MathsHUBS Resources

National Centre for Excellence in the Teaching of Mathematics

Mastery Professional Development

Number, Addition and Subtraction

1.22 Composition and calculation: 1,000 and four-digit numbers

Teacher guide | Year 4

Teaching point 1:

Ten hundreds make 1,000, which can also be decomposed into 100 tens and 1,000 ones.

Teaching point 2:

When multiples of 100 are added or subtracted, the sum or difference is always a multiple of 100.

Teaching point 3:

Numbers over 1,000 have a structure that relates to their size. This means they can be ordered, composed and decomposed.

Teaching point 4:

Numbers can be rounded to simplify calculations or to indicate approximates sizes.

Teaching point 5:

Calculation approaches learnt for three-digit numbers can be applied to four-digit numbers.

Teaching point 6:

1,000 can also be composed multiplicatively from 500s, 250s or 200s, units that are commonly used in graphing and measures.

Summer 2018 pilot

Overview of learning

In this segment children will:

- develop an understanding of how the number 1,000 can be decomposed in various useful ways by exploring additive and multiplicative composition
- relate units of measurement with prefixes milli- and kilo- to calculate with thousands and to read scales
- develop confidence working over the thousands boundary
- learn how to round numbers for the first time
- make decisions about whether to use column methods for addition and subtraction or mental strategies if they are more efficient.

From previous segments, children should know the connections between ones, tens and hundreds (see segments *1.17 Composition and calculation: 100 and bridging 100* and *1.18 Composition and calculation: three-digit numbers*). They should know the structure of multiples of 100 and where they appear on a number line. They should also be able to add and subtract three-digit numbers using column methods and informal mental methods (see segments *1.19 Securing mental strategies: calculation up to 999*, *1.20 Algorithms: column addition* and *1.21 Algorithms: column subtraction*). This segment covers many of the same concepts but looks at how they can be applied to four-digit numbers. It is strongly recommended that you read the guides for segments *1.17–1.21* alongside this guide when planning your lessons on four-digit numbers. This will allow you to see how the children have been taught these underpinning contexts and will provide additional useful information on teaching approaches that you can draw on when planning lessons for this segment.

Throughout the segment, children will develop their understanding of the number system up to 10,000. They will explore further connections between thousands, hundreds and ones. They will consider number as a representation of measurement, as well as a collection of objects. Addition and subtraction will be applied to situations involving measure, scales and statistics.

Children should have access to concrete mathematical equipment, particularly place-value counters and Dienes. It would also be useful to have practical measuring equipment available, such as measuring beakers and cylinders, balance scales and 1 kg, 100 g, 10 g and 1 g masses. Children should already have an understanding of representations, such as part–part–whole models, bar models, scales and graphs. It would be useful for you to have a counting stick to reinforce the names of numbers in order while counting. When counting, you should encourage the dual naming of numbers so that, for example, 1,200 can be read as *'one thousand two hundred'* and as *'twelve hundred'*. The Gattegno chart will also help with this.

For the first time, children will think about the need for rounding. In previous segments, they learnt how to identify the previous and next ten or hundred to a number. In this segment, they do the same for the previous and next thousand, before using this understanding to round four-digit numbers to the nearest ten, hundred or thousand.

Throughout the unit, children need to be guided to think about whether a mental method or a formal (written) method is the most efficient, as this can be a difficult point.

Teaching point 1:

Ten hundreds make 1,000, which can also be decomposed into 100 tens and 1,000 ones.

Steps in learning

	Guidance	Representations
1:1	See below	See below

Guidance

In segment *1.18 Composition and calculation: three-digit numbers*, children counted up in multiples of 100 to 1,000. Begin this segment by repeating this activity:

- First count using names, supporting children with what comes after 900 i.e. *'… eight hundred, nine hundred, one thousand.'*
- Then count describing structure, i.e. *'… eight hundred, nine hundred, ten hundred.'*

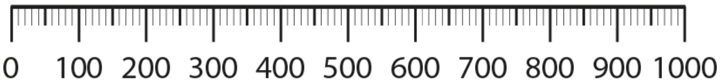
Compare both ways of counting using number lines, such as those shown opposite. Highlight how many hundreds are in each number, as shown on the second number line, to make the link between ten hundreds and one thousand.

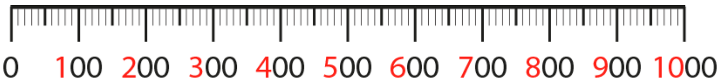
Then secure the understanding that there are ten hundreds in 1,000 using a range of representations, including:

- counting up in hundreds in both ways as before: *'One hundred, two hundred, three hundred… nine hundred, ten hundreds make one thousand.'*
- showing a one thousand Dienes block and ten hundred Dienes blocks; let children see that they are the same size.
- reminding children that 100 p make £1; ask how many lots of 100 p make £10 and show the representation of ten £1 coins.
- asking children to express 1,000 through the use of hundreds by writing additive and multiplicative equations.

Representations

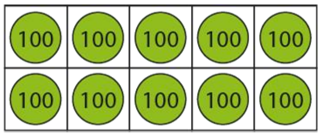
Number lines:



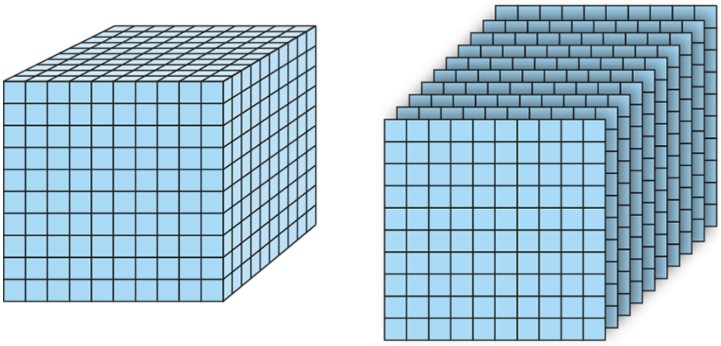


Representing ten hundreds in 1,000:

- Tens frame and 100 place-value counters



- Dienes



- Coins

1,000 p = £10									
100 p	100 p	100 p	100 p	100 p	100 p	100 p	100 p	100 p	100 p

- Additive and multiplicative equations

$$1{,}000 = 100 + 100 + 100 + 100 + 100 + 100 + 100 + 100 + 100 + 100$$

$1{,}000 = 10 \times 100$ $\quad$ $1{,}000 = 100 \times 10$

$1{,}000 \div 100 = 10$ $\quad$ $1{,}000 \div 10 = 100$

Finally, summarise by showing the bar model and, as a class, draw out and repeat the generalised statement: ***'There are ten hundreds in one thousand.'***

Summary – 1,000 as ten hundreds:

1,000									
100	100	100	100	100	100	100	100	100	100

1:2

Now secure understanding that 1,000 is made up of 100 tens.

Look again at the number line to 1,000 and explain that the lighter tick marks indicate divisions of ten, but this time, count up by stating the number of tens, i.e. *'ten tens, twenty tens, thirty tens… one hundred tens'*, pointing to each number as you count. This will support the children in making the connection between 100 tens and 1,000. As in step *1:1*, a number line with some of the digits highlighted (this time the number of tens) can support this.

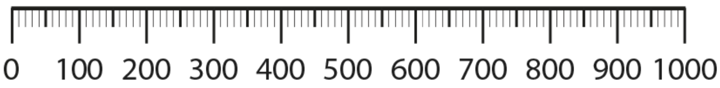
As a class, also count in tens between multiples of 100 to demonstrate the regularity of the number system, for example *'nine hundred, nine hundred and ten, nine hundred and twenty, nine hundred and thirty… one thousand.'* Support this by showing the corresponding section of the number line, pointing to the multiples of ten as you count.

Show children the bar model of ten hundreds making 1,000 from step *1:1*. Remind them that ten tens make 100, so the next representation shows how many tens make 1,000. Introduce the generalised statement: ***'There are one hundred tens in one thousand.'***

Revisit the multiplicative equations from step *1.1*. Discuss that, because multiplication is commutative, *1,000 = 10 × 100*, for example, can represent two structures:

- 1,000 = 10 lots of 100 (step *1:1*)
- 1,000 = 100 lots of 10 (step *1:2*).

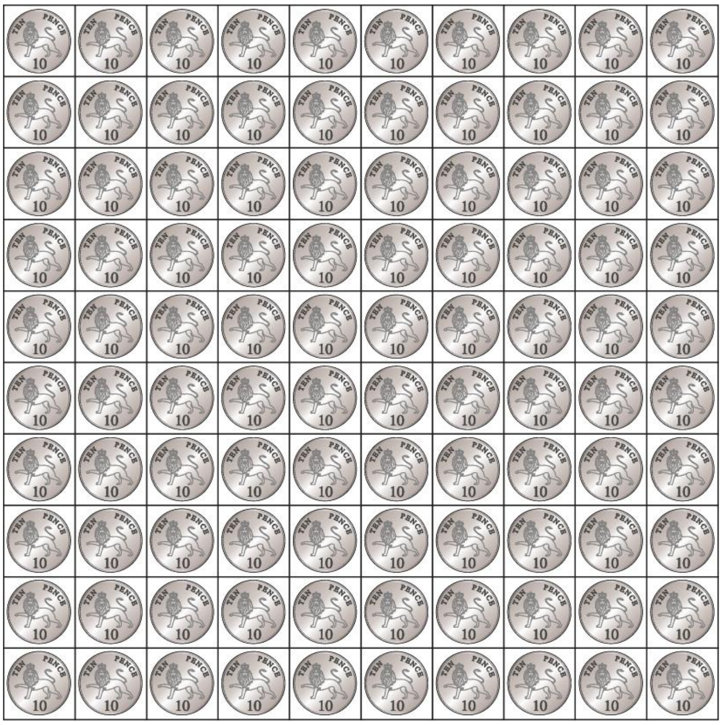
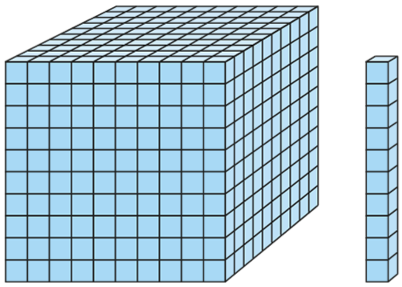
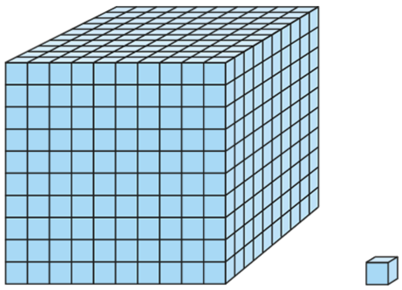
Number lines:

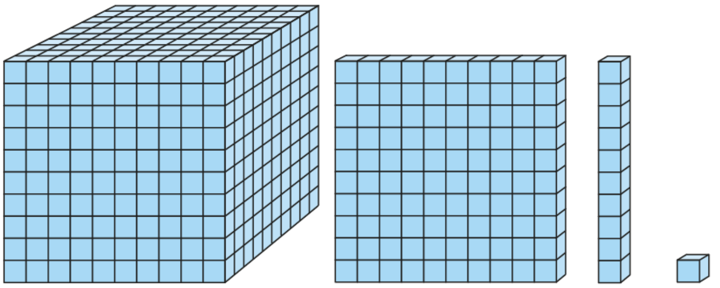


Bar model:

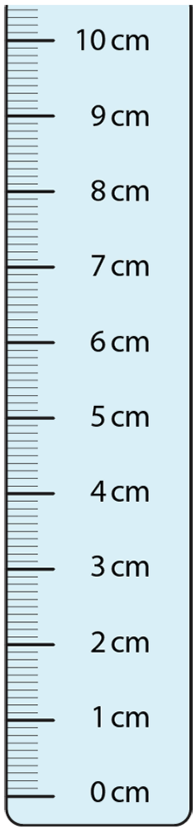
1,000									
100	100	100	100	100	100	100	100	100	100

