This guide is for parents/carers and any adult working with the child.

The Year 5 homework book is aimed to support children's in-class learning. There are ten pieces of homework, each linked to the units of work in the Year 5 programme of study. The tasks provided complement the work done in class and aim to provide opportunities for children to practise and consolidate their understanding of key concepts relevant to the Year 5 curriculum. Each piece of homework should take no more than 30 minutes to complete.

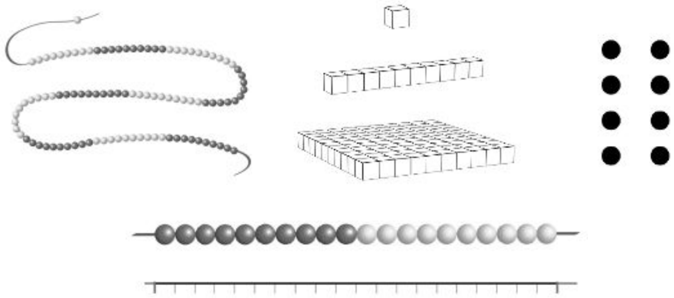
In order to support your child with the tasks, each piece of homework is accompanied by parental guidance. The guidance also aims to provide an opportunity for you to understand the methods your child is being taught, which may differ from methods you are familiar with. The methods used correspond to the expectations of the National Curriculum 2014 and are the expected methods that children are required to demonstrate understanding of. For additional support, there is also a glossary of key words at the end of the book.

What is 'Mastery'?

The 'mastery approach' to teaching mathematics is the underlying principle of Mathematics Mastery. Instead of learning mathematical procedures by rote, we want your child to build a deep understanding of concepts which will enable them to apply their learning in different situations. We do this by using three key principles:

Conceptual understanding

Your child will use multiple concrete and pictorial representations and make connections between them. A key part of a 'deep understanding' in maths is being able to represent ideas in lots of different ways.



34 864 - 25 423 = 9441

This is an ***equation.***

We don't round a number 'up' or 'down', we round it to the ***nearest multiple*** of 10, 100, 1000 etc.

Mathematical language

When asked to explain, justify and prove their ideas, your child is deepening their understanding of a concept. The correct mathematical vocabulary is taught from the outset and communication and discussions are encouraged.

Mathematical thinking

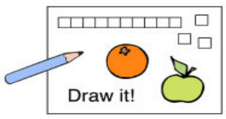
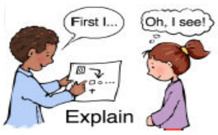
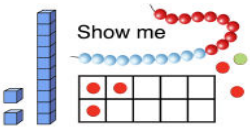
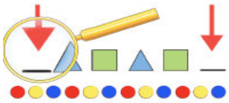
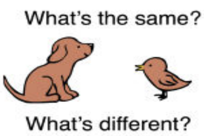
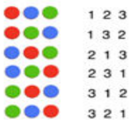
Lots of opportunities are planned for your child to investigate open questions that require them to sort and compare, seek patterns and look for rules. Good questioning, both for and from your child, build a deeper understanding of maths.

What is the same?
What is different?

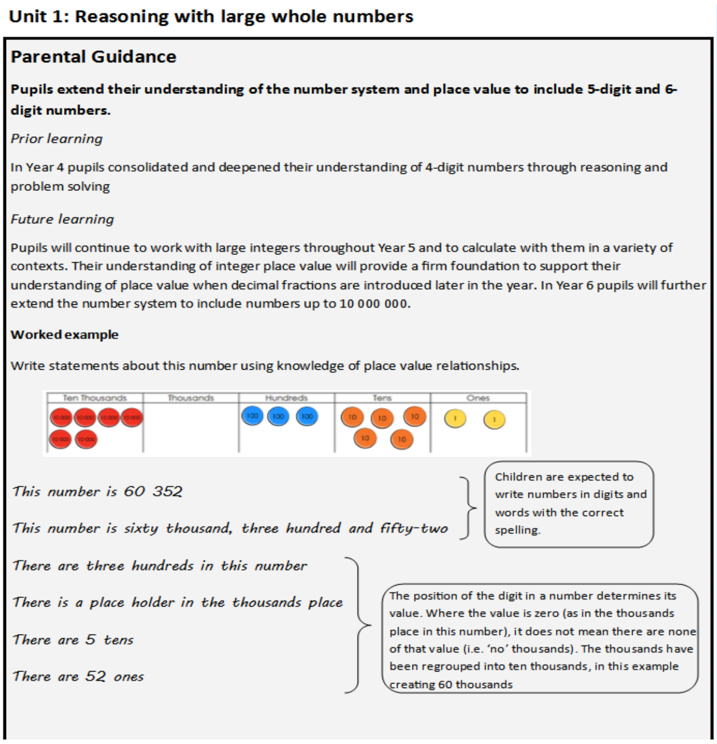
Is there a rule? Is it always, sometimes or never true?

Ideas for Depth

At the end of each homework piece there is an 'Idea for depth' question or activity for your child to engage with, which will provide further challenge to deepen their understanding of a concept. Children should use the blank pages at the back of the book to record their answers. These challenges may be open-ended, involve discussion and/or application to real life situations and you should encourage your child to apply their learning to each task. All depth challenges support the development of at least one of the principles of mastery. The ideas can also be used outside of maths homework tasks in day-to-day discussions to allow opportunities for your child to see maths in everyday situations. The table below explains the Ideas for depth.

	'**What's the question**?' If this is the answer, what could the question have been? This could be an equation or a word problem.
	'**What's wrong with this**?' Can you explain what is wrong with this and correct the error?
	'**Draw it'** Draw a picture to explain or demonstrate what you have worked out.
	'**Reason it'** Explain how you know.
	'**Show me!**' Convince me that you are right.
	**'Find a pattern'** Can you see a pattern (in the numbers)? Can you see a pattern in the answers? Continuing this pattern, what would happen if...? What came before? What comes next? Explain how you know.
	'**What's the same? What's different?**' Can you find anything that is the same about these two numbers/shapes/calculations? Now can you find something that is different?
	**'Have you found all possibilities**?' Is there more than one way of completing this? Is there more than one answer? Have you found them all?
	**'Maths story'** Make up a real-life story using your equation/numbers or shapes.
	'**Odd one out'** Find an odd one out and explain why it doesn't fit. Could another one be the odd one out? Why?

Parental guidance



Unit 1: Reasoning with large whole numbers

Parental Guidance

Pupils extend their understanding of the number system and place value to include 5-digit and 6-digit numbers.

Prior learning

In Year 4 pupils consolidated and deepened their understanding of 4-digit numbers through reasoning and problem solving

Future learning

Pupils will continue to work with large integers throughout Year 5 and to calculate with them in a variety of contexts. Their understanding of integer place value will provide a firm foundation to support their understanding of place value when decimal fractions are introduced later in the year. In Year 6 pupils will further extend the number system to include numbers up to 10 000 000.

Worked example

Write statements about this number using knowledge of place value relationships.

This number is 60 352

This number is sixty thousand, three hundred and fifty-two

Children are expected to write numbers in digits and words with the correct spelling.

There are three hundreds in this number

There is a place holder in the thousands place

There are 5 tens

There are 52 ones

The position of the digit in a number determines its value. Where the value is zero (as in the thousands place in this number), it does not mean there are none of that value (i.e. 'no' thousands). The thousands have been regrouped into ten thousands, in this example creating 60 thousands

Unit number and unit title

Key learning

Prior and future learning: where this objective fits into the sequence of learning over time.

A worked example followed by key points to support your child.

On every parental guidance page the unit title is located at the top, followed by an overview of the key learning. In addition, you will see where the key learning fits in with what your child has previously learnt, along with where the learning will be taken in subsequent units and years of study. It is important to understand that the principle of mastery does not encourage acceleration and remember that depth of understanding is key to your child becoming a confident mathematician who can think flexibly.

Additional information

Language use

For some homework tasks there is guidance on specific vocabulary or phrases that you and your child should use. E.g.

