

Using teacher
assessment to track
pupils' progress in
mathematics

Introduction

These materials have been developed to help teachers track the progress of Year 7 pupils who achieved level 3 in mathematics at the end of Key Stage 2. They should be used alongside the sample medium-term plan: Year 7 intervention which is part of *Targeting level 4 in Year 7: mathematics* (DfES 0085-2003).

The process of tracking progress

- Teachers do not need to assess every objective that is taught. Some objectives are more important than others in tracking pupils' progress towards level 4. These objectives form the **key indicators** and are listed on page 4.
- Many of these objectives are taught across several units during Year 7 so teachers need to identify appropriate times to assess pupils' understanding. Some suggestions are given in the grid on pages 5–11. All these objectives are best assessed through **observation** and **discussion** in normal lessons.
- A set of **probing questions** has been produced for each of the key indicators. These questions are intended to help teachers assess pupils' **understanding** and identify any **common misconceptions**. The questions are best used when pupils are engaged in activities based on the objective(s). They have been written so they can be used alongside any chosen activity, although they work best with open-ended or problem solving activities. The probing questions are also a good resource when planning plenaries.
- **Examples of what pupils should know and be able to do** are provided for most of the key indicators. The only exceptions are where the scope of the indicator is obvious. The examples are mainly from the Framework supplement of examples.
- A suggested checklist for recording the progress of individual pupils is provided on pages 12 and 13. Teachers need to judge whether pupils have a secure understanding, a developing understanding or are insecure with the objective.
- While teachers will be able to make this judgement for the majority of pupils through normal lessons, there may be some pupils they are unsure about. Flexi-time has been built into the sample medium-term plan: Year 7 intervention to give, for example, time for past test questions and consolidation lessons. These lessons provide a further opportunity for teachers to focus on this smaller group of pupils, stimulating discussion using the probing questions.

Using the assessment information

- The questions and dialogue will help teachers (and pupils) assess whether pupils have a secure understanding. For those that do not, the objective can be used to form a curricular target for the pupil, or groups of pupils.
- A suggestion for a sheet to record curricular targets for groups of pupils or individual pupils is provided on page 14. It is envisaged that teachers identify the curricular target(s) each half-term and indicate the targeted pupils.
- Teachers will need to adjust their planning to address any identified weaknesses. Strategies include:
 - using oral and mental starters to revisit the objective and give further practice;
 - identifying the next unit in which the objective(s) will be taught and carefully planning to address the identified misconceptions;
 - using the appropriate level 3 to level 4 lessons, consolidation lessons and/or mathematics challenge materials¹.

Tracking pupils' progress in Key Stage 3

This approach to tracking pupils' progress can be used throughout Key Stage 3. Key objectives (listed in section 2 of the Framework and highlighted in bold in the yearly teaching programmes) have been identified for this purpose. A good strategy is to identify the key objectives to be assessed every half-term and build in to your plan one or two lessons for this purpose.

¹ *Targeting level 4 in Year 7: mathematics* (DfES 0085-2003)

Key indicators

The following objectives are central to pupils' progress in moving from level 3 to level 4.

<p>Using and applying mathematics to solve problems</p> <ul style="list-style-type: none"> Solve word problems and investigate in a range of contexts: number, algebra, shape, space and measures, and handling data. <p>Numbers and the number system</p> <ul style="list-style-type: none"> Multiply and divide whole numbers by 10 or 100 and explain the effect. Compare and order decimals. Recognise and use multiples and factors and primes (less than 100); use simple tests of divisibility. Multiply a fraction by an integer. Understand percentage as the number of parts in every 100 and find simple percentages of small whole-number quantities. <p>Calculations</p> <ul style="list-style-type: none"> Calculate mentally a difference such as 8006 – 2993. Recall multiplication facts to 10 x 10 and derive associated division facts. Add and subtract decimals using written methods. Use written methods to calculate $HTU \times U$ and $HTU + U$. Check whether a result is the right order of magnitude. 	<p>Shape, space and measures</p> <ul style="list-style-type: none"> Recognise and visualise the transformation and symmetry of 2-D shapes: <ul style="list-style-type: none"> reflection in given mirror lines and line symmetry; rotation about a given point and rotational symmetry. Read and interpret scales on a range of measuring equipment. Understand area measured in square centimetres (cm^2). Know and use the formula for the area of a rectangle; calculate the perimeter and area of shapes made from rectangles. Read and plot coordinates in the first quadrant. <p>Handling data</p> <ul style="list-style-type: none"> Solve a problem by representing, extracting and interpreting data in tables, graphs and charts. Calculate statistics for small sets of discrete data: <ul style="list-style-type: none"> find the mode, median and range; calculate the mean in simple cases.
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Assessing the identified objectives

The following questions could be used to stimulate discussion between the teacher and pupil(s) on the identified objectives.