10	10	10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10	10	10

	Note that the equations are the same, but what each number represents in these first two steps is different. Ask children to explain what each number represents in each equation. They may wish to use some of the representations met in these first two steps to support their explanations. Use the representation shown opposite to make the link with money again. Ten lots of 10 p make 100 p (or £1), so 100 lots of 10 p make 1,000 p, which is £10.00. Then compare the Dienes 1,000 block and tens rod. Can the children see how 100 of the tens blocks would be needed to make 1,000?* Finally, draw out and repeat the generalisation that: ***'There are one hundred tens in one thousand.'*** *If you can find wooden Dienes 1,000 blocks in your school, it is worth showing these at this point. Sometimes the 'hollowness' of the plastic Dienes 1,000 blocks can make it harder to see the equivalence between (in this case) 100 tens rods and one 1,000 block.	Additive and multiplicative equations: $1{,}000 = 10 \times 100$ $\quad$ $1{,}000 = 100 \times 10$ $1{,}000 \div 100 = 10$ $\quad$ $1{,}000 \div 10 = 100$ Representing 100 tens in 1,000: • Coins  • Dienes 
1:3	Next, focus on how 1,000 is made up of 1,000 ones. Show a 1,000 Dienes block and a 'one' block. As before, discuss the relationship between them. As a class, also count in ones between multiples of ten to demonstrate the regularity of the number system, for example *'nine hundred and eighty, nine hundred and*	Representing 1,000 ones in 1,000 – Dienes: 

	eighty-one, nine hundred and eighty-two, nine hundred and eighty-three… nine hundred and ninety.' Draw out and repeat the generalisation that: ***'There are one hundred tens in one thousand.'***	 Thousands Hundreds Tens Ones

1:4	Now summarise the different multiplicative compositions of 1,000 explored in steps *1:1–1:3* by looking at the digits in the number 1,000. Look carefully at how they tell us the number of thousands, hundreds, tens and ones that make up 1,000.
	Generally, focus on the idea that each individual digit has a value that it represents, so the '1' here represents 'one thousand'. However, the digits can also be 'broken up' in different ways to show how many there are of each of the other units (hundreds, tens and ones). Unitising in this way can be helpful when calculating forwards and backwards, as will be seen in step *1:7*.
	In summary, there are at least three ways children can learn that there are 10 hundreds/100 tens/1,000 ones in 1,000:
	• Learn it as a fact by repeating the generalised sentences:
	  ◦ ***'There are ten hundreds in one thousand.'***
	  ◦ ***'There are one hundred tens in one thousand.'***
	  ◦ ***'There are one thousand ones in one thousand.'***
	• Work it out by thinking 'visually' about the cardinal composition of the number (for example, *'I know that there are ten tens in one hundred, so in*
		Decoding the digits in 1,000:
		1,000 is **1,000** (1 thousand)
		1,000 is **1,000** (10 hundreds)
		1,000 is **1,000** (100 tens)
		1,000 is **1,000** (1,000 ones)

	one thousand there must be ten lots of ten tens, which is one hundred tens.'). • Look at the digits of 1,000 and 'decode' them. All of these have value. Being confident with all of them will lead to a deep understanding of the unit 1,000.	
1:5	To further reinforce the composition of the unit 1,000, look at some common measures contexts: • 1,000 mm = 1 m • 1,000 m = 1 km • 1,000 ml = 1 l • 1,000 g = 1 kg This will also support children in developing meaningful contexts for these measures and equivalences between different units of measure. All are conversions that children can find difficult to learn without practical experience and *'How many millilitres are there in a litre, again?'* is a common question throughout Key Stage 2. Children are most familiar with talking about or measuring lengths so first spend some time looking at 1,000 mm = 1 m using a 1 m counting stick or metre ruler labelled with millimetres and centimetres. It is helpful if children can have these in pairs so they can all look carefully for themselves. If there aren't enough marked metre sticks in the school, you can use tape measures. Encourage the children to give alternative descriptions such as: • *'One metre is ten lots of one hundred millimetres'*, reinforcing that 10 hundreds make 1,000 (step *1:1*) • *'One metre is one hundred lots of ten millimetres'*, reinforcing that 100 tens make 1,000 (step *1:2*).	A 10 cm section of a metre ruler or counting stick: 

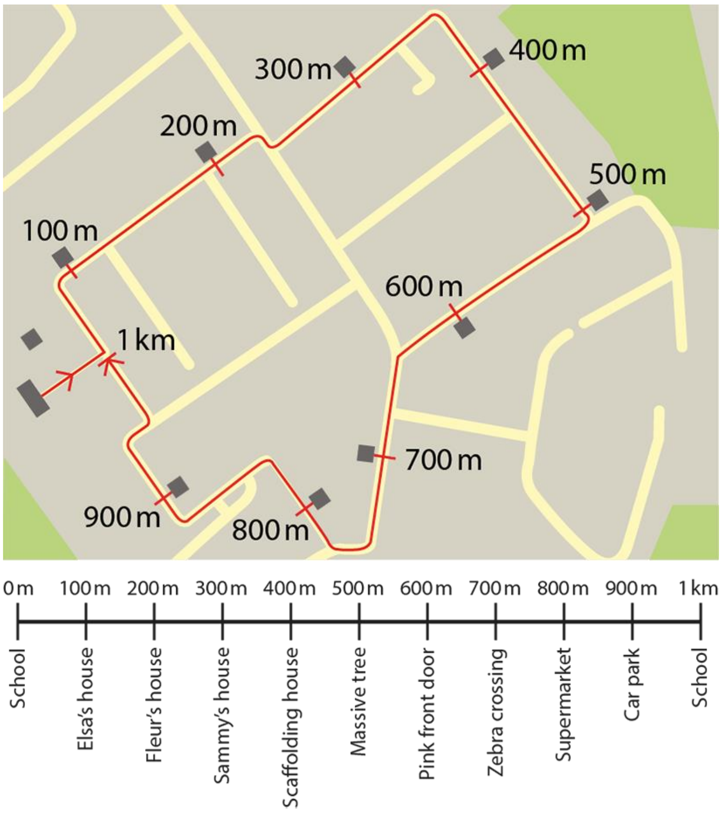
1:6

Explore other measures of 1,000 in the same way as in step *1:5*. You should include:

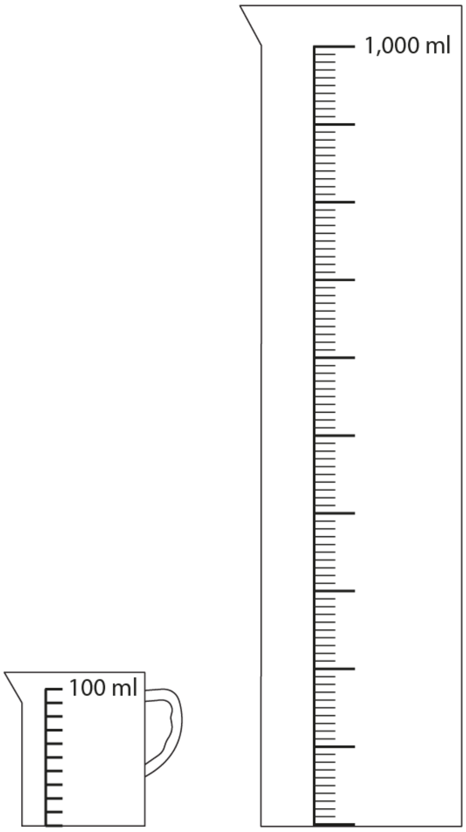
- 1,000 m = 1 km
  For example, going on a one-kilometre class walk will give a context for the equivalence 1,000 m = 1 km; it will also give children the opportunity to count from 0 to 1,000 in ones, something that they probably haven't done before (and which does take some time). After making sure that children have trundle wheels (individually or in pairs), ask them to count to 1,000 as they walk. At each multiple of 100, stop and recap how many lots of 100 m they have walked and how many more 100 m there will be until they reach 1 km. You could note landmarks and map these out once back at school, as shown opposite, to reinforce that there are ten hundreds in 1,000.
- 1,000 ml = 1 l
  For example, give children 10 ml syringes and ask them first to fill 100 ml beakers then then to fill a 1,000 ml measuring cylinder. Also give the children an opportunity to look at 1 ml squeezed into their hand.
- 1,000 g = 1 kg
  For example, use balance scales to look at the equivalence between one thousand 1 g items and a 1 kg weight. Some common items that weigh approximately 1 g are plastic Dienes one cubes, chocolate beans and smaller pieces of dried pasta, such as macaroni.

Remember that for all of these activities, the objectives are two-fold:

1,000 m = 1 km:



1,000 ml = 1 l:



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- to deepen understanding of 1,000 being composed of 1,000 ones, 100 tens, 10 hundreds and 1 thousand
- to support children with remembering common measure conversions that rely on 1,000 of one unit being equivalent to one of another unit.

Make sure you reinforce these points throughout whatever practical activities you plan, so the learning does not get lost in the activity.

Finally, summarise the work on equivalent measures by asking children to deduce the meaning of the prefixes:

- *milli-* (1,000 times smaller)
- *kilo-* (1,000 times larger).

They should then be able to describe the meaning of 1 millilitre, 1 milligram, 1 kilogram, and so on.
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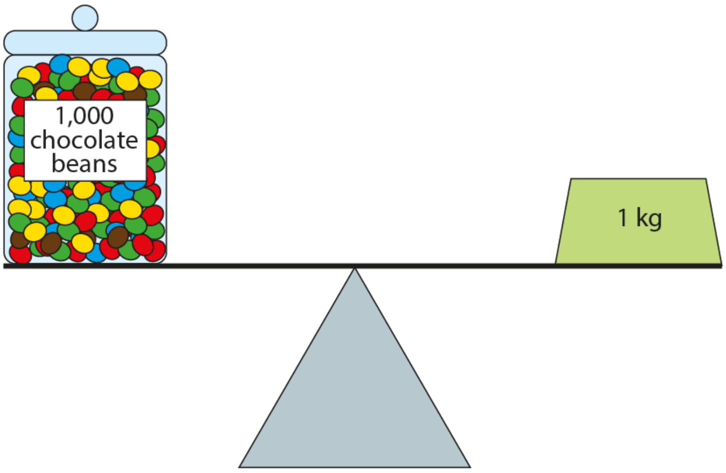
1,000 g = 1 kg:



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1:7
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Understanding of the number system in relation to 1,000 should support children in calculating forwards and backwards from the thousands boundary. At this stage, provide practice for them to do so.

Note that 1,000 = 100 tens has been learnt as a known fact, but this can also be derived from looking at the digits in the number and unitising, as introduced in step *1:4*. In this example, the unit is 'ten':

1,000 = 1,000 = 100 tens

So

100 tens – 1 ten = 99 tens = 990
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Calculating forwards and backwards from 1,000:

1,000 – 10 = 990
900 100
90

1,000 – 100 = $\square$ 1,000 – 300 = $\square$

1,000 – 10 = $\square$ 1,000 – 30 = $\square$

1,000 – 1 = $\square$ 1,000 – 3 = $\square$

600 + $\square$ = 1,000

920 + $\square$ = 1,000

995 + $\square$ = 1,000
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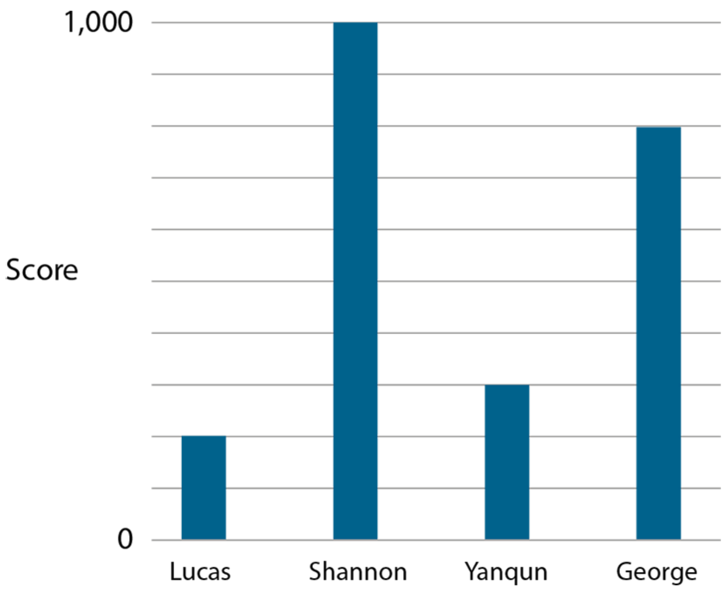
1:8	Complete this teaching point by applying the learning to real-life problems, including measures and graphing contexts, such as those shown opposite and below: • *'Faisal has taken 400 photos and Kate has taken 600 photos. How many photos have they taken altogether?'* (aggregation) • *'1,000 trees are planted in a forest. 90 are oak trees. How many are* not *oak trees?'* (partitioning) • *'James has 1 litre of milk. He removes 50 ml of cream from the top. How much milk is left?'* (reduction)	Data context: • *'How much did Lucas score?'* • *'How much more did Shannon score than Yanqun?'* • *'What was Lucas and George's combined score?'* 

Teaching point 2:

When multiples of 100 are added or subtracted, the sum or difference is always a multiple of 100.

