

Autumn Scheme of Learning

Year 5

#MathsEveryoneCan

2020-21

White  
Rose  
Maths

## New for 2020/21

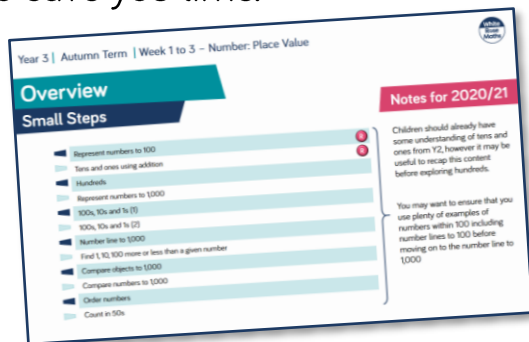
2020 will go down in history. The world has changed for all of us.

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](http://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](https://resources.whiterosemaths.com) or email us directly at [support@whiterosemaths.com](mailto:support@whiterosemaths.com)

The worksheets are titled "Numbers to 10,000" and feature the White Rose Maths logo. They contain the following content:

**Worksheet 1 (Top):**

1 What numbers are represented?  
 a)   
 b)

2 Circle 412  
  
 b) Draw counters in the place value chart to represent 5,321

3 Complete the calculations:  
 a)  $2,865 + 1 =$    
 $2,865 + 10 =$    
 $2,865 + 100 =$    
 $2,865 + 1,000 =$

**Worksheet 2 (Middle):**

1 What numbers are represented?  
 a)   
 b)   
 c) 

Th	Th	H	T	O

  
 d)   
 e) Circle 412  
  
 f) Draw counters in a place value chart to represent 5,321

2 Complete the calculations:  
 a)  $2,865 + 1$       b)  $1,256 - 1$   
 $2,865 + 10$        $1,256 - 10$   
 $2,865 + 100$        $1,256 - 100$   
 $2,865 + 1,000$        $1,256 - 1,000$

3 Complete the table:  

	1 more	10 more	100 more	1,000 more
3,600				
7,213				
	4,511			
		1,291		
			6,009	2,899

4 Draw an arrow to 3,009 on the number line:  
  
 b) Draw an arrow to 2,500 on the number line:

**Worksheet 3 (Bottom):**

1 What numbers are represented?  
 a)   
 b)

## 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



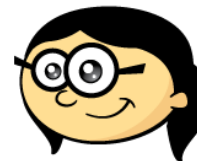
Tommy



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	

**White**

**Rose  
Maths**

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?

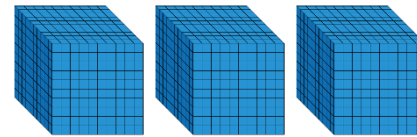
How do you know you have formed the number correctly? What could you use to help you?

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

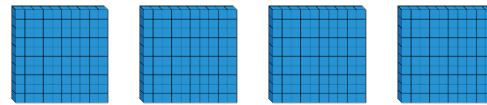
## Varied Fluency



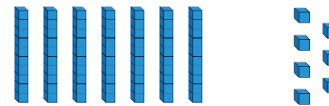
Complete the sentences.



There are \_\_\_\_\_ thousands,  
\_\_\_\_\_ hundreds, \_\_\_\_\_  
tens and \_\_\_\_\_ ones.

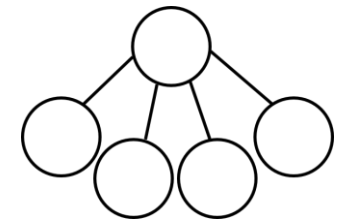
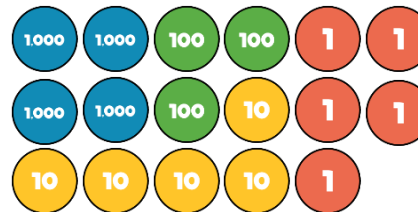


The number is \_\_\_\_\_.



\_\_\_ + \_\_\_ + \_\_\_ + \_\_\_ = \_\_\_

Complete the part-whole model for the number represented.



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

6,983

9,021

789

6,570

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.

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?

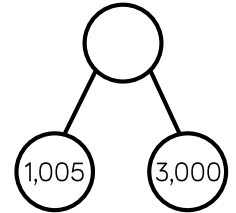
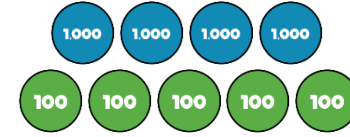
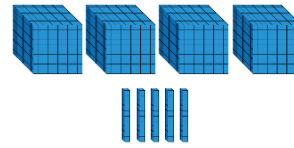
Which representation is the odd one out? Explain your reasoning.

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.

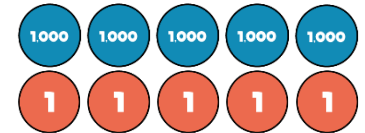
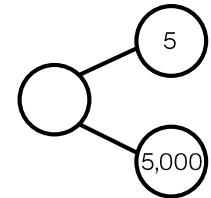
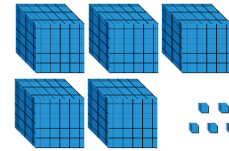


4,005

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?

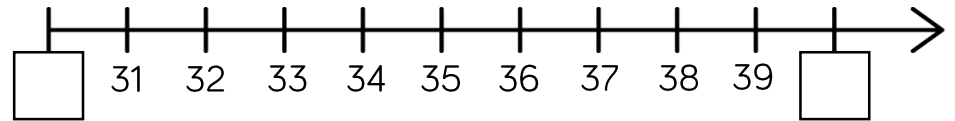
What do we do if the number in that column is a 5?

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

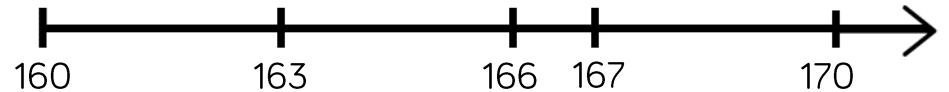
## Varied Fluency



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



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:



847 to the nearest 10 is 840

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?

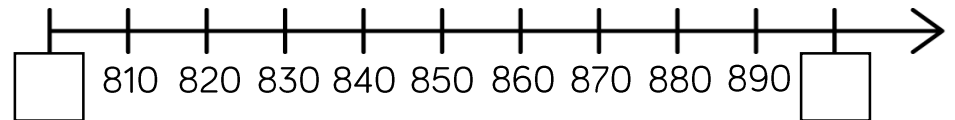
What would 49 round to, to the nearest 100?

Can the answer be 0 when rounding?

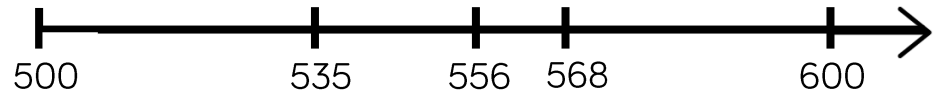
## Varied Fluency



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
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?

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

245, 246, 247, 248 and 249 are all possible answers.

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

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

What could Jack's number be?

Can you find all of the possibilities?

2,567 to the nearest 100 is 2,500




Whitney

Do you agree with Whitney?  
 Explain why.

---

Teddy



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

Explain the mistake Teddy has made.

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 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

# 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.

10,000s	1,000s	100s	10s	1s
5	1	4	14	8

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.

Counters	Part-whole model
65,048	
Bar model	Number line

Complete the missing numbers.

$$59,000 = 50,000 + \underline{\hspace{2cm}}$$

$$\underline{\hspace{2cm}} = 30,000 + 1,700 + 230$$

$$75,480 = \underline{\hspace{2cm}} + 300 + \underline{\hspace{2cm}}$$

# 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.

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

**A = 2,800**  
**B = 2,760**

**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?

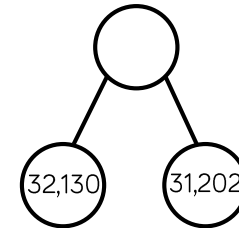
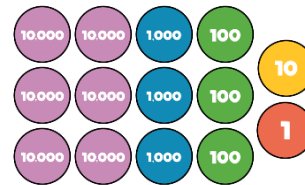
What is the value of \_\_\_\_\_ in this number?

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

What number does MMXVII represent?

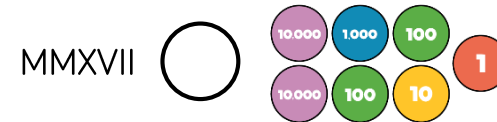
## Varied Fluency

Put these numbers in ascending order.

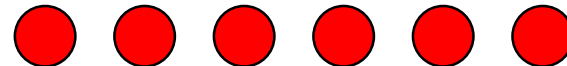


10,000s	1,000s	100s	10s	1s
6	3	3	2	0

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



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 digit 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 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.

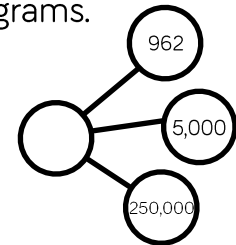
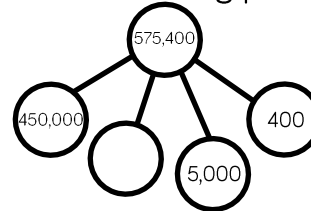
32,651

456,301

50,030

Can you say the numbers out loud?

