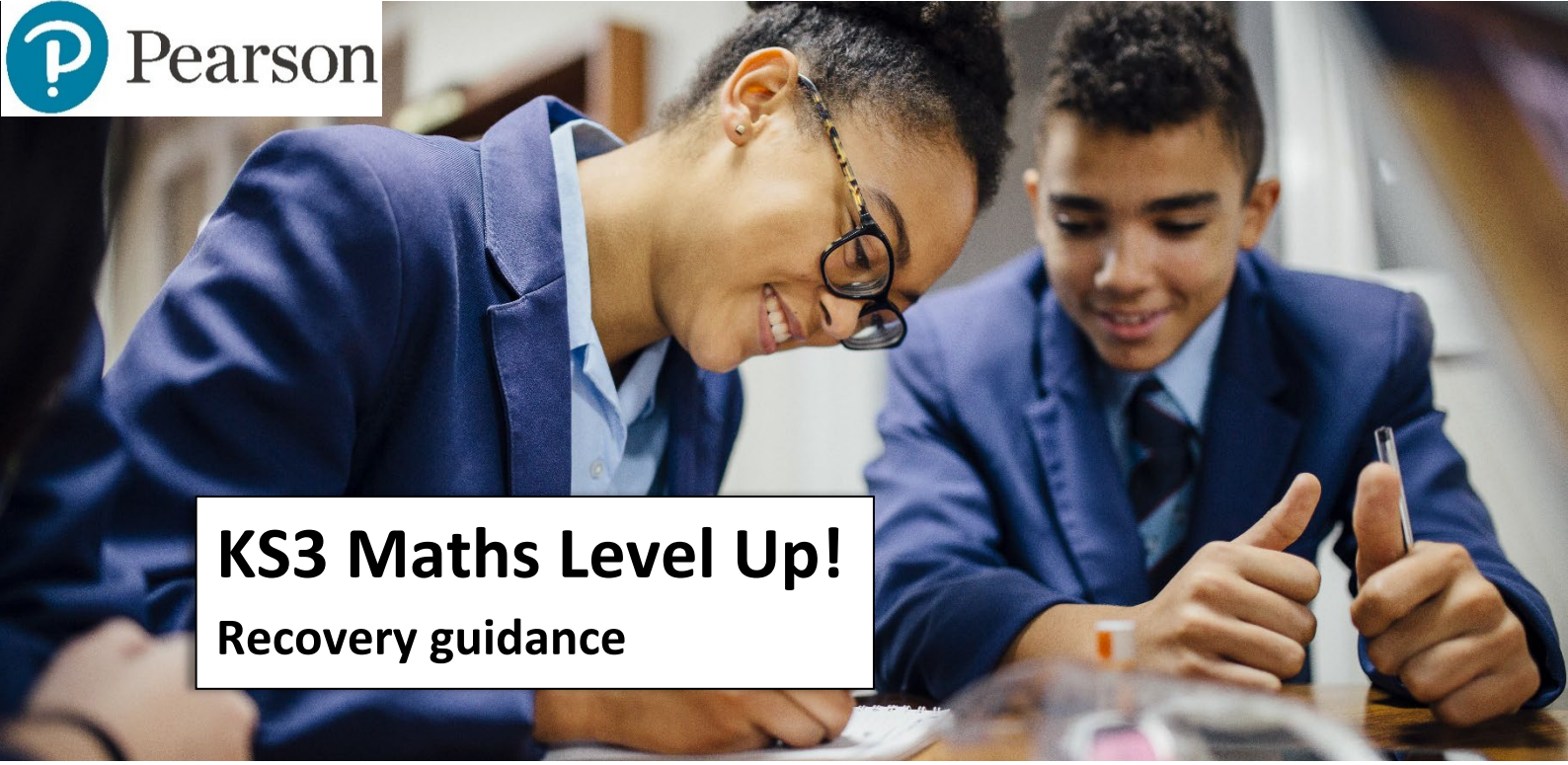


KS3 Maths Level Up!

Recovery guidance

What is the Recovery Fund Premium?

The Recovery Fund Premium has been introduced to help schools deliver evidence-based approaches to support disadvantaged students who may have fallen behind their peers over the last few years as a result of the pandemic.

Schools must show they are using their recovery premium effectively, with evidence that students have made progress. Spending plans and impact will be part of any Ofsted inspections. For more information on recovery catch-up visit: **pearsonschools.co.uk/recovery.**

How should the Recovery Fund Premium be used?

The EEF (Education Endowment Foundation) model focuses on three important areas for consideration when considering how to use this extra funding:

- **High-quality teaching:** the importance of diagnostic assessment to track student progress, concepts that need revisiting and students who would benefit from targeted individual support
- **Targeted academic support:** the importance of 1-2-1 and small group intervention, using assessment information. This support is best when delivered for brief periods of time, 15–20 minutes two to five times a week. Strong resource plans need to be developed which is where *Level Up!* comes into play
- **Wider strategies:** importance of transition, especially from primary to secondary schools, heightened by disruption and student adjustment

How the *Level Up!* series can help

Level Up! maths books provide academic support for working with target groups of students in small groups or during one-to-one support across Years 7 to 9. They are designed to:

- Support your students and raise their confidence so that they are better prepared for assessments.
- Help you know how to address the wide gaps in your school or setting and adapt teaching and learning to inspire and support students to achieve their potential despite lost learning.

- Give an integrated offer to help you understand, plan, and implement simple and effective recovery strategies.
- Provide solutions that recognise the external challenges you are facing.

Level Up! is related to the general advice from the EEF, in particular, advice relating to high-quality teaching and targeted support. *Level Up!* has targeted activities and questions for students working at the old levels 3 to 6, which cover students working at the age-related expectations of Years 4 to 7 on the National Curriculum. It is easy to assess where they are working from their responses. Activities can then be adapted to ensure to support catch-up.

Each year's curriculum has been populated with references to the appropriate units in the *Level Up!* books.