Steps in learning

	Guidance	Representations

2:1

Now we bridge the thousands boundary for the first time, continuing with the focus on groups of 100.

As a class, count forwards and backwards in units of 100 up to and across the thousands boundary. So that the children continue to associate, for example, 14 hundreds with 1,400, use dual counting, with both you and the children pointing at/tapping the numbers on a number line. Phase out your counting around 2,000 so that children initially consider only the 1,000 boundary. Other thousands boundaries will be considered in later steps and children will learn more about larger four-digit numbers in subsequent teaching points.

As well as starting at zero, practise starting with non-zero multiples of 100, for example:

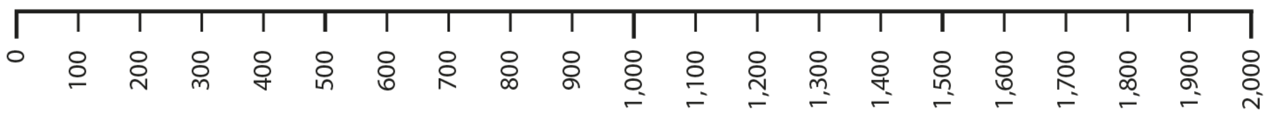
- *'Eight hundred, nine hundred, ten hundred, eleven hundred, twelve hundred, thirteen hundred, fourteen hundred… twenty hundred.'*
- *'Eight hundred, nine hundred, one thousand, one thousand one hundred, one thousand two hundred, one thousand three hundred, one thousand four hundred… two thousand.'*

On the number line, point at individual multiples of 100 up to 2,000 and practise saying these both ways (for example, point at '1,400' and say *'fourteen hundred'* and *'one thousand four hundred'*). Ask children to describe what each digit represents, using place-value charts for reinforcement.

Explain that, in England, the number 1,400 is normally called *'one thousand four hundred'*, but in the USA the same number is called *'fourteen hundred'*. They both mean the same thing and describe the same amount.

Provide further practice by asking children to point out numbers on a Gattegno chart or fill in missing-number sequences.

Number line:



Place-value chart:

1,000s	100s	10s	1s
1	4	0	0

1,400

- *'The "1" represents one thousand.'*
- *'The "4" represents four hundreds.'*
- *'The "0"s represent zero/no additional tens or ones.'*

Gattegno chart:

- *'Show me one thousand six hundred.'*
- *'Show me eighteen hundred.'*

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

Missing-number sequences:

'Fill in the missing numbers.'

600	700		900		1,100		1,300

2,000			1,700	1,600		1,400

2:2

Having practised counting in multiples of 100, use the idea of unitising to support addition of multiples of 100 that bridge 1,000. Give the children laminated tens-frame sheets and hundreds place-value counters. Ask them to represent each addition and then explain what the total is and why. Start adding multiples of 100 within 1,000, then to 1,000 and then over 1,000, using a progression like the one below:

600 + 200 = 800

600 + 300 = 900

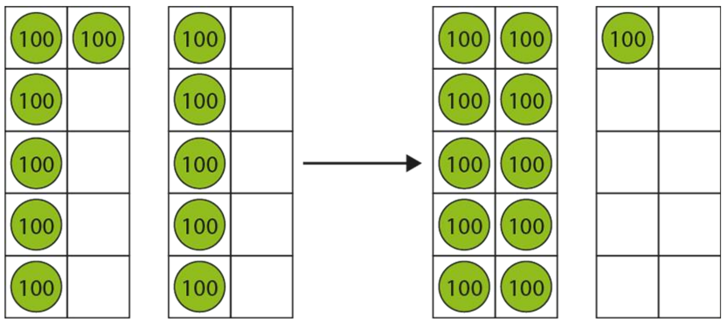
600 + 400 = 1,000

600 + 500 = 1,100

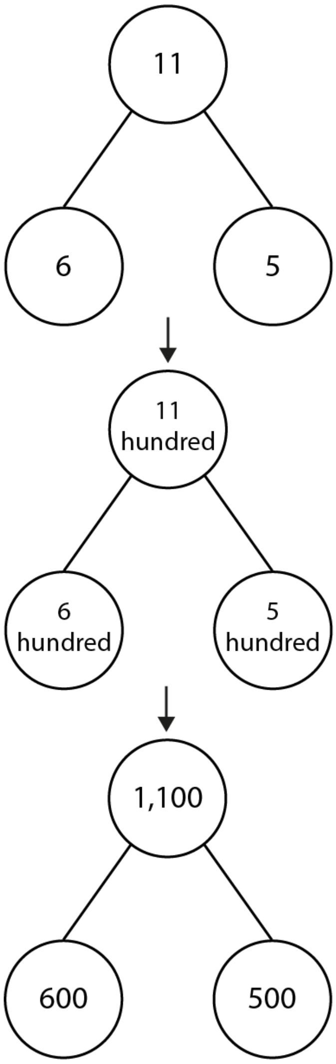
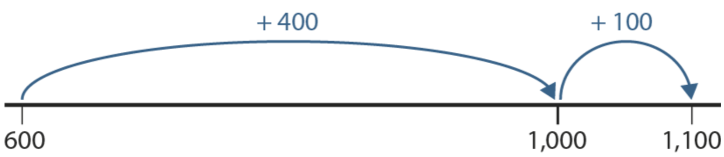
600 + 600 = 1,200

600 + 700 = 1,300

Tens frames:



600 + 500 = 1,100

	Once the children get on to bridging 1,000, make sure that they are confident in the equivalence of, for example, *'eleven hundred'*, *'one thousand one hundred'* and the written numeral '1,100'. Children can use part–part–whole models to help them with unitising. The following stem sentences can be used to support the children with writing the solutions: • ***'___ hundred plus ___ hundred is equal to ___ hundred.'*** • ***'We know there are ten hundreds in one thousand, so ___ hundred plus ___ hundred is equal to ___ thousand ___ hundred.'***	Part–part–whole models:  • *'Six hundred plus five hundred is equal to eleven hundred.'* • *'We know there are ten hundreds in one thousand, so six hundred plus five hundred is equal to one thousand one hundred.'*
2:3	Explore different methods for bridging the thousands boundary, for example, by representing it on a number line, as shown opposite. Alternatively, e.g. *600 + 500* can be solved by using near doubles, as taught in segment *1.19 Securing mental strategies: calculation up to 999*: $500 + 500 + 100 = 1{,}000 + 100$ $= 1{,}100$	Number line: 

Make sure that you celebrate and encourage sensible alternative methods to calculations that the children suggest.

2:4

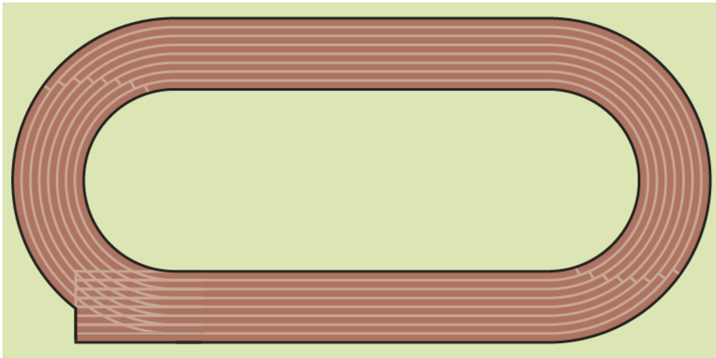
Apply understanding of multiples of 100 beyond ten (1,000) to real-life contexts.

You could watch a video of a 1,500 m athletics race to give the children a practical context for numbers of this size. Explain that it is commonly referred to as the *'fifteen hundred metres'*. It is usually run on a 400 m track. Discuss the distance of each lap. Ask:

- *'How do the athletes run their laps?'*
  (The first lap is 300 m, followed by three laps of 400 m:
  300 + 400 + 400 + 400 = 1,500)
- *'What about the three thousand metre race?'*
  (The first lap is 200 m, followed by seven laps of 400 m.)

These calculations can be represented using bar models.

Real-life context:



Bar model:

1,500			
300	400	400	400
300	3 × 400		

2:5

In the same way as for addition, we can use unitising hundreds for subtraction, for example:

1,200 – 100 = 1,100

1,200 – 200 = 1,000

1,200 – 300 = 900

1,200 – 400 = 800

1,200 – 500 = 700

These subtractions can be represented on bar models, as shown by the first bar model opposite.

Continue to make sure that children are confident with equivalences. The following stem sentences can be used to support them with writing the solutions:

Bar model:

1,200 or 12 hundred	
500	?
5 hundred	?

- *'We know there are ten hundreds in one thousand, so one thousand two hundred is equal to twelve hundred.'*
- *'Twelve hundred minus five hundred is equal to seven hundred.'*

- ***'We know there are ten hundreds in one thousand, so ___ thousand ___ hundred is equal to ___ hundred.'***
- ***'___ hundred minus ___ hundred is equal to ___ hundred.'***

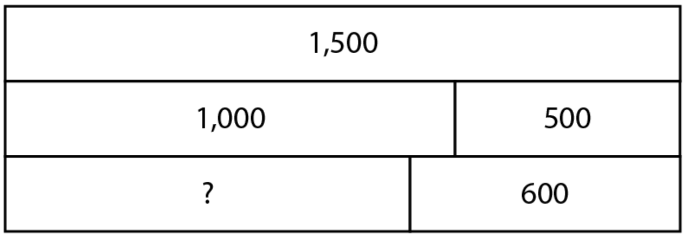
Again, apply the learning to real-life contexts, for example, by referring back to the 1,500 m race. Ask: *'In a fifteen hundred metre race, an athlete has run six hundred metres. How far does she still have to go?'*

This could be represented by a part–part–whole model (bar model or cherry diagram, both shown opposite).

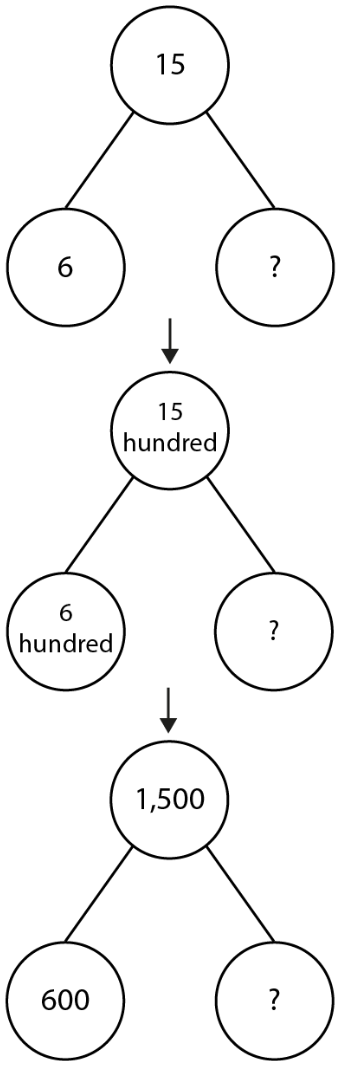
It may be helpful to first look at *1,500 – 500 = 1,000* and then, on the same bar model, show *1,500 – 600 = ?* (as shown opposite) so children can clearly visualise that 600 is a bigger part than 500 and, therefore, the missing number must be a smaller part than 1,000.

