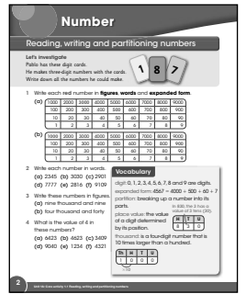
1A 1 Numbers and the number system

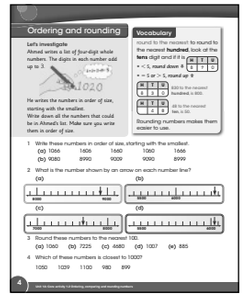
Quick reference

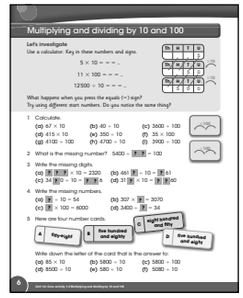
Core activity 1.1: Reading, writing and partitioning numbers (Learner's book: p2) Learners understand the place value of digits up to a four-digit number and use this knowledge to write numbers in figures, words and expanded form.

Core activity 1.2: Ordering, comparing and rounding four-digit numbers (Learner's book: p4) Learners compare numbers on a number line using the <, > and = notation. They round whole numbers to the nearest 10 or 100.

Core activity 1.3: Multiplying and dividing by 10 and 100 (Learner's book: p6) Learners practise multiplying and dividing by 10 and 100, including in the context of measures.







Prior learning

This chapter builds on work done in Stage 3 where learners worked with numbers up to 1000 exploring place value, ordering, comparing and rounding.

Objectives* – please note that listed objectives might only be partially covered within any given chapter but are covered fully across the book when taken as a whole

1A: Numbers and the number system

4Nn1 – Read and write numbers up to 10 000.
4Nn2 – Count on and back in ones, tens, hundreds and thousands from four-digit numbers.
4Nn3 – Understand what each digit represents in a three- or four-digit number and partition into thousands, hundreds, tens and units.
4Nn9 – Round three- and four-digit numbers to the nearest 10 or 100.
4Nn10 – Position accurately numbers up to 1000 on an empty number line or line marked off in multiples of 10 or 100.
4Nn11 – Estimate where three- and four-digit numbers lie on empty 0–1000 or 0–10 000 number lines.
4Nn12 – Compare pairs of three-digit or four-digit numbers, using the > and < signs, and find a number in between each pair.

1A: Calculation (*Mental strategies*)

4Nc15 – Understand the effect of multiplying and dividing three-digit numbers by 10.

1A: Calculation (*Multiplication and division*)

4Nc25 – Understand that multiplication and division are the inverse function of each other.

2A: Numbers and the number system

4Nn7 – Multiply and divide three-digit numbers by 10 (whole number answers) and understand the effect; begin to multiply numbers by 100 and perform related divisions.

1A: Problem-solving (*Using understanding and strategies in solving problems*)

4Ps4 – Explore and solve number problems and puzzles, e.g. logic problems.
4Ps5 – Use ordered lists and tables to help to solve problems systematically.
4Ps9 – Explain methods and reasoning orally and in writing; make hypotheses and test them out.

1B: Measure *(Length, mass and capacity)*

4Ml2 – Know and use the relationships between familiar units of length (m, cm and mm).

Vocabulary

digit • expanded form • partition • place value • thousand • round to the nearest

*for NRICH activities mapped to the Cambridge Primary objectives, please visit www.cie.org.uk/cambridgeprimarymaths

Core activity 1.1: Reading, writing and partitioning numbers

LB: p2

Resources: *Numbers all around us* photocopy master (p11); large version for class display. *Place value chart: 1–9000* photocopy master (CD-ROM); large version for class display. (Optional: 0–9 dice, 0–9 spinners or 0–9 digit cards (CD-ROM).)