How to use the *Level Up!* mathematics resource books

Before you begin a unit, share the Unit Opener with the students. This has an introduction to what will be covered, a striking background image and interesting facts to set the scene.

Assessing the students using the Unit Opener

The Unit Opener has a quick quiz to assess students' knowledge. You might want to extend this quiz by adding extra questions or giving students some of the practice questions in each unit to assess their current attainment. This will inform your planning. If students get them correct, you can move on to the next appropriate unit.

For example, in *Level Up! Levels 3–5* Unit 1, the 'Before you start this unit questions' are:

1. Which is missing from each of these patterns?
   a. B, C, D, ___, F, G, H
   b. S, R, Q, ___, O, N, M
   c. 5, 10, 15, ___, 25, 30, 35
   d. 12, 10, 8, ___, 4, 2, 0

   Describe how you know in your own words.
2. Copy and continue these patterns.

   a. 

   b. X + X + X +

   c. 
3. Which of these numbers are even?

   7 10 25 32 56 87

You might choose to add the *Practice, practice, practice* questions 1 to 7. Alternatively, you could add a few more of your own questions which are slightly harder than the first three questions.

4. Which of these numbers are multiples of both 5 and 10?
   24 45 71 80 120 235
   Explain how you know.
5. Write down the first 3 square numbers. How do you know that they are square numbers?
6. What are the missing numbers?

   a. 12, 15, ___, 21, ___, 27, ___

   b. 90, 85, ___, 75, ___, ___, 60

   c. 12, 16, ___, 24, ___, ___, ___

   Describe how you know in your own words.

There are also two activities in the Unit Opener which you could ask students to work through independently. For example, in *Level Up! Levels 3–5* Unit 1, ask students to find all the possible whole numbers to make this statement correct:

☐ + ☐ = 12

Once they have found them all, encourage them to think of fractional answers, which they would have looked at in KS2, for example, 11 ½ + ½ = 12, 6 ¼ + 5 ¾ = 12. They could then consider decimal fractions and statements involving negative numbers. They will have looked at these possibilities in Years 5 and 6.

Revision activities

For assessment purposes there is a selection of revision activities, one for each term. Consider doing this, for the concept you are working on, at the beginning of your work with students. These consist of a quiz, an extended activity, and some questions to help assess the level at which your students are currently working.

If they are successful, you may decide to move to another *Level Up!* unit as your starting point. These are also a good check to ascertain how well your students have understood their learning of the particular concept after your teaching.

Place value, properties of number, the four operations and algebra

Below are *Level Up!* links to the concepts of place value, properties of number, the four operations and algebra. These are suitable for students working at the old levels from 3 to 5. These equate roughly to the Pearson progression scale steps 1 and 2. Each link describes in brief the big ideas of the specific units.

Lesson ideas have been included for the first of each of these units for possible 15-to-20-minute small group or one-to-one interventions. These are designed to show how you can unpick each part of the unit to make them suitable for short sessions. They can be used as a model or be adapted to more appropriately suit your students and can be used to inspire similar plans.

Understand the value of digits in decimals, measure and integers

Unit 2 Know your numbers

***Level Up! Levels 3–5* Unit 2.1: Place value**

- The value of a digit depends on its position—its place value. **(Level 3)**
- The decimal point separates the whole number parts from the fractional parts. **(Levels 3 and 4)**
- To multiply and divide whole numbers and decimals by 10, 100, and 1,000 **(Levels 4 and 5)**

First session

Use a place value chart that has the headings in numerals instead of—or as well as—letters.

1000	100	10	1	.	$\frac{1}{10}$	$\frac{1}{100}$
6	4	5	8			

Recap how to get the value of the digits in the different positions. Ask students to place digit cards into a place value chart similar to the one above.

Discuss that the 6 is positioned in the thousands position and therefore 1,000 must be multiplied by 6 to get the value of 6000. Repeat for the other three digits and then to get the whole number add the different values: 6000 + 400 + 50 + 8 = 6,458.

Repeat this until students understand how numbers are made. Then ask students to make the numbers in practice question 1 in their grids and to write them in both words and numerals.

Note: Students may be unfamiliar with cheques, but Q2 offers them as a way to practice writing numbers in words. You may wish to begin by showing them a cheque and explaining how they were used.

Second session

Q3 asks students to identify the value of the 5 in different numbers. Decimals are included. Before working on this, ask students to make numbers with first one and then two decimal places in their grids. For example:

1000	100	10	1	.	$\frac{1}{10}$	$\frac{1}{100}$
6	4	5	8		7	2

Explain how the values of the tenths and hundredths are worked out: 7 is in the tenths position so 1/10 must be multiplied by 7. Students can count in tenths to make 7/10. The 2 is positioned in the hundredths position, so 1/100 must be multiplied by 2. Again, they could count in hundredths to find this.

Ask them to make each number in their place value grid with digit cards and identify the value of the 5 in each number. You could ask them to approach practice questions 4 and 5 in a similar way.

Third session

Q6 involves multiplying and dividing by 10 and 100. It is important students understand multiplying by 10/100 will make the number ten/hundred times greater and dividing by 10/100 will make the number 10/100 times smaller. Practice this using place value charts, physically moving the cards to make them 10/100 times greater/smaller.

1000	100	10	1	.	$\frac{1}{10}$	$\frac{1}{100}$
		5	8			

58 x 10 = 580. Students should explain that 50 becomes 500 and 8 becomes 80. There is nothing in the ones position, so zero as a place holder is put into this position. Repeat several times and then for multiplying by 100.

58 ÷ 10 = 5.8. They should explain that 50 becomes 5 and 8 becomes 8/10. Repeat several times for dividing by 100.

Finally, repeat this process for multiplying and dividing by 1,000. By this stage they should be able to draw their own place value grids with a section for 1/1,000s.

Students should then work on practice Q6 to Q9.