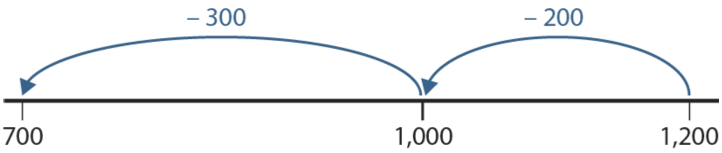
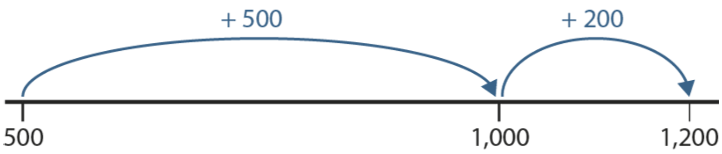
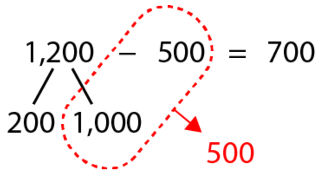
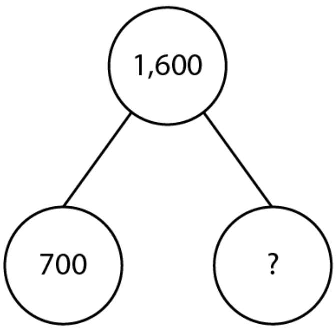
Real-life context:

- Bar model



- Part–part–whole models



2:6	For subtracting across the thousands boundary (e.g. *1,200 – 500*), alternative methods to unitising are: • subtracting on a number line by working backwards • working forwards on a number line (as addition) while bridging 1,000 • partitioning 1,200 into 1,000 and 200 and subtracting from the 1,000 (see segment *1.17 Composition and calculation: 100 and bridging 100* step *3:12*). You can continue to use the stem sentences from steps *2:5* and *2:2* to support the children with writing the solutions As with addition, children may suggest alternative strategies. You should ensure that these are efficient.	Number line – working backwards:  • *'We know there are ten hundreds in one thousand, so one thousand two hundred is equal to twelve hundred.'* • *'Twelve hundred minus five hundred is equal to seven hundred.'* Number line – working forwards:  • *'Five hundred plus seven hundred is equal to twelve hundred.'* • *'We know there are ten hundreds in one thousand, so five hundred plus seven hundred is equal to one thousand two hundred.'* Partitioning: 
2:7	Provide varied practice for the addition and subtraction of multiples of 100 across the thousands boundary, including: • part–part–whole models (bar model or cherry diagram) with a missing 'part' or 'whole' • missing-number problems • balancing equations with missing numbers or symbols • real-life problems, including measures and graphing contexts, such as those shown opposite and below:	Part–part–whole models: *'Fill in the missing numbers.'* 

- *'There are 800 adults taking part in a charity run. 500 children are also taking part. How many runners are taking part altogether?'* (aggregation)
- *'Sam is swimming 1,500 m in a triathlon. So far, she has swum 700 m. How much of the swim has she still got to do?'* (partitioning)
- *'I use 900 g of white flour in a recipe and add 800 g of brown flour. How much flour do I use altogether?'* (augmentation)
- *'Parveen has saved up £1,300. She uses £400 to buy a bicycle. How much has she got left?'* (reduction)
- *'A football team had 1,700 fans at their home game. 900 fans travelled to their away game. How many more fans were at the home game than the away game?'* (difference)
- *'A bowl contains 1,500 ml of fruit punch. 600 ml are drunk. Anthony then makes 800 ml more. How much is in the bowl now?'* (multi-step)

Continue to include problems that incorporate simple measure conversions. Children should be able to explain all of the strategies presented, but it is fine for them to choose the method they prefer, provided they can work quickly and confidently with it.

To promote and assess depth of understanding, use dòng nǎo jīn problems such as those shown opposite.

1,400	
?	600

Missing-number problems:

'Fill in the missing numbers.'

900 + 900 = ☐   1,200 – 700 = ☐

500 + 600 = ☐   800 = ☐ – 700

1300 = ☐ + 500   1,400 – ☐ = 500

Balancing equations:

'Use numbers or symbols (< > =) to complete the equations.'

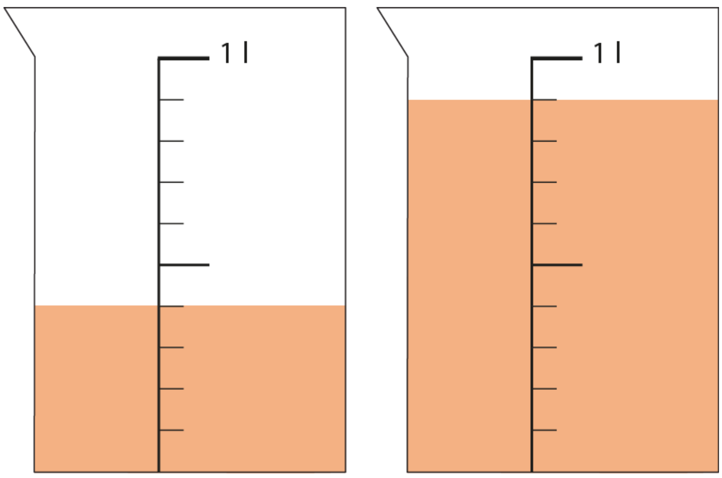
400 + 800 ◯ 300 + 900

900 + 500 = ☐ + 600

500 + 800 ◯ 600 + 800

Measures context:

'How much water is in the two measuring beakers altogether?'



<table>
<tr>
<td></td>
<td></td>
<td>
Dòng nǎo jīn:
• 'Decide whether each expression is true or false. Put a tick or a cross in each box.'
☐ 900 + 900 – 100   500 + 700 + 400 ☐
1,700
☐ 900 + 200 + 500   300 + 800 + 600 ☐
• 'Find three different ways to prove that the following equation is correct.'
600 + 800 = 1,400
• 'How many different ways can you split the bar into multiples of 100 so that each part is less than one thousand?'
<table>
<tr><td colspan="2">1,400</td></tr>
<tr><td>?</td><td>?</td></tr>
</table>
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</tr>
<tr>
<td>2:8</td>
<td colspan="2">
Following on from counting, children need be able to show they understand numbers close to whole thousands by adding and subtracting to and from them.
Start with subtracting from 1,000, which will already be familiar from step 1:7, and look for patterns in the numbers. The children may need reminding that:
100 – 10 = 90
100 – 1 = 99
They can use part–part–whole models (bar model or cherry diagram) to represent the calculations.
Once they have grasped this subtraction from 1,000, they should apply what they have noticed to subtracting from other multiples of 1,000, such as 2,000 and 5,000.
</td>
</tr>
</table>

Subtracting from whole thousands:

- Subtracting from 1,000

1,000	
100	900

1,000	
10	?

1,000	
1	?

1,000 – 1,000 = ☐

1,000 – 100 = ☐

1,000 – 10 = ☐

1,000 – 1 = ☐

- Subtracting from 2,000

2,000	
1,000	?

2,000	
100	?

2,000	
10	?

2,000	
1	?

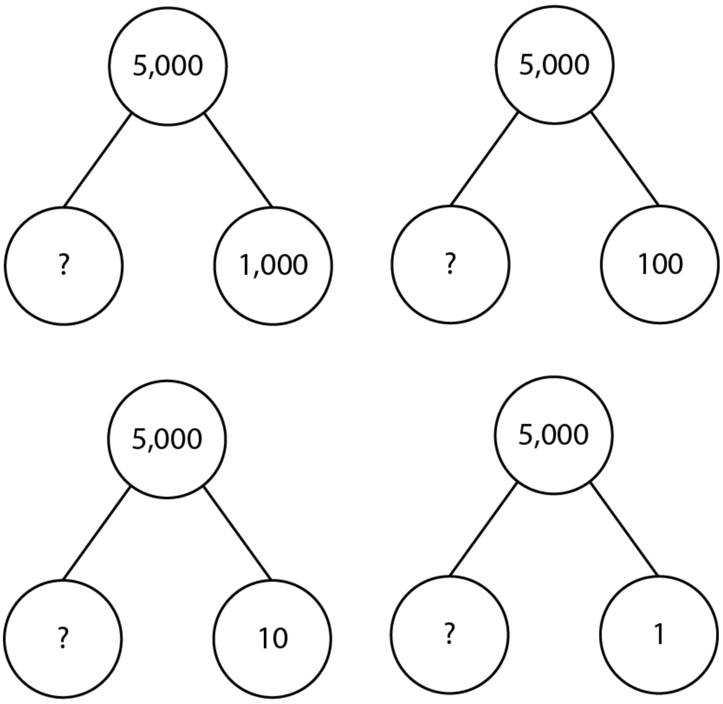
2,000 – 1,000 = ☐

2,000 – 100 = ☐

2,000 – 10 = ☐

2,000 – 1 = ☐

- Subtracting from 5,000



$5{,}000 - 1{,}000 = \boxed{}$

$5{,}000 - 100 = \boxed{}$

$5{,}000 - 10 = \boxed{}$

$5{,}000 - 1 = \boxed{}$

2:9 Now that children are confident that 1 m is equal to 1,000 mm (covered in step *1:5*), provide them with word problems including mixed units. Ideally, use real-life scenarios that they can visualise. At this stage, they should be able to consider crossing thousands boundaries other than 1,000. For example:

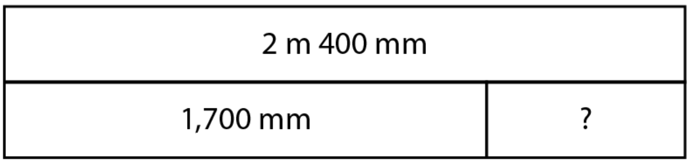
- *'A ceiling is 2 m 400 mm high. A woman is 1,700 mm tall. How much space is there above her head?'*
  (difference)
- *'A car is 4 m 700 mm long. A trailer is attached that is 2,800 mm long. What is the overall length of the car and trailer?'*
  (aggregation)

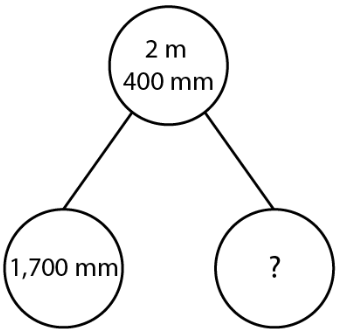
Continue to offer more varied practice by asking children to apply what they have learnt to a range of problems that involve crossing thousands boundaries using other measures, including mixed units. For example:

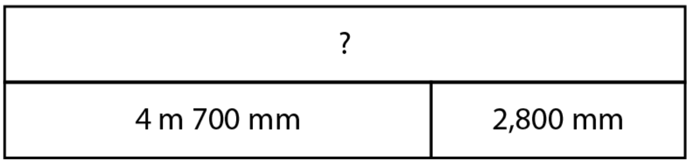
- *'Anna walks 1,800 m to Ellen's house, then a further 700 m to Lucy's house. How far does Anna walk in kilometres and metres?'*
  (augmentation)
- *'Dev's bag has a mass of 3,600 g. Harry's bag has a mass of 1,800 g. How much greater is the mass of Dev's bag than Harry's?'*
  (difference)
- *'Enza buys 2,400 g of dog food. She uses 1,300 g. Enza then buys 1 kg more. How much dog food does she have now?'*
  (multi-step)

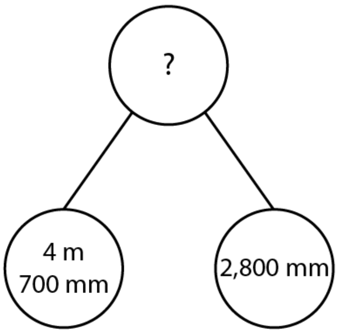
As shown below, children can use part–part–whole models (bar model or cherry diagram) to represent the calculations.

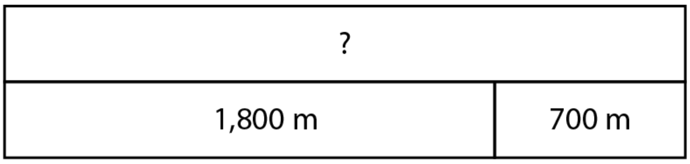
Representing word problems:

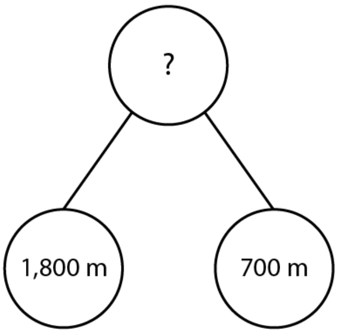


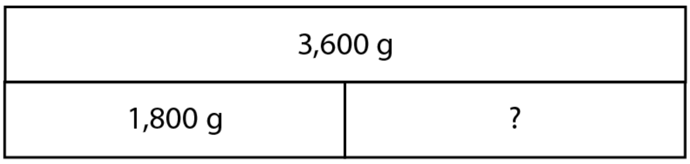


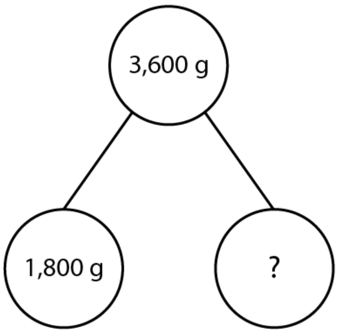












Teaching point 3:

Numbers over 1,000 have a structure that relates to their size. This means they can be ordered, composed and decomposed.

Steps in learning

	Guidance	Representations

3:1

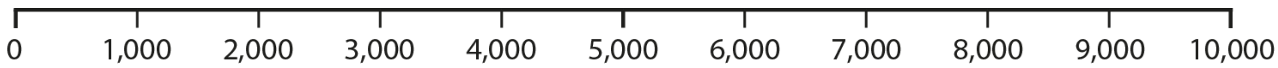
At this stage, it is recommended that you read segment *1.18 Composition and calculation: three-digit numbers* for a detailed progression of supporting understanding of place value. Much of this can be applied to four-digit numbers and some important pedagogical notes are not repeated in this segment. However, key teaching points are highlighted here.

