

Lesson plan

Year 1: One more than, one less than	
Focused learning objectives Stage 1: To identify one more than, when counting objects To identify one more than any given number up to 30 Stage 2: To identify one less than, using a number track To identify one less than any given number up to 30	Success criteria Count on in ones from a given number Identify one more than a given number on a number track Use the language 'one more than' in a number sentence Count back in ones from a given number Identify one less than a given number on a number track Use the language 'one less than' in a number sentence
Vocabulary one less than, one more than	
Resources <i>Stage 1</i> • Bag or tin and some counters (a tin helps to create opportunity for the listening aspect to counting, so it is good to use counters that will make a noise as they are dropped into the tin) • Number tracks to 30 (one large enough for all children to see and table-top versions, one between two children) • Sets of number cards 0–29 (pairs of children need a selection within the range – so perhaps need five or six sets) • Teddy counters (one teddy between two children) <i>Stage 2</i> • Bag or tin as used in stage 1 • Number tracks to 30 (one large enough for all children to see and table-top versions, one between two children) • Sets of number cards 2–31 (pairs of children need a selection within the range – so perhaps need five or six sets) • Teddy counters (one teddy between two children) <i>Plenary</i> • Set of number cards to show children (some numbers in range 0–30) and a bag to put them in • Whiteboards and pens for children to use	

	teddy as they do so. Children have to listen to each other and agree before they can change over roles. Each time, teddy will need to be taken off the track before the next turn. When all cards have been used, they can be turned over, shuffled and used again. <i>Support</i> Use number cards 0–10 and a number track from 0 to 11. <i>Challenge</i> Use a 1–100 number grid and a set of numbers cards reflecting this range. You only need to use a selection of the numbers; no need to have all cards 0–99.
10 minutes	Stage 2 Show the children the tin with 9 counters inside. Recount what happened at the beginning of the lesson; you put 8 counters in, then another one, so there were 9 counters, because one more than 8 is 9 (point to number track). Now ask how many there will be if you now take out one counter. Ask children to talk to their partner and agree what it would be and how they know. Take feedback, acknowledging that it would be 8, and ask someone to identify this number on the number track. Using the number track, point out the number 9 and 'tell the story': 'We had 9 counters in the tin, we took out one so now there are 8 because one less than 9 is 8 and 8 is the number before 9', connecting these ideas. Point to the appropriate numbers on the number track as you are telling the story. Ask the children to talk to their partner and take it in turns to retell this story. Explain that you will be listening to their conversations and you may ask some to repeat their 'story' to the whole class. Select one or two children to retell the story. Repeat for other numbers used, each time referring to numbers on the number track.
15 minutes	<i>Teddy moves – one less than</i> Select two children and demonstrate the activity to everyone before asking all children to work in pairs. Using some number cards in the range 1–31 (shuffled, placed face down in a stack), children take it in turns to turn over a card. Using the number track they place the teddy counter on the number they have turned over. They then have to decide where teddy needs to be placed if he has to move on to the number which is one less than the number he is placed on at the moment. They have to tell the story for teddy. 'Teddy was put on 8, one less than 8 is 7, so he has to move to 7',

moving teddy as they do so. Children have to listen to each other and agree before they can change over roles. Each time, teddy will need to be taken off the track before the next turn. When all cards have been used, they can be turned over, shuffled and used again.

Listen in to conversations and identify two children who are using the correct language for their activity. Ask them to demonstrate to others what they are saying and praise the two children for carrying out the activity so well and using the correct language to tell the story.

Support

Use number cards 2–11 and a number track from 1 to 10.

Provide them with the phrase 'one less than' on a card that they can use when telling the story. Model the activity again before asking the children to work in pairs.

Challenge

Use a 1–100 number grid and a set of numbers cards reflecting this range. You only need to use a selection of the numbers; no need to have all cards 2–101.

Some children might be challenged to use numbers beyond this range. Make sure they can carry out the activity for numbers 1–100 without using the grid before this challenge is set.

Timing
10
minutes

Plenary/conclusion

Put the number cards in a bag. Invite a child to take one out and read it to the rest of the children. Ask children, 'On your boards, can you write down the number that is one more than . . .'. Allow a few seconds and then ask all to show their number. Now model giving the answer. 'One more than . . . is . . .'.

Repeat this several times but now ask a different child to give the answer starting with the words, 'One more than . . .'.

Now repeat as above, drawing numbers out of the bag but this time asking if children can write down the number which is one less than the number drawn from the bag, following it up with your modelling and then asking children to give the answer in a sentence, 'One less than . . . is . . .'.