Fourth session

Q10 puts this concept into the context of measurement. It is important to recap the equivalent units for each measurement: 1,000 g = 1 kg, 1000 ml = 1 l, 100 cm = 1 m. You might need to spend time converting between these measurements. For example, by asking if I know that 1000 g = 1 kg, what else do I know? Expect them to come up with ideas such as 2000 g = 2 kg, 10,000 g = 10 kg, 500 g = ½ kg.

Encourage them to make the given measurements in Q5 in their drawn place value grids and move to the right or left accordingly.

Now try this! Part A is a game that you could play with your student or small group in pairs. *B* is an investigation. Encourage them to work independently as an opportunity to assess attainment.

Properties of number: factors, multiples, squares and cubes

Unit 1 All in order

***Level Up! Levels 3–5* Unit 1.1: Multiples, squares and triangle numbers**

- 3, 6, 9 and 12 are multiples of 3. 10, 20, 30 and 40 are multiples of 10. **(Level 3)**
- A number multiplied by itself is a square number. **(Level 4)**
- Square numbers make a square pattern of dots. **(Level 4)**
- Triangle numbers make a triangular pattern of dots. **(Level 5)**

First session

Ask students to count in multiples of 2 from zero to 20 and back. Ask them to list the numbers they say. What do they notice about them? Draw out the idea that they all end in 0, 2, 4, 6, 8 and that they are even numbers.

Ensure students understand an even number can be divided exactly into two equal parts, but an odd number will always have one remaining. Give them cubes and ask them to make a tower of different odd and even numbers. Then break each tower into two equal parts and identify those numbers that are even and those that are odd.

Ask them to count in multiples of 5 from zero to 50 and back. Ask them to list the numbers they said. What do they notice about the ones digits? They should be able to tell you that multiples of 5 end in 5 or zero. Repeat for multiples of 10. Then ask them to complete Q1.

Use the same idea for counting in multiples of 3. Point out that the digits total 3, 6 or 9. Ask them to think of other numbers that are multiples of 3 beyond 30 using the digit total idea.

Repeat for counting in multiples of 4. Inform them that for a number to be a multiple of 4, the last two digits are divisible by 4. Ask them to make up other multiplies of 4 beyond 40 using this rule, for example, 116, 120 and 144. Ask them to complete Q2.

Second session

Students should have heard about square numbers in KS2 but are likely to need reminding. Explore the patterns of square numbers shown in Q3. Ask them to describe how each one increases in size: 2 squared has an extra three counters from 1 squared, 3 squared has an extra five counters from 2 squared, and so on.

Ask students to spot the numerical pattern: 1, 4 (add 3 to 1), 9 (add 5 to 4), 16 (add 7 to 9). Can they extend the pattern? Point out that each diagram forms a square.

Ask them to make the square numbers using counters for the first five square numbers. They then complete Q3 and Q5.

The students are unlikely to have explored triangle numbers in KS2. Together, explore the patterns of triangle numbers shown in Q4. Ask them to describe how each one increases in size: the 2^{nd} triangle number has an extra two counters from the first, the 3^{rd} has an extra 3, the 4^{th} an extra 4. Can they spot the pattern and list the next few triangle numbers? Each diagram forms a triangle.

Ask them to make the triangle numbers using counters for the first seven triangle numbers. They then complete Q4.

Third session

Ask students to write down the next 8 square numbers from 10 x 10. Allow them to use a calculator. They compare their numbers with those in Q6 and identify those that are square numbers. Ask them to complete Q7.

Now try this! A is a game that you can play with your student or in pairs with a small group.

Now try this! B is an investigation you could ask students to try independently. Encourage them to be systematic, beginning by adding 1 and 4, then 1 and 9, then 1 and 16. Then try 4 and 9, 4 and 16, 4 and 25. Then 9 and 16, 9 and 25, 9 and 36. How many can they find that add to make another square number?

Arithmetic procedures with integers and decimals

Unit 2 Know your numbers

***Level Up! Levels 3–5* Unit 2.2: Addition and subtraction**

- Use partitioning to add and subtract mentally. **(Level 3)**
- Use compensations, by adding or subtracting too much and then compensating. **(Level 3)**
- Find the difference by counting on from the smaller number to the larger number. **(Level 3)**
- Integer compliments are useful when adding and subtracting mentally. **(Level 4)**
- Use standard column procedures to add and subtract whole numbers and decimals. **(Level 4)**

First session

Mental calculation strategies are important. Students need to know when it is more efficient to use one of these strategies with jottings, a written method, or a calculator.

Spend this session focusing on partitioning to add and subtract. Keep the first number whole and partition the second number, for example, 45 + 23 = 45 + 20 + 3 = 65 + 3 = 68, 87 – 45 = 87 – 40 – 5 = 47 – 5 = 42. Work through a few examples for both operations where exchange is not needed and then progress to calculations where exchange is needed. Work with 2-digit numbers and then 3-digit numbers. Encourage students to make jottings so they keep track of what they are doing.

Ask students to answer Q1–Q3 using partitioning.

Second session

Focus on compensation which is also known as rounding and adjusting. Begin by adding and subtracting 9 from 2-digit numbers by adding or subtracting 10 and adjusting: 54 + 9 = 54 + 10 – 1 = 63 and 83 – 9 = 83 – 10 + 1 = 74. Progress to adding and subtracting 99 by adding or subtracting 100 and adjusting.

Together work through some of the examples in Q1 and Q2 where they decide which number to make into a multiple of 10 and then adjust, for example, 27 + 43 = 30 + 43 – 3 = 73 – 3 = 70 and 94 – 77 = 94 – 80 + 3 = 14 + 3 = 17. After you have worked through examples, ask the students to independently answer the calculations using this method for Q1 to Q3.

Third session

Focus on finding the difference by counting on from the smallest number. Demonstrate this using a number line as in the example shown in *What's the big idea*. Give calculations to work through together, then ask students to complete Q2 using this method, drawing their own number lines.

Students should then work through Q5 using this method. The question puts the examples in the context of finding change. The students need to know that £1 is equivalent to 100p and they count on from the costs to 100. Again, expect them to draw number lines.