This is the first place that children have met numbers with four non-zero digits.

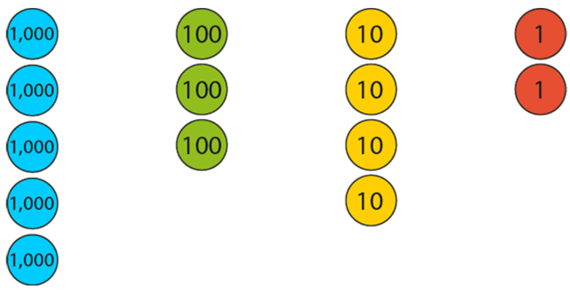
Start by showing the 0–10,000 number line to help children visualise the larger numbers they are now working with. In previous year groups, we looked at numbers up to 1,000 and so far in this segment the majority of the work has focused on multiples of 100 up to 2,000 (with some problems around other thousands boundaries introduced in steps *2:8* and *2:9*). In this teaching point, we will look in more detail at four-digit numbers up to the largest four-digit number of 9,999 (which, as the number line indicates, sits just before 10,000).

Now represent some four-digit numbers using place-value counters (e.g. 5,342, shown below). Move through the representations as shown, saying as a class what each digit represents.

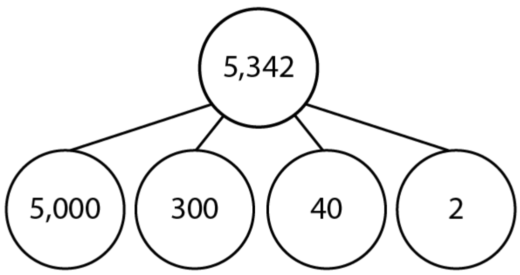
Number line:



Place-value counters:



Part–part–whole model*:



Place-value chart:

1,000s	100s	10s	1s
5	3	4	2

5,342

- *'The "5" represents five thousands.'*
- *'The "3" represents three hundreds.'*
- *'The "4" represents four tens.'*
- *'The "2" represents two ones.'*

*Up until this step and in previous segments, '*part–part–whole*' is used for partitioning into two parts, while '*part–part–part–whole*' is used for partitioning into three parts. As we begin to consider numbers with four or more digits, we will use the generalised term '*part–part–whole*' for partitioning into four or more parts.

3:2

Use the Gattegno chart to provide a different way of showing how four-digit numbers are formed. For example, highlight or put a counter on one number on each row and ask the children what number has been generated. Ask them to write out the addition equation for each number. Repeat until you are confident that the children understand the significance of each digit and the place-value composition of each four-digit number.

Give opportunities now to recognise numbers that have a zero in the hundreds, tens or ones column ('*place-holding zeros*'), as these can sometimes cause confusion. For example, highlight or put counters on numbers in the Gattegno chart to make: 1,024, 1,204, 1,240, 7,077, 7,707, 7,770.

Ensure that children can confidently add whole thousands, hundreds, tens and ones together irrespective of the order in which the addends are shown. Also provide some missing-number problems for practice.

Gattegno chart:

'What number is shown?'

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

2,000 + 100 + 40 + 3 = 2,143

Missing-number problems:

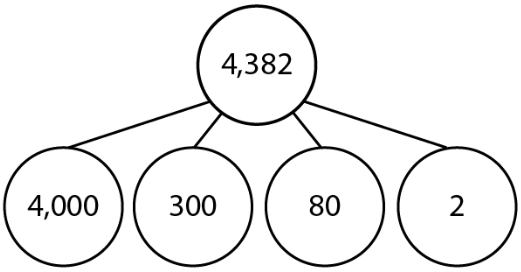
'Fill in the missing numbers.'

90 + 7 + 6,000 + 400 = $\boxed{}$

900 + 70 + 600 + 4 = $\boxed{}$

9 + 7,000 + 60 + 400 = $\boxed{}$

9,000 + 700 + 6 + 40 = $\boxed{}$

	Make sure that the children can move between the Gattegno chart, written numerals (e.g. 6,587) and spoken number names, (e.g. *'six thousand, five hundred and eighty-seven'*).	
3:3	Provide further missing-number problems to move children on to: • decomposing four-digit numbers into their components • identifying a missing component. Include some problems in which the components are not in place-value column order. While you could make Dienes or place-value counters available, children do need to move to working without equipment once a concept has been understood.	Missing-number problems: *'Fill in the missing numbers.'* $3{,}631 = \square + \square + \square + \square$ $4{,}724 = \square + \square + \square + \square$ $6{,}125 = 6{,}000 + \square + 20 + 5$ $8{,}901 = 8{,}000 + \square + \square$ $9{,}427 = 20 + 9{,}000 + 7 + \square$
3:4	Next, move on to calculations that involve adding to or subtracting from one of the parts of the numbers, e.g.: • 4,382 – 4,000 4,382 – 300 4,382 – 80 4,382 – 2 • 5,487 – 2,000 5,487 – 300 5,487 – 40 5,487 – 5 • 3,426 + 5,000 3,426 + 300 3,426 + 60 3,426 + 2 The part–part–whole model provides a visual representation of partitioning that may support these additions and subtractions. You can also use place-value counters to demonstrate the concept; however, children shouldn't need to use these to work out answers once the concept has been understood,	Part–part–whole model: 

	as they can draw on their single-digit addition and subtraction facts.	
3:5	Now that children have an understanding of decomposing four-digit numbers, present them with sets of addition and subtraction questions that require the partitioning or combining of parts of a number.	Addition and subtraction calculations: *'Fill in the missing numbers.'* 5,794 – 5,000 = ☐ 682 + 4,000 = ☐ 5,694 – 4,000 = ☐ 1,682 + 3,000 = ☐ 5,594 – 3,000 = ☐ 2,682 + 2,000 = ☐ 5,794 – 700 = ☐ 4,082 + 400 = ☐ 5,794 – 500 = ☐ 4,282 + 400 = ☐ 5,794 – 300 = ☐ 4,482 + 400 = ☐ 5,794 – 90 = ☐ 4,602 + 50 = ☐ 5,794 – 70 = ☐ 4,612 + 60 = ☐ 5,794 – 50 = ☐ 4,622 + 70 = ☐

		5,794 – 4 = ☐ 4,680 + 2 = ☐
3:6	You can now link this to a ‘redistributing’ calculation strategy, by applying it to addition and subtraction of four-digit numbers with small differences or close to whole thousands. Look at segment *1.19 Securing mental strategies: calculation up to 999* for extensive guidance on strategies such as these.	Redistributing strategy: **5,004 – 4,997 =** $\boxed{7}$ + 3 ↓ ↓ + 3 5,007 – 5,000 = $\boxed{7}$ **6,004 + 2,997 =** $\boxed{9{,}001}$ – 3 ↓ ↓ + 3 6,001 + 3,000 = $\boxed{9{,}001}$ **7,012 – 3,991 =** $\boxed{3{,}021}$ + 9 ↓ ↓ + 9 7,021 – 4,000 = $\boxed{3{,}021}$ **5,012 + 2,991 =** $\boxed{8{,}003}$ – 9 ↓ ↓ + 9 5,003 + 3,000 = $\boxed{8{,}003}$

3:7

Once children can confidently compose four-digit numbers, move them on to comparing and placing four-digit numbers in order by inspecting the value of each digit, starting from the left of the number.

Use balancing equations. Begin with pairs that only have the thousands digit the same, progressing on to numbers that also have the same hundreds digit, and so on. Tell children:

- *'Look at the thousands digit. If they are the same, look at the hundreds digit.'*
- *'If the hundreds are the same, look at the tens digit.'*
- *'What if the tens are the same?'*

Include some pairs where at least one of the numbers is broken down into its components, not listed in place-value order.

Then give children sets of numbers to compare and order. Using the same digits but arranged differently in each number, as shown opposite, will require children to think carefully about place value and can help to pick out the importance about which digits are most significant. Talk children through this, for example using the set of numbers opposite:

- *'Notice that the same digits are used but in different places.'*
- *'Start by comparing the thousands – they are all the same, so look at the hundreds. There are two numbers with zero in the hundreds: 5,076 and 5,007.'*
- *'Look at the tens. 5,007 has zero tens, so it is the smallest, then 5,076.'*
- *'5,607 has six in the hundreds, so it is the middle number.'*
- *'5,760 and 5,706 both have seven in the hundreds, so look at the tens: six and zero respectively so the order is 5,706 then 5,760.'*

Balancing equations:

'Use symbols (< > =) to complete the equations.'

2,048 ◯ 2,408   3,456 ◯ 3,465

2,048 ◯ 2,084   3,456 ◯ 3,465

4,532 ◯ 4,000 + 50 + 300 + 2

8,192 ◯ 90 + 100 + 2 + 8,000

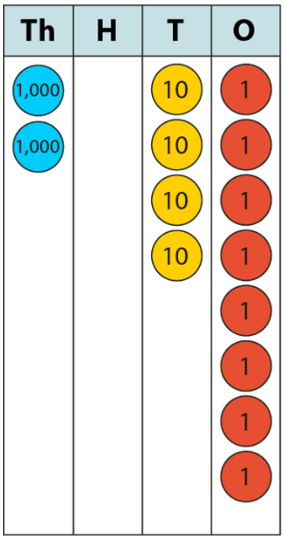
Ordering numbers:

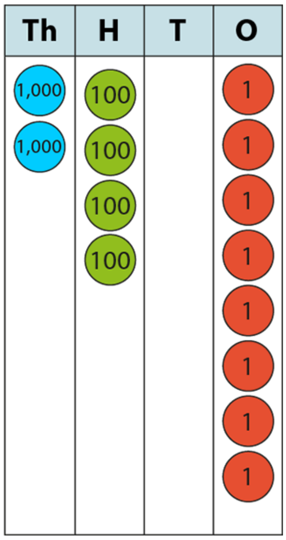
'Put these numbers in order from smallest to largest:'

5,607   5,076   5,760   5,007   5,706

Place-value charts:

'Compare 2,048 and 2,408.'





	It may be necessary to demonstrate using place-value charts and counters, but children shouldn't need to use these once the concept has been understood.	
3:8	To end this teaching point, children should use what they have learnt to apply their understanding to look for patterns in sets of calculations, formed using variation, that bring out the structure.	

'What do you notice about the calculations below?

Can you find easy ways to calculate?'

5,000 + 4,000 = ☐	5,230 + 400 = ☐	5,024 + 28 = ☐
4,000 + 5,000 = ☐	4,230 + 500 = ☐	4,024 + 28 = ☐
3,000 + 6,000 = ☐	3,230 + 600 = ☐	3,024 + 28 = ☐
2,000 + 7,000 = ☐	2,230 + 700 = ☐	2,024 + 28 = ☐
1,000 + 8,000 = ☐	1,230 + 800 = ☐	1,024 + 48 = ☐

Dòng nǎo jīn:

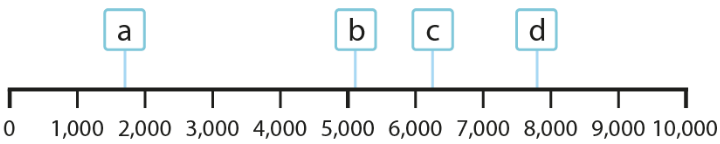
'Find the missing numbers. What do you notice?'

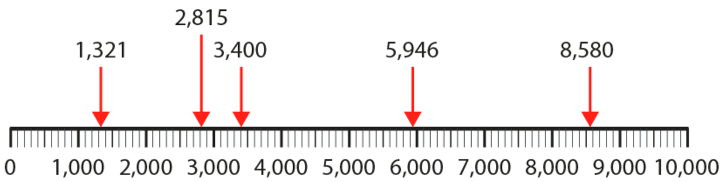
Make 9,999	**Make 9,998**	**Make 9,990**
5,000 + ☐ = 9,999	5,230 + ☐ = 9,998	5,023 + ☐ = 9,990
4,000 + ☐ = 9,999	4,230 + ☐ = 9,998	4,023 + ☐ = 9,990
3,000 + ☐ = 9,999	3,230 + ☐ = 9,998	3,023 + ☐ = 9,990
2,000 + ☐ = 9,999	2,230 + ☐ = 9,998	2,023 + ☐ = 9,990
1,000 + ☐ = 9,999	1,230 + ☐ = 9,998	1,023 + ☐ = 9,990

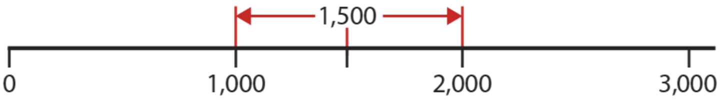
Teaching point 4:

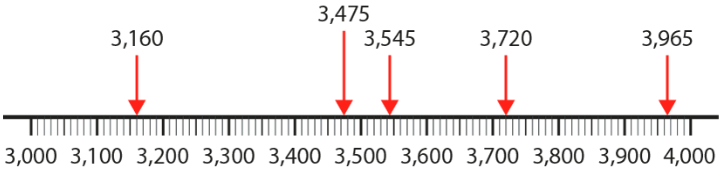
Numbers can be rounded to simplify calculations or to indicate approximates sizes.