Teaching objective	Probing questions	Examples of what pupils should know and be able to do
<p>Solve word problems and investigate in a range of contexts: number, algebra, shape, space and measures, and handling data.</p> <p>Focus for assessment: Shape, space and measures 1, Number 3A, Algebra 3</p>	<p>Explain in your own words what the problem is asking you to do.</p> <p>What information have you been given? What information is important to solving the problem?</p>	<p>See the full range of problems on pages 2–25 of the Framework supplement of examples.</p>
<p>Multiply and divide whole numbers by 10 or 100 and explain the effect.</p> <p>Focus for assessment: Number 2</p>	<p>Why do 6×100 and 60×10 give the same answer? What about $30 \div 10$ and $300 \div 100$?</p> <p>I have 37 on my calculator display. What single multiplication should I key in to change it to 3700? Explain why this works.</p> <p>Can you tell me a quick way of multiplying by 10, by 100?</p> <p>Can you tell me a quick way of dividing by 10, by 100?</p>	<p>Respond to oral and written questions such as:</p> <ul style="list-style-type: none"> • How many times larger is 2600 than 26? • How many £10 notes are in £120, £1200? • How many £1 coins, 10p coins, 1p coins? • Tins of dog food at 42p each are put in packs of ten. Ten packs are put in a box. How much does one box of dog food cost? Ten boxes? 100 boxes? <p>Work out mentally the answers to questions such as:</p> <p>$329 \times 100 = \square$ $8000 \div 100 = \square$ $56 \times \square = 5600$ $7200 \div \square = 72$ $420 \times \square = 4200$ $3900 \div \square = 390$</p>

Teaching objective	Probing questions	Examples of what pupils should know and be able to do
<p>Compare and order decimals. Focus for assessment: Number 2</p>	<p>What did you look for first? Which part of each number did you look at to help you? Which numbers did you think were the hardest to put in order? Why? What did you do when numbers had the same digit in the same place? Give me a number between 3.12 and 3.17. Which of the two numbers is it closer to? How do you know?</p>	<p>Place these decimals on a line from 6.9 to 7.1:</p> <ul style="list-style-type: none"> • 6.93, 6.91, 6.99, 7.01, 7.06 <p>Put these in order, largest/smallest first:</p> <ul style="list-style-type: none"> • 1.5, 1.375, 1.4, 1.3, 1.35, 1.425; • 7.765, 7.675, 6.765, 7.756, 6.776
<p>Recognise and use multiples and factors and primes (less than 100); use simple tests of divisibility. Focus for assessment: Algebra 2</p>	<p>Which numbers less than 100 have exactly three factors? What number up to 100 has the most factors? There are ten two-digit prime numbers that can be written as the sum of two square numbers. What are they? The sum of four even numbers is a multiple of 4. When is this statement true? When is it false?</p>	
<p>Multiply a fraction by an integer. Focus for assessment: Number 4</p>	<p>$\frac{2}{5}$ of a total is 32. What other fractions of the same total can you calculate? <i>Using a set of fraction cards (e.g. $\frac{3}{5}$, $\frac{7}{8}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{10}$, etc.) and a set of two-digit number cards, ask how the fractions and numbers might be paired to form a question with a whole-number answer.</i> Question related to activity: What clues did you use?</p>	

Teaching objective	Probing questions	Examples of what pupils should know and be able to do
<p>Understand percentage as the number of parts in every 100, and find simple percentages of small whole-number quantities.</p> <p>Focus for assessment: Number 4</p>	<p>What percentages can you easily work out in your head? Talk me through a couple of examples.</p> <p>When calculating percentages of quantities, what percentage do you usually start from? How do you use this percentage to work out others?</p> <p>To calculate 10% of a quantity, you divide it by 10. So to find 20%, you must divide by 20. What is wrong with this statement?</p> <p>Using a 1–100 grid, 50% of the numbers are even. How would you check? Give me a question with the answer of 20% (or other percentages).</p>	<p>Use mental methods. For example, find:</p> <ul style="list-style-type: none"> • 10% of £20 by dividing by 10; • 5% of £5 by finding 10% and then halving; • 15% of 40 by finding 10% then 5% and adding the results together. <p>Use informal written methods, including jottings. For example, find:</p> <ul style="list-style-type: none"> • 11% of £2800 by calculating 10% and 1% and adding the results together; • 70% of 130 g by calculating 10% and multiplying this by 7 or by calculating 50% and 20% as jottings and adding the results.
<p>Calculate mentally a difference such as 8006 – 2993.</p> <p>Focus for assessment: Number 1</p>	<p>Which of these subtractions can you do without writing anything down? Why is it possible to work this out mentally? What clues did you look for?</p> <p>How did you find the difference? Talk me through your method.</p> <p>If 2023 is the answer to a similar question, what could the question be?</p>	<p>Work out mentally that:</p> <p>4005 – 1997 = 2008 because it is</p> <p>4005 – 2000 + 3 = 2005 + 3 = 2008</p> <p>Work out mentally by counting up from the smaller to the larger number:</p> <p>8000 – 2785 is 5 + 10 + 200 + 5000 = 5215</p>