Fourth session

Focus on complements to 10 and 100 particularly for addition. Give examples, such as 23 + 17 = 30 + 10, 120 + 180 = 200 + 100, for the students to work on. When confident with this strategy, ask them to work through Q4.

You could move on to *Now try this!* which is a magic square investigation. As students find the sums for A, encourage them to look for complements to 10. Magic square B finds complements to 1. Link this to finding complements to 10, for example, if 1 + 9 = 10, then 0.1 + 0.9 = 1.

Fifth session

Focus on the column method. Remind students how these work for addition and subtraction. They should be familiar with this from work in KS2. When they are ready, ask them to answer Q6, Q7 and Q8. Once they have, ask them to check their answers using one of the mental calculation strategies they have been working on in previous sessions.

They should then work on Q9, Q10 and Q11, finding sums and differences using a method of their choice. For each, they check using a different method.

Algebra: sequences, expressions and equations

Unit 1 All in order

***Level Up! Levels 3–5* Unit 1.2: Number patterns**

- A sequence of numbers can be made by counting on or back by the same amount each time. **(Levels 3 and 4)**
- Each number in a sequence is called a term. **(Level 4)**
- Find the missing terms of a sequence by working out the difference between terms. **(Level 3)**
- A sequence can be described using the first term and the term-to-term rule. **(Level 4)**

First session

Explain a sequence is a series of numbers increasing or decreasing in steps of the same amount. Begin with examples that increase in steps of 2, then 5 and 10 from zero to the 10^{th} multiple, and then decreasing from the 10^{th} multiple back to zero. Explain each number in a sequence is called a term.

Q1 to Q3 are sequences that begin on different numbers, not zero. Encourage students to work out the step size and write the whole sequence with the additional or missing terms.

They could then work through Q5 and Q6.

Second session

Q4 involves a sequence of decimal terms. Recap that decimal numbers appear to the right of the decimal point and they are numbers less than one whole. Also recap that one tenth occurs when 1 is divided by 10 (from Unit 2.1—be sure that you have covered this unit first).

You could ask students to consider what they know, for example, if a term-to-term rule is add 0.2. They could work with the sequence as whole numbers and divide their terms by 10. When they are confident, students complete Q4 and then Q7, which involves sequences for numbers with one decimal place.

Third session

Focus on Q8. Give students matchsticks, strips of paper about 10 cm in length, or something similar. Ask them to make a triangle with three of them:

Once they have made one, ask them to add two sticks to make a second adjoining triangle and then to continue the pattern:

Ask students to think about what they are doing for each new term. Agree adding two sticks for each new triangle. Can they predict how many sticks it would take to make 10 triangles? Work through the idea that all the triangles are made from two sticks, but the first has an extra one, so the 10th triangle would be 10 x 2 plus an extra one, making 21. Ask them to use this 'formula' to find the number of sticks in 12, 15 and 20 triangles.

Carry out a similar investigation using sticks to make squares. Each square will have three sticks, and there would be one extra for the end. So, 10 squares would be made from 10 x 3 + 1 sticks.

Look at Q8. Ask students to copy and complete the table. Can they tell you what stays the same and what changes? Point out that the two people on the right and left of the tables stay the same but the amount on the top and bottom increases by one each time, two altogether. Thinking back to the triangles, can they see a pattern?

Explore the idea that one table has two people and an extra two at either end, two tables have four people and two extra at either end. Can they think of a quick way to find how many people will sit around 5, then 8 and finally 10 tables? Agree that they could multiply the number of tables by 2 and add the extra two people. So, five tables would be 5 x 2 + 2, eight would be 8 x 2 + 2, and ten would be 10 x 2 + 2. Increase the number of tables to 12, 15 and 20. Expect them to be able to explain how they found the number of people each time.

Fourth session

Together work through *Now try this!* In *Part A* they need Resource sheet 1.2. Students complete number lines and use them to crack the code.

Part B asks them to make up a number sequence for either you or a partner, who finds the next three terms. They then have to figure out the 10th term without continuing the pattern. They then describe the rule and use this to find other terms.

Algebra: letters, unknowns and formulae

Unit 6 Formula 1

***Level Up! Levels 3–5* Unit 6.4: Substituting into formulae**

- Formulae can be written in words or symbols (using algebra). **(Levels 4 and 5)**
- Substituting values into a formula or an expression allows you to work out its value. **(Levels 4 and 5)**

First session

Explain that formulae can be written in words and symbols. In this session, they will focus on formulae written in words.

Work through the first part of Q1 and Q2 together, highlighting each formula. Ask students to answer the last two parts of each question independently. Q1 and Q2 are quite straightforward. Give them a calculator for the arithmetic, so they can focus on the formula.

Q3 involves an extra step. The formula states the cooking time is 20 minutes per 500g. Therefore, the additional task in this is to work out how many lots of 500g there are in 2kg, 1.5kg and 3.5kg. You could ask them to make a list or table, as below, to show this first so that they can refer to it as they work through parts b and c independently:

1 = 500g

2 = 1kg

3 = 1.5kg

4 = 2kg

5 = 2.5kg

6 = 3kg

7 = 3.5kg

8 = 4kg

Second session

Focus on Q4. Ask students to tell you what they think the first line is. Agree that this shows that different letters have different values. Ask them to change the letters into numerals and to write then answer each calculation, for example, 3 x 2 = 6, 4 + 6 = 10, 4 x 3 = 12. Ensure that they know that a number directly in front of a letter means that the letter is multiplied by that number and two numbers side by side means they are multiplied together.

If students confidently work through Q4, ask them to do the same for Q5, Q7 and Q8.

Third session

Focus on Q6, similar to Q1–Q3. The formula has been written in words and the symbol *f* has been substituted for the number of flowers in a bunch. Work through the first two parts together and then ask students to finish the question independently.

Together look at Q9. Ask students to explain what the formula is for. You might need to explain Fahrenheit and that we now use Celsius to bring us in line with the rest of the world (apart from a few countries such as the United States, who still use Fahrenheit).