Steps in learning

	Guidance	Representations
4:1	In previous segments on two-digit and three-digit numbers, children spent time learning how to identify the previous and next ten to a number, and (for three-digit numbers) the previous and next 100. Being able to do this supports work on rounding, which is covered here explicitly for the first time. Start by supporting children to understand the point of rounding. Show them a selection of headlines or facts with rounded or approximated four-digit numbers (for example, *'The Tour de France covers approximately 3,500 km.'*). Discuss these, asking: • *'What exactly does each number mean?'* • *'Why has each been rounded?'*	
4:2	Once children understand the need for rounding as an estimate or approximation, it is time to look at how numbers are rounded. Display a number line from 0 to 10,000, with only steps of 1,000 marked. Draw arrows or boxes (labelled *a*, *b*, *c* and *d*) to some points on the line that lie between tick marks. For each point, determine with children the next and previous multiples of 1,000. Note the use of the *greater than* and *less than* signs in the inequality.	Number line: *'Write the multiples of 1,000 that come immediately before and after each of the numbers* a, b, c *and* d.*'*  Inequality: **previous** multiple of 1,000 **next** multiple of 1,000 $\boxed{1,000} < a < \boxed{2,000}$

4:3	Taking the first point, *a*, from the previous step, ask children to circle which multiple of 1,000 it is nearest to. At this stage, children should simply make a visual judgement based on the position of the point on the number line. Use the following stem sentences to reinforce understanding: • ***'a is between ___ and ___.'*** • ***'The previous multiple of one thousand is ___. The next multiple of one thousand is ___.'*** • ***'a is nearest to ___ thousand.'*** • ***'a is ___ when rounded to the nearest thousand.'*** Repeat the process for numbers *b, c* and *d,* using the stem sentences	Rounding to the nearest multiple of 1,000: **previous** multiple of 1,000 — **next** multiple of 1,000 1,000 < a < 2,000 • *'a is between one thousand and two thousand.'* • *'The previous multiple of one thousand is one thousand. The next multiple of one thousand is two thousand.'* • *'a is nearest to two thousand.'* • *'a is two thousand when rounded to the nearest thousand.'*
4:4	Once children are secure in identifying the multiples of 1,000 either side of a number, move to using arrows with marked numbers. Again, show where these appear on the number line as a useful scaffold in identifying the previous and next multiples of 1,000. Use the stem sentences again, encouraging children to repeat them for each of the numbers.	Rounding to the nearest multiple of 1,000: *'Look at the numbers the arrows point to. Write the mutiples of one thousand that come immediately before and after each number. Circle the multiple of one thousand each number is closest to.'*  **previous** multiple of 1,000 — **next** multiple of 1,000 1,000 < 1,321 < 2,000 • *'One thousand three hundred and twenty-one is between one thousand and two thousand.'* • *'The previous multiple of one thousand is one thousand. The next multiple of one thousand is two thousand.'* • *'One thousand three hundred and twenty-one is nearest to one thousand.'*

		• *'One thousand three hundred and twenty-one is one thousand when rounded to the nearest thousand.'*
4:5	Return to the first number from the previous step, (1,321) and look again at the inequality. Ask the children whether they would be able to identify whether 1,321 is nearer to 1,000 or 2,000 without the number line. Draw attention to the fact that you could, in fact, work out the previous and next multiples of 1,000 without using the number line. Spend some time discussing this with the class for each of the remaining numbers from step *4:4*. Now look at some specific numbers between 1,000 and 2,000, drawing out that when rounding to the nearest thousand, it is the hundreds digit that is critical in helping us decide whether to round up or down. For example, to round 1,321 to the nearest thousand, we looked at the digit '3'. Explain that all numbers less than 1,500 will round to 1,000 and all numbers greater than 1,500 will round to 2,000. Use the generalised statement: ***'When rounding to the nearest thousand, if the hundreds digit is four or less we round down. If the hundreds digit is five or more we round up.'***	Inequality: **previous** multiple of 1,000 $\boxed{}$ < 1,321 < $\boxed{}$ **next** multiple of 1,000 Rounding to the nearest multiple of 1,000:  *'Round each number to the nearest thousand.'* 1,670 1,439 1,815 1,079 1,501
4:6	Discuss the special case of 1,500. As this is the midpoint of 1,000 and 2,000, it is the same distance from both the previous and the next multiple of 1,000. In this case, we still apply the generalised statement. That is, as the hundreds digit is '5', we round it up and say that 1,500 rounded to the nearest thousand is 2,000.	**previous** multiple of 1,000 $\boxed{1,000}$ < 1,500 < $\boxed{2,000}$ **next** multiple of 1,000

4:7	Now look at how we can also round to other degrees of accuracy, starting with rounding to the nearest hundred. Show children a section of the 0–10,000 number line, for example 3,000–4,000 as shown opposite. As before, pick out some numbers with labelled arrows. Follow the same progression as before, firstly identifying the previous and next multiples of 100, before circling the one that each number is closer to with the support of the number line. This can be more challenging for children and reference to the number line is important at first to show that, in the case of 3,160 (shown opposite), the previous and next multiples of 100 are 3,100 and 3,200 (rather than 100 and 200, which is a relatively common error here). Focusing on the fact that there are 31 hundreds in 3,160 can support children with this. Adapt the stem sentences from the previous steps.	Rounding to the nearest multiple of 100: *'Look at the numbers the arrows point to. Write the mutiples of one hundred that come immediately before and after each number. Circle the multiple of one hundred each number is closest to.'*  **previous** multiple of 100 **next** multiple of 100 3,100 < 3,160 < 3,200 • *'Three thousand one hundred and sixty is between three thousand one hundred and three thousand two hundred.'* • *'The previous multiple of one hundred is three thousand one hundred. The next multiple of one hundred is three thousand two hundred.'* • *'Three thousand one hundred and sixty is nearest to three thousand two hundred.'* • *'Three thousand one hundred and sixty is three thousand two hundred when rounded to the nearest hundred.'*
4:8	Now look at another set of four-digit numbers up to 9,999, this time without the scaffold of a number line. Give children practice writing out the previous and next multiples of 100.	**previous** multiple of 100 **next** multiple of 100 4,500 < 4,527 < 4,600
4:9	Discuss examples such as rounding 5,976 to the nearest 100, where the nearest multiple of 100 is also a multiple of 1,000. Children should, by now, understand that 6,000 is a multiple of 100 (and 10 and 1) as well as being a multiple of 1,000.	**previous** multiple of 100 **next** multiple of 100 5,900 < 5,976 < 6,000

<table>
<tr>
<td>4:10</td>
<td>Finally, repeat the above sequence, now looking at rounding to the nearest ten.</td>
<td></td>
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<tr>
<td>4:11</td>
<td>Summarise by taking a number in context and exploring how it rounds to the nearest 10, 100 and 1,000. For example:

'5,725 people go to watch a football match. Round that number to the nearest:
10 100 1,000.'

Here it is useful to recap and identify the most important digit to consider each time; namely, the digit to the right of the place value the number needs to be rounded to. Use the generalised statements:

• 'When rounding to the nearest ten, the ones digit is the digit to consider. If it is four or less we round down. If it is five or more we round up.'
• 'When rounding to the nearest hundred, the tens digit is the digit to consider. If it is four or less we round down. If it is five or more we round up.'
• 'When rounding to the nearest thousand, the hundreds digit is the digit to consider. If it is four or less we round down. If it is five or more we round up.'

Children may find it helpful to organise the results in a place-value chart.</td>
<td>Place-value chart:
<table>
<tr><th>1,000s</th><th>100s</th><th>10s</th><th>1s</th><th></th></tr>
<tr><td>5</td><td>7</td><td>2</td><td>5</td><td></td></tr>
<tr><td>5</td><td>7</td><td>3</td><td>0</td><td>nearest 10</td></tr>
<tr><td>5</td><td>7</td><td>0</td><td>0</td><td>nearest 100</td></tr>
<tr><td>6</td><td>0</td><td>0</td><td>0</td><td>nearest 1,000</td></tr>
</table>
5,725</td>
</tr>
</table>

4:12

Repeat this for other numbers in context. This time, draw attention to numbers that may give the same answer when rounded to different degrees of accuracy. For example:

'A charity concert raises £8,972. Round this to the nearest:
£10 £100 £1,000.'

In this case, the nearest £100 is the same as the nearest £1,000.

Place-value chart:

1,000s	100s	10s	1s	
8	9	7	2	
8	9	7	0	nearest 10
9	0	0	0	nearest 100
9	0	0	0	nearest 1,000

8,972

4:13

Finally, provide varied practice for rounding in a range of contexts, including money and measures, such as those shown opposite and below. For each question, ask children to identify the important digit to consider.

- *'A baker needs 3,095 g of flour. How much does he need to the nearest kilogram?'*
- *'Darius made £93.75 at a car boot sale. How much is this to the nearest pound?'*
- *'Amy lives 4,320 m from school. How far is this to the nearest kilometre?'*

Dòng nǎo jīn:

- *'When I round my number to the nearest 100 the answer is 2,300. When I round my number to the nearest 10, I get the same answer. What could my number be? Find all possible answers.'*

Dòng nǎo jīn:

0	1	2	3	4	5	6	7

'Use the digit cards to create two numbers. ***You may use each digit card only once.***

The first number rounds to one thousand three hundred when rounded to the nearest hundred.'

☐ ☐ ☐ ☐ → 1,300

'The second number rounds to three thousand when rounded to the nearest hundred.'

☐ ☐ ☐ ☐ → 3,000

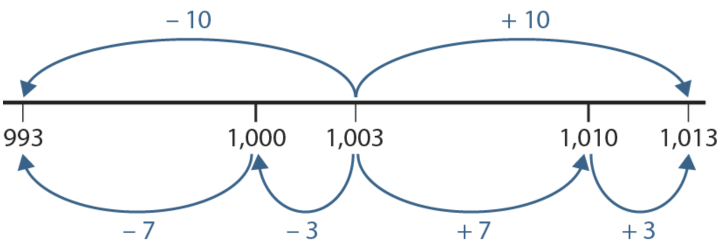
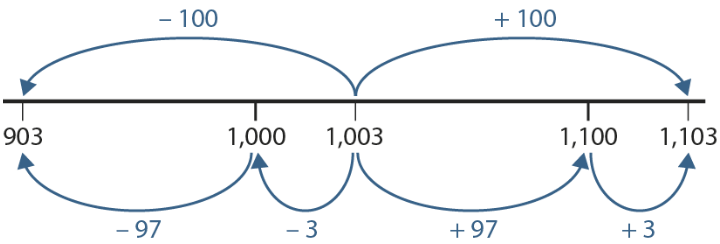
Teaching point 5:

Calculation approaches learnt for three-digit numbers can be applied to four-digit numbers.

