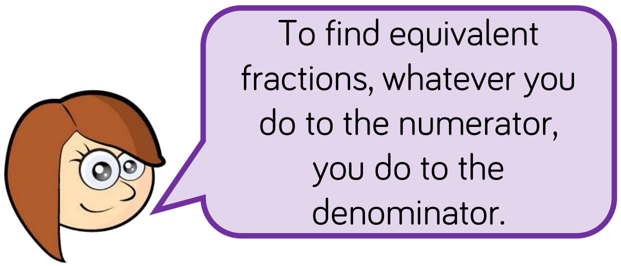
Eva uses the same approach to find equivalent fractions for these fractions. How will her method change?

$\frac{4}{12} = \frac{\boxed{}}{3}$ $\frac{6}{12} = \frac{\boxed{}}{4}$ $\frac{6}{12} = \frac{\boxed{}}{2}$

Equivalent Fractions

Reasoning and Problem Solving

Rosie says,



Using her method, here are the equivalent fractions Rosie has found for $\frac{4}{8}$

$\frac{4}{8} = \frac{8}{16}$ $\quad$ $\frac{4}{8} = \frac{6}{10}$

$\frac{4}{8} = \frac{2}{4}$ $\quad$ $\frac{4}{8} = \frac{1}{5}$

Are all Rosie's fractions equivalent?
Does Rosie's method work?
Explain your reasons.

$\frac{4}{8} = \frac{1}{5}$ and $\frac{4}{8} = \frac{6}{10}$ are incorrect.

Rosie's method doesn't always work. It works when multiplying or dividing both the numerator or denominator but not when adding or subtracting the same thing to both.

Ron thinks you can only simplify even numbered fractions because you keep on halving the numerator and denominator until you get an odd number.

Do you agree?
Explain your answer.

Ron is wrong. For example $\frac{3}{9}$ can be simplified to $\frac{1}{3}$ and these are all odd numbers.

Here are some fraction cards.
All of the fractions are equivalent.

$\frac{4}{A}$ $\quad$ $\frac{B}{C}$ $\quad$ $\frac{20}{50}$

A + B = 16
Calculate the value of C.

A = 10
B = 6
C = 15

Fractions Greater than 1

Notes and Guidance

Children use manipulatives and diagrams to show that a fraction can be split into wholes and parts.

Children focus on how many equal parts make a whole dependent on the number of equal parts altogether. This learning will lead on to Year 5 where children learn about improper fractions and mixed numbers.

Mathematical Talk

How many ____ make a whole?

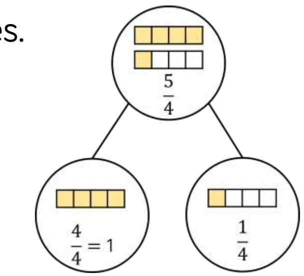
If I have _____ eighths, how many more do I need to make a whole?

What do you notice about the numerator and denominator when a fraction is equivalent to a whole?

Varied Fluency

R

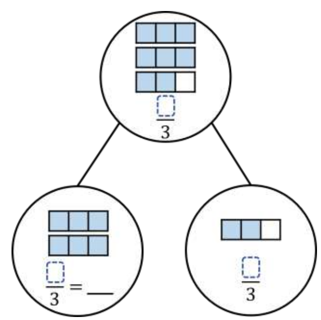
- Complete the part-whole models and sentences.

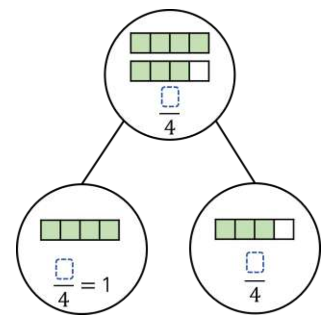


There are ____ quarters altogether.

___ quarters = ____ whole and ____ quarter.

Write sentences to describe these part-whole models.





- Complete. You may use part-whole models to help you.

$$\frac{10}{3} = \frac{9}{3} + \frac{\boxed{}}{3} = 3\frac{\boxed{}}{3}$$

$$\frac{\boxed{}}{3} = \frac{6}{3} + \frac{2}{3} = \boxed{}\,\frac{2}{3}$$

$$\frac{\boxed{}}{8} = \frac{16}{8} + \frac{3}{8} = \boxed{}\,\frac{\boxed{}}{\boxed{}}$$

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Fractions Greater than 1

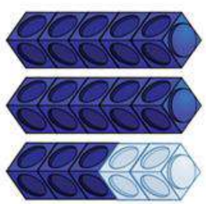
Reasoning and Problem Solving

R

3 friends share some pizzas.
Each pizza is cut into 8 equal slices.
Altogether, they eat 25 slices.
How many whole pizzas do they eat?

They eat 3 whole pizzas and 1 more slice.

Spot the mistake.



$\frac{13}{5}$ = 10 wholes and 3 fifths

There are 2 wholes not 10

$\frac{10}{5}$ = 2 wholes

$\frac{13}{5}$ = 2 wholes and 3 fifths

Rosie says,

$\frac{16}{4}$ is greater than $\frac{8}{2}$ because 16 is greater than 8

Do you agree?
Explain why.

I disagree with Rosie because both fractions are equivalent to 4

Children may choose to build both fractions using cubes, or draw bar models.

Improper to Mixed Numbers

Notes and Guidance

Children convert improper fractions to mixed numbers for the first time. An improper fraction is a fraction where the numerator is greater than the denominator. A mixed number is a number consisting of an integer and a proper fraction.

It is important for children to see this process represented visually to allow them to make the connections between the concept and what happens in the abstract.

Mathematical Talk

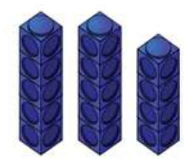
How many parts are there in a whole?

What do you notice happens to the mixed number when the denominator increases and the numerator remains the same?

What happens when the numerator is a multiple of the denominator?

Varied Fluency

- Whitney converts the improper fraction $\frac{14}{5}$ into a mixed number using cubes.
  She groups the cubes into 5s, then has 4 left over.



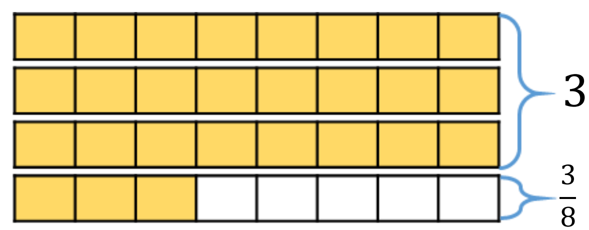
$\frac{5}{5}$ is the same as $\square$ $\frac{10}{5}$ is the same as $\square$

$\frac{14}{5}$ as a mixed number is $\square\frac{\square}{\square}$

Use Whitney's method to convert $\frac{11}{3}$, $\frac{11}{4}$, $\frac{11}{5}$ and $\frac{11}{6}$

- Tommy converts the improper fraction $\frac{27}{8}$ into a mixed number using bar models.

$\frac{27}{8}$



$3\frac{3}{8}$

Use Tommy's method to convert $\frac{25}{8}$, $\frac{27}{6}$, $\frac{18}{7}$ and $\frac{32}{4}$

Improper to Mixed Numbers

Reasoning and Problem Solving

Amir says,

$\frac{28}{3}$ is less than $\frac{37}{5}$ because 28 is less than 37

Do you agree?
Explain why.

Possible answer

I disagree because $\frac{28}{3}$ is equal to $9\frac{1}{3}$ and $\frac{37}{5}$ is equal to $7\frac{2}{5}$

$\frac{37}{5} < \frac{28}{3}$

Spot the mistake

- $\frac{27}{5} = 5\frac{1}{5}$
- $\frac{27}{3} = 8$
- $\frac{27}{4} = 5\frac{7}{4}$
- $\frac{27}{10} = 20\frac{7}{10}$

What mistakes have been made?

Can you find the correct answers?

Correct answers

- $5\frac{2}{5}$ (incorrect number of fifths)
- 9 (incorrect whole)
- $6\frac{3}{4}$ (still have an improper fraction)
- $2\frac{7}{10}$ (incorrect number of wholes)

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Mixed Numbers to Improper

Notes and Guidance

Children now convert from mixed numbers to improper fractions using concrete and pictorial methods to understand the abstract method.

Ensure children always write their working alongside the concrete and pictorial representations so they can see the clear links to the abstract.

Mathematical Talk

How many quarters/halves/eighths/fifths are there in a whole?

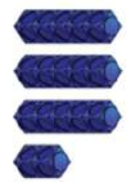
How does multiplication support us in converting from mixed numbers to improper fractions?

Can you explain the steps in converting an improper fraction to a mixed number? Use the vocabulary: numerator, denominator, multiply, add

How could we use the previous bar model to help?

Varied Fluency

- Whitney converts $3\frac{2}{5}$ into an improper fraction using cubes.



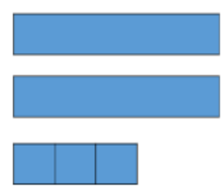
1 whole is equal to $\square$ fifths.

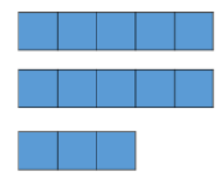
3 wholes are equal to $\square$ fifths.

$\square$ fifths + two fifths = $\square$ fifths

Use Whitney's method to convert $2\frac{2}{3}$, $2\frac{2}{4}$, $2\frac{2}{5}$ and $2\frac{2}{6}$

- Jack uses bar models to convert a mixed number into an improper fraction.





$2\frac{3}{5} = \square$ wholes + $\square$ fifths

2 wholes = $\square$ fifths

$\square$ fifths + $\square$ fifths = $\square$ fifths

Use Jack's method to convert $2\frac{1}{6}$, $4\frac{1}{6}$, $4\frac{1}{3}$ and $8\frac{2}{3}$

Mixed Numbers to Improper

Reasoning and Problem Solving

Three children have incorrectly converted $3\frac{2}{5}$ into an improper fraction.

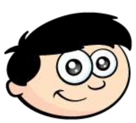
$3\frac{2}{5} = \frac{6}{15}$

Annie

$3\frac{2}{5} = \frac{15}{5}$

Mo

$3\frac{2}{5} = \frac{32}{5}$



Dexter

What mistake has each child made?

Annie has multiplied the numerator and denominator by 3

Mo has multiplied the correctly but then forgotten to add on the extra 2 parts.

Dexter has just placed 3 in front of the numerator.

Fill in the missing numbers.

How many different possibilities can you find for each equation?

$$2\frac{\square}{8} = \frac{\square}{8}$$

$$2\frac{\square}{5} = \frac{\square}{5}$$

Compare the number of possibilities you found.

$2\frac{1}{8} = \frac{17}{8}$ $2\frac{2}{8} = \frac{18}{8}$

$2\frac{3}{8} = \frac{19}{8}$ $2\frac{4}{8} = \frac{20}{8}$

$2\frac{5}{8} = \frac{21}{8}$ $2\frac{6}{8} = \frac{22}{8}$

$2\frac{7}{8} = \frac{23}{8}$

There will be 4 solutions for fifths.

Teacher notes: Encourage children to make generalisations that the number of solutions is one less than the denominator.

Number Sequences

Notes and Guidance

Children count up and down in a given fraction. They continue to use visual representations to help them explore number sequences.

Children also find missing fractions in a sequence and determine whether the sequence is increasing or decreasing and by how much.

Mathematical Talk

What are the intervals between the fractions?

Are the fractions increasing or decreasing?
How much are they increasing or decreasing by?

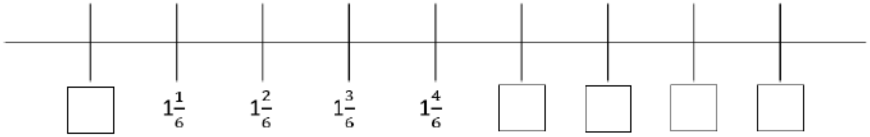
Can you convert the mixed numbers to improper fractions?
Does this make it easier to continue the sequence?

Varied Fluency

Use the counting stick to count up and down in these fractions.

- Start at 0 and count up in steps of $\frac{1}{4}$
- Start at 4 and count down in steps of $\frac{1}{3}$
- Start at 1 and count up in steps of $\frac{2}{3}$

Complete the missing values on the number line.



Complete the sequences.

$\frac{3}{4}, \frac{\square}{\square}, 1\frac{3}{4}, 2\frac{1}{4}$

$\frac{\square}{\square}, 3\frac{1}{3}, \frac{\square}{\square}, 2\frac{2}{3}$

$\frac{\square}{\square}, 5\frac{1}{2}, 5\frac{7}{10}, 5\frac{9}{10}$

$\frac{3}{5}, \frac{\square}{\square}, \frac{\square}{\square}, 3$

White Rose Maths

Number Sequences

Reasoning and Problem Solving

Three children are counting in quarters.

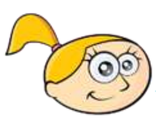
Whitney

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

Teddy

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

Eva



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

Who is counting correctly?
Explain your reasons.

They are all correct, they are all counting in quarter.
Teddy has simplified all answers and Eva has converted improper fractions to mixed numbers.

Play the fraction game for four players.
Place the four fraction cards on the floor.
Each player stands in front of a fraction.
We are going to count up in tenths starting at 0
When you say a fraction, place your foot on your fraction.

$\frac{1}{10}$ $\frac{1}{5}$

$\frac{3}{10}$ $\frac{1}{2}$

How can we make 4 tenths?
What is the highest fraction we can count to?
How about if we used two feet?

Children can make four tenths by stepping on one tenth and three tenths at the same time.
With one foot, they can count up to 11 tenths or one and one tenth.
With two feet they can count up to 22 tenths.

Compare & Order (Less than 1)

Notes and Guidance

Children build on their equivalent fraction knowledge to compare and order fractions less than 1 where the denominators are multiples of the same number.

Children compare the fractions by finding a common denominator or a common numerator. They use bar models to support their understanding.

Mathematical Talk

How does a bar model help us to visualise the fractions?

Should both of our bars be the same size? Why? What does this show us?

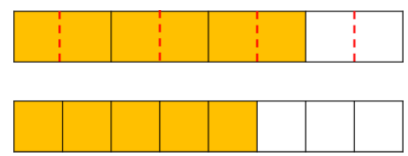
If the numerators are the same, how can we compare our fractions?

If the denominators are the same, how can we compare our fractions?

Do we always have to find a common denominator? Can we find a common numerator?

Varied Fluency

- Use bar models to compare $\frac{5}{8}$ and $\frac{3}{4}$



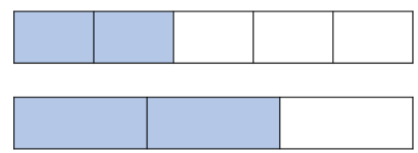
$\square > \square$

$\square < \square$

Use this method to help you compare:

$\frac{5}{6}$ and $\frac{2}{3}$ $\qquad$ $\frac{2}{3}$ and $\frac{5}{9}$ $\qquad$ $\frac{7}{16}$ and $\frac{3}{8}$

- Use common numerators to help you compare $\frac{2}{5}$ and $\frac{2}{3}$



$\square > \square$

$\square < \square$

Use this method to help you compare:

$\frac{6}{7}$ and $\frac{6}{8}$ $\qquad$ $\frac{4}{9}$ and $\frac{4}{5}$ $\qquad$ $\frac{4}{11}$ and $\frac{2}{5}$

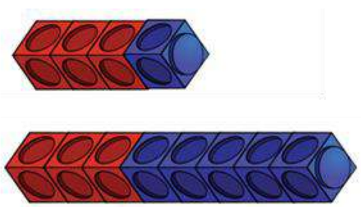
- Order the fractions from greatest to smallest:

$\frac{3}{7}, \frac{3}{5}$ and $\frac{3}{8}$ $\qquad$ $\frac{2}{3}, \frac{5}{6}$ and $\frac{7}{12}$ $\qquad$ $\frac{6}{11}, \frac{3}{5}$ and $\frac{2}{3}$

Compare & Order (Less than 1)

Reasoning and Problem Solving

Ron makes $\frac{3}{4}$ and $\frac{3}{8}$ out of cubes.

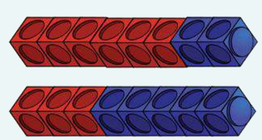


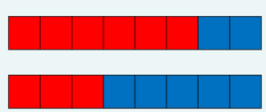
He thinks that $\frac{3}{8}$ is equal to $\frac{3}{4}$

Do you agree?
Explain your answer.

Possible answer:
I disagree with Ron because the two wholes are not equal. He could have compared using numerators or converted $\frac{3}{4}$ to $\frac{6}{8}$

If he does this he will see that $\frac{3}{4}$ is greater. Children may use bar models or cubes to show this.





Always, sometimes, never?

If one denominator is a multiple of the other you can simplify the fraction with the larger denominator to make the denominators the same.

Example:

Could $\frac{?}{4}$ and $\frac{?}{12}$ be simplified to $\frac{?}{4}$ and $\frac{?}{4}$?

Prove it.

Sometimes

It does not work for some fractions e.g. $\frac{8}{15}$ and $\frac{3}{5}$

But does work for others e.g. $\frac{1}{4}$ and $\frac{9}{12}$

Compare & Order (More than 1)

Notes and Guidance

Children use their knowledge of ordering fractions less than 1 to help them compare and order fractions greater than 1

They use their knowledge of common denominators to help them.

Children will compare both improper fractions and mixed numbers during this step.

Mathematical Talk

How can we represent the fractions?

How does the bar help us see which fraction is the greatest?

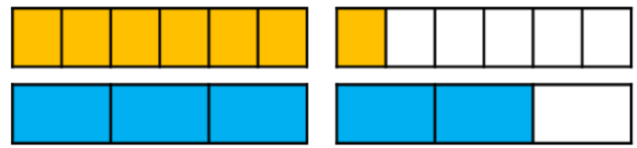
Can we use our knowledge of multiples to help us?

Can you predict which fractions will be greatest? Explain how you know.

Is it more efficient to compare using numerators or denominators?

Varied Fluency

Use bar models to compare $\frac{7}{6}$ and $\frac{5}{3}$



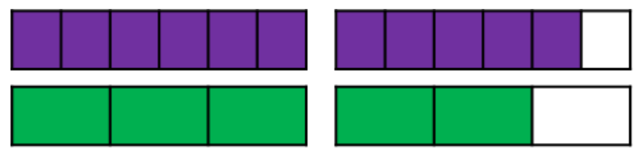
$\square > \square$

$\square < \square$

Use this method to help you compare:

$\frac{5}{2}$ and $\frac{9}{4}$ $\quad$ $\frac{11}{6}$ and $\frac{5}{3}$ $\quad$ $\frac{9}{4}$ and $\frac{17}{8}$

Use a bar model to compare $1\frac{2}{3}$ and $1\frac{5}{6}$



$\square > \square$

$\square < \square$

Use this method to help you compare:

$1\frac{3}{4}$ and $1\frac{3}{8}$ $\quad$ $1\frac{5}{8}$ and $1\frac{1}{2}$ $\quad$ $2\frac{3}{7}$ and $2\frac{9}{14}$

Order the fractions from greatest to smallest using common denominators:

$\frac{8}{5}$, $\frac{11}{10}$ and $\frac{17}{20}$

$\frac{?}{20}$, $\frac{?}{20}$ and $\frac{?}{20}$

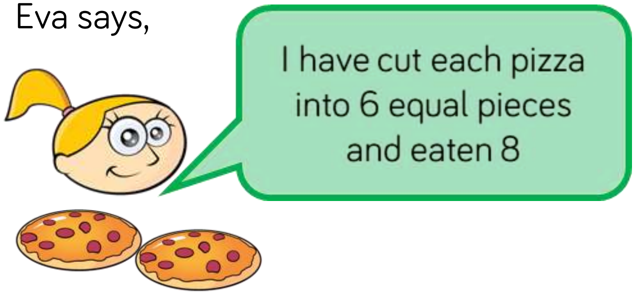
$1\frac{2}{3}$, $1\frac{7}{24}$ and $\frac{11}{12}$

Compare & Order (More than 1)

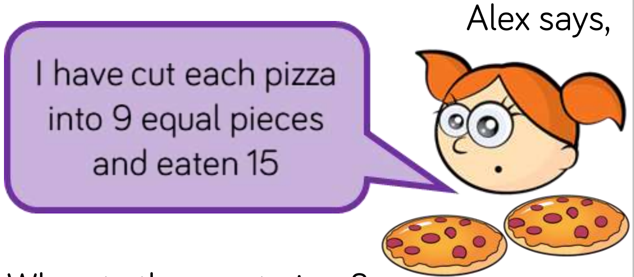
Reasoning and Problem Solving

Eva and Alex each have two identical pizzas.

Eva says,



Alex says,



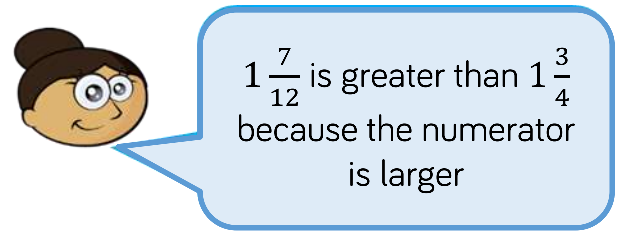
Who ate the most pizza?

Use a drawing to support your answer.

Alex ate the most pizza because $\frac{15}{9}$ is greater than $\frac{8}{6}$

Dora looks at the fractions $1\frac{7}{12}$ and $1\frac{3}{4}$

She says,



Do you agree?

Explain why using a model.

Possible answer:
I do not agree because $1\frac{3}{4}$ is equivalent to $1\frac{9}{12}$ and this is greater than $1\frac{7}{12}$

Add & Subtract Fractions

Notes and Guidance

Children recap their Year 4 understanding of adding and subtracting fractions with the same denominator.

They use bar models to support understanding of adding and subtracting fractions.

Mathematical Talk

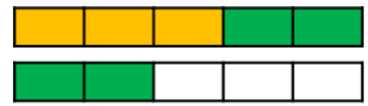
How many equal parts do I need to split my bar into?

Can you convert the improper fraction into a mixed number?

How can a bar model help you balance both sides of the equals sign?

Varied Fluency

- Here is a bar model to calculate $\frac{3}{5} + \frac{4}{5}$

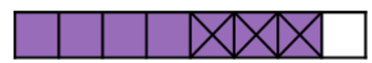


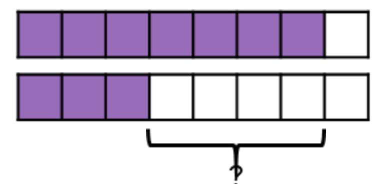
$\frac{3}{5} + \frac{4}{5} = \frac{7}{5} = 1\frac{2}{5}$

Use a bar model to solve the calculations:

$\frac{3}{8} + \frac{3}{8}$ $\quad$ $\frac{5}{6} + \frac{1}{6}$ $\quad$ $\frac{5}{3} + \frac{5}{3}$

- Here are two bar models to calculate $\frac{7}{8} - \frac{3}{8}$





What is the difference between the two methods?
Use your preferred method to calculate:

$\frac{5}{8} - \frac{1}{8}$ $\quad$ $\frac{9}{7} - \frac{4}{7}$ $\quad$ $\frac{5}{3} - \frac{5}{3}$ $\quad$ $1 - \frac{2}{5}$

- Calculate:

$\frac{3}{7} + \frac{5}{7} = \frac{\square}{\square} + \frac{4}{7}$ $\quad$ $\frac{9}{5} - \frac{5}{5} = \frac{6}{5} - \frac{\square}{\square}$ $\quad$ $\frac{2}{3} + \frac{\square}{\square} = \frac{11}{3} - \frac{4}{3}$

Add & Subtract Fractions

Reasoning and Problem Solving

How many different ways can you balance the equation? $\frac{5}{9} + \frac{\square}{9} = \frac{8}{9} + \frac{\square}{9}$	Possible answers: $\frac{5}{9} + \frac{3}{9} = \frac{8}{9} + \frac{0}{9}$ $\frac{5}{9} + \frac{4}{9} = \frac{8}{9} + \frac{1}{9}$ $\frac{5}{9} + \frac{5}{9} = \frac{8}{9} + \frac{2}{9}$ Any combination of fractions where the numerators add up to the same total on each side of the equals sign.
A chocolate bar has 12 equal pieces. Amir eats $\frac{5}{12}$ more of the bar than Whitney. There is one twelfth of the bar remaining. What fraction of the bar does Amir eat? What fraction of the bar does Whitney eat?	Amir eats $\frac{8}{12}$ of the chocolate bar and Whitney eats $\frac{3}{12}$ of the chocolate bar.

Add Fractions within 1

Notes and Guidance

Children add fractions with different denominators for the first time where one denominator is a multiple of the other.

They use pictorial representations to convert the fractions so they have the same denominator.

Ensure children always write their working alongside the pictorial representations so they see the clear links.

Mathematical Talk

Can you find a common denominator? Do you need to convert both fractions or just one?

Can you explain Mo and Rosie's methods to a partner? Which method do you prefer?

How do Mo and Rosie's methods support finding a common denominator?

Varied Fluency

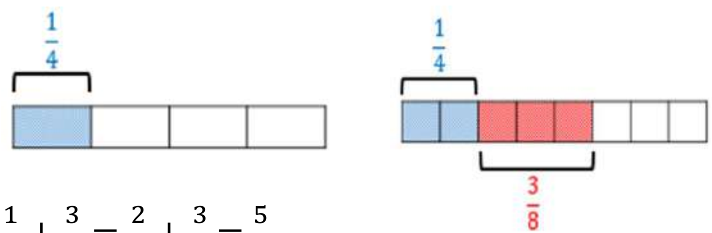
- Mo is calculating $\frac{1}{2} + \frac{1}{8}$
  He uses a diagram to represent the sum.

$\frac{1}{2} + \frac{1}{8} = \frac{4}{8} + \frac{1}{8} = \frac{5}{8}$

Use Mo's method to solve :

$\frac{1}{2} + \frac{3}{8}$ $\frac{1}{4} + \frac{3}{8}$ $\frac{7}{10} + \frac{1}{5}$

- Rosie is using a bar model to solve $\frac{1}{4} + \frac{3}{8}$



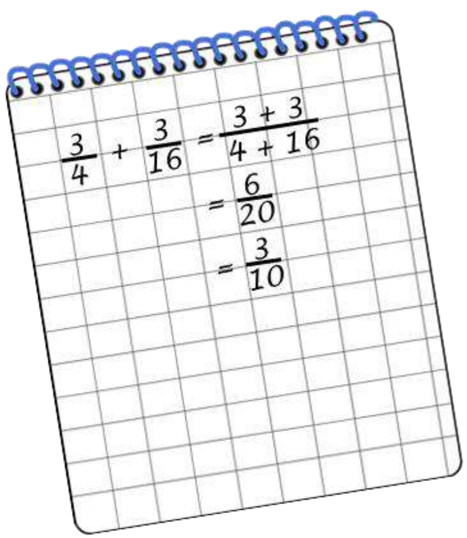
$\frac{1}{4} + \frac{3}{8} = \frac{2}{8} + \frac{3}{8} = \frac{5}{8}$

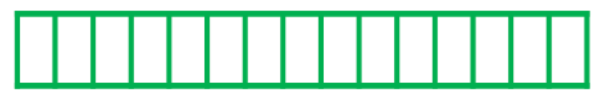
Use a bar model to solve:

$\frac{1}{6} + \frac{5}{12}$ $\frac{2}{9} + \frac{1}{3}$ $\frac{1}{3} + \frac{4}{15}$

Add Fractions within 1

Reasoning and Problem Solving

$\frac{5}{16} + \frac{\square}{8} = \frac{15}{16}$ $\frac{\square}{20} + \frac{7}{10} = \frac{17}{20}$	5 3
Annie solved this calculation.  Can you spot and explain her mistake?	Annie is wrong because she has just added the numerators and the denominators. When adding fractions with different denominators you need to find a common denominator.

Two children are solving $\frac{1}{3} + \frac{4}{15}$ Eva starts by drawing this model:  Alex starts by drawing this model:  Can you explain each person's method and how they would complete the question? Which method do you prefer and why?	Possible answer: Each child may have started with a different fraction in the calculation. e.g. Eva has started by shading a third. She now needs to divide each third into five equal parts so there are fifteen equal parts altogether. Eva will then shade $\frac{4}{15}$ and will have $\frac{9}{15}$ altogether.

Add 3 or More Fractions

Notes and Guidance

Children add more than 2 fractions where two denominators are a multiple of the other.

They use a bar model to continue exploring this.

Ensure children always write their working alongside the pictorial representations so they see the clear links.

Mathematical Talk

Can you find a common denominator? Do you need to convert both fractions or just one?

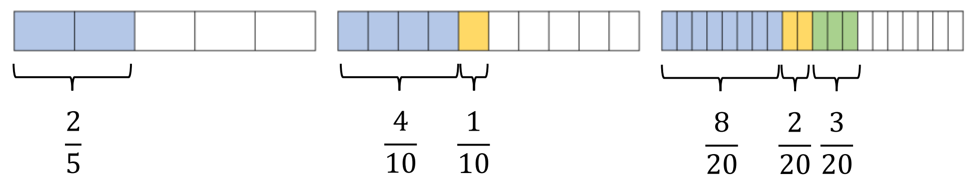
Can you explain Ron's method to a partner? How does Ron's method support finding a common denominator?

Can you draw what Farmer Staneff's field could look like? What fractions could you divide your field into?

Why would a bar model not be efficient for this question?

Varied Fluency

Ron uses a bar model to calculate $\frac{2}{5} + \frac{1}{10} + \frac{3}{20}$



Use a bar model to solve:

$\frac{1}{4} + \frac{3}{8} + \frac{5}{16}$ $\qquad$ $\frac{1}{2} + \frac{1}{6} + \frac{1}{12}$

Farmer Staneff owns a field.

He plants carrots on $\frac{1}{3}$ of the field.

He plants potatoes on $\frac{2}{9}$ of the field.

He plants onions on $\frac{5}{18}$ of the field.

What fraction of the field is covered altogether?

Complete the fractions.

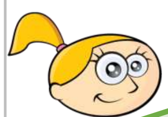
$\frac{1}{5} + \frac{\square}{10} + \frac{8}{20} = 1$ $\qquad$ $\frac{1}{5} + \frac{\square}{15} + \frac{1}{30} = 1$

Add 3 or More Fractions

Reasoning and Problem Solving

Eva is attempting to answer:

$$\frac{3}{5}+\frac{1}{10}+\frac{3}{20}$$

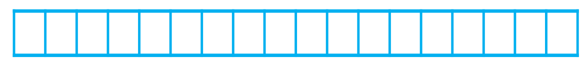


$$\frac{3}{5}+\frac{1}{10}+\frac{3}{20}=\frac{7}{35}$$

Do you agree with Eva?
Explain why.

Eva is wrong because she has added the numerators and denominators together and hasn't found a common denominator. The correct answer is $\frac{17}{20}$

Jack has added 3 fractions together to get an answer of $\frac{17}{18}$



What 3 fractions could he have added?

Can you find more than one answer?

Possible answers:

$$\frac{1}{18}+\frac{4}{18}+\frac{13}{18}$$

$$\frac{1}{9}+\frac{5}{9}+\frac{5}{18}$$

$$\frac{1}{6}+\frac{5}{9}+\frac{2}{9}$$

$$\frac{1}{18}+\frac{1}{6}+\frac{13}{18}$$

$$\frac{1}{3}+\frac{1}{6}+\frac{4}{9}$$

Add Fractions

Notes and Guidance

Children continue to represent adding fractions using pictorial methods to explore adding two or more proper fractions where the total is greater than 1

Children can record their totals as an improper fraction but will then convert this to a mixed number using their prior knowledge.

Mathematical Talk

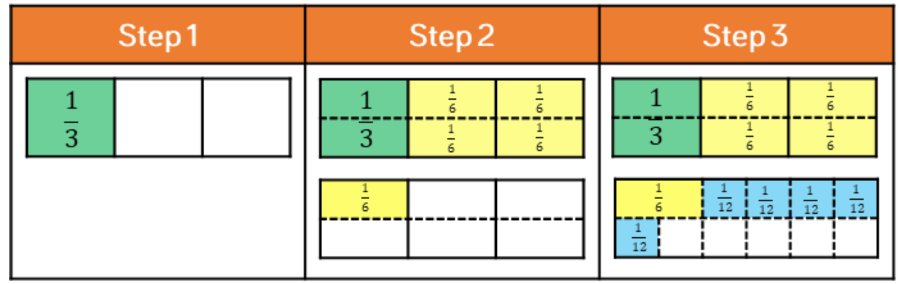
How does the pictorial method support me to add the fractions?