Learners should recognise the place value of the digits in 103 as one 'hundreds', zero 'tens' and three 'ones/units' from Stage 3 (Unit 1A, chapter 1). Remind them how our number system is based on 10: ten lots of ones/units makes 10; ten lots of ten makes 100. Ask, "*What do you think ten lots of one hundred makes?*" Elicit that this makes one thousand, and this is a further column in the place value table. Explain that there are different ways we can describe a number using place value. For example, in 1830 we can say there is one 'thousand', eight 'hundreds', 3 'tens' and zero 'ones'. Or we could say that are 18 'hundreds', three 'tens' and zero 'ones'. Or, one 'thousand' and 83 'tens'. Similarly, seven hundreds (700) is the same as 70 tens; and one thousand and 10 (1010) is the same as 101 tens. Give learners some four-digit numbers and ask them to count on and back in ones, tens, hundreds and thousands using the place value table to help them. Then ask questions such as, "*What is 1 less than 4000?*" **(Answer: 3999)** "*What is ten more than 2456?*" **(2466)**, encouraging them to think of the place value of each digit as they do so.

Reading numbers

Display the *Numbers all around us* photocopy master. Learners discuss in pairs what they notice. Remind learners about place value by pointing to the picture of the car number plate (**A357 NNM**), and reading out these comments made by three learners: (1) "*I think the 3 means three hundred.*"; (2) "*I think the value of the digit 3 on the number plate is three.*"; (3) "*I don't think the 3 has a place value that is important. It's just a number in a list of letters and numbers.*" Discuss these comments with the class. Ensure that learners understand that groups of digits can have different purposes. For example, place value is important when recording a score of 3 or 30, but is irrelevant in a telephone number.

Reading, writing and partitioning numbers

Explain that a palindromic number reads the same when written forwards or backwards. Show how **343** is a palindromic number and ask learners to give other examples.

Vocabulary

digit: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 are digits; we use digits to make up the numbers we need.
place value: the value of a digit is determined by its position. For example, in 1830 the 3 is worth 3 tens (30).

Th	H	T	U
1	8	3	0

Each place value can only contain a single digit; if there are 11 units, then a 1 is placed in 'U' and the other 1 is carried over to 'T'. For whole numbers, you must **always** have a digit in a smaller place value to the right in order to show the size of the number; zero is the placeholder.
partition: breaking up a number into parts.
expanded form: what you get when you partition a number according to place values, e.g.

$$4567 = 4000 + 500 + 60 + 7$$

thousand: a four-digit number that is 10 times longer than a hundred.

Opportunity for display

Display examples of numbers from newspaper articles, magazines and photographs.

Take examples, such as **9779** and:

- **write** the number on the board
- **say** the number, "*Nine thousand, seven hundred and seventy-nine*". As you say 'nine thousand' point to it on the place value chart. Repeat for seven hundred, for seventy and for nine.
- **partition** the number into thousands, hundreds, tens and units: 9000 + 700 + 70 + 9.

Challenge pairs of learners to write down all the four-digit palindromic numbers where the sum of the digits is 10. Collect responses, ensuring that the numbers are written, said and partitioned (as above). Learners should be encouraged to work in an organised way. **(Answer: 1441, 2332, 3223, 4114, 5005)**.

Look out for!

Learners who write what they hear, e.g. they write '60009' when they hear **"six thousand and nine"**. *Ensure that learners understand that the position of the digit determines its value.*

Summary

- Learners are able to read and write numbers from 1 to 10 000.
- They understand the value of each digit and use this knowledge to write a number in expanded notation. For example: 9876 = 9000 + 800 + 70 + 6

Notes on the Learner's Book

Reading, writing and partitioning numbers (p2): learners investigate how many three-digit numbers they can make from the numbers 1, 8 and 7. They then practise reading and writing numbers in figures, words and expanded form.

Check up!

- "*What number is represented by 7000 + 40 + 2?*"
- "*Show me on the place value chart.*"
- "*How would you write it in words?*"

More activities

Boxes (for the whole class or groups)

You will need a 0–9 dice, 0–9 spinner or set a of 0–9 digit cards (CD-ROM); templates for the dice and spinner can be found on the CD-ROM.

