MathsHUBS Resources

National Centre for Excellence in the Teaching of Mathematics

Mastery Professional Development

Number, Addition and Subtraction

1.17 Composition and calculation: 100 and bridging 100

Teacher guide | Year 3

Teaching point 1:

There are ten tens in 100; there are 100 ones in 100. 100 can also be composed multiplicatively from 50, 25 or 20, units that are commonly used in graphing and measures.

Teaching point 2:

Known addition facts can be used to calculate complements to 100.

Teaching point 3:

Known strategies for addition and subtraction across the tens boundary can be combined with unitising to count and calculate across the hundreds boundary in multiples of ten.

Teaching point 4:

Knowledge of two-digit numbers can be extended to count and calculate across the hundreds boundary from/to any two-digit number in ones or tens.

Overview of learning

In this segment children will:

- gain a deeper understanding of the number 100 by exploring additive and multiplicative composition
- make links to common measures, such as pounds (money) and metres, and to data contexts
- extend their understanding of place value to three-digit numbers, initially working with a restricted set of numbers (up to 199)
- draw on known strategies and number facts to calculate across the hundreds boundary.

In Year 3, children begin to work with numbers up to 999. This segment acts as a precursor to more general work on three-digit numbers by focusing on the number 100 and crossing the boundary between two- and three-digit numbers. Throughout the segment, numbers are limited to below 200; children focus on understanding the numbers 100–199 as 'one-hundred-and-a-bit' numbers (just as they were first introduced to teens numbers as 'ten-and-a-bit' numbers).

The segment starts by securing children's understanding of the unit 100. Although, in Year 2, children worked with numbers up to 100, they can now be given the opportunity to explore, in detail, both the additive and multiplicative composition of 100. Children need to be able to confidently partition 100 in many different ways to gain a full understanding of this important number. This will also prepare them for further work in Key Stage 2, when they extend their understanding of place value to other powers of ten (e.g. 1000 or 0.1); for example, the partitioning of a power of ten into two equal parts (here 50), four equal parts (here 25), five equal parts (here 20) and ten equal parts (here 10), will later be applied to the other powers of ten. 50, 25, 20 and 10 are not the only factors of 100, but they are critical ones that will be drawn on repeatedly in the context of graphing, measures, fractions and decimals. The counting sequence 25, 50, 75, 100 does not build on known counting sequences (i.e. counting in twos, fives and tens), and as such merits particular focus.

Teaching point 2 offers the opportunity to explore further the additive composition of 100 and, in particular, two-digit complements to 100. A common mistake is for children to find complements to 110 (e.g. 63 and 47) instead of 100 (e.g. 63 and 37); this point is addressed head on, so teachers can ensure that children avoid 'creating' an extra ten. Again, this idea underpins work throughout Key Stage 2, including:

- extending to larger powers of ten (e.g. $380 + 620 = 1000$ or $387 + 613 = 1000$)
- finding decimal complements (e.g. $0.38 + 0.62 = 1$)
- finding change (for example, from £10 for an item costing £3.80).

Once children have a secure understanding of the unit 100 and its composition, the segment moves on to teaching strategies for bridging the boundary between two- and three-digit numbers (both addition and subtraction across the hundreds boundary). This is another area that requires particular attention if children are to avoid common mistakes. Time is spent building children's confidence counting across the hundreds boundary (in ones or tens), before moving to related calculations, e.g.:

- $80 + 50$, $130 - 50$ and $130 - 80$
- $98 + 7$ and $105 - 7$
- $98 + 30$ and $128 - 30$

To avoid overload at this stage, calculations of the form $105 - 98$ and $128 - 98$ will be covered in segment *1.19 Securing mental strategies: calculation up to 999*.

Necessarily, this segment includes teaching on place value to the extent that children have a meaningful understanding of how the numbers 100–199 are represented. A further study of place value, in the context of three-digit numbers, and related additive calculations for numbers beyond 199 (e.g. $374 = 300 + 70 + 4$) can be found in segment *1.18 Composition and calculation: three-digit numbers*.

At first glance, this segment appears to cover a significant amount of content; however, the teaching points build strongly on prior learning and strategies, and children should be expected to progress through the steps quite quickly.

An explanation of the structure of these materials, with guidance on how teachers can use them, is contained in this NCETM podcast: www.ncetm.org.uk/primarympdpodcast. The main message in the podcast is that the materials are principally for professional development purposes. They demonstrate how understanding of concepts can be built through small coherent steps and the application of mathematical representations. Unlike a textbook scheme they are not designed to be directly lifted and used as teaching materials. The materials can support teachers to develop their subject and pedagogical knowledge and so help to improve mathematics teaching in combination with other high-quality resources, such as textbooks.

Teaching point 1:

There are ten tens in 100; there are 100 ones in 100. 100 can also be composed multiplicatively from 50, 25 or 20, units that are commonly used in graphing and measures.

Steps in learning

	Guidance	Representations

1:1

Guidance

In segment *1.8 Composition of numbers: multiples of 10 up to 100*, children briefly learnt that the number we call 'one hundred' is made up of ten tens and written in numerals as '100'. In this segment, we focus more deeply on the unit 'one hundred' and its composition.

Children will already have a sense of the value of 100, so begin by considering, in more detail, how 100 is written as numerals. Recap that ten is written as '10'; show the digits on a place-value chart and ask children to describe what each digit represents (as shown opposite). Then, in the same way, explore how 'one hundred' is written as '100'. Avoid statements such as

- *'one hundred has no tens/ones',*

since 100 is composed of ten tens or 100 ones; a more accurate statement would be

- *'one hundred has no tens/ones in addition to the hundred.'*

Representations

Representing ten as numerals:

10s	1s
1	0

10

- *'The 1 represents one ten.'*
- *'The 0 represents zero/no additional ones.'*

Representing one hundred as numerals:

100s	10s	1s
1	0	0

100

- *'The 1 represents one hundred.'*
- *'The first 0 represents zero/no additional tens.'*
- *'The second 0 represents zero/no additional ones.'*

1:2

Guidance

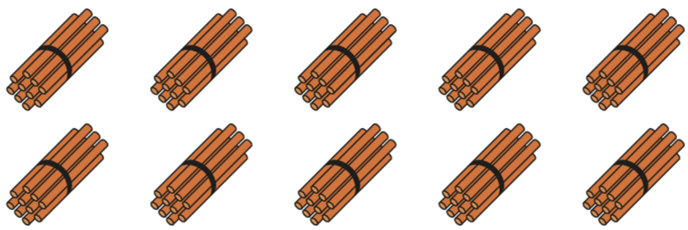
Now review counting in tens from zero to 100, using dual counting to emphasize that there are ten tens in 100:

- *'No tens, one ten, two tens… nine tens, ten tens.'*
- *'Zero, ten, twenty… ninety, one hundred.'*

Use a range of ordinal and cardinal representations (both concrete and pictorial), including familiar examples

Representations

Ten bundles of ten sticks:



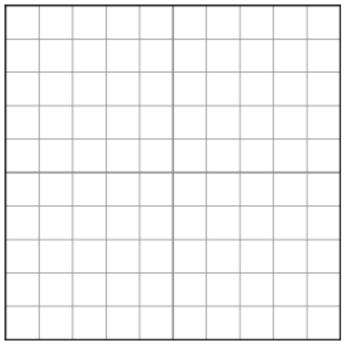
from segment *1.8 Composition of numbers: multiples of 10 up to 100*, such as:

- groups of ten items (for example, packs of pencils, bundles of ten sticks)
- Dienes tens rods
- a one-hundred grid (as introduced in segment *1.9 Composition of numbers: 20–100*; note the heavier-weight grid lines splitting the square into quarters – these aid subitising, and will support later steps)
- a Dienes hundred square (this is a good opportunity to introduce this manipulative, which will be used later)
- measures contexts such as ten-pence coins (here we can't see the individual ones), measuring sticks/tape with only the tens marked etc.
- ten value place-value counters on a tens frame (again, we can't see the individual ones)
- a number line with the multiples of ten labelled
- the Gattegno chart
- a bead bar.

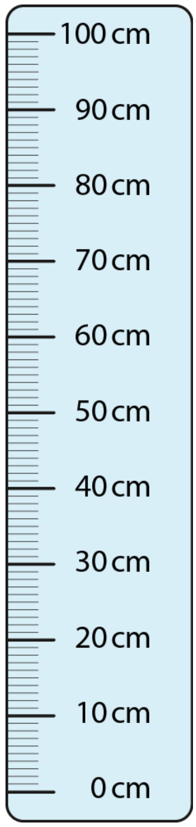
Some of these representations draw particular attention to the fact that 100 is composed of ten tens; this can be emphasized as you discuss the representations with children. In all cases, use the generalised statement: ***'There are ten tens in one hundred.'***

Throughout this teaching point, when using the Dienes hundred square or the printed hundred grid, encourage children to run a finger over each group (here, a row or column of ten) as it is counted.

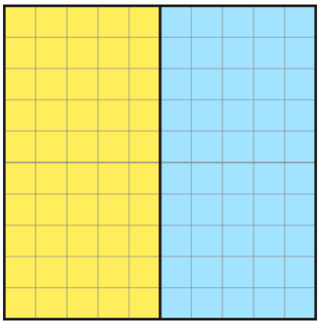
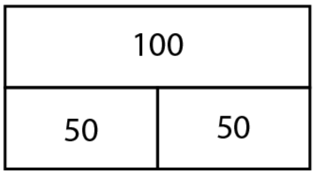
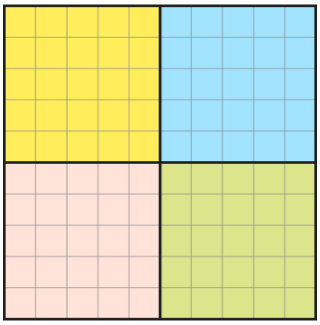
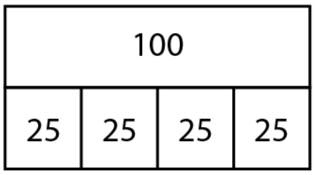
One-hundred grid:



Measuring in 10 cm 'units':



<table>
<tr>
<td>1:3</td>
<td>Summarise the equality between ten tens and one hundred, and review both additive equations (as in segment 1.8 Composition of numbers: multiples of 10 up to 100) and multiplicative equations (as in Spine 2: Multiplication and Division) for this relationship. Use the bar model to support both structures.</td>
<td>Summary – 100 as ten tens:
<table>
<tr><th>Digits</th><th>What it means</th></tr>
<tr><td>10</td><td>1 ten</td></tr>
<tr><td>20</td><td>2 tens</td></tr>
<tr><td>30</td><td>3 tens</td></tr>
<tr><td>40</td><td>4 tens</td></tr>
<tr><td>50</td><td>5 tens</td></tr>
<tr><td>60</td><td>6 tens</td></tr>
<tr><td>70</td><td>7 tens</td></tr>
<tr><td>80</td><td>8 tens</td></tr>
<tr><td>90</td><td>9 tens</td></tr>
<tr><td>100</td><td>10 tens</td></tr>
</table>
Additive and multiplicative expressions:
<table>
<tr><td colspan="10">100</td></tr>
<tr><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td><td>10</td></tr>
</table>
$100 = 10 + 10 + 10 + 10 + 10 +$
$10 + 10 + 10 + 10 + 10$
$100 = 10 \times 10$
$100 \div 10 = 10$</td>
</tr>
<tr>
<td>1:4</td>
<td>Now, move on to showing there are 100 ones in 100, by counting in ones. Use some of the representations from step 1:2 (for example, a Gattegno chart or a bead bar); for cardinal representations use examples that show the individual ones (for example, one-pence coins instead of ten-pence coins, a metre stick with each centimetre labelled etc.). Make sure you include concrete resources that can be split out into individual ones (such as</td>
<td></td>
</tr>
</table>

	the ten bundles of ten sticks, now separated). You can also include a variety of everyday contexts, such as number of pieces in a jigsaw or the number of steps to walk to a particular point. Use the generalised statement: ***'There are one hundred ones in one hundred.'*** Again, review both additive and multiplicative equations for this relationship; start writing *100 = 1 + 1 + 1 + 1 + 1 + 1…* and discuss how many ones we would need to write. Then write the relationship multiplicatively: 100 = 100 × 1 100 = 1 × 100 100 ÷ 1 = 100 100 ÷ 100 = 1	
1:5	This and the next step look at other multiplicative compositions for one hundred (20, 25 and 50), since these are the common 'divisions' that children will encounter in graphing and measures. Continuing to use Dienes hundred squares and/or the printed one-hundred grid, ask children if they can see any other ways that 100 can be divided into equal parts. Discuss any equal groupings that children identify and give value to these, and then focus in on children who have identified two groups of 50 or four groups of 25. As before, write both additive and multiplicative equations for this relationship, using the bar model to support both structures. As a class, count to 100 in 50s or 25s,	Composition of 100: **Two groups of 50**   100 = 50 + 50 **Four groups of 25**   100 = 25 + 25 + 25 + 25

with children placing their fingers on\the corresponding sections of their hundred grids as they count.

