The Literacy, Numeracy and Key Stage 3
National Strategies

Guidance

Curriculum and Standards

Transition from Year 6 to Year 7 Mathematics

Units of Work

Heads of Mathematics Departments and Year 6 & 7 teachers

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department for
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creating opportunity, releasing potential, achieving excellence

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Raising Standards
Standards and Effectiveness Unit

Contents

Introduction to the transition units

The move from Year 6 to Year 7 can be daunting for pupils. After a long summer break, they are working in a new environment. They may have few friends, as their peers come from many different schools. They have to get to know new teachers and a different organisation. Teaching approaches may not be the same.

Your school will already have some effective arrangements to help pupils to make a successful start at secondary school. For example, there may be a local project, such as use of QCA or other bridging units. If this is the case, you may prefer to continue using these materials rather than introduce the transition units.

There are two pairs of transition units, one for mathematics and one for literacy/English:

- *Calculation and problem solving*: one unit involving five lessons at the end of Year 6 and a second unit of five lessons at the beginning of Year 7
- *Authors and texts*: one unit involving ten lessons at the end of Year 6 and a second unit of six lessons at the beginning of Year 7.

These units use teaching objectives drawn from the primary and Key Stage 3 Frameworks for teaching literacy/English or mathematics. If you are using the National Literacy Strategy's Year 6 Planning Guidance, or the National Numeracy Strategy's Year 6 Unit Plans, the Year 6 transition units will already form part of your work for the summer term. The Key Stage 3 Frameworks help to provide continuity in teaching approaches and progression in what is taught in mathematics and English.

The Common Transfer Form provides information about pupils' attainment in end of key stage assessments. Nevertheless, it is often difficult for Year 7 teachers to gauge the curricular strengths and weaknesses of pupils who are new to their schools. The transition unit is another means of providing secondary teachers with some common information about pupils from different primary schools. Each Year 6 unit sets out to provide useful information about pupils' attainment in a manageable form by passing on information on pupils' strengths and weaknesses in certain aspects of the curriculum. The assessments and targets arising from the units can also be used to inform the teaching programmes developed for local literacy and numeracy summer schools.

The transition units are intended to ensure that:

- pupils experience a lesson structure they are familiar with and understand
- there is a consistency in teaching approach that will help pupils to respond to new people in new surroundings
- pupils are able to build on their early successes and demonstrate what they know, understand and can do in the context of the work they did in Year 6
- teachers are better informed about pupils' strengths and weaknesses and can use the lessons to confirm their assessments and plan teaching programmes that meet the needs of their pupils
- there is greater continuity and progression and less repetition of work.

For the transition units to succeed, primary schools need to make sure that pupils' work from the Year 6 units is transferred to the appropriate secondary school. When it is not clear to which secondary school pupils will transfer, the pupils may keep their work themselves, to take it to their new schools.

This is the first year that the transition units have been used. The Strategy teams would welcome feedback via the LEA's literacy/English and numeracy/mathematics consultants on the extent to which the units have supported transition arrangements, and ways in which the units could be developed further.

The mathematics transition units

The Year 6 transition unit is one of the summer term units from the Unit Plans being developed by the National Numeracy Strategy. The unit, *Calculation and problem solving*, like all six units in the second half of the summer term, focuses on three of the Year 6 key objectives identified in the *Framework for teaching mathematics from Reception to Year 6*. There is a strong emphasis on pupils solving problems and developing their mathematical reasoning skills.

The material in the Year 6 unit is developed in the Year 7 mathematics unit. These transition units are designed to provide pupils with a continuity and familiarity in content and approach, while maintaining the momentum of pupils' progress from Year 6 to Year 7. The units set out to teach pupils the knowledge, skills and understanding in key areas of learning that teachers can build upon in later lessons. The lessons are intended to do this in an interesting way that will motivate pupils and help them to recognise what they are achieving.

Included within the Year 6 transition unit are two self-assessment sheets for pupils to complete. Time for pupils to undertake short tasks to help them with their self-assessment is built into the plenary sessions. The assessments are based on the key objectives in the unit. Pupils are also invited to set themselves a target for the next stage in their mathematics learning. The self-assessment sheets and targets are to be attached to the pupils' work. This information can be used by Year 7 teachers to help pupils to recognise their progress, and by teachers preparing summer numeracy school programmes to help these pupils to meet their targets before they start at secondary school.

Schools using the Year 6 Unit Plans will be able to add this assessment information to what they are already gathering over the term. This will give a summary of their pupils' performance against the key objectives for Year 6 and provide secondary teachers with a valuable profile of achievement to direct their teaching in Year 7.