Complete the following part-whole diagrams.



Eva has the following number.

Thousands			Ones		
H	T	O	H	T	O
	●●●● ●●●●	●●●●●● ●●●●●●	●●●● ●●●●	●● ●●	● ●

She adds 4 counters to the hundreds column.

25 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

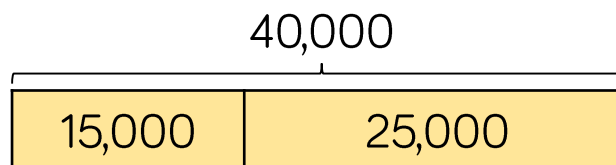
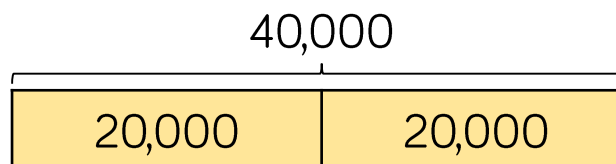
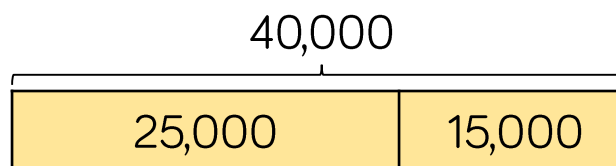
25,571

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.

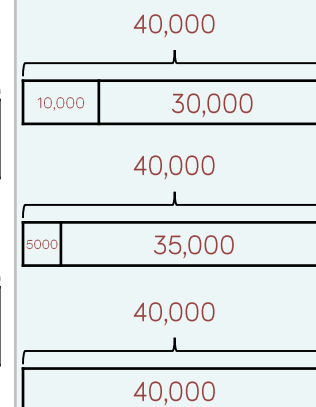
25,571: the value is 7 tens. It is one column to the left of the ones column.

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.

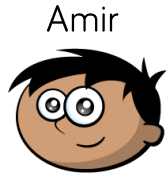
# Counting in Powers of 10

## 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

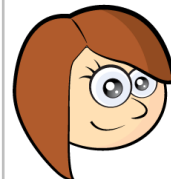
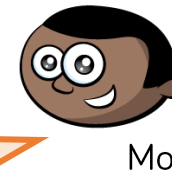
The 10<sup>th</sup> term will be 15,322 because I will double the 5<sup>th</sup> term.



Is he correct?  
Explain why.

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

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



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

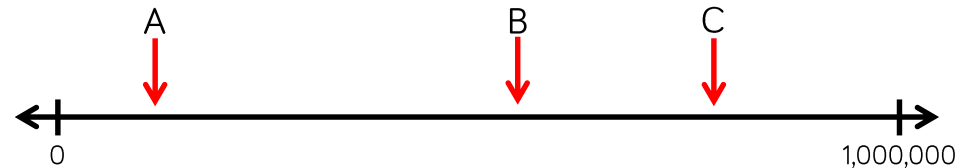
- What do we need to know to be able to compare and order large numbers?
- Why can't we just look at the thousands columns when we are ordering these five numbers?
- What is the value of each digit?
- What is the value of \_\_\_\_ in this number?
- What is the value of the whole? Can you suggest other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



Jack

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



Jack



Dora

My number is exactly 100 less than 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.

499 and 501  
498 and 500

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

What could the two numbers be?

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?

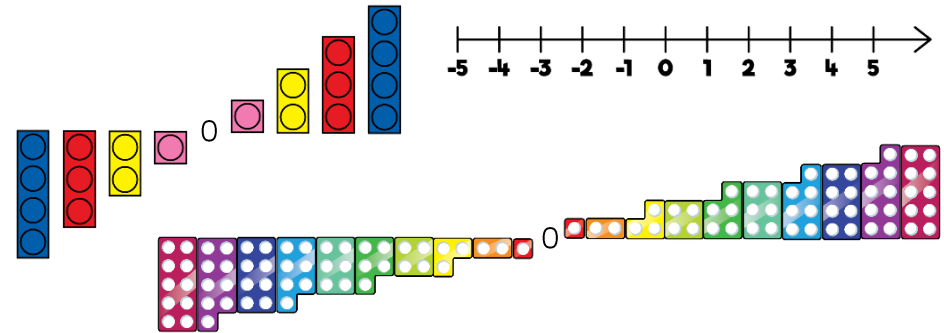
Does it help to estimate where zero goes first? Why?

What was the temperature increase/decrease?.

Can you show how you know the increase/decrease on a number line?

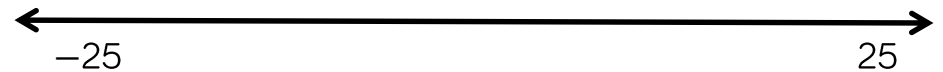
## Varied Fluency

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  $32^{\circ}\text{C}$   
The Arctic room has a temperature of  $-24^{\circ}\text{C}$   
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  $-76$  52
- The even number that is less than  $-18$  but greater than  $-22$   $-20$
- The number that is half way between 40 and  $-50$   $-5$
- The difference between  $-6$  and 7 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?

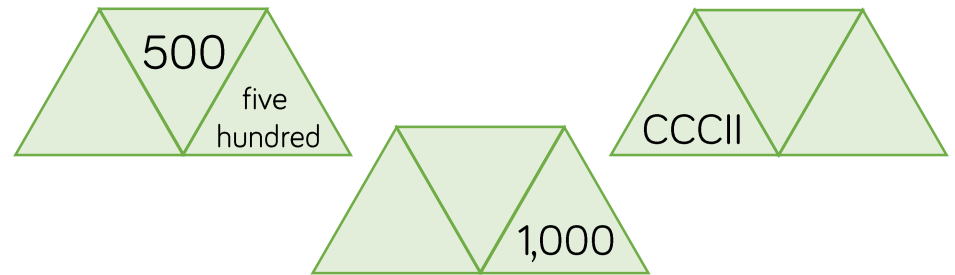
How can you check you have represented the Roman Numeral correctly?

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

## Varied Fluency

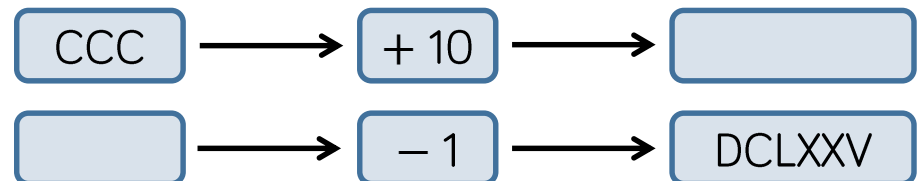
- Lollipop stick activity.  
 The teacher shouts out a number and the children make it with lollipop sticks.  
 Children could also do this in pairs or groups, or for a bit of fun they could test the teacher!

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



Complete the diagrams.

- Complete the function machines.



# Roman Numerals

## Reasoning and Problem Solving

Solve

$$\text{CCCL} + \text{CL} =$$

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

**White**

**Rose  
Maths**

Autumn - Block 2

**Addition & Subtraction**

# Overview

## Small Steps

## Notes for 2020/21

- ▶ 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

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
1000 1000 1000	100 100 100	10 10 10 10 10	1 1 1 1 1 1
1000 1000	100 100 100 100	10 10 10	1 1 1 1 1

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

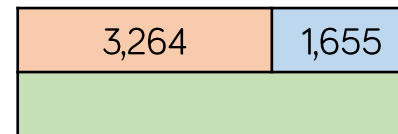
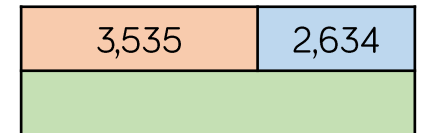
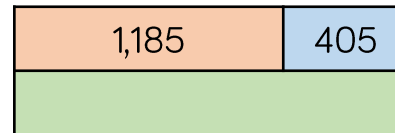
Use Rosie's method to calculate:

$3,356 + 2,437$     
  $3,356 + 2,473$     
  $3,356 + 2,743$

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.



# Add Two 4-digit Numbers (2)

## Reasoning and Problem Solving



What is the missing 4-digit number?

2,554

	Th	H	T	O
	—	—	—	—
+	6	3	9	5
	8	9	4	9

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

### Annie's Strategy

$$6,000 + 2,000 = 8,000$$

$$300 + 800 = 1100$$

$$70 + 20 = 90$$

$$4 + 3 = 7$$

$$8,000 + 1100 + 90 + 7 = 9,197$$

### 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



Use counters and a place value grid to calculate:

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

Find the total of 4,844 and 2,156

Th	H	T	O

	4	8	4	4
+	2	1	5	6

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

- |                 |                       |                 |
|-----------------|-----------------------|-----------------|
| $3,456 + 789$   | <input type="radio"/> | $1,810 + 2,436$ |
| $2,829 + 1,901$ | <input type="radio"/> | $2,312 + 2,418$ |
| $7,542 + 1,858$ | <input type="radio"/> | $902 + 8,496$   |
| $1,818 + 1,999$ | <input type="radio"/> | $3,110 + 707$   |

# 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

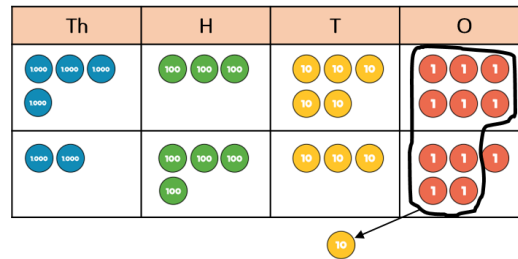
Will you have to exchange? How do you know which columns will be affected?