> The word 'sum' should only be used for calculations involving addition, e.g. the sum of 23 plus 24 is equal to 47. 45 - 32 = , 12 × 4 = , 240 ÷ 4 = are NOT 'sums' they are '**equations**' or '**calculations**'.

The way that pupils speak and write about mathematics has been shown to have an impact on their success in mathematics (Morgan, 1995; Gergen, 1995). Therefore, there is a carefully sequenced, structured approach to introducing and reinforcing mathematical vocabulary throughout maths tasks. You may find some terminology different to that which you are used to.

Use of commas versus spaces in numbers

In Mathematics Mastery, numbers with 5-digits or more are represented using a space after the 'thousands' number, e.g. 32 500 (thirty-two thousand, five hundred). However, such numbers can also be represented using a comma instead of a space e.g. 32,500.

You can find further information about the Mathematics Mastery programme online at **www.mathematicsmastery.org.** If you have any questions regarding this homework book please speak with your child's class teacher.

Unit 1: Reasoning with large whole numbers (week 1 of 2)

Parental Guidance

Pupils extend their understanding of the number system and place value to include 5-digit and 6-digit numbers. This week explores writing, ordering, comparing and rounding 5-digit and 6-digit numbers.

Prior learning

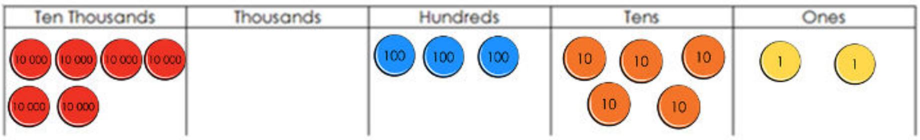
In Year 4, pupils consolidated and deepened their understanding of 4-digit numbers through reasoning and problem solving.

Future learning

Pupils will continue to work with large integers throughout Year 5 and to calculate with them in a variety of contexts. Their understanding of integer place value will provide a firm foundation to support their understanding of place value when decimal fractions are introduced later in the year. In Year 6, pupils will further extend the number system to include numbers up to 10 000 000.

Worked examples

1. Write statements about this number using knowledge of place value relationships.



This number is 60 352.

Children are expected to write numbers in **digits** and **words** with the correct spelling.

This number is sixty thousand, three hundred and fifty-two.

There are three hundreds in this number.

There is a place holder in the thousands place.

There are five tens.

The position of the digit in a number determines its **value.** Where the value is zero (as in the thousands place in this number), it does not mean there are none of that value (i.e. 'no' thousands). The thousands have been regrouped into ten thousands, in this example creating 60 thousands.

2. Write three different 5-digit numbers that can be made with these digits and where the digit '3' has a different value in each number. Compare the value of the digit '3' in two of your numbers.

3 0 1 8 6

Numbers beginning with 0 cannot be included as a 5-digit number. E.g. The number 01368 is a 4-digit number as the 0 has no purpose.

18 603

68 301

31 680

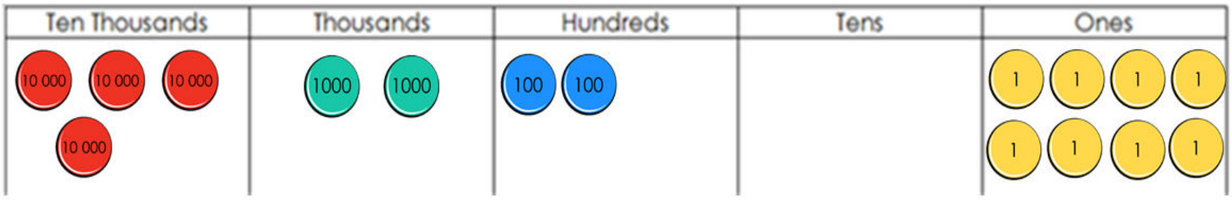
In the number 68 301, the '3' has a value of 300.

In the number 31 680, the value of the '3' is one hundred times bigger as it is representing 30 000.

The value of a digit changes depending on the **place** it holds in a number. When talking about **place value** relationships, each digit becomes ten times greater/smaller when it is one place to the left/right.

Pupil tasks

1. Look at the place value chart below.



A) What number is represented? Write your answer in digits. ________________________

B) Circle True or False for the statements below. For any that are false, correct the statement.

There are two thousands in this number TRUE FALSE ________________________

This number is 40 000 + 2000 + 20 + 8 TRUE FALSE ________________________

This number is 40 000 + 2000 + 200 + 8 TRUE FALSE ________________________

2. | 5 | 7 | 0 | 1 | 4 |

A) Write down the greatest 5-digit number that can be made with these digits. ________________________

Write down the smallest 5-digit number that can be made with these digits. ________________________

Write down a number using these digits where the '4' has a value ten times smaller than the value it has in the smallest number you have made. ________________________

B) Draw the number 678 345 in the place value chart below (using place value counter representations as above).

Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones

Write a number where the value of the '4' is one hundred times bigger. ________________________

Write a number where the value of the '7' is one thousand times smaller. ________________________

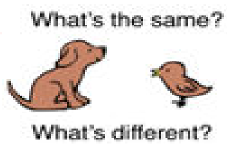
3. A number rounded to the nearest 1000 is 35 000.

A) Write down the smallest number it could have been. ________________________

B) Write down the largest number it could have been. ________________________

C) What is the rule for rounding to the nearest 1000? ________________________

Idea for depth



Look at the three numbers below. Write three facts that show how the numbers are different and three facts that show how the numbers are the same.

72 039 70 239 72 390

Unit 1: Reasoning with large whole numbers (week 2 of 2)

Parental Guidance

Pupils extend their understanding of the number system and place value to include 5-digit and 6-digit numbers. This week explores rounding and comparing 6-digit numbers along with extending and describing sequences.

Prior learning

See previous week

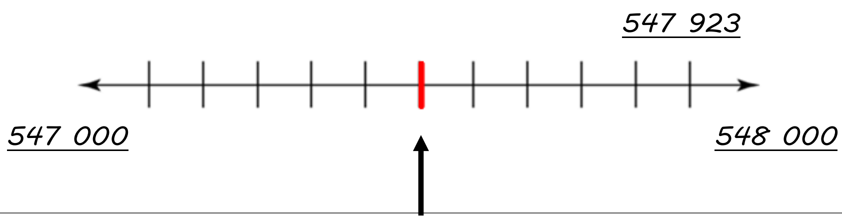
Future learning

See previous week

Worked examples

1. For the following number write the two closest multiples of 1000 at each end of the number line and approximate where the number could lie.

547 923



When rounding, positional language such as "round up/ down" can be confusing. Instead, say "***round to the nearest multiple of…***"

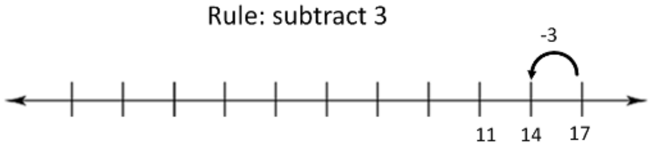
547 923 lies somewhere between the two multiples of one thousand 54**7 000** and 54**8 000**. Knowing whether it is closest to 547 000 or 548 000 is determined by how many hundreds there are in the number. In 547 **9**23 there are nine hundreds which means it is closer to the next multiple of 1000, i.e. 548 000. This would have been the case if there were 5, 6, 7 or 8 hundreds as well. If there were 4, 3, 2, 1 or 0 hundreds, then the number would have been rounded to the preceding multiple of 1000. This rule works for all numbers.

Choosing which power of ten to round to depends on how accurate you want to be. For example, you may round to the nearest ten when describing a short journey "it takes about 20 minutes to walk to school" when it may take 18 minutes. Rounding to the nearest 10 000, in contrast, is useful for approximating with larger numbers, for example house prices: "The house cost approximately £250 000", when the exact price could have been £248 985. You wouldn't approximate this to the nearest ten (£248 990). Find opportunities to discuss when you would approximate and estimate in every day life.