Since this is the first time that children have encountered splitting a power of ten into quarters (since the single-digit equivalent would require understanding of decimals – e.g. 2.5, 7.5), it is now worth practising counting in 25s and 50s beyond 100. At this stage, counting will be quite procedural, but it will serve as useful preparation for later teaching points when children are working beyond the hundreds boundary. To support this counting, use items that come in 25s or 50s – for example, a pack of 25 of something, 50-pence coins or the Gattegno chart (for the latter, have children tap out the numbers themselves; familiarity with the gestural patterns supports depth and fluency).

$100 = 2 \times 50$	$100 = 4 \times 25$
$100 = 50 \times 2$	$100 = 25 \times 4$
$100 \div 2 = 50$	$100 \div 4 = 25$
$100 \div 50 = 2$	$100 \div 25 = 4$

Counting in 25s:

25 stickers 25 stickers 25 stickers 25 stickers 25 stickers

- *'Twenty-five, fifty, seventy-five, one hundred, one hundred and twenty-five…'*

Counting in 50s:

50 pence 50 pence 50 pence 50 pence

- *'Fifty, one hundred, one hundred and fifty, two hundred.'*

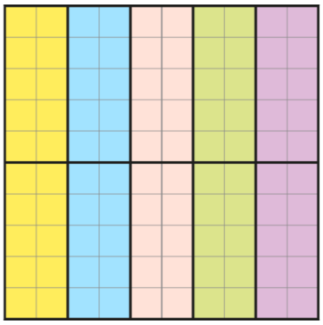
1:6

Now look at 100 as five groups of 20. Children may have identified this composition in the previous step; now draw attention to it by including:

- counting to 100 in 20s while children run their fingers down/across groups of 20
- writing additive and multiplicative equations supported by the bar model.

For counting in 20s, apply unitising in tens to make the link to single-digit counting in twos with which children will, by now, be very confident. Then extend, as before, to counting beyond 100 using, for example, 20-pence coins or the Gattegno chart.

Composition of 100 – five groups of 20:



100				
20	20	20	20	20

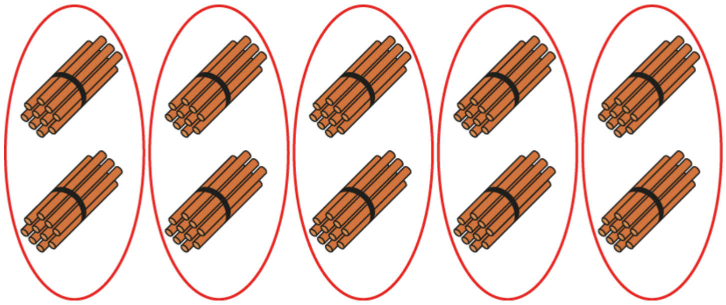
$100 = 20 + 20 + 20 + 20 + 20$

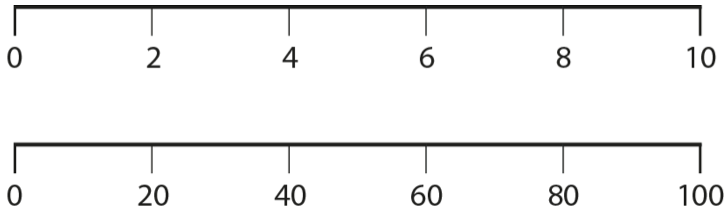
$100 = 5 \times 20$ $\quad$ $100 \div 5 = 20$

$100 = 20 \times 5$ $\quad$ $100 \div 20 = 5$

Note, it is worth displaying all four bar models (100 composed of 10s, 20s, 25s and 50s) on the classroom wall until children are fluent at decomposing 100 in these four ways.

Linking counting in twos to counting in 20s:





- *'Two, four, six, eight, ten.'*
- *'Two tens, four tens, six tens, eight tens, ten tens.'*
- *'Twenty, forty, sixty, eighty, one hundred.'*

Counting in 20s beyond 100:

20 pence | 20 pence | 20 pence | 20 pence | 20 pence | 20 pence …

- *'Twenty, forty, sixty, eighty, one hundred, one hundred and twenty…'*

1:7

To complete this teaching point, provide practice that brings together the different ways of composing 100, including:

- bar models with missing parts
- missing-number sequences
- missing-number equations
- graphing and measures contexts, in which children are required to read scales.

Missing number sequences and equations:

'Fill in the missing numbers.'

100			
?	?	?	?

0	25			100

0	10	20		40		60		80	90	

100		60	40		0

When children are completing bar models or reading scales, encourage them to reason using the stem sentence: ***'One hundred is divided into ___ equal parts; so each part/division has a value of ___.'***

$100 = 25 + \square + 25 + 25$

$100 = 50 + \square$

$100 - 25 = \square$ $\qquad$ $100 - 50 = \square$

$100 = 4 \times \square$ $\qquad$ $2 \times \square = 100$

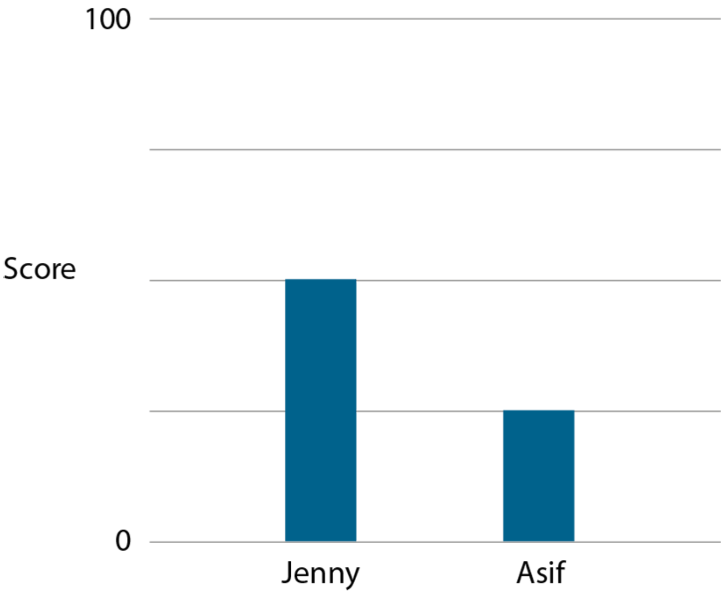
$100 \div 4 = \square$ $\qquad$ $\square = 100 \div 2$

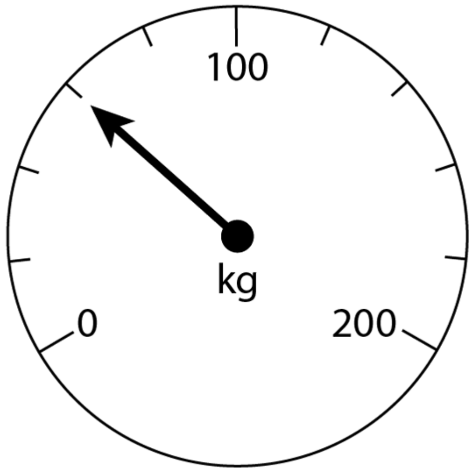
$100 - 20 - 20 = \square$

$\square = 100 - 10 - 10 - 10$

Measures and graphing contexts:

- *'What were Jenny and Asif's scores?'*



		• *'Miss Scot weighs herself. How much does she weigh?*  • *'How long is the ribbon?'* 

Teaching point 2:

Known addition facts can be used to calculate complements to 100.

Steps in learning

2:1

Guidance

This teaching point looks at the different additive ways to compose and partition 100, including:

- 100 composed of two multiples of ten (e.g. *70 + 30 = 100, 100 – 30 = 70* and *100 – 70 = 30*)
- 100 composed of a two-digit number and a single-digit number (e.g. *97 + 3 = 100, 100 – 3 = 97* and *100 – 97 = 3*)
- 100 composed of two two-digit numbers (e.g. *77 + 23 = 100, 100 – 23 = 77* and *100 – 77 = 23*).

The first two points follow on fairly easily from segments *1.8 Composition of numbers: multiples of 10 up to 100* and *1.13 Addition and subtraction: two-digit and single-digit numbers*, while children often find the third point more challenging.

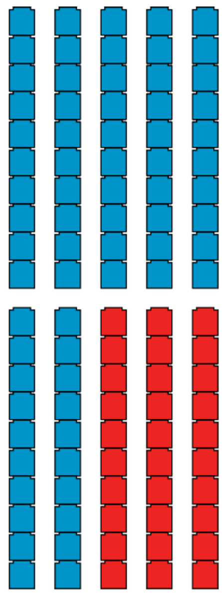
Begin by looking at the addition of two 'whole-tens' complements to 100 and the corresponding subtraction calculations. As in segment *1.8*, start by linking a single-digit bond to ten with the equivalent bond to 100, using base-ten representations such as place-value counters on a tens frame, Dienes or shading rows (or columns) on one-hundred grids.

Use the following stem sentences:

- ***'I know that ___ plus ___ is equal to ten.'***
- ***'So, ___ tens plus ___ tens is equal to ten tens.'***
- ***'___ plus ___ is equal to 100.'***

Representations

Multi-link and part–part–wholes:



10	
7	3

10 tens	
7 tens	3 tens

7 + 3 = 10 70 + 30 = 100

- *'I know that seven plus three is equal to ten.'*
- *'So, seven tens plus three tens is equal to ten tens.'*
- *'Seventy plus thirty is equal to one hundred.'*

10 – 3 = 7 100 – 30 = 70

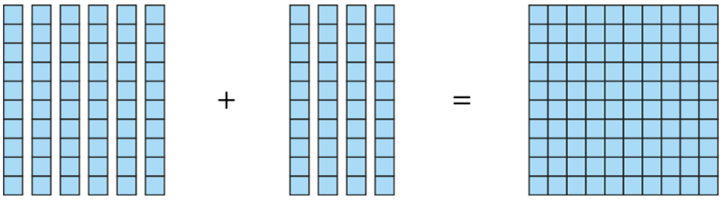
- *'I know that ten minus three is equal to seven.'*
- *'So, ten tens minus three tens is equal to seven tens.'*
- *'One hundred minus thirty is equal to seventy.'*

And for subtraction:

- ***'I know that ten minus ___ is equal to ___.'***
- ***'So, ten tens minus ___ tens is equal to ___ tens.'***
- ***'100 minus ___ is equal to ___.'***

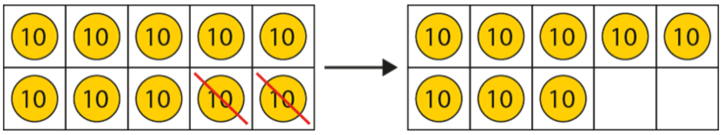
You should be able to remove the concrete/pictorial representations over quite a short time period, so that children rely on combining their known facts with unitising without this layer of scaffolding. You can provide a variation exercise such as that shown opposite, with children working through the sequence of complements to 100.

Dienes:



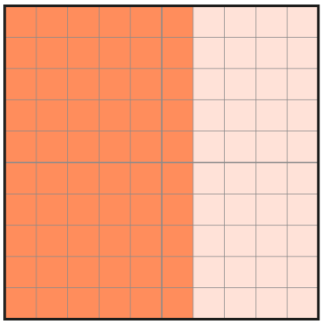
60 + 40 = 100

Tens frames:



100 – 20 = 80

Hundred grid:



100 – 40 = 60

Sequence of complements to 100:

'Fill in the missing numbers.'