Each learner draws four boxes in a row. They use a dice, a spinner or digit cards to generate numbers from 0 to 9. As each number is generated, learners decide which box to write the digit in. Once they have made a decision they cannot change it. The winner is the learner with the highest four-digit number. Learners should be asked to say their number in words. The game can be varied so that the learner with the smallest number is the winner.

Guess my number (for groups)

One learner decides on a three- or four-digit number, for example, 471. They make up some sentences to define the number. For example: "*My number has three digits.*", "*The units digit is 1.*", "*The tens digit is 3 more than the hundreds digit.*", "*The sum of the digits is 12.*" Other learners attempt to guess the number. The learner who gives the correct answer gains one point and defines the next number. Alternatively, one learner chooses a number and it is identified by other learners who ask questions with a yes/no answer. Demonstrate how learners might use questions to guess the number. For example: "*Is the tens digit less than six?*"

Core activity 1.2: Ordering, comparing and rounding four-digit numbers

LB: p4

Resources: *Number line 0–1000* photocopy master (CD-ROM). (Optional: 0–9 dice; 0–9 spinners or 0–9 digit cards (CD-ROM); *Volcanoes cards* photocopy master (CD-ROM).)

Generate a sequence (whole class mental activity)

One learner is given a four-digit starting number and the rest of the class continues the sequence following a given rule. For example, add or subtract 1, 10, 100 or 1000.

Visualisation (whole class activity)

Ask learners to close their eyes and visualise a blank number line.

- "*Using the digits 1, 2, 3 and 4, what is the largest number you can make? Visualise this on your number line.*" **(Answer: 4321)**
- "*What is the smallest two-digit number you can make? Visualise this on your number line.*" **(Answer: 1234)**
- "*Use the four digits to make a number in between your two numbers. Is this number closer to the largest number or the smallest number?*"

Learners then draw a number line, mark their numbers on it and compare their results with a partner's by stating if their number is greater than, less than or equal to their partner's. Repeat with other digits.

Rounding

Challenge pairs of learners to discuss which of these numbers gives 50 when rounded to the nearest 10: 40, 54, 57, 42, 46, 60. **(Answer: 46 & 54)**. Ask learners to explain their answers to the class.

Show a number line marked only from 3000 to 4000 (no other numbers marked). Ask learners:

- "*Where would you position 3241 on this number line?*"
- "*Is the number nearer to 3000 or 4000?*"
- "*How do you know?*"

Explain that if 3241 was rounded to the **nearest thousand** the answer would be 3000 because 3241 is nearer to 3000 than to 4000.

Show another number line marked only from 3200 to 3300.
"*What number is halfway between 3200 and 3300?*" **(Answer: 3250)**

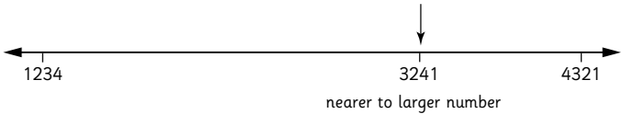
Vocabulary

round to the nearest: to round a number to the nearest *hundred* look at the tens digit:

- if it is less than 5 round down
- if it is 5 or more round up.

(Look at the place value to the right when determining to round up or down; for example, if rounding to the nearest 10, you would look at the unit place value.)

Example:



Example:

"*Where would you place 3241 on the number line? Why?*" **(Answer: less than the halfway mark because 3241 < 3250)**
"*Is it nearer to 3200 or 3300?*" **(Answer: 3200)**

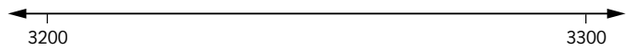
Explain that if 3241 was rounded to the **nearest hundred** the answer would be 3200 because 3241 is nearer to 3200 than to 3300. Ask:
- Look at the tens digit.
- If it is less than 5 round down.
- If it is 5 or more round up.