Rounding to	Look at the
10	Ones
100	Tens
1000	Hundreds
10 000	Thousands
100 000	Ten thousands

2. Complete the next four terms of this number sequence:

Rule: subtract 3



17, 14, 11 , 8 , 5 , 2 , -1

A number sequence is an ordered set of numbers which follows a rule. Each number in the sequence is called a ***term.*** The ***rule*** is a description of what needs to be done to get from one term to the next.

Pupil tasks

1. For the following numbers write the two closest multiples of 10 000 at each end of the number line and approximate where the number could lie.

A) 264 967

B) 856 487

2. Here are four 6-digit numbers:

623 084 326 408 620 843 308 624

A) Each of the four numbers has the same digits. Explain why the numbers have different values.

____

____

B) Using the numbers above, complete the boxes below. Write a statement comparing each pair of numbers.

[ ] < [ ] ____

[ ] > [ ] ____

3. Here is part of a number sequence: 23, 17, 11, 5, ________, ________, ________, -19

A) Fill in the missing terms of this sequence.

What would the 10th term of this sequence be? The 10th term will be ___________

Write three statements that describe this sequence.

difference between terms		
decreasing	increasing	rule

____

____

____

B) Circle the sequence(s) that will contain the number 1000. How do you know?

25, 35, 45, 55, 65, …. 100, 200, 300, 400, …… 850, 825, 800, 775, 750,….

I know because ____

____

Write the first five terms of an increasing sequence with the rule 'add 0.7'. The first term is 2.1.

________, ________, ________, ________, ________

Idea for depth

I'm thinking of a whole number…

It has six digits and it is odd.

It is approximately equal to 358 000 when rounded to the nearest 1000.

What is the greatest number it could be? Smallest? Suggest two numbers it could not be and explain why.

Unit 2: Addition and subtraction (week 1 of 2)

Parental Guidance

Pupils explore a variety of addition and subtraction calculation strategies, including the formal written layout. Pupils are taught to be flexible, in that they understand there are a range of strategies to solve the same calculation. This week focuses on estimating and partitioning.

Prior learning

Pupils are familiar with a variety of addition and subtraction strategies from previous years, such as partitioning, regrouping, counting on and back. In Year 4, pupils consolidated these strategies with numbers with up to four digits.

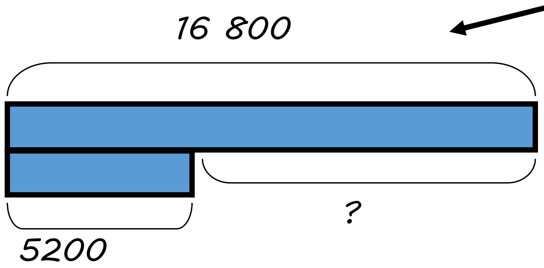
Future learning

In Year 5, pupils will use larger (5-digit and 6-digit numbers) integers to add and subtract. Pupils will calculate with large integers in a variety of contexts throughout Year 5. Their understanding of integer problem solving will provide a firm foundation to support their understanding when calculating with decimal numbers and fractions later in the year. In Year 6, pupils will continue to extend the number system up to ten million.

Worked examples

1. 16 800 - 5200 =

A) Construct a bar model for this calculation



Bar models support pupils to solve calculations. They are not a method for calculating, but a pictorial representation of the relationship between numbers. They help pupils decide which kind of calculation they need to do to solve a problem.

B) Estimate the answer to this calculation

16 800 ≈ 17 000
5200 ≈ 5000

*<u>17 000 - 5000 = **12 000**</u>*

"Rounding to estimate" is a useful strategy used to mentally calculate an estimate but still be relatively accurate. Choosing which multiple of 10, 100, 1000 etc. to round to determines the accuracy of the estimated calculation. Rounding before calculating also assists with checking an answer and reasoning if the answer generated is appropriate.

C) Complete the calculation using the following partitioning strategies.
i) Partition both numbers into place value amounts
Ii) Partition one number and count back

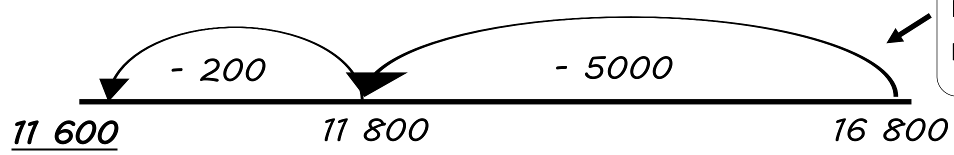
i)

<u>16 800</u>	*<u>5200</u>*		
10 000 -	*0*	*=*	*10 000*
6000 -	*5000*	*=*	*1000*
800 -	*200*	*=*	*600*

*<u>So, 16 800 - 5200 = **11 600**</u>*

Partitioning a number means splitting the number up into smaller parts so they are easier to work with. Partitioning a number helps a child work out large calculations in their head by combining similar numbers (e.g. all the hundreds). Children start by partitioning in place value amounts (ones, tens, hundreds etc.) before exploring the many other ways of partitioning to calculate e.g. 75 as 30 + 45.

ii)



Here, only 5200 has been partitioned (5000 + 200).

Pupil tasks

1. $\boxed{14\ 620 + 3240 =}$

Bar model

A) Construct a bar model to represent this calculation.

B) Estimate the answer to this calculation.

14 620 ≈ 3240 ≈

____________ + ____________ = ____________

C) Complete the calculation by partitioning both numbers into place value amounts.

D) Complete the calculation by partitioning 3240 and counting on using a number line.

14 620

2. $\boxed{16\ 480 - 4250 =}$

Bar model

A) Construct a bar model for this calculation.

B) Estimate the answer to this calculation.

16 480 ≈ 4250 ≈

____________ - ____________ = ____________

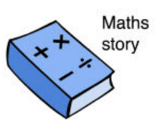
C) Complete the calculation by partitioning both numbers into place value amounts.

D) Complete the calculation by partitioning 4250 and counting back using a number line.

16 480

3. Which of the two partitioning methods do you prefer? Why?

Idea for depth



Make up and solve a maths story for this calculation:

87 500 + 4300 =

Think about an appropriate context for the given numbers e.g. do they represent people, money, distances etc.?

Parental Guidance

Pupils explore a variety of addition and subtraction calculation strategies, including the formal written layout. Pupils are taught to be flexible, in that they understand there are a range of strategies to solve the same calculation. This week focuses on using the formal method of addition and subtraction.

Prior learning

See previous week

Future learning

See previous week

Worked example

The 'formal methods' for addition and subtraction are **column addition** and **column subtraction**. Conceptual understanding of this method is first taught in Year 2 and is developed in subsequent year groups by using concrete and pictorial representations. By Year 5 the more efficient formal method is introduced, moving children to use abstract representations of number.

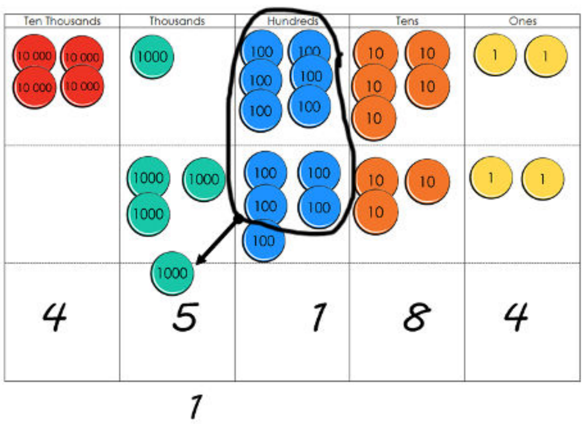
A quick guide to re-grouping in addition

Re-grouping is what some people may refer to as 'carrying' and 'borrowing'. Mathematics Mastery always uses the term re-grouping as it supports the conceptual understanding of the formal methods for addition and subtraction, as modelled below.