Steps in learning

	Guidance	Representations
5:1	Begin this teaching point by recapping the column addition algorithm for adding two or more three-digit numbers from segment *1.20 Algorithms: column addition*. Show children that this can be applied to addition of four-digit numbers in the same way. Children should pay attention to placing digits in the correct columns, so make sure they start by adding digits in the furthest right column. You may wish to use concrete apparatus such as Dienes, as in segment *1.20*, to demonstrate the column addition initially. However, children are already confident with this method so should be able to extend it to four-digit numbers relatively easily. Include some additions where: • there are more than two addends • there are different numbers of digits in the addends (for example, three-digit number + four-digit number).	Column additions: $\begin{array}{rcccc} & 6, & 5 & 8 & 4 \\ + & 2, & 7 & 3 & 9 \\ \hline & 9, & 3 & 2 & 3 \\ \hline & {\scriptstyle 1} & {\scriptstyle 1} & {\scriptstyle 1} & \end{array}$ $\begin{array}{rcccc} & 2, & 3 & 7 & 3 \\ & 6, & 0 & 5 & 8 \\ + & 1, & 5 & 4 & 1 \\ \hline & 9, & 9 & 7 & 2 \\ \hline & & {\scriptstyle 1} & {\scriptstyle 1} & \end{array}$ $\begin{array}{rcccc} & 3, & 3 & 6 & 2 \\ + & & 6 & 4 & 9 \\ \hline & 4, & 0 & 1 & 1 \\ \hline & {\scriptstyle 1} & {\scriptstyle 1} & {\scriptstyle 1} & \end{array}$
5:2	Next, recap the column subtraction algorithm for subtracting two three-digit numbers from segment *1.21 Algorithms: column subtraction*. Show children that this can be applied to subtracting four-digit numbers in the same way. Again, children should pay attention to placing digits in the correct columns, so ensure they start by subtracting digits in the rightmost column. Encourage children to make their calculations clear to follow, particularly where exchanging (for example, exchanging one ten for ten ones) is necessary.	Column subtractions: $\begin{array}{rcccc} & \cancel{6}^{5}, & \cancel{5}^{14} & \cancel{3}^{12} & {}^{1}8 \\ - & 2, & 7 & 8 & 9 \\ \hline & 3, & 7 & 4 & 9 \\ \hline \end{array}$ $\begin{array}{rcccc} & \cancel{3}^{2}, & \cancel{7}^{16} & \cancel{3}^{12} & {}^{1}2 \\ - & & 8 & 3 & 7 \\ \hline & 2, & 8 & 9 & 5 \\ \hline \end{array}$

	Place-value counters may be used initially, but as with the previous step, children should be able to move to working without them relatively quickly. Include some subtractions where there are different numbers of digits in the minuend and subtrahend (for example, four-digit number – three-digit number).	
5:3	Move on to consider when it is appropriate to use a column method for four-digit numbers. This may be a difficult point for children as, once proficient, some children will use no other strategy. Present the set of calculations shown opposite and discuss for which of these calculations it might be appropriate to use a column method and which are easier to solve with a mental strategy (including jottings where necessary, see segment *1.19 Securing mental strategies: calculation up to 999*).	Calculations to discuss: 2,000 – 1,998 5,000 – 3,990 5,184 – 1,329 9,037 – 5,794
5:4	Next, consider how changing to an equivalent calculation using same difference can make the calculation easier. For example, subtracting from whole thousands commonly causes difficulties (e.g. *7,000 – 2,648*). To start with, exchanging would be needed from the thousands column to eventually be able to do ten ones subtract eight ones. Instead, teach children to adjust the calculation in a similar vein to the 'redistributing' strategy they used for additions in segment *1.19 Securing mental strategies: calculation up to 999.* Begin by discussing simple cases with two-digit and single-digit numbers: *'Compare the differences of ten minus eight and nine minus seven. They are the*	Same difference: $\begin{array}{rcr} 7,0\ 0\ 0 & \xrightarrow{-1} & 6,9\ 9\ 9 \\ -\ 2,6\ 4\ 8 & \xrightarrow[-1]{} & -\ 2,6\ 4\ 7 \\ \hline \\ \hline \end{array}$

	same. We have just subtracted one from the minuend and one from the subtrahend. The difference stays the same.' Then move on to applying this to subtractions involving four-digit numbers: *'So, if we subtract one from the minuend and one from the subtrahend in the calculation seven thousand minus two thousand six hundred and forty-eight, we will keep the same difference.'* Discuss how *6,999 – 2647* is an 'easier' calculation to work out, as we don't need to do any exchanging. If children need more convincing that the two subtractions are equivalent, refer back to the redistribution calculations in step *3:6* above.	
5:5	Discuss with the children how some other calculations are best done mentally or with a number line (e.g. *1,003 – 10*). Some children mistakenly give the answer as 997, thinking of *10 – 3 = 7* when, instead, they need to think of *1,003 – 3 – 7*. This calculation can also be thought of as *'one hundred tens and three ones subtract one ten, which is equal to ninety-nine tens and three ones.'* Similarly, a calculation such as *1,003 – 100* can be thought of as *'ten hundreds and three ones subtract one hundred, which is equal to nine hundreds and three ones.'*	Number lines:  
5:6	To complete this teaching point, children need to be able to use inverses to solve problems involving missing digits in the augend and addend. Children should have been exposed to problems like this in segment *1.20 Algorithms: column addition* with three-digit numbers so, at this stage, you just need to extend this to addition calculations with four-digit numbers.	Addition and subtraction calculations with missing digits: • Addition with no regrouping $\begin{array}{r} 3,\square 4 \square \\ +\ \square, 5 \square 7 \\ \hline 7,879 \\ \hline \end{array}$

Start with examples that require no regrouping (i.e. no column totals greater than nine). Then move on to examples where regrouping occurs once, considering cases where the addition in the tens column has bridged the hundreds column. Children should be encouraged to write the carried digit in the calculation, rather than keeping it in their head. Next, move on to examples where regrouping occurs more than once, including cases where the hundreds column totals greater than nine (carrying a digit to the thousands column).

Likewise, give children practice of subtraction calculations with missing digits in the minuend and subtrahend. Start with an example involving no exchanging, then exchanging only once and finally exchanging three times.

- Addition with regrouping once

$$\begin{array}{rcccc} & 3, & \square & 4 & \square \\ + & \square, & 5 & \square & 5 \\ \hline & 5, & 7 & 2 & 9 \\ \hline \end{array}$$

- Addition with regrouping more than once

$$\begin{array}{rcccc} & 3, & \square & 4 & \square \\ + & \square, & 5 & \square & 7 \\ \hline & 8, & 2 & 3 & 9 \\ \hline \end{array}$$

- Subtraction with no exchanging

$$\begin{array}{rcccc} & 7, & \square & 8 & \square \\ - & \square, & 2 & \square & 4 \\ \hline & 4, & 4 & 7 & 5 \\ \hline \end{array}$$

- Subtraction with exchanging once

$$\begin{array}{rcccc} & \square, & 7 & \square & 8 \\ - & 1, & \square & 5 & \square \\ \hline & 3, & 0 & 7 & 5 \\ \hline \end{array}$$

- Subtraction with exchanging three times

$$\begin{array}{rcccc} & \square, & 3 & \square & 4 \\ - & 2, & \square & 8 & \square \\ \hline & 3, & 7 & 8 & 5 \\ \hline \end{array}$$

Teaching point 6:

1,000 can also be composed multiplicatively from 500s, 250s or 200s, units that are commonly used in graphing and measures.

Steps in learning

6:1

Guidance

This final teaching point looks at other multiplicative compositions for 1,000 (500, 250 and 200) since these are the other common 'divisions' that children will encounter in graphing and measures. Having already learnt that 100 can be composed multiplicatively from 50, 25 or 20 in segment *1.17 Composition and calculation: 100 and bridging 100*, children may find some of this work familiar.

Begin by exploring how 1,000 splits up into two equal parts of 500, representing this with a bar model.

Go on to explain that if there are two spaces between the 1,000s marked on a scale, then each division is 500. This is because *1000 ÷ 2 = 500*. Bring in a measures context with a simple scale from 0 to 2,000 g as shown opposite. Ensure children can accurately read the scale by asking questions such as:

- *'What measurement is the arrow pointing to?'*
- *'If one kilogram is added, what will the scale show?'*
- *'What needs to be added to make two kilograms?'*

Encourage children to check this by counting in multiples of 500, first up to 1,000 and then beyond (within 10,000). Scaffold this counting with missing-number sequences.

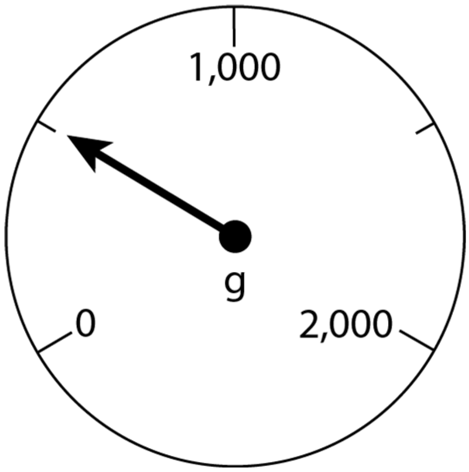
To help children become more familiar with the word 'multiple', ensure that you use it explicitly throughout this teaching point, for example:

Representations

Bar model:

1,000	
500	500

Measures context:



Missing-number sequence:

'Fill in the missing numbers.'

0	500	1,000		2,000	
3,000		4,000	4,500	5000	

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- *'We are counting in multiples of five hundred.'*

not

- *'We are counting in five hundreds.'*

You can also present children with a graph using a scale of two squares for every thousand, as shown opposite. Only the thousands should be labelled. Initially, children might need to write the 500s on the scale, so it is important to ensure that they write numbers *on the grid lines*, not in the spaces. Ask:

- *'What does the red bar represent?'*
- *'What is the difference between the red bar and the blue bar?'*
- *'What is the sum of the red and blue bars?'*

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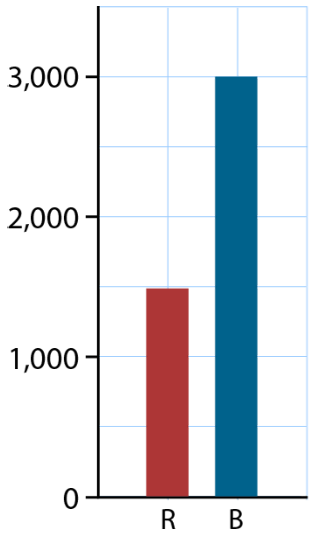
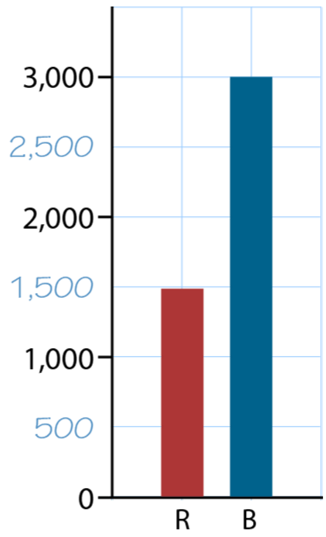
Graphing context:





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<td>**6:2**</td>
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Extend the work on scales from the previous step by linking with the learning from *Teaching point 1*. Recall that 1,000 splits up into ten equal parts of 100.

Children should therefore already be able to deduce that if there are ten spaces between the 1,000s marked on a scale then each division is 100, because *1,000 ÷ 10 = 100*.

You can check this as a class by counting in multiples of 100 up to 1,000, tapping out the gridlines on the scale as you go.

Once again, children need to be able to read scales and charts to answer questions such as (for the bar chart shown opposite):

- *'What do the red and blue bars represent?'*
- *'What is the difference between the red bar and the blue bar?'*
- *'What is the sum of the red and blue bars?'*

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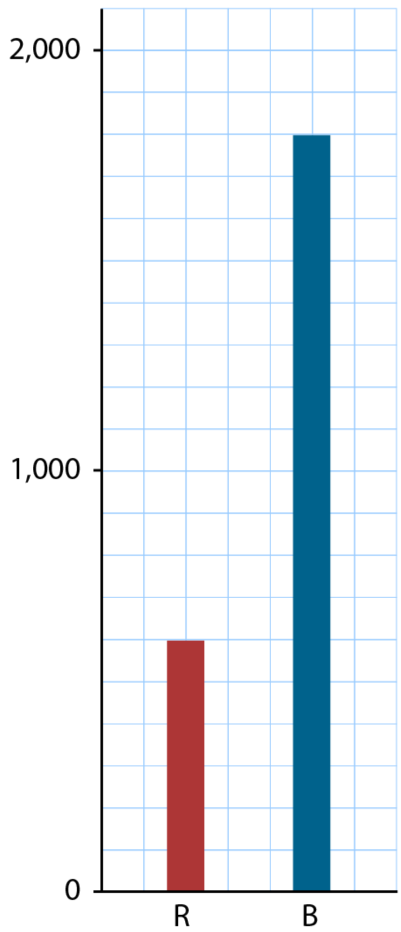
Graphing context:



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6:3

Next, explore how 1,000 splits up into four equal parts of 250 using the representation of a bar model.

Apply this to measures and graphs, such as those shown opposite. Children should see that if there are four spaces between the 1,000s marked on a scale, then each division is 250, because *1,000 ÷ 4 = 250*. Check this as a class by counting in multiples of 250, tapping on the divisions or gridlines as you go.

Initially, children might write more numbers on the scales, either by labelling the mid-points of the 1,000s or labelling every multiple of 250.

Use missing-number sequences if an additional scaffold is needed for counting in multiples of 250.