Remind students of the order of operations and that, in this formula, the brackets are calculated first, then the multiplication and finally the division. Give each student a calculator to use for the arithmetic so they can focus on the formula. Together, work through part a: 5 x 90 = 450, 450 ÷ 9 = 50, 122°F is 50°C. Make up some other temperatures to convert and work through these together. When the students are confident, have them attempt parts b and c independently.

Fourth session

Work through *Now try this!* Play the game in *Part A* with your student or in your group.

Work through *Part B* row by row, and have students take turns to find the values. Can they find the number that is not there?

Algebra: sequences

Unit 1 Pattern perfect

***Level Up! Levels 4–6* Unit 1.1: Sequences**

- Sequences are patterns. Each pattern or number in a sequence is called a term. The number at the start of a sequence is called the first term. The term-to-term rule shows you how to get the next term. **(Level 4)**
- Sequences where the numbers increase are called ascending sequences. **(Level 4)**
- A sequence which carries on forever is infinite. A sequence which has a fixed number of terms is finite. **(Level 4)**
- A sequence can be made with decimal or negative numbers. **(Level 5)**

First session

Recap that number sequences are a series of numbers that increase or decrease in steps of the same size and each step is known as a term. The step size is called the term-to-term rule. Together, count in ones from zero to 10 and back. The terms increase and decrease in ones. Say the first five numbers of a few sequences that increase in steps of 2, 3, 4 and 5 from zero. Ask students to tell you the term-to-term rule. For each, count up to the 10^{th} term and back to the beginning.

Work through Q1a and 1b together. For part 1a provide counters so that students can physically extend the pattern for the next three terms. They then write it as a number sequence (1, 3, 5, 7, 9, 11) and identify the term-to-term rule. Can they predict what the 10^{th} term will be? Repeat for part 1b with matchsticks, strips of paper or similar. Students then try part 1c independently.

Second session

Q3 involves decimal numbers. Begin by counting in steps of one tenth: 0, 0.1, 0.2, 0.3 etc. Continue until they need to cross the ones boundary. Do they say 0.10 or 1? If they say 0.10, spend time to explain that this is 0.1 again, so it can't be the next term. Continue the count to 2.5. Ask students what this is similar to. Agree counting in steps of one, but the numbers are ten times smaller, or have been dividing by 10.

Practice counting in 5s to 25, then ask students to use this to write the sequence in steps of 0.5 to 5 as in Q3a. Repeat for the other parts of the question, each time counting in whole numbers first, before students apply this to the decimal count. Ask the students to complete Q4 and Q7.

Third session

Q5, Q6, Q8 and Q9 involve an emphasis on vocabulary. Ask students to write down the next three terms in Q5. Then discuss the following terms: term-to-term rule, ascending, descending, finite, infinite. Ensure that they understand what each word or phrase means. They then answer parts b, c, d and e in Q5.

They should now be able to answer Q6 and Q8.

Together work through the whole of Q9. Students need to make up three sequences with two term-to-term rules. Once you have done this together, ask them to make up three of their own with their own two rules independently. They then answer parts 9b and 9c.

Fourth session

Ask students to write the next five terms in the parts of Q10. Part 10c has negative numbers. For this, ask them to draw a number line from –10 to 10 and to mark on the given numbers, then identify the next five.

Work through a possible example for each part of Q11 and ask students to make up their own second example for each.

Together, work through *Part A* Sequence challenge 1 in *Now try this!* Give them the challenge to work through independently: *Part B* Sequence challenge 2.

Algebra: the *n*th term

Unit 10 All about algebra

***Level Up! Levels 4–6* Unit 10.1: Position-to-term rule**

- Find a term in a sequence using the position-to-term rule if you know its position. **(Level 5)**
- The *n*th term gives the position-to-term rule for a sequence. **(Level 5)**

First session

Together look at Q1a. Ask students to copy the table and add the three missing terms. Can they tell you the rule? (The sequence increases in steps of 4.) Ask them to look vertically. What happens to get from each position to each term? (Multiply the position by the sequence step of 4.) Students use this to find the 10^{th}, 20^{th}, 30^{th}, $40^{th}$and 50^{th} terms. When they multiply multiples of 10 by four, encourage them to multiply, for example, 2, 3, 4 and 5 by four and then make the product ten times greater, by multiplying by 10. Once they have done this with you, ask them to complete part 1c independently.

Together focus on parts 1b and 1d. Part 1b had a rule of add one, but it starts on 3. Discuss how they could find the 4^{th} term, without counting in ones. (They could multiply one by four, but then they add two.) Ask them to find the 10^{th} and 50^{th} terms by doing this. Part 1d begins on zero, so multiplying one by 10 and 50 won't work. Point out that the 5^{th} term is 4 which is the same as 1 x 5 – 1. Suggest they try this for the 10^{th} term (1 x 10 – 1). Together, check this out by writing the positions and the steps. If it works for the 10^{th} term, then the 50^{th} will be 1 x 50 – 1.

Together, work through Q2. Point out the positions and the terms. The positions haven't been given. Expect students to draw a table and write the positions as well as the terms.

Part 2b is slightly different. The term-to-term rule is add one, the first given term is 11, not 1. Can they multiply one by 50 to get the 50^{th} term? Agree they can't. Investigate multiplying the term by

the step increase and adding 10. Does this work for the 5th term? Agree that it does and work out what the 50th term must be (1 x 50 + 10). Part 2f involves a negative number. Again, work out the step increase, which is 1. If they multiply 5 by one for the 5th term, what else must they do? Agree they subtract 2. Apply this for the 50th term.

Second session

Focus on practice Q3. Explain that the position-to-term rule is the position of the number in the sequence and the appropriate term that goes with it as shown in the tables in Q1. Together, work through each example, using a table as in the examples below. In part 3a, ensure the students understand that 4 is added to the position number:

Position	1	2	3	4	5	6	7	8	9	10
Operation	+4	+4	+4	+4	+4	+4	+4	+4	+4	+4
Term	5	6	7	8	9	10	11	12	13	14

How would they work out the 100th term? Agree to add 4 to 100. Draw a table to show the position, operation and term for part 3b.