Repeat, to round 3241 to the **nearest ten**.
- Look at the units digit.
- If it is less than 5 round down.
- If it is 5 or more round up. **(Answer: 3200)**

Placing numbers on a number line

Display the Number line: *0–1000* photocopy master for the whole class to see. The line is marked off in multiples of 100, *(see right)*.
Explain that sometimes we need to place numbers more accurately than we did earlier.
- "*Where would I place 350 on the number line? How did you decide?*" **(Answer includes 'estimating' halfway between 300 and 400)**
- "*Where would I place 920? How did you decide?*" **(Answer includes close to 900)**
- "*How can I write a statement to show that 350 is less than 920?*" **(Answer: 350 < 920)**

Example:



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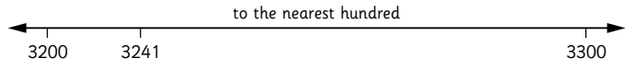

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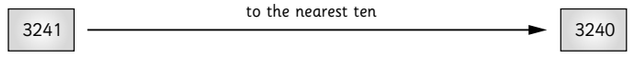

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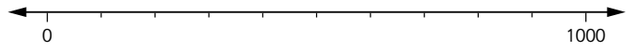


Summary

- Learners confidently use marked and unmarked number lines to locate the relative positions of numbers.
- They compare pairs of numbers using the notation <, > or =.
- When necessary, they round any whole number to the nearest 10 or the nearest 100.

Notes on the Learner's Book
Ordering and rounding (p4): begins with an investigation involving ordering four-digit numbers with digits that add up to three. It then includes questions that feature rounding, number lines and the < and > symbols.

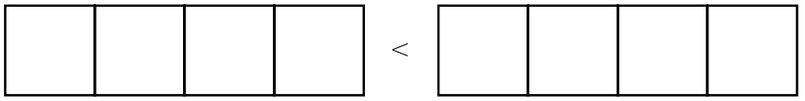
Check up!

- "*I rounded a number to the nearest 10. The answer is 830. What number could I have started with?*"
- "*The news report stated that 1500 people attended the match. What is the smallest number that could have attended? What is the largest number?*"
- "*How could you choose numbers to make this number sentence correct?* □ + Δ < 10"

More activities

Boxes again (class or groups)

You will need a 0–9 dice, 0–9 spinner or set of 0–9 digit cards (CD-ROM); templates for the dice and spinner can be found on the CD-ROM.



Each learner draws a grid including the 'less than' symbol, as shown on the right.

Use the dice, spinner or digit cards to generate eight digits. Learners write each digit in their grid, aiming to make a true statement.

Once the digit is placed, its position cannot be changed. When complete, ask:

- "*Is your statement true? How do you know?*"
- "*How did you decide where to put the digits?*"
- "*Which spaces were the most important? Why?*"

Volcano database (pairs)

You will need the *Volcano cards* photocopy master (CD-ROM); one per pair of learners.

The teacher or learners prepare, then answer, questions related to ordering, comparing and rounding numbers. For example:

- "*Name the volcanoes that are 4000 metres high when rounded to the nearest 100 metres.*"
  (Answer: Colima, Fuego, Fuji, Mauna Loa, Semeru, Tajumulco)
- "*List in order of height, lowest first, all the volcanoes less than 1000 metres high.*"
  (Answer: Surtsey 169 m, Krakatoa 813 m, Stromboli 926 m)
- "*Place the volcanoes on a number line according to their height.*"

Games Book (ISBN 9781107685420)

Find the largest number (p1) is a game for two players. It can be used to practise ordering four-digit numbers.

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Core activity 1.3: Multiplying and dividing by 10 and 100

LB: p6

Resources: *Place value chart: 1–9000* photocopy master (CD-ROM); large version for class display. *Whole-number slider* photocopy master and approximately 10 *slider strips* (p12 to 14) for **each** learner and a large version for demonstration. (Optional: *10s* and *100s dominoes* (CD-ROM).)

Multiplying by 10 and 100

Show the statement '74 metres = □ centimetres' and ask learners, "*How might we find the answer?*" Remind learners that **100 cm = 1 m** (a fact to be memorised).