You may need alternative ways for some children to provide the number asked for (if they have difficulty writing the numbers). You could, for example, use a grid of numbers up to 30, and they can 'answer' by pointing to the numbers on the grid as they speak.

Assessment opportunities

Whilst they are working, ask children questions such as these. You might want to focus on those children whose level of understanding you are unsure about. These might be children you think are unclear or children whose thinking you can extend.

- Can you explain to me why teddy has been moved from 20 to 21?
- Suppose someone said that teddy now needs moving to 23. Would they be right?
- This teddy has just been moved to 17. What number has he been moved from? Why?
- You've written the number 27 on your board. Why do you think one less than 28 is 27? How might you use the number track to explain to someone who wasn't sure?
- If one more than 68 is 69, what number do you think is one more than 78?

Commentary

This lesson aims to encourage children not only to understand the concept of 'one more than' and 'one less than' but to use this language themselves. As Gifford (2005) points out, some children can tell you one more than/one less than a number but do not necessarily use the language of more than/less than themselves. Children are sometimes expected to understand and use language that they themselves rarely utter, unless it is made part of the activity and, as in the case of this lesson, unless someone else is listening.

The main part of the lesson uses a number track as a representation of the number sequence and offers this as a visual image to support their mathematics. The plenary uses no such image (although there is a suggestion for some children who might need support in 'recording' their answer) and it is hoped that children will be able to identify 'one more than' or 'one less than' a seen number - so there is some level of support, but not as much as in the main part of the lesson. It will be interesting to see whether/which children struggle without the sequence of numbers in sight.

Lesson plan

Year 2: Place value

Focused learning objectives

Starter: compare and order numbers from 0 up to 100

Main: Recognise the place value (quantity value) of each digit in a two-digit number (tens, ones)

Success criteria

Read two-digit numbers

Know that the numbers are in order on a number line or in a hundred grid and use these to help order numbers

Know which digit is the tens and which digit is the ones in a given two-digit number

Use practical resources and/or images to represent the number of tens and ones in a given two-digit number

Vocabulary

tens, ones, digit, two-digit number, in order, between

Resources

Starter

- Number card for every child (a selection of numbers between 0 and 100 appropriate for the class)
- Set of pre-prepared 'selection' cards and one blank card in a bag, e.g.

More than 40

Between 10 and 20

Less than 50

Main

- Individual whiteboards and pens
- Bags of balloons with ten in each bag (or the lesson context could be changed to another resource that is packaged in tens)
- A set of numbers for each pair of children to use during the main activity (these can be differentiated)

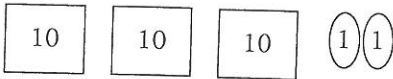
Timing

10/15 minutes

Starter

Take the children out on to the playground. Altogether, rehearse counting in tens and counting in ones from a multiple of ten, e.g.

- Count in tens from 0 to 100
- Count in tens from 30 to 80
- Count in ones from 30 to 42

	Now give each child a number card so each child has a different number. Explain that you are going to ask some children to get in order. Ask the children to talk to the person next to them to agree what 'in order' means and take feedback. Now choose five children and ask them to see if they can get in order. Ask all the children to watch carefully to see whether they agree. When everyone agrees that the five numbers are correctly placed, choose another five children and ask them to position themselves amongst the numbers already there so that all the numbers are in the right order. Continue to add five children to the line until all numbers have been placed. Now, using the bag of cards, ask a child to take out one of the cards and read out what is written. The children holding numbers that fit the selection take one step forward. Continue to take out cards from the bag for a few minutes, asking (some) children to justify their step forward. Has everyone taken at least one step forward? If not, ask children to think of what could be written on a card to allow them to move forward. Write this on a card and read it out. <i>Support</i> Number lines from 0 to 100 or hundred squares could be available for children to use and check against. <i>Challenge</i> What could you write on a selection card that would mean: • no one steps forward? • everyone steps forward?
Timing 30 minutes	Main Introduce the context for the main part of the lesson. Mr Bumble owns a balloon shop. He sells balloons individually and in packs of ten. Explain that we are going to help him with his customers today. The first customer wants 32 balloons. Ask the children in pairs to discuss how many bags and how many individual balloons Mr Bumble needs to give the customer. Draw three bags and write '10' on each bag and then draw two small balloons and write '1' on each balloon. Count in tens and write '30' underneath the packets and count in ones and write '2' underneath the individual balloons. Now record $30 + 2 = 32$:  $30 + 2 = 32$

Now draw two bags and five individual balloons. Ask the children how many balloons this customer has ordered. On whiteboards see if the children can write this calculation ($20 + 5 = 25$). Repeat the above as necessary and include a 'teens' number. Finally ask the children to close their eyes and try to visualise the number of packets of balloons and individual balloons Mr Bumble will give to the next customer, who wants 43 balloons. Ask the children to draw on their whiteboards what they were seeing in their heads. If there are variations in what the children have drawn, encourage these children to come to the front so you can discuss and show the rest of the class what they have drawn.