Formal Column Method

$$\begin{array}{r} 41652 \\ +\quad 3532 \\ \hline 45184 \\ {\scriptstyle 1}\quad\ \ \end{array}$$

Pictorial representation



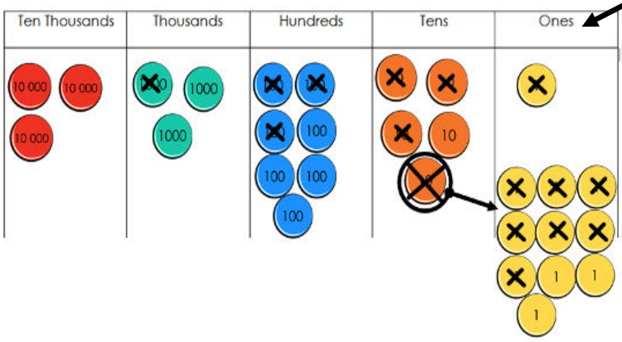
Look at the Hundreds column. Adding six and five hundreds results in 11 hundreds and so re-grouping is necessary. Ten 100s make 1000 and this is added to the Thousands column, leaving one 100. The re-grouped 1000 is added to the four thousands already there.

A quick guide to re-grouping in subtraction

Formal Column Method

$$\begin{array}{r} 3\ 3\ 7\ \overset{4}{\cancel{5}}\ {}^{1}1 \\ -\quad 1\ 3\ \ 3\ 8 \\ \hline 3\ 2\ 4\ \ 1\ 3 \end{array}$$

Pictorial representation



Look at the Ones column. Re-grouping is needed in order to subtract eight from one. One of the tens can be 're-grouped' back into ten ones to make the calculation 11 - 8. Doing this reduces the number of tens to four (40). Nothing has been removed from the calculation, it has just been reorganised.

Pupil tasks

1. For each of the following calculations draw a bar model and complete the calculation by drawing place value counters in the chart alongside the formal column method.

A) 45 253 + 31 462 =

Bar model

Column method

10 000	1000	100	10	1
Ten Thousands	Thousands	Hundreds	Tens	Ones

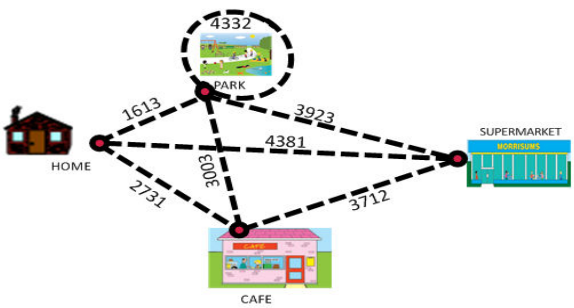
B) 185 491 – 53 234 =

Bar model

Column method

100 000	10 000	1000	100	10	1
Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones

2. I walk from home to the supermarket, then to the café before going home again. However, I want to reach my target of taking 15 000 steps in a day. What could I do to make this happen? Show your working.



Idea for depth

What has gone wrong? What guidance should you give?

76 827	76 827	132 754	132 754
+12 412	+ 12 412	- 12 346	- 12 346
64 415	881 239	120 412	120 418

Parental Guidance

Pupils interpret and create line graphs and solve comparison, sum and difference problems using information presented in this way.

Prior learning

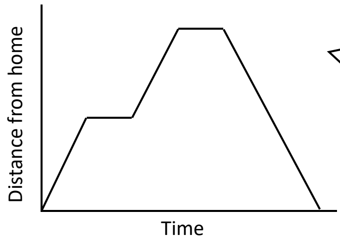
Pupils have interpreted and presented data in a range of ways, such as pictograms, bar charts and Venn diagrams. In Year 4 they worked with line graphs.

Future learning

Pupils continue to work with data in a range of representations and in Year 6 interpret and construct pie charts.

Worked example

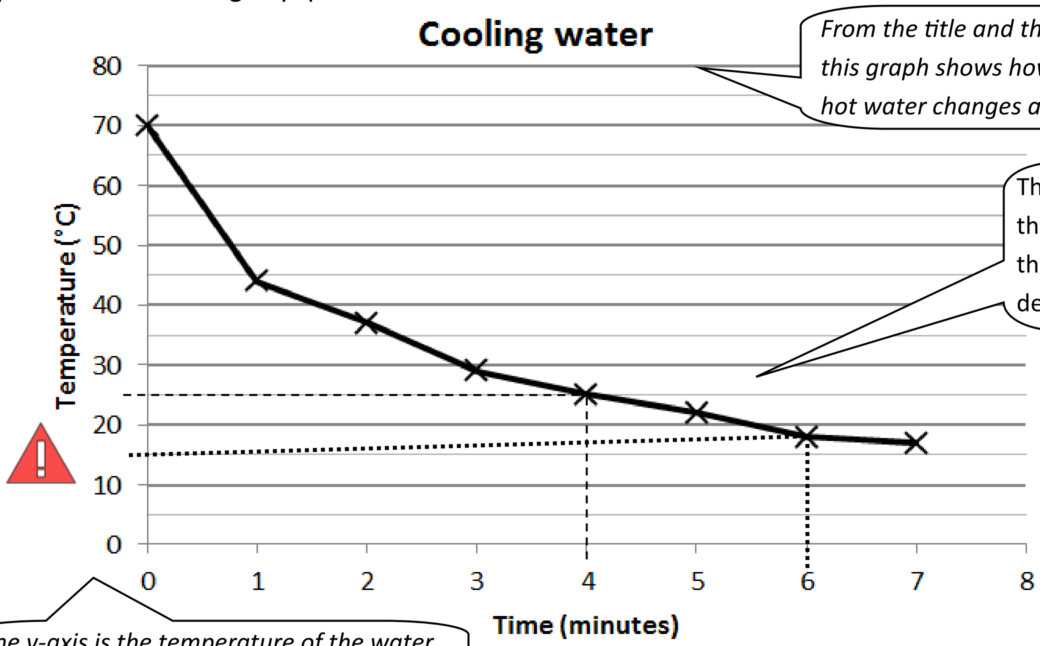
Line graphs show information that is connected in some way and often shows how something changes over time in relation to something else. Line graphs can be thought of as telling a "Maths story". A lot can be told from the shape of the line.



I popped out to the shops and on the walk there I stopped to chat with a friend. When I was finished shopping I came straight home.

Reading and interpreting line graphs

All of the information available on a graph is important and pupils should be encouraged to think about the whole graph before answering any questions.



From the title and the axes I can see that this graph shows how the temperature of hot water changes across seven minutes.

The line is going down and this shape tells you that the temperature is decreasing as time passes.

The x-axis is time and the scale increases in steps of one minute.

The y-axis is the temperature of the water. The scale is increasing in steps of ten.

Time (minutes)	Temperature (°C)
0	70
1	44
2	37
3	29
4	
5	22
6	
7	17

In order to complete the table, I need to find out the temperature of the water after four minutes. On the time axis, the x-axis, I find the number four and draw a line up to the data point (‐ ‐ ‐ ‐ on the graph). I then draw another line from the data point to the y-axis and read this interval to find that the temperature after four minutes is 25 °C.

It is important that pupils use a ruler and draw straight lines that are parallel to the axes. Using the gridlines on the graph paper is a useful guide.

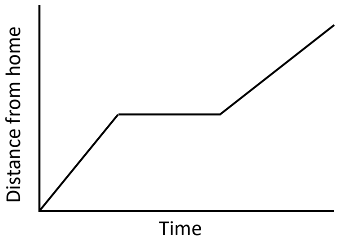
A deliberate mistake has been made when finding the temperature of the water at the sixth minute. The line from the data point to the y-axis (••••••)is not parallel to the x-axis and so the reading will not be accurate.

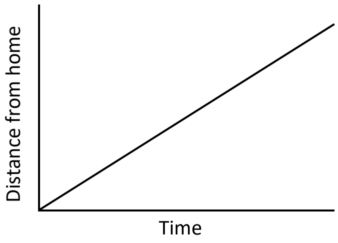
Pupil tasks

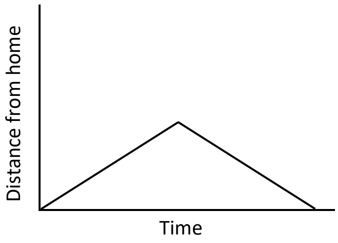
Story A: I was on my way to school when I felt unwell, so I turned around and went home.