The structure of the lesson plans in the Year 6 mathematics transition unit will be familiar to most teachers. Each lesson refers to the objectives in the Framework and follows a three-part structure. The oral and mental starter is often linked to the work in the main teaching in the lesson, where associated problems are set and developed. The lessons include key questions that direct pupils' attention to the important areas for learning; these also provide teachers with some informal assessment information to direct the next steps in their teaching. The plenary sessions draw together pupils' ideas and often introduce an extension to the task that requires pupils to apply what they have learned in the lesson. The later plenary sessions give a strong focus to assessment to help pupils to recognise what they can do and what they might continue to strive to achieve.

A key feature of the Year 6 transition unit is its drawing together of earlier teaching and learning. The emphasis is on enabling pupils to use and apply what they have already learned to solve problems, to test a hypothesis and present an argument to justify their decisions. As pupils come to the end of Key Stage 2 it is important that they can draw upon what they have learned, refreshing what they might have forgotten by applying it in different and interesting contexts. The unit aims to keep pupils engaged and motivated in mathematics, ready to meet the challenges they are to encounter during their secondary education.

The Year 7 transition unit is based on the unit 'Number 1' in the Key Stage 3 *Sample medium-term plans for mathematics,* with some minor changes to follow on more appropriately from the Year 6 unit.

The Year 7 unit focuses on two of the distinctive features in number in Key Stage 3 (Guide to the Framework pp 10–13):

- building on the approach to calculation developed in Key Stage 2, which emphasises mental methods and gradually refined written methods, extending to calculations with fractions, decimals and percentages
- developing effective use of calculators, including choosing appropriate methods for estimating, calculating and checking.

The key objectives in the Year 6 transition unit aim to ensure pupils can:

- carry out short multiplication and division of numbers involving decimals
- carry out long multiplication of a three-digit by a two-digit integer
- identify and use the appropriate operations to solve word problems involving numbers and quantities, and explain methods and reasoning

These are extended by the objectives in Year 7, to:

- understand negative numbers as positions on a number line; order, add and subtract positive and negative integers in context
- multiply and divide three-digit by two-digit whole numbers; extend to multiplying and dividing decimals with one or two places by single-digit whole numbers
- solve word problems and investigate in the context of number; compare and evaluate solutions.

This Year 7 unit of work aims to support mathematics teachers in building upon the work pupils completed in Year 6, by providing opportunities to draw on pupils' shared mathematical experiences to establish a sense of continuity and cohesion, and by revising knowledge and skills developed in Key Stage 2 in order to extend attainment. The unit sets some of the work in a context similar to that of the Year 6 unit, for example, using sets of coins and solving puzzles where numbers are put into boxes, but it also extends the context to include negative integers.

Throughout the Year 7 unit pupils are encouraged to work collaboratively. This allows them and the teacher to begin to get to know each other in these early weeks of the term, recognising that in some areas secondary schools may have new pupils from several feeder schools. Using and applying mathematics and thinking skills are integrated within the teaching, with problems used to set a context for the work.

Year 6 transition unit: calculation and problem solving

Unit objectives

The objectives for this unit are:

- Carry out short multiplication and division of numbers involving decimals.
- Carry out long multiplication of a three-digit by a two-digit integer.
- Identify and use appropriate operations (including combinations of operations) to solve problems involving numbers and quantities, and explain methods and reasoning.
- Choose and use appropriate number operations to solve problems and appropriate ways of calculating: mental, mental with jottings, written methods, calculator.
- Factorise numbers into prime factors.
- Develop calculator skills and use a calculator effectively.

Differentiation

The teaching set out in the unit emphasises a whole-class, interactive, teaching approach. The intention is that all pupils are engaged in discussion and collaborative working and share a common experience. This is to provide pupils with work they can build on, as they engage with other pupils in their secondary school.

Those pupils who complete the work easily and quickly should be asked questions that will encourage them to extend the work and explore alternative approaches. For example, on day one the questions may require pupils to decide whether each of the two coins needs to represent an odd number of pence, whether both coins could represent even amounts and to explore why certain pairs of coins may be better choices than others. Pupils who find the work demanding may benefit from using practical resources to enable them to understand the processes involved and begin to see that the 3p and 5p coins can be used for payments of many different amounts of money.

Resources

Day 1: None, but coins made from card might help some pupils.

