

Bridging KS3 to KS4 Maths

Recovery guidance

Revise KS3 Mathematics Study Guide & GCSE Maths Purposeful Practice Foundation

This booklet suggests how these resources can be used to support students about to begin their GCSE study who have seen disruption to their KS3 learning and missed out on some of the groundwork and key understanding needed to meet their potential at GCSE.

Targeted academic support

There are a wide range of evidence-based strategies schools can implement to support recovery for students, and help bridge gaps in learning. These could include:

- **Diagnostics** to help target interventions and focus on a small number of learning goals
- **One-to-one and small group interventions** linked to in-class teaching and the curriculum to provide tailored support in a structured setting
- **Homework** and homework clubs to help students progress towards mastery of key learning objectives and to develop effective learning habits

This booklet is intended to help teachers and teaching assistants deliver structured interventions and provide targeted academic support to help students transition from KS3 to KS4 Maths and, ultimately, be better prepared for assessments. They are designed to be used in a mediated setting or independently. This adaptable, flexible resource can support learning and recovery for all Foundation GCSE Maths students to help them reach their potential despite lost learning.

An overview of the resources covered in this booklet

Pages 2–3

Support for delivering interventions using *Purposeful Practice* and *Study Guides*

Page 4

Curriculum content: *Purposeful Practice* → *Study Guide*

Pages 5–7

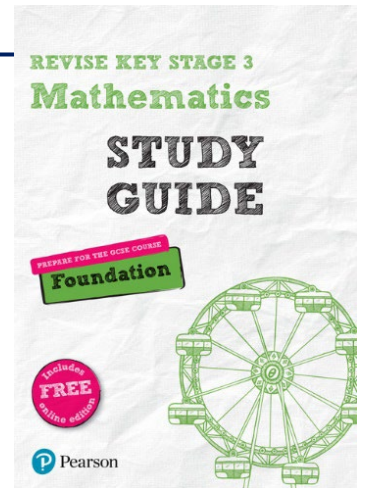
Support, progression and further resources

Page 8

Revise Key Stage 3 Mathematics: Study Guide

The study guide focuses on Key Stage 3 level material only and is designed to help students at the end of Key Stage 3 to:

- **Target** key skills, with a one-topic-per-page format
- **Track** their progress with at-a-glance checkboxes
- **Check** their understanding with worked examples
- **Develop** their technique with practice questions and full answers
- **Progress** towards the GCSE (9–1) Maths Foundation course with problem-solving practice



Each topic page uses consistent features, so you and your students know what to expect.

ALGEBRA Had a look Nearly there Nailed it!

Writing equations

An **equation** is a mathematical sentence that tells you that the quantities on either side of the = sign are equal. You use a letter to represent an unknown quantity or **variable**. You can use an equation to describe a word problem. The equation $3x - 6 = 12$ has one variable (x). It tells you that if you multiply x by 3 and then subtract 6, the answer is 12.

$$3x - 6 = 12$$

Golden rules

- ✓ Read the question carefully and choose a letter to represent the unknown.
- ✓ Write an expression that describes the situation.

Three times a number subtract one $\rightarrow 3n - 1$

Three times a number subtract one equals 29 $\rightarrow 3n - 1 = 29$

For a reminder on writing expressions turn to page 29.

Worked example

Posters cost £3 each plus a one-off charge for postage of £2. Max spends £17 buying posters. Write an equation for this word problem.

Cost of posters is $3 \times p = 3p$
 Add the postage charge of £2 $\rightarrow 3p + 2$
 $3p + 2 = 17$

Choose a letter to represent the unknown (p).
 Write an expression for the cost of the posters.
 Add the postage charge. Make your expression equal to the amount Max spends.

Worked example

The perimeter of a regular hexagon is 30 cm. Write an equation for this word problem using s for the length of one side.

$$s + s + s + s + s + s = 6s$$

$$6s = 30$$

Problem solved!

A regular hexagon has six equal sides. The perimeter is the distance around the hexagon, so is the sum of all the sides. Use the information that the perimeter = 30 cm to write the equation.

You'll need brilliant problem-solving skills to succeed in GCSE - get practising now!

Now try this

Write an equation for each word problem. Use the letter in brackets for the unknown number.