Explain that they are now going to work in pairs to help Mr Bumble in his shop. They will take it in turns to be Mr Bumble and the customer. Give each pair a set of numbers you would like them to select from during this activity. The customer will pick one of these numbers and ask for that number of balloons. Mr Bumble will then draw and record the number of balloons the customer will receive (using images and the calculation as above). The customer will try to visualise the number of packets of balloons and individual balloons. The customer must always check that Mr Bumble hasn't made a mistake!

Simplify

Ask the children to count the balloons practically into packets of ten for Mr Bumble. Focus on the teens numbers, e.g. for 13 encourage the children to put ten balloons into a packet and then put three single balloons with it. Encourage the children to describe what they have done to make the required number of balloons.

Extend

Ask the children to work in pairs. Provide them with a sequence of numbers (of balloons) which can be made by adding/removing either tens or ones, e.g. 23 balloons, 27 balloons, 47 balloons, 17 balloons, 12 balloons, 52 balloons, etc.

Explain that there is a difficult customer who keeps changing his mind about how many balloons he wants. Ask them to pick the first number (e.g. 23) and each draw the correct number of packets of balloons and individual balloons. After they have checked each other's drawings they look at the next one on the list (e.g. 27). The customer has changed his mind and now wants a different number of balloons. How can they change their drawing to represent 27? The children must explain to each other what they have done and why, e.g. 'I already had 20 balloons and three balloons, which is 23, so I needed to add another four balloons to give me 27'.

	This activity could be recorded in their books or on an activity sheet, with the different numbers shown. This means that changes made are recorded. Try to encourage the children to decide how they might record the changes so that anyone reading their work would be able to follow what they had done.
Timing 10 minutes	Plenary/conclusion Write the numbers 23 and 32 on the board. Ask what is the same and what is different about these two numbers? Ask the children to share their ideas with a partner before sharing ideas as a whole class. Ask further questions to probe their understanding, e.g. • How many packets of balloons would I need for 23 balloons? For 32 balloons? • Would you rather be given 23 sweets or 32 sweets? Why? • Would you rather have 23 days or 32 days left until your birthday? Why? • What else can you tell me about number 23?
Assessment opportunities Whilst they are working, ask children questions such as these. You might want to focus on those children whose level of understanding you are unsure about. These might be children you think are unclear or children whose thinking you can extend. • Can you explain to me why the picture you've drawn shows 43 balloons? • This picture shows three bags and four balloons. Would this be right for a customer who asked for 43 balloons? Why? • This picture shows 43 balloons. If a customer wanted 63 balloons, how many more do you need to give the customer? • What if a customer wanted 48 balloons but Mr Bumble only has two packets left but lots of single balloons? Can he give the customer what he has asked for? How could he do this? Could we write a numbers sentence to show what this would look like?	

Commentary

This lesson aims to make use of a real-life resource to help bridge the gap between the real world and the classroom and to help children see contexts in which it is helpful to recognise tens and ones. Look out for, and encourage the children to find, everyday items that are packaged in tens. You could create an interactive display that encourages children to create a visual representation of numbers using a range of materials either grouped in tens or as individual items; for example you might have interlocking cubes in towers of ten and some everyday objects in groups of ten. To help children gain a

broad understanding of place value, you can also integrate many of these contexts into your lessons.

Other particular features of this lesson include:

- using the outside environment;
- developing understanding through concrete materials, symbols, language and pictures;
- visualisation;
- asking related probing questions during the plenary to assess the depth of their understanding.

Mathematics does not have to take place sitting down within the classroom. Working outside and utilising the space that this environment offers can provide more opportunity for children to be active and physically engaged in their learning. In this lesson the outside space gives all of the children room to order themselves. In other lessons you might also look out for mathematics that can be found in the natural and built environment to show children that mathematics is part of the real world. The Council for Learning Outside the Classroom believes that all children should be given the opportunity to experience lessons beyond the classroom walls and actively champion learning outside the classroom to enable children to learn through the real world and hands-on experience (www.lotc.org.uk/about).

The lesson also makes use of concrete materials, symbols, language and pictures. These are the four key components of mathematical experience that Haytock and Cockburn (2008) suggest we can use to help children develop their understanding of number. Within this particular lesson packets of balloons provide the real and concrete materials, the language of quantity value is reinforced throughout, children are encouraged to draw images of the mathematics (by sketching images of the balloons) and they are also encouraged to represent the balloons using mathematical symbols.