Day 2: OHT 1, OHP calculator, class set of calculators, Resource sheet 1, Self-assessment sheet 1

Day 3: OHT 1, Resource sheet 1, Self-assessment sheet 1

Day 4: OHT 2, OHT 3, OHP calculator, class set of calculators, Resource sheet 1, Self-assessment sheet 1

Day 5: OHT 4, Resource sheet 2, Resource sheet 3, Self-assessment sheet 1, Self-assessment sheet 2

Key mathematical terms and notation

commutative, dimensions, exact, factor, index notation, measures of area, multiples, prime, prime factor, remainder

Year 6 transition unit: calculation and problem solving

Summer term **Unit objectives** **Five daily lessons**

- **Carry out short multiplication and division of numbers involving decimals.**
- **Carry out long multiplication of a three-digit by a two-digit integer.**
- **Identify and use appropriate operations (including combinations of operations) to solve problems involving numbers and quantities, and explain methods and reasoning.**
- Choose and use appropriate number operations to solve problems and appropriate ways of calculating: mental, mental with jottings, written methods, calculator.
- Factorise numbers into prime factors.
- Develop calculator skills and use a calculator effectively.

Link objectives

- Use informal paper and pencil methods to support, record or explain multiplications and divisions.
- **Extend written methods to: short multiplication of HTU** or U.t **by U; long multiplication of TU by TU; short division of HTU by U** (with integer remainder).
- **Use all four operations to solve simple word problems involving numbers and quantities and explain methods and reasoning.**
- Choose and use appropriate number operations to solve problems and appropriat ways of calculating: mental, mental with jottings, written methods, calculator.
- Find all the pairs of factors of any number up to 100.
- Develop calculator skills and use a calculator effectively.

- **Multiply and divide three-digit by two-digit whole numbers; extend to multiplying and dividing decimals with one or two places by single-digit whole numbers.**
- **Solve word problems and investigate** in the context of number; compare and evaluate solutions.
- Enter numbers in a calculator and interpret the display in different contexts (decimals, money, metric measures).

Kev objectives are in **bold**

Day 1 Calculation and problem solving

Oral and mental		Main teaching			Plenary
Objectives, vocabulary and resources	**Teaching activities**	**Objectives, vocabulary and resources**	**Teaching activities**		**Teaching activities and assessment**
Objectives ■ Recognise and extend number sequences ■ Recognise multiples up to 10 x 10 **Vocabulary** Multiples3	Write on the board: 3 5 Quickly rehearse the multiplication tables for 3 and 5 with the whole class. **Q: What numbers appear in the 3 and the 5 times tables?** Divide the class into two groups. Set one group to count in 3s, the other to count in 5s to generate the sequence: 3, 5, 6, 9, 10, 12, 15, … **Q: What numbers do not appear in the sequence? Why?** Establish that only multiples of 3 or 5 (or both) can be in the sequence. Draw on the board: (3p) (5p) Ask the children to imagine that, as from today, the Government has decided it will issue only 3p and 5p coins. **Q: What sums of money can we make using only 3p and 5p coins?** Quickly collect responses and record on the board. **Q: Can you make 4p?** Establish that 4p cannot be made. **Q: Does this mean we could not buy anything that costs 4p?**	**Objectives** ■ Identify and use appropriate operations (including combinations of operations) to solve problems involving numbers and quantities, and explain methods and reasoning	Tell the children that you want them to think about how they could pay for goods if they could only use 3p and 5p coins. **Q: How could you pay for a 2p sweet?** Establish that you could give 5p and get 3p change. Record as: (5p) – (3p) = 2p **item costing 29p?** Collect and compare answers. 8 × (3p) + (5p) = 29p 7 × (5p) – 2 x (3p) = 29p **Q: What method of payment involves fewest coins changing hands?** 4 × (5p) + 3 x (3p) = 29p Agree on: **Q: How would you pay for a 49p can of cola?** Collect and compare answers. Ensure that the children understand the nature of this problem. Point out that 49p is 20p more than 29p and that one way of solving this problem is to build on the answer from the previous question. Ask children, in pairs, to explore how they would pay for goods costing different amounts, and to look for patterns. Stop the class and discuss their observations. Draw out that they are using and combining multiples of 3p and 5p. Write the following statement on the board. **'Using only 3p and 5p coins, you can pay for goods of any price.'** Ask children whether they think this is true or false. Let the children work in pairs to explore the statement. Stop the class and ask the children whether they have changed their views and, if so, why. Write, in a column, on the board: 1p, 2p, 3p, 4p, 5p, 6p, 7p, 8p, 9p, 10p. **Q: Which of these amounts can you pay?** Fill in the obvious amounts, such as 3p, 5p, 6p, 9p and 10p, and 2p from earlier. Let the children work on the remaining amounts. Invite children to write their answers on the board. Ensure that each amount has an answer.	**Q: Can we pay for goods costing 10p, 20p, 100p, 200p …?** Establish that only 5p coins will be needed. **Q: How can we pay a bill of £4.67?** Explain that £4.67 is equivalent to 400p + 60p + 7p. Say that we can pay the 400p and 60p with just 5p coins. **Q: How could we pay the 7p?** Return to the list on the board, to establish that the 7p could be paid by giving 10p (2 × 5p) and receiving a 3p coin in change. Ask the children to think how they might convince someone that you can pay for goods of any price using only 3p and 5p coins. Collect their reasons and explain that communicating and reasoning are important skills in mathematics. **Q: What other pairs of coins could the Government introduce? What about 7p and 10p?** **Homework** Ask the children to decide whether 7p and 10p coins would work and to prepare a convincing argument for the next lesson. **Assessment** Explain to the children that, during the week, they will be completing 'My Mathematics' self-assessment sheets that they will take to their secondary school.