Which common denominator will we use?

How do my times-tables support me to add fractions?

Which representation do you prefer? Why?

Varied Fluency



$\frac{1}{3} + \frac{5}{6} + \frac{5}{12} = 1\frac{7}{12}$

Explain each step of the calculation.
Use this method to help you add the fractions.
Give your answer as a mixed number.

$\frac{2}{3} + \frac{1}{6} + \frac{7}{12}$ $\quad$ $\frac{1}{4} + \frac{7}{8} + \frac{3}{16}$ $\quad$ $\frac{1}{2} + \frac{5}{6} + \frac{5}{12}$

Use the bar model to add the fractions. Record your answer as a mixed number.

$\frac{3}{4} + \frac{3}{8} + \frac{1}{2} =$

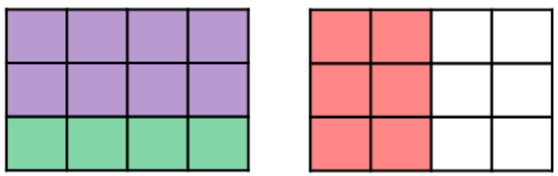
Draw your own models to solve:

$\frac{5}{12} + \frac{1}{6} + \frac{1}{2}$ $\quad$ $\frac{11}{20} + \frac{3}{5} + \frac{1}{10}$ $\quad$ $\frac{3}{4} + \frac{5}{12} + \frac{1}{2}$

Add Fractions

Reasoning and Problem Solving

Annie is adding three fractions.
She uses the model to help her.



What could her three fractions be?

How many different combinations can you find?

Can you write a number story to represent your calculation?

Possible answer:

$$\frac{2}{3} + \frac{4}{12} + \frac{1}{2} = 1\frac{1}{2}$$

Other equivalent fractions may be used.

Example story:
Some children are eating pizzas. Jack eats two thirds, Amir eats four twelfths and Dexter eats half a pizza. How much pizza did they eat altogether?

The sum of three fractions is $2\frac{1}{8}$

The fractions have different denominators.

All of the fractions are greater than or equal to a half.

None of the fractions are improper fractions.

All of the denominators are factors of 8

What could the fractions be?

$$\frac{1}{2} + \frac{3}{4} + \frac{7}{8}$$

Children could be given less clues and explore other possible solutions.

Add Mixed Numbers

Notes and Guidance

Children move on to adding two fractions where one or both are mixed numbers or improper fractions.

They will use a method of adding the wholes and then adding the parts. Children will record their answer in its simplest form.

Children can still draw models to represent adding fractions.

Mathematical Talk

How can we partition these mixed numbers into whole numbers and fractions?

What will the wholes total? Can I add the fractions straight away?

What will these mixed numbers be as improper fractions?

If I have an improper fraction in the question, should I change it to a mixed number first? Why?

Varied Fluency

- $1\frac{1}{3} + 2\frac{1}{6} = 3 + \frac{3}{6} = 3\frac{3}{6}$ or $3\frac{1}{2}$

  $1 + 2 = 3$

  $\frac{1}{3} + \frac{1}{6} = \frac{2}{6} + \frac{1}{6} = \frac{3}{6}$

  Add the fractions by adding the whole first and then the fractions. Give your answer in its simplest form.

  $3\frac{1}{4} + 2\frac{3}{8}$ $\quad$ $4\frac{1}{9} + 3\frac{2}{3}$ $\quad$ $2\frac{5}{12} + 2\frac{1}{3}$

- $1\frac{3}{4} + 2\frac{1}{8} = \frac{7}{4} + \frac{17}{8} = \frac{14}{8} + \frac{17}{8} = \frac{31}{8} = 3\frac{7}{8}$

  Add the fractions by converting them to improper fractions.

  $1\frac{1}{4} + 2\frac{5}{12}$ $\quad$ $2\frac{1}{9} + 1\frac{1}{3}$ $\quad$ $2\frac{1}{6} + 2\frac{2}{3}$

- Add these fractions.

  $4\frac{7}{9} + 2\frac{1}{3}$ $\quad$ $\frac{17}{6} + 1\frac{1}{3}$ $\quad$ $\frac{15}{8} + 2\frac{1}{4}$

  How do they differ from previous examples?

Add Mixed Numbers

Reasoning and Problem Solving

Jack and Whitney have some juice. Jack drinks $2\frac{1}{4}$ litres and Whitney drinks $2\frac{5}{12}$ litres. How much do they drink altogether? Complete this using two different methods. Which method do you think is more efficient? Why?	They drink $4\frac{2}{3}$ litres altogether. Encourage children to justify which method they prefer and why. Ensure children discuss which method is more or less efficient.
Fill in the missing numbers. $4\frac{5}{6} + \square\frac{\square}{\square} = 10\frac{1}{3}$	$5\frac{3}{6}$ or $5\frac{1}{2}$

Subtract Fractions

Notes and Guidance

Children subtract fractions with different denominators for the first time, where one denominator is a multiple of the other.

It is important that subtraction is explored as both take away and finding the difference.

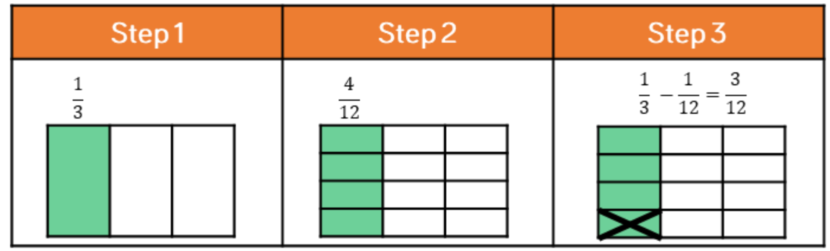
Mathematical Talk

What could the common denominator be?

Can you draw a model to help you solve the problem?

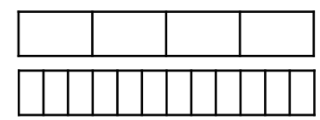
Is it easier to use a take away bar model (single bar model) or a bar model to find the difference (comparison model)?

Varied Fluency

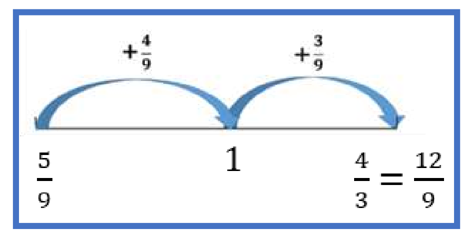


Explain each step of the calculation.
Use this method to help you solve $\frac{5}{6} - \frac{1}{3}$ and $\frac{7}{8} - \frac{5}{16}$

Tommy and Teddy both have the same sized chocolate bar. Tommy has $\frac{3}{4}$ left, Teddy has $\frac{5}{12}$ left.
How much more does Tommy have?



Amir uses a number line to find the difference between $\frac{5}{9}$ and $\frac{4}{3}$



Use this method to find the difference between:

$\frac{3}{4}$ and $\frac{5}{12}$ $\quad$ $\frac{19}{15}$ and $\frac{3}{5}$ $\quad$ $\frac{20}{9}$ and $\frac{4}{3}$

Subtract Fractions

Reasoning and Problem Solving

Which subtraction is the odd one out?

A $\frac{13}{4} - \frac{3}{8}$

B $\frac{10}{3} - \frac{2}{9}$

C $\frac{23}{7} - \frac{1}{3}$

Explain why.

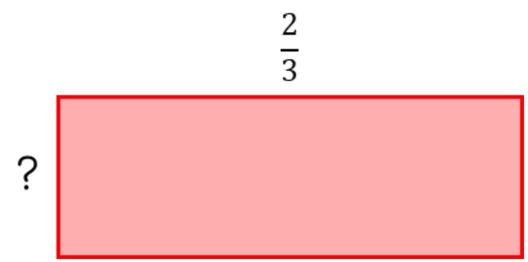
Possible answers:

C is the odd one out because the denominators aren't multiples of each other.

A is the odd one out because the denominators are even.

B is the odd one out because it is the only answer above 3

The perimeter of the rectangle is $\frac{16}{9}$



Work out the missing length.

The missing length is $\frac{2}{9}$

White Rose Maths

Subtract Mixed Numbers (1)

Notes and Guidance

Children apply their understanding of subtracting fractions where one denominator is a multiple of the other to subtract proper fractions from mixed numbers.

They continue to use models and number lines to support their understanding.

Mathematical Talk

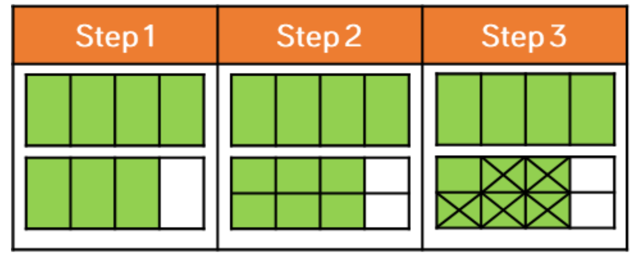
Which fraction is the greatest? How do you know?

If the denominators are different, what can we do?

Can you simplify your answer?

Which method do you prefer when subtracting fractions: taking away or finding the difference?

Varied Fluency



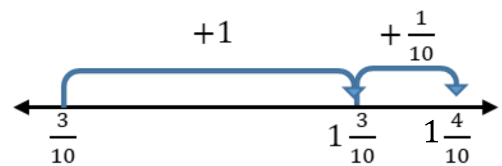
$1\frac{3}{4} - \frac{5}{8} = 1\frac{1}{8}$

Use this method to help you solve:

$2\frac{3}{5} - \frac{3}{10}$ $\quad$ $1\frac{2}{3} - \frac{1}{6}$ $\quad$ $1\frac{5}{6} - \frac{7}{12}$

Use a number line to find the difference between $1\frac{2}{5}$ and $\frac{3}{10}$

$1\frac{2}{5} = 1\frac{4}{10}$



Use a number line to find the difference between:

$3\frac{5}{6}$ and $\frac{1}{12}$ $\quad$ $5\frac{5}{7}$ and $\frac{3}{14}$ $\quad$ $2\frac{7}{9}$ and $\frac{11}{18}$

Solve:

$1\frac{2}{3} - \frac{5}{6}$ $\quad$ $1\frac{3}{4} - \frac{7}{8}$ $\quad$ $2\frac{3}{8} - \frac{11}{16}$

Subtract Mixed Numbers (1)

Reasoning and Problem Solving

Amir is attempting to solve $2\frac{5}{14} - \frac{2}{7}$

Here is his working out:

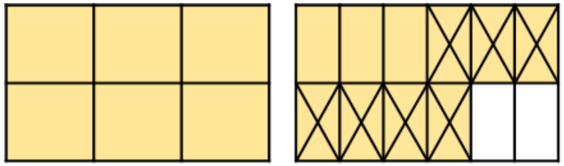
$$2\frac{5}{14} - \frac{2}{7} = 2\frac{3}{7}$$

Do you agree with Amir?
Explain your answer.

Possible answer:

Amir is wrong because he hasn't found a common denominator when subtracting the fractions he has just subtracted the numerators and the denominators. The correct answer is $2\frac{1}{14}$

Here is Rosie's method.
What is the calculation?



Can you find more than one answer?
Why is there more than one answer?

The calculation could be $1\frac{5}{6} - \frac{7}{12}$ or $1\frac{10}{12} - \frac{7}{12}$

There is more than one answer because five sixths and ten twelfths are equivalent. Children should be encouraged to write the question as $1\frac{5}{6} - \frac{7}{12}$ so that all fractions are in their simplest form.

Subtract Mixed Numbers (2)

Notes and Guidance

Children use prior knowledge of fractions to subtract two fractions where one is a mixed number and you need to break one of the wholes up.

They use the method of flexible partitioning to create a new mixed number so they can complete the calculation.

Mathematical Talk

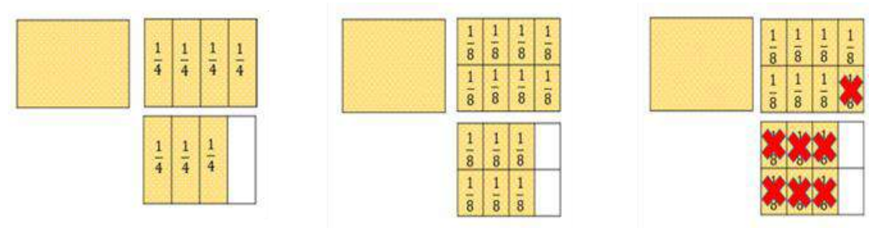
Is flexible partitioning easier than converting the mixed number to an improper fraction?

Do we always have to partition the mixed number?

When can we subtract a fraction without partitioning the mixed number in a different way?

Varied Fluency

- We can work out $2\frac{3}{4} - \frac{7}{8}$ using this method.



Use this method to calculate:

$3\frac{1}{3} - \frac{5}{6}$ $\quad$ $4\frac{1}{5} - \frac{7}{10}$ $\quad$ $5\frac{2}{3} - \frac{4}{9}$

- Use flexible partitioning to solve $7\frac{1}{3} - \frac{5}{6}$

$$7\frac{1}{3} - \frac{5}{6} = 6 + 1\frac{1}{3} - \frac{5}{6} = 6 + 1\frac{2}{6} - \frac{5}{6} = 6\frac{3}{6} = 6\frac{1}{2}$$

Use this method to calculate:

$4\frac{2}{3} - \frac{5}{6}$ $\quad$ $4\frac{1}{5} - \frac{7}{15}$ $\quad$ $5\frac{1}{4} - \frac{7}{8}$

- Mr Brown has $3\frac{1}{4}$ bags of flour. He uses $\frac{7}{8}$ of a bag. How much flour does he have left?

Subtract Mixed Numbers (2)

Reasoning and Problem Solving

Place 2, 3 and 4 in the boxes to make the calculation correct.

$$27\frac{1}{\square} - \frac{\square}{6} = 26\frac{\square}{3}$$

$27\frac{1}{3} - \frac{4}{6} = 26\frac{2}{3}$

3 children are working out $6\frac{2}{3} - \frac{5}{6}$

They partition the mixed number in the following ways to help them.

Dora $5 + 1\frac{2}{3} - \frac{5}{6}$

Alex $5 + 1\frac{4}{6} - \frac{5}{6}$

Jack $5 + \frac{10}{6} - \frac{5}{6}$

Are they all correct?
Which method do you prefer?
Explain why.

All three children are correct.

$1\frac{2}{3}$, $1\frac{4}{6}$ and $\frac{10}{6}$ are all equivalent therefore all three methods will help children to correctly calculate the answer.

Subtract 2 Mixed Numbers

Notes and Guidance

Children use different strategies to subtract two mixed numbers.

Building on learning in previous steps, they look at partitioning the mixed numbers into wholes and parts and build on their understanding of flexible partitioning as well as converting to improper fractions when an exchange is involved.

Mathematical Talk

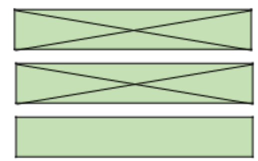
Why is subtracting the wholes and parts separately easier with some fractions than others?

Can you show the subtraction as a difference on a number line? Bar model? How are these different to taking away?

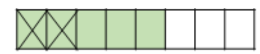
Does making the whole numbers larger make the subtraction any more difficult? Explain why.

Varied Fluency

Here is a bar model to calculate $3\frac{5}{8} - 2\frac{1}{4}$



$3 - 2 = 1$



$\frac{5}{8} - \frac{1}{4} = \frac{5}{8} - \frac{2}{8} = \frac{3}{8}$

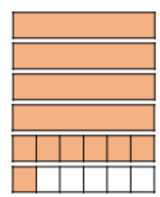
$3\frac{5}{8} - 2\frac{1}{4} = 1\frac{3}{8}$

Use this method to calculate:

$3\frac{7}{8} - 2\frac{3}{4}$ $\quad$ $5\frac{5}{6} - 2\frac{1}{3}$ $\quad$ $3\frac{8}{9} - 2\frac{5}{27}$

Why does this method not work effectively for $5\frac{1}{6} - 2\frac{1}{3}$?

Here is a method to calculate $5\frac{1}{6} - 2\frac{1}{3}$



$5\frac{1}{6} - 2\frac{1}{3} = 4\frac{7}{6} - 2\frac{1}{3} = 4\frac{7}{6} - 2\frac{2}{6} = 2\frac{5}{6}$

Use this method to calculate:

$3\frac{1}{4} - 2\frac{5}{8}$ $\quad$ $5\frac{1}{3} - 2\frac{7}{12}$ $\quad$ $27\frac{1}{3} - 14\frac{7}{15}$

Subtract 2 Mixed Numbers

Reasoning and Problem Solving

There are three colours of dog biscuits in a bag of dog food: red, brown and orange. The total mass of the dog food is 7 kg. The mass of red biscuits is $3\frac{3}{4}$ kg and the mass of the brown biscuits is $1\frac{7}{16}$ kg. What is the mass of orange biscuits?	$3\frac{3}{4} + 1\frac{7}{16} = 5\frac{3}{16}$ $7 - 5\frac{3}{16} = 1\frac{13}{16}$ The mass of orange biscuits is $1\frac{13}{16}$ kg.

Rosie has $20\frac{3}{4}$ cm of ribbon. Annie has $6\frac{7}{8}$ cm less ribbon than Rosie. How much ribbon does Annie have? How much ribbon do they have altogether?	Annie has $13\frac{7}{8}$ cm of ribbon. Altogether they have $34\frac{5}{8}$ cm of ribbon.

Multiply by an Integer (1)

Notes and Guidance

Children are introduced to multiplying fractions by a whole number for the first time. They link this to repeated addition and see that the denominator remains the same, whilst the numerator is multiplied by the integer.
This is shown clearly through the range of models to build the children's conceptual understanding of multiplying fractions.
Children should be encouraged to simplify fractions where possible.

Mathematical Talk

How is multiplying fractions similar to adding fractions?

What is the same/different between: $\frac{3}{4} \times 2$ and $2 \times \frac{3}{4}$?

Which bar model do you find the most useful?

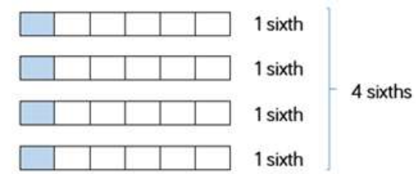
Which bar model helps us to convert from an improper fraction to a mixed number most effectively?

What has happened to the numerator/denominator?

Varied Fluency

Work out $\frac{1}{6} \times 4$ by counting in sixths.

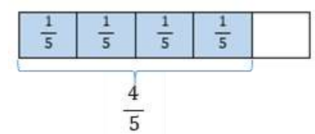
$\frac{1}{6} \times 4 = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{4}{6} = \frac{2}{3}$



Use this method to work out:

$2 \times \frac{1}{3}$ $\frac{1}{5} \times 3$ $6 \times \frac{1}{10}$

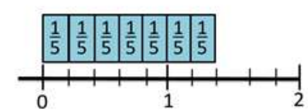
Mo uses a single bar model to work out: $\frac{1}{5} \times 4 = \frac{4}{5}$



Use this method to work out:

$\frac{1}{4} \times 3$ $6 \times \frac{1}{8}$ $\frac{1}{10} \times 8$

Eva uses a number line and repeated addition to work out $\frac{1}{5} \times 7 = \frac{7}{5} = 1\frac{2}{5}$



Use this method to work out:

$5 \times \frac{1}{8}$ $\frac{1}{3} \times 3$ $\frac{1}{4} \times 7$

Multiply by an Integer (1)

Reasoning and Problem Solving

Amir is multiplying fractions by a whole number.

$\frac{1}{5} \times 5 = \frac{5}{25}$

Can you explain his mistake?

Amir has multiplied both the numerator and the denominator so he has found an equivalent fraction. Encourage children to draw models to represent this correctly.

Always, sometimes, never?

When you multiply a unit fraction by the same number as it's denominator the answer will be one whole.

Always - because the numerator was 1 it will always be the same as your denominator when multiplied which means that it is a whole.
e.g. $\frac{1}{3} \times 3 = \frac{3}{3} = 1$

I am thinking of a unit fraction.

When I multiply it by 4 it will be equivalent to $\frac{1}{2}$

When I multiply it by 2 it will be equivalent to $\frac{1}{4}$

What is my fraction?

What do I need to multiply my fraction by so that my answer is equivalent to $\frac{3}{4}$?

Can you create your own version of this problem?

$\frac{1}{8}$ because
$4 \times \frac{1}{8} = \frac{4}{8} = \frac{1}{2}$
and
$2 \times \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$

6 because
$6 \times \frac{1}{8} = \frac{6}{8} = \frac{3}{4}$

Multiply by an Integer (2)

Notes and Guidance

Children apply prior knowledge of multiplying a unit fraction by a whole number to multiplying a non-unit fraction by a whole number.
They use similar models and discuss which method will be the most efficient depending on the questions asked.
Reinforce the concept of commutativity by showing examples of the fraction first and the integer first in the multiplication.

Mathematical Talk

Can you show me 3 lots of $\frac{3}{10}$ on a bar model?

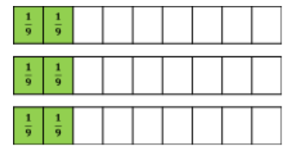
How many tenths do we have altogether?

How does repeated addition help us with this multiplication?

How does a number line help us see the multiplication?

Varied Fluency

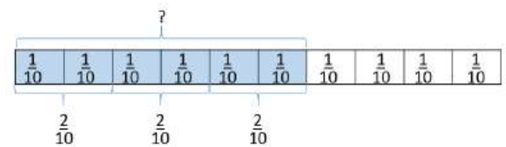
- Count the number of ninths to work $3 \times \frac{2}{9}$



Use this method to work out:

$\frac{3}{8} \times 2$ $\frac{5}{16} \times 3$ $4 \times \frac{2}{11}$

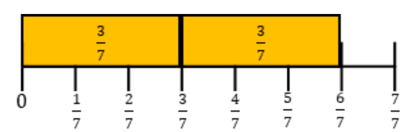
- Use the model to help you solve $3 \times \frac{2}{10}$



Use this method to work out:

$\frac{2}{7} \times 3$ $\frac{3}{16} \times 4$ $4 \times \frac{5}{12}$

- Use the number line to help you solve $2 \times \frac{3}{7}$



Use this method to work out:

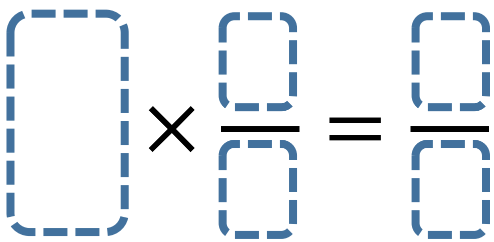
$\frac{3}{10} \times 3$ $\frac{2}{7} \times 2$ $4 \times \frac{3}{20}$

Multiply by an Integer (2)

Reasoning and Problem Solving

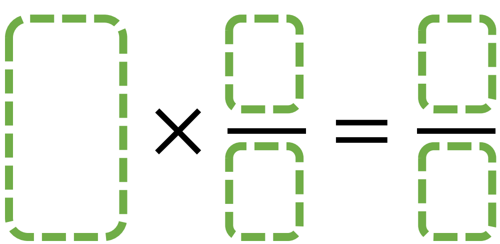
Use the digit cards only once to complete these multiplications.

9 2 4 6 3



$2 \times \frac{3}{4} = \frac{9}{6}$

1 2 3 4 5 6

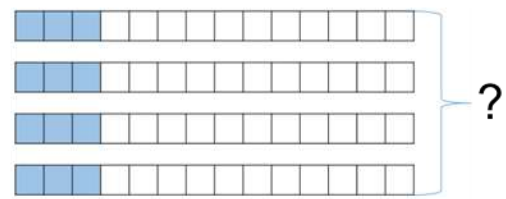


Possible answers:

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

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

Whitney has calculated $4 \times \frac{3}{14}$



From the picture I can see that $4 \times \frac{3}{14} = \frac{12}{56}$

Do you agree?

Explain why.

Possible answer:

I disagree. Whitney has shaded 12 fourteenths. She has counted all of the boxes to give her the denominator when it is not needed. The answer should be $\frac{12}{14}$ or $\frac{6}{7}$

Multiply by an Integer (3)

Notes and Guidance

Children use their knowledge of fractions to multiply a mixed number by a whole number.

They use the method of repeated addition, multiplying the whole and part separately and the method of converting to an improper fraction then multiplying.

Continue to explore visual representations such as the bar model.

Mathematical Talk

How could you represent this mixed number?

What is the denominator? How do you know?

How many wholes are there? How many parts are there?

What is multiplying fractions similar to? (repeated addition)

What representation could you use to convert a mixed number to an improper fraction?

Varied Fluency

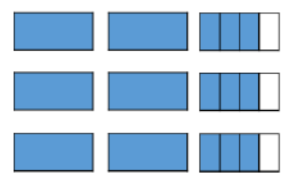
- Use repeated addition to work out $2\frac{2}{3} \times 4$

$$2\frac{2}{3} \times 4 = 2\frac{2}{3} + 2\frac{2}{3} + 2\frac{2}{3} + 2\frac{2}{3} = 8\frac{8}{3} = 10\frac{2}{3}$$

Use this method to solve:

$2\frac{1}{6} \times 3$ $\quad 1\frac{3}{7} \times 2$ $\quad 3\frac{1}{3} \times 4$

- Partition your fraction to help you solve $2\frac{3}{4} \times 3$



$2 \times 3 = 6$

$\frac{3}{4} \times 3 = \frac{9}{4} = 2\frac{1}{4}$

$6 + 2\frac{1}{4} = 8\frac{1}{4}$

Use this method to answer:

$2\frac{5}{6} \times 3$ $\quad 3\frac{4}{7} \times 2$ $\quad 2\frac{1}{3} \times 5$

$$1\frac{5}{6} \times 3 = \frac{11}{6} \times 3 = \frac{33}{6} = 5\frac{3}{6} = 5\frac{1}{2}$$

- Convert to an improper fraction to calculate:

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

Multiply by an Integer (3)

Reasoning and Problem Solving

Jack runs $2\frac{2}{3}$ miles three times per week.

Dexter runs $3\frac{3}{4}$ miles twice a week.

Who runs the furthest during the week?

Explain your answer.

Jack runs $2\frac{2}{3} \times 3 = 8$ miles.

Dexter runs $3\frac{3}{4} \times 2 = 7\frac{1}{2}$ miles.

Jack runs further by half a mile.

Work out the missing numbers.

$$2\frac{\boxed{}}{8} \times \boxed{} = 7\frac{7}{8}$$

Explain how you worked it out.

Possible answer:

$2\frac{5}{8} \times 3 = 7\frac{7}{8}$

I knew that the multiplier could not be 4 because that would give an answer of at least 8. So the multiplier had to be 3. That meant that the missing numerator had to give a product of 15. I knew that 5 multiplied by 3 would give 15

Fractions of a Quantity

Notes and Guidance

Children use their knowledge of finding unit fractions of a quantity, to find non-unit fractions of a quantity.

They use concrete and pictorial representations to support their understanding. Children link bar modelling to the abstract method in order to understand why the method works.

Mathematical Talk

What is the whole? What fraction of the whole are we finding? How many equal parts will I divide the whole into?

What's the same and what's different about the calculations? Can you notice a pattern?

What fraction of her chocolate bar does Whitney have left? How many grams does she have left? Can you represent this on a bar model?

Varied Fluency

R

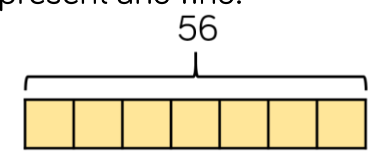
- Mo has 12 apples.
  Use counters to represent his apples and find:
  $\frac{1}{2}$ of 12 $\frac{1}{4}$ of 12 $\frac{1}{3}$ of 12 $\frac{1}{6}$ of 12

  Now calculate:
  $\frac{2}{2}$ of 12 $\frac{3}{4}$ of 12 $\frac{2}{3}$ of 12 $\frac{5}{6}$ of 12

  What do you notice? What's the same and what's different?

- Use a bar model to help you represent and find:

  $\frac{1}{7}$ of 56 = 56 ÷ $\boxed{}$

  $\frac{2}{7}$ of 56 $\frac{3}{7}$ of 56 $\frac{4}{7}$ of 56 $\frac{4}{7}$ of 28 $\frac{7}{7}$ of 28

- Whitney eats $\frac{3}{8}$ of 240 g bar of chocolate.
  How many grams of chocolate has she eaten?

Fractions of a Quantity

Reasoning and Problem Solving

R

True or False?

To find $\frac{3}{8}$ of a number, divide by 3 and multiply by 8

Convince me.

False.
Divide the whole by 8 to find one eighth and then multiply by three to find three eighths of a number.

Ron gives $\frac{2}{9}$ of a bag of 54 marbles to Alex.

Teddy gives $\frac{3}{4}$ of a bag of marbles to Alex.

Ron gives Alex more marbles than Teddy.

How many marbles could Teddy have to begin with?

$$\frac{2}{9} \text{ of } 54 > \frac{3}{4} \text{ of } \square$$

Teddy could have 16, 12, 8 or 4 marbles to begin with.

Fraction of an Amount

Notes and Guidance

Children recap previous learning surrounding finding unit and non-unit fractions of amounts, quantities and measures.

It is important that the concept is explored pictorially through bar models to support children to make sense of the abstract.

Mathematical Talk

How many equal groups have you shared 49 into? Why?

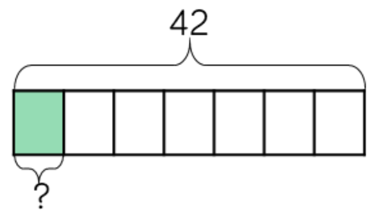
What does each equal part represent as a fraction and an amount?

What could you do to 1 metre to make the calculation easier?

1 litre = ____ ml 1 kg = _____ g

Varied Fluency

Find $\frac{1}{7}$ of 42

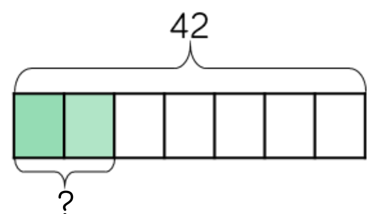


$42 \div 7 = 6$
$\frac{1}{7}$ of 42 is 6

Use this method to find:

$\frac{1}{8}$ of 56 $\frac{1}{6}$ of 480 $\frac{1}{9}$ of 81 m

Find $\frac{2}{7}$ of 42



$42 \div 7 = 6$
$6 \times 2 = 12$
$\frac{2}{7}$ of 42 is 12

Use this method to find:

$\frac{3}{8}$ of 56 $\frac{5}{6}$ of 480 $\frac{4}{9}$ of 81 m

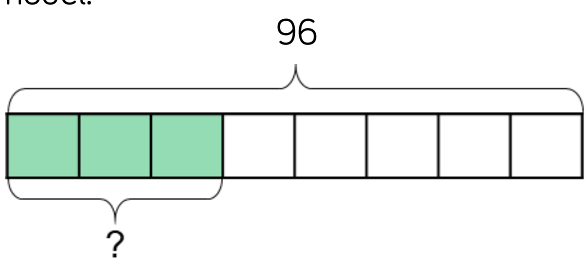
Draw a bar model to help you calculate:

$\frac{4}{5}$ of 1 m $\frac{5}{12}$ of 1.44 litres $\frac{3}{7}$ of 21 kg

Fraction of an Amount

Reasoning and Problem Solving

Write a problem that matches the bar model.



What other questions could you ask from this model?

Possible response:

There are 96 cars in a car park. $\frac{3}{8}$ of them are red. How many cars are red?

How many were not red? etc.

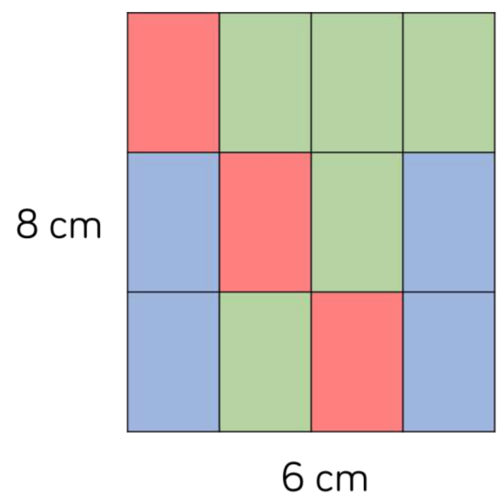
$\frac{7}{16}$ of a class are boys.