- Five times a number (n) subtract seven is eighteen.
- The perimeter of a regular octagon of side length (s) is 32 cm.
- My family bought cinema tickets (t) at £9 each, and there was a separate booking fee of £1. The total cost was £64.

• Use real numbers or empty boxes if you are not sure.
 • Half a number is written as a fraction with denominator 2.
 • Double a number is $2 \times$ the number, written as $2n$.
 • The square of a number is written as n^2 .

Explanations to supplement teacher guidance and lessons

Multiple worked examples to show processes and methods for a range of cases

Additional hints and descriptions to support each stage of the worked examples

Golden rules to encourage students to get into good study habits and remember mathematical rules

Problem-solving question bringing in key topic skills

Now try this exam-style question to check understanding and progress to the next topic or more challenge.

Purposeful Practice Book: Foundation

This book covers the full Edexcel GCSE Maths Foundation curriculum, with a focus on building understanding of key concepts and developing mathematical confidence. There are hundreds of practice questions, including minimal variation, problem-solving, reasoning, exam practice and reflection.

The topics are split into short double-page spreads that follow the same format, so students know what to expect.

Key points at the beginning of each section remind students what they need to know.

Key points

- The priority of operations is: Brackets, Indices, Division and Multiplication, Addition and Subtraction.
- Adding and subtracting are inverse operations; multiplying and dividing are inverse operations. You can use inverse operations to check answers.
- Finding the square root is the inverse of finding the square.
- Finding the cube root is the inverse of finding the cube.

There are 2–3 **Purposeful practice exercises** per section. Each Purposeful practice exercise helps develop understanding in one of three ways:

- Carefully crafted questions that are minimally varied throughout an exercise
- A mixture of minimally varied questions with small-stepped questions that get incrementally harder
- Questions where the skills required become incrementally harder

△ Purposeful practice 1

Calculate

1 $2 \times 4 + 8$

2 $8 + 2 \times 4$

3 $(8 + 2) \times 4$

4 $(8 - 2) \times 4$

5 $8 - 2 \times 4$

6 $-2 \times 4 + 8$

7 $\frac{8 \times 4}{2}$

8 $\frac{8}{2} \times 4$

9 $8 \times \frac{4}{2}$

10 $\frac{8}{2} \times \frac{4}{2}$

11 $\frac{8}{4} \times \frac{4}{2}$

12 $\frac{8}{4} \times \frac{4}{4}$

Reflect and reason

Why do Q7–9 have the same answer?

Each short Purposeful practice exercise is followed by a thought-provoking **Reflect and reason** question. These questions help students to become aware of their own thinking and encourages them to notice the structure and relationships within their mathematical work.

Problem-solving practice at the end of each section allows students to apply the skills they have learnt in different contexts. The steps aren't always obvious, and students may need to apply different strategies.

For students with low confidence, you might suggest they work on only the first two problem-solving questions.

The sections end with an **Exam practice** question. These are based on real exam papers, so you may decide to wait until students have progressed further with their GCSE course before they attempt these.

⊠ Problem-solving practice

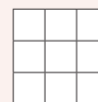
1 Use all the numbers 1, 2, 3, 4, 5, brackets and the operations + and \times . Write one calculation that gives the answer 29.

2 $7 + 5 \times 3 + 8 = 30$.

Insert a pair of brackets to change the answer to 62.

3 Copy this 3×3 grid.

Write the numbers $-4, -3, -2, -1, 0, 1, 2, 3, 4$ into the grid. Every row, column and diagonal should total 0.

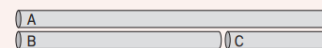


4 Here are three poles.

Pole A is equal in length to the sum of poles B and C.

A is 18 m long. C is half the length of B.

What is the length of C?



5 Place the numbers 1, 7 and 8 in the boxes to make the calculation correct.

$$\frac{2 \times (11 - \square)}{\square} = \square$$

6 Sarah wants to find out how much it will cost to decorate her kitchen.

A tin of paint costs £4. She needs 80 tins of paint.

She says the paint will cost £20 because $80 \div £4$ is £20.

Is Sarah correct? Show your method.