10 + 90 = ☐	100 = 60 + ☐
20 + 80 = ☐	100 = 70 + ☐
30 + 70 = ☐	100 = 80 + ☐
40 + 60 = ☐	100 = 90 + ☐
50 + 50 = ☐	

2:2

Provide varied practice for 'whole-tens' complements to 100, in the form of:

- part–part–whole models (bar model or cherry diagram) with a missing 'part' or 'whole'
- missing-number problems
- balancing equations (missing numbers or symbols)
- real-life problems, including measures and graphing contexts, such as those shown opposite and below:
  - *'Sarah has 30 marbles and Freddie has 70 marbles. How many marbles do they have together?'* (aggregation)
  - *'Mrs Christie has 100 stickers. 40 of them are gold and the rest are silver. How many are silver?'* (partitioning)
  - *'Dana had 90 p, then she found 10 p more. How much does Dana have now?'* (augmentation)
  - *'A dressmaker had 1 m of ribbon. She used 20 cm of it. How much ribbon does she have left?'* (reduction)

Note that in examples such as the final two above, it is worth setting the expectation that children can incorporate simple conversions with which they should already be familiar (e.g. 100 p = £1 and 100 cm = 1 m). Be sure to include problems that link to work on multiplicative composition of 100 in *Teaching point 1*, such as the data example opposite.

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

Missing-number problems:

'Fill in the missing numbers.'

100	
10	?

100	
50	?

100 = 70 + ☐　　100 = ☐ + 40

☐ + 30 = 100　　60 + ☐ = 100

100 – 30 = ☐　　☐ – 60 = 40

☐ = 100 – 70　　☐ = 100 – 40

Balancing equations:

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

30 + 70 ◯ 60 + 40

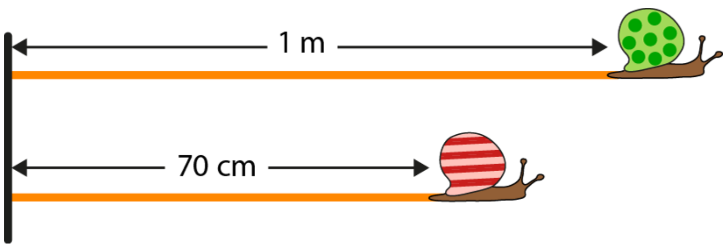
60 + 40 = ☐ + 10

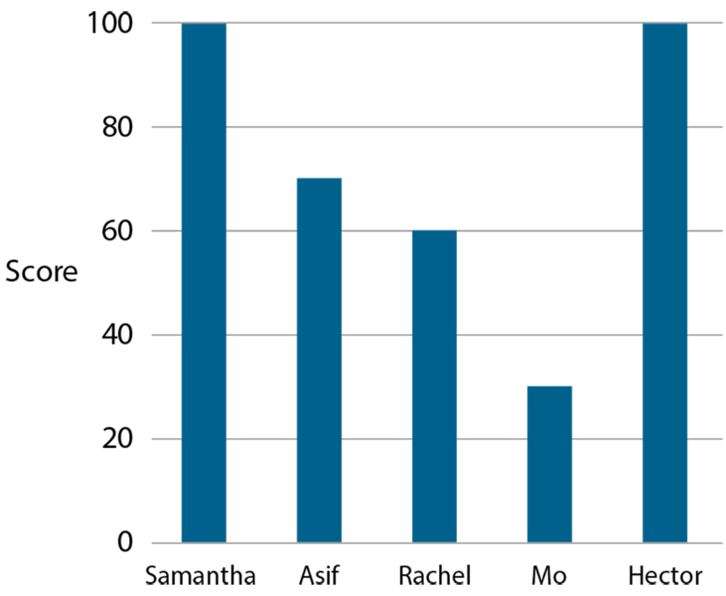
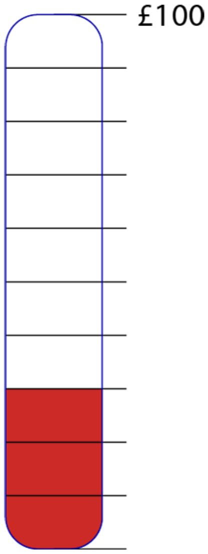
20 + 70 ◯ 80 + 20

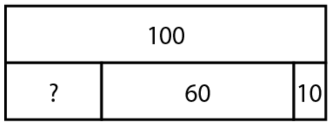
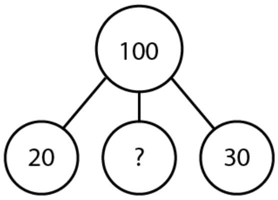
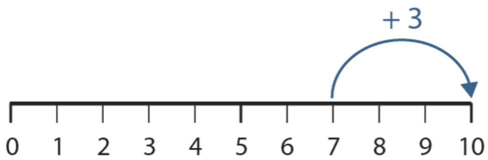
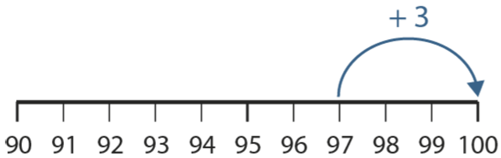
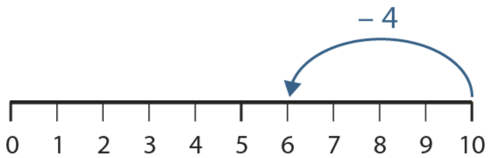
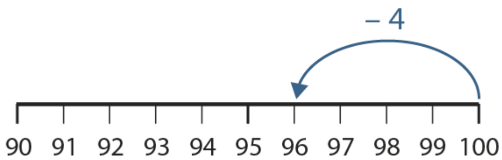
90 + ☐ = ☐ + 20 = 100

Measures context (difference):

'How much further has the spotty snail travelled compared to the stripy snail?'



	'James had 10 packs of pencils, with 10 pencils in each. He gave 40 pencils away. How many packs did he have left?'	Data contexts: • *'How much more did Samantha score than Asif?* • *'How much less did Rachel score than Hector?'* • *'What was Asif and Mo's combined score?'*  *'How much more money needs to be raised?'* 

		Dòng nǎo jīn: *'Fill in the missing numbers.'*   100 = 10 + 10 + ☐ tens 3 tens + ☐ = 100 10 tens = 30 ones + ☐ ☐ = 100 – 4 tens 100 = 40 + 1 ten + 20 ones + ☐
2:3	In segment *1.13 Addition and subtraction: two-digit and single-digit numbers*, calculations of the form *97 + 3* and *100 – 3* were embedded in the exemplar practice problems. Now, review calculations of this form, again linking the two-digit plus/minus single-digit calculation to the relevant single-digit fact. As in segment *1.13*, encourage children to describe the link to the known fact using the following stem sentences: • ***'I know that ___ plus ___ is equal to ten, so I know that ___ plus ___ is equal to one hundred.'*** • ***'I know that ten minus ___ is equal to ___, so I know that one hundred minus ___ is equal to ___.'*** Summarise and extend the pattern, before presenting children with practice calculations 'out of sequence'.	Linking known facts – number line representation:  7 + 3 = 10  97 + 3 = 100 *'I know that seven plus three is equal to ten, so I know that ninety-seven plus three is equal to one hundred.'*  10 – 4 = 6  100 – 4 = 96

<table>
<tr>
<td></td>
<td>Dòng nǎo jīn:

‘Dylan says that one hundred minus six is forty. Explain his mistake and think of a way to show him what the correct answer is.’</td>
<td>Missing-number problems – in sequence:

‘Fill in the missing numbers’.

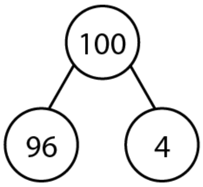
100 – 1 = ☐   99 + ☐ = 100
100 – 2 = ☐   98 + ☐ = 100
100 – 3 = ☐   97 + ☐ = 100
etc…   etc…

Missing-number problems – isolated calculations:

‘Fill in the missing numbers’.

93 + = ☐ = 100   100 – 6 = ☐
☐ + 97 = 100   100 – 2 = ☐</td>
</tr>
<tr>
<td>2:4</td>
<td>Use part–part–whole models and intelligent practice to demonstrate that, since we know how to calculate, e.g. 96 + 4 = 100 and 100 – 4 = 96, we also know how to calculate 100 – 96 = 4.

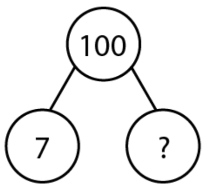
Children can practice writing equations to go with complete part–part–whole diagrams, and practice filling in the missing two-digit number in incomplete part–part–whole diagrams and equations.</td>
<td>Related calculations:

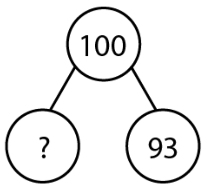


96 + 4 = 100   100 – 4 = 96
4 + 96 = 100   100 – 96 = 4

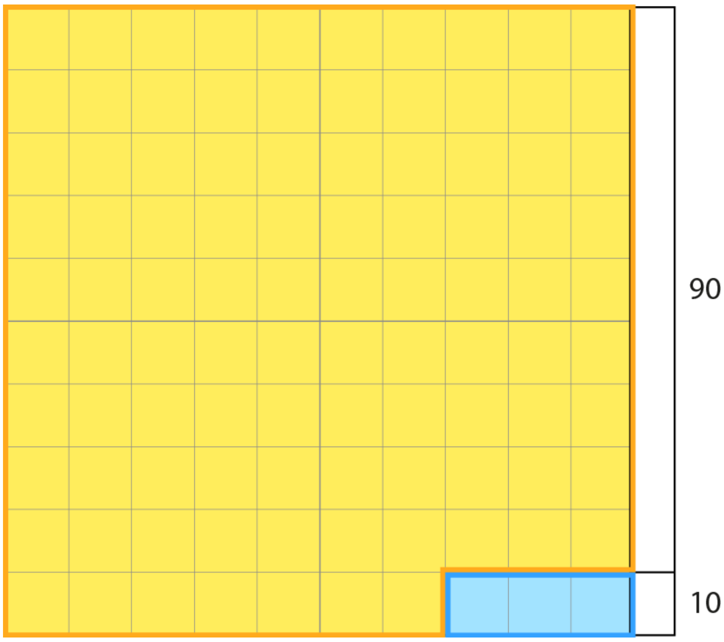
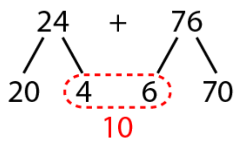
Missing-number problems:

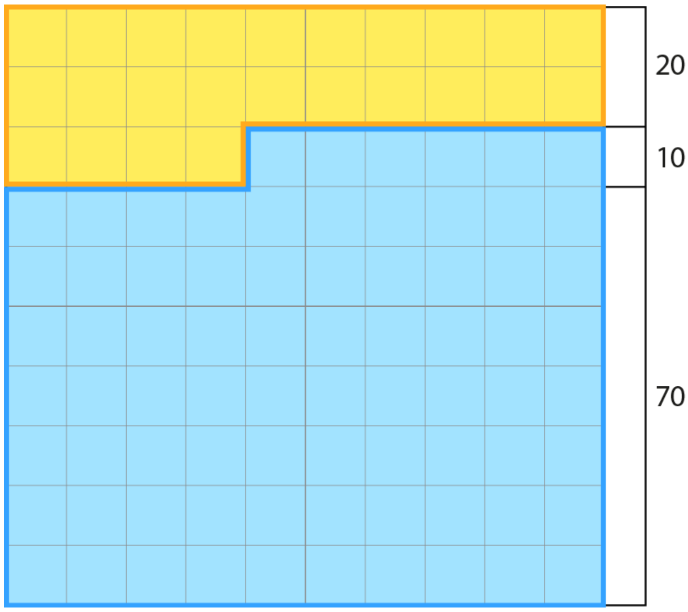
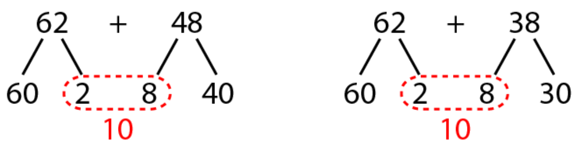
‘Fill in the missing numbers.’