There are 18 girls in the class.

How many children are in the class?

There are 32 children in the class.

Find the area of each colour in the rectangle.



What would happen if one of the red or green rectangles was changed to a blue?

Area of rectangle: $6 \times 8 = 48$ cm^2

Blue

$\frac{4}{12}$ of $48 = 16$ cm^2

Red

$\frac{3}{12}$ of $48 = 12$ cm^2

Green

$\frac{5}{12}$ of $48 = 20$ cm^2

Children need to show that this would impact both the blue and the other colour.

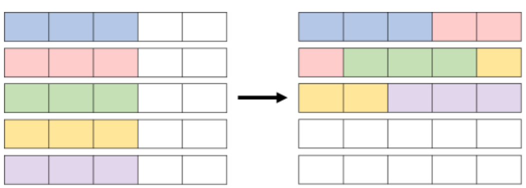
Fractions as Operators

Notes and Guidance

Children link their understanding of fractions of amounts and multiplying fractions to use fractions as operators.

They use their knowledge of commutativity to help them understand that you can change the order of multiplication without changing the product.

Mathematical Talk



What is the same and different about these bar models?

Is it easier to multiply a fraction or find a fraction of an amount?

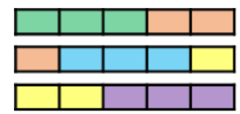
Does it depend on the whole number you are multiplying by?

Can you see the link between the numbers?

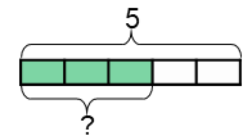
Varied Fluency

Tommy has calculated and drawn a bar model for two calculations.

$5 \times \frac{3}{5} = \frac{15}{5} = 3$



$\frac{3}{5}$ of $5 = 3$



What's the same and what's different about Tommy's calculations?

Complete:

2 lots of $\frac{1}{10} = \square$ $\frac{1}{10}$ of $2 = \square$

6 lots of $\square = 3$ $\square$ of $6 = 3$

8 lots of $\frac{1}{4} = \square$ $\frac{1}{4}$ of $8 = \square$

Which calculation on each row is easier? Why?

Use this to complete:

$20 \times \frac{4}{5} = \frac{\square}{\square}$ of $20 = \square$

$\square \times \frac{2}{3} = \frac{\square}{\square}$ of $18 = 12$

$\square \times \frac{1}{3} = \frac{1}{3}$ of $\square = 20$

White Rose Maths

Fractions as Operators

Reasoning and Problem Solving

Which method would you use to complete these calculations: multiply the fractions or find the fraction of an amount? Explain your choice for each one. Compare your method to your partner. $25 \times \frac{3}{5}$ or $\frac{3}{5}$ of 25 $6 \times \frac{2}{3}$ or $\frac{2}{3}$ of 6 $5 \times \frac{3}{8}$ or $\frac{3}{8}$ of 5	Possible response: 1. Children may find it easier to find 3 fifths of 25 rather than multiply 25 by 3 2. Children may choose either as they are of similar efficiency. 3. Children will probably find it more efficient to multiply than divide 5 by 8
Dexter and Jack are thinking of a two-digit number between 20 and 30 Dexter finds two thirds of the number. Jack multiplies the number by $\frac{2}{3}$ Their new two-digit number has a digit total that is one more than that of their original number. What number did they start with? Show each step of their calculation.	They started with 24 Dexter: $24 \div 3 = 8$ $8 \times 2 = 16$ Jack: $24 \times 2 = 48$ $48 \div 3 = 16$

White Rose Maths

Spring - Block 3

Decimals & Percentages

Overview

Small Steps

- Decimals up to 2 d.p.
- Decimals as fractions (1)
- Decimals as fractions (2)
- Understand thousandths
- Thousandths as decimals
- Rounding decimals
- Order and compare decimals
- Understand percentages
- Percentages as fractions and decimals
- Equivalent F.D.P.

Notes for 2020/21

There are no recap steps here as this is all new learning for Year 5, building on the fractions block.

Children learn that both proper fractions and decimals can be used to represent values between whole numbers.

Rounding builds on earlier work on place value and explores different contexts, including measures.

White Rose Maths

Decimals up to 2 d.p.

Notes and Guidance

Children use place value counters and a place value grid to make numbers with up to two decimal places.

They read and write decimal numbers and understand the value of each digit.

They show their understanding of place value by partitioning decimal numbers in different ways.

Mathematical Talk

How many ones/tenths/hundredths are in the number?
How do we write this as a decimal? Why?

What is the value of the ____ in the number ______?

When do we need to use zero as a place holder?

How can we partition decimal numbers in different ways?

Varied Fluency

Which number is represented on the place value chart?

Ones	Tenths	Hundredths
	0.1	0.01 0.01
0	1	2

There are ____ ones, ____ tenths and ____ hundredths.

The number is ____

Represent the numbers on a place value chart and complete the stem sentences.

0.28 | 0.65 | 0.07 | 1.26

Make the numbers with place value counters and write down the value of the underlined digit.

2.<u>4</u>5 | 3.0<u>4</u> | <u>4</u>.44 | <u>4</u>3.34

$0.76 = 0.7 + 0.06 = 7$ tenths and 6 hundredths.
Fill in the missing numbers.

$0.83 =$ _____ $+ 0.03 =$ ______________ and 3 hundredths.

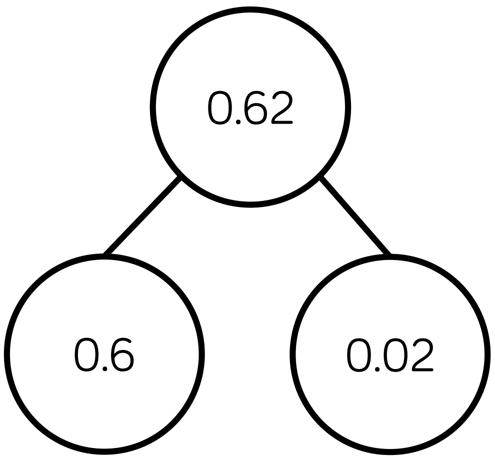
$0.83 = 0.7 +$ _____ $= 7$ tenths and ______________

How many other ways can you partition 0.83?

Decimals up to 2 d.p.

Reasoning and Problem Solving

Dexter says there is only one way to partition 0.62



Prove Dexter is incorrect by finding at least three different ways of partitioning 0.62

0.62 = 0.12 + 0.5

0.62 = 0.4 + 0.22

0.62 = 0.3 + 0.32

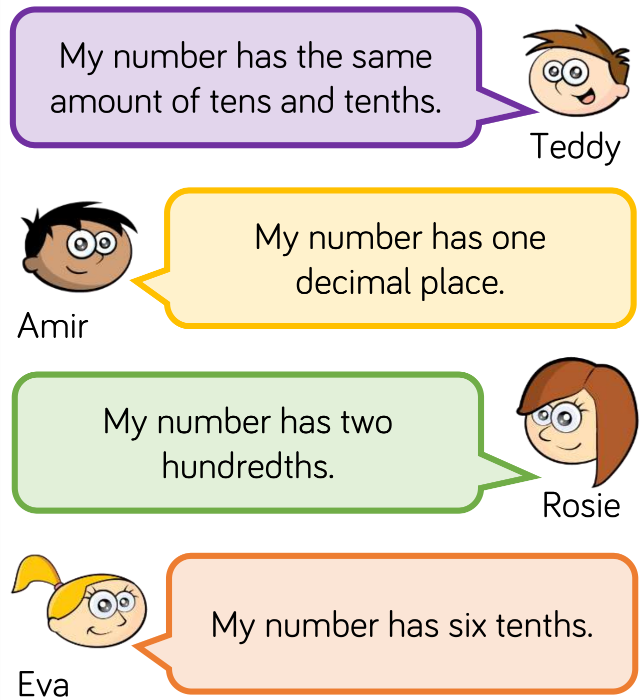
0.62 = 0.42 + 0.2

0.62 = 0.1 + 0.52

0.62 = 0.03 + 0.59

etc.

Match each description to the correct number.



46.2	2.64	46.02	40.46

Teddy – 40.46
Amir – 46.2
Rosie – 46.02
Eva – 2.64

Decimals as Fractions (1)

Notes and Guidance

Children explore the relationship between decimals and fractions. They start with a fraction (including concrete and pictorial representations of fractions) convert it into a decimal and as they progress, children will see the direct link between fractions and decimals.

Children use their previous knowledge of fractions to aid this process.

Mathematical Talk

What does the whole grid represent?

What can we use to describe the equal parts of the grid (fractions and decimals)?

How would you convert a fraction to a decimal?

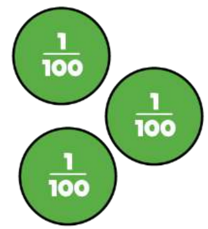
What does the decimal point mean?

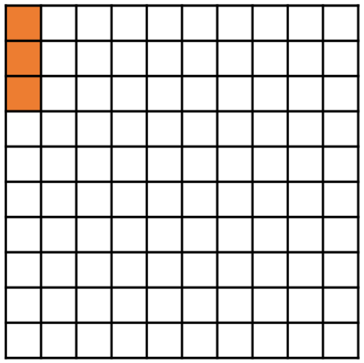
Can the fraction be simplified?

How can you prove that the decimal ____ and the fraction ____ are the same?

Varied Fluency

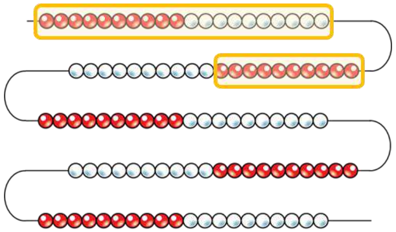
What fraction is shown in both representations?
Can you convert this in to a decimal?





The fraction $\frac{\square}{\square}$ is the same as the decimal ______

If the whole bead string represents one whole, what decimal is represented by the highlighted part? Can you represent this on a 100 square?

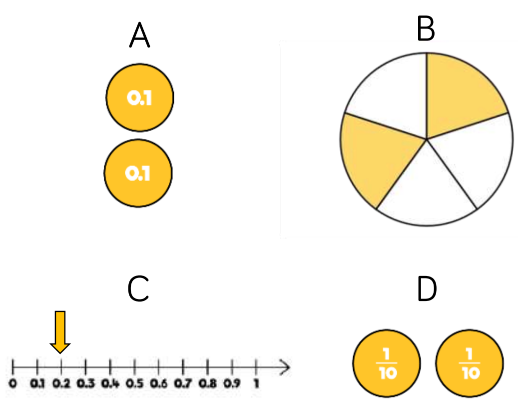


Decimals as Fractions (1)

Reasoning and Problem Solving

Odd one out

Which of the images below is the odd one out?



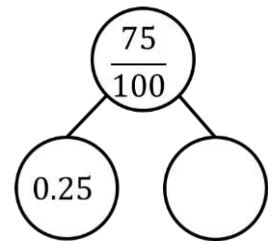
Explain why.

Possible answer:

B is the odd one out because it shows $\frac{2}{5}$, which is $\frac{4}{10}$ or 0.4

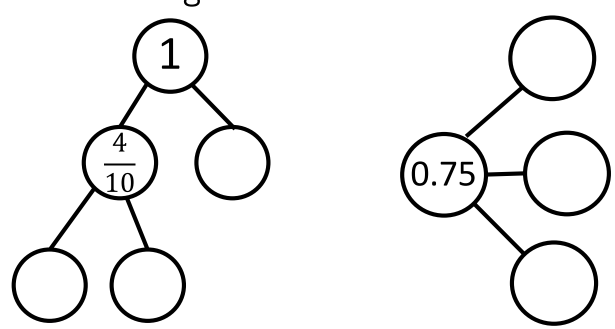
The other images show $\frac{2}{10}$ or 0.2

How many different ways can you complete the part-whole model using fractions and decimals?



Create another part-whole model like the one above for your partner to complete.

Now complete the following part-whole models using fractions and decimals.



Possible answers:

$\frac{50}{100}$

$\frac{1}{2}$

0.5

There are various possible answers when completing the part-whole models. Ensure both fractions and decimals are represented.

Decimals as Fractions (2)

Notes and Guidance

Children concentrate on more complex decimals numbers (e.g. 0.96, 0.03, 0.27) and numbers greater than 1 (e.g. 1.2, 2.7, 4.01).

They represent them as fractions and as decimals.

Children record the number in multiple representations, including expanded form and in words.

Mathematical Talk

In the number 1.34 what does the 1 represent, what does the 3 represent, what does the 4 represent?

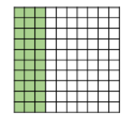
Can we represent this number in a different way, and another, and another?

On the number line, where can we see tenths? Where can we see hundredths?

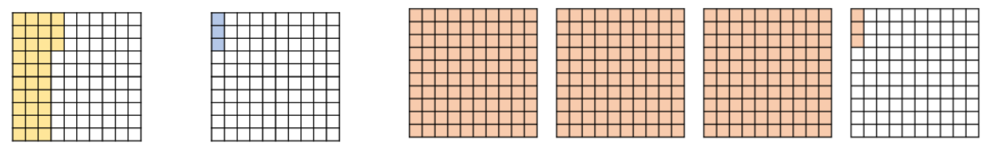
On the number line, tell me another number that is between c and d. Now give your answer as a fraction. Tell me a number that is not between c and d.

Varied Fluency

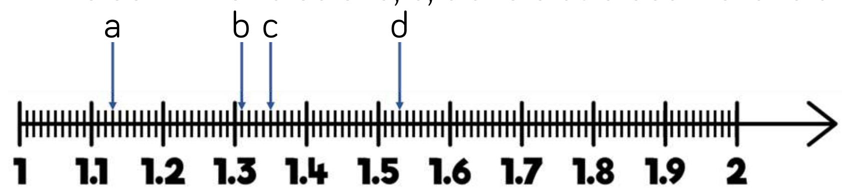
- Use the models to record equivalent decimals and fractions.



$$0.3 = \frac{3}{10} = \frac{30}{100}$$



- Write down the value of a, b, c and d as a decimal and a fraction.



- Complete the table.

Concrete	Decimal	Decimal – expanded form	Fraction	Fraction – expanded form	In words
	3.24	3 + 0.2 + 0.04	$3\frac{24}{100}$	$3+\frac{2}{10}+\frac{4}{100}$	Three ones, two tenths and four hundredths.
	3.01		$3\frac{1}{100}$		
				$3+\frac{4}{10}+\frac{2}{100}$	
					Two ones, three tenths and two hundredths.

Decimals as Fractions (2)

Reasoning and Problem Solving

2.25 = 2 ones, 2 tenths and 5 hundredths. Can you write the following numbers in at least three different ways? 23.7 2.37 9.08 0.98	Possible answer: Children may represent it in words, decimals, fractions, expanded form but also by partitioning the number in different ways.
Amir says, "To convert a fraction to a decimal, take the numerator and put it after the decimal point. E.g. $\frac{21}{100} = 0.21$"  Write two examples of converting fractions to decimals to prove this does not always work.	Possible answers could include $\frac{1}{100}$ is not equal to 0.1

Use the digits 3, 4 and 5 to complete the decimal number. □ 0 . □ □ List all the possible numbers you can make.	30.45, 30.54, 40.35, 40.53, 50.43, 50.34
Write these decimals as mixed numbers. Choose three of the numbers and write them in words.	$30\frac{45}{100}$, $30\frac{54}{100}$, $40\frac{35}{100}$, $40\frac{53}{100}$, $50\frac{43}{100}$, $50\frac{34}{100}$

Understand Thousandths

Notes and Guidance

Children build on previous learning of tenths and hundredths and apply this to understanding thousandths.
Opportunities to develop understanding of thousandths through the use of concrete and pictorial representations need to be incorporated.
When exploring the relationships between tenths, hundredths and thousandths, consider decimal and mixed number equivalences.

Mathematical Talk

If 4 tenths = 0.4, 4 hundredths = 0.04, what is 4 thousandths equal to?

Using the place value charts:

- How many tenths are in a whole?
- How many hundredths are there in 1 tenth?
- Using place value counters complete the final chart.
- How many thousandths in 1 hundredth?

Varied Fluency

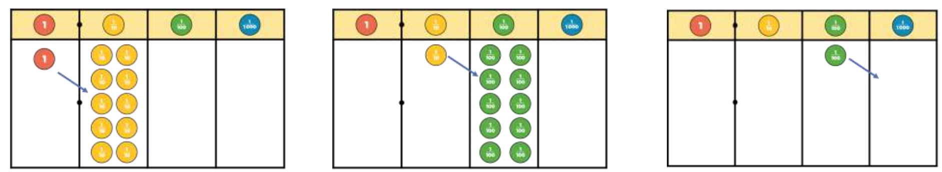
Eva is using Base 10 to represent decimals.

= 1 whole = 1 tenth = 1 hundredth = 1 thousandth

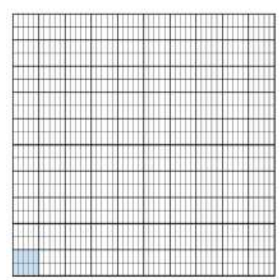
Use Base 10 to build:

- 4 wholes, 4 tenths, 4 hundredths, 4 thousandths
- 5 tenths, 7 hundredths and 5 thousandths
- 2.357

Use the place value counters to help you fill in the final chart.



1 = ___ tenths $\frac{1}{10}$ = ___hundredths $\frac{1}{100}$ = ___ thousandths

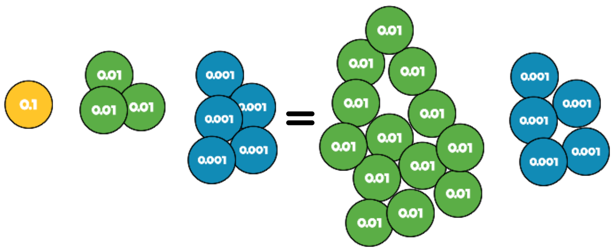


What has this hundred square been divided up into?
How many thousandths are there in one hundredth?
How many thousandths are in one tenth?

Understand Thousandths

Reasoning and Problem Solving

Rosie thinks the 2 values are equal.



Do you agree?
Explain your thinking.

Can you write this amount as a decimal and as a fraction?

Agree.

We can exchange ten hundredth counters for one tenth counter.

$0.135 = \frac{135}{1000}$

0.394

$= 3$ tenths, 9 hundredths and 4 thousandths

$= \frac{3}{10} + \frac{9}{100} + \frac{4}{1000}$

$= 0.3 + 0.09 + 0.004$

Write these numbers in three different ways:

0.472 | 0.529 | 0.307

$0.472 = 4$ tenths, seven hundredths and 2 thousandths $= \frac{4}{10} + \frac{7}{100} + \frac{2}{1000} = 0.4 + 0.07 + 0.002$

$0.529 = 5$ tenths, two hundredths and 9 thousandths $= \frac{5}{10} + \frac{2}{100} + \frac{9}{1000} = 0.5 + 0.02 + 0.009$

$0.307 = 3$ tenths and 7 thousandths $= \frac{3}{10} + \frac{7}{1000} = 0.3 + 0.007$

Thousandths as Decimals

Notes and Guidance

Children build on their understanding of decimals and further explore the link between tenths, hundredths and thousandths.

They represent decimals in different ways and also explore deeper connections such as $\frac{100}{1000}$ is the same as $\frac{1}{10}$

Mathematical Talk

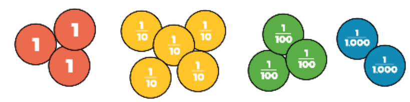
What number is represented? How will we show this on the place value chart? How many ones/tenths/hundredths/ thousandths do I have?

Where would 2.015 be positioned on the number line? How many thousandths do I have? How do I record this as a mixed number?

Varied Fluency

Use the place value chart and counters to represent these numbers.
Write down the numbers as a decimal.

a)

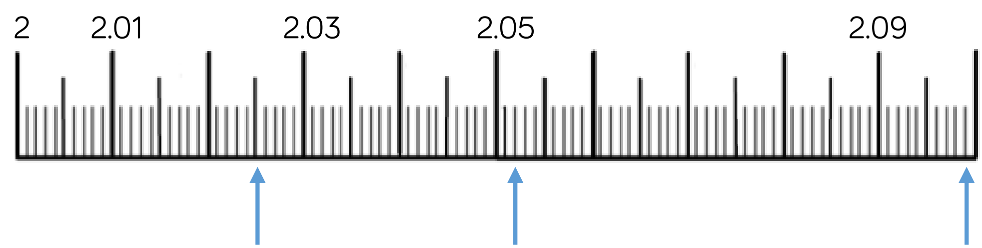


1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

b) 4 ones, 6 tenths, 0 hundredths and 2 thousandths

c) $3\frac{34}{1000}$

The arrows are pointing to different numbers.
Write each number as a decimal and then as a mixed number.



Thousandths as Decimals

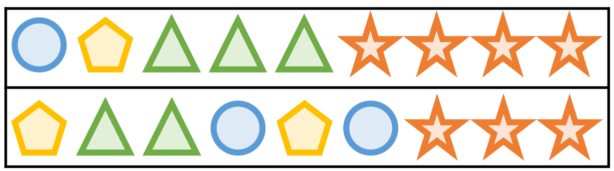
Reasoning and Problem Solving

Ron has 8 counters. He makes numbers using the place value chart.
At least 3 columns have counters in.
What is the largest and the smallest number he can make with 8 counters?

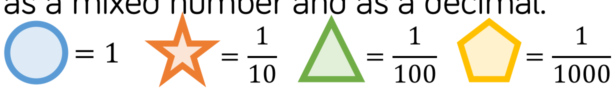
1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

Can you record the numbers in different ways?

Smallest: 0.116
Largest: 6.11



In this problem symbols have been used to represent two different numbers. Write down the value of each, as a mixed number and as a decimal.



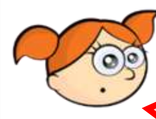
1.431

2.322

Three children are representing the number 0.504

$0.504 = \frac{504}{1000}$

Annie



Alex

$0.504 = \frac{3}{10} + \frac{2}{10} + \frac{4}{1000}$

$0.504 = \frac{5}{10} + \frac{4}{1000}$

Teddy

Who is correct?
Explain why.

Possible answer:

They are all correct. Annie has recorded it as a fraction. Alex and Teddy have partitioned it differently.

Rounding Decimals

Notes and Guidance

Children develop their understanding of rounding to the nearest whole number and to the nearest tenth.

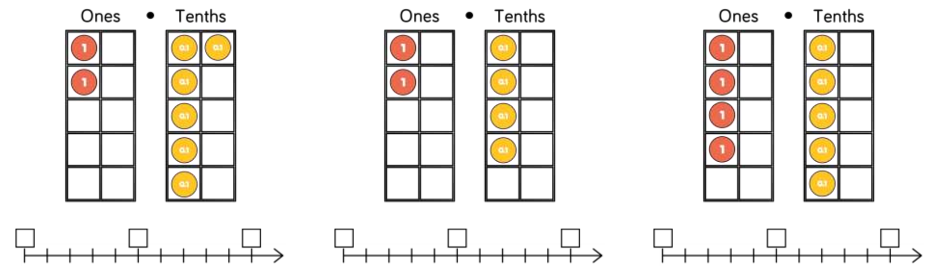
Number lines support children to understand where numbers appear in relation to other numbers and are important in developing conceptual understanding of rounding.

Mathematical Talk

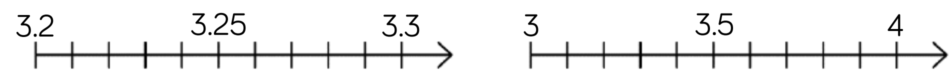
What number do the ones and tenths counters represent?
How many decimal places does it have?
When rounding to the nearest one decimal place, how many digits will there be after the decimal point?
Where would 3.25 appear on both number lines?
What is the same and what is different about the two number lines?

Varied Fluency

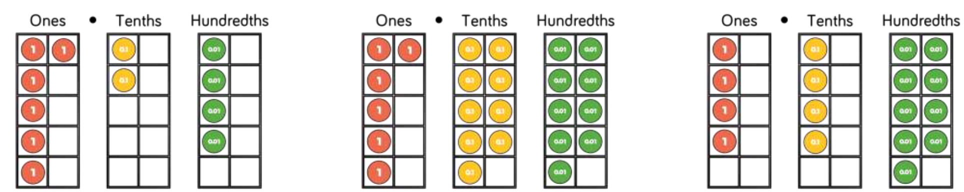
Complete the number lines and round the representations to the nearest whole number:



Use the number lines to round 3.24 to the nearest tenth and the nearest whole number.



Round each number to the nearest tenth and nearest whole number. Use number lines to help you.



Round Decimals

Reasoning and Problem Solving

Dexter is measuring a box of chocolates with a ruler that measures in centimetres and millimetres.  He measures it to the nearest cm and writes the answer 28 cm. What is the smallest length the box of chocolates could be?	Smallest: 27.5 cm
Whitney is thinking of a number.  Rounded to the nearest whole her number is 4 Rounded to the nearest tenth her number is 3.8 Write down at least 4 different numbers that she could be thinking of.	Possible answers: 3.84 3.83 3.82 etc. Some children might include answers such as 3.845

A number between 11 and 20 with 2 decimal places rounds to the same number when rounded to one decimal place and when rounded to the nearest whole number? What could this be? Is there more than one option? Explain why.	The whole number can range from 11 to 19 and the decimal places can range from ___.95 to ___.99 Can children explain why this works?

Order & Compare Decimals

Notes and Guidance

Children order and compare numbers with up to three decimal places.

They use place value counters to represent the numbers they are comparing.

Number lines support children to understand where numbers appear in relation to other numbers.

Mathematical Talk

What number is represented by the place value counters?

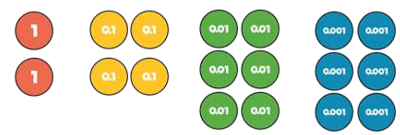
______ is greater/less than ______ because…

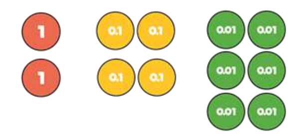
Explain how you know.

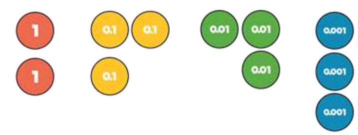
Can you build the numbers using place value counters? How can you use these concrete representations to compare sizes?

Varied Fluency

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



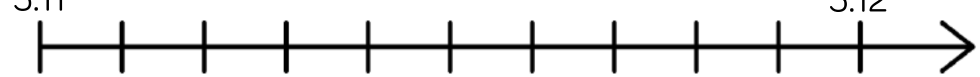




$13.33 \div 10$

Place the numbers in ascending order on the number line.

3.115	$3\frac{113}{1000}$	Three and 11 hundredths



Place in descending order.

- 0.123 0.321 0.231 0.103
- 3.2 km 3.21 km 3.212 km 3202 m
- 65.394 65.309 63.999 65.493

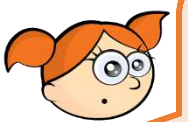
Check your answers using place value chart.

White Rose Maths

Order & Compare Decimals

Reasoning and Problem Solving

Alex says,



3.105 is greater than 3.2 because 105 is greater than 2

Do you agree?
Explain your answer.

Alex is wrong because 2 tenths is larger than 105 thousandths.

Tommy says,

I have put some numbers into ascending order:

3.015

$3\frac{51}{1000}$

3.105

$3\frac{51}{100}$

Tommy has missed one number out.
It should go in the middle of this list.
What could his number be?
What can't his number be?

Could be:
3.052
3.053
3.054
3.104 etc.

It can't be a number below 3.051 or above 3.105

Understand Percentages

Notes and Guidance

Children are introduced to 'per cent' for the first time and will understand that 'per cent' relates to 'number of parts per hundred'.

They will explore this through different representations which show different parts of a hundred. Children will use 'number of parts per hundred' alongside the % symbol.

Mathematical Talk

How many parts is the square split in to?

How many parts per hundred are shaded/not shaded?

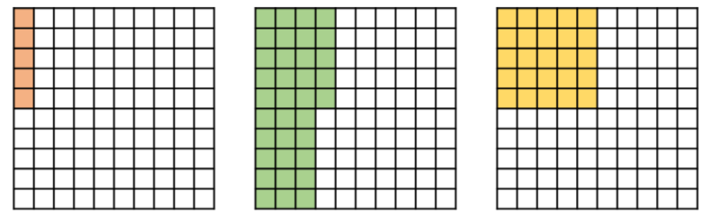
Can we represent this percentage differently?

Look at the bar model, how many parts is it split into?

If the bar is worth 100%, what is each part worth?

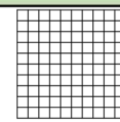
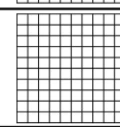
Varied Fluency

Complete the sentence stem for each diagram.

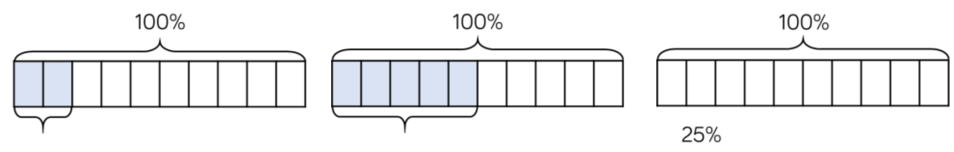


There are ____ parts per hundred shaded. This is ____%

Complete the table.

Pictorial	Parts per hundred	Percentage
	There are 51 parts per hundred.	
		75%

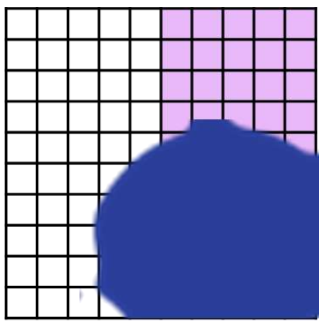
Complete the bar models.



Understand Percentages

Reasoning and Problem Solving

Oh no! Dexter has spilt ink on his hundred square.



Complete the sentence stems to describe what percentage is shaded.

It could be…

It must be…

It can't be…

Some possible answers:

It could be 25%

It must be less than 70%

It can't be 100%

Mo, Annie and Tommy all did a test with 100 questions. Tommy got 6 fewer questions correct than Mo.

Name	Score	Percentage
Mo	56 out of 100	
Annie		65%
Tommy		

Complete the table.
How many more marks did each child need to score 100%?

56%
65 out of 100
50 out of 100
50%

Mo needs 44
Annie needs 35
Tommy needs 50

Dora and Amir each have 100 sweets. Dora eats 65% of hers. Amir has 35 sweets left.
Who has more sweets left?

Neither. They both have an equal number of sweets remaining.

Percentages as Fractions & Decimals

Notes and Guidance

Children represent percentages as fractions using the denominator 100 and make the connection to decimals and hundredths.

Children will recognise percentages, decimals and fractions are different ways of expressing proportions.

Mathematical Talk

What do you notice about the percentages and the decimals?

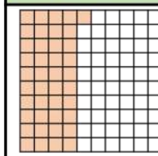
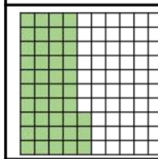
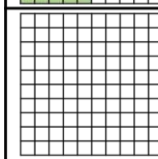
What's the same and what's different about percentages, decimals and fractions?

How can we record the proportion of pages Alex has read as a fraction? How can we turn it into a percentage?

Can you convert any percentage into a decimal and a fraction?

Varied Fluency

- Complete the table.

Pictorial	Percentage	Fraction	Decimal
	41 parts per hundred 41%	41 out of 100 $\frac{41}{100}$	41 hundredths 0.41
			
	7 parts per hundred 7%		

- Alex has read 93 pages of her book. Her book has 300 pages. What proportion of her book has she read? Give your answer as a percentage and a decimal.

$$\frac{93}{300} = \frac{?}{100} = \_\_\_\_\_\ \% = \_\_\_\_\_$$

- Record the fractions as decimals and percentages.

$$\frac{120}{300} \qquad \frac{320}{400} \qquad \frac{20}{200} \qquad \frac{12}{50}$$

Percentages as Fractions & Decimals

Reasoning and Problem Solving

Teddy says,

To convert a fraction to a percentage, you just need to put a percent sign next to the numerator.

Is Teddy correct? Explain your answer.

Teddy is incorrect, this only works when the denominator is 100 because percent means parts per hundred.

At a cinema, $\frac{4}{10}$ of the audience are adults.
The rest of the audience is made up of boys and girls.
There are twice as many girls as boys.

