

Year 6 Autumn 1

Unit 1: Place Value

Lesson 8: Describe and extend number sequences including powers of 10

Lesson Objectives:

Describe and extend number sequences.

Lesson Focus:

In the previous lesson, the children found powers of 10 more and less than given numbers. This lesson extends that by exploring sequences of these steps before moving on to counting in equal steps of different sizes. Initially the learning will be supported with the use of a place value chart and counters before moving to purely abstract representations. When working in the abstract way, children will be encouraged to identify patterns in the numbers in the sequence, identify the rule from a complete sequence and identify missing numbers in sequences after identifying the rule.

Starter (No more than 10 minutes)

Divide whole numbers by 10, 100 or 1,000, numbers with up to two decimal places by 10, and numbers with up to one decimal place by 100

Show page 1 of the SMART Notebook file.

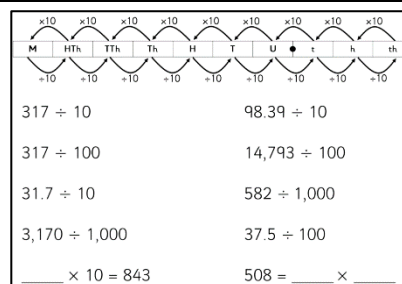
- What does the diagram show at the top?

That the place value column to the left of any is 10 times greater in value. That the place value column to the right of any is one tenth the value.

Ask children to work down the left-hand calculations, writing their answers on their whiteboards.

Mark these together (addressing any issues) before asking the children to complete the calculations on the right on their whiteboards.

Children may need reminding/showing that dividing by 1,000 is the same as dividing by 10 then by ten again (equivalent to $\div 100$) then dividing by 10 again because ten 100s is equal to 1,000.

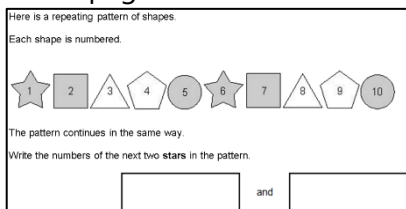


A place value chart with columns: M, HTh, TTh, Th, H, T, U, ., d, th. Above the chart are arrows labeled $\times 10$ pointing right and $\div 10$ pointing left. Below the chart are two columns of calculations:

| | |
|----------------------------|----------------------------------|
| $317 \div 10$ | $98.39 \div 10$ |
| $317 \div 100$ | $14,793 \div 100$ |
| $31.7 \div 10$ | $582 \div 1,000$ |
| $3,170 \div 1,000$ | $37.5 \div 100$ |
| $____ \times 10 = 843$ | $508 = ____ \times ____$ |

Initial Problem

Show page 2 of the SMART Notebook file with the initial problem. Read the prompt and question.



Here is a repeating pattern of shapes.
Each shape is numbered.

The pattern continues in the same way.
Write the numbers of the next two stars in the pattern.

and

Take feedback of children's responses. The Guided Learning part 2 will explain this in more detail and take the thinking further still.

Scaffold

What numbers are shown in the stars?

What is the step to move from one number to the other?

What is the step sequence for the stars?

What will you have to do with the last 'star number' to get the next?

Extension

What do you notice about all of the 'star numbers'?

Tell me three numbers between 3,500 and 3,600 that would be in the sequence.

Guided Learning

Show page 3 of the SMART Notebook file.

- Make this number on your place value chart.

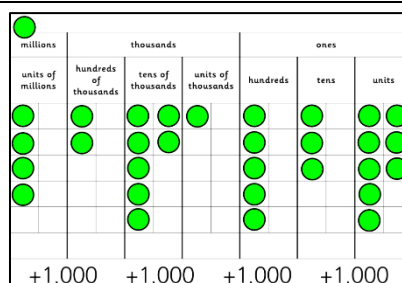
- What number is this? 4,271,538

Write this on the page in the spaces below each column.

- What are we asked to do at the bottom? $+1,000$ four times

- Show me on your charts and write the answer.

Check children's accuracy and agree that the answer is 4,275,538



A place value chart with columns: millions, hundreds of thousands, tens of thousands, units of thousands, hundreds, tens, units. Below the chart are four columns of $+1,000$ additions. Green counters are placed in the chart to represent the number 4,271,538.

hundreds of thousands column.

- On your place value charts, complete the sequence adding 200,000 four times.

Check children's answers and model on the page adding 200,000 each time. The completed slide should look like the image on the right:

| millions | hundreds of thousands | thousands | units of thousands | ones | units |
|----------|-----------------------|-----------|--------------------|----------|-------|
| 3 | 1 | 4 | 6 | 7 | 2 |
| 3 | 3 | 4 | 6 | 7 | 2 |
| 3 | 5 | 4 | 6 | 7 | 2 |
| 3 | 7 | 4 | 6 | 7 | 2 |
| 3 | 9 | 4 | 6 | 7 | 2 |
| +200,000 | | +200,000 | | +200,000 | |

Show page 14 which has the same starting number but a different step size for the sequence.

Repeat the approach for the previous page, identifying the digit that will always change and allowing children to have a go on their place value charts.