Resources to support structured intervention

One-to-one and small group structured interventions are very effective ways of improving student outcomes. They can be mediated by teachers, teaching assistants or other adults, and provide students with targeted support to reinforce in-class teaching and recover lost learning.

Intervention sessions should typically be brief (20–30 minutes) and regular (3–5 times a week), and delivered over a set period of time, up to 10 weeks.

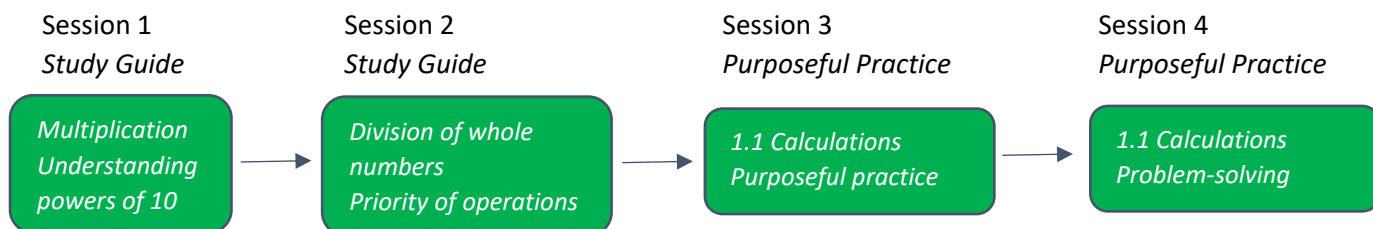
Below are two approaches for using these resources in this way.

Suggested approach A: (Re)introduce with *Study Guides*, reinforce with *Purposeful Practice*

Allow two to four sessions per topic.

Students may have already met most of the topics from the *Study Guides*, but with varying degrees of stability of understanding. The descriptions, worked examples and sample questions make these *Study Guides* an ideal resource to remind students of concepts they might have met during their disrupted KS3 years. In sessions 1 to 2, use 2 to 4 pages of the study guide that are relevant to the topic. Reinforce these concepts in the next session with *Purposeful Practice*. If appropriate, spend the following session working on problem-solving.

Example

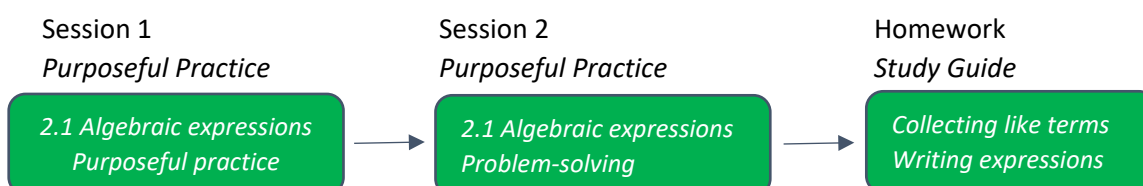


Suggested approach B: Develop understanding with *Purposeful Practice*, reinforce at home with *Study Guides*

Allow two sessions per topic.

Students may have been taught methods and concepts many times already. These intervention sessions can be used to develop their understanding of these concepts with the *Purposeful Practice* books. *Study Guides* can be used as homework to reinforce key concepts using the ‘Now try this’ questions.

Example



Curriculum content

The table below maps the *Purposeful Practice* book content to each section of the *KS3 Study Guide* to help ensure students are best prepared to begin their GCSE course, despite lost learning.

Note that some areas do not appear at KS3 and so are shaded grey here. Your students may still be able to access this content, depending on their prior experience. There is guidance on the final page of this booklet for progressing to the Higher tier.

Purposeful Practice	Study Guide
1 Number	Number
1.1 Calculations	Decimals Addition Subtraction Understanding powers of 10 Multiplication Division of whole numbers Negative numbers Priority of operations Calculator buttons
1.2 Decimal numbers	Division with decimals
1.3 Place value	Whole numbers Rounding
1.4 Factors and multiples	Factors, multiples and primes HCF and LCM
1.5 Squares, cubes and roots	Squares, cubes and roots
1.6 Index notation	More powers Standard form
1.7 Prime factors	Prime factors
2 Algebra	Algebra
2.1 Algebraic expressions	Collecting like terms Writing expressions
2.2 Simplifying expressions	Simplifying expressions Indices
2.3 Substitution	Substitution
2.4 Formulae	Formulae Writing formulae
2.5 Expanding brackets	Expanding brackets
2.6 Factorising	Factorising
2.7 Using expressions and formulae	Expression, equation, identify or formula? Speed, distance, time