Day 2 Calculation and problem solving

Oral and mental

Objectives, vocabulary and resources

Objectives
- Explain methods and reasoning
- Use a calculator effectively

Vocabulary
commutative

Resources
OHT 1
OHP calculator
Class set of calculators

Teaching activities

Quickly rehearse the 7 times table.
Present the children with the following problem.

Q: Using only the numbers 7 and 10 and the operations + and –, can you make all the numbers from 1 to 10?

Explain that they can use the numbers and operations more than once, for example the number 4 can be made as follows.
7 + 7 – 10 = 4
Remind the children of the last lesson and ask how this problem is similar to the one in the homework they were set.
Discuss children's reasons and explanations, and make connections between their reasons and the above problem.
Show OHT1. Explain that they are going to work on a problem in which numbers will represent the letters of the alphabet.
Say that every work is to have a value that is found by multiplying the values of the letters in the word, for example, 'PLAN' will have a value:
16 × 12 × 1 × 14 = 2688
Demonstrate the on the OHP calculator. Let children use their calculators to check.

Q: What would be the value of the word 'TEAR'?
Q: Can you find another word that will have the same value as 'TEAR'?

Ask the children to work in pairs.
Discuss children's solutions and establish that one method is to use the same letters from the original word. Use this to highlight the commutative property of multiplication.

Q: What word can you find that has the smallest value?

Establish that two-letter words and words containing the letter A often give the smallest values, but that letters towards the end of the alphabet are to be avoided (for example, BE = 10, but MY = 325).

Q: What is the value of the word 'LONE'?
Q: What is the value of the word 'ALONE'?

Establish that the value of the two words is the same and that this is because multiplying any number by 1 does not change its value.

Main teaching

Objectives, vocabulary and resources

Objectives
- Choose and use appropriate number operations to solve problems and appropriate ways of calculating
- Develop calculator skills and use a calculator effectively
- Factorise numbers

Vocabulary
factor

Resources
Resource sheet 1
'My Mathematics' Self-assessment sheet 1

Teaching activities

Give out Resource sheet 1.

Q: What is the value of the word MILLION?

With the class, establish that the answer is 31 842 720. Ask the children to say the number and note that this value is much more than a million.
Say that today they are going to try to find a word with a value of exactly 1 000 000. Refer to the above example and point out that the solution is not necessarily going to be a long word.
Let the children work in pairs to explore the values of different words.
After a time, bring the children together and discuss some of the words they have found. On the board, record the five words with values closest to 1 000 000.
Explain that sometimes it is useful to look at the problem another way. Write BAD, CAT and SIT in a list on the board and ask the children to find their values. Write their responses on the board, as shown.

Word	Value	Factors of the word's value (≤)
BAD	2 × 1 × 4 = 8	1, 2, 4, 8
CAT	3 × 1 × 20 = 60	1, 2, 3, 4, 5 6, 10, 12, 15, 20
SIT	19 × 9 × 20 = 3240	1, 2, 3, 4, 5 6, 9, 10, 12 15, 18, 19 20

Establish why BAD has a small value compared with SIT.

Q: Which letters can you use to make a word with a value of 8?

Establish that the only letters that can be used are A, B, D and H and that these represent the factors of 8. Record the factors of 8 in the third column, as shown.

Q: Which letters can you use to make a word with a value of 60?

Establish that the letters that can be used are A, B, C, D, E, F, J, L, O and T and record their values in the third column of the table.
Explain that these numbers are some of the factors of 60.