Practical and concrete resources are important to mathematics learning as without them the subject can become very abstract. Helping children to internalise images of practical and concrete materials can help them to manipulate them in their minds so that they can still see the mathematics when the resources aren't available. In this lesson children are encouraged to close their eyes, visualise some mathematics and then record what they are seeing. This is also a helpful technique to help you to know what images of mathematics they are beginning to develop.

Questioning is a vital element of mathematics lessons and a few good questions within a lesson plan can help to assess the depth of children's understanding and uncover any misconceptions that may be developing. Within this lesson a key question used in the plenary is, 'What is the same and what is different about these two numbers?' This open question will allow children to make a range of different contributions and provides an opportunity to assess their understanding. It is also a very adaptable question that can be used in lessons that cover other areas of mathematics (e.g. What is the same and what is different about these two shapes?).

Lesson plan

Year 3: Patterns when counting in multiples	
Focused learning objectives	Success criteria
Starter: Use multiplication facts for the 2, 3, 5 and 10 multiplication tables	Describe a pattern made by multiples of 4
Main: Explore patterns in multiples of 4 and 8	Describe a pattern made by multiples of 8
Vocabulary	
number sentence, multiple, digit, units digit, times, groups of, lots of, commutative	
Resources	
<i>Starter</i>	
Individual whiteboards and pens for the children	
<i>Main</i>	
- Copies of 'multiples of 4' table and 'multiples of 8' table for children who may have difficulty generating this format independently (see example in the main part of the lesson) - Copies of digit wheels the children can use for recording - Multiplication grids (see Models, images and practical resources section at the back of this book) to support children who are struggling to recall multiples of 4 or 8	
Timing	Starter/introduction
10/15 minutes	Write the following numbers randomly on the board: 2 3 5 10 15 20 Ask the children to choose three of the numbers to make a multiplication number sentence. How many different number sentences can they record on their whiteboards? Invite contributions from the children and write their responses systematically on the board, e.g. $2 \times 5 = 10$ $2 \times 10 = 20$ $3 \times 5 = 15$ $5 \times 2 = 10$ $10 \times 2 = 20$ $5 \times 3 = 15$ Ask children why they think you have recorded them in pairs. Take feedback. Explain that when you multiply two numbers together it does not matter which number comes first (you may want to let the class know that because of this, mathematicians say that multiplication is commutative). Draw an array/grid on the board to reinforce this.

For example, Figure 7.1 shows not only 2 rows of 5 but also 5 columns of 2.

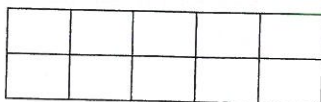


Figure 7.1 An array

You may also want to show them a pegboard arrangement and demonstrate rotating the board through 90 degrees.

Now ask the children if they can think of and record other pairs of multiplication number sentences that have an answer of 20. This time record these randomly on the board and then ask children to identify pairs of calculations to show that multiplication is commutative.

Finally pick one of the number sentences, e.g. $4 \times 5 = 20$, and ask the children to think about and discuss with their partner different ways of reading the number sentence, e.g.

- 4 multiplied by 5 equals 20
- 4 five times equals 20
- 4 lots of 5 equals 20
- 4 times 5 equals 20
- 20 equals four times five

Take feedback.

Timing

30
minutes

Main

Explain that in the lesson they are going to explore multiples and their patterns.

Ask the children in pairs to remind each other what a multiple is and to be ready to say to the whole class a sentence using the word 'multiple'. Take feedback from different pairs of children and then agree on a class definition.

To check for misconceptions and to assess the depth of their understanding ask questions such as:

- I'm going to start at 1 and count in threes: 1, 4, 7, 10 . . . I'm counting in threes, so am I saying numbers which are multiples of 3? Why/Why not?
- What numbers is 10 a multiple of (1, 2, 5, 10)? Why?
- Ask children, in pairs, to pick another number and write all of the numbers it is a multiple of. Take feedback, asking children to speak in sentences using the word multiple, e.g. 8 is a multiple of 1, 2, 4 and 8.

Explain that in this lesson they are going to explore patterns in multiples to see how that might help them to recognise multiples of different numbers. Model, using multiples of 2, the activity you would like them to explore. Quickly complete the grid in Figure 7.2 with the support of the children (you could count together as a class or you could target individuals to fill in some of the gaps). Complete the 'multiples of 2' row first and then identify the 'units digit' in each number and record it in the bottom row.