What percentage of the audience are girls?

60% are children, so 40% are girls and 20% boys.

Children may use a bar model to represent this problem.

Three children have each read 360 pages of their own book.

Ron's book has 500 pages.
Dora's book has 400 pages.
Eva's book has 600 pages.

What fraction of their books have they each read?

What percentage of their books have they read?

How much of their books have they each read as a decimal?

Who has read the most of their book?

Ron has read $\frac{360}{500}$, 72% or 0.72

Dora has read $\frac{360}{400}$, 90% or 0.9

Eva has read $\frac{360}{600}$, 60% or 0.6

Dora has read the most of her book.

Equivalent F.D.P.

Notes and Guidance

Children recognise simple equivalent fractions and represent them as decimals and percentages.

When children are secure with the percentage and decimal equivalents of $\frac{1}{2}, \frac{1}{4}, \frac{1}{5}, \frac{2}{5}, \frac{4}{5},$ they then consider denominators of a multiple of 10 or 25

Use bar models and hundred squares to support understanding and show equivalence.

Mathematical Talk

How many hundredths is each bead worth? How does this help you convert the decimals to fractions and percentages?

How many hundredths is the same as 0.1?

What fractions does the bar model show? How does this help to convert them to percentages?

Which is closer to 100%, $\frac{4}{5}$ or 50%? How do you know?

Varied Fluency

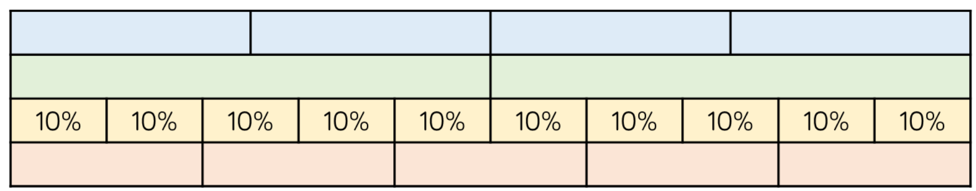
- Use a bead string to show me:

  0.25 0.3 0.2 0.5

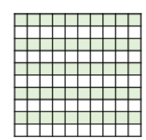
  What are these decimals as a percentage?
  What are they as a fraction? Can you simplify the fraction?

- Use the bar model to convert the fractions into a percentages and decimals.

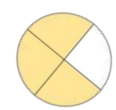
  $\frac{1}{2}$ $\frac{1}{4}$ $\frac{3}{10}$ $\frac{1}{5}$



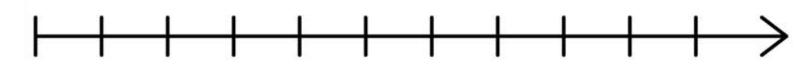
- Draw arrows to show the position of each representation on the number line.



40%



$\frac{4}{5}$



Equivalent F.D.P.

Reasoning and Problem Solving

Sort the fractions, decimals and percentages into the correct column.

50%	100%	$\frac{30}{60}$
Seven tenths	60%	0.25
70 hundredths	$\frac{1}{4}$	7%

Less than $\frac{1}{2}$	Equal to $\frac{1}{2}$	Greater than $\frac{1}{2}$

Less than $\frac{1}{2}$:
$\frac{1}{4}$, 0.25, 7%

Equal to $\frac{1}{2}$:
50% and $\frac{30}{60}$

Greater than $\frac{1}{2}$:
Seven tenths, 70 hundredths, 60% and 100%

Jack has £55
He spends $\frac{3}{5}$ of his money on a coat and 30% on shoes.
How much does he have left?

£5.50

Tommy is playing a maths game.
Here are his scores at three different levels.

Level A – 440 points out of 550

Level B – 210 points out of 300

Level C – 45 points out of 90

At which level did he have a higher success rate?

Level A: 80%
Level B: 70%
Level C: 50%

Tommy had a higher success rate on level A.

Children may wish to compare using decimals instead.

Summer Scheme of Learning

Year 5

#MathsEveryoneCan

2020-21

White Rose Maths

New for 2020/21

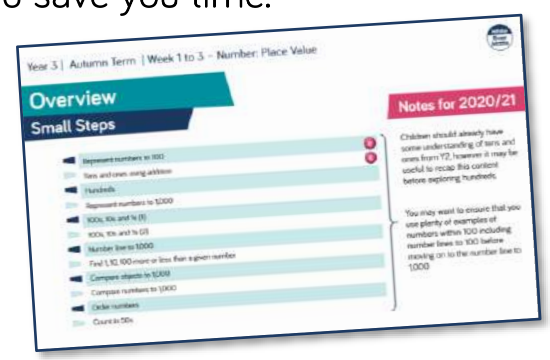
2020 will go down in history. The world has changed for all of us.

We want to do as much as we can to support children, teachers, parents and carers in these very uncertain times.

We have amended our schemes for 2020/21 to:

- ★ highlight key teaching points
- ★ recap essential content that children may have forgotten
- ★ flag any content that you might not have covered during the school closures period.

We hope these changes will add further value to the schemes and save you time.



Lesson-by-lesson overviews

We've always been reluctant to produce lesson-by-lesson overviews as every class is individual and has different needs. However, many of you have said that if blended learning becomes a key feature of school life next year, a weekly plan with linked content and videos could be really useful.

As always, we've listened! We've now produced a complete lesson-by-lesson overview for Y1 to Y9 that schools can use or adapt as they choose. Each lesson will be linked to a free-to-use home learning video, and for premium subscribers, a worksheet. This means that you can easily assign work to your class, whether they are working at home or in school.

Inevitably, this lesson-by-lesson structure won't suit everyone, but if it works for you, then please do make use of this resource as much as you wish.

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.

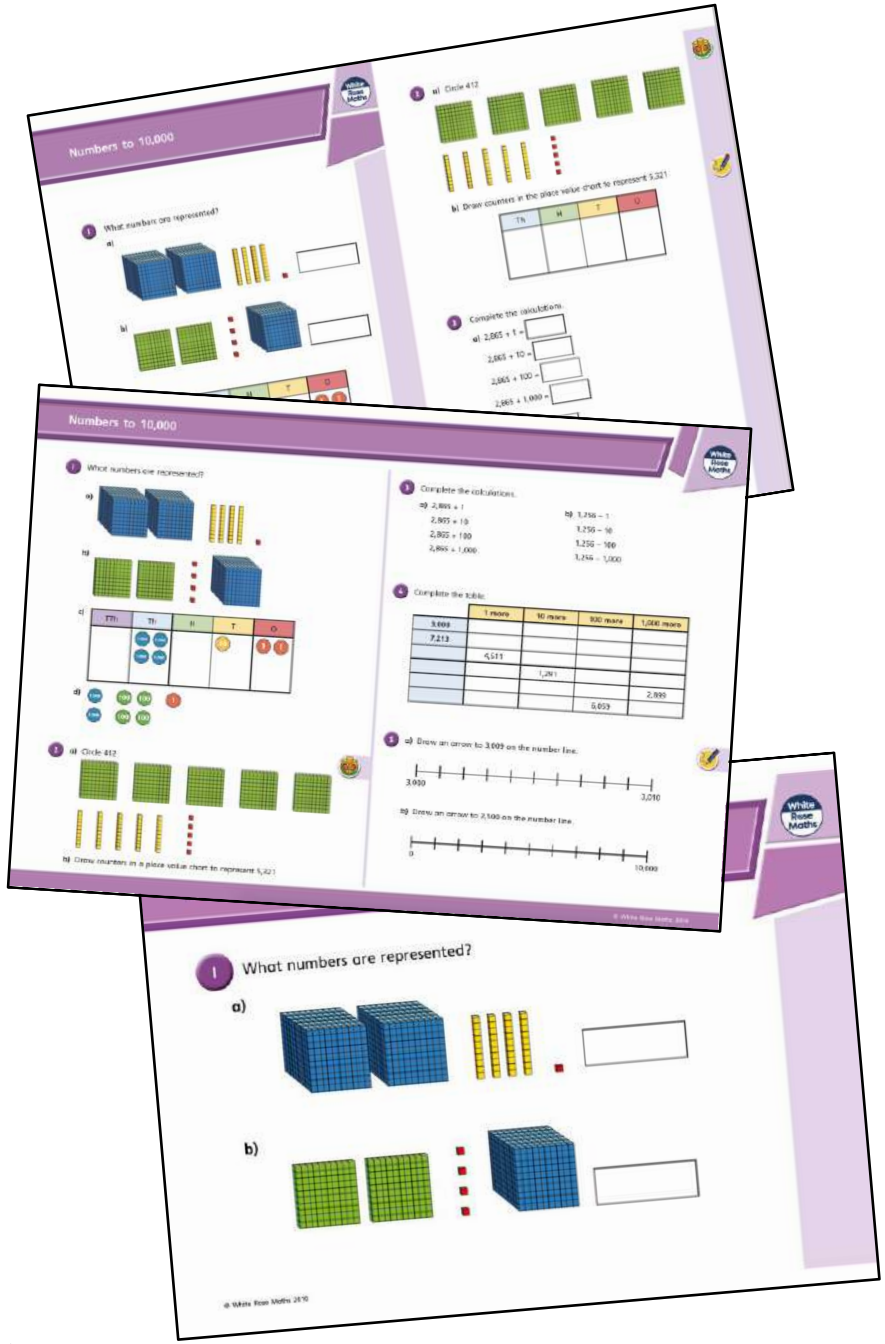
Supporting resources

We have produced supporting resources for every small step from Year 1 to Year 11.

The worksheets are provided in three different formats:

- Write on worksheet – ideal for children to use the ready made models, images and stem sentences.
- Display version – great for schools who want to cut down on photocopying.
- PowerPoint version – one question per slide. Perfect for whole class teaching or mixing questions to make your own bespoke lesson.

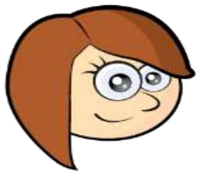
For more information visit our online training and resources centre resources.whiterosemaths.com or email us directly at support@whiterosemaths.com



Meet the Characters

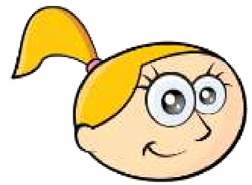
Children love to learn with characters and our team within the scheme will be sure to get them talking and reasoning about mathematical concepts and ideas. Who's your favourite?

Teddy

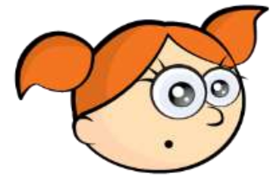


Rosie

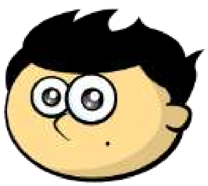
Mo



Eva

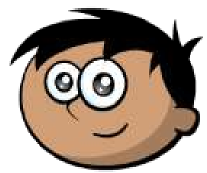


Alex

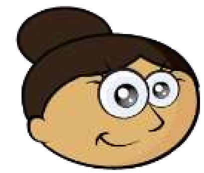


Jack

Whitney



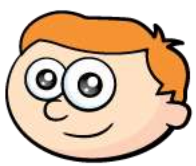
Amir



Dora

Tommy

Dexter



Ron

Annie

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

Summer - Block 1

Decimals

Overview

Small Steps

- Adding decimals within 1
- Subtracting decimals within 1
- Complements to 1
- Adding decimals – crossing the whole
- Adding decimals with the same number of decimal places
- Subtracting decimals with the same number of decimal places
- Adding decimals with a different number of decimal places
- Subtracting decimals with a different number of decimal places
- Adding and subtracting wholes and decimals
- Decimal sequences
- Multiplying decimals by 10, 100 and 1,000
- Dividing decimals by 10, 100 and 1,000

Notes for 2020/21

This block follows on from learning on decimals in the spring term.

Note that the block has been pushed back to start in the second week of the summer term. This allows the first week to be used to ensure that children are confident in the decimals work they have covered previously.

Adding Decimals within 1

Notes and Guidance

Children add decimals within one whole. They use place value counters and place value charts to support adding decimals and understand what happens when we exchange between columns.

Children build on their understanding that 0.45 is 45 hundredths, children can use a hundred square to add decimals.

Mathematical Talk

What is the number represented on the place value chart?
What digit changes when I add a hundredth?

How many hundredths can I add before the tenths place changes? Explain why.

How can the children shade in the hundred square to support their calculations?

Why does using column addition support adding decimals? What is the same and what is different?

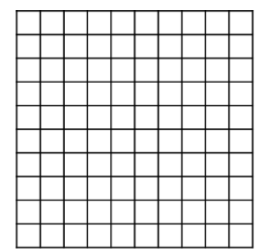
Varied Fluency

Use this place value chart to help answer the questions.

Ones	Tenths	Hundredths	Thousandths
	0.1 0.1 0.1 0.1	0.001	0.01 0.01

- What number is one hundredth more?
- Add 0.3, what number do you have now?
- How many more thousandths can I add before the hundredths digit changes?

Each box in this hundred square represents one hundredth of the whole. Use this to answer:



0.07 + 0.78 | 0.87 + 0.07

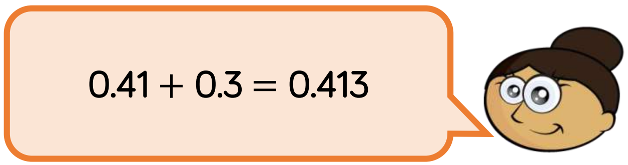
Use the column method to complete the additions.

0.45 + 0.5 | 0.45 + 0.05 | 0.45 + 0.005

Adding Decimals within 1

Reasoning and Problem Solving

What mistake has Dora made?



Use at least 2 representations to show why she is incorrect.

Dora has put the 3 tenths in the thousandths place.

The correct answer is 0.71

Compare the numbers sentences using $<$, $>$ or $=$

0.7 + 0.03 + 0.001	◯	0.07 + 0.3 + 0.1
0.4 + 0.1 + 0.05	◯	0.3 + 0.2 + 0.05

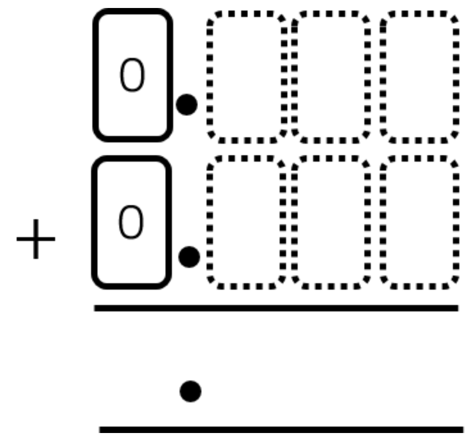
$>$

$=$

Rosie has some digit cards.

0	1	2	3	4	5

She uses each card once to make a number sentence.



What is the largest number she can make? What is the smallest?

Largest: 0.951

Smallest: 0.159

Subtracting Decimals within 1

Notes and Guidance

Children subtract decimals using a variety of different methods.
They look at subtracting using place value counters on a place value grid. Children also explore subtraction as difference by using a number line to count on from the smaller decimal to the larger decimal.
Children use their knowledge of exchange within whole numbers to subtract decimals efficiently.

Mathematical Talk

What is the number represented on the place value chart?
What is one tenth less than one?
What is one hundredth less than one?
Show me how you know.
If I'm taking away tenths, which digit will be affected? Is this always the case?
How many hundredths can I take away before the tenths place is affected?

Varied Fluency

Here is a number.

Ones	Tenths	Hundredths	Thousandths
	0.1 0.1 0.1	0.001 0.001 0.001 0.001	0.01 0.01 0.01 0.01

- What is three tenths less than the number?
- Take away 0.02, what is your number now?
- Subtract 5 thousandths. What is the final number?

Find the difference between the two numbers using the number line.

0.424 0.618

Calculate.

0.584 – 0.154 =	0.44 – 0.1 =
0.684 – 0.254 =	0.44 – 0.09 =
0.685 – 0.255 =	0.44 – 0.11 =

Subtracting Decimals within 1

Reasoning and Problem Solving

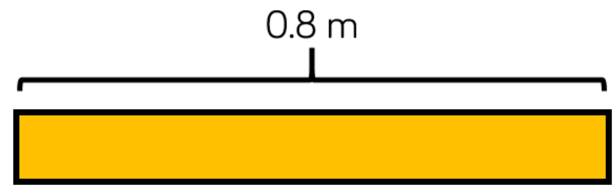
Here are four calculations.
Which one is the easiest to answer?
Which one is the trickiest to answer?
Explain your choice of order.

$0.45 - 0.3 =$
$0.45 - 0.15 =$
$0.45 - 0.23 =$
$0.45 - 0.18 =$

Children justify the order they have given.

Possible order:

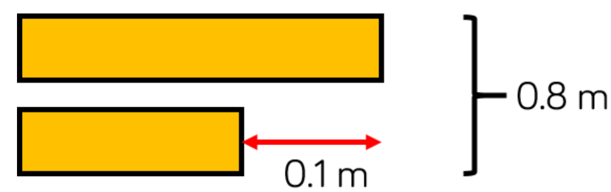
$0.45 - 0.23 = 0.22$
(no exchange)
$0.45 - 0.15 = 0.3$
(no exchange with 0)
$0.45 - 0.3 = 0.15$
(no exchange, different dp)
$0.45 - 0.18 = 0.27$
(exchange)



The strip of paper is 0.8 m long.

It is cut into two unequal parts.

The difference in lengths between the two strips of paper is 0.1 m



How long are the two strips of paper?

Strip 1: 0.45 m

Strip 2: 0.35 m

Complements to 1

Notes and Guidance

Children find the complements which sum to make 1

It is important for children to see the links with number bonds to 10, 100 and 1000

This will support them when finding complements to 1, up to three decimal places.

Children can use a hundred square, part-whole models and number lines to support finding complements to one.

Mathematical Talk

What number bonds can you use to help you?

How can shading the hundred square help you find the complement to 1?

How many different ways can you make 1? How many ways do you think there are?

If I add _______, which place will change? How many can I add to change the tenths/hundredths place?

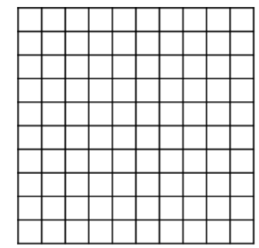
Varied Fluency

- Using a blank hundred square, where each square represents one hundredth, find the complements to 1 for these numbers.

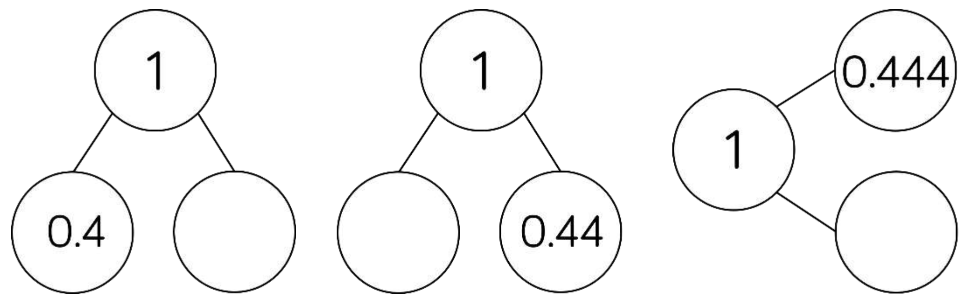
  $0.55 + \boxed{} = 1$

  $1 = 0.32 + \boxed{}$

  $0.11 + 0.5 + \boxed{} = 1$



- Complete the part-whole models.



- Use the number line to find the complements to 1

  0.324 ———————————— 1

  0.459 ———————————— 1

Complements to 1

Reasoning and Problem Solving

$0.333 + \boxed{} = 1$

I think the answer is 0.777 because
$0.3 + 0.7 = 1$
$0.03 + 0.07 = 0.1$
$0.003 + 0.007 = 0.01$

Do you agree with Tommy?
Can you explain what his mistake was?

Tommy has forgotten that when you have ten in a place value column you need to use your rules of exchanging.

e.g.
10 tenths = 1 one
10 hundredths = 1 tenth
10 thousandths = 1 hundredth

The correct answer is 0.667

How many different ways can you find a path through the maze, adding each number at a time, to make a total of one?

Start →

0.02	0.01	0.05	0.08	0.3	0.04	0	0.001
0.2	0.06	0.07	0.09	0.001	0.004	0.02	0.04
0.005	0.04	0.2	0.02	0.05	0.06	0.07	0.6
0.5	0.005	0.05	0.02	0.03	0.017	0.006	0.06
0.009	0.8	0.001	0.05	0.015	0.01	0.008	0.007
0.09	0.2	0.08	0.03	0.199	0.01	0.04	0.05
0.01	0.008	0.1	0.09	0.005	0.08	0.02	0.02
0.05	0.03	0.01	0.22	0.07	0.003	0.04	0.09

→ 1

Once you have found a way, can you design your own smaller maze for others to solve?

0.02	0.01	0.05	0.08	0.3	0.04	0	0.001
0.2	0.06	0.07	0.09	0.001	0.004	0.02	0.04
0.005	0.04	0.2	0.02	0.05	0.06	0.07	0.6
0.5	0.005	0.05	0.02	0.03	0.017	0.006	0.06
0.009	0.8	0.001	0.05	0.015	0.01	0.008	0.007
0.09	0.2	0.08	0.03	0.199	0.01	0.04	0.05
0.01	0.008	0.1	0.09	0.005	0.08	0.02	0.02
0.05	0.03	0.01	0.22	0.07	0.003	0.04	0.09

Adding – Crossing the Whole

Notes and Guidance

Children use their skills at finding complements to 1 to support their thinking when crossing the whole. Children require flexibility at partitioning decimals, as bridging will be extremely important. Encourage children to make one first, then add the remaining decimal.

For example: 0.74 + 0.48 =

0.74 + 0.26 + 0.22 = 1.22

Mathematical Talk

What happens when we have 10 in a place value column?

How would partitioning a number help us?

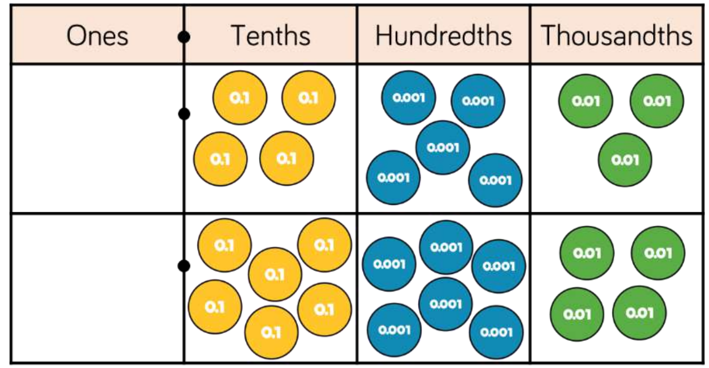
How do you decide what number to partition?

Why is partitioning 0.67 into 0.55 and 0.12 more helpful than 0.6 and 0.07?

What complement to 1 would I use to answer this question?

Varied Fluency

- Use the place value grid to answer 0.453 + 0.664



- Amir is using complements to 1 to add decimals.

0.45 + 0.67 =

0.55 + 0.12

0.45 + 0.55 + 0.12 = 1.12

Use Amir's method to solve:

a) 0.56 + 0.78

b) 3.42 + 0.79

- Use the column method to solve the additions.

0.47 + 0.6

0.982 + 0.18

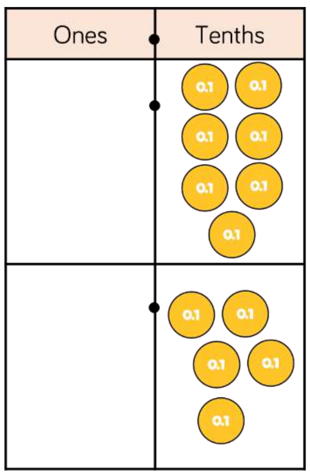
0.92 + 0.8

Adding – Crossing the Whole

Reasoning and Problem Solving

A place value grid is used to solve

0.7 + 0.5



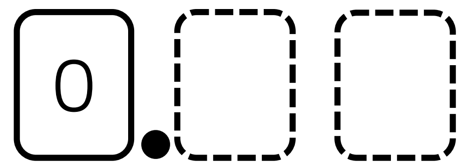
Alex thinks the answer is 0.12

What mistake has she made?

Ten lots of one tenth is one whole. There are 12 tenths so Alex needs to make an exchange. She should exchange 10 tenths for 1 one.

The correct answer is 1.2

You will need a partner and a six-sided dice for this game.



Take it in turns rolling the dice twice and placing the digits in the blank spaces above. Record the number in a table.

Swap over with your partner.

Roll the dice again and add your new number to the first number. The winner is the person who after adding 4 numbers is the closest to 1.5 **without** going over.

Example:

Player 1 rolls a 1 and a 4. 0.14

Player 1 then rolls a 2 and a 6. 0.26

0.14 + 0.26 = 0.38

Player 1	Player 2
0.14	0.64
0.38	1.23
0.69	1.49
1.24	~~1.60~~

White Rose Maths

Adding – Same Decimal Places

Notes and Guidance

Children add numbers greater than one with the same number of decimal places.

Place value grids and counters are extremely helpful in ensuring children are understanding the value of each digit and understanding when to exchange.

Ensure children see the formal written method (column addition) alongside the place value chart.

Mathematical Talk

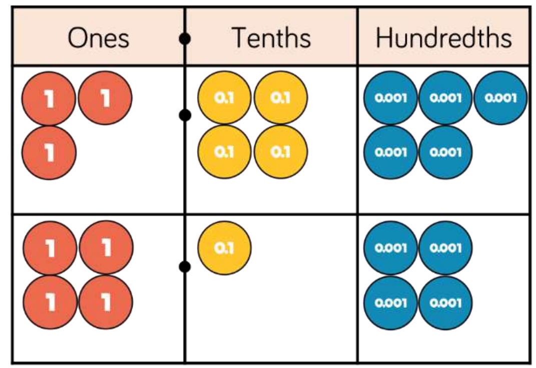
Why is it important to line up the columns?

What happens when there are a total of ten counters in a place value column?

Why is the position of the decimal point important?

Varied Fluency

- Use the place value chart to add 3.45 and 4.14



$$\begin{array}{r} 3.45 \\ +\,4.14 \\ \hline \\ \hline \end{array}$$

- Use the column method to solve these additions.

$$\begin{array}{r} 4.42 \\ +\,7.63 \\ \hline \\ \hline \end{array} \qquad \begin{array}{r} 4.55 \\ +\,3.07 \\ \hline \\ \hline \end{array}$$

- Ron goes to the shops. He buys 3 items. What is the most he could pay? What is the least he could pay?


£4.45


£5.59


£3.99


£4.05

Adding – Same Decimal Places

Reasoning and Problem Solving

$+\,0.2$

$$3.2 + 2.8 = 3 + 3$$

$-\,0.2$

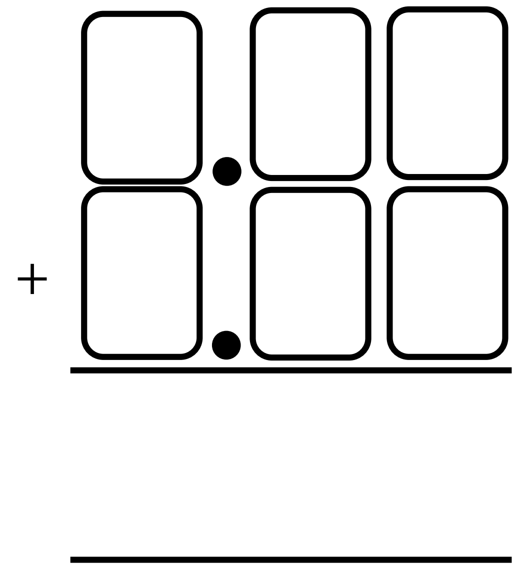
$+\,0.18$

$$3.18 + 2.82 = 3 + 3$$

$-\,0.18$

Using these strategies, can you find more number sentences which have the same total as 3 + 3

Children may find a range of answers. The important teaching point is to highlight that you have added the same to one number as you have taken away from the other.



Using the digits 0 – 9 only once in each of the spaces above, what is:

- The largest sum possible
- The smallest sum possible

Is there more than one way of creating each total?

Largest

9.75 + 8.64

9.65 + 8.74

9.64 + 8.75

9.74 + 8.65

Smallest

0.24 + 1.35

0.25 + 1.34

0.34 + 1.25

0.35 + 1.24

Subtract – Same Decimal Places

Notes and Guidance

Children subtract numbers with the same number of decimal places. They use place value counters and a place value grid to support them with exchanging.

Children should be given opportunities to apply subtraction to real life contexts which could involve measures. Bar models can be a useful representation of the problems.

Mathematical Talk

What happens when you need to subtract a greater digit from a smaller digit e.g. 3 hundredths subtract 4 hundredths?

How many tenths are equivalent to one hundredth?

Do we only ever make one exchange in a subtraction calculation?

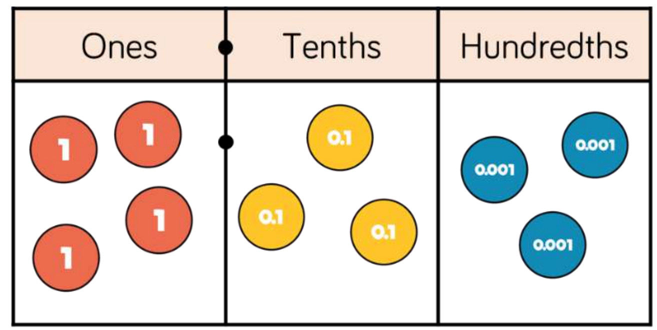
Which of these numbers will need exchanging?

Can you predict what the answer might be?

How could you check your answer?

Varied Fluency

- Use the place value chart to find the to answer 4.33 – 2.14



$$\begin{array}{r} 4\,.\,3\,3 \\ -\ 2\,.\,1\,4 \\ \hline \\ \hline \end{array}$$

- Use the column method to answer these questions.

$$\begin{array}{r} 6\,.\,4 \\ -\ 3\,.\,8 \\ \hline \\ \hline \end{array} \qquad \begin{array}{r} 5\,.\,0\,5 \\ -\ 2\,.\,1\,5 \\ \hline \\ \hline \end{array}$$

- Jack has £12.54 in his wallet.
  He buys a football which costs £5.82

  How much money does he have left?

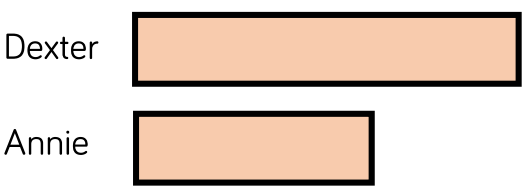
Subtract – Same Decimal Places

Reasoning and Problem Solving

Dexter and Annie have some money.
Dexter has £3.45 more than Annie.

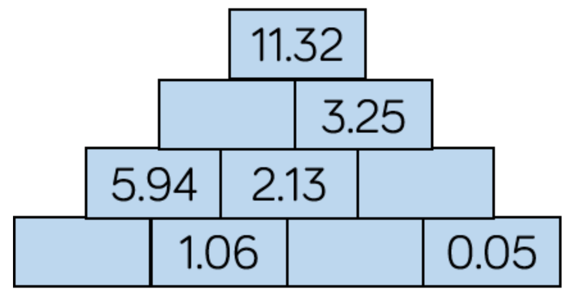
They have £12.45 altogether.

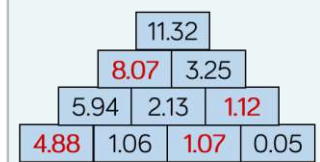
How much money does Annie have?



Annie has £4.50

In this number pyramid, each number is calculated by adding the two numbers underneath.





Adding – Different D.P.

Notes and Guidance

Children add numbers with different numbers of decimal places. They focus on the importance of lining up the decimal point in order to ensure correct place value.

Children should be encouraged to think about whether their answers are sensible. For example, when adding 1.3 to 1.32 and getting an answer 1.45, how do we know it is not a sensible answer? Discuss the importance of estimation.

Mathematical Talk

Why is the decimal point important when we are reading and writing a number?

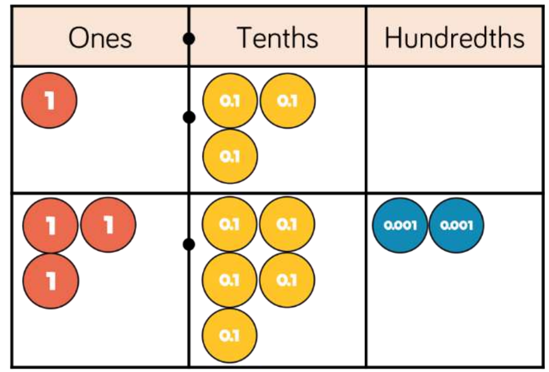
What would a sensible estimate be?