Display the *Place value chart: 1–9000* photocopy master and ask, "*What is 7 × 10?*" Take answers, and then demonstrate how to model this on the chart by pointing to 7, and then to 70. Repeat for 70 × 10 and 700 × 10 and ask, "*Can you describe what happens?*" Guide them to the explanation that to multiply by 10, digits move **one place value to the left**; if this leaves any place values to the right without a digit, insert a zero. Show the results on a place value grid, for example 700 × 10.

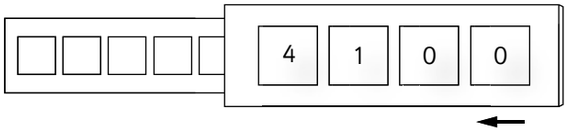
Provide each learner with a slider from the *Whole-number slider* photocopy master and demonstrate how to use it. Emphasise how the zero is placed in the unit column as a place-value holder.

Set these questions:

- "*What is 70 × 10?*" **(Answer: 700)**
- "*What is 7 × 100?*" **(Answer: 700)**
- "*What is 70 × 100?*" **(Answer: 7000)**
- "*What is the missing number in this number sentence: 7 × □ = 700?*" **(Answer: 100)**

Model these calculations on a place value grid so learners find out that to multiply by 100, the digits move **two places to the left**.

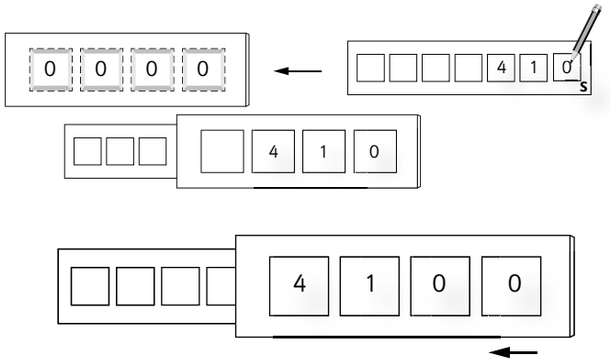
Demonstrate how the slider can be used to model 41 × 100 by moving digits two places to the left.



Example: 700 × 10.

Th	H	T	U
	7	0	0
7	0	0	0

Example: how to calculate 410 × 10 using the slider (for full instructions see the *Whole-number Slider* photocopy master).
To calculate 410 × 10.



Return to the question posed earlier: 74 metres = □ centimetres. Ask: "*What is the answer? How do you know?*" Learners should use their slider to find that 74 × 100 = 7400. Therefore, 74 metres = 7400 centimetres.

Dividing by 10 and 100

Show a similar missing number problem: 5300 centimetres = □ metres. Ask: "*How can I work out the answer?*" Establish that you must divide 5300 by 100. Learners use their sliders to 'undo' the process of multiplication to find the answer. Remind learners that multiplication and division are inverse operations, one undoes the effect of the other.

Learners work on the next activity using their sliders. Show these six numbers:

4 40 400 4000 10 100

Ask learners to choose three numbers to make a multiplication statement: □ × □ = □

Ask them to use the *same* three numbers to make a division statement: □ ÷ □ = □

Model answers. Repeat with different numbers.

Look out for!

Learners who try to apply rules that do not always work, for example:

- To multiply by 10, add a zero.
- To divide by 10, cross out the last digit.

Learners should be discouraged from applying any 'rule' that does not generalise, so 16.52 × 10 ≠ 16.520.

Summary

- Learners use a slider to model multiplying and dividing whole numbers by 10.
- They begin to multiply and divide by 100.
- Learners begin to perform calculations mentally.
- They understand that multiplication and division are inverse operations.

Notes on the Learner's Book

Multiplying and dividing (p6): learners practise multiplying and dividing by 10 and 100, including in the context of measures. Please note that the idea of the "*Let's investigate*" is that repeatedly pressing the = sign will multiply the previous answer by 10 (or 100 etc) each time. So, learners should see the following pattern:

5 × 10 = 50, 500, 5000, 50000

11 × 100 = 1100, 11000, 110000

12500 ÷ 10 = 1250, 125, 12,5

Please note that in order for this to work on some calculators, the learners would need to enter the numbers in the opposite order i.e., 10 × 5 = , rather than 5 × 10 =.