Position	1	2	3	4	5	6	7	8	9	10
Operation	X5	X5	X5	X5	X5	X5	X5	X5	X5	X5
Term	5	10	15	20	25	30	35	40	45	50

If they know the 10th term, how can they use this to find the 100th term? (multiply by 10) Repeat for parts 3c and 3d, drawing tables as above.

Third session

Q4 to Q8 focus on the *n*th term. Explain that the *n*th term is a way of expressing an unknown term. In 4a, the rule is to add 3. Students should begin with the position of one and add 3 to it. They do the same for the first 10 terms, writing in a table that they draw themselves.
For 4b, you may need to explain that 4*n* is the term multiplied by 5. You may wish to work through the first two parts together and then, students complete part 4c independently. Use a similar approach to Q5 to Q8, with students finishing each question independently.

Fourth session

Now try this! Part A can be used to reinforce or consolidate positions and terms. If you have time and the resources, you might want to take students through how to make a spreadsheet to find the terms in the sequence as suggested in *Part B*. If not, they could find the answers and present their results in a table that they draw.

Algebra: formulae

Unit 6 Forming formulae

***Level Up! Levels 4–6* Unit 6.4: Substituting into expressions and formulae**

- A formula is a rule which connects two or more variables. **(Level 4)**
- Use a formula to calculate an unknown value by substituting values for the letters or words. **(Level 4)**
- You can substitute values into a formula with indices to work out the unknown value. **(Level 6)**

First session

Explain that a formula is a rule which connects two or more variables and that a variable can change. Formulae can be used to calculate an unknown value by substituting values for letters or words. Show this using a formula that students should be familiar with, for example, area of a rectangle = *l* x *w*. Point out that *l* and *w* are variables, and they are given a value that isn't always the same. Substitute the *l* and *w* for values and work out the area of the rectangle.

Repeat this a few times where *l* and *w* have different values. Ask them to tell you of other formulae they have come across and explore these in a similar way.

Work through the first parts of Q1 and Q2 together and then, when you think students are confident, ask them to complete the questions independently.

Second session

Focus on Q3. This is straightforward and most students should be able to substitute the letters for their values. Ask them to write the new calculations with the values and then work out the solutions. Give other values for 3a, 3b and 3c and ask them to work through parts 3a to 3h again with these new values.

Q4a is very similar to Q3, so approach it in the same way. Q4b asks them to simplify the expressions. This is essentially collecting like terms. It also involves the shorthand way of showing a multiplication. Explain that in 4a part i, there are 3 *x*s so this would be shown as 3*x*. In 4a part ii, the simplified way is *xy*. Can they work out that part iii would be 3*z*? Can they explain why?

Ask students to make up their own expressions using *x*, *y* and *z* and then to substitute the letters for the values in Q4.

Third session

Focus on Q5 to Q7. Formulae are put into real-life contexts in Q5 and Q7. Q6 is similar to those in the second session. For 6h, students might need to be reminded what a square number is.

Ask students to read the information in Q5 and Q7 and to use it to solve the problems. In Q5, you may need to recap the number of seconds in a minute and practise converting from one to the other. You could give students calculators so they can focus on the formulae rather than the arithmetic.

Fourth session

Focus on practice Q8 to Q10. Q8 involves multiplying negative numbers. This may need exploring.

Multiplying positive integers: 4 x 3 = 3 x 4, products are always even.

Multiplying a positive integer by a negative integer: use a number line to show 4 x –3 means

0 – 4 – 4 – 4 = –12. Because of commutativity –3 x 4 must also be –12.

This multiplication grid helps explain why multiplying two negative numbers gives a positive product. Students might find it helpful to have a copy of this. Ask them to multiply different positive and negative numbers together using this table.

Once they see the pattern, they can make generalisations that multiplying a positive number by a positive number gives a positive product, multiplying a negative number by a negative number

gives a positive product and multiplying a positive number by a negative number (or vice versa) gives a negative product.

Once they have these generalisations, ask them to work through Q8.

x	- 4	- 3	- 2	- 1	0	1	2	3	4
- 4	16	12	8	4	0	- 4	- 8	-12	- 16
- 3	12	9	6	3	0	- 3	- 6	- 9	- 12
- 2	8	6	4	2	0	- 2	- 4	- 6	- 8
- 1	4	3	2	1	0	- 1	- 2	- 3	- 4
0	0	0	0	0	0	0	0	0	0
1	- 4	- 3	- 2	- 1	0	1	2	3	4
2	- 8	- 6	- 4	- 2	0	2	4	6	8
3	- 12	- 9	- 6	- 3	0	3	6	9	12
4	- 16	- 12	- 8	- 4	0	4	8	12	16

Work through the first parts of Q9 and Q10 together and then ask students to complete the questions if they feel confident.

Algebra: equations

Unit 13 Balancing act

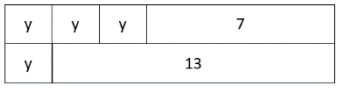
***Level Up! Levels 4–6* Unit 13.1: Solving simple equations**

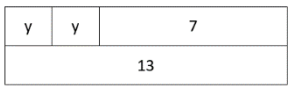
- An equation contains an unknown number and an = sign. **(Level 5)**
- You can use the balancing method to solve an equation. **(Level 5)**
- Check your answer by substituting it back into the equation. **(Level 5)**

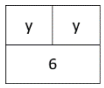
First session

Explain that an equation is different from an expression because there is a solution and it always contains an unknown and an equal to symbol, so what is on one side must be equivalent to what is on the other. Work through the idea that students can solve an equation using a balancing method. Use these examples:

$3y + 7 = y + 13$

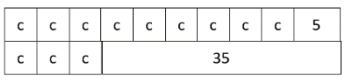




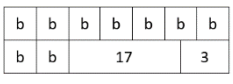


$9 + 7 = 3 + 13$

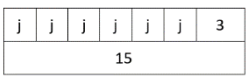
$9c + 5 = 3c + 35$



$7b - 3 = 2b + 17$



$3j + 3 = 15 - 3j$



You could give the students counters to represent the letters and digit cards for the numbers.