	1	2	3	4	5	6	7	8	9	10	11	12
Multiples of 2	2	4	6	8	10	12	14	16	18	20	22	24
The units digits	2	4	6	8	0	2	4	6	8	0	2	4

Figure 7.2 Completing the grid

Once the 'units digits' have been recorded ask what the children notice. Do they see a pattern? Show how you can make a diagram of this pattern by recording this visually using the digit wheel (Figure 7.3: e.g. draw a line to join the numbers in order from the row of 'units digits' in Figure 7.2, from 2 to 4, then from 4 to 6, then from 6 to 8, etc.).

What shape do they see? Establish that this pattern creates a pentagon.

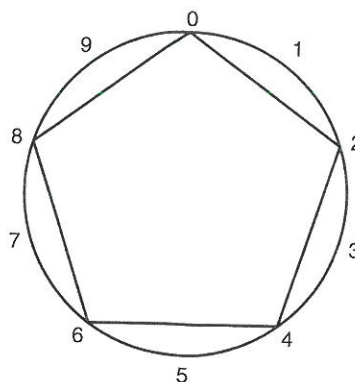


Figure 7.3 Digit wheel

Explain that you would like them to explore the digits that multiples of 4 end in and multiples of 8 end in. Quickly as a class count in 4s and then 8s and then explain that you would like them to complete a table before recording the outcome on a digit wheel. Do they think they will also make pentagons or will the unit numbers join together to make a different shape?

Reinforce that the lesson is all about multiples so this is a key word you expect them to be using throughout the rest of the lesson.

	<i>Simplify</i> Provide the children with a resource to help them to complete the multiples of 4 and multiples of 8 tables if appropriate (e.g. a multiplication square). <i>Extend</i> The enquiry could be extended by considering the patterns in the units digit and the shapes made on the digit wheel when exploring other multiples, e.g. multiples of 3, 6 and 9. Alternatively, the children could be challenged to explore multiples of 4 with larger numbers, e.g. give them the following statement: 'If the last two digits in a number are multiples of 4 then the number is a multiple of 4. Is this statement sometimes, always or never true?'
Timing 10 minutes	Plenary/conclusion Start the plenary by asking the children to get into pairs and to tell each other what patterns they noticed whilst exploring multiples of 4 and multiples of 8. Share all of the patterns the children noticed. Now ask them to use this information to answer questions such as: • Can a multiple of 4 ever end in a 7? How do you know? • Can 187 be a multiple of 8? How do you know? • If I know that the 13th multiple of 4 ends in a 2, what must the 14th multiple of 4 end in? Why? • 100 is a multiple of 4. Can you tell me some multiples of 4 bigger than 100? Finally ask the whole class to count in 2s, 4s and 8s, emphasising the units digit as they do so to reinforce the pattern you would like them to go away and try to remember.
Assessment opportunities Whilst they are working ask children questions such as these: • How can you describe the patterns you have found? • How does this help you to predict what the next number would be? • Can you now tell me a number that can't be a multiple of 4? How do you know?	

Commentary

Two particular features of this lesson include:

- developing children's understanding and accurate use of mathematical vocabulary;
- exploring patterns in number.

(Continued)

(Continued)

If we want children to talk about mathematics then we need to give them the vocabulary to do so; for example, it is much harder to describe two perpendicular lines if you don't know the word 'perpendicular'. Technical mathematical language can be used infrequently and as a result can become difficult to remember. We therefore need to provide regular and planned opportunities to engage children in using the language of mathematics within mathematics lessons. While it is important for children to listen to the teacher using appropriate mathematical vocabulary this alone is not enough. To gain confidence children also need to use the words and phrases within the context of the lesson. Within this lesson children have the opportunity to discuss the word 'multiple' with a partner before sharing ways in which it can be used within a sentence. This not only provides a good opportunity to assess their understanding but it also enables the class to hear the word used in a variety of sentences and contexts. It is also an interesting word to focus on as it has an everyday meaning as well as a mathematical meaning. In everyday life it can mean 'several' whilst in mathematics it has a very specific link to multiplication.

As teachers it is important to be aware of words with multiple meanings so that potential difficulties can be anticipated in mathematics. Think about some of the following words that are used in mathematics that children may have also encountered with a different meaning in everyday life: odd, face, difference, table, volume, product and take-away. You may want to consider buying a mathematics dictionary, using an online version or involve the children in adding their own entries into a class dictionary you develop throughout the year.