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.

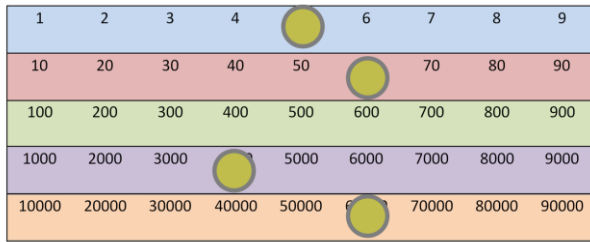
How many points do Jack and Rosie have altogether?  
 How many points do Rosie and Eva have altogether?  
 How many points do Jack and Eva have altogether?  
 How many points do Jack, Rosie and Eva have altogether?

# 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?

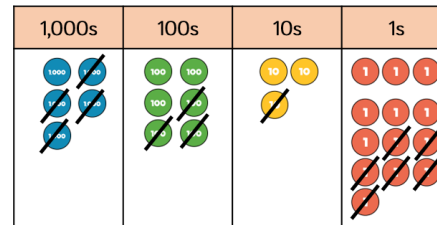
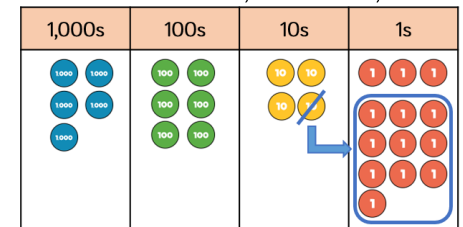
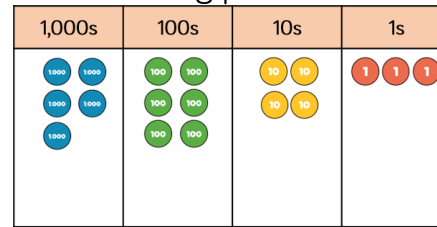
How many bars are you going to use in your bar model?  
Can you find out how many tokens Mo has?  
Can you find out how many tokens they have altogether?

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

## Varied Fluency



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



	Th	H	T	O
	5	6	3	4
-	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.

$$\underline{\quad} - 1,345 = 4\underline{\quad}6$$

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-digit 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:

$5,783 - 844$

$6,737 - 759$

$8,252 - 6,560$

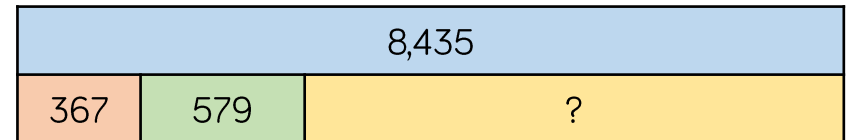
$1,205 - 398$

$2,037 - 889$

$2,037 - 1,589$

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

How many magazines are left?



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



Amir and Tommy solve a problem.

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



Amir

Tommy is correct.

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



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?

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.  
 $1,464 + 2,114 = 3,578$

# 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?

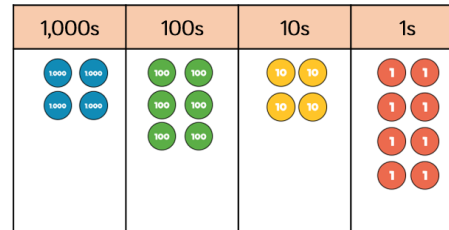
Does it matter which number goes on top? Why? Will you have to exchange? How do you know which columns will be affected?

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

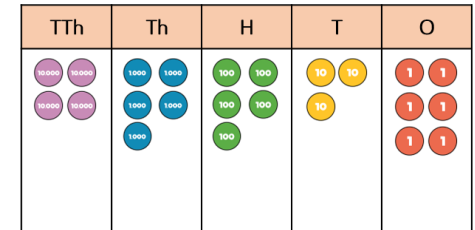
## Varied Fluency

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.

$$\begin{array}{r}
 28701 \\
 - 7621 \\
 \hline
 21180
 \end{array}$$

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?

$$49,999 - 19,999 = 50,000 - 20,000$$



Dora

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

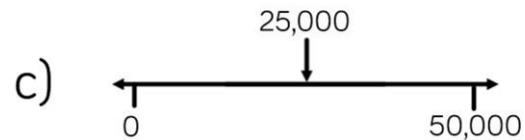
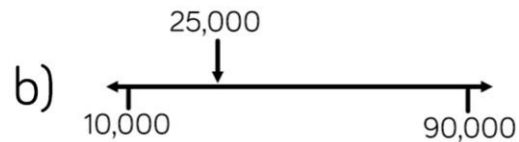
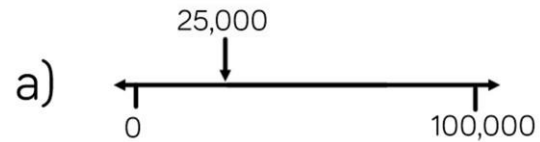
Can you explain why Dora's method work?

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?



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?

$$8,947 + 8,631 = 17,468$$

$$8,947 + 8,521 = 17,468$$

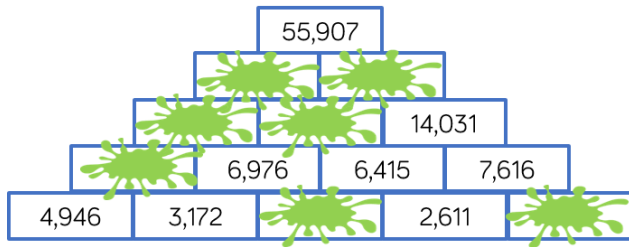
$$8,251 + 8,947 = 17,468$$

- 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.

I have double the amount of marbles Mo has.



Whitney



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?

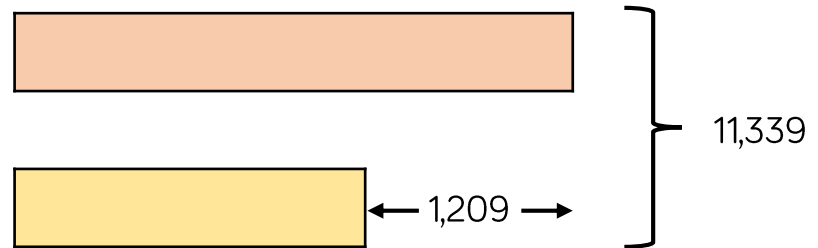
What are the key bits of information?

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

## Notes for 2020/21

- ▶ 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

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.

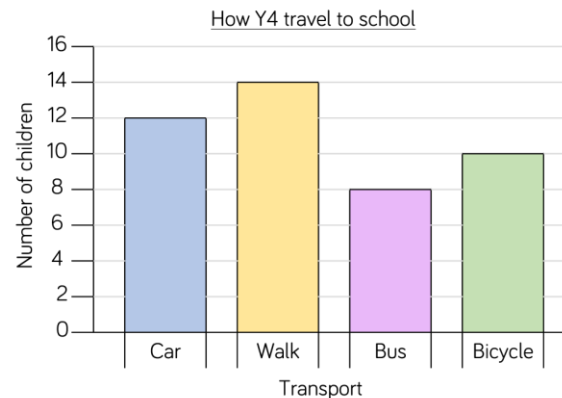
## Mathematical Talk

- 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



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.

Team	Number of house points
Sycamore	
Oak	
Beech	
Ash	

= 20 points

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.



I will use this image  to represent 5 children.

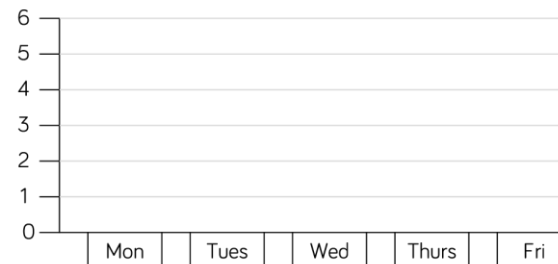
Explain why this is not a good idea.

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



Team	Number of house points
Sycamore	
Oak	
Beech	
Ash	

= 20 points

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.

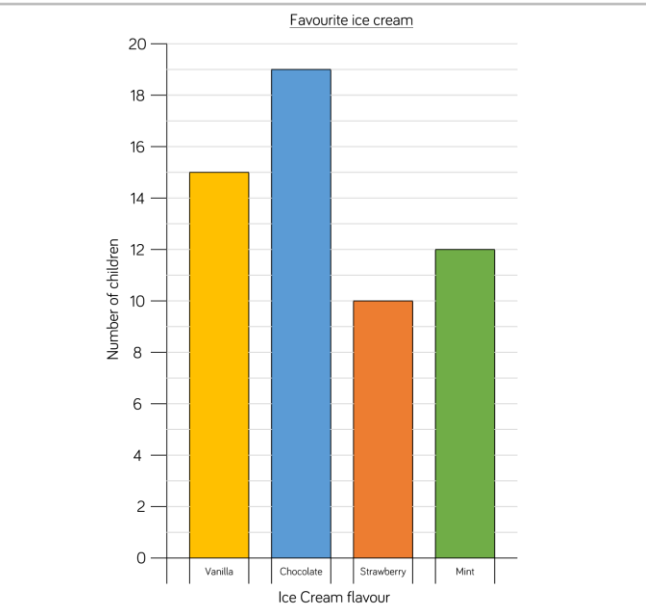
Collect and record the data in a table.