Other equations can be solved using the inverse. Remind students the inverse of addition is subtraction and the inverse of multiplication is division. They can use one operation to solve another.

Ask students to work through practice Q1–Q6 using whichever method suits the particular question, e.g., Q3 inverse is best, Q5 balancing would work well.

Second session

Focus on Q7 to Q13. Encourage students to use the balancing method where appropriate, for example, Q7, Q10 and Q12. Work through a few examples before they continue independently.

Properties of number

Unit 2 Number knowledge

***Level Up! Levels 4–6* Unit 2.1: Decimal know-how**

- Digits after the decimal point are fractions. **(Level 4)**
- To compare decimal measurements, all the measurements must be in the same units. **(Level 4)**
- When you multiply/divide a number by 10, the digits move one place to the left/right. **(Level 4)**
- To order decimals, first compare the whole numbers, next compare the tenths, then hundredths, and so on. **(Levels 4 and 5)**

First session

You might find it helpful to recap the positional, multiplicative and additive aspects of place value before beginning these practice questions. For example: **45.63**

The digit 4 is positioned in the tens position. 10 is multiplied by 4 to give the value 40.

The digit 5 is positioned in the ones position. 1 is multiplied by 5 to give the value 5.

The digit 6 is positioned in the tenths position. 1/10 is multiplied by 6 to give the value 6 tenths.

The digit 3 is positioned in the hundredths position. 1/100 is multiplied by 3 to give the value 3 hundredths.

The values are added together to give the whole number: 40 + 5 + 6/10 + 3/100 = 45 63/100 or 45.63.

It would be a good idea to use place value charts and digit cards. Ask students to make different numbers and then explain how the values and the whole number are made.

Ask students to complete Q1–3. Practice saying the numbers first to ensure they say them correctly, e.g., 2.365 is two point three, six, five not two point three hundred and sixty-five.

Second session

Focus on Q4 to Q6 and then Q10 to Q11, which involve ordering numbers with decimal places. It might be helpful to practice ordering numbers with decimal places first so that students are confident enough to work independently. Ensure that they think about the position of the digits and their values when they attempt to order. For example, in Q4a, 4.56 is four point five six not four point fifty six and is therefore smaller than 4.8.

Q11 uses the greater than and less than symbols to compare numbers with decimal places.

Third session

Focus on Q7 to Q9. These are about multiplying and dividing by 10. Remind students that the numbers become 10 times greater when multiplying and 10 times smaller when dividing. The digits move across the decimal point which remains constantly in the same position.

Work through one or two examples together and then ask students to complete the questions. You may wish to add some examples of your own to these.

Fourth session

Together, work through *Now try this! Parts A and B*. Both are games that you could play with your student. If working in a small group, they could play together against you.

Fractions, percentages, ratio and proportion

Unit 4 Bit parts

***Level Up! Levels 4–6* Unit 4.1: Fractions**

- A fraction can be used to describe part of a whole. **(Level 3)**
- The top number of a fraction is the numerator and the bottom is the denominator. **(Level 3)**
- Equivalent fractions are fractions that have the same value. **(Level 3)**
- You can find equivalent fractions by multiplying or dividing the numerator and denominator by the same number. **(Level 4)**
- Fractions can be simplified by cancelling common factors. **(Level 5)**
- A decimal is another way to describe part of a whole. **(Level 4)**
- Convert a decimal to a fraction by writing it with a denominator of 10, 100 or 1,000 and then cancelling. **(Level 5)**

First session

Ask students to tell you what they know about fractions. Ensure they know a fraction is the result of dividing a whole into equal parts. Talk through the terms *vinculum* (line separating the denominator and numerator), *denominator* (number of equal parts) and *numerator* (number of parts considered). Ask students to work through Q1, identifying the fraction shaded. Ask them to tell you the fraction that isn't shaded and to write the commutative and inverse facts, for example, in part 1a, 3/5 + 2/5 = 5/5 = 1, 2/5 + 3/5 = 5/5 = 1, 1 – 3/5 = 2/5, 1 – 2/5 = 3/5.

Q2 and Q3 involve equivalent fractions. Give students a multiplication square. Ask them to look at the first two rows. They should be able to see some fractions equivalent to one half.

$$\frac{1}{2} = \frac{2}{4} = \frac{3}{6}$$

x	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24

Ask them to write down all the equivalent fractions they can see, continuing the pattern to 12/24. Repeat for the fractions equivalent to one third, as shown below.

$$\frac{1}{3} = \frac{2}{6} = \frac{3}{9}$$

x	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36

Give them time to explore other equivalent fractions by shading two rows at a time and listing them. Discuss what happens when we make equivalent fractions. For example, in 1/3 = 3/9, both the numerator and denominator have been multiplied by three, and in 12/36 = 3/9, both the numerator and denominator have been divided by four. Discuss the generalisation that to get an equivalent fraction, the numerator and denominator are multiplied or divided by the same number. Ask them to work through Q2, Q3 and Q6. Q6 asks them to write the fractions in the simplest form. Explain that this means using the lowest numbers possible.

Second session

Focus on the fraction wall. What do the students notice about the fractions? Draw out the fact that the higher the denominator, the smaller the fraction. Ask students to tell you which is the smallest fraction on the wall and which is the largest.

Write down some unit fractions (fractions with a numerator of 1) and ask them to compare pairs of them using the greater than and less than symbols. They need to consider the denominator only. Then ask them to work through Q4, comparing non-unit fractions independently, using the fraction wall to help them. Again, expect them to write both fractions with the greater than symbol separating them.