3 Graphs, tables and charts	Statistics
3.1 Frequency tables	Averages and range Averages from tables
3.2 Two-way tables	
3.3 Representing data	Analysing data
3.4 Time series	
3.5 Stem and leaf diagrams	Stem and leaf diagrams
3.6 Pie charts	Pie charts Writing a report
3.7 Scatter graphs	Scatter graphs
3.8 Line of best fit	Scatter graphs
4 Fractions and percentages	Number
4.1 Working with fractions	Changing fractions Add and subtract fractions
4.2 Operations with fractions	Fraction basics
4.3 Multiplying fractions	Multiply and divide fractions
4.4 Dividing fractions	Multiply and divide fractions
4.5 Fractions and decimals	Fractions, division, decimals
4.6 Fractions and percentages	Equivalence
4.7 Calculating percentages 1	Percentages
4.8 Calculating percentages 2	Number problem-solving Percentage change

Purposeful Practice	Study Guide
5 Equations, inequalities and sequences	Algebra
5.1 Solving equations 1	Writing equations Solving simple equations
5.2 Solving equations 2	Solving harder equations
5.3 Solving equations with brackets	Solving harder equations
5.4 Introducing inequalities	Inequalities
5.5 More inequalities	
5.6 Using formulae	Formulae
5.7 Generating sequences	Linear sequences
5.8 Using the n th term of a sequence	The n th term
6 Angles	Geometry & measures
6.1 Properties of shapes	Measuring and drawing angles Angles in polygons
6.2 Angles in parallel lines	Angles 1 Angles 2
6.3 Angles in triangles	Angles 2
6.4 Exterior and interior angles	Angles in polygons
6.5 More exterior and interior angles	
6.6 Geometrical problems	
7 Averages and range	Statistics
7.1 Mean and range	Averages and range
7.2 Mode, median and range	Averages from tables
7.3 Types of average	Averages from tables
7.4 Estimating the mean	Averages from tables
7.5 Sampling	Analysing data
8 Perimeter, area and volume 1	Geometry and measures
8.1 Rectangles, parallelograms and triangles	Area of rectangles and triangles Area of parallelograms and trapeziums
8.2 Trapezia and changing units	Area of parallelograms and trapeziums
8.3 Area of compound shapes	Compound shapes
8.4 Surface area of 3D solids	
8.5 Volume of prisms	Volume
8.6 More volume and surface area	
9 Graphs	Algebra

9.1 Coordinates	Coordinates and midpoints
9.2 Linear graphs	Straight-line graphs
9.3 Gradient	Gradient
9.4 $y = mx + c$	$y = mx + c$
9.5 Real-life graphs	Real-life graphs
9.6 Distance-time graphs	
9.7 More real-life graphs	
10 Transformations	Shape
10.1 Translation	Translation
10.2 Reflection	Reflection
10.3 Rotation	Rotation
10.4 Enlargement	Enlargement
10.5 Describing enlargements	Enlargement
10.6 Combining transformations	
11 Ratio and proportion	Ratio & proportion
11.1 Writing ratios	Ratios
11.2 Using ratios 1	Ratios
11.3 Ratios and measures	Metric measures Time
11.4 Using ratios 2	
11.5 Comparing using ratios	
11.6 Using proportion	Proportion
11.7 Proportion and graphs	Direct proportion
11.8 Proportion problems	Proportion problem-solving Inverse proportion
12 Right-angled triangles	Geometry & measures
12.1 Pythagoras' theorem 1	Pythagoras' theorem
12.2–12.7 Trigonometry	
13 Probability	Probability
13.1 Calculating probability	Probability
13.2 Two events	Outcomes
13.3 Experimental probability	Experimental probability
13.4 Venn diagrams	Probability diagrams
13.5 Tree diagrams	Probability tree diagrams
13.6 More tree diagrams	Mutually exclusive and independent events