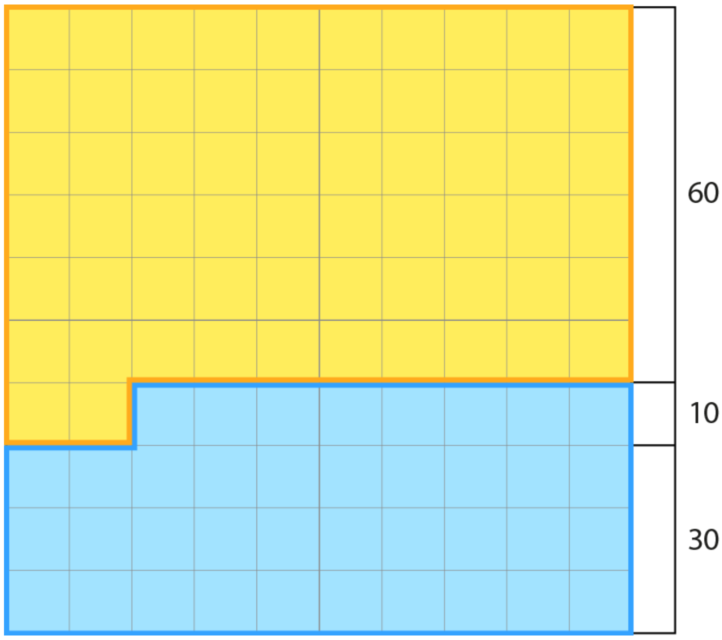
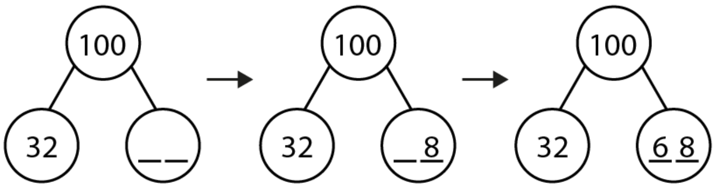




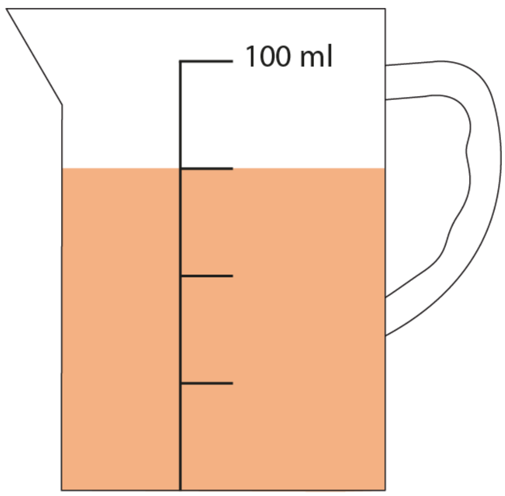
7 + ☐ = 100   ☐ + 93 = 100
100 – 7 = ☐   100 – 93 = ☐
92 + ☐ = 100   95 + ☐ = 100</td>
</tr>
</table>

		100 – 8 = ☐ 100 – 5 = ☐ 100 – 92 = ☐ 100 – 95 = ☐
2:5	In preparation for the next step, draw attention to the fact that, in each calculation of this type (in steps *2:3* and *2:4*), we have ninety, and two single-digit numbers that sum to ten. Use a representation such as the shaded hundred grid example opposite to emphasize that the single-digit numbers constitute a row/column of ten.	
2:6	Now progress to looking at two two-digit complements to 100. This is a critical learning point, as children often bond both the ones digits to ten and the tens digits to ten (e.g. *24 + 86*), giving a total of 110 instead of 100. Begin by describing an aggregation context, such as that shown opposite, and ask children to prove the total is 100. The children will probably present a range of proofs, including partitioning and adding on. Discuss the strategies offered and give credit for all the different ways that children prove the total is 100. The key idea with complements to 100 for children to understand is that, as there are already ten ones (coming from the ones digits), only nine additional tens are needed to make 100. Focus on this structure by using the method of partitioning both addends to summarise the calculation.	*'Jane blows up 24 balloons for her party. Jane's mum blows up another 76 balloons. Prove that altogether they have blown up 100 balloons.'* Partitioning both addends: 24 + 76 20 + 70 = 90 4 + 6 = 10 90 + 10 = 100 

	The partitioning diagram opposite shows clearly where the ten tens are 'coming from'. Describe how the ones digits (e.g. 4 and 6) give *one* ten, and that the *nine* additional tens give a total of ten tens, or 100. Further emphasise this structure using a hundred grid. Begin with a blank hundred grid and ask children to prove the answer again, by shading the grid. Once it has been shaded, annotate the grid to show the ten tens composed of the nine complete tens and the one additional ten from the ones values.	
2:7	Now address the common error (finding complements to 110 instead of to 100) to increase children's depth of understanding. Present a problem with both correct and incorrect answer options, such as the example opposite. As before, use the partitioning method and the shaded hundred grid to highlight that one ten is made by the ones digits, so we only need nine additional tens. Explicitly tell children that the mistake Sienna has made is a very common one; discuss what her thinking was (that she needed to bond both the ones and the tens to ten) and encourage children to look out for this mistake whenever they are calculating complements to 100. You may want to provide another similar example before moving on.	*'Year 3 need to earn 100 class points for a treat. They have 62 already. Sienna says they need 48 more. Jasleen says they need 38 more. Who is right?'* Comparing the answers:  Sienna Jasleen Sienna: 60 + 40 = 100 2 + 8 = 10 100 + 10 = 110 Jasleen: 60 + 30 = 90 2 + 8 = 10 90 + 10 = 100 

		Correct complement: 
2:8	Now that children have been taught to spot the common error, given them practice sorting correct complements to 100 and those that incorrectly have an extra ten. Use this to help children to really focus on looking for two tens-digits that bond to nine.	*'Which of these are correct complements to 100 and which have an extra ten?'* 28 + 72 61 + 49 55 + 45 43 + 67 84 + 16 39 + 71
2:9	Now that children can *identify* correct complements to 100, model how to *find* complements to 100 by first completing the ones digits using bonds to ten and then the tens digit using bonds to nine. Use the generalised sentence: ***'First we make ten ones. We have one ten from***	

Correct bond to 100	Incorrect bond to 100 (extra ten)

	the ones digits, so we need nine more tens.' As you work through some examples, you could include some deliberate mistakes ('accidentally' bonding the tens digits to ten) for children to spot.	
2:10	Give children practice finding complements to 100 on part–part–whole diagrams and as missing addend addition calculations and missing difference subtraction calculations, as shown opposite. To assess and promote depth of understanding, use dòng nǎo jīn problems such as those shown opposite. Note that, while the vast majority of two-digit complements to 100 will need to be *calculated* by the children (rather than memorised as a known fact), the pair 75 and 25 should be *memorised*, drawing on their knowledge of the 25, 50, 75, 100 pattern from *Teaching point 1*.	Missing addend addition calculations and missing difference subtraction calculations: 65 + □ = 100 100 − 29 = □ 100 = 42 + □ □ = 100 − 83 75 + □ = 100 100 − 25 = □ Dòng nǎo jīn: 100 = [___ 4] + [6 ___] 100 − [8 ___] = [___ 5] 100 = 40 + 27 + □ 39 + □ + 20 = 100
2:11	Complete this teaching point by providing varied practice for: • two-digit and single-digit complements to 100 (e.g. 97 and 3) • two two-digit complements to 100 (e.g. 77 and 23). For example: • balancing equations (missing numbers or symbols) • real-life problems, including measures and graphing contexts, such as those shown opposite and below: • *'Sarah has 32 marbles and Freddie has 68 marbles. How many marbles do they have together?'* (aggregation)	*'How much more juice needs to be added to make 100 ml?'* 

	• *'Mrs Christie has 100 stickers. 47 of them are gold and the rest are silver. How many are silver?'* (partitioning) • *'Dana had 96 p, then she found 4 p more. How much does Dana have now?'* (augmentation) • *'A dressmaker had 1 m of ribbon. She used 12 cm of it. How much ribbon does she have left?'* (reduction) • *'A toy shop sells bouncy balls for £1 each and ping-pong balls for 65 p each. What is the difference between the cost of a bouncy ball and a ping-pong ball?'* (difference) As before, expect children to incorporate simple conversions with which they should already be familiar (e.g. 100 p = £1 and 100 cm = 1 m). Include problems, such as the example opposite, linking to work on decomposition of 100 into 25s (*Teaching point 1*).	

Teaching point 3:

Known strategies for addition and subtraction across the tens boundary can be combined with unitising to count and calculate across the hundreds boundary in multiples of ten.

Steps in learning

3:1

To prepare children for calculations of the form *70 + 50* and *120 – 50* (steps *3:9–3:13*):

- practise counting across the hundreds boundary in multiples of ten (steps *3:1–3:3*)
- extend children's understanding of place value so that they can confidently represent multiples of ten greater than 100, including representing and performing additive calculations such as *100 + 60*, *160 – 60* and *160 – 100* (steps *3:4–3:8*).

Start by skip-counting in tens from zero, up to and over 100, and back again. Use ordinal representations, including a 0–200 number line with only multiples of ten labelled and a Gattegno chart. So that the children come to associate, for example 14 tens with 140, count in two ways, with both you and the children pointing at/tapping the numbers as you go:

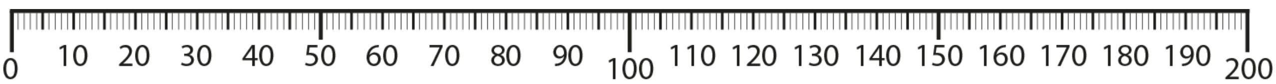
- *'Zero, ten, twenty…, one hundred, one hundred and ten, one hundred and twenty…'*
- *'No tens, one ten, two tens…, ten tens, eleven tens, twelve tens…'*

The Gattegno chart is particularly useful for highlighting the place-value structure of the numbers – you will need to 'double tap' once you get to 110, by tapping first 100 and then the multiple of 10. This is good preparation for a closer examination of place value and the meaning of the digits (step *3:4*).

For forwards-counting, as well as beginning at zero, practise starting with a non-zero multiple of ten, e.g. 80, 90, 100, 110, 120…

Then, point to a given multiple of ten greater than 100 on the number line or Gattegno chart and ask children to say the number, or say a number and ask children to point it out on the representation. Also practise saying the number in terms of multiples of ten (for example, *'thirteen tens'*) with the children identifying the corresponding number (130) on the representation or saying the number name (*'one hundred and thirty'*) and vice versa.

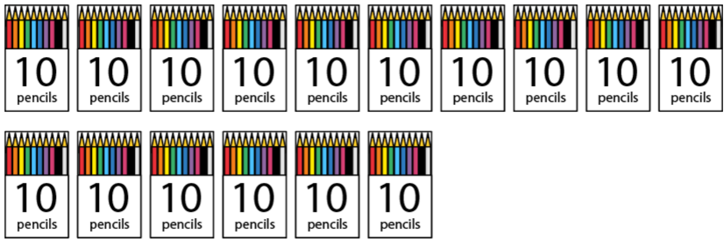
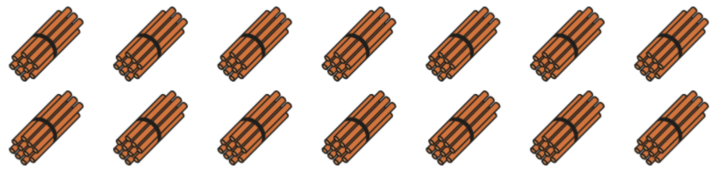
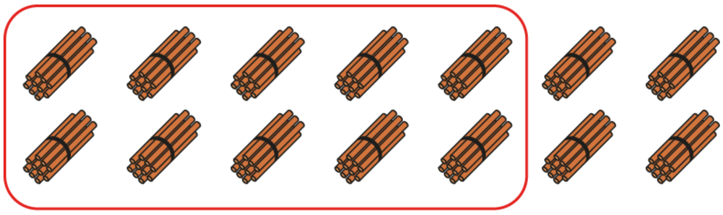
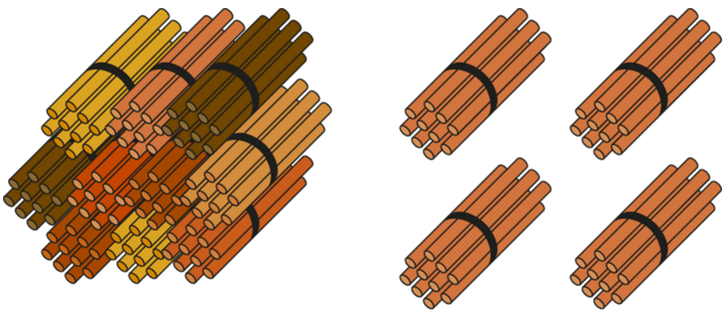
Number line:



Gattegno chart:

'Show me one hundred and fifty.'