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 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.

Rosie says,



We asked 54 people altogether.

Can you spot Rosie's mistake?  
How many 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?

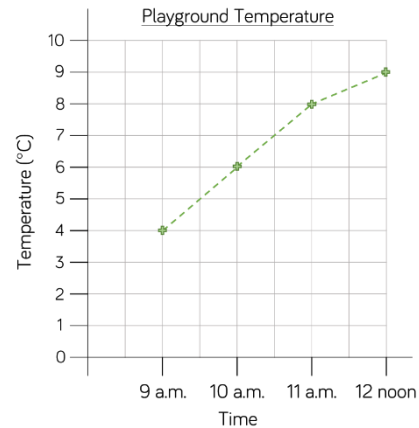
How would you estimate the temperature at 9:30 a.m.?

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

## Varied Fluency



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?

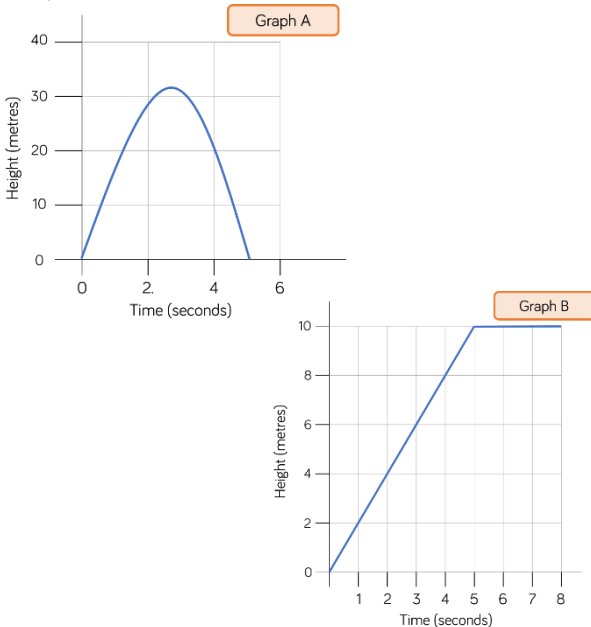
Between which two weeks did the plant reach a height of 10 cm?

# 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.

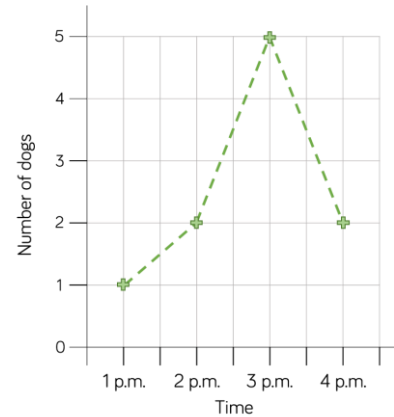


Make up your own story for the other graph.

**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,



At half past one there are 1.5 dogs in the park.

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?

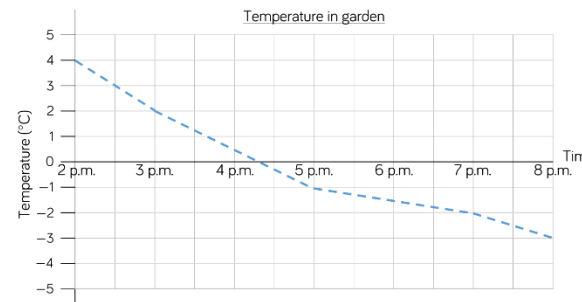
Where do we see examples of line graphs in real life?

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.?

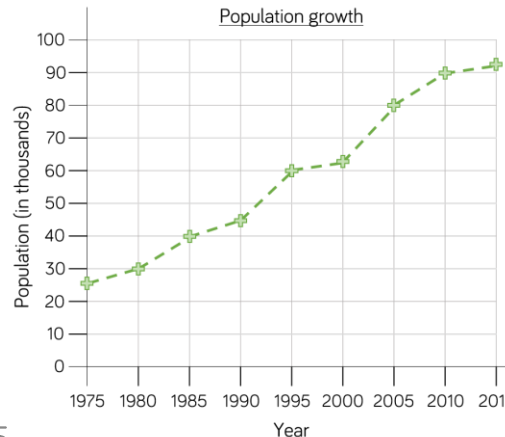
What was the difference in temperature between 3 p.m. and 7 p.m.?

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?

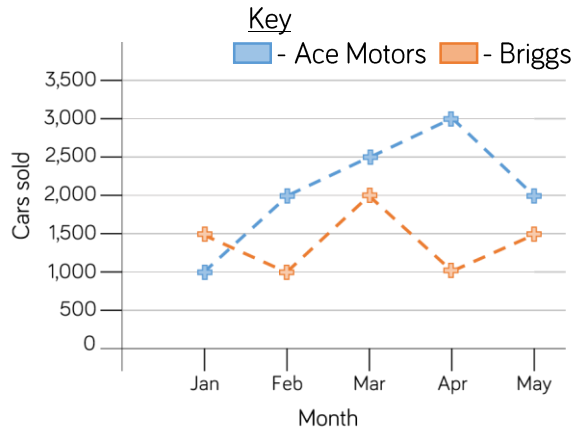
How much did the population grow between 1990 and 2010?

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.

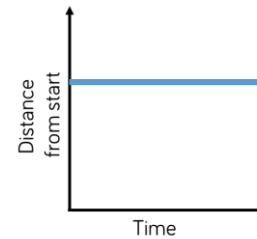


- How many more cars did Ace Motors sell than Briggs in April?
- From January to March, how many cars did each company sell? Who sold more? How many more did they sell?
- Crooks Motors sold 250 more cars than Briggs each month. Plot Crooks Motors' sales on the graph.

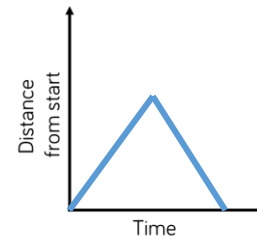
2,000  
 Ace 5,500  
 Briggs 4,500  
 Difference of 1,000  
 Ace sold more.

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

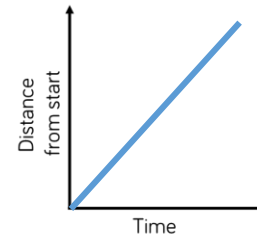
Match the graph to the activity.



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?

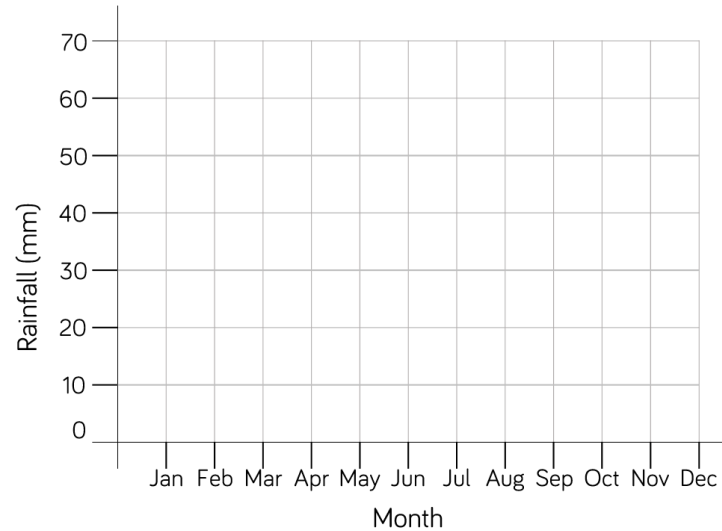
What scale will you use for the rupees on the conversion graph?

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.

<b>Pounds</b>	1	2	3	4	5	6	7	8	9	10
<b>Rupees</b>	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

Here is a table of data.

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

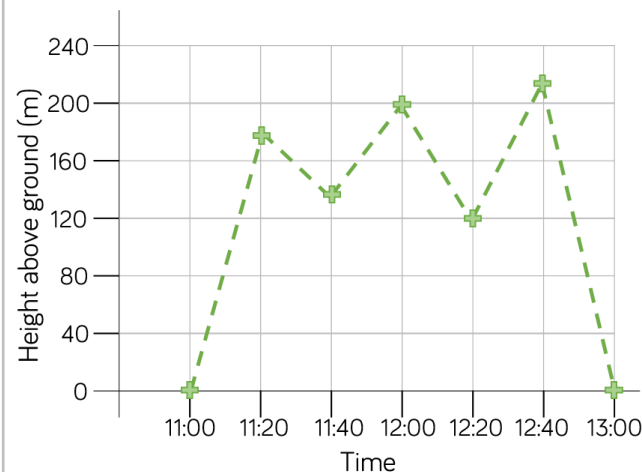
Which intervals would be the most appropriate for the vertical axis of the line graph?  
Explain your answer.