Purposeful Practice	Study Guide
15 Constructions, loci and bearings	Geometry & measures
15.1 3D solids	3D shapes
15.2 Plans and elevations	Plans and elevations
15.3 Accurate drawings 1	Measuring and drawing angles Drawing triangles
15.4 Scale drawings and maps	Maps and scales
15.5 Accurate drawings 2	
15.6 Constructions	Constructing perpendicular lines
15.7 Loci and regions	
15.8 Bearings	
16 Quadratic equations and graphs	Algebra
16.1 Expanding double brackets	Expanding double brackets
16.2 Plotting quadratic graphs	Plotting quadratic graphs
16.2–16.5 Quadratic equations and graphs	

17 Perimeter, area and volume 2	Geometry & measures
17.1 Circumference of a circle 1	Circumference
17.2 Circumference of a circle 2	
17.3 Area of a circle	Area of circles
17.4 Semicircles and sectors	Circles problem-solving
17.5 Composite 2D shapes and cylinders	Shape problem-solving
17.6 Pyramids and cones	
17.7 Spheres and composite solids	
18 Fractions, indices and standard form	
19 Congruence, similarity and vectors	Shape
19.1 Similarity and enlargement	Congruent and similar shapes
19.2 More similarity	
19.3 Using similarity	
19.5 Congruence 2	
19.6 Vectors 1	
19.7 Vectors 2	
20 More algebra	

The tables above show the approximately 100 sections of the *Purposeful Practice* book. It is not expected that students will cover the full course as part of their small group intervention work.

Choose approximately 40 sections (or 5 chapters) that students need the most support with. To help with this decision, KS3–GCSE baseline assessments are available here. Alternatively, you may choose to discuss with each student the topics they feel least confident in, or you may already know specific topics they have missed.

The recommended approach for intervention is little and often. One approach is 4 half-hour sessions each week, over 10 weeks.

If time allows, it is a good idea to start with the number sections, regardless of their pre-assessment. A student's number sense and fluency are key to confidence in other areas of mathematics. A fresh look at the multiplicative rules for number will help them notice similarities when working with algebra, for example.

More Edexcel schemes of work, including 2 year, 3 year and 5 year routes are available at: www.pearsonschoolsandfecolleges.co.uk/secondary/subjects/mathematics-secondary/pearson-edexcel-gcse-9-1-mathematics#structure.

For more information on recovery catch-up visit: pearsonschools.co.uk/recovery.

Addressing barriers to learning

The EEF guidance on School Improvement planning outlines these non-academic barriers to learning, some of which have been exacerbated due to disrupted schooling:

- Adapting to curriculum discontinuity
- Familiarising with formal school systems, expectations and routines
- Developing healthy peer networks

(<https://educationendowmentfoundation.org.uk/support-for-schools/school-improvement-planning/3-wider-strategies>)

Allocating staff from within the school to support the small group intervention work allows there to be consistency between the students' regular maths lessons and their intervention sessions, meaning the two complement each other. Once the topics have been chosen, it is a good idea for the session teacher to check when students will meet these in lessons with the students' maths teacher.

There are benefits to both one-to-one tuition and small group work. The former allows the teacher to give bespoke support to each student, whilst the latter allows the formation of peer-to-peer relationships, and peer learning, both of which can boost confidence and progress.

Progressing to Higher tier

"We know that disadvantaged pupils' learning has been most heavily impacted as a result of the pandemic. Our own estimates suggest that the attainment gap will widen significantly, likely reversing the past decade's progress."

Prof. Becky Francis, Chief Executive of the Education Endowment Foundation

The attainment gap exists across all ages and grade ranges, and the disruption to students' learning over the past few years might result in students working at Foundation level despite previously being on a trajectory towards Higher tier. This change could be due to gaps in knowledge of content and processes, lack of confidence, previous mis-placement in attainment groups and non-academic barriers to learning, such as a change in circumstances at home.

The small group intervention sessions are a good opportunity to formatively assess students for the most appropriate tier. Students who are consistently and successfully completing the problem-solving sections of the *Purposeful Practice* books might be ready to progress to working at Higher tier.

Remember that you do not need to decide the tier for each student until February for exam sittings the following June.