Story B: I travelled to school at the same speed and didn't stop until I got there.

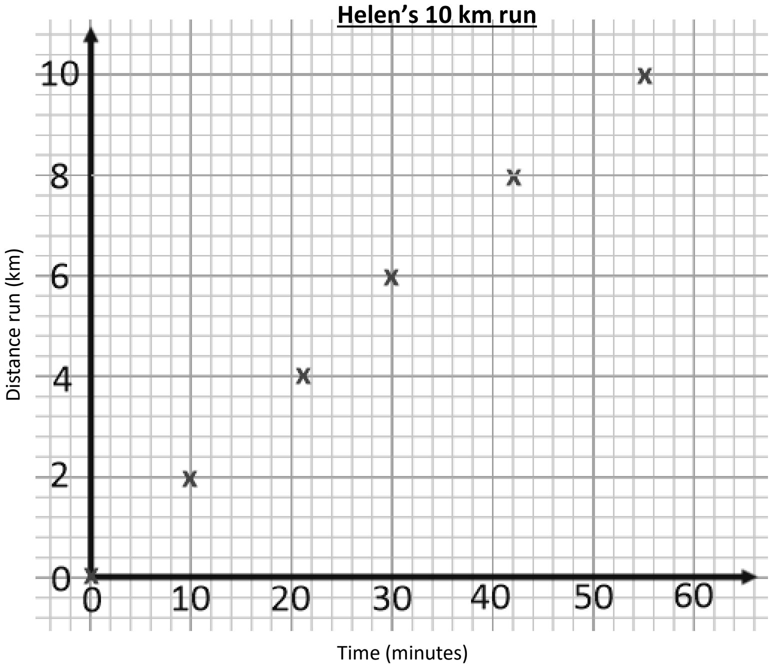
1) Which graph represents which "Maths story"?







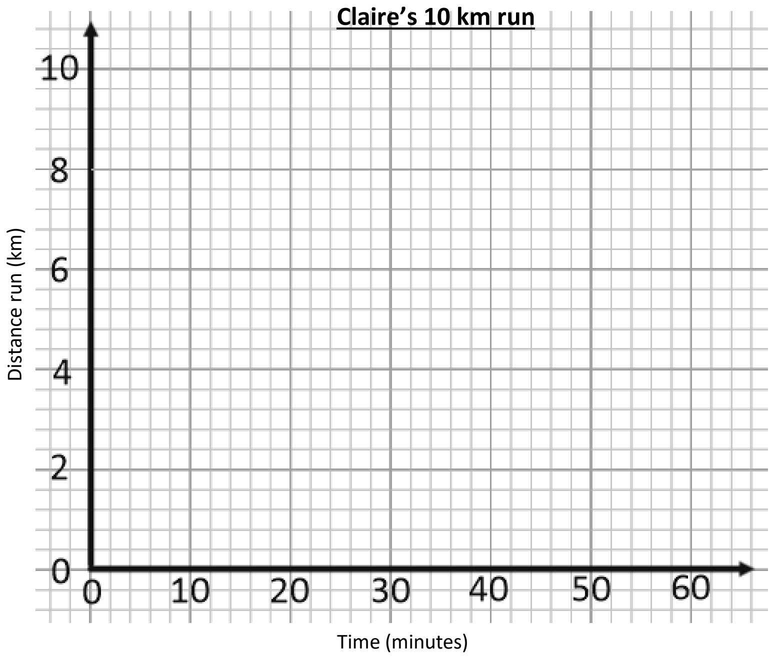
2) Helen and Claire complete a 10 km run and record their time after each 2 km. Complete the table.



Distance (km)	Helen's run time	Claire's run time
0	0	0
2	10	13
4		24
6	30	32
8		41
10	55	50

a) How long did Helen take to run from the 4 km mark to the end of the race?

3) Use the table below to draw a graph representing Claire's run.



Write a questions that can be answered using this data.

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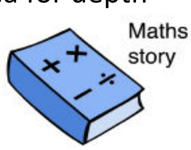
Idea for depth



Write a third "Maths story" for the graph in question 1 that doesn't have one. Create three new stories that could be represented with the three graphs. Create your own graphs and "stories" for a range of different situations. For example, your journey to school.

Unit 3: Line graphs and timetables (week 2 of 2)

Parental Guidance

Pupils complete, read and interpret data presented in charts, including timetables. They solve a range of problems using data presented in this way, including calculating time intervals using both the 12-hour and 24-hour clock.

Prior learning
Pupils have interpreted and presented data in a range of ways, including charts. They have learned to tell the time in both digital and analogue format and calculated intervals of time within the hour.

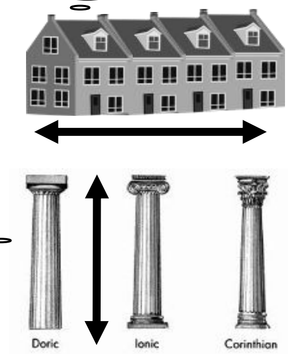
Future learning
Pupils continue to work with data presented in a variety of ways.

Rows are horizontal

Worked example

Data charts can take many forms but their purpose is to allow information to be easily understood. Their layout is designed to display data in an organised way.
There is often confusion between rows and columns which can lead to difficulties when describing charts. Making connections to other meanings of the words can help pupils recall that rows are horizontal (rows of houses, rows of flowers) and columns are vertical (like the pillars that hold up buildings).

Columns are vertical



Reading and completing timetables
A timetable is a table of information showing when things will happen. Reading and interpreting timetables is a useful life skill that can be put to use in a range of practical situations.

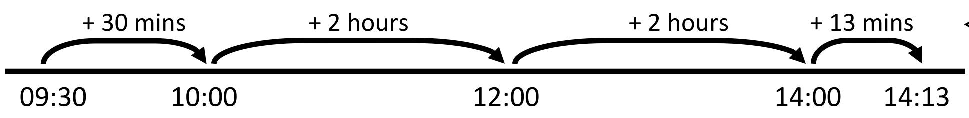
London St Pancras	06:18	07:01	08:31	09:22	10:01
Ashford International	06:55	-	-	09:55	-
Paris Gare du Nord	09:47	10:17	11:47	12:47	13:17

Pupils should be exposed to timetables in different orientations.

Train times from London to Edinburgh		
Depart	Arrive	Duration
09:30	14:13	
10:00		4h 20m
	16:22	5h 39m

Calculating time intervals
To complete the information on this timetable, the information available needs to be read and interpreted and then intervals of time need to be calculated. Representing these calculations on empty number lines can help keep track of the steps.

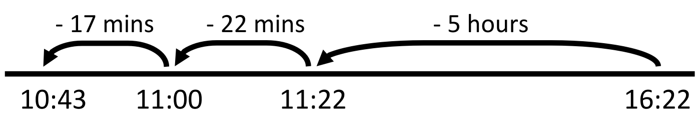
? ***For the train leaving at 09:30, what is the duration of the journey?***



I need to find the difference between 09:30 and 2:13 p.m. I could count forwards or backwards.

? ***At what time did the last train on the chart leave London?***

I need to work out what time it was 5 hours and 39 minutes before 4:22 p.m. I will jump back to work it out.



Suggested activities: Make use of the many opportunities to use table, charts and timetables. Create timetables for your daily or weekly routines. Look at timetables and bus stops and train stations. Use online websites together to book real or imaginary journeys, exploring the different route options and times available.

Pupil tasks

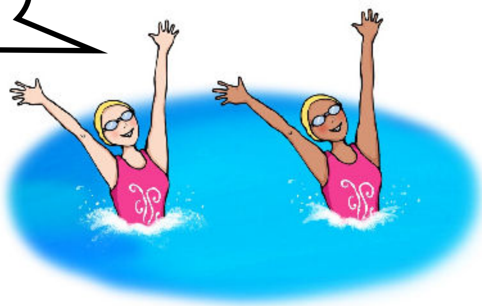
1a)

I have 8 hours and 20 minutes until my event. If the time is 9:45 a.m., what time is my event?