Q5 looks at ordering fractions. Begin by ordering unit fractions, then ask students to work through Q5 independently. This time they order non-unit fractions. Again, they use the fraction wall to help them. Ask students to work through Q8 independently.

Third session

Focus on Q7. This involves converting decimals into fractions. Work through the idea that tenths are fractions with a denominator of 10. Write some tenths and ask students to write these as fractions, for example, 0.6, 0.3, 0.9. Where applicable, ask them to write them in their simplest forms, for example, 0.6 = 6/10 = 3/5. Repeat this for hundredths and then thousandths.

Ask them to work through Q7 independently.

Fractions: solving problems

Unit 16 Safety in numbers

***Level Up! Levels 4–6* Unit 16.5: Solving fraction problems**

- The word ‘of’ means multiply. **(Level 4)**
- To find a fraction of a quantity, divide the number by the denominator and multiply by the numerator. **(Level 3)**
- You can multiply a fraction by a whole number by multiplying the numerator by the whole number and then simplify. **(Level 4)**
- You can add and subtract fractions easily if they have the same denominator. You may need to convert them to equivalent fractions. **(Level 4)**

- To divide a whole number by a fraction, you find out how many groups of the fraction can be made out of the whole number. **(Level 5)**

First session

It is worth spending one session on adding and subtracting fractions. Practice this before working through the questions. You could begin by discussing the fact that 3 + 5 = 8, so 3 tens plus 5 tens equals 8 tens, £3 + £5 = £8 and 3/8 + 5/8 = 8/8. Likewise, 8 – 5 = 3, 8 tens minus 5 tens equals 3 tens, £8 £5 = £3 and 8/8 – 5/8 = 3/8. Adding and subtracting fractions with the same denominator is similar to adding and subtracting whole numbers.

Move on to fractions with different denominators. Talk through the idea that you cannot add or subtract an amount of money and a number of tins of beans because they are different. For example: **A tin of beans + £1.50 = ?**

If a tin of beans costs 50p, you can change the tin to money or the money to tins and then add them. It's the same with fractions. They need a common denominator. Therefore, knowledge of equivalent fractions and how to make them is essential. Write some fractions that are simple to make equivalent for the students to add and subtract, for example, ½ + ¼, ¾ + 3/8, ½ – ¼, ¾ – 3/8. Ask students to work through Q8 independently.

Second session

Focus on multiplying fractions and whole numbers. Explain that the model for this is repeated addition. For example, 12 x 2/3 is 2/3 added 12 times. All the students need to do is multiply 2 and 12 to give 24/3. Give students examples to practice. You could also ask them to change any improper fractions to mixed numbers, for example, 24/3 is 8 wholes (divide the denominator into the whole number). You may need to spend a session converting fractions to mixed numbers.

Move on to multiplying fractions by fractions. Give students strips of paper. Ask them to fold one in half. If they are to find half of half and therefore multiply half by one half, they fold the strip in half again. They colour one of the parts to show that ½ x ½ = ¼ . Repeat this a few times with unit fractions. Move on to non-unit fractions, for example, 2/3 x ½. They fold a strip into thirds and then fold it in half and colour two parts. 2/3 x ½ = 2/6. Then ask them to tell you what they notice. Is there a generalisation they can make for multiplying fractions by fractions? Lead them to the generalisation that they can multiply the numerators and denominators.

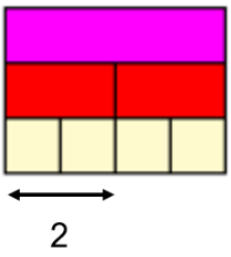
Students then work through Q5, Q6 and Q10 independently.

Third session

Focus on dividing fractions. Begin by dividing whole numbers by fractions. Ensure that students understand that they are finding how many of the fraction will fit into the whole number. Cuis*enaire* is a good resource for doing this.

1 ÷ ½ = 2

2 ÷ ½ = 4. Repeat this a number of times with different wholes and fractions. Ask the students to make the model, draw it and write the calculation.



Move on to dividing fractions by fractions, still using Cuisenaire or a similar resource. Begin with a simple one, for example, ½ divided by ¼. Students are finding out how many quarters or fourths go into one half.

This model shows that ½ ÷ ¼ = 2. Repeat this a few times. Then explore how ½ x 4/1 gives the same result.

Ask students to work out the quotients for Q7 and Q9, which involve dividing whole numbers by fractions.

Fourth session

Together, work through Q1, Q4 and Q11. Q4 asks students to convert a decimal to a fraction and then compare the two fractions. For the comparison, give them fraction walls to help. Q11 involves squaring numbers and finding square roots. It might be that you need to remind students about these.

For Q2 use the bar model. Students draw the model for each question. A petrol tank holds 42 litres. If it is 2/7 full, how much petrol is in the tank?

42 litres						
1/7	1/7	1/7	1/7	1/7	1/7	1/7

Drawing the bar helps students to see that they need to divide 42 by 7 to get one part. They need two parts so the answer is 12 litres.

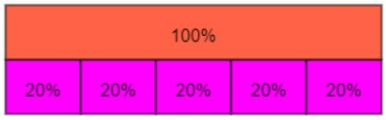
The second problem asks them to find 3/5 of 500. Again, drawing the bar helps them to see that they need to divide 500 by 5 and then multiply by 3 to find the number of sheets left.

Repeat this approach for Q3.

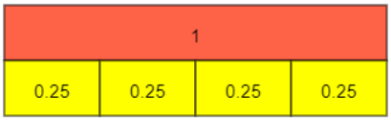
Fifth session

Focus on practice Q12 which involves percentages, decimals and fractions. Remind students that percentages are fractions with a denominator of 100. Work through this question together, drawing the bar model for each person.

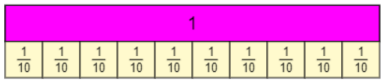
Jane



Makena



Lowri



If they colour the amounts spent, they can clearly see that Jane has the most left. Together, work through *Now try this! Parts A and B*.