Check up!

- "*Fill in the missing numbers.*"
  608 × □ = 6080 □ ÷ 10 = 68
- "*Copy and complete.*" 43 metres = ____ centimetres
  90 metres = ____ centimetres
  7100 centimetres = ____ metres
  1500 centimetres = ____ metres

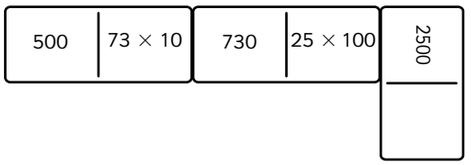
More activities

Dominoes (pairs)

You will need 18 dominoes from the *Dominoes* photocopy master (CD-ROM); per pair of learners. (You might also want to create a larger version for demonstration.)

Attach or draw a large set of dominoes on the board in a random way. Place one domino in the centre of the board and ask, "*Which domino fits on this end?*"

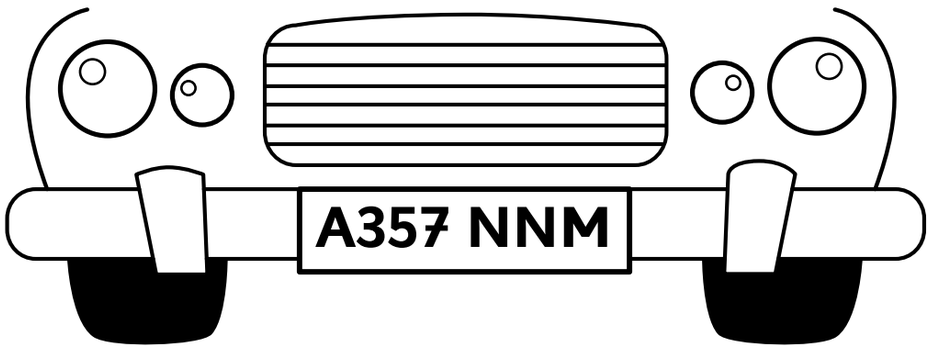
The correct domino is placed in position.

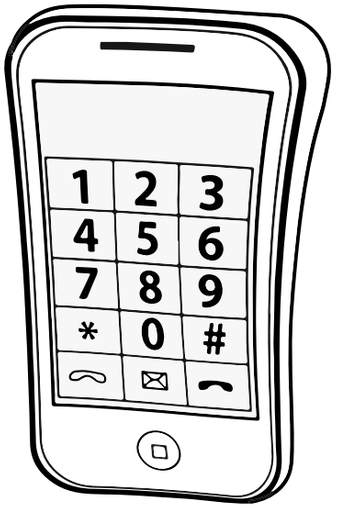


The game continues until the dominoes form a complete ring.

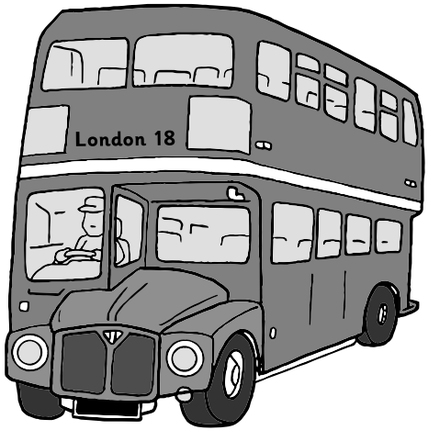
Games Book (ISBN 9781107685420)

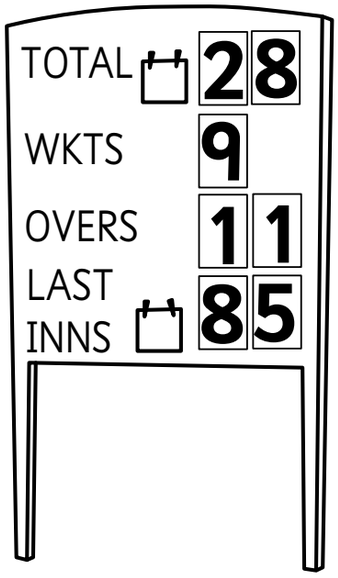
Hexalines (p1), a game of strategy for two players, involves recall of number facts and multiplication by 10 and 100.