Buchanan (no date) describes mathematics as the study of pattern. When exploring multiples and multiplication tables there are some obvious and some less obvious patterns that can help to lessen the burden of memorising so many individual facts. Our place value system helps children to realise that multiples of ten only produce numbers that end with zero whilst counting in fives produces a pattern of units digits that alternate between 5 and 0. This lesson helps children to recognise that other patterns also exist when exploring other multiples and these can be represented in different ways. In this example they are represented visually using the idea of a digit wheel.

Lesson plan

Year 5: Big numbers																																																																
Focused learning objectives Starter: Recognise, read and write sequences of numbers being multiplied by ten each time Main: Recognise the value of each digit in numbers up to a million Read and write numbers up to a million	Success criteria Be able to partition numbers with up to six digits Know the value of each digit with numbers up to six digits Read numbers with up to six digits Write numbers with up to six digits																																																															
Vocabulary hundred thousand, million, place value chart																																																																
Resources <i>Starter</i> - Individual whiteboards and pens <i>Main</i> - Place value chart (Figure 10.1) with rows from millions through to units/ones – ideally an electronic version that can be annotated for the whole class to see																																																																
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Figure 10.1 Place value chart																																																																
- Sets of place value charts for pupils to use (ideally laminated so that they can be written on) - Sets of prepared number cards, reflecting differing needs. For example, one set might include numbers over a million, another set might be numbers up to a million and one set might consist of numbers up to ten thousand. You will need enough sets so that there is one set between two children (approximately ten cards in each set) - Individual whiteboards and pens																																																																
Timing 10/15 minutes	Starter/introduction Write the following numbers on the board, making sure that the digits are aligned to represent their value. Explain that you would like children to watch you and think about what you are doing.																																																															

Write:

3

30

300

Now ask the children what number you might write next, asking them to talk to their partner and agree how it would be written and read. Establish that 3 000 is the number written in numerals and three thousand is how we read it. Ask how they knew this was the next number. From the feedback given, establish that it is ten times bigger than the previous number (they may describe how the digit 3 moves into the next column or has an extra zero to show the number is bigger). Record 3 000 on the board. Continue with thirty thousand and three hundred thousand, being aware that some children may become less confident as the numbers increase. Emphasise the 'thirty' in thirty thousand, and 'three hundred' in three hundred thousand, as these are the parts of numbers some children find difficult to read. The recording on the board should help reinforce the position of the digits and the written form.

Now ask for the next number (three million) and go through the process as above. Now ask the children to read, with you, the numbers you have written down on the board. As the children read the numbers, write the number in words alongside each number on the board.

Now ask children to work in pairs and choose a different single-digit number and then take their number up to millions, recording on a whiteboard the different stages and making sure they can read each number. Take some feedback, asking a few children to read out their set of numbers to the rest of the class.

Support

Prepare a set of cards, e.g. 5, 50, 500, 5 000, 50 000, 500 000, 5 000 000, and a set of cards with the corresponding written forms. Shuffle the cards and ask children to put the number cards in order and then match up to the cards with numbers in written form and ask children to read the numbers.

Ask children to choose their own start number (between 0 and 10) and create their own set of numbers, using the card set they have to support their thinking.

Challenge

Ask children to start with a two-digit number and carry out the task as above. See how far they can take their number, being clear they can read it and say it, write it in numerals and in words. Alternatively, ask

	children to start with a number such as 403 and continue to make it ten times bigger for as long as they can! Again, it is important for children to be able to read and say their numbers. Children could then be asked to choose their own start number.
Timing 30 minutes	Main Show the place value chart (see Figure 10.1 on page 95) and ask children to talk to the person next to them about what they can see and what they notice. Ask them to think of three things each. Take feedback and establish that the numbers in the rows are increasing from ones/units to millions. Point to a number and ask someone to read the number being pointed to. Repeat for different numbers. Now model combining numbers, e.g. underline/circle 2 000, 900, 30, 7 and explain that if we combine these numbers our combined number would be two thousand, nine hundred and thirty-seven. Point to each component part as it is read and write it as 2 937. Now circle several numbers in different rows, reading them as you do so, e.g. circle 6 000, 500, 70, 4. Ask the children to discuss with a partner and agree how to say and write the number that is obtained when these parts are put together. Repeat several times, going up to tens of thousands and then hundreds of thousands. Note that using tens of thousands and hundreds of thousands gets tricky because you cannot simply read the component parts; you have to wait to see what follows. For example, if you circle 300 000 and then 70 000, you need to know both numbers before you can put them together to give three hundred and seventy thousand. It will therefore be easier to let the children know all the numbers before they try to combine the different parts. Establish how the numbers are said and how they are written, in numerals and in words. Children could be asked to record these numbers on their whiteboards. Do allow time for children to discuss these numbers before asking them to record the numbers (in numerals and in words) on their whiteboards. Now write down a number (e.g. 54 923) and ask children which numbers on the chart would need to be circled to create the number you have written. Again, ask them to discuss with a partner and perhaps record on their whiteboards. Repeat this several times, making sure that at least one of the numbers modelled contains zero. e.g. 603 567. Explain that children are now going to be number detectives and find the parts that make up a number. Model the activity as follows. Using a set of cards (maybe those up to a million) ask a child to choose one of the cards. Show it to the class. Can they say the number to their partner? When all are agreed, draw attention