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

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.

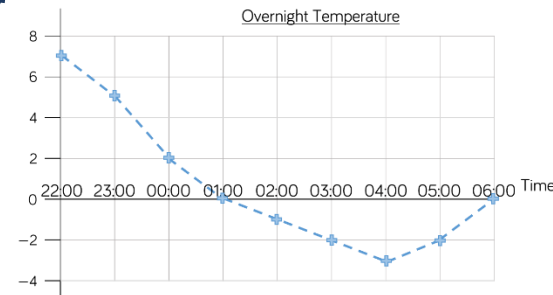
## Mathematical Talk

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

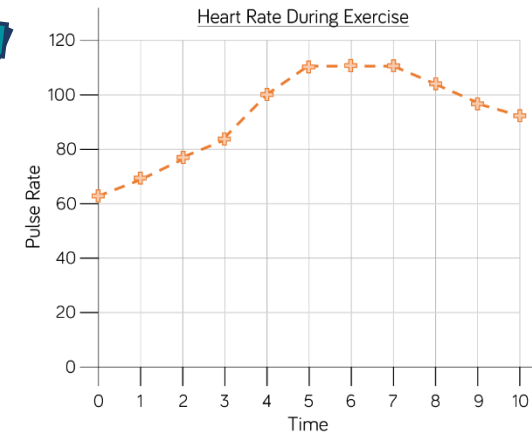
How will you plan out your own heart rate experiment? What information will you need to gather? What unit will you measure in? How will you label your axes?

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

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

Do you agree?  
Explain your answer.

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.
- There are 6 stadiums with a capacity of more than 80,000
- Three of the largest stadiums are in England.

False

False

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?

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

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

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

## Notes for 2020/21

- ▶ 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

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?

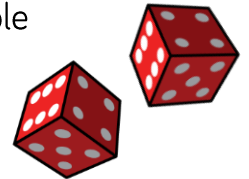
- 7,135 is a multiple of 5. Explain how you know.

- 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  $\times$  factor = product).

## Mathematical Talk

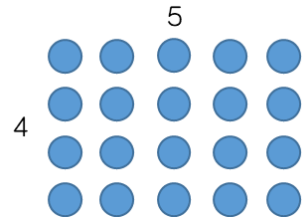
How can you work in a systematic way to prove you have found all the factors?

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

$1 \times \underline{\quad}$                        $\underline{\quad} \times 12$

$3 \times \underline{\quad}$                        $\underline{\quad} \times \underline{\quad}$

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?

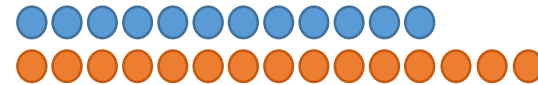
Which number is a common factor of a pair of numbers?

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.

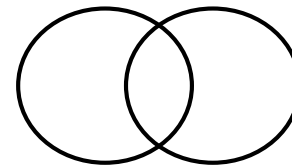
Can we arrange each number in counters in two equal rows?



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. True
- 1 is a multiple of every number. False
- 0 is a factor of every number. False
- 0 is a multiple of every number. True

I am thinking of two 2-digit numbers.

24 and 60

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?

# 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 table? 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

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

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

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

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  $\square^2$

### Mathematical Talk

Why are square numbers called 'square' numbers?

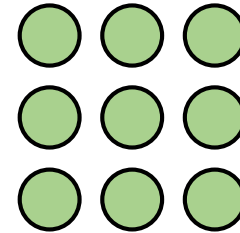
Are there any patterns in the sequence of square numbers?

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.

How many square numbers can you make by adding prime numbers together?

Here's one to get you started:

$$2 + 2 = 4$$

No.

Square numbers have an odd number of factors (e.g. the factors of 25 are 1, 25 and 5).

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  $\quad^3$

## 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:

$4^3 = \underline{\quad}$

$5^3 = \underline{\quad}$

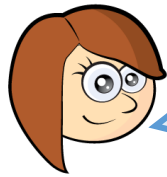
$3 \text{ cubed} = \underline{\quad}$

$6 \text{ cubed} = \underline{\quad}$

# 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



On each card there is a cube number.  
Use these calculations to find each number.

$$A \times A = B$$

$$B + B - 3 = C$$

$$\text{Digit total of } C = A$$

$$A = 8$$

$$B = 64$$

$$C = 125$$

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

## 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?

$45 \times 10$

$46 \times 10$

$47 \times 10$

$48 \times 10$

$49 \times 10$

$50 \times 10$

$51 \times 10$

$52 \times 10$

$53 \times 10$

(or the above calculations written as  $10 \times 45$  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

$3 \times \square = \square \square \square = 3 \text{ ones} = 3$

Complete:

$3 \times \begin{array}{|c|} \hline \square \\ \hline \end{array} = \begin{array}{|c|} \hline \square \\ \hline \end{array} \begin{array}{|c|} \hline \square \\ \hline \end{array} \begin{array}{|c|} \hline \square \\ \hline \end{array} = \text{___ tens} = \text{___}$

$3 \times \begin{array}{|c|c|} \hline \square & \square \\ \hline \end{array} = \begin{array}{|c|c|} \hline \square & \square \\ \hline \end{array} \begin{array}{|c|c|} \hline \square & \square \\ \hline \end{array} \begin{array}{|c|c|} \hline \square & \square \\ \hline \end{array} = \text{___ hundreds} = \text{___}$

Use a place value grid and counters to calculate:

$7 \times 10$        $63 \times 10$        $80 \times 10$

$7 \times 100$        $63 \times 100$        $80 \times 100$

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.

$75 \times 100$              $75 \times 10$

$39 \times 100$              $39 \times 10 \times 10$

$460 \times 10$              $100 \times 47$

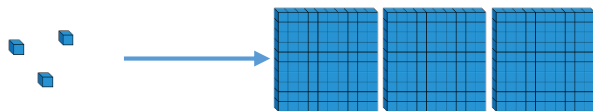
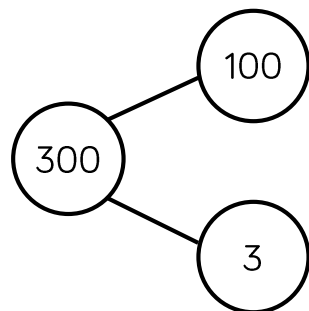
# Multiply by 100

## 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

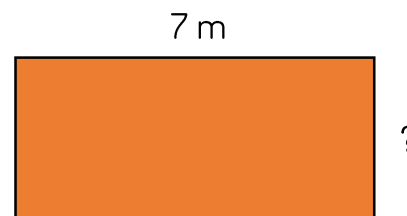
Part-whole models show addition (the aggregation structure) and subtraction (the partitioning structure), so if the whole is 300 and there are two parts, the parts added together should total 300 (e.g. 100 and 200, or 297 and 3). If the parts are 100 and 3, the whole should be 103.

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.

$234 \times 100 = \underline{\quad}$

$100 \times 36 = \underline{\quad}$

$45,020 \times 10 = \underline{\quad}$

$\underline{\quad} = 324 \times 100$

$1,000 \times 207 = \underline{\quad}$

$\underline{\quad} = 3,406 \times 1,000$

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

$71 \times 1,000$



$71 \times 100$

$100 \times 32$



$16 \times 1,000$

$48 \times 100$



$48 \times 10 \times 10 \times 10$

# Multiply by 10, 100 and 1,000

## Reasoning and Problem Solving

<p>Rosie has £300 in her bank account.</p> <p>Tommy has 100 times more than Rosie in his bank account.</p> <p>How much more money does Tommy have than Rosie?</p>	<p>Tommy has £30,000</p> <p>Tommy has £29,700 more than Rosie.</p>	<p>Jack is thinking of a 3-digit number.</p> <p>When he multiplies his number by 100, the ten thousands and hundreds digit are the same.</p> <p>The sum of the digits is 10</p> <p>What number could Jack be thinking of?</p>	<p>181</p> <p>262</p> <p>343</p> <p>424</p> <p>505</p>
<p>Whitney has £1,020 in her bank account.</p> <p>Tommy has £120 in his bank account.</p> <p>Whitney says,</p> <div data-bbox="103 1013 673 1228"> </div> <p>Is Whitney correct? Explain your reasoning.</p>	<p>Whitney is incorrect, she would need to have £1,200 if this were the case (Or Tommy would need to be £102).</p>		

## 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

R

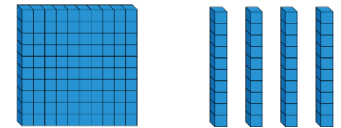
Use place value counters to show the steps to divide 30 by 10



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



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

350	35
3,500	53

- Alex – 53
- Jack – 350
- Dora – 35
- Mo – 3,500

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.

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?

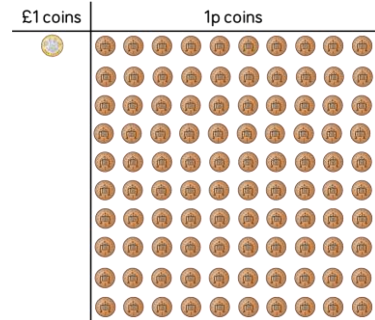
How are multiplying and dividing by 100 related?