Is this a sensible answer? Why/why not?

What advice would you give to someone that is struggling with recording their numbers in the correct place?

Varied Fluency

- Use the place value grid to add 1.3 and 3.52



$$\begin{array}{r} 1\,.\,3 \\ +\;3\,.\,52 \\ \hline \\ \hline \end{array}$$

- Use the column method to answer these questions.

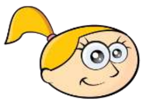
$$\begin{array}{r} 4\,.\,4 \\ +\;7\,.\,044 \\ \hline \\ \hline \end{array} \qquad \begin{array}{r} 4\,.\,42 \\ +\;1\,.\,6 \\ \hline \\ \hline \end{array}$$

- Whitney is cycling in a race.
  She has cycled 3.145 km so far and has 4.1 km left to go. What is the total distance of the race?

Adding – Different D.P.

Reasoning and Problem Solving

Eva is trying to find the answer to



4.144 + 1.4

Here is her working out.

$$\begin{array}{r} 4\,.\,1\,4\,4 \\ +\quad 1\,.\,4 \\ \hline 4\,.\,2\,4\,8 \\ \hline \end{array}$$

Can you spot and explain her error?

Work out the correct answer.

The digits are lined up incorrectly.

Eva needs to line up the decimal point.

The correct answer is 5.544

Place the calculations in the correct column in the table.

9.99 + 0.1

9.99 + 1

9.99 + 0.001

9.99 + 0.01

Some calculations might need to go in more than one place.

No exchange	Exchange in the ones column	Exchange in the tenths column	Exchange in the hundredths column	Exchange in the thousandths column

Add 2 more calculations to each column.

No exchange:

9.99 + 0.001

Exchange in the ones column:

9.99 + 1

9.99 + 0.1

9.99 + 0.01

Exchange in the tenths column:

9.99 + 0.1

9.99 + 0.01

Exchange in the hundredths column:

9.99 + 0.01

Subtracting – Different D.P.

Notes and Guidance

Children subtract decimals with different numbers of decimal places.

They continue to focus on the importance of lining up the decimal point in order to ensure correct place value.

Children identify the importance of zero as a place holder.

Mathematical Talk

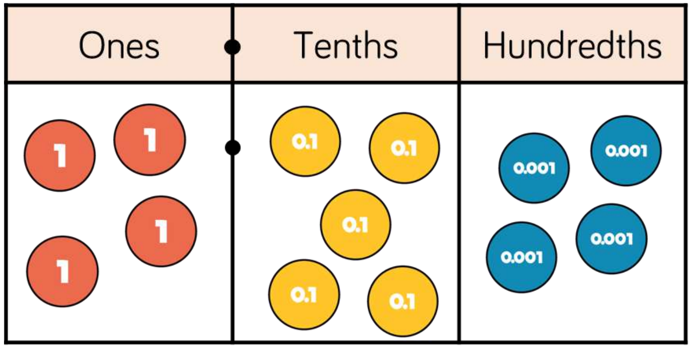
What does it mean if there is nothing in a place value column? How can we represent this in the formal written method?

What do you notice about 4.7 – 3.825 and 4.699 – 3.824? Is one of them more difficult than the other? Why?

Are there more efficient methods for this question?

Varied Fluency

- Use the place value grid to help subtract 1.4 from 4.54



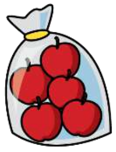
$$\begin{array}{r} 4\,.\,54 \\ -\ 1\,.\,4 \\ \hline \\ \hline \end{array}$$

- Use the column method to work out the following.

$$\begin{array}{r} 6\,.\,06 \\ -\ 3\,.\,7 \\ \hline \\ \hline \end{array} \qquad \begin{array}{r} 4\,.\,7 \\ -\ 3\,.\,825 \\ \hline \\ \hline \end{array}$$

3.3 – 1.34 =
14.41 – 1.43 =
3 – 1.87 =

- How much change would I get from £10 if I bought a bag of apples costing £4.27?



Subtracting – Different D.P.

Reasoning and Problem Solving

If there are 5 hundredths and I subtract nothing from it then there are still 5 hundredths.

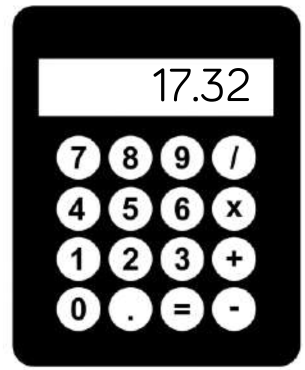
$$\begin{array}{r} 4.9 \\ -\ 3.85 \\ \hline 1.15 \\ \hline \end{array}$$

Do you agree with Whitney?
Explain your answer.

Whitney is not correct. She needs to use zero as a place value holder in the hundredths column of 4.9 and then exchange.

Encourage children to explore more efficient mental strategies as well as correcting the formal method.

The correct answer is 1.05



Teddy used a calculator to solve:
31.4 – 1.408

When he looked at his answer of 17.32 he realised he'd made a mistake.

He had typed all the correct digits in.

Can you spot his mistake?
What should the correct answer be?

Teddy placed the decimal point after the 4 making 14.08 instead of 1.408

The correct answer is 29.992

Wholes and Decimals

Notes and Guidance

Children add and subtract numbers with decimals from whole numbers. Highlight that whole numbers are written without a decimal point.

There may be a misconception when recording integers, link this to the place value grid. Emphasise prior understanding that the decimal point is to the right of the ones place.

Mathematical Talk

What is a whole number/integer?

Where can we add a decimal point to the number 143 so that its value stays the same?

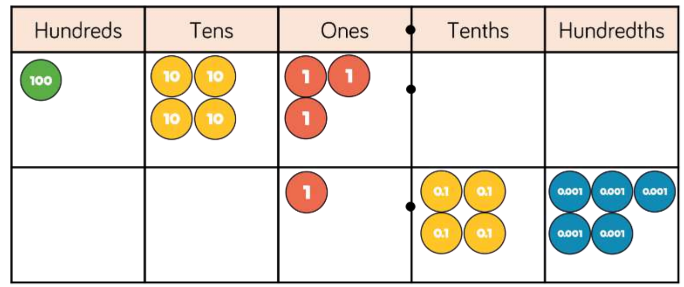
What's the same and what's different about 10 and 10.0 ?

Can you use different methods? (Number line, column subtraction, mentally).

Which is most efficient for this calculation? Explain why.

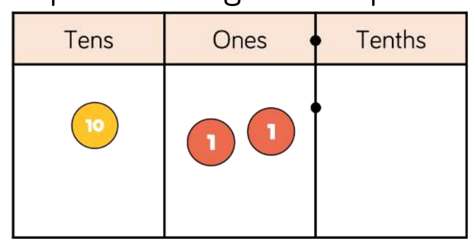
Varied Fluency

Use the place value grid to help add 143 and 1.45



$$\begin{array}{r} 1\,4\,3\,. \\ +\quad 1\,.\,4\,5 \\ \hline \\ \hline \end{array}$$

Use the place value grid to help work out 12 – 1.2



$$\begin{array}{r} 1\,2\,. \\ -\quad 1\,.\,2 \\ \hline \\ \hline \end{array}$$

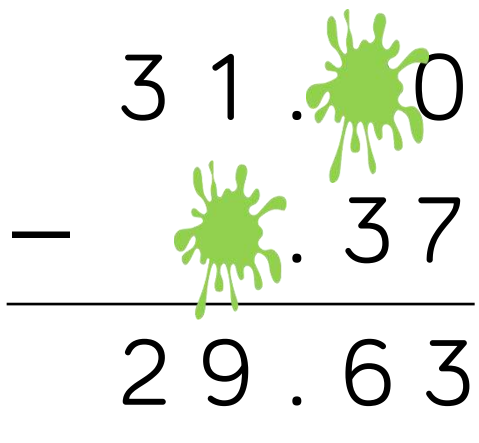
Find the most efficient method to solve this calculations.

43 – 2.14 + 0.86 =	19 – 0.25 =
23 + 4.105 =	19 – 17.37 =

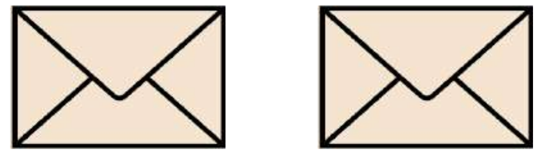
Wholes and Decimals

Reasoning and Problem Solving

What are the missing digits in the calculation?



3 1 . 0 0
– 1 . 3 7
2 9 . 6 3



Two envelopes contain two different numbers.

- The sum of the numbers is 9.92
- The difference between the numbers is 2.32

What numbers are inside the envelopes?

How can this bar model help?

3.8 and 6.12

White Rose Maths

Decimal Sequences

Notes and Guidance

Children look at decimal sequences and create simple rules, for example: adding 0.5 every time.

It is important to note that they are not expected to generate algebraic expressions for the sequences, but the use of the word 'term' could be used to predict the next number in the sequence. For example, what would be the value of the 10th term in the sequence?

Mathematical Talk

What do increasing and decreasing mean?

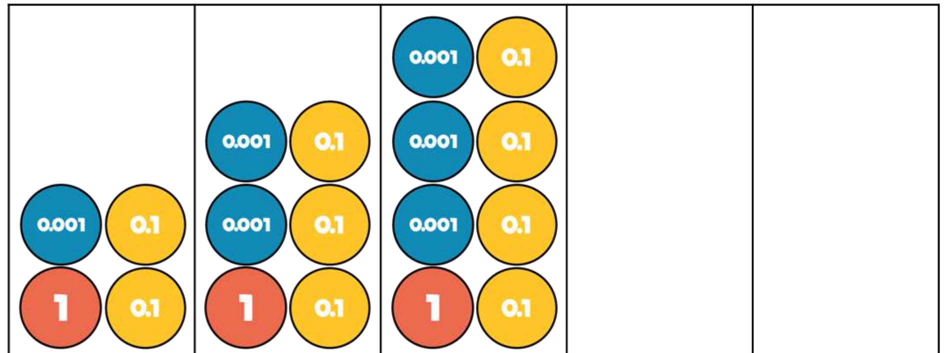
Is the sequence increasing by the same amount each time? By how much?

What is the same about each term? What is changing in each term?

What will the next term in the sequence be?

Varied Fluency

Complete the sequence.



1st	2nd	3rd	4th	5th
1.21	1.32	1.43		

Write the rules for each sequence.

- 0.45, 0.6, 0.75, 0.9 The rule is
- 1.25, 2.5, 3.75, 5, 6.25 The rule is

Generate the first 5 terms of this sequence.

The 1st term is 1.74
The sequence decreases by 0.24 each time.

Decimal Sequences

Reasoning and Problem Solving

9.48 9.52 9.56 9.6 …

The number 9.7 will be in this sequence.

Do you agree with Jack?
Explain your answer.

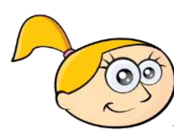
Jack is incorrect, 9.68 and 9.72 will be in the sequence but not 9.7

The terms are increasing by 0.04 therefore 9.7 will not be in the sequence.

	1st sequence	Relationship →	2nd sequence
1st term	0.1		1
2nd term	0.2		2
3rd term	0.3		3
4th term	0.4		4
5th term			

Eva compared the two sequences above. What do you notice about the differences between the terms in the two sequences?

Investigate Eva's sequences below and explain your thinking.



I wonder what the differences would be between sequences that go up in + 0.01 and +1 sequence…

The difference between the terms is increasing by 0.9 each time e.g.

1st + 0.9

2nd + 1.8

3rd + 2.7

4th + 3.6

Children may also notice that the terms in the 2nd sequence are ten times larger than in the first.

The differences would increase by 0.99 each time.

Multiply by 10, 100 and 1,000

Notes and Guidance

Children learn how to multiply numbers with decimals by 10, 100 and 1,000 They look at moving the counters in a place value grid to the left in order to multiply by multiples of 10 Children may have previously made the generalisation that when a number is ten times greater they put a zero on the end of the original number. This small step highlights the importance of understanding the effect of multiplying both integers and decimal numbers by multiples of 10.

Mathematical Talk

What is the value of each digit? Where would these digits move to if I multiplied the number by 10?

Why is the zero important in this number? Could we just take it out to make it easier for ourselves? Why/why not?

What do you notice about the numbers you are multiplying in the table?

Varied Fluency

- Use the place value grid to multiply 3.24 by 10, 100 and 1,000

Thousands	Hundreds	Tens	Ones	Tenths	Hundredths
			●●●	●●	●●●●

When you multiply by ____, you move the counters _____ places to the left.

- Use a place value grid to multiply these decimals by 10, 100 and 1,000

4.24 2.401 42.1

- Complete the table below.

	×10	×100	×1,000
3.14			
13			
0.233			

Multiply by 10, 100 and 1,000

Reasoning and Problem Solving

Multiplying by 1,000 is the same as doing 10 × 10 × 10

Do you agree with Mo?
Explain your answer.

Mo is correct, as you move the digits 3 places to the left in both cases.

Using the digits 0-9 create a number with up to 3 decimal places, for example, 3.451

Cover the number using counters on your Gattegno chart.

10,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000	90,000
1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000
100	200	300	400	500	600	700	800	900
10	20	30	40	50	60	70	80	90
1	2	3	4	5	6	7	8	9
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009

Explore what happens when you multiply your number by 10, then 100, then 1,000
What patterns do you notice?

Children will be able to see how the counter will move up a row for multiplying by 10, two rows for 100 and three rows for 1,000. They can see that this happens to each digit regardless of the value.

For example,

3.451 × 10 becomes 34.51

Each counter moves up a row but stays in the same column.

Divide by 10, 100 and 1,000

Notes and Guidance

Children learn how to divide numbers with decimals by 10, 100 and 1,000

Children use the place value chart to support the understanding of moving digits to the right.

Following on from the previous step, the importance of the place holder is highlighted.

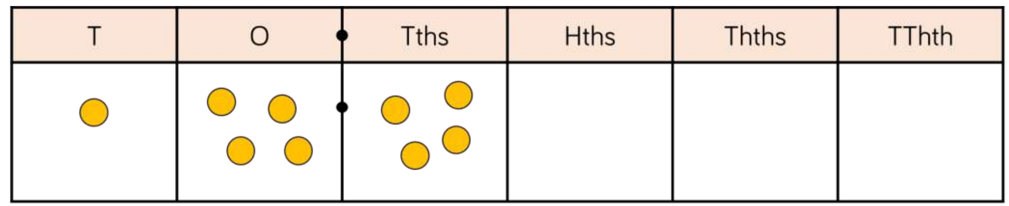
Mathematical Talk

What is the value of each digit? Where would these digits move to if I divided the number by 10?

Which direction do I move the digits of the number when dividing by 10, 100 and 1,000?

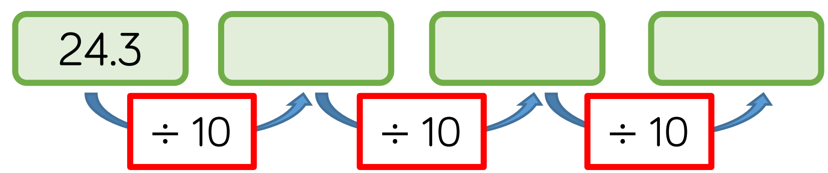
Varied Fluency

Use the place value grid to divide 14.4 by 10, 100 and 1,000



When you divide by ____, you move the counters _____ places to the right.

Fill in the missing numbers in the diagram.



Fill in the missing numbers in these calculations.

$34.2 \div \square = 0.342$ $\square \div 10 = 54.1$

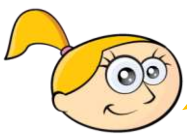
$\square \div 10 = 1.93 \div 100$

Divide by 10, 100 and 1,000

Reasoning and Problem Solving

If you multiply a number by 1,000, you can just divide the answer by 1,000 to get back to your original number.

Whitney



That's not true, you would need to divide the answer by ten three times.

Eva

Who do you agree with?
Explain your thinking.

Both girls are correct, as dividing by 1,000 is the same as dividing by 10 three times.

Here are three rectangles.

The lengths of rectangle B are 10 times larger than rectangle A.
The lengths of rectangle C are 100 times smaller than rectangle B.

The perimeter of rectangle A is 1,000 times greater than the perimeter of rectangle C.

Do you agree with Mo?
Explain your thinking.

Mo is incorrect.

He has multiplied 10 and 100 to get 1,000 times greater.

The perimeter of rectangle A is only 10 times greater than rectangle C. Children may calculate the perimeters of each rectangle or may just notice the relationship between each.

White Rose Maths

Summer - Block 2

Properties of Shape

Overview

Small Steps

- Identify angles R
- Compare and order angles R
- Measure angles in degrees
- Measuring with a protractor (1)
- Measuring with a protractor (2)
- Drawing lines and angles accurately
- Calculating angles on a straight line
- Calculating angles around a point
- Triangles R
- Quadrilaterals R
- Calculating lengths and angles in shapes
- Regular and irregular polygons
- Reasoning about 3-D shapes

Notes for 2020/21

Learning on properties of shape may have been missed during lockdown or covered remotely.

Children should recap the essential prerequisite knowledge from year 4 before moving on to look at year 5 content.

Identify Angles

Notes and Guidance

Children develop their understanding of obtuse and acute angles by comparing with a right angle. They use an angle tester to check whether angles are larger or smaller than a right angle.
Children learn that an acute angle is more than 0 degrees and less than 90 degrees, a right angle is exactly 90 degrees and an obtuse angle is more than 90 degrees but less than 180 degrees.

Mathematical Talk

How many degrees are there in a right angle?

Draw an acute/obtuse angle.

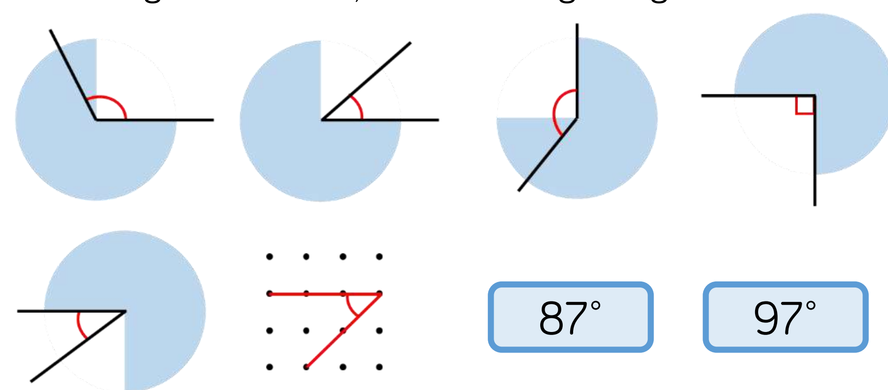
Estimate the size of the angle.

Varied Fluency

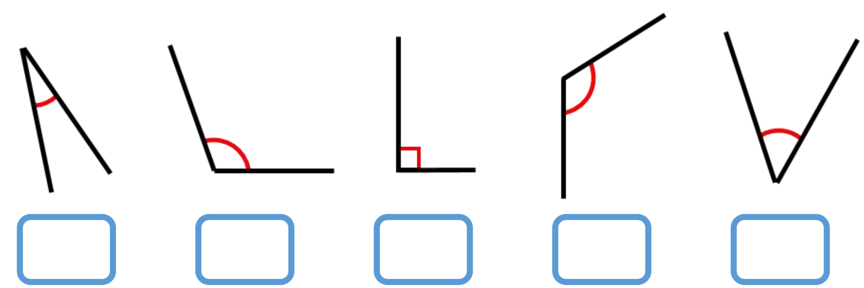
R

- A right angle is _____ degrees.
  Acute angles are _____ than a right angle.
  Obtuse angles are _____ than a right angle.

- Sort the angles into acute, obtuse and right angles.

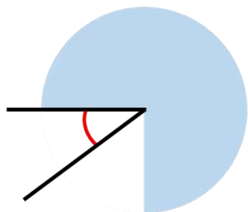


- Label the angles. O for obtuse, A for acute and R for right angle.



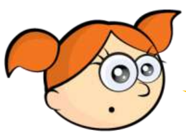
Identify Angles

Reasoning and Problem Solving



I know the angle is not obtuse.

Teddy



Alex

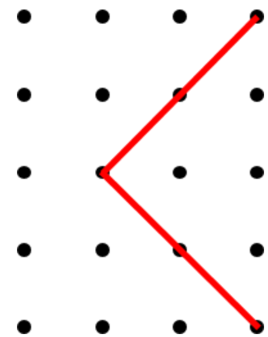
I know the angle is acute.

I think the angle is roughly 45°.

Whitney

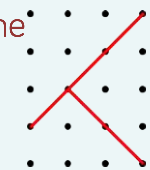
Who is correct?
Explain your reasons.

All are correct.
Children may reason about how Whitney has come to her answer and discuss that the angle is about half a right angle. Half of 90 degrees is 45 degrees.



Is the angle acute, obtuse or a right angle?
Can you explain why?

The angle is a right angle.
Children may use an angle tester to demonstrate it, or children may extend the line to show that it is a quarter turn which is the same as a right angle.



Find the sum of the largest acute angle and the smallest obtuse angle in this list:

12°	98°	87°	179°	90°
		5°		

$87° + 98° = 185°$

Compare & Order Angles

Notes and Guidance

Children compare and order angles in ascending and descending order.

They use an angle tester to continue to help them to decide if angles are acute or obtuse.

Children identify and order angles in different representations including in shapes and on a grid.

Mathematical Talk

How can you use an angle tester to help you order the angles?

How many obtuse/acute/right angles are there in the diagrams?

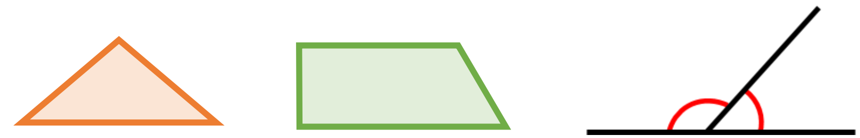
Compare the angles to a right angle. Does it help you to start to order them?

Rotate the angles so one of the lines is horizontal. Does this help you to compare them more efficiently?

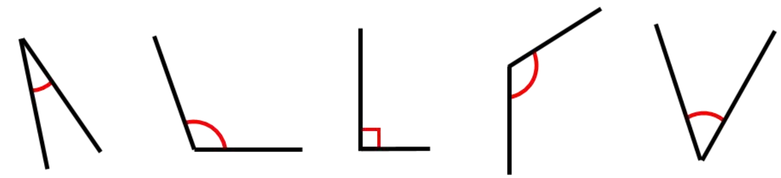
Varied Fluency

R

- Circle the largest angle in each shape or diagram.

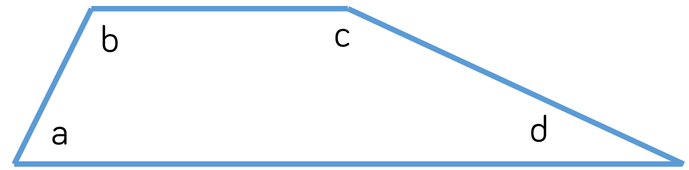


- Order the angles from largest to smallest.



Can you draw a larger obtuse angle?
Can you draw a smaller acute angle?

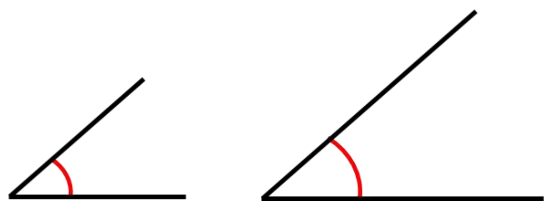
- Order the angles in the shape from smallest to largest. Complete the sentences.



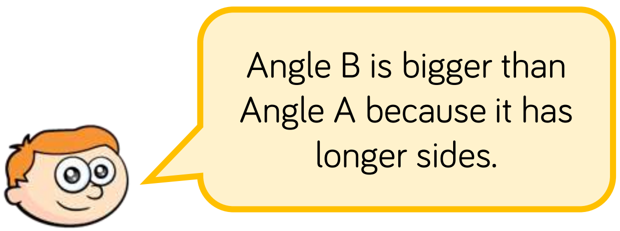
Angle _____ is smaller than angle _____.
Angle _____ is larger than angle _____.

Compare & Order Angles

Reasoning and Problem Solving



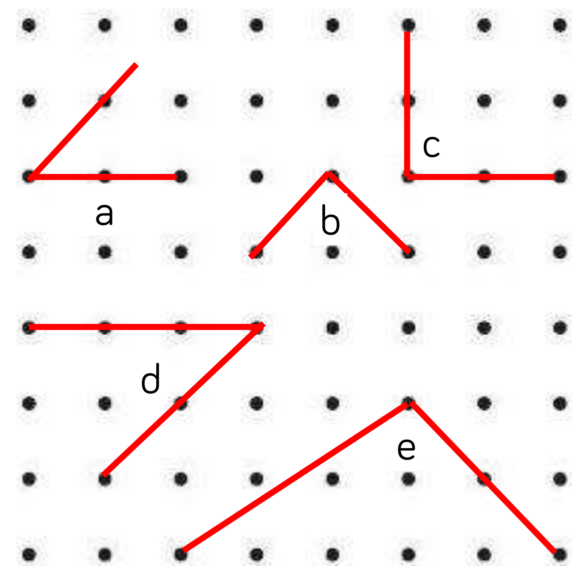
Angle A Angle B



Do you agree with Ron? Explain your thinking.

Angle A and Angle B are the same size. Ron has mixed up the lengths of the lines with the size of the angles.

Here are five angles.
There are two pairs of identically sized angles and one odd one out.
Which angle is the odd one out?
Explain your reason.



Angle e is the odd one out.

Angle b and c are both right angles.

Angle a and d are both half of a right angle or 45 degrees.

Angle e is an obtuse angle.

Measuring Angles in Degrees

Notes and Guidance

Children recap acute and obtuse angles. They recognise a full turn as 360 degrees, a half-turn as 180 degrees and a quarter-turn (or right angle) as 90 degrees. They consider these in the context of compass directions. Children also deduce angles such as 45 degrees, 135 degrees and 270 degrees. Reflex angles are introduced explicitly for the first time. Children define angles in terms of degrees and as fractions of a full turn.

Mathematical Talk

What is an angle?

Can you identify an acute angle on the clock?

Can you identify an obtuse angle?

What do we call angles larger than 180° but smaller than 360°?

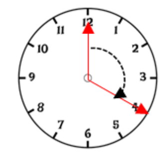
What angles can you identify using compass directions?

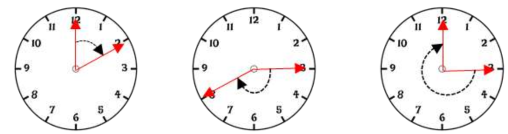
What is the size of the angle?

What fraction of a full turn is the angle?

Varied Fluency

Use the sentence stems to describe the turns made by the minute hand. Compare the turns to a right angle.

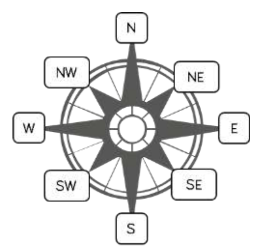




The turn from 12 to 4 is larger than a right angle. It is an obtuse angle.

The turn from ___ to ___ is _______ than a right angle.
It is an ______ angle.

Use the compass to complete the table.



Turn	Degrees	Type of angle	Fraction of a turn
North-East to South-East Clockwise	90°	Right angle	$\frac{1}{4}$ of a turn
North-West to North-West Clockwise			
South-West to South-East Anti-clockwise			
South-West to ______ Clockwise	180°		
North-East to East Clockwise			$\frac{1}{8}$ of a turn

Measuring Angles in Degrees

Reasoning and Problem Solving

Which angle is the odd one out? 180° 45° 79° 270° Could another angle be the odd one out for a different reason?	Multiple responses e.g. 79° is the odd one out because the others are multiples of 45 degrees. They would relate to compass point..
Always, sometimes or never true? • If I turn from North-East to North-West, I have turned 90° • If I turn from East to North-West, I will have turned through an obtuse angle. • If I turn from South-West to South, my turn will be larger than 350°	All are sometimes true, depending on whether you turn clockwise or anti-clockwise or even more than one turn.

Pick a starting point on the compass and describe a turn to your partner. Use the mathematical words to describe your turns: • Clockwise • Anti-clockwise • Degrees • Acute • Obtuse • Reflex • Right angle Can your partner identify where you will finish?	Lots of possibilities. Children can be challenged further e.g. I am equivalent to three right angles, I start at North-West and turn clockwise, where do I finish?

Measuring with a Protractor (1)

Notes and Guidance

Children are taught to use a protractor for the first time. They begin with measuring angles less than 90° - acute angles. They use their knowledge of right angles to help estimate the size of acute angles e.g. "It's close to a right angle, so about 80°."
Children need to develop their understanding of using both the inside and outside scales of the protractor, and need to be taught how to decide which to use.

Mathematical Talk

What unit do we use to measure angles?

How can we tell whether an angle is acute?

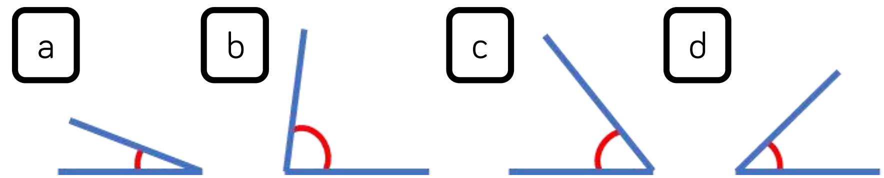
How do we know which scale to use on a protractor?

Where will you place your protractor when measuring an angle?

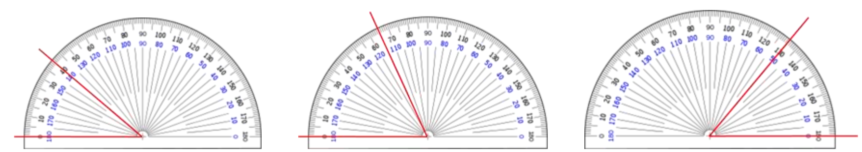
Does moving the paper help you to measure an angle?

Varied Fluency

- Put these angles in order of size. Explain how you know.

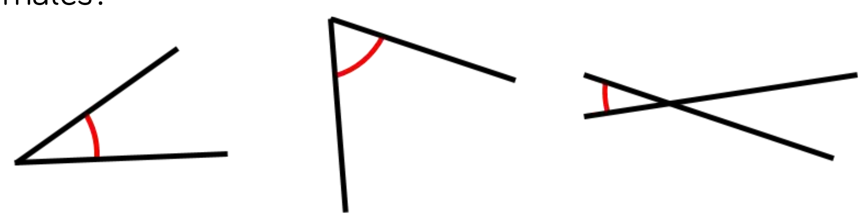


- Read the angles shown on the protractor.



What's the same? What's different?

- Estimate the size of the angles and then use a protractor to measure them to the nearest degree. How close were your estimates?

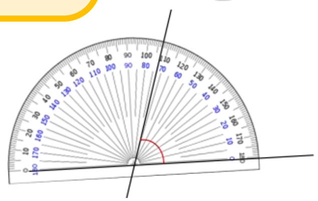


Measuring with a Protractor (1)

Reasoning and Problem Solving

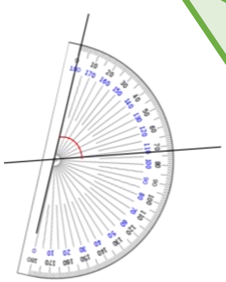
I have measured the angle correctly because my protractor is the right way round.

Teddy



Whitney

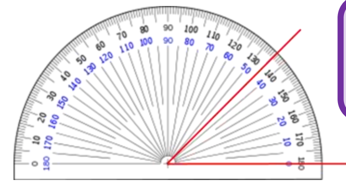
I have measured the angle correctly because my protractor is on the line accurately.



Who do you agree with? Explain why.

They are both correct. It doesn't matter which way the protractor is as long as it is placed on the angle correctly.

Three children are measuring angles. Can you spot and explain their mistake?