	to the place value chart. Now, can they discuss with their partner which numbers would need to be circled to combine together to create the number on the card? Ask children to feed back and instruct you to circle the numbers – encourage them to be clear in their instructions and ask them to give you them in order of size, one number for each digit. Carry out their instructions and then ask if this is correct. Try to avoid making any judgement at this stage; you want the children to tell you whether the correct numbers have been circled. When all agree, explain that they are going to do this activity in pairs, using different sets of cards. Set up the activity in pairs so that one person chooses a card and reads it out to the partner. When the partner agrees it has been read correctly they circle the numbers needed for each digit and when both children agree this is correct, they record the number, e.g. 57 302, and write down the numbers they circled, e.g. 50 000, 7 000, 300, 2. Emphasise that they must read out the number on the card before finding the numbers on the grid. When they have done this, children can write down the number in words. <i>Support</i> Use cards with fewer digits. <i>Challenge</i> Use cards with numbers up to and beyond a million. An extension for all groups is to write their own numbers for their partner and carry out the activity as above.
Timing 10 minutes	Plenary/conclusion • Ask pairs to talk about which numbers they found easy and which numbers they found difficult. Take feedback and then provide some additional numbers for them to consider. For example, 7 000, 50 032, 7 824, 97 378, 124 048. Write them on the board for all to see and ask them, without circling numbers on their charts, how they would say those numbers. Are they easy? Are they difficult? Why? • Ask children if they can go away and find some big numbers – in newspapers, on television, on their computers – and bring them into school. Can we find some numbers less than a million but bigger than ten thousand?
Assessment opportunities Whilst they are working, ask children questions such as these. You might want to focus on those children whose level of understanding you are unsure about. These might be children you think are unclear or children whose thinking you can extend.	

- Can you explain to me why you've circled those numbers on the chart?
- What number would be one more/ten more/hundred more than the number on your card?
- What number would you get if you circled 400 instead of 300 on your chart?
- Can you think of a number that would only need two numbers to be circled on the chart? What about a number with six digits that only needs two numbers to be circled?

Commentary

This lesson aims to strengthen children's understanding of place value/digit value with larger numbers and provides an opportunity for them to read and write large numbers. By using the place value chart (also known as *trattegno* chart, named after Caleb *trattegno*, a French mathematics educator), children can visualise the constituent parts of a number. The chart can be an effective tool in helping children to appreciate the patterns in our counting structure. Children should have some familiarity with the layout and ways in which it can be used before carrying out the lesson described.

Lesson plan

Year 6: Understanding decimals	
Focused learning objectives Starter: solve problems involving the size of numbers Main: identify the value of each digit in numbers to three decimal places	Success criteria Know that the numbers after the decimal point are tenths, hundredths and thousandths Use the value of digits in numbers to three decimal places to identify the relative size of a number
Vocabulary place value, digit, ones, units, tenths, hundredths, thousandths, decimal, decimal point, decimal place, descending	
Resources Starter - Children may want individual whiteboards and pens to record their thinking on Main - Place value apparatus to provide visual support as necessary (see the models, images and resources suggested later in this chapter) - Sets of cards with the following or similar statements on them if the game suggested in the extension is used. - The biggest number possible - The smallest number possible - A number bigger than 5.4 - A number with 5 thousandths - A number smaller than 2.3	
Timing 10/15 minutes	Starter/introduction Explain that you are going to give the class some statements about numbers. In pairs they need to decide if each statement is: - always true - sometimes true - never true They will need to provide examples and convincing reasons for their decision and be prepared to share their answer and their reasoning with the whole class. - The more digits a number has, then the larger its value - A number with two decimal places is bigger than a number with one decimal place

3. A number that has a decimal point is smaller than a number that doesn't

Take feedback, dealing with any differences of opinion and question the children to ensure they are clear about when the statement is true and when it is not true.

Support: Ask questions to support children with their reasoning. For example ask children if they can write numbers to show that the statement is true. Then ask if they can think of any numbers that would show that the statement isn't true.