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.

$4,200 \div 10$

$4,200 \div 100$

$420 \div 10$

420

42

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

$3,600 \div 10$    $3,600 \div 100$

$2,700 \div 100$    $270 \div 10$

$4,200 \div 100$    $430 \div 10$

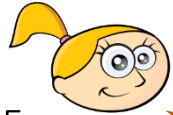
# Divide by 100

## 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.



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

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

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

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

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

$$170 \div 10 = 17$$

$$320 \times 10 = 3,200$$

$$1,860 \div 10 = 186$$

$$59 \times 100 = 5,900$$

$$64 = 6,400 \div 100$$

# 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



HTh	TTh	Th	H	T	O
	●	● ●	● ● ●		

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  $45,000 \div 10 \div 10$

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:

$36 \times 50 = \underline{\quad}$        $500 \times 36 = \underline{\quad}$   
 $5 \times 360 = \underline{\quad}$        $360 \times 500 = \underline{\quad}$

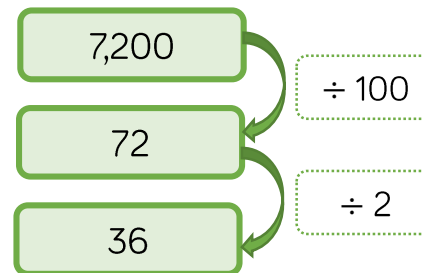
■ Here are two methods to solve  $24 \times 20$

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:



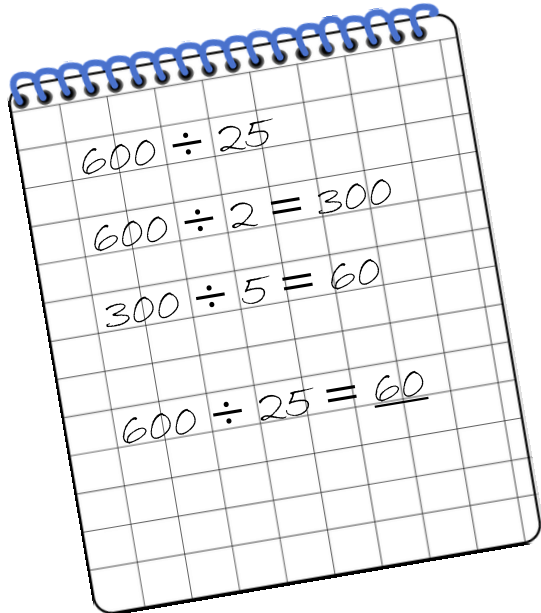
$3,600 \div 200 = \square$   
 $18,000 \div 200 = \square$   
 $5,400 \div \square = 27$   
 $\square = 6,600 \div 200$

# 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.

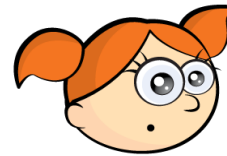
The correct answer should be 24

$$6 \times 7 = 42$$

Alex uses this multiplication fact to solve

$$420 \div 70 = \underline{\quad}$$

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.

$$6 \times 70 = 420, \text{ therefore } 420 \div 70 = 6$$

**White**

**Rose  
Maths**

Autumn - Block 5

**Perimeter & Area**

# Overview

## Small Steps

### Notes for 2020/21

- ▶ 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

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  $(l \times w) \times 2$

### Mathematical Talk

What is perimeter of a shape?

What's the same/different about these shapes?

Do we need to measure every side?

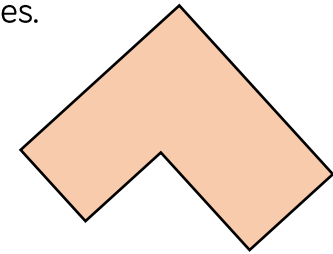
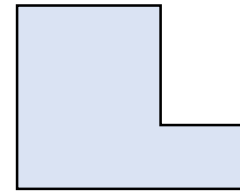
Once we have measured each side, how do we calculate the perimeter?

### Varied Fluency

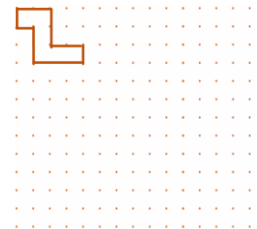
- Measure the perimeter of the rectangles.



- Measure the perimeter of the shapes.



- Make this shape double the size using dot paper.



Measure the perimeter of both shapes.

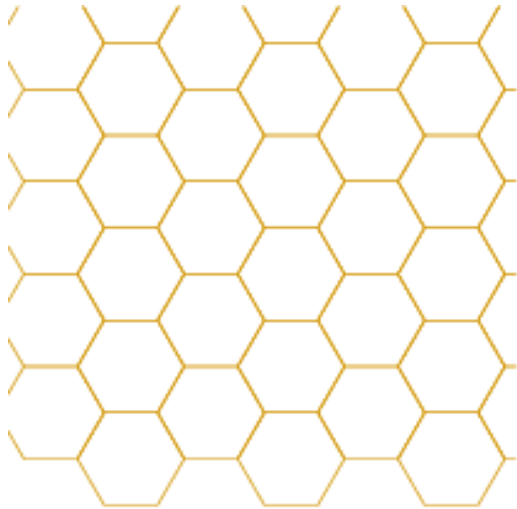
What do you notice about the perimeter of the larger one? Why?

# Measure Perimeter

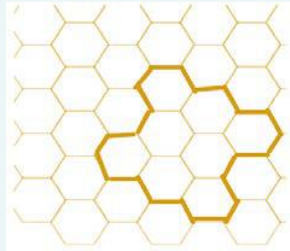
## Reasoning and Problem Solving

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?

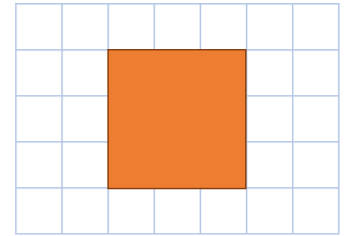
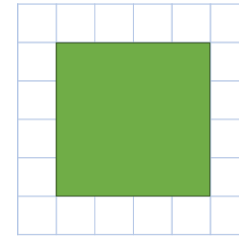
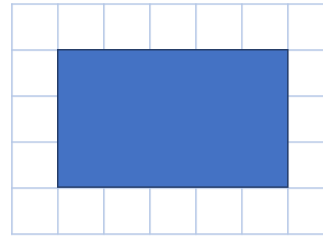
What do you think rectilinear means? Which part of the word sounds familiar?

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

### Varied Fluency

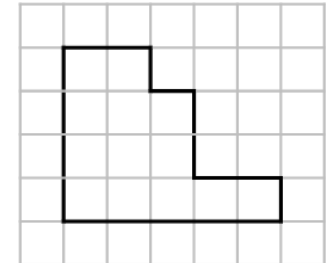
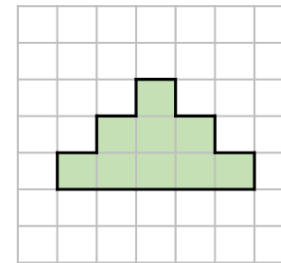
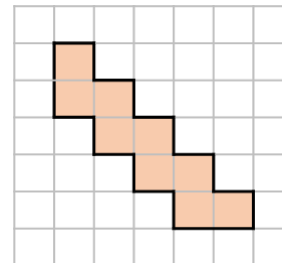
R

- 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.



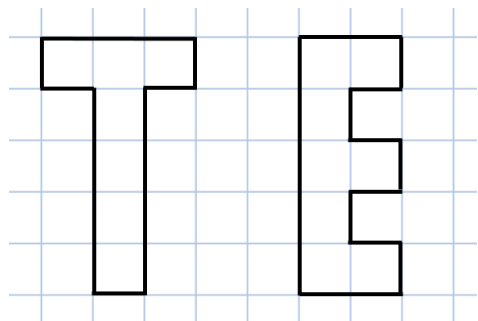
Order the shapes from smallest to largest perimeter.

# 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.

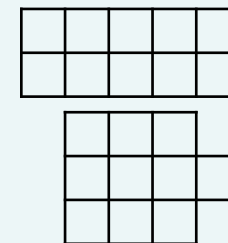
You have 10 paving stones to design a patio. The stones are one metre square.

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

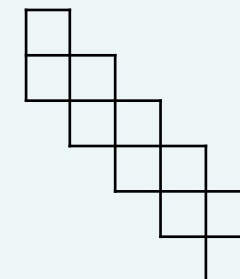


Use squared paper to show which design would give the longest perimeter and which would give the shortest.

The shortest perimeter would be 14 m in a  $2 \times 5$  arrangement or  $3 \times 3$  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



Calculate the perimeter of the rectangles.

2 cm			
	5 cm	4 cm	8 cm
			8 cm
			$\_\_ \text{ cm} + \_\_ \text{ cm} + \_\_ \text{ cm} + \_\_ \text{ cm} = \_\_ \text{ cm}$

Eva is finding the perimeter of the rectangle.



I added the length and width together and then multiplied by 2

5 cm	
	10 cm
	$5 \text{ cm} + 10 \text{ cm} = 15 \text{ cm}$
	$15 \text{ cm} \times 2 = 30 \text{ cm}$

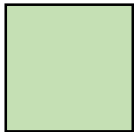

Use Eva's method to find the perimeter of the rectangles.