Numbers all around us





Instructions on page 2

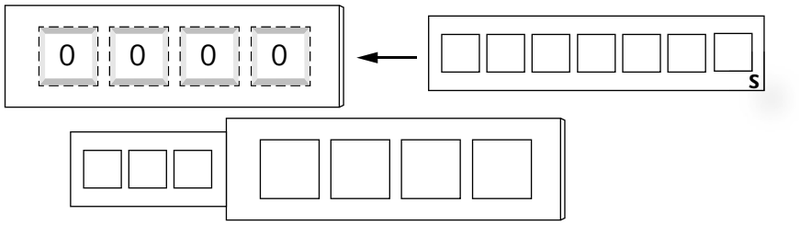
Whole-number slider

To make the slider, you will need:

- slider sleeve (see page 13)
- scissors
- sticky tape
- slider strip (see page 14).

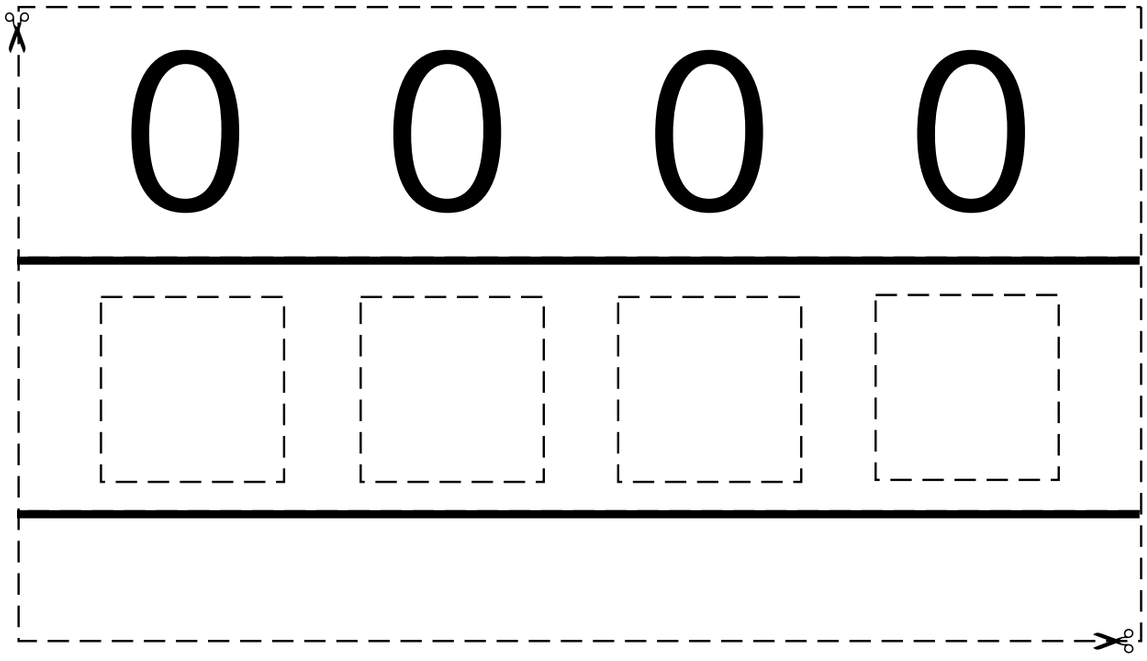
Instructions

1. To make the sleeve, cut along the dashed lines to create four square 'windows'.
2. Fold the sleeve **inwards** along the solid lines, so that you create a top flap, and the zeros show through the windows.
3. Stick down the flap to the back of the slider sleeve.
4. Fit the slider strip into the sleeve, ensuring that it slides freely.
5. When using the slider, always place it in the start position, with the corner marked 'S' hidden behind the furthest square to the right on the sleeve.