1000	2000	3000	4000	5000	6000	7000	8000	9000
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

	Guidance	**Representations**
3:2	Now practise the same skip-counting as in step *3:1*, this time using cardinal representations, such as packs of ten items or bundles of ten sticks. Include the numbers written as numerals.	160  140 
3:3	Now, continuing to count both with number names (*'ten, twenty…'*) and in multiples of ten (*'one ten, two tens…'*), count a specific number of groups of ten (for example, 14 bundles of ten sticks). To draw attention to the 'one-hundred-and-some-tens' structure, once ten tens/ one hundred is reached, draw around or group the ten tens. Use the following stem sentences to describe the completed count: • ***'There are ___ groups of ten.'*** • ***'There is one group of one hundred and ___ more tens.'*** • ***'There are ___ ___.'*** To further emphasize the 'one-hundred-and-some-tens' structure, go on to show the same set of objects, but with the 100 already circled/grouped and count on in tens from one hundred. In the same way, include examples where the cardinality of the one hundred can't be seen. Count a variety of sets of ten in this way.	Bundles of ten sticks:  • *'There are fourteen groups of ten.'* • *'There is one group of one hundred and four more tens.'* • *'There are one hundred and forty sticks'* One hundred and some tens:  *'One hundred, one hundred and ten, one hundred and twenty, one hundred and thirty, one hundred and forty.'*

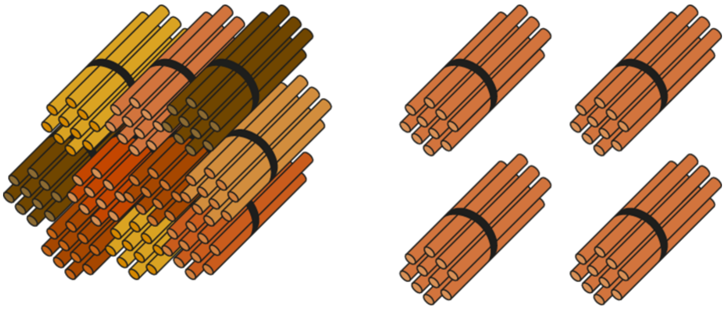
<table>
<tr>
<td></td>
<td></td>
<td>Cardinality of one hundred not shown:


'There is one group of one hundred and two more tens.'
'There is one hundred and twenty pence.'

</td>
</tr>
<tr>
<td>3:4</td>
<td>Now examine more closely how the numbers are written with digits. In step 1:1 children were exposed to 100 written on a place-value chart. Now, returning to an example used in the previous step (for example, 140 sticks), write the digits on a place-value chart, emphasising that we have one hundred and four tens. As in step 1:1, ask children to describe what each digit represents. Explore a range of examples in this way.

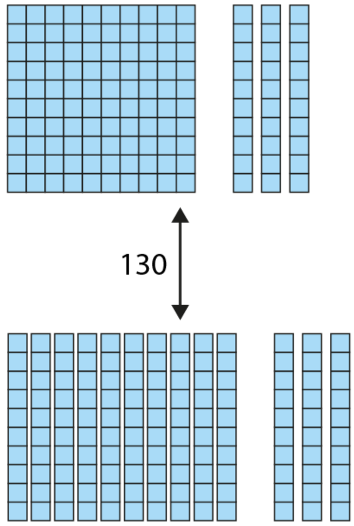
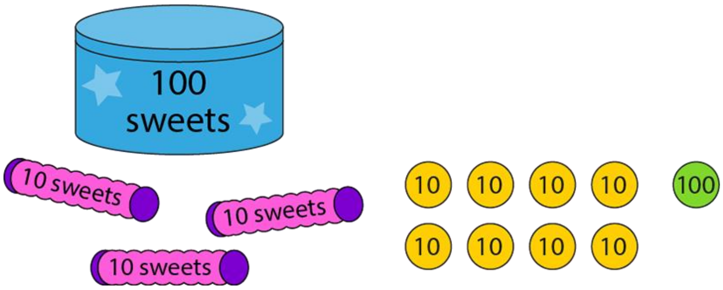
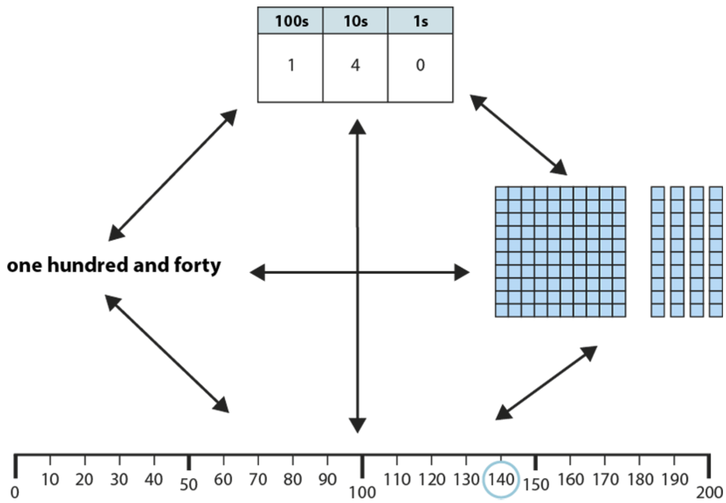
When referring to place value, avoid asking questions such as 'How many tens are there in one hundred and forty?' since this is ambiguous – one hundred and forty is composed of fourteen tens, or it has four tens in addition to the hundred. Be clear in your questions, for example:

'What is the value of the tens digit in one hundred and forty?'
(four)
or
'What does the four represent in one hundred and forty?'
(four tens)
'How many tens are there, in total, in one hundred and forty?'
(14 tens)
or
'What number is composed of fourteen tens?'
(140)

</td>
<td>Sticks and place-value chart:

<table>
<tr><th>100s</th><th>10s</th><th>1s</th></tr>
<tr><td>1</td><td>4</td><td>0</td></tr>
</table>
140

'The 1 represents one hundred.'
'The 4 represents four tens.'
'The 0 represents zero/no additional ones.'

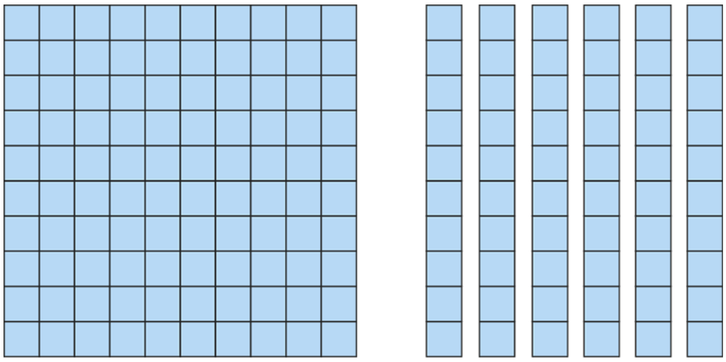
</td>
</tr>
</table>

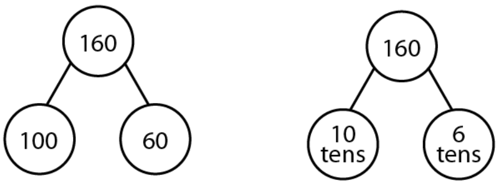
3:5	Give children practice moving between name (*'one hundred and forty'*), numerals (*'140'*) and cardinal representation (for example, Dienes). Show some numbers with Dienes and ask children to say and write the number represented. Similarly, say or write a number and ask children to represent it with Dienes. Include practice using only Dienes tens rods to make a number (for example, 13 tens Dienes to represent 130), as well as Dienes hundred squares. Also use concrete/pictorial representations in which: • the individual items in the tens and hundreds *can* be seen (such as the sticks in the previous step) • the individual items in the tens and hundreds *can't* be seen (such as the examples opposite). Include variation in the arrangement of the tens and the hundreds, including: • representations with the tens and hundreds 'mixed up' (as with the sweets opposite) • representations with the tens on the left and the hundreds on the right (as with the counters opposite).	Dienes and numerals:  Variation in representation and positioning of tens and hundreds: 
3:6	Before moving on, check that children can confidently move between any pair of the following representations of multiples of ten above 100: • the number written as numerals • the number name • cardinal representations (both when shown as one hundred and four tens, and when shown as 14 tens) • ordinal representations.	

3:7

Now that children are secure in their understanding of, for example, 160 as *'one hundred and six tens'*, this can be extended to additive calculations based on this structure. Show the composition of some of these numbers on part–part–whole diagrams, each alongside the corresponding Dienes representation. Then write the associated addition and subtraction equations.

Dienes, part–part–whole and equations:





100 + 60 = 160 160 – 60 = 100

60 + 100 = 160 160 – 100 = 60

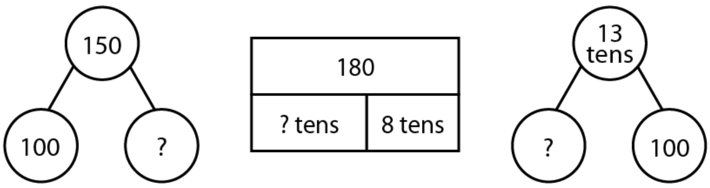
3:8

Provide varied practice for additive calculations based on the hundreds-and-tens structure of the multiples of ten from 100 to 190, in the form of:

- part–part–whole models (bar model or cherry diagram) with a missing 'part' or 'whole'
- missing-number problems
- real-life problems, including measures contexts, such as those shown opposite and below:
  - *'Flynn has 100 football stickers and Ellie has 20 football stickers. How many stickers do they have together?'* (aggregation)
  - *'A baker has made 150 buns. 50 of them have chocolate icing; the rest have vanilla icing. How many have vanilla icing?'* (partitioning)
  - *'Stephanie has £1. Then her gran gives her 70 p more. How much does Stephanie have now?'* (augmentation)

Missing-number problems:

'Fill in the missing numbers.'



100 + 70 = ☐ 120 – 100 = ☐

30 + 100 = ☐ 80 = ☐ – 100

140 = ☐ + 40 110 – ☐ = 10

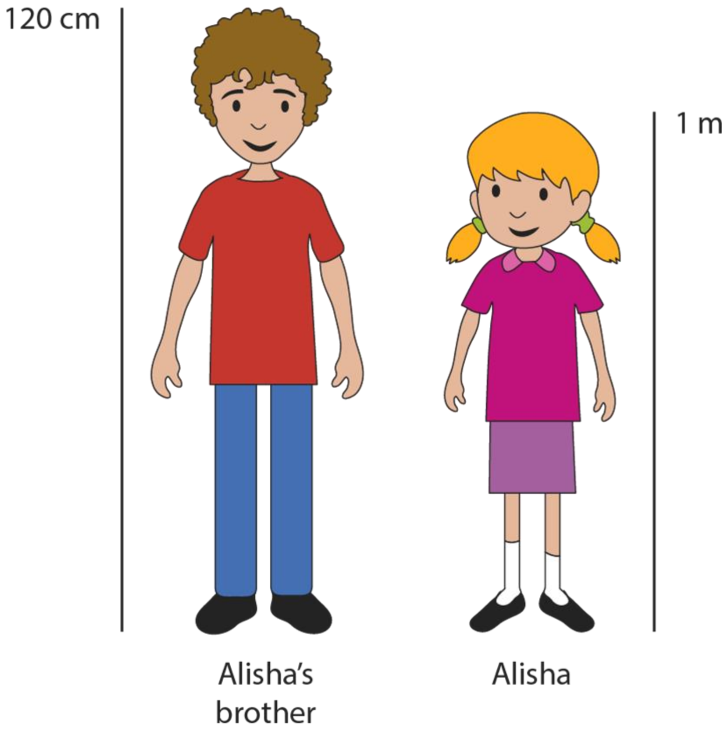
- *'Cara buys an* Amazingly Long Stickberry Lace, *that is 160 cm long. She gives 60 cm of it to her friend. How much does she have left?'* (reduction)

As before, it is worth setting the expectation that children can incorporate simple measures conversions.

To promote and assess depth of understanding, use dòng nǎo jīn problems such as those shown opposite and below. Examples that involve three parts/addends, of which two are multiples of ten that sum to 100, will serve as useful preparation for bridging 100 in steps *3:9–3:13*.

- *'Sarah has 10 bags of 10 marbles. Freddie has 20 marbles. How many marbles do they have altogether?'*
- *'A dressmaker needs 15 strips of ribbon, each 10 cm long. He has 1 m of ribbon. How much more ribbon does he need?'*

Measures context (difference):



'How much shorter is Alisha than her brother?'

Dòng nǎo jīn:

?		
70	30	50

160		
100	?	40

$14 \times 10 = 40 + \square$

$100 + 80 = \square \times 10$

3:9

Now progress to addition of multiples of ten, bridging 100 (e.g. *70 + 50*). Sometimes children may make an error of the form:

70 + 50 = 112 ✗

They can see the answer is *'bigger than one hundred'* and can see the *'twelve'* but aren't sure how to bring those concepts together. Previous work on unitising in tens (for example, associating 12 tens with 120) should help children to avoid this type of mistake, but you will still need to look out for it.