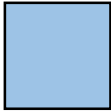
6 m		
	16 m	9 cm
		9 cm

# Perimeter of a Rectangle

## Reasoning and Problem Solving



<p>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.</p>	<p>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</p>
<p>Each of the shapes have a perimeter of 16 cm.                  Calculate the lengths of the missing sides.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div>	<p>4 cm                  6 cm</p>

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

# 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

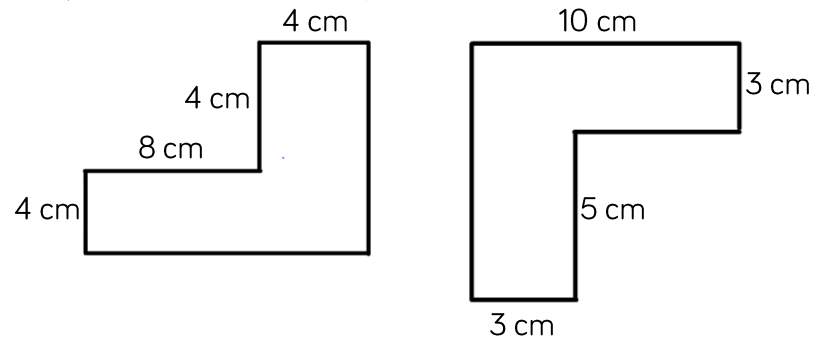
Why are opposite sides important when calculating the perimeter of rectilinear shapes?

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?

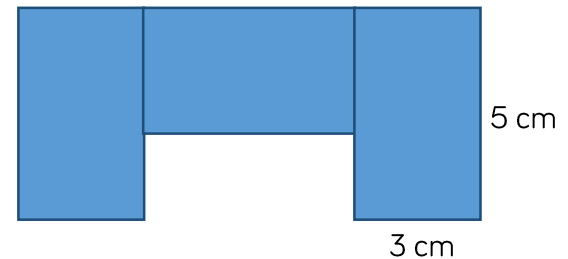
If a rectilinear shape has a perimeter of 24 cm, what is the greatest number of sides it could have? What is the least number of sides it could have?

## Varied Fluency R

Find the perimeter of the shapes.



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



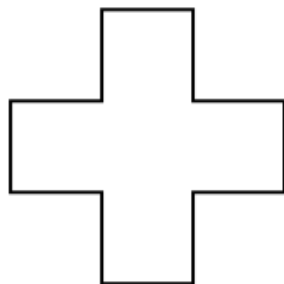
How many different rectilinear shapes can you draw with a perimeter of 24 cm? How many sides do they each have? What is the longest side? What is the shortest side?

# 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?

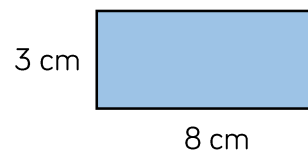
48 cm, 36 cm, 80 cm, 120 cm, 66 cm

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

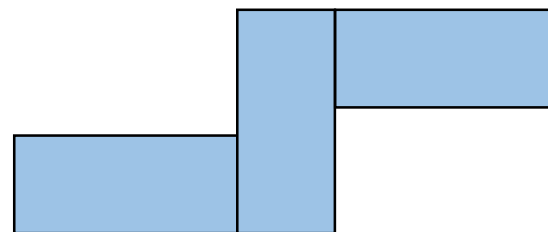
48 cm, 36 cm or 120 cm as there are 12 sides and these numbers are all multiples of 12

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

Amir has some rectangles all the same size.

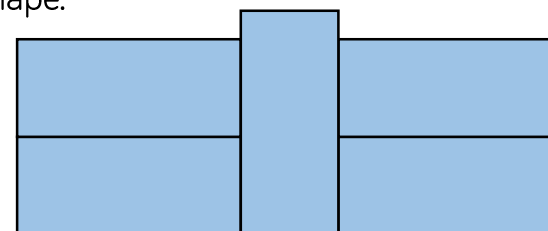


He makes this shape using his rectangles. What is the perimeter?



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?

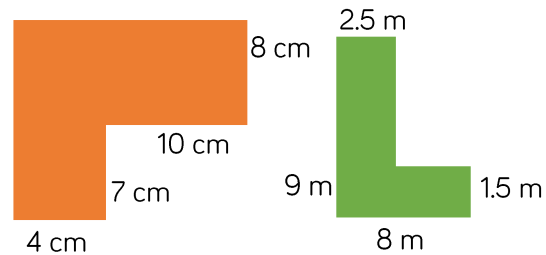
How can you use the labelled sides to find the length of the unknown sides?

What strategies can you use to calculate the total perimeter?

What does regular mean? Why are rectangles irregular?

## Varied Fluency

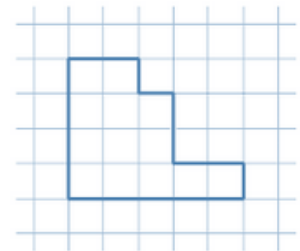
Find the perimeter of the following shapes.



Each square has an area of 4 square cm.

What is the length of each square?

What is the perimeter of the whole shape?



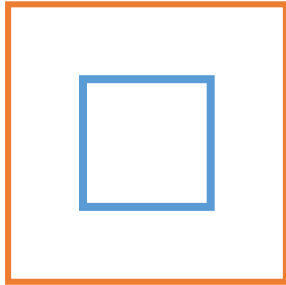
How many \_\_\_\_\_ can you draw with a perimeter of \_\_\_\_ cm?  
e.g. rectangles, other rectilinear shapes.

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.

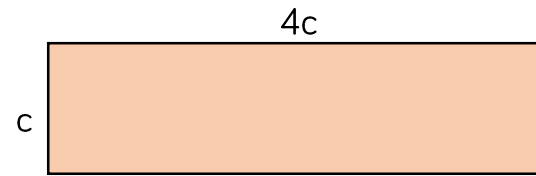
What is the length of one side of the outer square?

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.

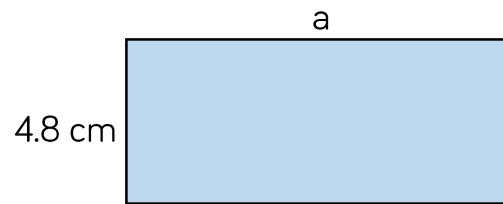


The value of  $c$  is 14 m.

What is the total perimeter of the shape?

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

$$10 \times 14 = 140 \text{ m}$$



The blue rectangle has a perimeter of 38 cm.

What is the value of  $a$ ?

$$\text{Total perimeter} = 38 \text{ cm}$$

$$38 - (4.8 + 4.8) = 28.4$$

$$\text{So } 28.4 \text{ divided by } 2 = 14.2 \text{ cm}$$

# 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?

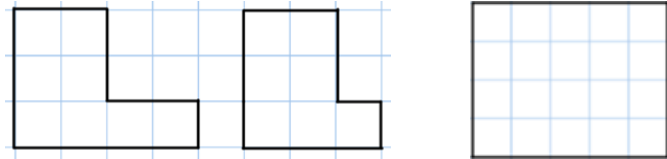
Which colour covers the largest area of the quilt?  
Which colour covers the smallest area of the quilt?

Will Jack's method work for every rectilinear shape?

## Varied Fluency

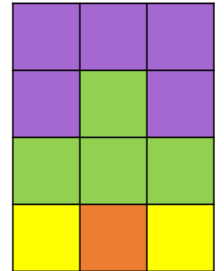


Complete the sentences for each shape.



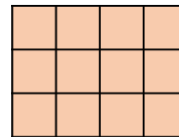
The area of the shape is \_\_\_ squares.

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



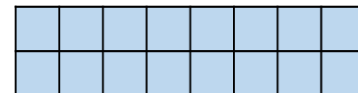
Purple = \_\_\_ squares      Green = \_\_\_ squares  
Yellow = \_\_\_ squares      Orange = \_\_\_ squares

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.

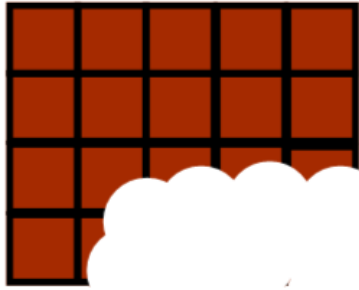


# Counting Squares

## Reasoning and Problem Solving



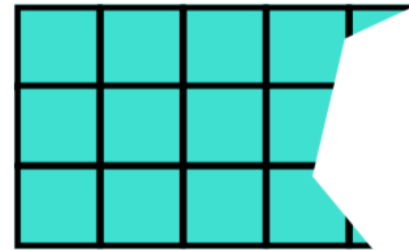
Dexter has taken a bite of the chocolate bar.



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  $36 \text{ cm}^2$  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  $\times$  width' work for any shape, or only squares and rectangles?

### Varied Fluency

-  How many rectangles can you draw with an area of \_\_\_\_  $\text{cm}^2$ ?
-  What is the area of this shape if:
  - each square is 2 cm in length?
  - each square is 3.5 cm in length?