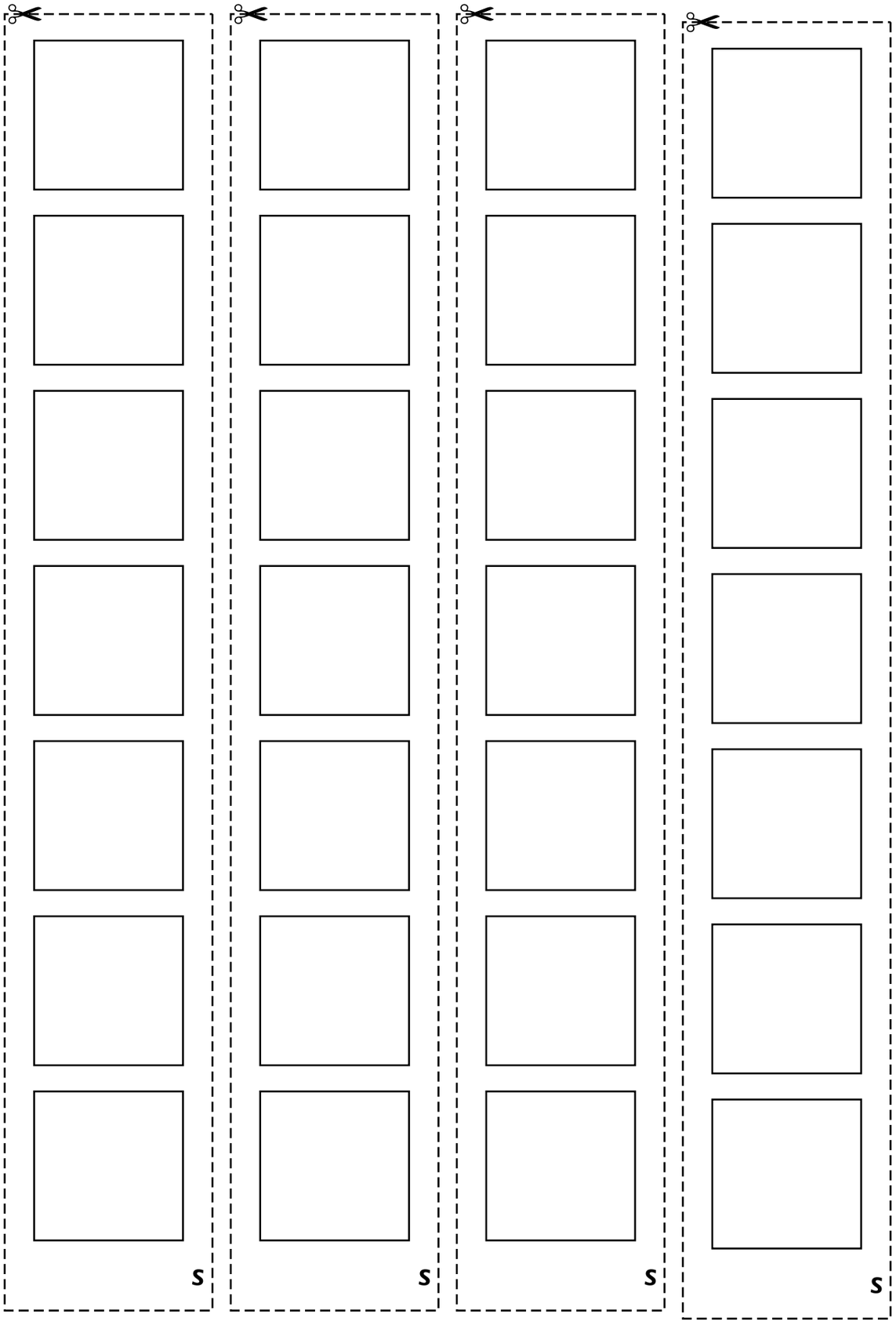
Instructions on page 8

Slider sleeves



Instructions on page 8

Slider strips



Instructions on page 8