There are two ways to approach these calculations:

- Method A: using a known bridging-ten addition fact (e.g. *7 + 5 = 12*), then scaling up by a factor of ten (e.g. *12 → 120*)
- Method B: working directly with the multiples of 10 to make, and then bridge, 100 (e.g. *70 + 30 = 100*, then *100 + 20 = 120*).

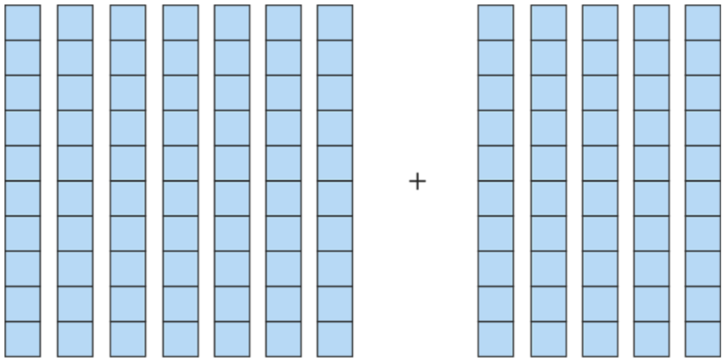
Beginning with method A, present a calculation (e.g. *70 + 50*), and then ask the children to represent it with Dienes ten rods, identifying that we have seven tens plus five tens. You can build on the unitising stem sentences used in step *2:1* (and earlier segments) to help children apply their knowledge of bridging ten to bridging 100:

- ***'I know that ___ plus ___ is equal to ___.'***
  (single-digit addends)
- ***'So ___ tens plus ___ tens is equal to ___ tens.'***
  (multiple-of-ten addends)
- ***'___ plus ___ is equal to one hundred and ___.'***
  (number names)

Record the three equations as you speak and make sure children associate

Addition across 100 in multiples of ten – method A:

70 + 50



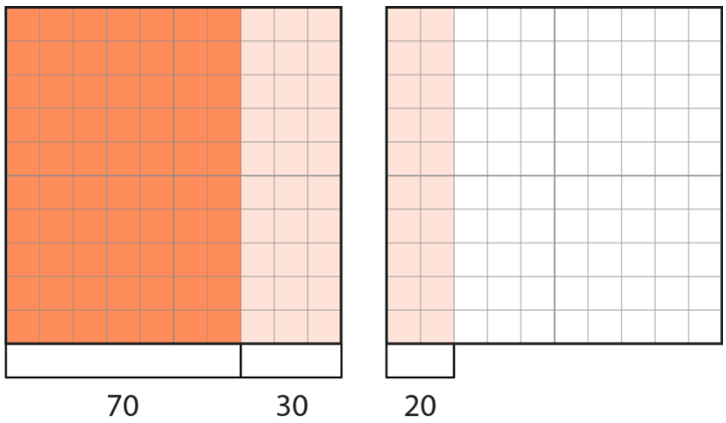
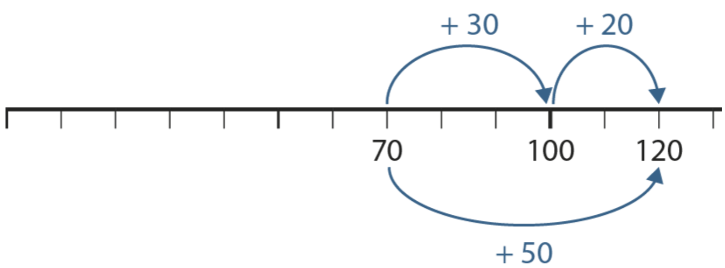
- *'I know that seven plus five is equal to twelve.'*
- *'So seven tens plus five tens is equal to twelve tens.'*
- *'Seventy plus fifty is equal to one hundred and twenty.'*

7	+	5	=	12
7 tens	+	5 tens	=	12 tens
70	+	50	=	120

Completing equation sequences:

'Fill in the missing numbers.'

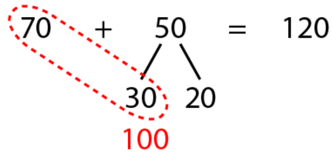
6	+	9	=	☐
6 tens	+	9 tens	=	☐
60	+	90	=	☐

	the 12 tens with 120 (rather than with 112). Work through a few examples, using Dienes, before removing this scaffolding, ensuring that children can complete the sequences of equations without the support of the manipulatives. Emphasise that when we add or subtract multiples of ten, we get a multiple of ten, and encourage children to check that the answers they give are multiples of ten (i.e. for the example opposite, checking they have given an answer of 150 rather than 115).	
3:10	Now explore method B, working directly with the multiples of ten to bridge 100. The strategy is the same as the one children learnt in segment *1.11 Addition and subtraction: bridging 10*, but here it is applied to make, then bridge, 100. Working with one of the same calculations you explored in detail in step *3:9* (to draw attention to the difference in strategies), use tens frames with ten-value place-value counters, or two one-hundred grids side-by-side, to support the 'making 100' strategy. Encourage children to describe the steps in the same way as for the 'making ten strategy', for example: • *'Seventy plus thirty is equal to one hundred…'* • *'…and one hundred plus twenty is equal to one hundred and twenty.'* Record with equations in one of the ways shown opposite. You could also use a number line to represent this strategy. To encourage children to work flexibly, also look at partitioning the 70 (instead of the 50), to give 'double 50 and 20	Addition across 100 in multiples of ten – method B: 70 + 50 Partitioning 50: Hundred grids:  Number line: 

more'; the tens frames with counters and equation representations can be used here.

Work through a few examples, using tens frames, hundred grids or number lines, before removing the scaffolding; ensure that children can complete the calculations without these supporting representations.

Equations:

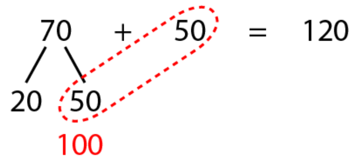


$70 + 50 = 70 + 30 + 20$

$= 100 + 20$

$= 120$

Partitioning 70:



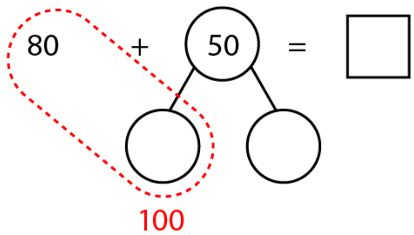
$70 + 50 = 20 + 50 + 50$

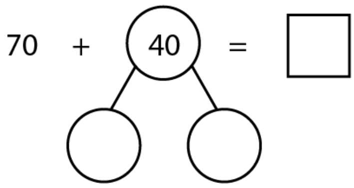
$= 20 + 100$

$= 120$

Completing calculations:

'Fill in the missing numbers.'

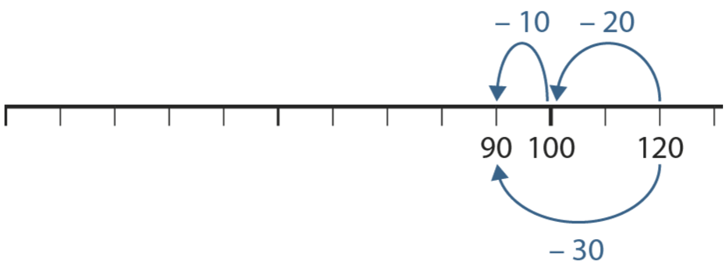
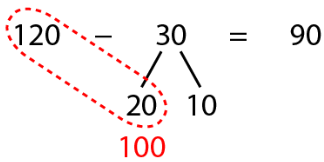


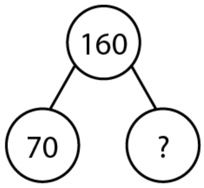
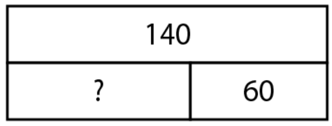


$90 + 60 = 90 + \square + 50$

$= \square + \square$

$= \square$

3:11	Work through a range of calculations, using the representations described in steps *3:9* and *3:10*. Either of the strategies discussed can be applied to the addition of any two multiples of ten that bridge 100. However, depending on the particular numbers involved, there may also be other efficient strategies. For example, a near-doubles approach could be used to calculate *70 + 60*, i.e. *'seventy plus sixty is equal to double-sixty plus ten'*. Discuss different approaches with your class as you encounter different calculations. Irrespective of the strategy used, ensure that children can confidently perform the calculations without concrete/pictorial scaffolding, using only equations, jottings or mental arithmetic.	
3:12	Now explore similar subtraction calculations (e.g. *120 – 40*), using the inverse of steps *3:9* and *3:10* respectively, with the same representations as above (only a subset of these representations are shown opposite). First use a known bridging-ten subtraction fact (e.g. *12 – 3 = 9*), followed by scaling up by a factor of ten (e.g. *9 → 90*) – method A: inverse of step *3:9*. Use the same representations as in step *3:9*, and the analogous stem sentences: • ***'I know that ___ minus ___ is equal to ___.'*** (bridging ten) • ***'So ___ tens minus ___ tens is equal to ___ tens.'*** (bridging ten tens) • ***'One hundred and ___ minus ___ is equal to ___.'*** (number names)	Subtraction across 100 in multiples of ten – method A: • *'I know that twelve minus three is equal to nine.'* • *'So twelve tens minus three tens is equal to nine tens.'* • *'One hundred and twenty minus thirty is equal to ninety.'* 12 – 3 = 9 12 tens – 3 tens = 9 tens 120 – 30 = 90 Subtraction across 100 in multiples of ten – method B:  

	Then work directly with the multiples of ten to make, then bridge, 100 (e.g. *120 – 20 = 100*, then *100 – 10 = 90*) – method B: inverse of step *3:10*). For each method, move children away from using the concrete/pictorial scaffolding until they can confidently perform the calculations using only equations, jottings or mental arithmetic.	120 – 30 = 120 – 20 – 10 = 100 – 10 = 90
3:13	Finally, provide varied practice for the addition and subtraction of multiples of ten across the hundreds boundary, including: • part–part–whole models (bar model or cherry diagram) with a missing 'part' or 'whole' • missing-number problems • balancing equations (missing numbers or symbols) • real-life problems, including measures and graphing* contexts, such as those shown opposite and below: ◦ *'Ben has 80 colouring pencils and Freddie has 40. How many colouring pencils do they have together?'* (aggregation) ◦ *'There are 150 children in Year 3. 70 of them are going swimming. How many are not going swimming?'* (partitioning) ◦ *'Florence had 90 p in her piggy-bank. Then she added another 80 p. How much is in the piggy-bank now?'* (augmentation) ◦ *'Anelise had string 1 m 50 cm in length. She used 90 cm of it to play conkers. How much string does she have left?'* (reduction).	Missing-number problems: *'Fill in the missing numbers.'*  90 + 90 = □ 120 – 70 = □ 50 + 60 = □ 80 = □ –70 130 = □ + 50 140 – □ = 50 Balancing equations: *'Use numbers or symbols (< > =), to complete the equations.'* 40 + 80 ○ 30 + 90 90 + 50 = □ + 60 50 + 80 ○ 60 + 80

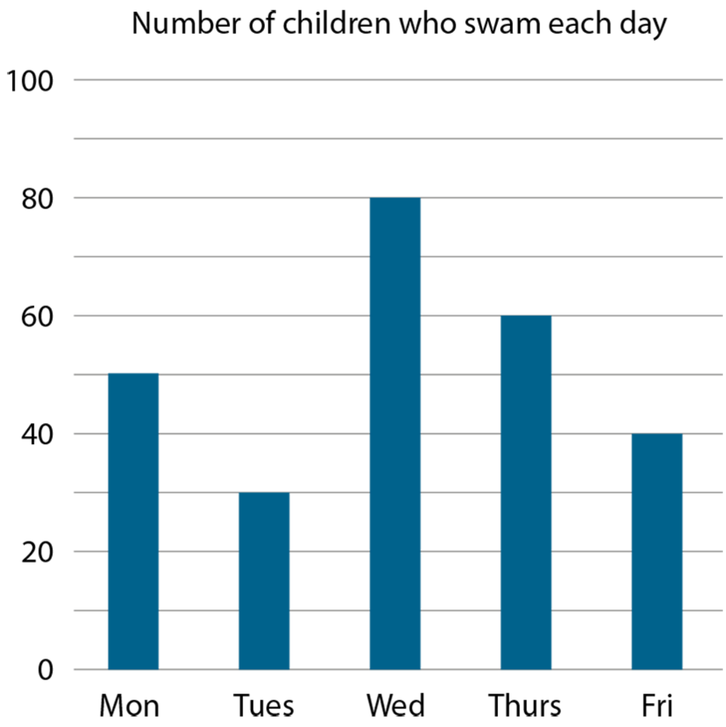
- *'John ran 400 m in 130 seconds. It took him 80 seconds less to run 200 m. How long did it take John to run 200 m?'*
  (difference)

Continue to include problems that incorporate simple measures conversions. Children should be able to explain all of the strategies presented (step *3:9* onwards), 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.