You can pose the same types of questions as in step *6:1*:

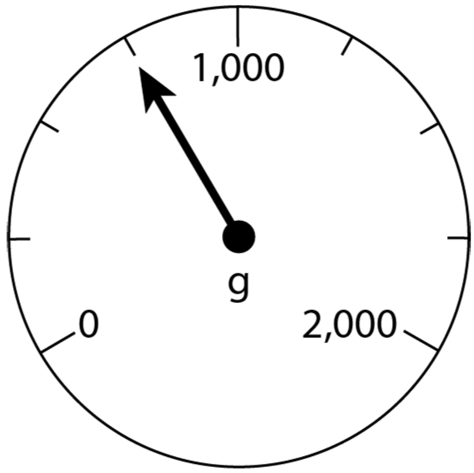
- *'What measurement is the arrow pointing to?'*
- *'If one kilogram is added, what will the scale show?'*
- *'Draw the arrow to show half a kilogram more or half a kilogram less.'*
- *'What needs to be added to make two kilograms?'*
- *'What do the red and blue bars represent?'*
- *'What is the difference between the red bar and the blue bar?'*
- *'What is the sum of the red and blue bars?'*

For further practice, addition and subtraction questions (difference – how much more or less?) can be posed using other forms of statistical chart.

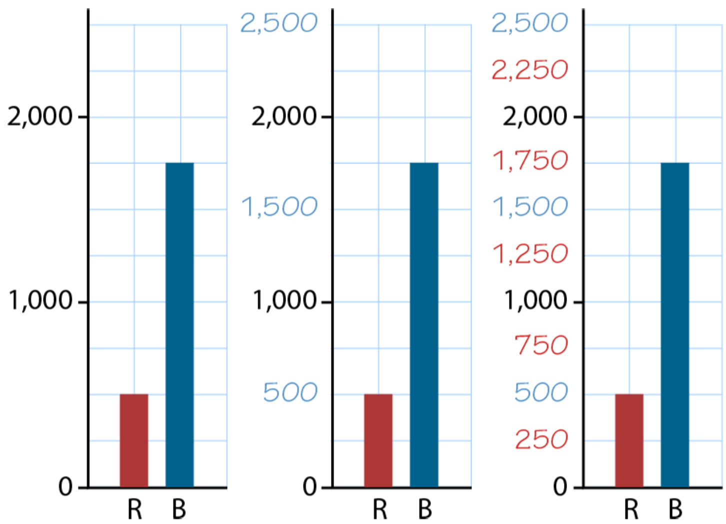
Bar model:

1,000			
250	250	250	250

Measures context:



Graphing context:



Missing-number sequence:

'Fill in the missing numbers.'

0	250		750	1,000	

1,500		2,000			2,750

6:4

Next, follow the same process as in the previous steps to explore how 1,000 splits up into five equal parts of 200. As before, represent this using a bar model.

By this step, children should quickly make the connection that if there are five spaces between the 1,000s marked on a scale, then each division is 200, because *1000 ÷ 5 = 200*. Check by counting in multiples of 200, tapping on the divisions as you go.

Children might want to write more numbers on the scale, but it could start to look cramped (as shown on the middle bar chart opposite). If they need to do this, encourage them to just put the figures in between 0 and 1,000 (as shown on the rightmost bar chart opposite).

Use missing-number sequences if more support is needed for counting in multiples of 200.

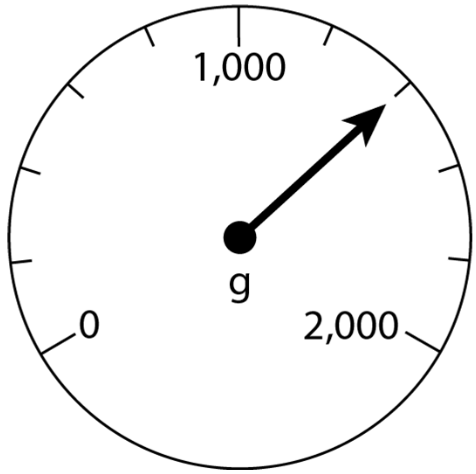
You can ask the same types of questions as in previous steps:

- *'What measurement is the arrow pointing to?'*
- *'If one kilogram is added, what will the scale show?'*
- *'Draw the arrow to show half a kilogram more or half a kilogram less.'*
- *'What needs to be added to make two kilograms?'*
- *'What do the red and blue bars represent?'*
- *'What is the difference between the red bar and the blue bar?'*
- *'What is the sum of the red and blue bars?'*

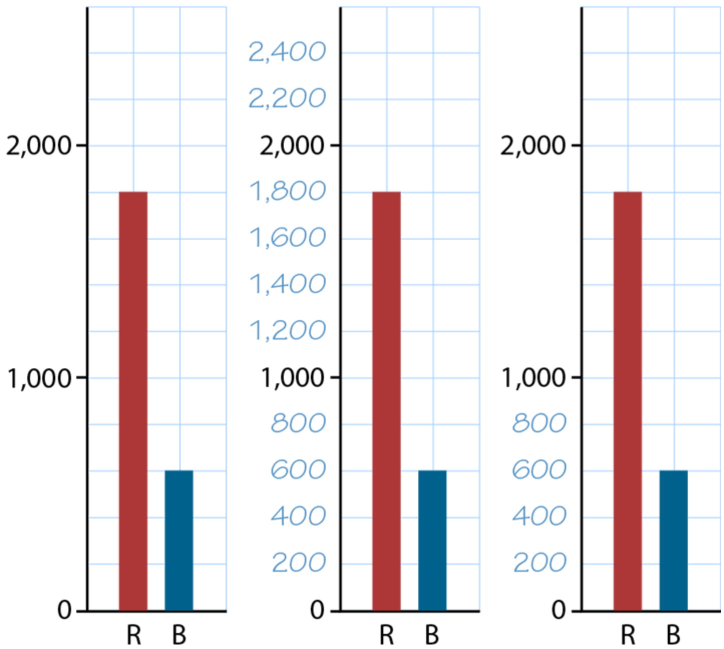
Bar model:

1,000				
200	200	200	200	200

Measures context:



Graphing context:



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<td>
Missing-number sequence:
'Fill in the missing numbers.'
<table>
<tr><td>1,000</td><td>1,200</td><td></td><td>1,600</td><td></td><td>2,000</td></tr>
</table>
<table>
<tr><td></td><td>2,400</td><td></td><td></td><td>3,000</td><td>3,200</td></tr>
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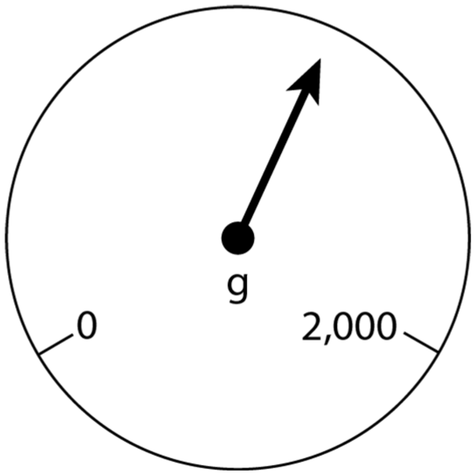
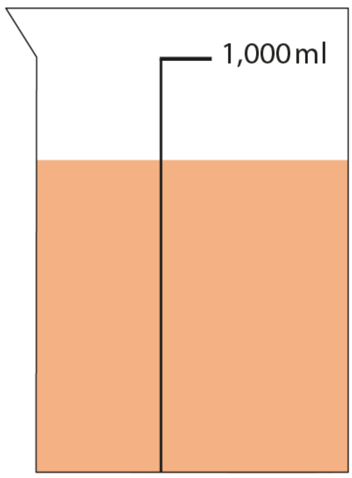
<tr>
<td>6:5</td>
<td>Finally, once children have an understanding of how to read scales by working out the meaning of each division, present them with varied practice using blank scales, such as the problems shown opposite, for which they must use reasoning.</td>
<td>
Measures contexts:

'Estimate the measurement the arrow is pointing to.'
'What needs to be added to make 2 kg?'



'Estimate how much liquid is in the measuring cylinder.'
'Estimate how much needs to be added to make 1 l.'



'Where would you place 600 g on this scale?'

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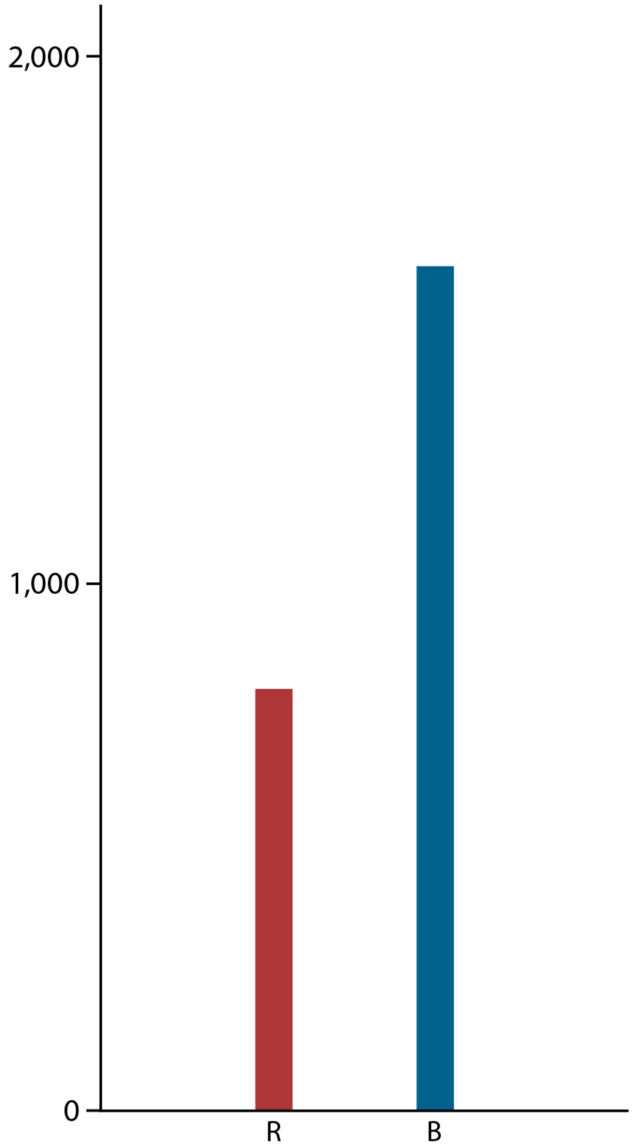
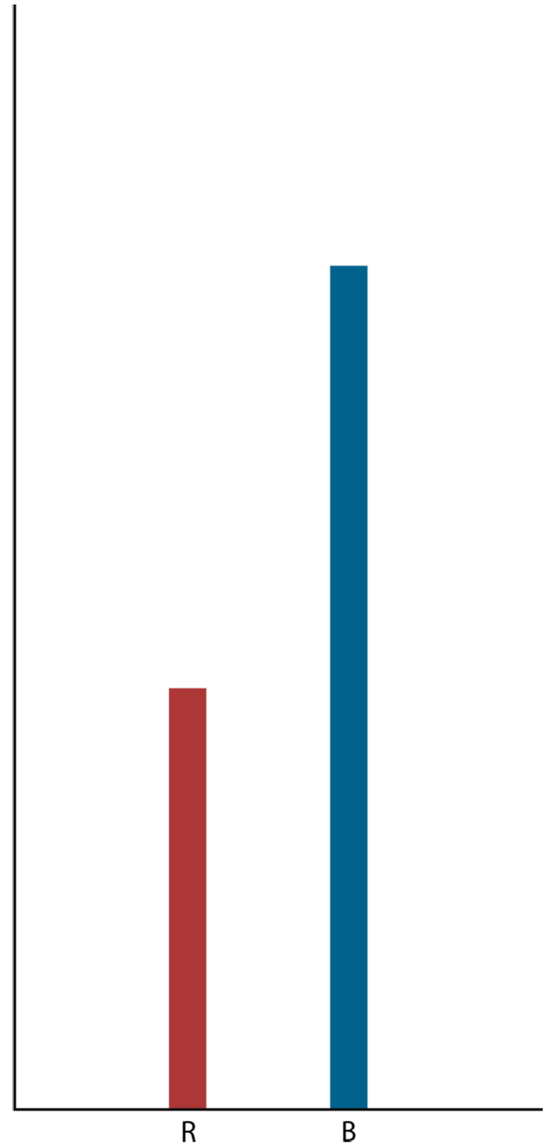
		Graphing context: • *'Estimate what the red and blue bars represent.'* • *'Estimate their difference.'* • *'Estimate their sum.'* 

Dòng nǎo jīn:

- *'The red bar has a value of 3,200. The blue bar has a value of 6,100. Draw bars with values of approximately:*

  2,000 4,900 3,199'



- *'The representation below shows two values on a number line. Estimate the values of* a, b *and* c.*'*