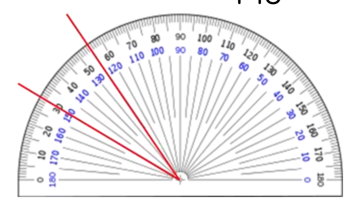


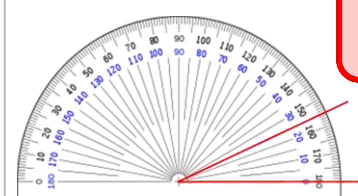
My angle measures 135°

Mo

My angle measures 55°

Dora





My angle measures 35°

Alex

Mo hasn't recognised his angle is acute so his measurement is wrong.

Alex has not placed one of her lines on 0. Her angle measures 25°.

Dora has misread the scale. Her angle measures 25°.

Measuring with a Protractor (2)

Notes and Guidance

Children continue to learn how to use a protractor and focus on measuring obtuse angles.
They use their knowledge of right angles to help estimate the size of obtuse angles e.g. "It's just over a right angle, so about 100°."
Children need to develop their understanding of using both the inside and outside scales of the protractor, and need to be taught how to decide which to use.

Mathematical Talk

How do you know an angle is obtuse?

Can you see where obtuse angles would be measured on the protractor?

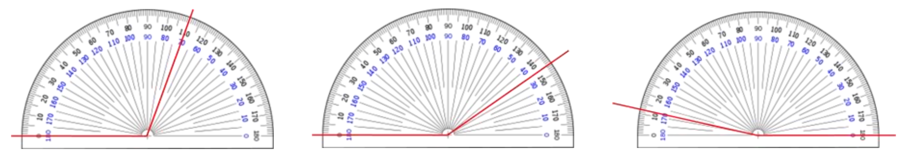
Can you estimate the size of this angle?

What is the size of the angle? What mistake might someone make?

Where will you place your protractor first?

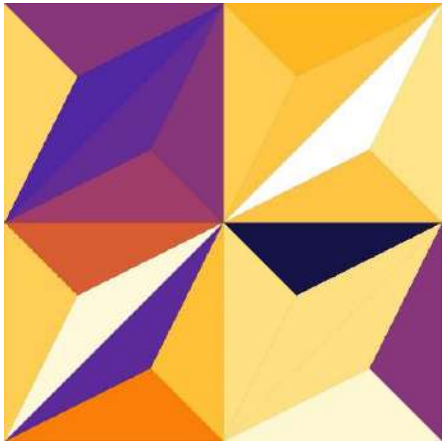
Varied Fluency

- Measure the angles shown on the protractors.



- Estimate the size of the angles and then use a protractor to measure them to the nearest degree.

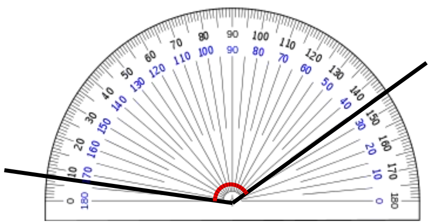
- Identify obtuse angles in the image.
Estimate the size of the angles, and then measure them?



Measuring with a Protractor (2)

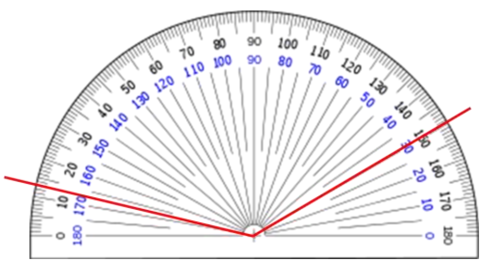
Reasoning and Problem Solving

Rosie is measuring an obtuse angle.
What's her mistake?



Rosie has not placed the 0 line of the protractor on one of the arms of the angle.

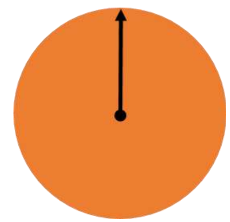
How many ways can you find the value of the angle?



Children may:

- subtract 150 – 13 = 137°
- add up on the protractor as a number line e.g. +7 +100 +30 = 137°
- place the protractor correctly.

Use a cut out of a circle and place a spinner in the centre.



- Point the arrow in the starting position above.
- Move the spinner to try to make the angles shown on the cards below.
- Check how close you are with a protractor.

40° | 72° | 154°

Drawing Accurately

Notes and Guidance

Children need to draw lines correct to the nearest millimetre. They use a protractor to draw angles of a given size, and will need to be shown this new skill.

Children continue to develop their estimation skills whilst drawing and measuring lines and angles. They also continue to use precise language to describe the types of angles they are drawing.

Mathematical Talk

How many millimetres are in a centimetre?

How do we draw a line that measures ___?

Explain how to draw an angle.

What's the same and what's different about drawing angles of 80° and 100° ?

How can I make this angle measure ___ but one of the lines have a length of ___?

Varied Fluency

Draw lines that measure:

4 cm and 5 mm	45 mm	4.5 cm

What's the same? What's different?

Draw:
- angles of 45° and 135°
- angles of 80° and 100°
- angles of 20° and 160°

What do you notice about your pairs of angles?

Draw:
- an acute angle that measures 60° with the arms of the angle 6 cm long
- an obtuse angle that measures 130° but less than 140° with the arms of the angle 6.5 cm long

Compare your angles with your partner's.

Drawing Accurately

Reasoning and Problem Solving

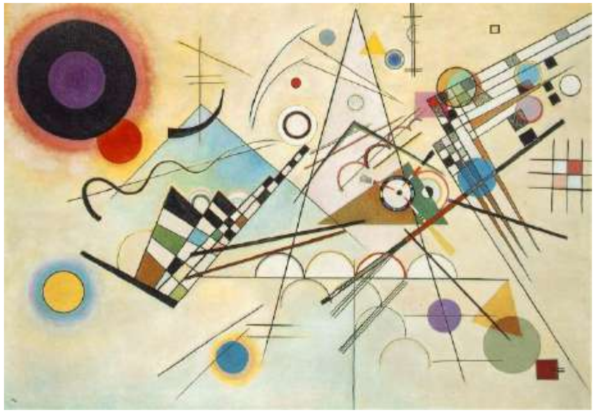
Draw a range of angles for a friend. Estimate the sizes of the angles to order them from smallest to largest.
Measure the angles to see how close you were.

Always, sometimes or never true?

- Two acute angles next to each other make an obtuse angle.
- Half an obtuse angle is an acute angle.
- 180° is an obtuse angle

- Sometimes
- Always
- Never

Use Kandinsky's artwork to practice measuring lines and angles.



Create clues for your partner to work out which line or angle you have measured.

For example, "My line is horizontal and has an obtuse angle of 110° on it."

Angles on a Straight Line

Notes and Guidance

Children build on their knowledge of a right angle and recognise two right angles are equivalent to a straight line, or a straight line is a half of a turn.
Once children are aware that angles on a straight line add to 180 degrees, they use this to calculate missing angles on straight lines.
Part-whole and bar models may be used to represent missing angles.

Mathematical Talk

How many degrees are there in a right angle?

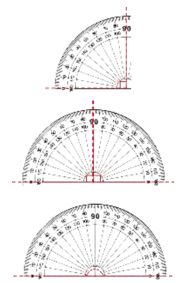
How many will there be in two right angles?

If we place two right angles together, what do we notice?

How can we calculate the missing angles?

How can we subtract a number from 180 mentally?

Varied Fluency

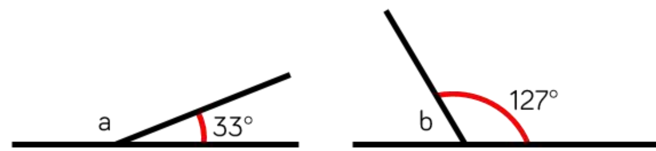


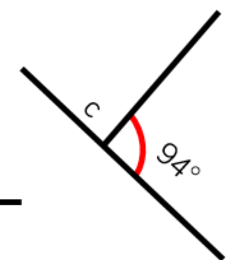
There are ______degrees in a right angle.

There are ______right angles on a straight line.

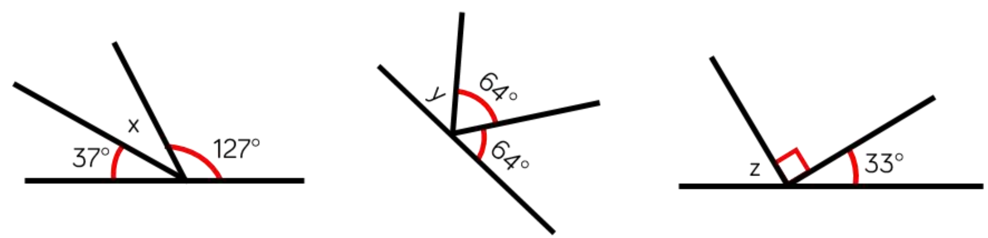
There are ______degrees on a straight line.

Calculate the missing angles.





Calculate the missing angles.

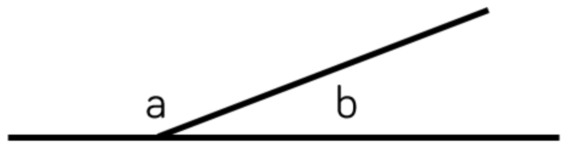


Is there more than one way to calculate the missing angles?

Angles on a Straight Line

Reasoning and Problem Solving

Here are two angles.



Angle b is a prime number between 40 and 50

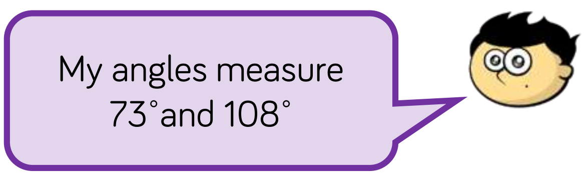
Use the clue to calculate what the missing angles could be.

$b = 41°, a = 139°$

$b = 43°, a = 137°$

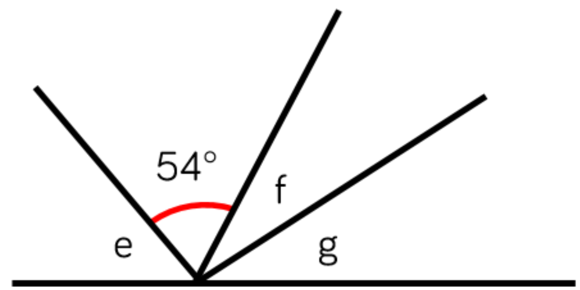
$b = 47°, a = 133°$

Jack is measuring two angles on a straight line.



Explain why at least one of Jack's angles must be wrong.

His angles total more than 180°.



- The total of angle f and g are the same as angle e
- Angle e is 9° more than the size of the given angle.
- Angle f is 11° more than angle g

Calculate the size of the angles.

Create your own straight line problem like this one for your partner.

$e = 63°$

$f = 37°$

$g = 26°$

Angles around a Point

Notes and Guidance

Children need to know that there are 360 degrees in a full turn. This connects to their knowledge of right angles, full turns and compass points.

Children need to know when they should measure an angle and when they should calculate the size of angle from given facts.

Mathematical Talk

How many right angles are there in $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$ of a full turn?

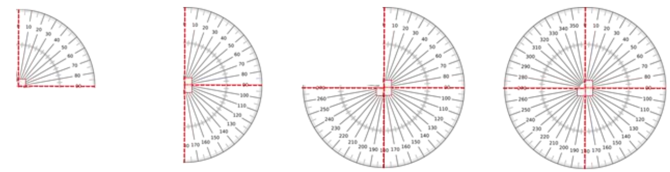
If you know a half turn/full turn is 180/360 degrees, how can this help you calculate the missing angle?

What is the most efficient way to calculate a missing angle? Would you use a mental or written method?

When you have several angles, is it better to add them first or to subtract them one by one?

Varied Fluency

Complete the sentences.



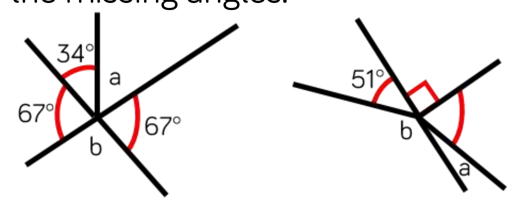
$\frac{1}{4}$ of a turn = 1 right angle = 90°

$\frac{1}{2}$ of a turn = __ right angles = _____°

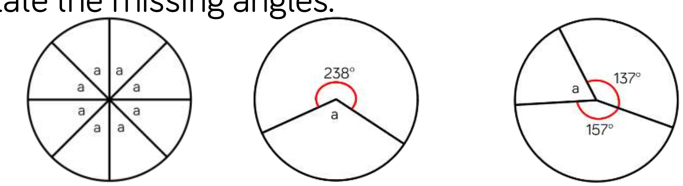
$\frac{\square}{\square}$ of a turn = 3 right angles = _____°

A full turn = __ right angles = _____°

Calculate the missing angles.

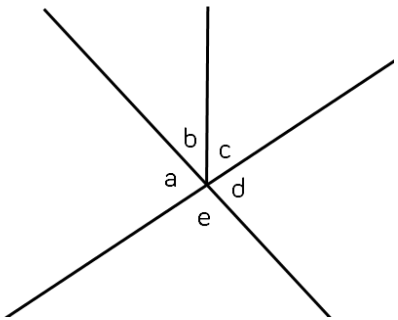


Calculate the missing angles.



Angles around a Point

Reasoning and Problem Solving



$a + b + c + d + e = 360°$
$d + e = 180°$
Write other sentences about this picture.

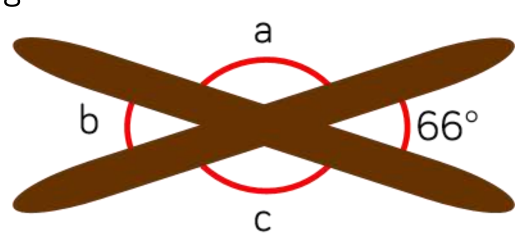
Various answers e.g.

$a + b + c = e + d$

$360° - e - d = 180°$

Etc.

Two sticks are on a table.
Without measuring, find the three missing angles.



$a = 114°$

$b = 66°$

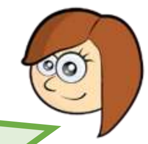
$c = 114°$

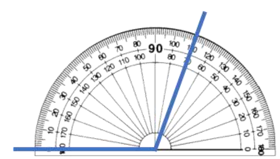
Eva says,

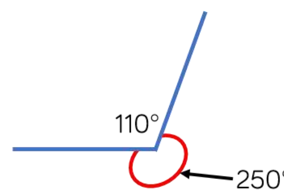
My protractor only goes to 180 degrees, so I can't draw reflex angles like 250 degrees.

Rosie says,

I know a full turn is 360 degrees so I can draw 110 degrees instead and have an angle of 250 degrees as well.







Use Rosie's method to draw angles of:

- 300°
- 200°
- 280°

Triangles

Notes and Guidance

Teachers might start this small step by recapping the definition of a polygon. An activity might be to sort shapes into examples and non-examples of polygons.
Children will classify triangles for the first time using the names 'isosceles', 'scalene' and 'equilateral'. Children will use rulers to measure the sides in order to classify them correctly.
Children will compare the similarities and differences between triangles and use these to help them identify, sort and draw.

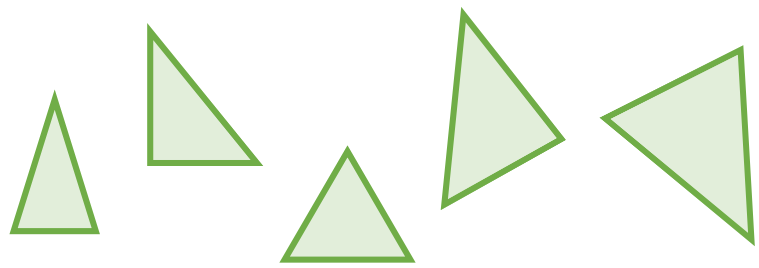
Mathematical Talk

What is a polygon? What isn't a polygon?
What are the names of the different types of triangles?
What are the properties of an isosceles triangles?
What are the properties of a scalene triangle?
What are the properties of an equilateral triangle?
Which types of triangle can also be right-angled?
How are the triangles different?
Do any of the sides need to be the same length?

Varied Fluency

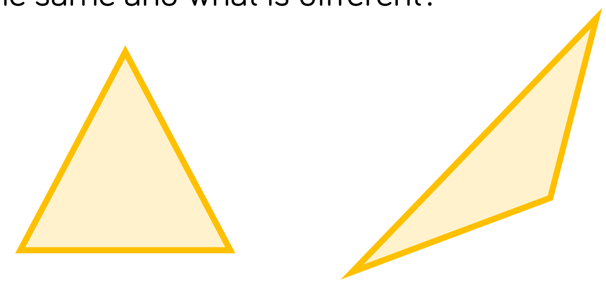
R

- Label each of these triangles: isosceles, scalene or equilateral.



Are any of these triangles also right-angled?

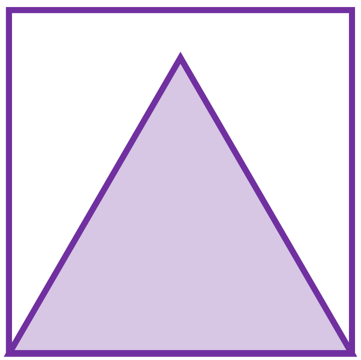
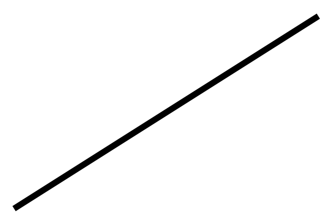
- Look at these triangles.
What is the same and what is different?



- Using a ruler, draw:
  - An isosceles triangle
  - A scalene triangle

Triangles

Reasoning and Problem Solving

Here is a square. Inside the square is an equilateral triangle. The perimeter of the square is 60 cm. Find the perimeter of the triangle. 	The perimeter of the triangle is 45 cm.
Eva: If I use 6 straws to make a triangle, I can only make an equilateral triangle. Investigate whether Eva is correct.	Eva is correct. 2, 2, 2 is the only possible construction. 1, 1, 4 and 1, 2, 3 are not possible.
Draw two more sides to create: • An equilateral triangle • A scalene triangle • An isosceles triangle  Which is the hardest to draw?	Children will draw a range of triangles. Get them to use a ruler to check their answers. Equilateral will be difficult to draw accurately because the angle between the first two sides drawn, must be 60°

Quadrilaterals

Notes and Guidance

Children name quadrilaterals including a square, rectangle, rhombus, parallelogram and trapezium. They describe their properties and highlight the similarities and differences between different quadrilaterals.
Children draw quadrilaterals accurately using knowledge of their properties.
Teachers could use a Frayer Model with the children to explore the concept of quadrilaterals further.

Mathematical Talk

What's the same about the quadrilaterals?

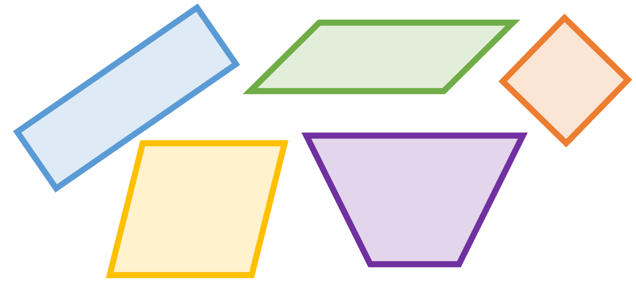
What's different about the quadrilaterals?

Why is a square a special type of rectangle?

Why is a rhombus a special type of parallelogram?

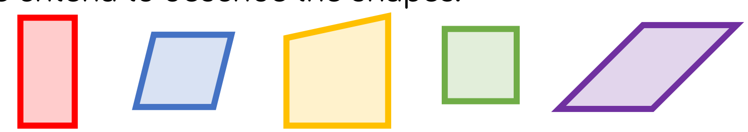
Varied Fluency R

- Label the quadrilaterals using the word bank.



trapezium
square
rhombus
rectangle
parallelogram

- Use the criteria to describe the shapes.



four sides	2 pairs of parallel sides	four equal sides
polygon	1 pair of parallel sides	4 right angles

Which criteria can be used more than once?
Which shapes share the same criteria?

- Draw and label:
  - a rhombus.
  - a parallelogram.
  - 3 different trapeziums

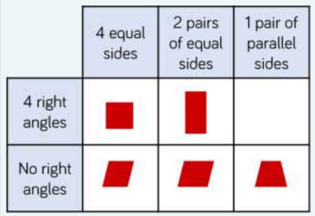
Quadrilaterals

Reasoning and Problem Solving

Complete each of the boxes in the table with a different quadrilateral.

	4 equal sides	2 pairs of equal sides	1 pair of parallel sides
4 right angles			
No right angles			

Which box cannot be completed? Explain why.



Children can discuss if there are any shapes that can go in the top right corner. Some children may justify it could be a square or a rectangle however these have 2 pairs of parallel sides.

You will need:

Some 4 centimetre straws
Some 6 centimetre straws

How many different quadrilaterals can you make using the straws?

Calculate the perimeter of each shape.

Square: Four 4 cm - perimeter is 16 cm or four 6 cm- perimeter is 24 cm
Rectangle: Two 4 cm and two 6 cm- perimeter is 20 cm
Rhombus: Four 4 cm - perimeter is 16 cm
Four 6 cm straws- perimeter is 24 cm
Parallelogram: Two 4 cm and two 6 cm - perimeter is 20 cm
Trapezium: Three 4 cm and one 6 cm- perimeter is 18 cm

Lengths and Angles in Shapes

Notes and Guidance

Children look at squares and rectangles on a grid to identify right angles.
Children use the square grids to reason about length and angles, for example half a right angle is 45 degrees.
Children should be confident in understanding parallel and perpendicular lines and right angles in relation to squares and rectangles.

Mathematical Talk

Look at the rectangle and square, where can you see parallel lines? How many right angles do they have?

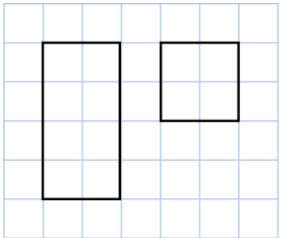
What can you say about the lengths of the sides in a rectangle or in a ______?

If I fold a square in half diagonally to make a triangle, what will the size of the angles in the triangle be?

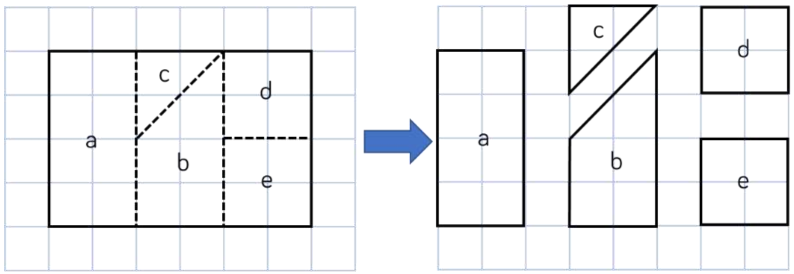
Using what you know about squares and rectangles, how can you calculate the size of the angles?

Varied Fluency

- Look at the square and the rectangle.
What's the same? What's different?

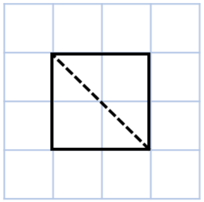


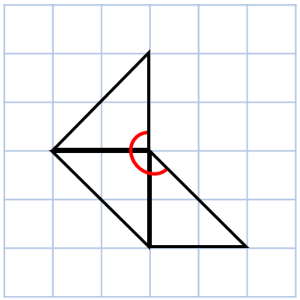
- Calculate the size of the angles in each shape.



What's the same? What's different?

- Here is a square cut into two triangles.



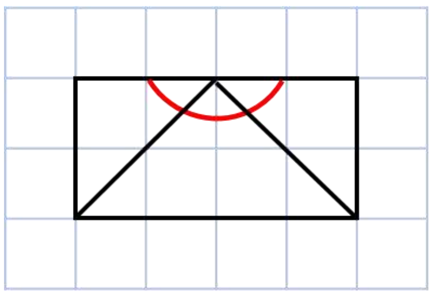


Use the square to calculate the size of the angle.

Lengths and Angles in Shapes

Reasoning and Problem Solving

Whitney is calculating the missing angles in the shape.



She says,

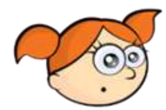
The missing angles are 60 degrees because $180 \div 3 = 60$

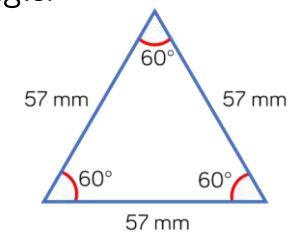
Do you agree?
Explain why.

Whitney is wrong. The angles are not equal.

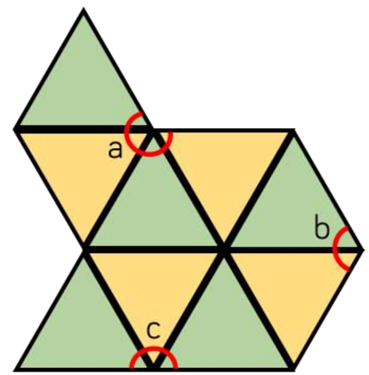
The angles will be worth 45°, 90° and 45° because the line shows a square being split in half diagonally. This means 90° has been divided by 2.

Alex has this triangle.





She makes this composite shape using identical triangles to the one above.



- Calculate the perimeter of the shape.
- Calculate the missing angles.

Use your own triangle, square or rectangle to make a similar problem?

Perimeter $= 57 \times 9 = 513$ mm

$a = 60 \times 4$

$a = 240°$

$b = 60 \times 2$

$b = 120°$

$c = 60 \times 3$

$c = 180°$

Regular & Irregular Polygons

Notes and Guidance

Children distinguish between regular and irregular polygons. They need to be taught that "regular" means all the sides and angles in a shape are equal e.g. an equilateral triangle and a square are regular but a rectangle and isosceles triangle are irregular polygons.
Once they are confident with this definition they can work out the sizes of missing angles and sides.

Mathematical Talk

What is a polygon?

Can a polygon have a curved line?

Name a shape which isn't a polygon.

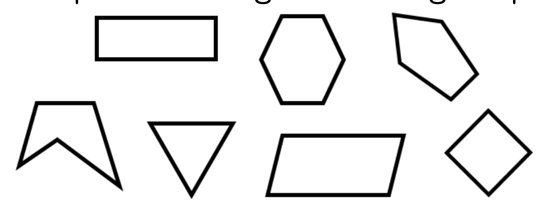
What makes a polygon irregular or regular?

Is a square regular?

Are all hexagons regular?

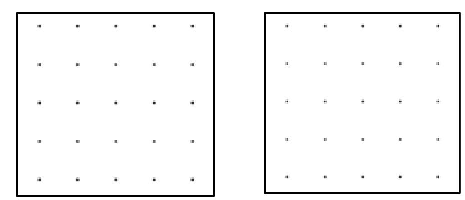
Varied Fluency

- Sort the shapes in to irregular and regular polygons.

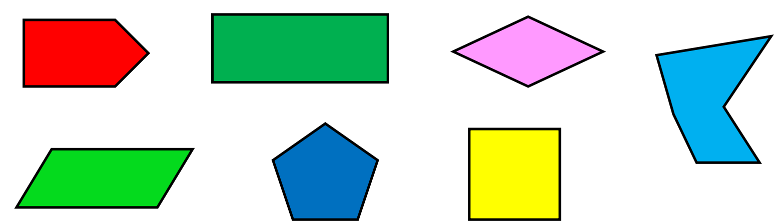


What's the same? What's different?

- Draw a regular polygon and an irregular polygon on the grids.



- Look at the 2D shapes. Decide whether the shape is a regular or irregular polygon. Measure the angles to check.



Regular & Irregular Polygons

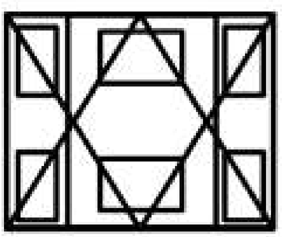
Reasoning and Problem Solving

Always, sometimes or never true?

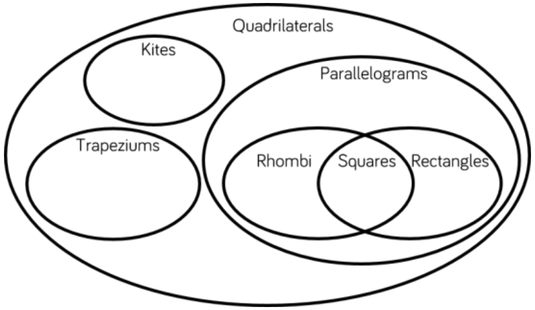
- A regular polygon has equal sides but not equal angles.
- A triangle is a regular polygon.
- A rhombus is a regular polygon.
- The number of angles is the same as the number of sides in any polygon.

- Never true – equal sides and equal angles.
- Sometimes true – equilateral triangles are, isosceles are not.
- Sometimes true – if the rhombus has right angles and is a square.
- Always true.

How many regular and irregular polygons can you find in this picture?



Cut out lots of different regular and irregular shapes. Ask children to work in pairs and sort them into groups. Once they have sorted them, can they find a different way to sort them again? Children could use Venn diagrams and Carroll diagrams to deepen their understanding, for example:



	Regular polygon	Irregular polygon
Has at least one right angle		
Has no right angles		

Multiple responses

Reasoning about 3-D Shapes

Notes and Guidance

Children identify 3-D shapes, including cubes and cuboids, from 2-D shapes. They should have a secure understanding of language associated with the properties of 3-D shapes, for example, faces, curved surfaces, vertices, edges etc.

Children also look at properties of 3-D shapes from 2-D projections, including plans and elevations.

Mathematical Talk

What's the difference between a face and a curved surface?

Name some 3-D solids which have curved surfaces and some which don't.

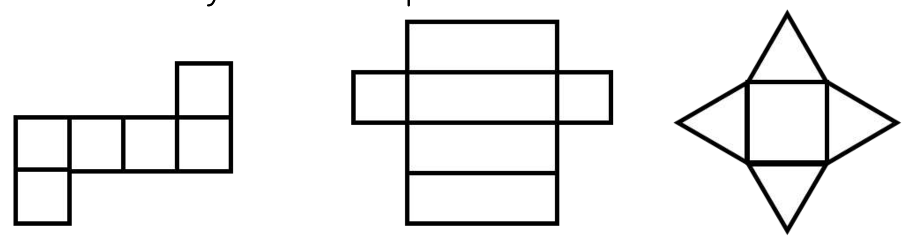
What faces can we see in the net? What shape will this make?

Which face will be opposite this face? Why?

Can we spot a pattern between the number of faces and the number of vertices a prism or pyramid has?

Varied Fluency

Look at the different nets. Describe the 2-D shapes used to make them and identify the 3-D shape.

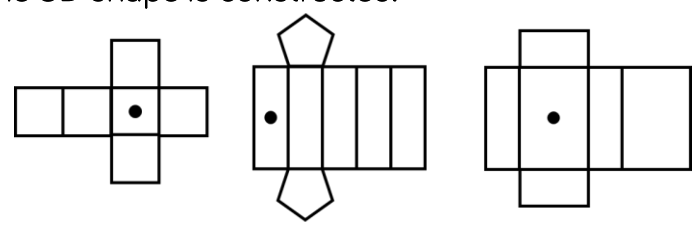


Use equipment, such as Polydron or 2-D shapes, to build the 3-D solids being described.

- My faces are made up of a square and four triangles.
- My faces are made up of rectangles and triangles.

Can the descriptions make more than one shape?

Draw another dot on the nets so the dots are on opposite faces when the 3D shape is constructed.



Reasoning about 3-D Shapes

Reasoning and Problem Solving

Amir says,

If two 3-D shapes have the same number of edges, then they also have the same number of vertices.

Do you agree?
Explain why.

No. If the 3-D shape is a prism then there will be more vertices than edges.

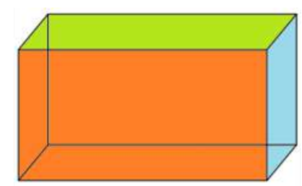
Children could investigate this and look for a pattern.

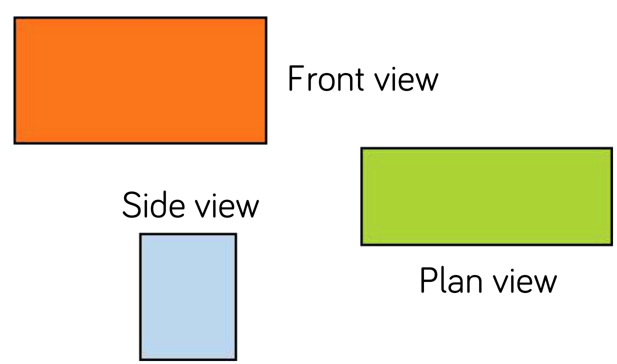
Create cubes and cuboids by using multilink cubes.
Draw these on isometric paper.
Would it be harder if you had to draw something other than squares or rectangles?