*Note that the data context shown opposite also involves practice reading scales based on the multiplicative composition of 100, covered in *Teaching point 1*.

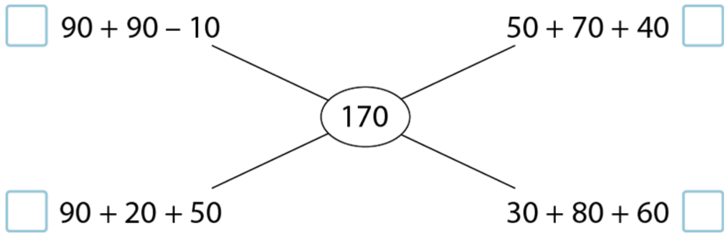
Data context:



'What was the total number of children who swam on Wednesday and Thursday?'

Dòng nǎo jīn:

- *'Decide whether each expression is true or false. Put a tick or a cross in each box.'*



- *'Find three different ways to prove that the following equation is correct.'*
  60 + 80 = 140
- *'How many different ways can you split the bar into multiples of ten so that each part is less than one hundred?'*

120	
?	?

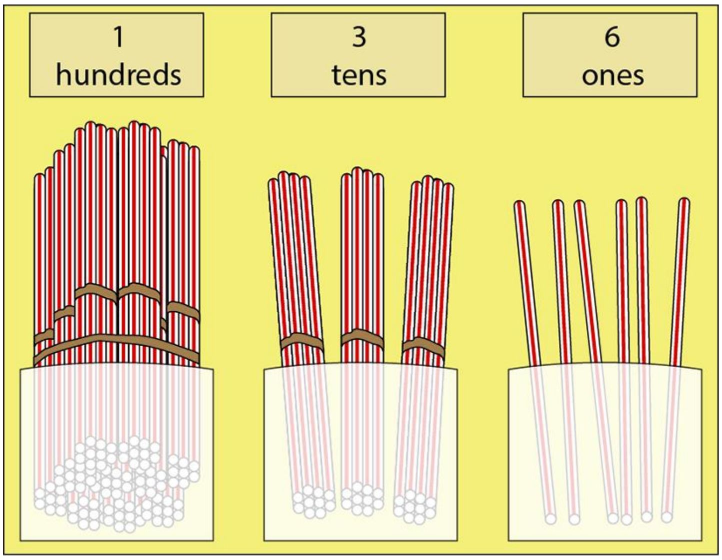
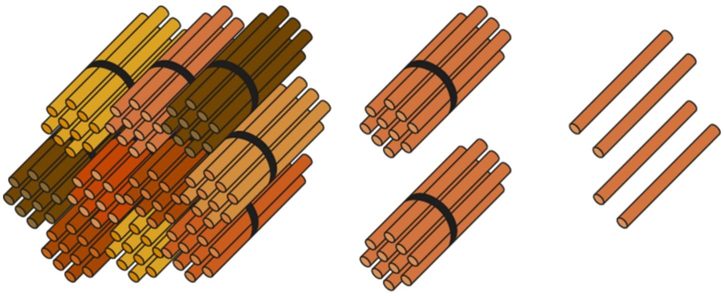
Teaching point 4:

Knowledge of two-digit numbers can be extended to count and calculate across the hundreds boundary from/to any two-digit number in ones or tens.

Steps in learning

	Guidance	Representations
4:1	In this teaching point, the following types of calculation are explored: • 98 + 7 and 105 – 7 (steps *4:5–4:6*) • 87 + 30 and 117 – 30 (steps *4:8–4:9*) To prepare children for these calculations: • practise counting across 100 in ones (step *4:1*) or tens (step *4:7*); the latter progresses from the previous teaching point, since the starting number is no longer a multiple of ten • extend children's understanding of place value so that they can confidently represent the numbers 100–199 (steps *4:2–4:4*). Begin by counting forwards and backwards over the hundreds boundary in ones, supported by a two-hundred grid or Gattegno chart, pointing/tapping as you count. Begin the forward counting at zero at least a couple of times, continuing all the way up to 199, but then practice counting from/to a number closer to 100 (e.g. 80 to 120). Similarly, count back from 199 all the way to 0 a couple of times, but then count from a number closer to 100 (e.g. 120 down to 80). The 'daily-count chart' with one straw per day is a useful way to build children's understanding of counting up to and over 100. As part of your register routine, you can place one more straw in the chart each day, grouping ten ones into one ten as each	Two-hundred grid: (see below)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170
171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190
191	192	193	194	195	196	197	198	199	200

	ten is reached, and grouping ten tens into one 100 as 100 is reached. You may wish to encourage your Year 1 and Year 2 colleagues to start this routine with their classes, so that the children you are teaching this content to, right at the start of Year 3, have had experience of counting over 100 and have started to associate these numbers with place-value equipment and numerals.	Daily count chart: 
4:2	Now, count a specific number of items between 101 and 199 (inclusive), focusing on the 'one-hundred-and-some-more' structure. At this stage, you can begin with the 100 already circled/grouped, and count on in ones, or in tens then ones, summarising the total number using the following stem sentences: • ***'There is one group of one hundred and ___ more.'*** • ***'There are ___ ___.'*** Include some examples where the cardinality of the 100 can't be seen – beginning with a £1 coin, for example, then counting on in ten-pence coins and then single pennies up to 109, or just in single pennies for numbers up to 109. Avoid using two-pence coins or five-pence coins at this stage, to preserve the one-to-one relationship between the coins and the digits of the number represented.	Bundle of 100 and 'some more':  • *'One hundred, one hundred and one… one hundred and twenty-four.'* • *'There is one group of one hundred and twenty-four more.'* • *'There are one hundred and twenty-four sticks.'* Cardinality of 100 not shown:  • *'There is one group of one hundred and three more.'* • *'There is one hundred and three pence.'*

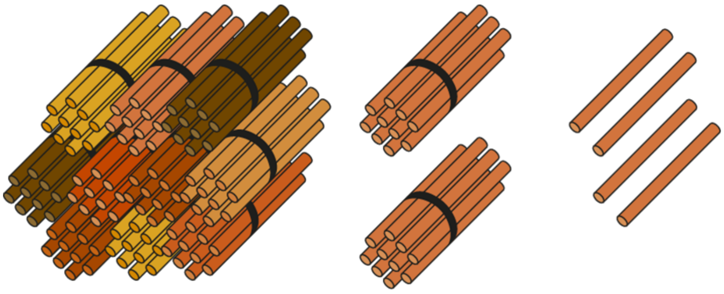
4:3

Now examine the numbers written with digits. Returning to an example used in the previous step (for example, 124 sticks), write the digits on a place-value chart, emphasising that we have one hundred, two tens and four ones. Explore a range of examples in this way, asking children to describe what each digit represents. Include some examples with no additional tens (e.g. 104).

Then, prepare some numbers with Dienes or point them out on the two-hundred grid or Gattegno chart, and ask children to say and write each number represented. Similarly say and write a number and ask children to represent it with Dienes or to point it out on the two-hundred grid or Gattegno chart. As before, when referring to place value, avoid asking questions such as *'How many tens are there in one hundred-and-four?'* (for detailed explanation and exemplar questions see step *3:4*).

Look out for children who write *'10024'* or *'1004'* to represent 124 or 104 respectively; work with them to link the physical representations to the place-value chart and emphasize the fact that all 'hundreds numbers' have three digits.

Representing 124:

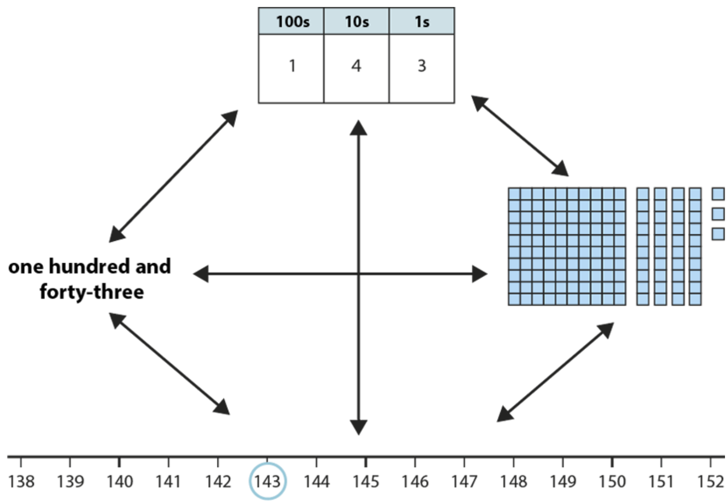


- *'The 1 represents one hundred.'*
- *'The 2 represents two tens.'*
- *'The 4 represents four ones.'*

Gattegno chart:

'Show me one hundred and six.'

1000	2000	3000	4000	5000	6000	7000	8000	9000
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

<table>
<tr>
<td>4:4</td>
<td>Now check that children can confidently move between any pair of the following representations for the numbers 101–199 (inclusive):
• the number written as digits
• the number name
• cardinal representations
• ordinal representations.</td>
<td>
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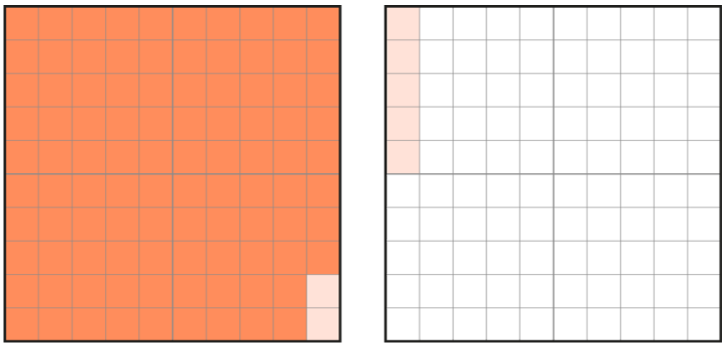
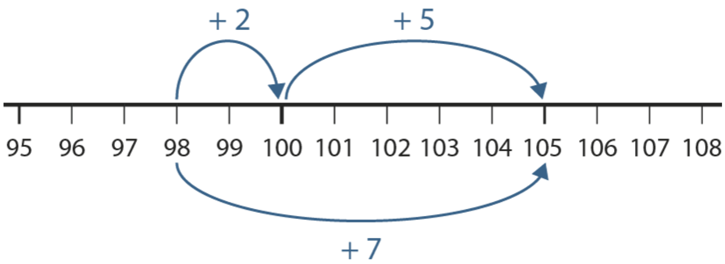
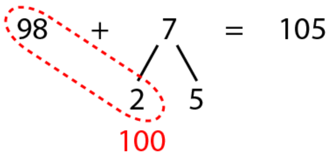
<tr>
<td>4:5</td>
<td>Once children have a secure understanding of the composition of numbers greater than 100, progress to bridging 100 with the addition/subtraction of single-digit numbers.

Begin looking at addition calculations (e.g. 98 + 7) by building on children's knowledge of making 100 (step 2:3), representing calculations using hundred grids, number lines, and equations. Encourage children to describe the steps in the calculation, for example:
• 'Ninety-eight plus two is one hundred…'
• '…and one hundred plus five is one hundred and five.'

Work through a few examples in this way before removing the scaffolding. Ensure that children can complete the calculations with jottings/equations alone, or mentally.</td>
<td>98 + 7
Hundred grids:

Number line:


Jotting and equations:


98 + 7 = 98 + 2 + 5
= 100 + 5
= 105</td>
</tr>
</table>

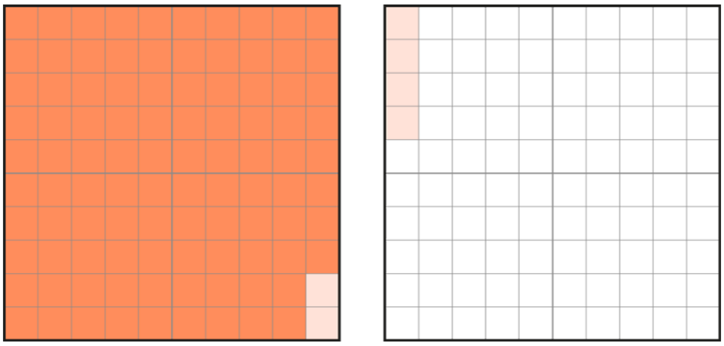
4:6

Now explore similar subtraction calculations, using a subtraction through one hundred strategy (the inverse of step *4:5*), using the same representations and continuing to encourage children to describe the steps in the calculation.