9:45 a.m.

The event is at

We are performing at 3:15 p.m. tomorrow. If it is 10:30 p.m. now, how long is it until the event?



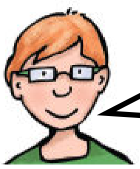
22:30

It is this long until the event:

2) This is the timetable for a train service that runs between London and Manchester via Birmingham.

London	08:37	08:58	09:22	09:45	10:08	
Birmingham	09:59	10:23	-	11: 08	-	
Manchester	11:02	11:25	11:39	12:52	12:33	

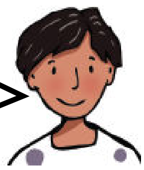
a)



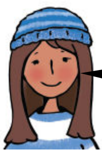
I catch the 08:37 train from London to Manchester. How long is my journey?

b)

I catch the train that takes the least amount of time to reach Manchester. Which train did I get?

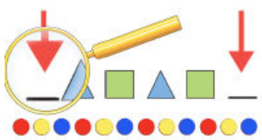


c) Write this train in the last column of the timetable:



I arrive in Manchester at 13:42 having been on the train for 2 hours and 15 minutes. I travelled here from London.

Idea for depth



A bus leaves the depot every 17 minutes starting at 06:15.

What time does the fourth bus leave?

What time does the tenth bus leave?

Parental Guidance

Pupils consolidate their understanding of factors and multiples by finding factor pairs and common factors of two numbers. They are introduced to the terms 'prime number' and 'square number'.

Prior learning

Pupils have been using the term 'multiple' since Year 2, and 'factor' was formally introduced in Year 4. The expectation is that pupils are secure with multiplication facts up to 12 × 12 by the end of Year 4.

Future learning

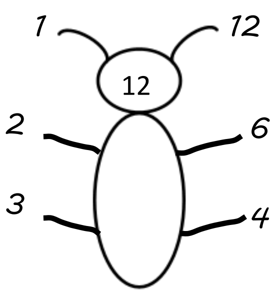
Pupils will apply this knowledge to develop efficient calculation strategies for multiplication and division. They will solve problems using their knowledge of factors, multiples, squares and cubes. This knowledge will be used when working with equivalent fractions. In Year 6 pupils will find common factors and multiples, use common factors to simplify fractions and use common multiples to express fractions in the same denomination.

Worked example

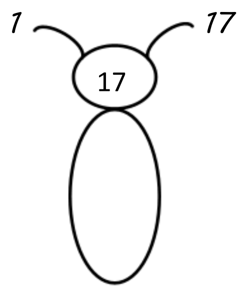
The terms **factor**, **multiple**, **prime** and **square** are defined in the glossary at the end of this workbook.

1. Create a factor bug for the following numbers

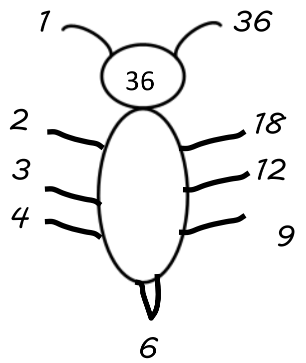
A) 12



B) 17



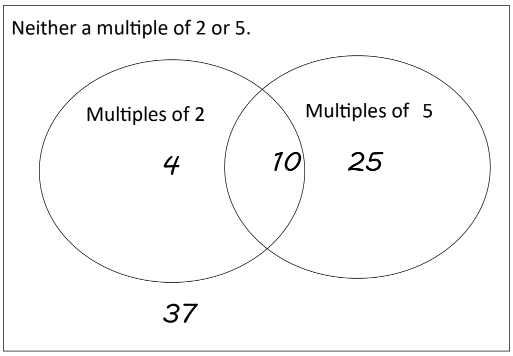
C) 36



Children explore different properties of numbers through their factors. Factor bugs are used as a systematic way to find all factors for a given number. Every number will have the factors one and itself and these are represented by the 'antennae' on the factor bug. Other factors make up the 'legs' of the factor bug which are recorded in pairs. If there are no more factors, the factor bug has no legs and becomes a slug. Slugs are **prime numbers**. Some numbers have a 'stinger'. These numbers are **square numbers** because they have a pair of equal factors, only one of which is represented on the factor bug. Children are asked to compare numbers based on their factors to further explore properties of number. Responses could include comparing the total number of factors ('12 has six factors, 17 has two factors'), the number of even/odd factors ('12 has four factors which are even, 36 has six factors which are even'), numbers that have the same factors ('12 and 16 both have a factor of four') etc.

2. Sort these numbers into the Venn diagram.

4	10	25	37

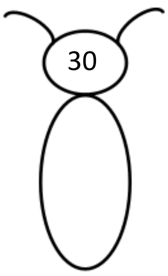


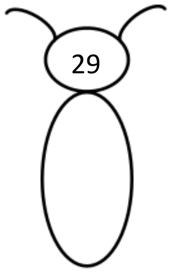
In this example, a Venn diagram is used to sort numbers into **sets**. There are two sets in this example: 'multiples of 2' and 'multiples of 5'. Where a number is part of both sets they are written in the intersection. A number that does not belong to either set is written outside the diagram. By sorting numbers this way, children are deepening their understanding of properties of numbers.

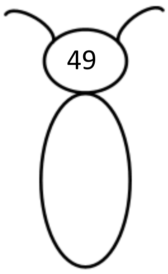
Pupil tasks

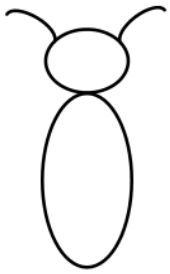
1. Create factor bugs for the following numbers:

A) 30 B) 29 C) 49 D) A number of your own choice









E) Choose two of the factor bugs you have created above and explain how they are **same** and how they are **different**.

Factor bug ________ and Factor bug _________

____

____

____

2.
A) Sort these numbers into the Venn diagram below.

16 18 20 24 30 32 36 48

B) What other numbers can you include? Write these in the Venn diagram.

C) Write two facts for each set of numbers (including the ones not in the circles).
e.g. All multiples of six are also multiples of three.

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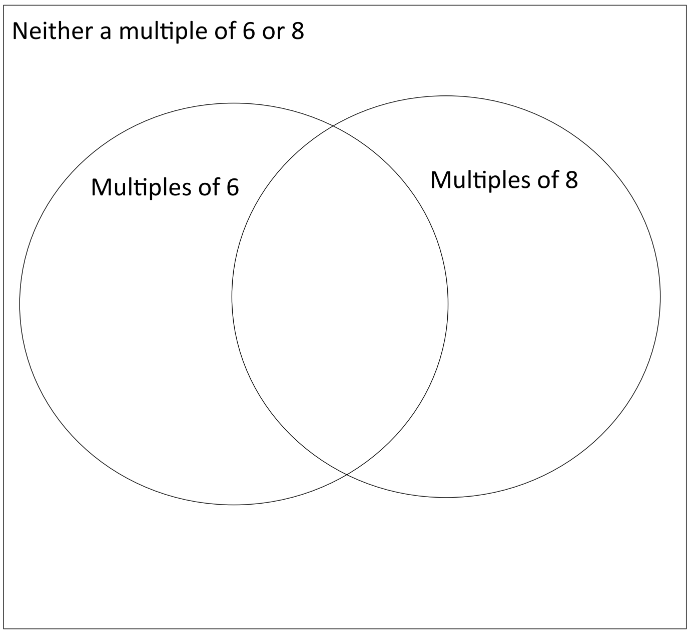
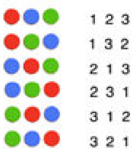


Idea for depth



Find all the common factors of

24 and 42

36 and 48

Unit 4: Multiplication and division (week 2 of 3)

Parental Guidance

Pupils will multiply and divide whole numbers by 10, 100 and 1000. They will gain a secure understanding of the relationship between this concept and place value. It is assumed that pupils know their multiplication facts up to 12 × 12 and they will learn how to use these facts in a variety of ways to calculate with larger numbers. This week focuses on using known facts to calculate other facts.