Timing

30
minutes

Main

Record a number with three decimal places on the board, e.g. 44.444, and ask the children to read the number out loud. Now ask them what each of the digits is worth. Record it on a place value grid (Figure 11.1) to emphasise the value of each digit, particularly those after the decimal point. Explain that in the lesson you want them to use the language of tenths, hundredths and thousandths when reading decimal numbers.

H	T	U	t	h	th
	4	4	4	4	4

Figure 11.1 Decimal place value grid

Ask questions to assess their understanding and to check that they understand how 0 is used as a place holder. For example, record the number 44.044 and ask the children to discuss with a partner whether they think this is a bigger or smaller number than 44.444 and why. How about 44.440? Why can we also write 44.440 as 44.44? How about 44.404? Can we also write this as 44.44? Why/Why not?

Record some of the above on the place value chart to reinforce the value of each digit.

Now record a range of different pairs of numbers on the board, such as:

97.8 and 9.87 9.78 and 9.68 9.87 and 9.867

9.678 and 9.867 968.7 and 9.687

Check that the children can identify what the digit 8 is worth in each of these numbers.

Then ask children firstly to convince their partner and then be ready to convince you which is the bigger number in each pair. Discuss their responses and ask questions such as:

- How did you decide which number was bigger?
- Which pair of numbers was the trickiest? Why?

	Now write four digits on the board, for example, 5 3 4 2. Explain that you want them to use these digits to make a number with three decimal places ($\square.\square\square\square$), for example, 5.342. Challenge them to make: • the biggest number possible • the smallest number possible • a number bigger than 5.4 • a number with 5 thousandths • a number smaller than 2.3 (why isn't this possible if you use all four numbers?) Discuss their responses. Explain that you are going to give the children other sets of digits and with each set you would like them to make numbers that have three decimal places that fit the same categories you've just used. If it isn't possible to make one of the numbers they should state why. The sets of digits could include 1 5 2 8, 1 7 3 5, 2 3 5 3, 1 5 1 5, 3 0 5 5, 2 4 0 5, 3 0 0 5. <i>Simplify</i> Adapt the activity to focus on numbers with one or two decimal places (for example, give sets of three digits to make $\square.\square\square$ or $\square\square.\square$). Provide the children with a structured resource such as place value apparatus (see the models, images and resources suggested later in this chapter) to help them to visualise the size of the numbers. <i>Extension</i> Provide children with sets with more digits to enable them to make $\square\square.\square\square\square$ or $\square.\square\square\square\square$ numbers, for example: 1 2 3 4 5, 5 3 0 4 0 2 Alternatively the activity could be developed into a game by printing copies of the categories on to cards, shuffling them and placing them face down on the table. In pairs each of the children could be challenged to make a number with three decimal places. They then select a category card and if the number they have created fulfils the category, they win a point. The first to reach 5 points wins.
Timing 10 minutes	Plenary/conclusion Record the following pairs of numbers on the board and ask the children to identify which number in each pair is the bigger number and why: • 1.516 and 1.651 • 5.053 and 5.503 • 0.165 and 0.17

- 0.2 and 0.10
- 0.650 and 0.65

Now write these numbers on the board and challenge the children to write them in ascending order.

1.023 1.03 1.320 1.302 1.3

Finally ask the children to work in pairs to suggest some useful tips they could give each other in order to know which number in a pair of decimal numbers is the bigger.

Assessment opportunities

During the whole-class teaching input and while the children are working, listen for accurate use of place value language such as tenths, hundredths and thousandths.

While the children are working ask questions to assess their understanding, such as:

- How do you know that this number is bigger than this number?
- What does this digit stand for? How do you know?

Commentary

The starter for the lesson uses 'sometimes, always, never true' statements as an opportunity for children to discuss their thinking with a partner to prepare them for justifying their reasoning as part of a whole-class discussion. This type of activity encourages children to produce examples and counterexamples to test whether a statement is true or not. Haylock (2010) discusses the key processes in mathematical reasoning and highlights the importance of engaging children in generalisations and encouraging them to consider possible counterexamples and special cases. Swan (2005) supports using statements such as these as they potentially provide the opportunity to expose children to cognitive conflict by exploring their existing beliefs and any possible contradictions. They can be used by a teacher as a mechanism to confront common misconceptions and as a vehicle to help children develop their ability to explain their thinking with conviction. The teacher therefore has an important role during such discussions to challenge learners to think deeply and develop convincing reasons.

Within the main part of the lesson children continue to be challenged by being asked to consider whether some of the numbers they are being asked to generate are possible (e.g. can they make a number smaller than 2.3 with the digits they have been given?). This again puts them in the position of explaining why but also challenges the perceptions of some children, who may believe that mathematics is always about finding the 'right answer'.