Multiple responses.

Using different 3-D solids, how can you represent them from different views?
Work out which representation goes with which solid.

For example,





Children may explore a certain view for a prism and discover that it could always look like a cuboid or cube due to the rectilinear faces.

White Rose Maths

Summer - Block 3

Position & Direction

Overview

Small Steps

- Describe position (R)
- Draw on a grid (R)
- Position in the first quadrant
- Translation
- Translation with coordinates
- Lines of symmetry (R)
- Complete a symmetric figure (R)
- Reflection
- Reflection with coordinates

Notes for 2020/21

Children have looked at plotting and reading coordinates in year 4 and this should be revisited before moving on to year 5 content.

You might notice that the order of reflection and translation has been changed, this is so clearer links can be made between reflection and previous learning on symmetry.

Describe Position

Notes and Guidance

Children are introduced to coordinates for the first time and they describe positions in the first quadrant.

They read, write and use pairs of coordinates. Children need to be taught the order in which to read the axes, x-axis first, then y-axis next. They become familiar with notation within brackets.

Mathematical Talk

Which is the x-axis?

Which is the y-axis?

In which order do we read the axes?

Does it matter in which order we read the axes?

How do we know where to mark on the point?

What are the coordinates for ______?

Where would (__ , __) be?

Varied Fluency

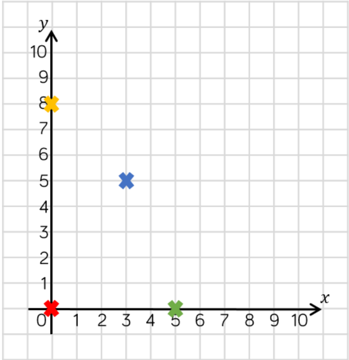
R

- Create a large grid using chalk or masking tape. Give the children coordinates to stand at. Encourage the children to move along the axis in the order they read them.

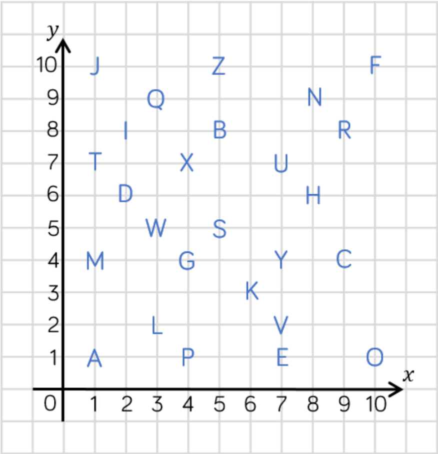
- Write the coordinates for the points shown.

  (__ , __)   (__ , __)

  (__ , __)   (__ , __)

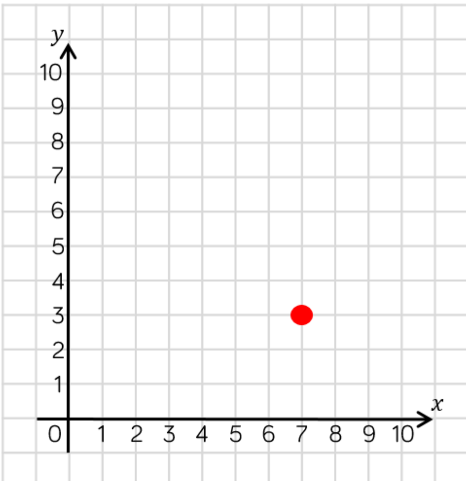


- Write out the coordinates that spell your name.



Describe Position

Reasoning and Problem Solving



The point is plotted at (7, 3)

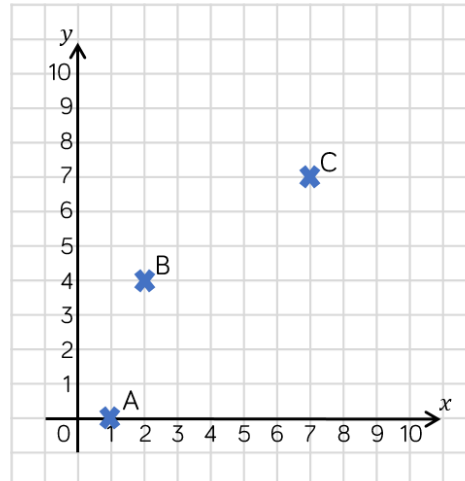
Teddy

The point is plotted at (3, 7)

Rosie

Who is correct?
What mistake has one of the children made?

Teddy is correct.
Rosie has read the y-axis before the x-axis.



Which clue matches which coordinate?

Clue 1	My x coordinate is half of my y coordinate.
Clue 2	My y coordinate is less than my x coordinate.
Clue 3	Both my coordinates are prime numbers.

Clue 1 - B
Clue 2 - A
Clue 3 - C

Draw on a Grid

Notes and Guidance

Children develop their understanding of coordinates by plotting given points on a 2-D grid.

Teachers should be aware that children need to accurately plot points on the grid lines (not between them).

They read, write and use pairs of coordinates.

Mathematical Talk

Do we plot our point on the line, or next to the line?

How could we use a ruler to help plot points?

In which order do we read and plot the coordinates?

Does it matter which way we plot the numbers on the axis?

What are the coordinates of ______?

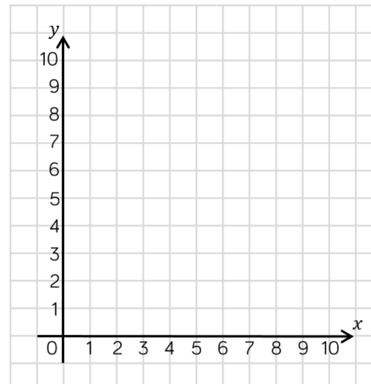
Where would (__, __) be?

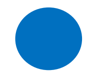
Can you show _____ on the grid?

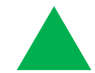
Varied Fluency

R

- Draw the shapes at the correct points on the grid.



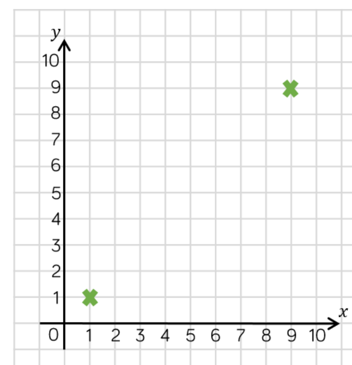
 (7, 8)

 (4, 6)

 (9, 1)

 (10, 0)

- Plot two more points to create a square.



- Plot these points on a grid.

(2, 4) (4, 2) (5, 8) (7, 6)

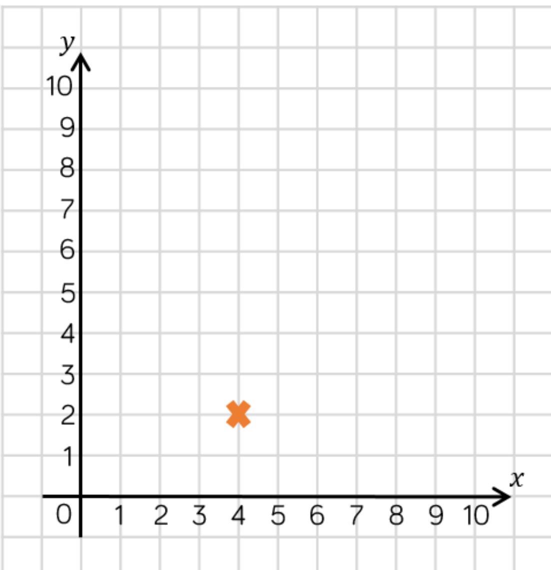
What shape has been created?

Draw on a Grid

Reasoning and Problem Solving

R

What shapes could be made by plotting three more points?



The children could make a range of quadrilaterals dependent on where they plot the points.
If children plot some of the points in a line they could make a triangle.

When you are plotting a point on a grid it does not matter whether you go up or across first as long as you do one number on each axis.

Amir

Do you agree with Amir?
Convince me.

Amir is incorrect. The x-axis must be plotted before the y-axis.
Children prove this by plotting a pair of coordinates both ways and showing the difference.

Always, Sometimes, Never.

The number of points is equal to the number of vertices when they are joined together.

Sometimes.
If points are plotted in a straight line they will not create a vertex.

Position in the 1st Quadrant

Notes and Guidance

Children recap their use of coordinates from Year 4.

They start with an understanding of the origin (0, 0), before moving onto reading other coordinates. They understand that the first number represents the x-coordinate and the second number represents the y-coordinate. Teachers might explain how a coordinate is fixed (does not move) whereas a point can be plotted at different coordinates, so it can be moved.

Mathematical Talk

Which of the numbers represents the movement in the direction of the x-axis (from the origin)? Which of the numbers represents the movement on the y-axis (from the origin)?

Does it matter which way around coordinates are written?

Look at the point I have marked, what are the coordinates of this point?

If I moved the point one place to the left, what would be different about the coordinates? If I moved the point down one, what would be different about the coordinates?

Varied Fluency

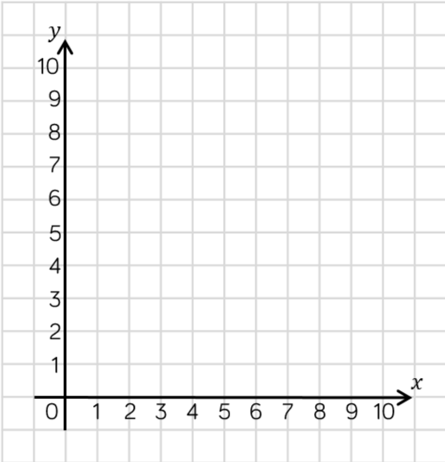
- Plot the following points on the grid.

(3, 5)

(4, 4)

(0, 2)

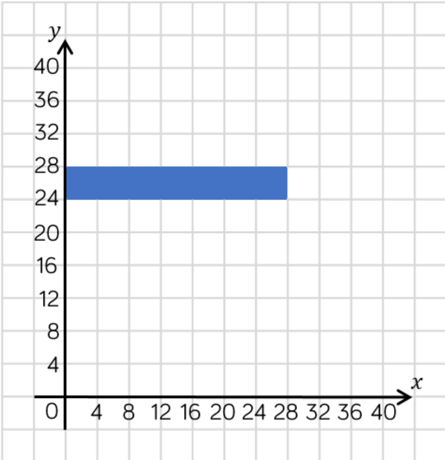
(4, 0)



- What are the coordinates of the vertices of the rectangle?

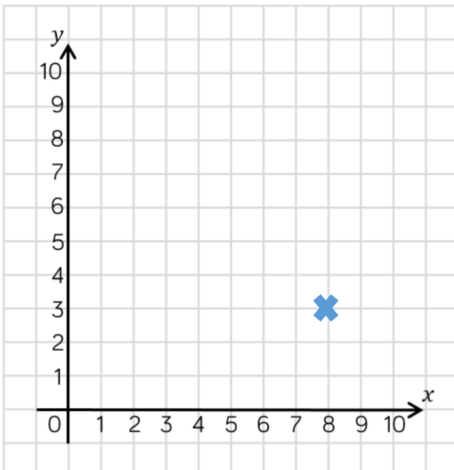
(,) (,)

(,) (,)



Position in the 1st Quadrant

Reasoning and Problem Solving



The point is at (8, 3)

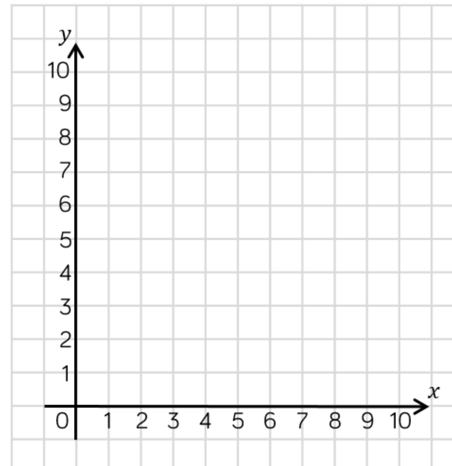
Mo

The point is at (3, 8)

Alex

Who do you agree with? Can you spot the mistake the other child has made?

Mo is correct. Alex has made a mistake by thinking the first number is the y-coordinate.



Annie is finding co-ordinates where the x-coordinate and the y-coordinate add up to 8.

For example: (3, 5) $3 + 5 = 8$

Find all of Annie's coordinates and plot them on the grid. What do you notice?

Now do the same for a different total.

Annie's coordinates form a diagonal line (8, 0) to (0, 8)

Translation

Notes and Guidance

Children learn to translate shapes on a grid.

Children could focus on one vertex at a time when translating.

Attention should be drawn to the fact that the shape itself does not change size nor orientation when translated.

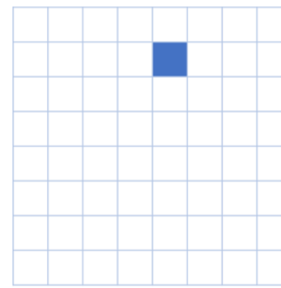
Mathematical Talk

What does translate mean?

Look what happens when I translate this shape. What has happened to the shape? Have the dimensions of the shape changed? Does it still face the same way?

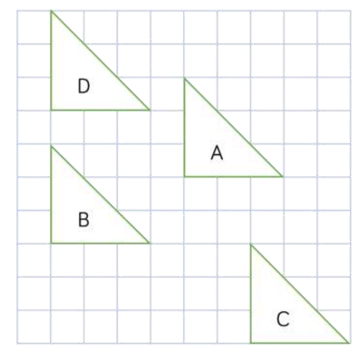
Are there any other ways I can get the shape to this position?

Varied Fluency

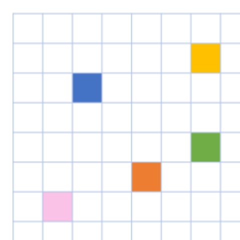


A square is translated two squares to the right and three down.
Draw the new position of this square.

Describe the translation of shape A to shape B, C and then D. Use the stem sentence to help you.
Shape A has been translated ________ left/right and ________ up/down.



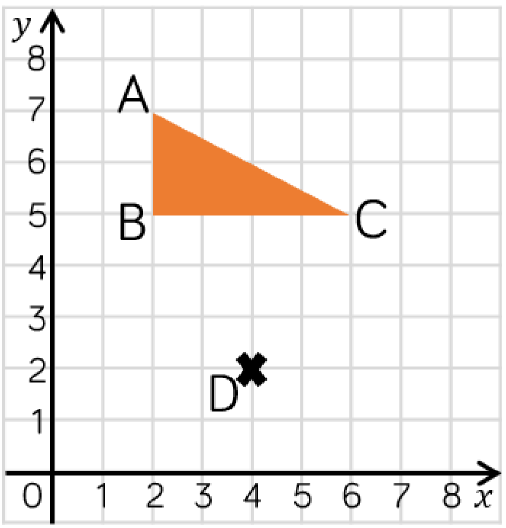
Match the translations.



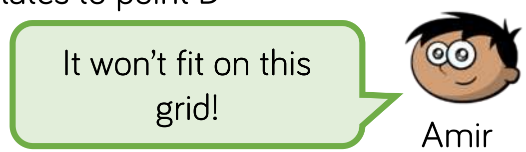
4 right, 2 down
2 left, 3 up
5 left, 5 down

Translation

Reasoning and Problem Solving

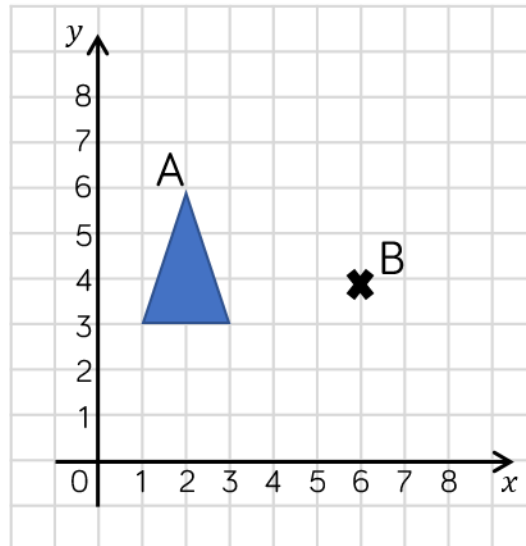


Triangle ABC is translated so that point B translates to point D



Do you agree with Amir?
Explain your thinking.

Amir is incorrect, the shape is translated two to the right and three down. It will fit on this grid.



A triangle is drawn on the grid.
It is translated so that point A translates to point B.

What would be the coordinates of the other vertices of the translated triangle?

(7, 1)

(5, 1)

Translation with Coordinates

Notes and Guidance

Children translate coordinates and also describe translations of coordinates.

Attention should be drawn to the effect of the translation on the x-coordinate and the y-coordinate. For example, how does a translation of 3 up affect the x and y-coordinate?

Mathematical Talk

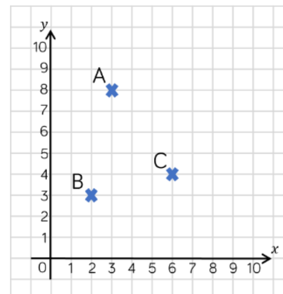
If we move this point down, what will happen to its coordinates? What if it moves up?

If I move the point two right, what will happen to the coordinates?

If these are the translated coordinates, what were the original coordinates?

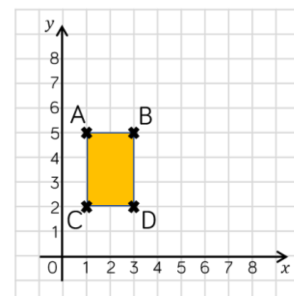
Varied Fluency

Translate each coordinate 2 down, 1 right. Record the coordinates of its new position.



	Before translation	After translation
A	(3, 8)	
B		
C		

Rectangle ABCD is translated so vertex C is translated to (3, 5). Describe the translation. What are the coordinates of the other vertices of the translated rectangle?



Translate the coordinates below.

(3, 6) → 3 left → (,) → 1 up → (,)

(5, 7) → 2 right → (,) → 4 down → (,)

Translation with Coordinates

Reasoning and Problem Solving

These three coordinates have all been translated in the same way.

(_ , _) → (3 , 1)

(_ , 5) → (4 , 3)

(4 , _) → (6 , 1)

Can you work out the missing coordinates?

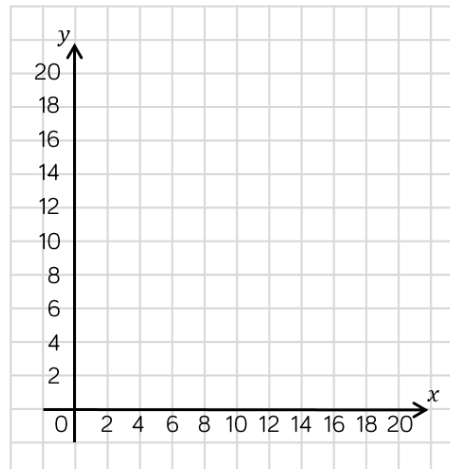
Describe the translation.

Translation 2 right 2 down.

(1 , 3) → (3 , 1)

(2 , 5) → (4 , 3)

(4 , 3) → (6 , 1)



A rectangle is translated two to the left and 4 up.

Three of the coordinates of the translated rectangle are: (6, 8) (10, 14) and (10, 8).

What are the coordinates of the original rectangle?

(8, 10) (12, 10)

(8, 4) (12, 4)

Lines of Symmetry

Notes and Guidance

Children find and identify lines of symmetry within 2-D shapes. Children explore symmetry in shapes of different sizes and orientations. To help find lines of symmetry children may use mirrors and tracing paper.
The key aspect of symmetry can be taught through paper folding activities. It is important for children to understand that a shape may be symmetrical, but if the pattern on the shape isn't symmetrical, then the diagram isn't symmetrical.

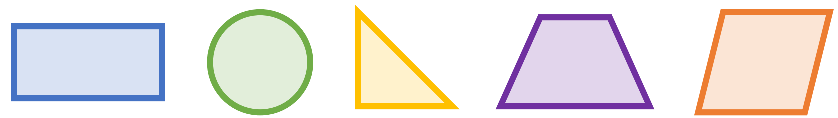
Mathematical Talk

Explain what you understand by the term 'symmetrical'.
Can you give any real-life examples?
How can you tell if something is symmetrical?
Are lines of symmetry always vertical?
Does the orientation of the shape affect the lines of symmetry?
What equipment could you use to help you find and identify lines of symmetry?
What would the rest of the shape look like?

Varied Fluency

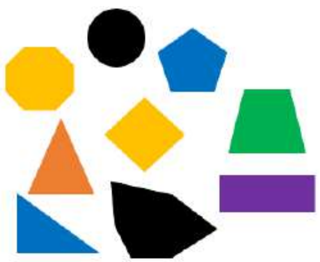
R

- Using folding, find the lines of symmetry in these shapes.

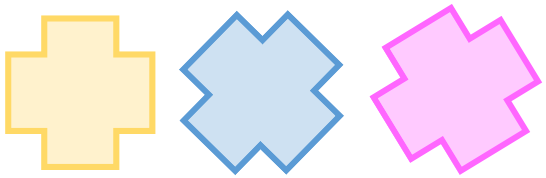


- Sort the shapes into the table.

	1 line of symmetry	More than 1 line of symmetry
Up to 4 sides		
More than 4 sides		



- Draw the lines of symmetry in these shapes (you could use folding to help you).



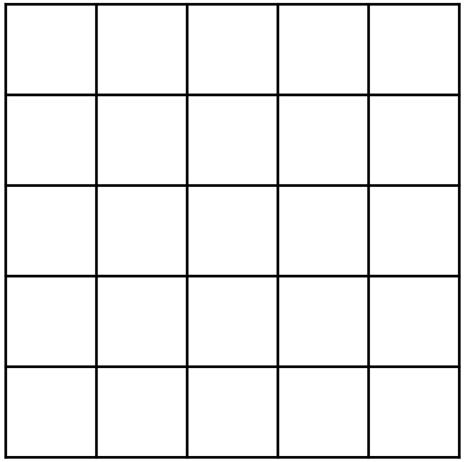
What do you notice?

Lines of Symmetry

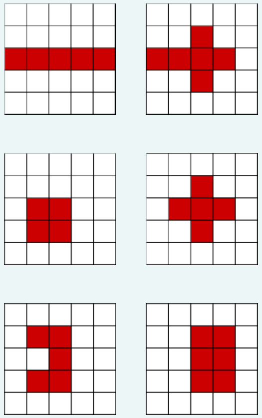
Reasoning and Problem Solving

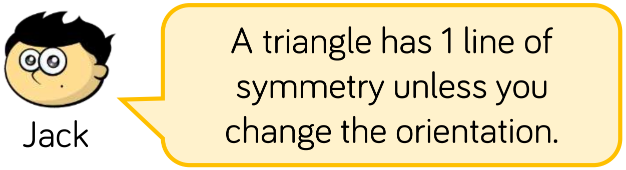
R

How many symmetrical shapes can you make by colouring in a maximum of 6 squares?



There are a variety of options. Some examples include:





Is Jack correct? Prove it.

Jack is incorrect. Changing the orientation does not change the lines of symmetry. Children should prove this by drawing shapes in different orientations and identifying the same number of lines of symmetry.

Always, Sometimes, Never.

A four-sided shape has four lines of symmetry.

Sometimes, provided the shape is a square.

Symmetric Figures

Notes and Guidance

Children use their knowledge of symmetry to complete 2-D shapes and patterns.

Children could use squared paper, mirrors or tracing paper to help them accurately complete figures.

Mathematical Talk

What will the rest of the shape look like?

How can you check?

How can you use the squares to help you?

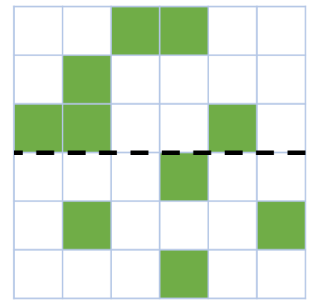
Does each side need to be the same or different?

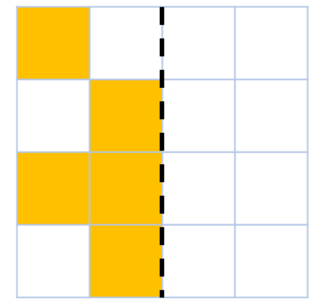
Which lines need to be extended?

Varied Fluency

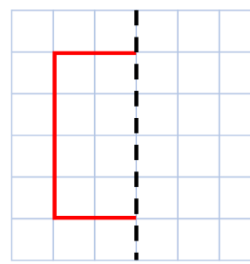
R

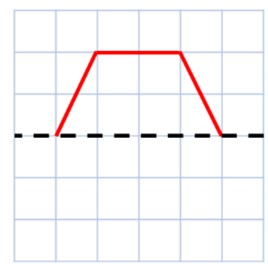
- Colour the squares to make the patterns symmetrical.

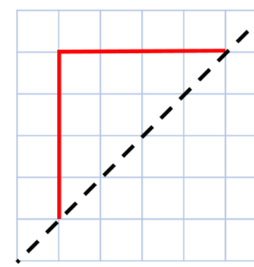




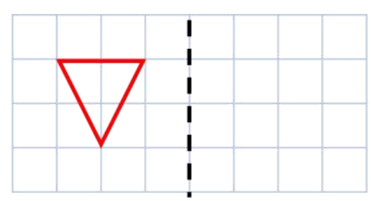
- Complete the shapes according to the line of symmetry.

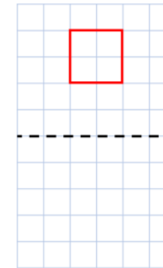






- Reflect the shapes in the mirror line.





Symmetric Figures

Reasoning and Problem Solving

R

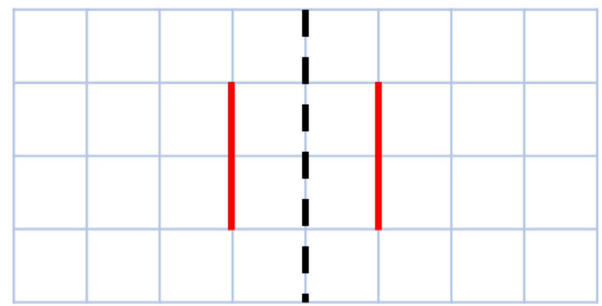

Dora

When given half of a symmetrical shape I know the original shape will have double the amount of sides.

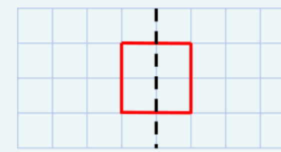
Do you agree with Dora?
Convince me.

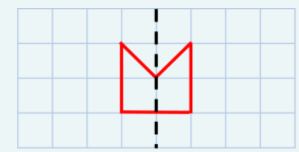
Dora is sometimes correct. This depends on where the mirror line is. Encourage children to draw examples of times where Dora is correct, and to draw examples of times when Dora isn't correct.

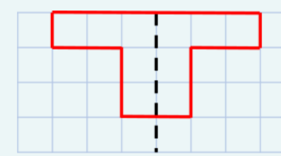
How many different symmetrical shapes can you create using the given sides?



Children will find a variety of shapes. For example:







Reflection

Notes and Guidance

Children reflect objects using lines that are parallel to the axes. Children continue to use a 2-D grid and coordinates in the first quadrant. Teachers might want to encourage children to use mirrors, or to count how far the point is away from the mirror line, so that they can work out where the reflected point will be located. Children should be introduced to the language object (name of shape before reflection) and image (name of shape after reflection).

Mathematical Talk

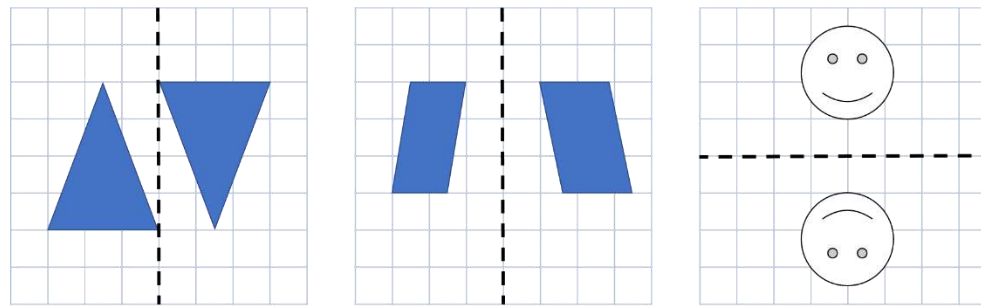
When I reflect something, what changes about the object? Is it exactly the same?

What are the coordinates of this point? If I reflect it in the mirror line, what are the new coordinates?

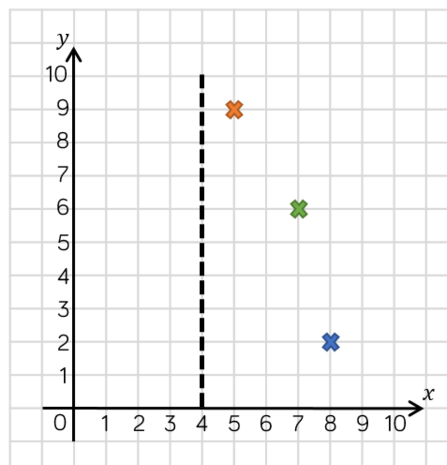
If I reflect this point/shape in a vertical/horizontal mirror line, what will happen to the x-coordinate/y-coordinate?

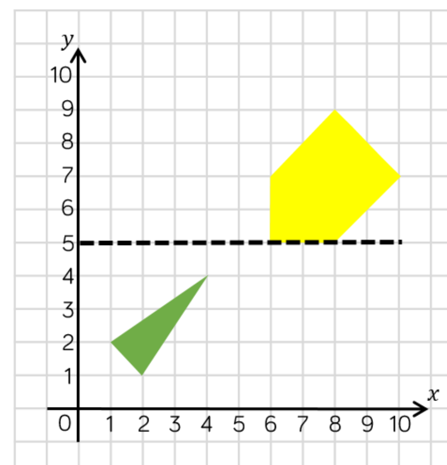
Varied Fluency

Which of the diagrams show reflections in the given mirror line?



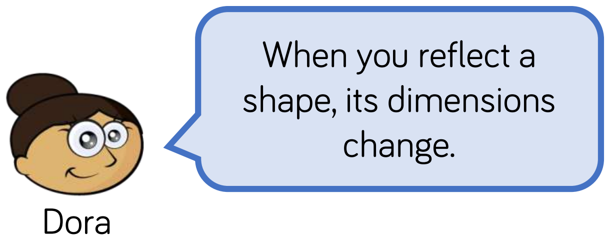
Reflect the coordinates and the shapes in the mirror line.





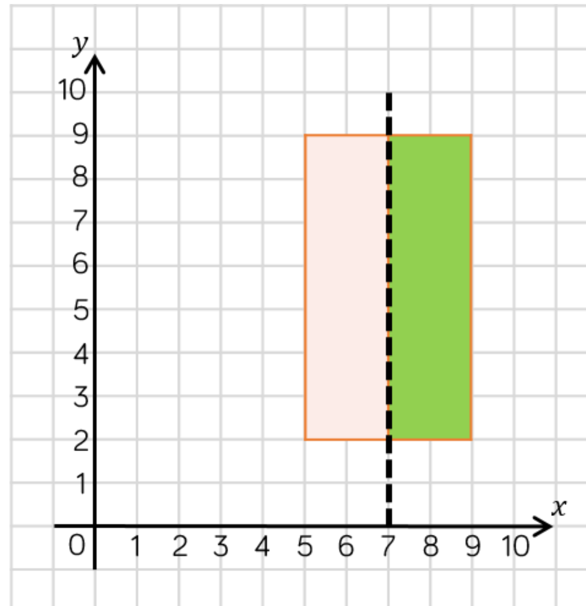
Reflection

Reasoning and Problem Solving



Do you agree with Dora?
Explain your thinking.

Dora is incorrect, the shape's dimensions do not change, only its position is changed.



The rectangle is pink and green.
The rectangle is reflected in the mirror line.
What would its reflection look like?

The shape would remain in the same position, although the colours would be swapped – green on the left and pink on the right.

Reflection with Coordinates

Notes and Guidance

Teachers should explore what happens to points when they are reflected in lines parallel to the axes.