When modelling, at the point when exchange/crossing a boundary occurs, ask:

| millions | hundreds of thousands | thousands | units of thousands | ones | units |
|----------|-----------------------|-----------|--------------------|---------|-------|
| 3 | 1 | 4 | 6 | 7 | 2 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| +30,000 | | +30,000 | | +30,000 | |

- If we have 70,000 in the tens of thousands place, and we add 30,000 to it, what will we have made? 70 thousand + 30 thousand = 100 thousand

- What is the new number after the next step? 3,206,772

Write the number in and complete the sequence.

| millions | hundreds of thousands | thousands | units of thousands | ones | units |
|----------|-----------------------|-----------|--------------------|---------|-------|
| 3 | 1 | 4 | 6 | 7 | 2 |
| 3 | 1 | 7 | 6 | 7 | 2 |
| | | | | | |
| | | | | | |
| | | | | | |
| +30,000 | | +30,000 | | +30,000 | |

Repeat with page 15 which has a subtraction rule.

Show page 16 which revisits the Initial Problem.

Read the problem together to remind the children of the question, and then ask the questions at the bottom.

- What are the numbers in the stars? 1 and 6

- What is the step for the sequence? The sequence for stars is increasing by 5 or add 5.

- What are the next two stars? 11 and 16 because you add 5 to 6 to get 11 and then add 5 to 11 to get 16.

Answer the question by putting these numbers in the boxes on the page.

- What do you notice about these numbers? They are all 1 more than multiples of 5

- Tell me another number that would be in a star. Share answers and ensure children are giving the reason that the number chosen is 1 more than a multiple of 5.

Here is a repeating pattern of shapes.

Each shape is numbered.

The pattern continues in the same way.

Write the numbers of the next two stars in the pattern.

and

What are the numbers in the stars?
 What is the step for the sequence?
 What are the next two stars?
 What do you notice about these numbers?

Show page 17 with another past test question.

Read the question together and give children time to work in pairs on answering the question.

Share ideas and agree that Yes (Mary is correct) because the sequence increases by 3 each time but does not start with a multiple of 3 so a multiple of 3 can never appear in this sequence.

The rule for this sequence of numbers is 'add 3 each time'.

1 4 7 10 13 16 ...

The sequence continues in the same way.

Mary says,

'No matter how far you go there will never be a multiple of 3 in the sequence'.

Is she correct?
 Circle Yes or No. Yes / No

Explain how you know.

Ask children to complete **Guided Learning Task 2**.

Guided Learning Task 2 (Answer the questions)

e)

| | | | | |
|-----------------|----------------------|----------------------|----------------------|----------------------|
| 34 215 | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Starting number | + 0.02 | + 0.02 | + 0.02 | + 0.02 |

f)

| | | | | |
|-----------------|----------------------|----------------------|----------------------|----------------------|
| 768 332 | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Starting number | - 3,000 | - 3,000 | - 3,000 | - 3,000 |

g)

| | | | | |
|-----------------|----------------------|----------------------|----------------------|----------------------|
| 27 016 | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Starting number | - 0.005 | - 0.005 | - 0.005 | - 0.005 |

h) What is the rule for this sequence?
 (689,255) (701,255) (713,255) (725,255) (737,255)

Which pair of numbers did you use to identify the step size? Why?

Circulate and support as necessary.

Extension:

- If the final sequence continued, would the number 975,265 appear? Explain how you know.

Children should identify that 975,265 cannot appear because the tens digit is staying the same each time and 975,265 has a different tens digit.

Independent Learning

Independent Learning Tasks

o Starting number 787,400 + 100,000 + 100,000 + 100,000 + 100,000

j) Starting number 8,352 - 0.1 - 0.1 - 0.1 - 0.1

k) Starting number 56,352 - 1,100 - 1,100 - 1,100 - 1,100

l) Starting number 23,656 + 1.2 + 1.2 + 1.2 + 1.2

m) Fill in the blanks in this counting sequence:
 135,222 128,222

n) Fill in the blanks in this counting sequence:
 14.5 14.9

o) Fill in the blanks in this counting sequence:
 43,100 44,000

p) The numbers in this sequence increase by 7 each time.
 1 8 15 22 29

The sequence continues in the same way.
 Will the number 777 be in the sequence? _____
 Explain how you know.

The first four questions replicate the Guided Tasks, counting forwards and back in different step sizes. The variation being that the step size is a single power of 10 then other step sizes. Question m requires children to identify the counting step size from the two adjacent numbers given in the sequence. Question n requires children to do the same but the numbers are not adjacent: there are two steps to get from 14.5 to 14.9, so the difference of 0.4 needs to be split into two equal steps of 0.2. Question o takes it a step further in which there are three steps to get from one number given to the other, so the difference between them needs to be split into three equal steps of 300,000. All of the question m to o involve counting on and back. Question p is a previous test question in the same style as those in the Guided Learning 2.

Deeper Learning

This problem requires children to identify the difference between the two numbers in the sequence and factors of this difference. The difference between 78 and 54 is 24, so the rule could be **-24 such as 126, 102, 78, 54, 30, 6**. Other rules are derived from the factors of 24 so: **-12 such as 102, 90, 78, 66, 54, 42** **-8 such as 94, 86, 78, 70, 62, 54** **And then -6, -4, -3, -2 and -1**

Tom makes a sequence of numbers.



He chooses a starting number then subtracts equal amounts each time.

The third number in his sequence is 78.

Another number in his sequence is 54.

What could his sequence be?

Key Outcomes

Children can count on and back in equal steps including crossing boundaries.
 Children can recognise which digits will always change, which might change and which will stay the same for any counting sequence.
 Children know how to identify the rule for a sequence when given at least two numbers.
 Children can explain whether a number will or will not appear if the sequence continued.

Resources

Starter Task sheet (optional)
 Whiteboards and pens
 Place value chart
 Plain counters
 Ten frame place value grid
 Children's task sheets copied (one per child)