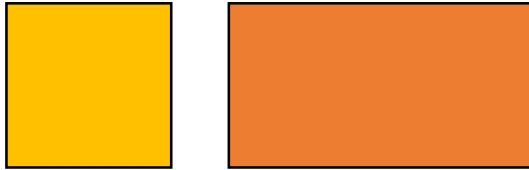


-  Mo buys a house with a small back garden, which has an area of  $12 \text{ m}^2$ . His house lies in a row of terraces, all identical. If there are 15 terraced houses altogether, what is the total area of the garden space?

# Area of Rectangles

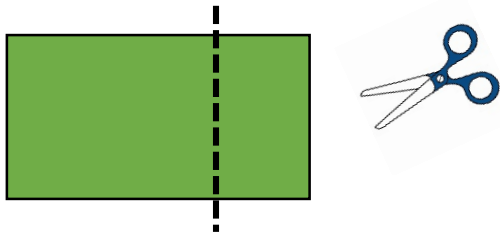
## Reasoning and Problem Solving

Investigate how many ways you can make different squares and rectangles with the same area of  $84 \text{ cm}^2$   
 What strategy did you use?

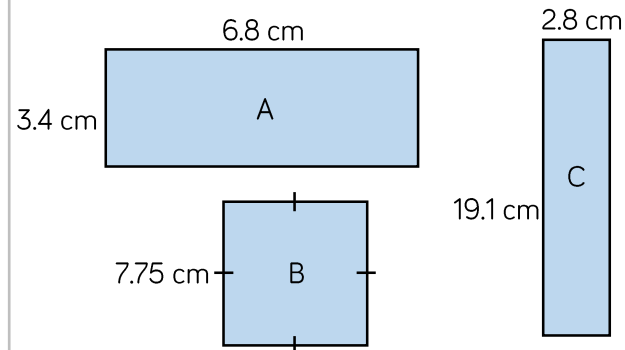


### True or False?

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



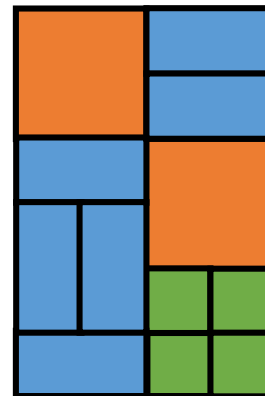
True



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

Answer:  $A = 3\text{cm} \times 7\text{cm} = 21\text{cm}^2$   
 $B = 8\text{cm} \times 8\text{cm} = 64\text{cm}^2$   
 $C = 3\text{cm} \times 19\text{cm} = 57\text{cm}^2$

Order: B, C, A



Each orange square has an area of  $24 \text{ cm}^2$ .  
 Calculate the total orange area.  
 Calculate the blue area.  
 Calculate the green area.  
 What is the total area of the whole shape?

Answer:  
 Orange =  $48 \text{ cm}^2$   
 Blue =  $72 \text{ cm}^2$   
 Green =  $24 \text{ cm}^2$   
 Total =  $144 \text{ cm}^2$

# 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?

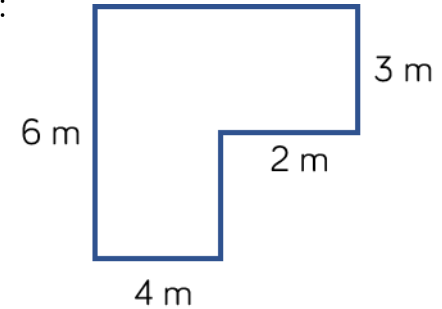
How can we split the compound shape?

Is there more than one way?

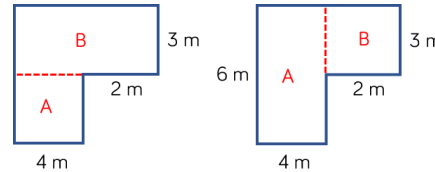
Do we get a different answer if we split the shape differently?

## Varied Fluency

- Find the area of the compound shape:  
How many ways can we split the compound shape?

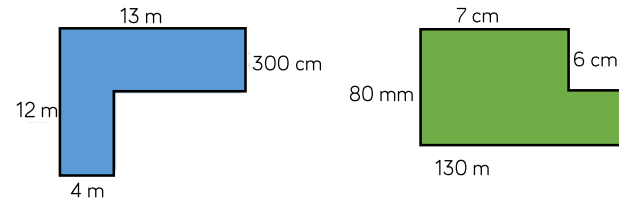


Is there more than one way?

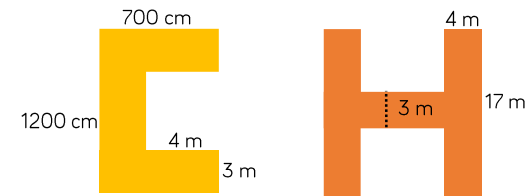


Could we multiply  $6\text{ m} \times 6\text{ m}$  and then subtract  $2\text{ m} \times 3\text{ m}$ ?

- Calculate the area.



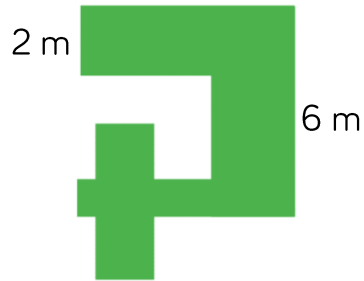
- Calculate the area of these symmetrical shapes.



# 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:

$$A = 2 \text{ m} \times 5 \text{ m} = 10 \text{ m}^2$$

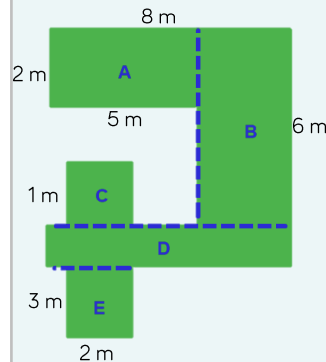
$$B = 6 \text{ m} \times 3 \text{ m} = 18 \text{ m}^2$$

$$C = 1 \text{ m} \times 2 \text{ m} = 2 \text{ m}^2$$

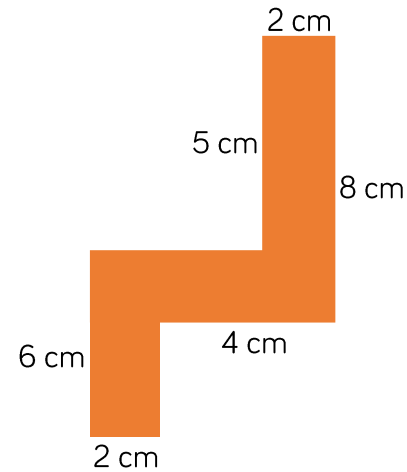
$$D = 1 \text{ m} \times 8 \text{ m} = 8 \text{ m}^2$$

$$E = 3 \text{ m} \times 2 \text{ m} = 6 \text{ m}^2$$

$$\text{Total area} = 36 \text{ m}^2$$



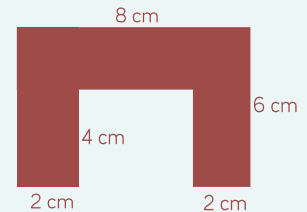
Jack says this shape has an area of  $34 \text{ cm}^2$ .



Show that Jack is correct.

Find three more possible compound shapes that have an area of  $34 \text{ cm}^2$ .

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

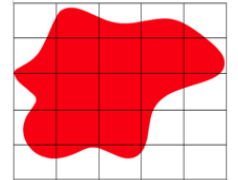
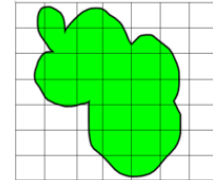
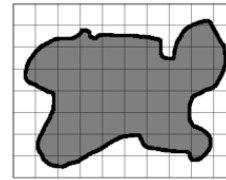
- Estimate the area of the pond.  
Each square = 1 m<sup>2</sup>



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?

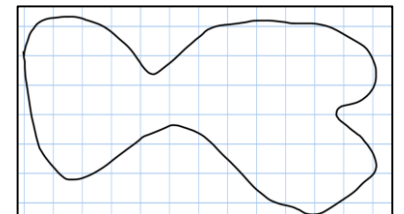


Is the red shape the greatest because it fills more squares?

Why or why not?

What is the same about each image? What is different about the images?

- Each square is \_\_\_ m<sup>2</sup>  
Work out the approximate area of the shape.

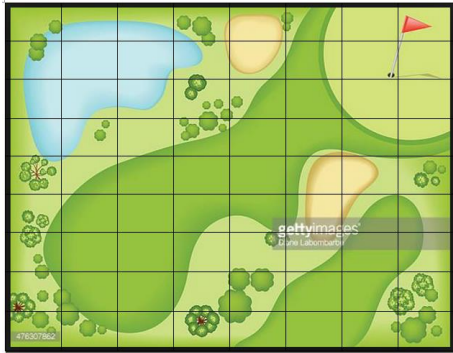


# Area of Irregular Shapes

## Reasoning and Problem Solving

Draw a circle on 1 cm<sup>2</sup> paper. What is the estimated area?

Can you draw a circle that has area approximately 20 cm<sup>2</sup>?



If each square represents 3 m<sup>2</sup>, 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<sup>2</sup>.

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

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