Prior learning

Pupils are formally introduced to multiplication in Year 2 and have developed a range of calculation strategies (e.g. double and double again for (×4) since then. By the end of Year 4, it is expected that all pupils know their multiplication facts up to 12 × 12. In Year 5, this is extended to work with larger numbers and developing flexibility.

Future learning

Pupils are working towards formal long multiplication and long division by the end of Year 6 and they will use this knowledge to calculate with decimals and fractions.

Children learn to be flexible with calculation strategies and understand that there are multiple ways of solving problems.

To calculate '**mentally**' means deriving an answer without using the formal written method. To begin with, jottings can be used to support visualisation. When children become more fluent they will be able to calculate mentally in their heads. Using **known facts** is a key skill in calculating mentally.

Worked example

Write down facts you can derive from knowing 3 × 5 = 15

3 × 5 = 15

Corresponding division calculations.

15 ÷ 5 = 3

15 ÷ 3 = 5

Distributive law

(3 × 10) + (3 × 5) = 30 + 15 = 45

3 x 15 = 45

Associative law

It doesn't matter how the calculation is grouped for multiplication. 30 is 3 × 10 so (3 × 10) × 5 is the same as (3 × 5) × 10 = 150.

30 x 5 = 150

and

33 x 5 = 165

Distributive law

33 × 5 = (30 × 5) + (3 × 5) = 150 + 15 = 165

Partition 33 into 30 and 3 and multiply both by 5.

5 x 3 = 15

Commutative law

Numbers can be swapped around when multiplying: a × b = b × a

30 x 50 = 1500

Both multipliers are ten times bigger, therefore the answer is 100 times bigger (because 10 × 10 = 100). If the calculation was 300 × 50, the answer would be 1000 times bigger (100 × 10 = 1000), so 15 000.

When multiplying by 10, 100, 1000, etc., 'adding zeros' is a classic misconception that can cause confusion later down the line. Adding zero means adding nothing; errors occur with conceptual understanding but particularly when multiplying and dividing with decimals, for example, 1.4 × 10 is equal to 14, not 1.40.

Pupil tasks

1. Complete the table

	× 2	× 20	× 200	× 2000
43				
26				
63				

B) What do you notice about the digits of a number when it is multiplied by 10, 100 and 1000?

____

____

2. Write down facts you can derive from knowing 4 × 3 = 12. One has been done for you,

$4 \times 3 = 12$

$4 \times 30 = 120$

2. Use known facts, (e.g. factors, partitioning, distributive law etc.) to solve the following calculations.

A) $15 \times 4 =$ ______________________________

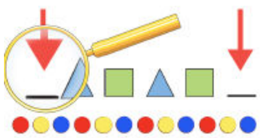
B) $6 \times 13 =$ ______________________________

C) $23 \times 20 =$ ______________________________

D) Which known fact will help you solve this calculation? Solve it.

$270 \div 30 =$ ______________________________

Idea for depth



Write out all of the multiples of 11 from 1 × 11 up to 20 × 11.

What patterns do you notice in the numbers? Describe and explain the pattern.

Unit 4: Multiplication and division (week 3 of 3)

Parental Guidance

Pupils will multiply and divide whole numbers by 10, 100 and 1000. They will gain a secure understanding of the relationship between this concept and place value. It is assumed that pupils know their multiplication facts up to 12 × 12 and they will learn how to use these facts in a variety of ways to calculate with larger numbers. This week focuses on the formal method of multiplication and division.

Prior learning

See previous week

Future learning

See previous week

Children are expected to know and use the formal methods of multiplication and division. Historically, children were often taught this by rote; to follow a procedure without much understanding of what they were doing or why. Mathematics Mastery teaches with conceptual understanding at the core - when working with your child ask them to explain what they are doing and why, instead of expecting them to follow a meaningless procedure.

Worked example

1. Use the formal method of multiplication to solve the following calculations.

	2	7
×		2
	5	4
	1	

Just like in addition, re-grouping ones, tens and hundreds etc. is sometimes necessary in multiplication (see Unit 2, week 2 for guidance). Here, 2 × 7 = 14, so ten ones have been re-grouped into one ten.

	2	7
×	2	0
5	4	0
1		

Place holder which makes 27 × 2 ten times bigger.

Multiplying by 20 is the same as multiplying by ten and then by two. When you multiply a number by ten, the digits have to be in a place which is ten times larger. For whole numbers this is achieved by putting a place holder (i.e. ‘0’) in the ones place. Then you can carry out the steps of multiplying by two as before. If you are multiplying by 100, you will need two place holders (00), and thousands would require three (000).

2. There are 87 children in Year 5. How many full teams of six can be made?

		1	4	r	3
	6	8	27		

14 teams of six can be made.

There will be three children left.

Here, 87 is the **dividend** (the number being divided) and six is the **divisor** (the number you are dividing by). Children will first be taught how to divide using this short method using place value counters in order to eventually articulate it as follows:

- I can divide eight tens into six equal groups of one ten. Two tens are left and cannot be divided equally into six groups.
- Two tens are regrouped into 20 ones. There are now 27 ones.
- I can divide 27 ones into six equal groups of four ones, with three left over. Three ones becomes the remainder.

The context of the question will determine how the remainder is articulated (i.e. if it is left as a remainder or the answer is rounded to the previous or next whole number).

Pupil tasks

1. Use the formal method of multiplication to solve these calculations.

A)

	4	6
×		3

B)

	3	1	4
×			4

C)

	2	1	4	3
×				5

D)

	3	2
×	3	0

E)

	2	1	3
×		4	0

F)

		1	6	4
	×	2	0	0

2. Use the formal short method of division to solve these calculations.

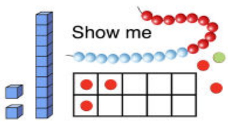
A) $6\overline{)474}$

B) $5\overline{)730}$

C) $7\overline{)574}$

3. Medals for the winning athletes arrive in boxes of 149. There are six boxes. They need to be taken out and polished before being presented at the medal ceremony. After polishing, one gold, one silver and one bronze are arranged on trays. How many trays are needed in total?

Idea for depth



Using place value counters explain how to solve:

87 ÷ 4

Unit 5: Perimeter and area (week 1 of 1)

Parental Guidance

Pupils will calculate and compare the area of rectangles in square centimetres and square metres and link to their understanding of multiplication arrays. They will estimate the area of non-rectilinear shapes that are presented on a grid by counting squares and parts of squares. Pupils are introduced to volume using 1 cm^3 blocks to build cuboids and will develop an ability to estimate volume and capacity.

Prior learning

Pupils were introduced to area in Year 4 and found the area of rectangles on a grid by counting squares. This was linked to their understanding of multiplication arrays to see that, for example, a rectangle that is 3 cm by 4 cm has an area of 12 cm^2 and that that 3 × 4 as an array with counters has 12 counters. Pupils have experience from previous years of measuring capacity in millilitres and litres.

Future learning

Pupils will use their understanding of calculating measures to work with simple formulae where appropriate. They will find the area of more complex shapes such as parallelograms and triangles. They will be introduced to using mm^3, m^3, and km^3 in calculating, estimating and comparing volume.

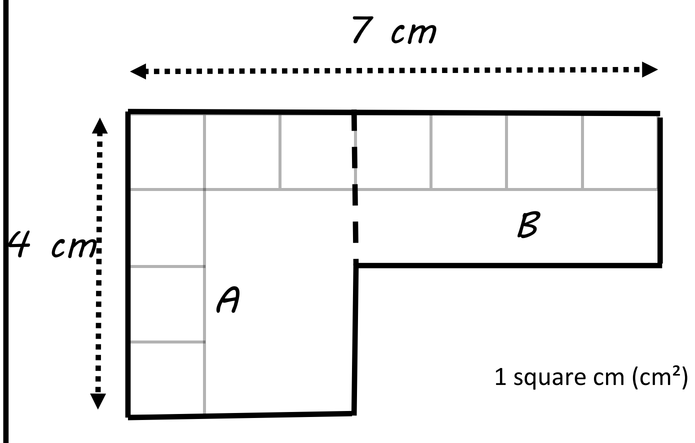
Perimeter is a measure of length, for example the distance around a field or the total length of all the sides of a pentagon. Length is measured in **one dimension**, e.g. cm, m, km.