Teaching objective	Probing questions	Examples of what pupils should know and be able to do						
<p>Recall multiplication facts to 10 x 10 and derive associated division facts.</p> <p>Focus for assessment: Number 2 and then ongoing</p>	<p>If someone has forgotten the eight times table, what tips would you give them to work it out?</p> <p>What other links between tables are useful?</p> <p>If you know that $4 \times 7 = 28$, what else do you know?</p> <p>Start from a two-digit number with at least six factors, e.g. 56. How many different multiplication and division facts can you make using what you know about 56? How have you identified the divisions?</p>	<p>Respond rapidly to oral and written questions like:</p> <ul style="list-style-type: none"> • nine sevens? • how many eights in 48? • 6×7? • 5 multiplied by 9? • multiply 9 by 6; • 7 multiplied by 0? <p>Respond quickly to questions like:</p> <ul style="list-style-type: none"> • divide 36 by 9; • what is 48 shared between 8? • $\frac{1}{7}$ of 35? <p>Know by heart or derive quickly:</p> <ul style="list-style-type: none"> • doubles of all numbers 1 to 100; • doubles of multiples of 10 up to 1000; • doubles of multiples of 100 up to 10 000; <p>and all the corresponding halves.</p>						
<p>Add and subtract decimals using written methods.</p> <p>Focus for assessment: Number 3A</p>	<p><i>Give pupils some completed questions to mark. Questions should be written horizontally as well as in column form. Include incorrect answers like $12.3 + 9.8 = 21.11$; $4.07 - 1.5 = 3.92$; $3.2 - 1.18 = 2.18$.</i></p> <p>Which are correct/incorrect? How do you know? Explain what has been done wrong and correct the answers.</p>	<p>Working with numbers to two decimal places, including:</p> <ul style="list-style-type: none"> • sums and differences with different numbers of digits; • totals of more than two numbers. <p>For example:</p> <table style="margin-left: 20px;"> <tr> <td>$671.7 - 60.2$</td> <td>$543.65 + 45.8$</td> </tr> <tr> <td>$45.89 + 653.7$</td> <td>$1040.6 - 89.09$</td> </tr> <tr> <td>$764.78 - 56.4$</td> <td>$76.312 + 312.2 + 5.07$</td> </tr> </table>	$671.7 - 60.2$	$543.65 + 45.8$	$45.89 + 653.7$	$1040.6 - 89.09$	$764.78 - 56.4$	$76.312 + 312.2 + 5.07$
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<p>Use written methods to calculate HTU x U and HTU ÷ U.</p> <p>Focus for assessment: Number 2</p>	<p><i>Give pupils some worked examples that are incorrect.</i></p> <p>Is this correct? How do you know? How could you put it right?</p>							

Teaching objective	Probing questions	Examples of what pupils should know and be able to do
<p>Check whether a result is the right order of magnitude.</p> <p>Focus for assessment: Number 3A</p>	<p>Roughly what answer do you expect to get? How did you come to that estimate?</p> <p>Do you expect your answer to be less than or greater than your estimate? Why?</p>	<p>Discuss questions such as:</p> <ul style="list-style-type: none"> A girl worked out the cost of eight bags of apples at 47p a bag. Her answer was £4.06. Without working out the answer, say whether you think it is right or wrong. A boy worked out how many 19p stamps you can buy for £5. His answer was 25. Do you think he was right or wrong? Why? I buy six items costing 76p, 89p, 36p, £1.03, 49p and 97p. I give the shop assistant a £10 note and get £3.46 change. I immediately think the change is wrong. Without calculating the sum, explain why you think I am right. A boy worked out $£2.38 + 76p$ on a calculator. The display showed 78.38. Why did the calculator give the wrong answer? <p>See page 110 of the supplement of examples for more examples.</p>
<p>Recognise and visualise the transformation and symmetry of 2-D shapes:</p> <ul style="list-style-type: none"> reflection in given mirror lines, and line symmetry; rotation about a given point, and rotational symmetry. <p>Focus for assessment: Shape, space and measures 4</p>	<p>Give me instructions to reflect this shape into this mirror line.</p> <p>What would you suggest I do first?</p> <p>Make up a reflection that is easy to do.</p> <p>Make up a reflection that is hard to do. What makes it hard?</p> <p>Devise similar questions for rotation.</p>	<p>Sketch the reflection of a simple shape in a mirror line, where the edges of the shape are not necessarily parallel or perpendicular to the mirror line.</p> <p>Sketch the reflection of a simple shape in a mirror line which is not horizontal or vertical.</p>