Children might use mirrors to do this. This might be done through investigation where children record coordinates of vertices of the object and coordinates of vertices of the image in a table.

Mathematical Talk

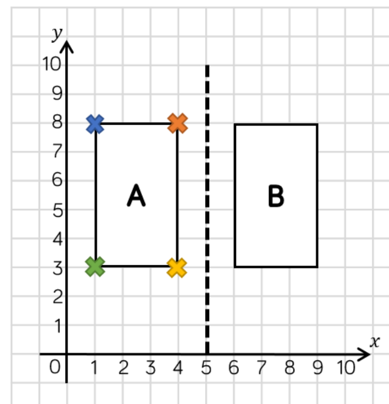
What is the x-coordinate for this vertex? What is the y-coordinate for this vertex?

If we look at this point, where will its new position be on the image, when it is reflected? What's different about the coordinates of the object compared to the coordinates of the image?

Do you always need to use a mirror? How else could you work out the coordinates of each vertex?

Varied Fluency

Object A is reflected in the mirror line to give image B.
Write the coordinates of the vertices for each shape.



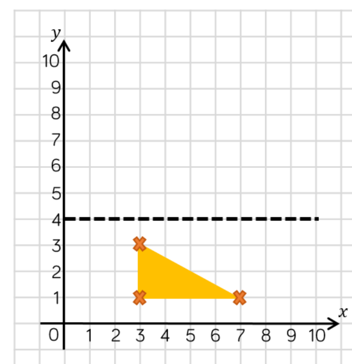
	Original Coordinate	Reflected Coordinate
✖		
✖		
✖		
✖		

Write the coordinates of the image after the object (triangle) has been reflected in the mirror line.

(,)

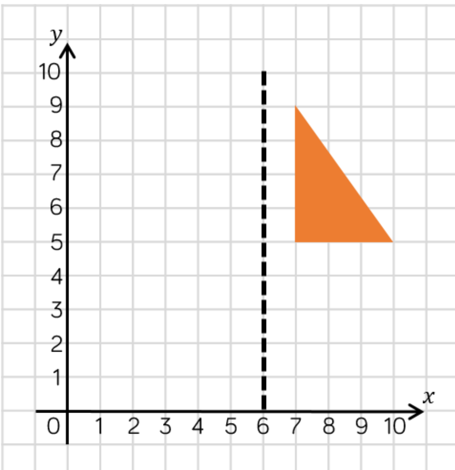
(,)

(,)



Reflection with Coordinates

Reasoning and Problem Solving

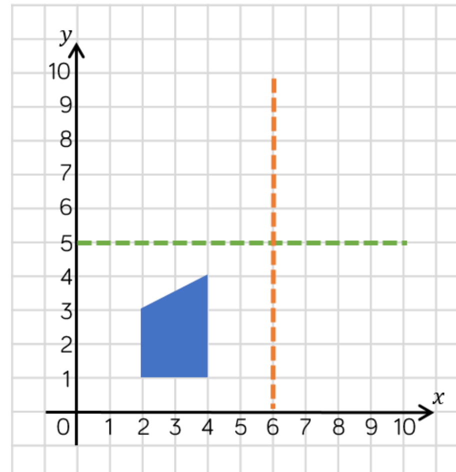


Eva reflects the shape in the mirror line. She thinks that the coordinates of the vertices for the reflected shape are:

(5, 5) (2, 5) (2, 9)

Is Eva is correct?
Explain why.

The (2, 9) coordinate is incorrect, it should be (5, 9).



This is a shape after it has been reflected. This is called the image.

Use the grid and the marked mirror lines to show where the original object was positioned.

Is there more than one possibility?

There are two possibilities for the object.

Summer - Block 4

Converting Units

Overview

Small Steps

- Kilometres R
- Kilograms and kilometres
- Millimetres and millilitres
- Metric units
- Imperial units
- Converting units of time
- Timetables

Notes for 2020/21

Children have converted between metres and kilometres in year 4 and now build on this to look at other conversions. It is a good idea to recap the small step on kilometres to reinforce the idea of the prefix 'kilo-' meaning 'thousand'.

Kilometres

Notes and Guidance

Children multiply and divide by 1,000 to convert between kilometres and metres.
They apply their understanding of adding and subtracting with four-digit numbers to find two lengths that add up to a whole number of kilometres.
Children find fractions of kilometres, using their Year 3 knowledge of finding fractions of amounts. Encourage children to use bar models to support their understanding.

Mathematical Talk

Can you research different athletic running races? What different distances are the races? Can you convert the distances from metres into kilometres? Which other sports have races over distances measured in metres or kilometres?
If 10 children ran 100 metres each, how far would they run altogether? Can we go outside and do this? How long do you think it will take to run 1 kilometre?
How can we calculate half a kilometre? Can you find other fractions of a kilometre?

Varied Fluency

R

Complete the statements.

3,000 m = ___ km	8 km = _______ m
5 km = ___ m	3 km + 6 km = _______ m
500 m = ___ km	250 m = _______ km
9,500 m = ___ km	4,500 m – 2,000 m = _____ km

Complete the bar models.

3 kilometres	
	1,800 metres

___ km	
2,870 m	4,130 m

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

500 m	◯	$\frac{1}{2}$ km
7 km	◯	800 m
5 km	◯	500 m

Kilometres

Reasoning and Problem Solving

Dexter and Rosie walk 15 kilometres altogether for charity.
Rosie walks double the distance that Dexter walks.
How far does Dexter walk?

Rosie walks 10 km.

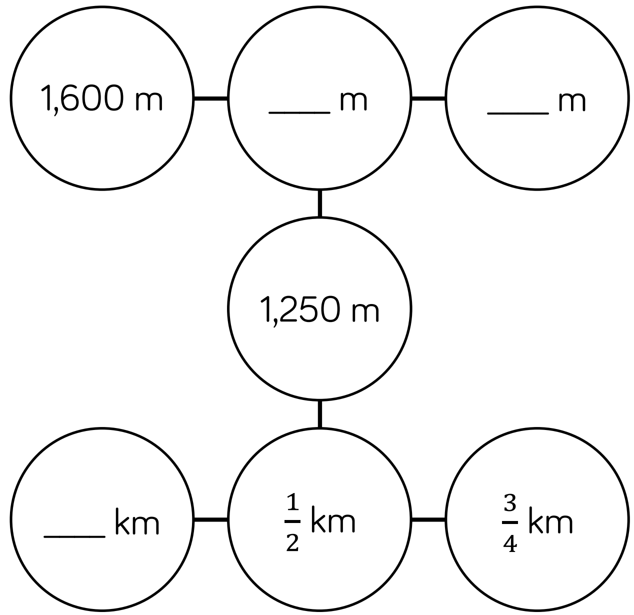
Dexter walks 5 km.

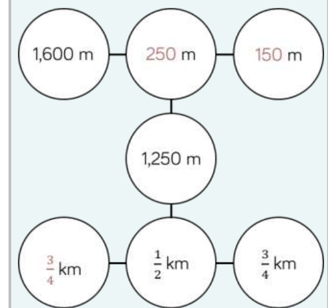
Dexter and Rosie each raise £1 for every 500 metres they walk.
How much money do they each make?

Rosie raises £20

Dexter raises £10

Complete the missing measurements so that each line of three gives a total distance of 2 km.





Kilograms and Kilometres

Notes and Guidance

Children focus on the use of the prefix ‘kilo’ in units of length and mass, meaning a thousand. They convert from metres to kilometres (km), grams to kilograms (kg) and vice versa. It is useful for children to feel the weight of a kilogram and various other weights in order for them to have a better understanding of their value.
Bar Models or double number lines are useful for visualising the conversions.

Mathematical Talk

What does ‘kilo’ mean when used at the start of a word?

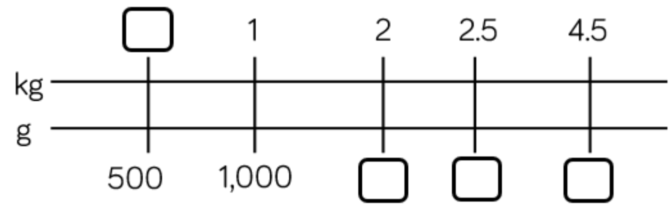
Complete the stem sentence:
There are ______ grams in ___ kilograms.

How would you convert a fraction of a kilometre to metres?

What is the same and what is different about converting from kg to g and km to m?

Varied Fluency

- Find the missing values on the double number line.



Write your conversions as sentences.

- Complete the missing information.

$\frac{1}{10}$ kilogram = $\square$ grams $\frac{3}{10}$ km = $\square$ metres

7 kg + $\frac{1}{4}$ kg = $\square$ g   12 km + $\square$ km = 12,500 m

- Compare the measurements using <, > or =

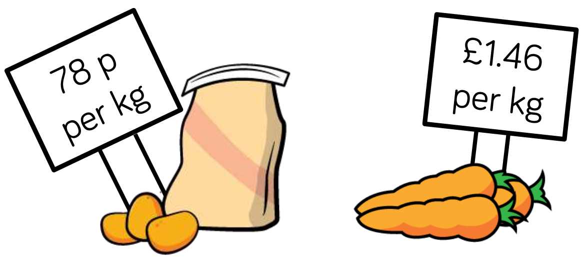
5 kg ◯ 4,500 g   12 kg ◯ 12,000 g

3.7 km ◯ 370 m   37,000 m ◯ 3.7 km

Kilograms and Kilometres

Reasoning and Problem Solving

Amir buys 2,500 grams of potatoes and 2,000 grams of carrots.



He pays with a £5 note.
How much change does he get?

Amir receives

13 p change.

Eva is converting measurements.
She says,

I have divided by 1,000 to convert the measurements.

Which conversions could Eva have completed?

- 3 km ⟶ 3,000 m
- 3,000 m ⟶ 3 km
- 5,500 g ⟶ 5.5 kg
- 2.8 kg ⟶ 2,800 g

Eva could have converted 3,000 m to 3 km or 5,500 g to 5.5 kg.

Milligrams and Millilitres

Notes and Guidance

Children focus on the use of milli- in units of length and mass.

They understand that milli- means $\frac{1}{1,000}$.

They convert from metres to millimetres (mm), litres to millilitres (ml) and vice versa.

Using rulers, metre sticks, jugs and bottles helps children to get a better understanding of the conversions.

Mathematical Talk

Can you complete the stem sentences to convert from millimetres to metres…

What does 'milli' mean when used at the start of a word?

Would it be appropriate to measure your height in millimetres?

Where have you seen litres before?

Varied Fluency

Complete the conversions.

1,000 mm = 1 m	1,000 ml = 1 l
5,000 mm = ☐ m	☐ ml = 3 l
50,000 mm = ☐ m	☐ ml = 30 l
500 mm = ☐ m	300 ml = ☐ l
5,500 mm = ☐ m	☐ ml = 0.3 l

Complete the missing information

$\frac{1}{1,000}$ m = ☐ mm $\frac{1}{100}$ m = ☐ mm $\frac{1}{10}$ m = ☐ mm

3 l + $\frac{1}{4}$ l = ☐ ml 2 l + ☐ ml = 2,500 ml

Compare the measurements using < , > or =

2 l ◯ 1,500 ml 60 l ◯ 6,000 ml

2.8 m ◯ 280 mm 3,700 m ◯ 3.7 mm

Milligrams and Millilitres

Reasoning and Problem Solving

Cola is sold in bottles and cans.

330 ml
48 p

1.25 litres
£1.59

Alex buys 5 cans and 3 bottles.
She sells the cola in 100 ml glasses.
She sells all the cola.
How many glasses does she sell?

Alex charges 50 p per glass.
How much profit does she make?

Alex sells 54 glasses.

Alex makes £19.83 profit.

Ribbon is sold in 225 mm pieces.
Teddy needs 5 metres of ribbon.
How many pieces does he need to buy?

Teddy would like to make either a bookmark or a rosette with his left over ribbon. Which can he make?

To make 5 bookmarks you will need:
1.2 metres of ribbon
1 pair of scissors

To make 1 mini rosette you will need:
4 pieces of ribbon cut to 35 mm
A stapler

Teddy buys 23 pieces of ribbon.

Teddy will have 175 mm left over.

A bookmark needs 240 mm, and a rosette needs 140 mm so he can make the rosette.

Metric Units

Notes and Guidance

Children convert between different units of length and choose the appropriate unit for measurement. They recap converting between millimetres, metres and kilometre to now include centimetres (cm).

Children see that they need to divide by different multiples of 10 to convert between the different measurements.

Mathematical Talk

What is the same and what is different about these conversions?

- Converting from cm to m
- Converting from m to cm

What does 'centi' mean when used at the start of a word?

Which unit of measure would be best to measure: the height of a door frame, the length of a room, the width of a book?

Varied Fluency

Measure the height of the piles of books in centimetres.

Find the difference between the tallest and shortest pile of books in millimetres.

Line A is 6 centimetres long.
Line B is 54 millimetres longer than line A.
Line C is $\frac{2}{3}$ of line B.
Draw lines A, B and C.

Here are the heights of 4 children.

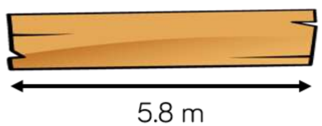
Whitney	Jack	Rosie	Mo
1.3 m	124 cm	1.32 m	141 cm

Put the children in height order, starting with the shortest.
Write their heights in millimetres.

Metric Units

Reasoning and Problem Solving

A plank of wood is 5.8 metres long.



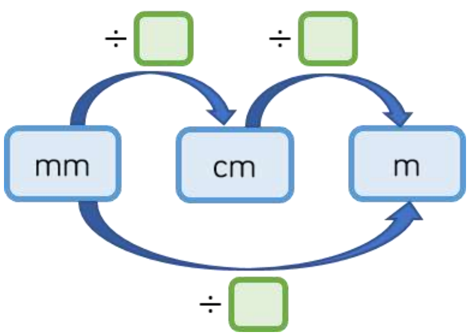
Two lengths are cut from the wood.

175 cm $3\frac{4}{5}$ m

How much of the wood is left?

There is 25 cm left.

Complete the conversion diagram.



Can you make a diagram to show conversions from m and cm to mm?

÷ 10   ÷ 100

÷ 1,000

A 10 pence coin is 2 mm thick.

Eva makes a pile of 10 pence coins worth £1.30

What is the height of the pile of coins in centimetres?

The pile of coins is 2.6 cm tall.

Dora says,

One metre is 100 times bigger than one centimetre. One centimetre is 10 times bigger than one millimetre. So, one metre is 110 times bigger than one millimetre

Is Dora correct?
Explain your answer.

Dora is incorrect. She has added the number of times bigger together rather than multiplying.

One metre is 1,000 times bigger than one millimetre.

White Rose Maths

Imperial Units

Notes and Guidance

Children are introduced to imperial units of measure for the first time. They understand and use approximate equivalences between metric units and common imperial units such as inches, pounds (lbs) and pints.

Using the measurements in the classroom, such as with rulers, pint bottles, weights and so forth, helps children to get an understanding of the conversions.

1 kg is sometimes seen as approximating to 2.2 lbs.

Mathematical Talk

What do we still measure in inches? Pounds? Pints?

Why do you think we still use these imperial measures?

What does approximate mean?

Why do we not use the equals (=) sign with approximations?

How precise should approximation be?

Varied Fluency

One inch is approximately 2.5 centimetres
1 inch ≈ 2.5 cm

Use the bar models to help with the conversions.

$\overbrace{\boxed{1\text{ in}}\boxed{1\text{ in}}\boxed{1\text{ in}}\boxed{1\text{ in}}}^{?\text{ cm}}$

$\overbrace{\boxed{5\text{ cm}}}^{?\text{ in}}$

16in ≈ ☐ cm

15in ≈ ☐ cm

33in ≈ ☐ m

10cm ≈ ☐ in

1cm ≈ ☐ in

5.5m ≈ ☐ in

1 kilogram is approximately 2 pounds
1 kg ≈ 2 lbs

Use this information to complete the conversions.

2 kg ≈ ☐ lbs

5 kg ≈ ☐ lbs

☐ kg ≈ 22 lbs

55 kg ≈ ☐ lbs

There are 568 millilitres in a pint.
How many litres are there in:

2 pints | 5 pints | 0.5 pints | 2.5 pints

Imperial Units

Reasoning and Problem Solving

Jack's house has 3 pints of milk delivered 4 times a week.
How many litres of milk does Jack have delivered each week?

He uses about 200 ml of milk every day in his cereal. Approximately, how many pints of milk does Jack use for his cereal in a week?

12 pints is approximately 6,816 millilitres, or 6.8 litres.

$200 \times 7 = 1{,}400$ ml

$1400 \div 568 = 2.46$ pints

So Jack uses approximately 2 and a half pints.

- Dora weighed 7.8 lbs when she was born.
- Amir weighed 3.5 kg when he was born.

Who was heavier, Dora or Amir?
Explain your answer.

Children convert both measures to the same unit.

Dora weighed approximately 3.9 kg and Amir weighed 3.5 kg so Dora was heavier.

White Rose Maths

Converting Units of Time

Notes and Guidance

Children convert between different units of time including years, months, weeks, days, hours, minutes and seconds.
Bar modelling will support these conversions.
Use of time lines, calendars, clocks is recommended to enhance pupils' understanding.
It is worth reminding pupils that time is not decimal so some methods may not be effective for conversions.

Mathematical Talk

How many months / weeks / days are there in a year?

How many hours / minutes / seconds are there in a day?

Can 21 days be written in weeks? Can 25 days be written in weeks? Explain your answers.

Is 0.75 hours the same as 75 minutes? Why or why not?

Varied Fluency

- Complete the conversions.

  1 year = ☐ months

  ☐ years = 24 months

  ☐ years = 60 months

  2.5 years = ☐ months

  3 years 2 months = ☐ months

  ☐ years ☐ months = 75 months

- Complete the table.

Days	Weeks / Weeks and Days
42 days	
	5 weeks and 5 days
	10 weeks and 5 days
100 days	

- Use this information to complete the conversions.

  $\frac{1}{3}$ hour = ☐ minutes

  3 ☐ and 24 ☐ = 204 ☐

  1.5 minutes = ☐ seconds

  1.05 minutes = ☐ seconds

Converting Units of Time

Reasoning and Problem Solving

Teddy's birthday is in March.
Amir's birthday is in April.
Amir is 96 hours older than Teddy.
What dates could Teddy and Amir's birthdays be?

28th March and 1st April

29th March and 2nd April

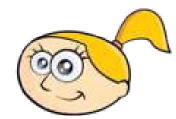
30th March and 3rd April

31st March and 4th April

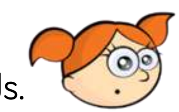
Three children are running a race.

- Whitney finishes the race in 3 minutes 5 seconds.

- Eva finishes the race in 192 seconds.



- Alex finishes the race in 2 minutes and 82 seconds.



Who finishes the race first?

Whitney: 3 min 5 s

Eva: 3 min 12 s

Alex: 3 min 22 s

Whitney finishes the race first.

Timetables

Notes and Guidance

Children use timetables to retrieve information. They convert between different units of time in order to solve problems using the timetables.

Children will be tempted to use the column method to find the difference between times. Time lines are a more efficient method since time is not decimal.

Children create their own timetables based on start and end times of their day.

Mathematical Talk

When do we use timetables in every day life?

How do we know where the important information is on the timetable?

When does column method not work for finding the difference between times?

Varied Fluency

Use the timetable to answer the questions.

Bus Timetable					
Halifax Bus Station	06:05	06:35	07:10	07:43	08:15
Shelf Roundabout	06:15	06:45		07:59	08:31
Shelf Village Hall	06:16	06:46	07:35	08:00	08:32
Woodside	06:21	06:50	07:28		
Odsal	06:26	06:55	07:33	08:15	08:45
Bradford Interchange	06:40	07:10	07:48	08:30	09:00

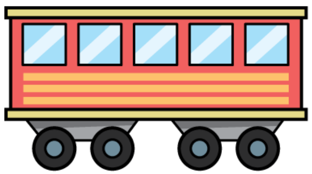
Is the time to get from Shelf Roundabout to Bradford Interchange the same for every bus?
Why might the time not always be the same?
Why are some of the times blank?

There are five TV programmes on between 17:00 and 23:00
The News starts at 6 p.m. and lasts for 45 minutes.
Mindless is on for 1 hour and ends at 18:00.
Junk Collectors is on for 75 minutes and starts straight after The News.
Catch Up is on for 300 seconds and starts at 20:00
The Thirsty Games is on for 175 minutes and ends at 23:00
Make a timetable for the evening TV.

Timetables

Reasoning and Problem Solving

Three trains travel from Halifax to Leeds on the same morning: the express train, the slow train and the cargo train.



The express train leaves Halifax 10 minutes after the slow train, but arrives at Leeds 10 minutes before it.
The slow train takes 50 minutes to reach Leeds and arrives at 10:33
The cargo train leaves 20 minutes before the slow train and arrives at Leeds 39 minutes after the Express.

What time does each train leave Halifax and what time does each train arrive at Leeds Station?

The slow train leaves Halifax at 9:43 and arrives in Leeds at 10:33

The express train leaves Halifax at 9:53 and arrives in Leeds at 10:23

Goods train leaves Halifax at 9:23 and arrives in Leeds at 11:02

Make a timetable of your school day.

Calculate how many hours each week you spend on each subject.
Can you convert this into minutes?
Can you convert this into seconds?

If this is an average week, how many hours a year do you spend on each subject?
Can you convert the time into days?

Answers will vary depending on the school day.

Summer - Block 5

Volume

Overview

Small Steps

- What is volume?
- Compare volume
- Estimate volume
- Estimate capacity

Notes for 2020/21

Here children are reintroduced to the idea of volume but in a more formal way than they have seen previously.

What is Volume?

Notes and Guidance

Children understand that volume is the amount of solid space something takes up. They look at how volume is different to capacity, as capacity is related to the amount a container can hold.
Children could use centimetre cubes to make solid shapes. Through this, they recognise the conservation of volume by building different solids using the same amount of centimetre cubes.

Mathematical Talk

Does your shape always have 4 centimetre cubes? Do they take up the same amount of space?
How can this help us understand what volume is?

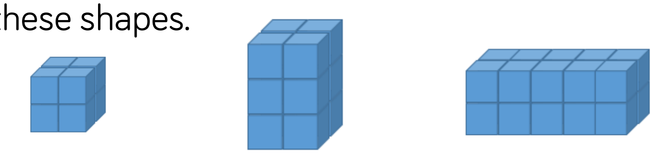
If the solid shapes are made up of 1 cm cubes, can you complete the table?
Look at shape A, B and C. What's the same and what's different?

How is capacity different to volume?

Varied Fluency

- Take 4 cubes of length 1 cm. How many different solids can you make? What's the same? What's different?

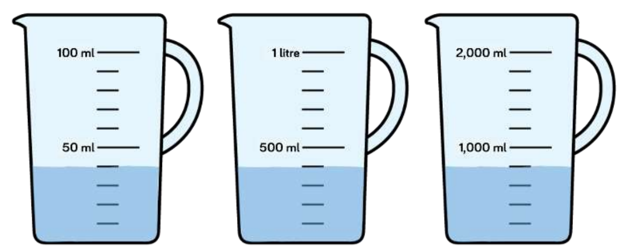
- Make these shapes.



Complete the table to describe your shapes.

Shape	Width (cm)	Height (cm)	Length (cm)	Volume (cm^3)
A				
B				
C				

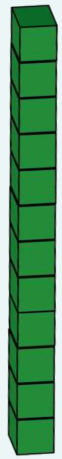
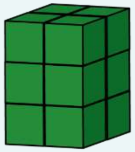
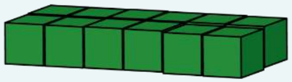
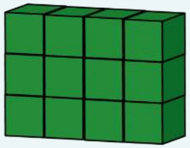
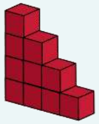
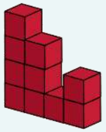
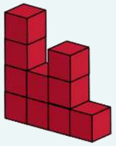
- Compare the capacity and the volume. Use the sentence stems to help you.



Container ___ has a capacity of ____ ml
The volume of water in container ___ is ___ cm^3

What is Volume?

Reasoning and Problem Solving

How many possible ways can you make a cuboid that has a volume of 12 cm^3?	Possible solutions:    
My shape is made up of 10 centimetre cubes. The height and length are the same size. What could my shape look like? Create your own shape and write some clues for a partner.	Possible solutions include:   

Compare Volume

Notes and Guidance

Children use their understanding of volume (the amount of solid space taken up by an object) to compare and order different solids that are made of cubes.

They develop their understanding of volume by building shapes made from centimetre cubes and directly comparing two or more shapes.

Mathematical Talk

What does volume mean?
What does cm^3 mean?

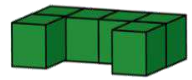
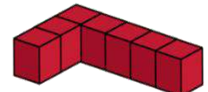
How can we find the volume of this shape?
Which shape has the greatest volume?
Which shape has the smallest volume?

Do we always have to count the cubes to find the volume?

Varied Fluency

- Work out the volume of each solid.

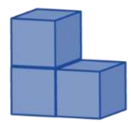
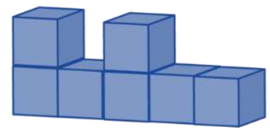
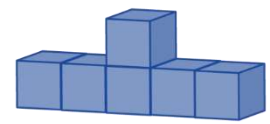
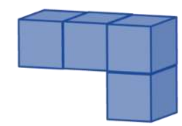
  Shape A | Shape B

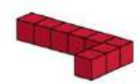
  Shape A has a volume of ___ cm^3
  Shape B has a volume of ___ cm^3

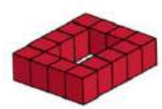
  Which has the greatest volume?

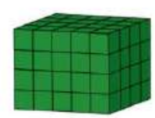
- Look at the 4 solids below. Put the shapes in ascending order based on their volume.

- Count the cubes to find the volume of the shapes and use ‘greater than’, ‘less than’ or ‘equal to’ to make the statements correct.

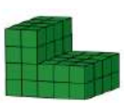
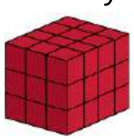
   

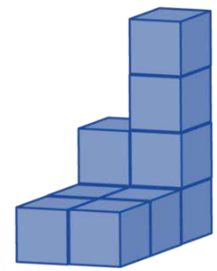
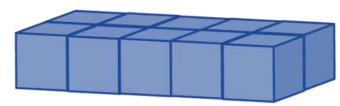
   

Compare Volume

Reasoning and Problem Solving

Shape A has a height of 12 cm. Shape B has a height of 4 cm. Dora says Shape A must have a greater volume. Is she correct? Explain your answer.	Dora is incorrect e.g. Shape A 12 cm × 1 cm × 2 cm = 24 cm^3 Shape B 4 cm × 9 cm × 2 cm = 72 cm^3
Amir, Whitney and Mo all build a shape using cubes. Mo has lost his shape, but knows that it's volume was greater than Whitney's, but less than Amir's. Amir's  Whitney's  What could the volume of Mo's shape be?	The volume of Amir's shape is 56 cm^3 The volume of Whitney's shape is 36 cm^3 The volume of Mo's shape can be anywhere between.

Eva has built this solid:  Tommy has built this solid:  Eva thinks that her shape must have the greatest volume because it is taller. Do you agree? Explain your answer.	Eva is incorrect, both solids have an equal volume of 10 cm^3. Children might want to build this to see it.

Estimate Volume

Notes and Guidance

Children estimate volume and capacity of different solids and objects.
They build cubes and cuboids to aid their estimates.
Children need to choose the most suitable unit of measure for different objects e.g. using m^3 for the volume of a room.
Children should understand that volume is the amount of solid space taken up by an object, whereas capacity is the amount a container can hold.

Mathematical Talk

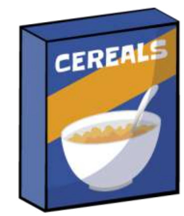
What is the difference between volume and capacity?

Do you need to fill the whole box with cubes to estimate its volume?

Would unit to measure would you use to estimate the volume of the classroom?

Varied Fluency

- Estimate and match the object to the correct capacity.



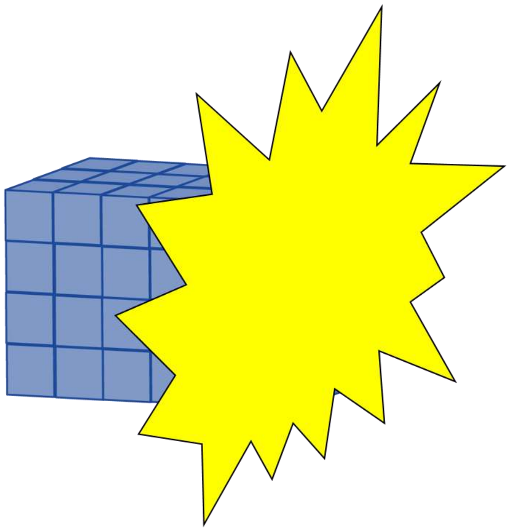
3,600 cm^3	1,000 cm^3	187,500 cm^3

- Use a box or drawer from your classroom.
Use cubes to estimate the volume of the box or drawer when it is full.

- Estimate then work out the capacity of your classroom.

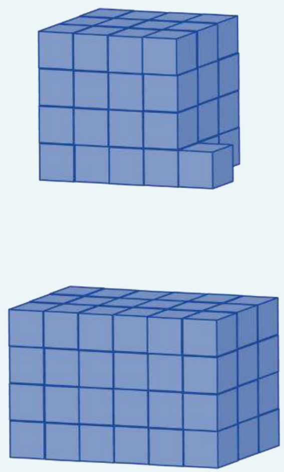
Estimate Volume

Reasoning and Problem Solving

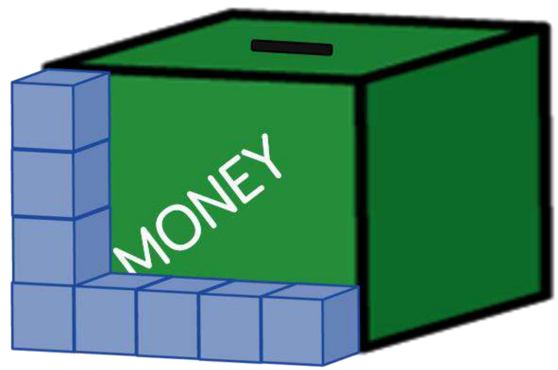


Each of the cubes have a volume of 1 m^3
The volume of the whole shape is between 64 m^3 and 96 m^3
What could the shape look like?

Any variation of cubes drawn between the following:



Jack is using cubes to estimate the volume of his money box.



He says the volume will be 20 cm^3

Do you agree with Jack?
Explain your answer.

What would the approximate volume of the money box be?

Jack is incorrect because he has not taken into account the depth of the money box.

The approximate volume would be 80 cm^3

Estimate Capacity

Notes and Guidance

Children estimate capacity using practical equipment such as water and rice.

Children explore how containers can be different shapes but still hold the same capacity.

Children will understand that we often use the word capacity when referring to liquid, rather than volume.

Mathematical Talk

Can I fill the tumbler so it is ___ full?
Compare two tumblers, which tumbler has more/less volume? Do they have the same capacity?

Can we order the containers?

If I had ___ ml or litres, which container would I need and why?

How much rice/water is in this container? How do you know?

Varied Fluency

Use five identical tumblers and some rice.

- Fill a tumbler half full.
- Fill a tumbler one quarter full.
- Fill a tumbler three quarters full.
- Fill a tumbler, leaving one third empty.
- Fill a tumbler that has more than the first but less than the third, what fraction could be filled?

Show children 5 different containers.
Which containers has the largest/smallest capacity?
Can we order the containers?
If I had ___ ml/l, which container would I need and why?
Fill each container with rice/water and estimate then measure how much each holds.

Match the containers to their estimated capacity.

5,000 ml	500 ml	5 ml

Use this to help you compare other containers. Use 'more' and 'less' to help you.

Estimate Capacity

Reasoning and Problem Solving

Give children a container. Using rice, water and cotton wool balls, can children estimate how much of each they will need to fill it? Discuss what is the same and what is different. Will everyone have the same amount of cotton wool? Will everyone have the same amount of rice? Will everyone have the same amount of water?	Possible response: Explore how cotton wool can be squashed and does not fill the space, whereas water and rice fill the container more.	Give children a container. Using rice/water and a different container e.g. cups, discuss how many cups of rice/water we will need to fill the containers. Link this to the capacity of the containers.	Various different answers.