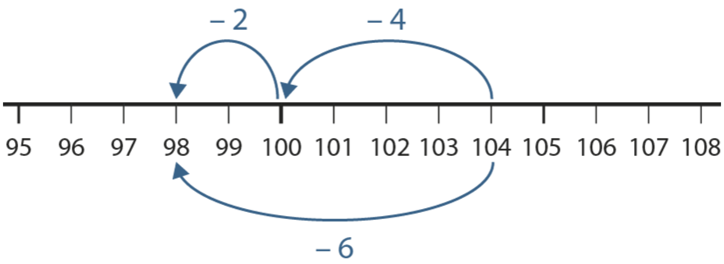
Note: another strategy would be to subtract the minuend from 100, analogous to the 'subtraction from ten' strategy discussed in segment *1.11 Addition and subtraction: bridging 10.* However, it is not necessarily an efficient strategy here since children can easily partition the minuend; the 'subtraction from one hundred' strategy, similar to 'counting on', will be more useful when we consider calculations of the form 104–98 in segment *1.19 Securing mental strategies: calculation up to 999.*

104 – 6

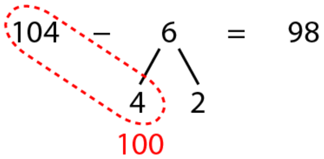
Hundred grids:



Number line:



Jotting and equations:



104 – 6 = 104 – 4 – 2
= 100 – 2
= 98

4:7

Now move on to counting in tens across the hundreds boundary, both forward and backwards, from/to any two-digit number. Initially supported by the two-hundred grid, practise counting on in tens from any two-digit number (e.g. 34, 44, 54…), drawing attention to the fact that the ones digit remains the same (this builds on segment *1.14 Addition and subtraction: two-digit numbers and multiples of ten*). Pay particular attention to the numbers closest to the hundreds boundary (e.g.

Counting in tens across 100 – covering key numbers:

81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103		105	106	107	108	109	110
111	112	113		115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140

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<tr>
<td></td>
<td>94, 104, 114 and 124); children often find the step from, for example, 104 to 114 the most challenging. After a while, begin to remove the scaffolding of the two-hundred grid, by covering some of the numbers in each counting sequence (as shown). Practise until the children can count any sequence without the grid. Take other opportunities to practise outside of the maths lesson (for example, lining up for assembly/play).

Once children can confidently count in tens across 100, both forward and backwards, from/to any two-digit number, ask them to identify ten more/less than a given number, focusing on numbers between 90 and 130, for example:
• 'What is ten more than ninety-eight?'
• 'What is ten less than one hundred and twenty-three?'
• 'What is ten more than one hundred and six?'

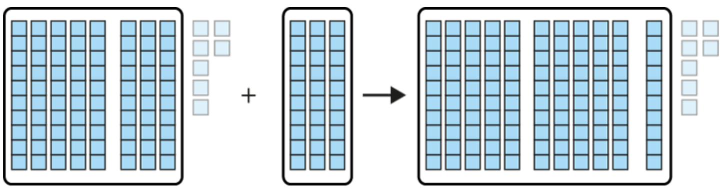
Again, you can initially provide the two-hundred grid for support, but soon start covering key numbers, then progress to working without the grid at all.

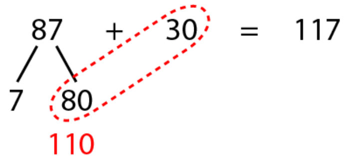
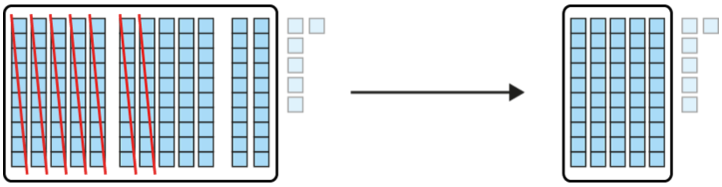
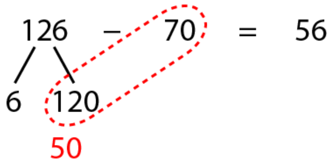
Give children practice completing sequences with missing numbers, and ten-more/less calculations near to and across the hundreds boundary.</td>
<td>Missing-number problems:
'Fill in the missing numbers.'
78 | □ | □ | 108 | □ | 128
135 | 125 | □ | □ | 95 | 85

ten more: 95 → □
ten more: 103 → □

ten less: □ ← 126
ten less: □ ← 104

99 + 10 = □
□ + 10 = 117
□ = 113 – 10
□ – 10 = 92</td>
</tr>
<tr>
<td>4:8</td>
<td>Children should now be ready for the final type of calculation in this segment – addition/subtraction across the hundreds boundary from/to any two-digit number in tens.

You can begin by using children's knowledge of counting on in tens (step 4:7) to find the answer to a given addition calculation (e.g. 87 + 30), either with or without reference to the two-hundred grid.</td>
<td>87 + 30
Dienes:

87 + 30 = 117</td>
</tr>
</table>

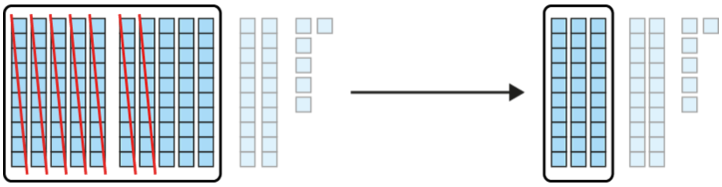
	Then demonstrate, using Dienes, that it is more efficient to add the multiples of ten together 'in one go'. This builds on children's knowledge of adding multiples of ten to bridge 100 (*Teaching point 3*). Many children will now be able to add multiples of ten across the hundreds boundary (e.g. *80 + 30*) without having to explicitly unitise. However, some children may benefit from returning to use of unitising language – if so, refer back to the stem sentences in step *3:9*. Draw attention, again, to the fact that, when we add a multiple of ten, the ones digit remains the same. Ensure that all children can apply the method using jottings or equations, and give children practice applying it to other calculations (e.g. *78 + 60*, *93 + 40*, *62 + 80*, etc.).	Jotting and equations:  87 + 30 = 80 + 7 + 30 = 110 + 7 = 117
4:9	Now look at subtraction of a multiple of ten from a three-digit number (e.g. *126 – 70*). The difference can be calculated by counting back in tens. However, there are other, more efficient methods that build on children's prior learning. Ask children to represent the minuend (here 126) with Dienes and then to explore how they can subtract the subtrahend (here 70) from it. Children may make the 100 using a hundred square or tens rods; if they use the hundred square they may not necessarily need tens rods to exchange (in order to use a 'take away' or 'reduction' approach); they could work mentally or by indicating a splitting of the minuend (in order to use a 'partitioning'). Ask children to describe and explain, using the Dienes, their various approaches, which may include (among others):	Two methods of calculating 126 – 70:   126 – 70 = 120 – 70 + 6 = 50 + 6 = 56

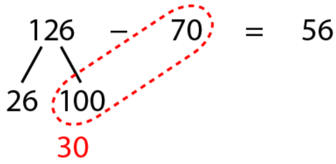
- subtracting the 26 to make 100, and then subtracting the remaining 44; this method is valid, but requires more complex arithmetic than some of the other methods (partitioning the subtrahend)
- examining the hundred square or ten tens and understanding that 70 can be subtracted from that to make 30, then adding the 26 (subtracting from 100)*
- viewing 120 as 12 tens (unitising), subtracting 70 from this giving 50, plus the remaining 6. (subtracting from 120)

Recognise the mathematical thinking in all approaches presented, representing it with jottings or equations, then discuss which are the simplest/most efficient. A key idea here is that the calculated difference (minuend minus subtrahend) is the same whichever strategy we use so we can choose. Focus on developing a flexible understanding of the composition of number so that children can think about the simplest way to remove the subtrahend from the minuend – i.e. which 'part' of the number it is easiest to subtract from.

Ensure that all children can then apply one of the simpler methods (shown opposite), using jottings or equations, and give children practice applying these to other calculations (e.g. *156 – 60, 117 – 40, 145 – 80*, etc.). Draw attention to the fact that, when we subtract a multiple of ten, the ones digit remains the same. If some children are counting up (or back) to subtract 70 from 100, or 70 from 120, encourage them instead to use known number facts.

When children are writing equations to represent the steps in their calculations, check that all expressions

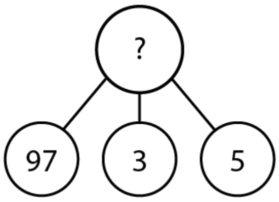
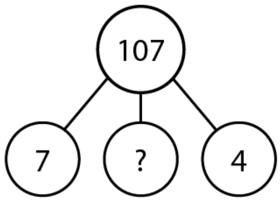
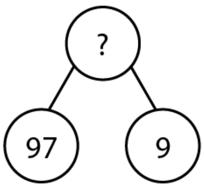
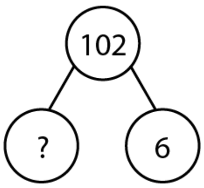




126 – 70 = 100 – 70 + 26

= 30 + 26

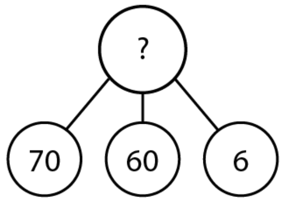
= 56

	have the same value. Children may incorrectly record, e.g. 120 – 70 = 50 + 6 = 56 ✘ (120 – 70 ↓ 50; 50 + 6 ↓ 56) This follows their sequence of thinking but is not mathematically correct. *Note that the strategy of subtracting the subtrahend from 100 is analogous to the 'subtracting *from* ten' strategy discussed in detail in segment *1.11 Addition and subtraction: bridging 10.*	
4:10	To complete this teaching point provide varied practice bridging 100 with addition/subtraction: • of a single-digit number • from/to any two-digit number in tens. Include: • part–part(–part)–whole models (bar model or cherry diagram) with a missing 'part' or 'whole' • missing-number problems • real-life problems, including measures contexts, for example: ◦ *'Frankie has 80 stickers and Lydia has 45 stickers. How many stickers do they have together?'* (aggregation) ◦ *'Mr Rayner has 104 pens. 8 of them are red and the rest are blue. How many are blue?'* (partitioning) ◦ *'A bamboo shoot was 1 m 45 cm tall. Then it grew another 30 cm. How tall is the bamboo shoot now?'* (augmentation) ◦ *'Stephan has £1 and 35 p, then he spends 60 p. How much does Stephan have now?'* (reduction)	Missing-number problems: *'Fill in the missing numbers.'*   94 + 7 = 94 + □ + 1 95 + 7 = 95 + □ + 2 96 + 7 = 96 + □ + 3 101 – 7 = 101 – 1 – □ 102 – 7 = 102 – 2 – □ 103 – 7 = 103 – 3 – □   □ = 97 + 6 103 = 98 + □ 103 = □ + 4 □ = 103 – 6 98 = □ – 5 99 = 103 – □

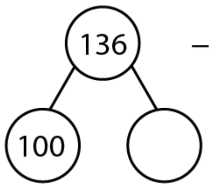
- *'Jane jumps 1 m 5 cm in high jump. John jumps 7 cm less. How high does John jump?'* (difference)

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

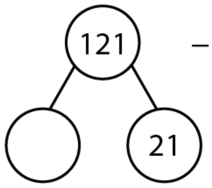
- *'Pete has £40 more than Dev. Sarah has £30 less than Dev. Sarah has £87. How much money does Pete have?'*
- *'How many different ways can you find 145 – 90? Show your methods using diagrams and equations. Which method do you prefer? Why?'*



62 + 50 = □ + 50 + 2	□ = 84 + 20
72 + 50 = 70 + □ + 2	□ = 84 + 30
82 + 50 = 80 + 50 + □	□ = 84 + 40



136 – 60 = □ + 36



121 – 40 = 60 + □

□ = 163 – 80	137 – 50 = □
□ = 153 – 80	137 – □ = 77
□ = 143 – 80	□ – 70 = 67

		Dòng nǎo jīn: *Draw lines matching each calculation with the number fact that will help you solve the calculation* **Calculations** / **Number facts** 96 + 8 = / 8 = 4 + 4 103 – 7 = / 4 – 1 = 3 99 + 5 = / 5 = 1 + 4 101 – 4 = / 7 – 3 = 4 *'How would the calculations above help you to solve the following calculations?'* 96 + 18 103 – 27 99 + 45 101 – 34