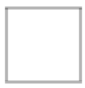
Area is measured in square units, for example cm^2, articulated as 'square centimetres', or 'centimetres squared'. 'Squared' represents the **two dimensions** of a shape to calculate its area. Area is the amount of surface something covers. For example, the area of a field is calculated by multiplying the two dimensions of length and width.

Worked example

Area = length × width

1. Find the area and perimeter of this shape.



1 square cm (cm^2) = 

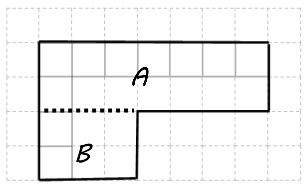
Area of rectangle A = 3 x 4 = 12 cm²

Area of rectangle B = 4 x 2 = 8 cm²

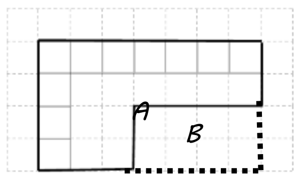
Area of shape = 12 cm² + 8 cm² = 20 cm²

Perimeter = 7 + 2 + 4 + 2 + 3 + 4 = 22 cm

To find the area of this shape, two rectangles have been created. The area of each rectangle is calculated and then the two are combined to find the total area. There are other ways that this shape could be split.



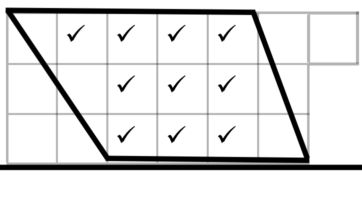
Area = A + B



Area = A - B (where A = the whole shape).

This is a non-rectilinear shape. Whole squares are counted and part squares are combined to form approximate whole squares.

2. Find the approximate area of this shape.



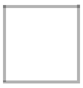
= 1 square cm (cm^2)

There are 10 whole squares and parts of squares that create approximately 3 whole squares.

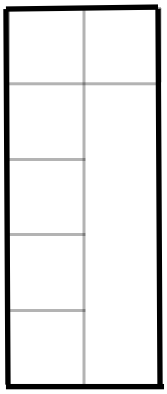
The area is approximately 13 cm².

Pupil tasks

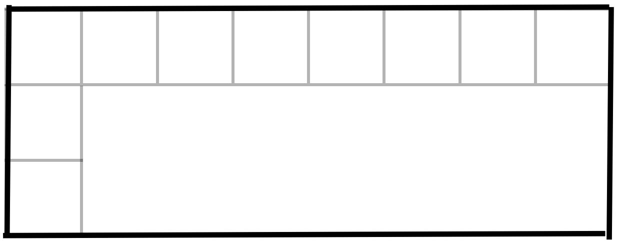
1. Calculate the area and perimeter of these shapes.

 = 1 square cm (cm^2)

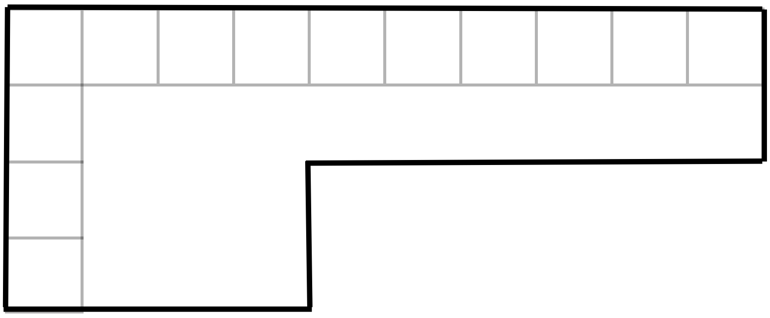
A)



B)



C)



<u>Rectangle A</u>

Area = ____________

Perimeter = ____________

<u>Rectangle B</u>

Area = ____________

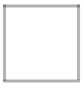
Perimeter = ____________

<u>Rectangle C</u>

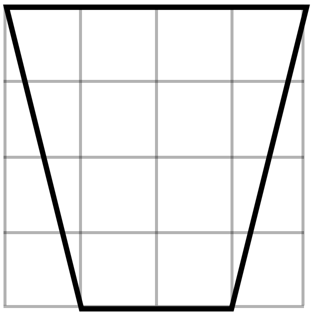
Area = ____________

Perimeter = ____________

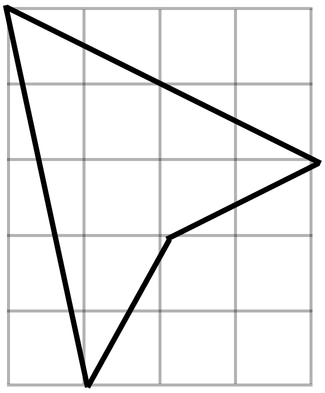
2. Find the approximate area of these shapes

 = 1 square cm (cm^2)

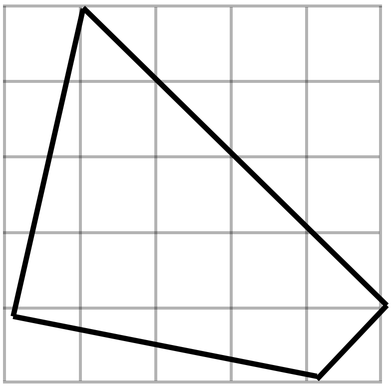
A)



B)



C)

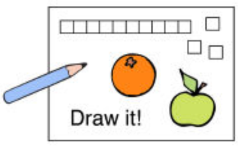


A) Approximate area = _________

B) Approximate area = _________

C) Approximate area = _________

Idea for depth



Draw three different shapes with an area of 12 cm^2.
Will the perimeter of these shapes be the same? Why? Why not?
(There is grid paper at the back of this book)

Notes pages

Notes pages

Notes pages

Notes pages

Notes pages

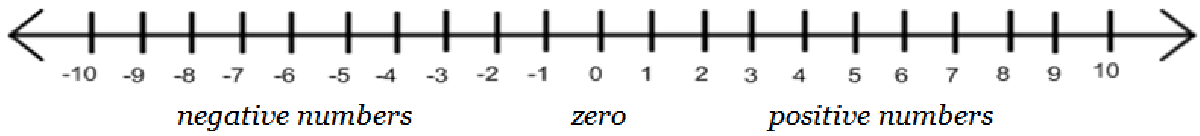
Notes pages

Notes pages

Notes pages

Glossary

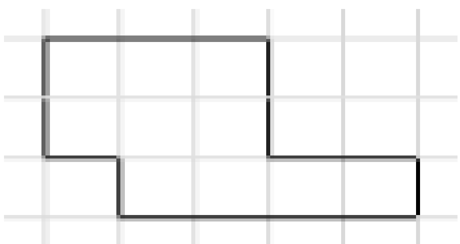
Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones	tenths	hundredths	thousandths



Word	Definition	*Example*
integer	A positive or negative whole number	*The number line above*
factor	A number, that when multiplied with one or more other factors, makes a given number	*3 × 4 = 12* *3 is a factor of 12* *12 is a multiple of 3*
multiple	The result of multiplying a number by an integer	
square number	The product of two equal factors	$3^2 = 3 \times 3$ $= 9$
prime number	A whole number that has exactly two factors, itself and one	*The first prime numbers are* *2, 3, 5, 7, 11, and 13*
prime factor	A factor that is also a prime number	*3 and 5 are prime factors of 15*
composite number	A number with more than two factors A number that is not a prime number	*6 is a composite number. It has four factors: 1, 2, 3 and 6.*

Units of measure

perimeter	The total distance around the outside of a shape
area	The amount of surface covered by a 2-D shape. Measured in square units such as square centimetres (cm^2)



Perimeter = 16 cm

Area = 10 cm^2

Time
60 seconds = 1 minute
60 minutes = 1 hour
24 hours = 1 day
7 days = 1 week
52 weeks ≈ 1 year
12 months = 1 year