Teaching objective	Probing questions	Examples of what pupils should know and be able to do
<p>Read and interpret scales on a range of measuring equipment.</p> <p>Focus for assessment: Number and measures 3B</p>	<p>What is the first thing you look for when you are reading a scale on measuring equipment?</p> <p>How do you decide what each division on the scale represents?</p>	<p>Read and interpret scales on a range of measuring instruments, including:</p> <ul style="list-style-type: none"> vertical scales, e.g. thermometer, tape measure, ruler; scales around a circle or semi-circle, e.g. for measuring time, mass, angle
<p>Understand area measured in square centimetres (cm²).</p> <p>Focus for assessment: Shape, space and measures 1</p>	<p>Would you expect the area of:</p> <ul style="list-style-type: none"> a paperback book to be 100 cm², 600 cm², or 6000 cm²? a digit card to be 5 cm², 50 cm² or 100 cm²? <p>Explain why.</p> <p>Suggest areas of 2-D shapes/objects that could be measured in cm².</p>	<p>Ensure that pupils can work with shapes other than rectangles. The focus is on having a feel for the area – not calculating the area.</p>
<p>Know and use the formula for the area of a rectangle; calculate the perimeter and area of shapes made from rectangles.</p> <p>Focus for assessment: Shape, space and measures 1</p>	<p>Why is it a good idea to split this shape into rectangles to find the area?</p> <p>How do you go about calculating the dimensions of the rectangles in this compound shape?</p> <p>Form a compound shape by pushing two rectangles together. Compare the area and perimeter of the rectangles with that of the compound shape. What has changed and why? What happens if you join the rectangles in a different way? Why?</p>	
<p>Read and plot coordinates in the first quadrant.</p> <p>Focus for assessment: Shape, space and measures 2</p>	<p>A square has vertices at (0,0), (3,0) and (3,3). What is the coordinate of the fourth vertex?</p> <p>A square has vertices at (1,3) and (2,4). Give two possible answers for the coordinates of the other two vertices.</p> <p>Make up some similar problems for a friend to solve.</p>	

Teaching objective	Probing questions	Examples of what pupils should know and be able to do
<p>Solve a problem by representing, extracting and interpreting data in tables, graphs and charts.</p> <p>Focus for assessment: Handling data 2A</p>	<p>For a given graph/table/chart, make up three questions that can be answered using the information represented.</p> <p>What makes the information easy or difficult to represent?</p>	
<p>Calculate statistics for small sets of discrete data:</p> <ul style="list-style-type: none"> • find the mode, median and range; • calculate the mean in simple cases. <p>Focus for assessment: Handling data 1</p>	<p>List a small set of data that has a mode of 5.</p> <p>List a small set of data that has a mode of 5 and a range of 10.</p> <p>List a small set of data that has a range of 12 and a mean of 6.</p> <p>How did you work this out?</p>	<p>Test a prediction such as:</p> <ul style="list-style-type: none"> • Most of our class play computer games for more than one hour a day. <p>Discuss questions like:</p> <ul style="list-style-type: none"> • How can we find out if this is true? • What information should we collect? • How shall we organise it? • What does the mode tell us? • What does the range tell us?

Checklist for recording against the identified objectives

- S: secure understanding
 D: developing understanding
 I: insecure

Teaching objective	Pupil 1			Pupil 2			Pupil 3			Pupil 4			Pupil 5			
	S	D	I	S	D	I	S	D	I	S	D	I	S	D	I	
Solve word problems and investigate in a range of contexts: number, algebra, shape, space and measures, and handling data.																
Multiply and divide whole numbers by 10 or 100 and explain the effect.																
Compare and order decimals.																
Recognise and use multiples and factors and primes (less than 100); use simple tests of divisibility.																
Multiply a fraction by an integer.																
Understand percentage as the number of parts in every 100 and find simple percentages of small whole-number quantities.																
Calculate mentally a difference such as 8006 – 2993.																
Recall multiplication facts to 10 x 10 and derive associated division facts.																

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	S	D	I	S	D	I	S	D	I	S	D	I	S	D	I
Add and subtract decimals using written methods.															
Use written methods to calculate HTU x U and HTU ÷ U.															
Check whether a result is the right order of magnitude.															
Recognise and visualise the transformation and symmetry of 2-D shapes: <ul style="list-style-type: none"> • reflection in given mirror lines and line symmetry; • rotation about a given point and rotational symmetry. 															
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Solve a problem by representing, extracting and interpreting data in tables, graphs and charts.															
Calculate statistics for small sets of discrete data: <ul style="list-style-type: none"> • find the mode, median and range; • calculate the mean in simple cases. 															

Curricular targets	Pupil 1	Pupil 2	Pupil 3	Pupil 4	Pupil 5
October					
January					
March					