Q: Can you find any other factors of 60?

Agree that the missing factors are 30 and 60.

Q: Why do you think any factor greater than 26 is not important?

Establish that factors greater than 26 are not necessary as there are only 26 letters in the alphabet.
Point out the heading in the third column (≤26).

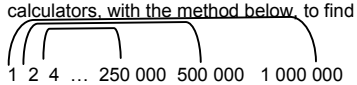
Q: How can we use factors to help us find a word with a value of 3420?

Take responses. Use the factors of 19, 9 and 20 to identify all the factors of 3420 < 26.
Set the children to work in pairs to find words with the value of 36, using the ideas discussed above.
Remind the children that they can use A as many times as they wish.
Collect different words and note any common letters used.

Plenary

Teaching activities and assessment

Work with the class to begin to find the factors of 1 000 000.
Remind the children that factors come in pairs. Let them use calculators, with the method below, to find the factors.



Stop after the first few factors.

Q: Which factors are we interested in?

Explain that we are looking for the factors that are less than 26. Establish that these are 1, 2, 4, 5, 8, 10, 16, 20 and 25 and that the associated letters are A, B, D, E, H, J, P, T and Y.
Let the children work in pairs to make up a 'new' word that 'hits a million'. Explain that it need not be a real word, it may be just a group of letters.
With the class, collect some of their 'new' words and check that their value is 1 000 000.

Q: Can any word that has a value of 1 000 000 include C or K?

Ensure that the children recognise that neither 3 (C) nor 11 (K) are factors of 1 000 000 and that the only letters that can ever be used to make a million are A, B, D, E, H, J, P, T and Y.
Collect in the calculators.

Assessment

Give out the 'My Mathematics' Self-assessment sheet 1.
Explain that, during the rest of the week, the children will be asked to say how well they can do some of the mathematics they have been working on. Say that there will be some time at the end of each lesson to complete their sheet.
Refer to the first multiplication on the sheet. Explain that they can choose to multiply 257 by 2, 3, 5, 8 or 9 and that the number they choose will depend on how confident they feel. Tell the children they should choose the number that they think shows how well they can multiply without using a calculator.
When they have done the multiplication they should share their work with a friend. Some of the children may need help, from you or another child. When the child has completed the question they should then tick the box that records whether they required any help.
Give the children a few minutes to work on the first multiplication question.
Give out answers and discuss.

Day 3 Calculation and problem solving

Oral and mental		Main teaching			Plenary
Objectives, vocabulary and resources	**Teaching activities**	**Objectives, vocabulary and resources**	**Teaching activities**		**Teaching activities and assessment**
Objectives ■ Carry out short and long multiplication ■ Recognise prime numbers to at least 20 **Resources** OHT 1 Resource sheet 1	Quickly, ask the children to recite the sequence of prime numbers starting at 2, going as far as they can. Remind the children that 1 is not a prime number (because it does not have two different factors). Ask the children to describe the work from yesterday's lesson. Show OHT 1 and ask the children to calculate the value of the word 'TODAY'. Confirm the answer is: 20 × 15 × 4 × 1 × 25 = (20 × 15) × (4 × 25) = (300) × (100) = 30 000 Say that they are going to continue using numbers to represent letters. The relationship between them is still as set out on Resource sheet 1. **Q: A four-letter word contains the letter A and three other letters with values that are all prime numbers. The value of the word is 66. What could the word be?** Establish that the product of the three letters will be 66 and that the three prime numbers will be 2, 3 and 11. So the letters are B, C and K, but as A can always be used, the word is BACK. Ensure that the children can identify letters with values that are prime numbers. **Q: What other words can you make that just use letters with prime number values and the letter A?** Let the children work in pairs to find words made from letters that have prime number values and the letter A and work out their values. Pick two of the children's words, without revealing them to the class. Give the other children the values and ask them to identify the words.	**Objectives** ■ Choose and use appropriate number operations to solve problems and appropriate ways of calculating ■ Carry out short division, and short and long multiplication ■ Factorise numbers into prime factors **Vocabulary** prime factor **Resources** 'My Mathematics' Self-assessment sheet 1	Ask the children to work in pairs to find words made from the 'prime letters' B, C, E, G. K, M, Q, S and W. Say that each letter may be used more than once. Say that they are going to begin by finding only two-, three- and four-letter words. After a time collect children's answers and note the value of each word, for example: SEEM = 19 × 5 × 5 × 13 = 6175 MESS = 13 × 5 × 19 × 19 = 23 465 Point to one of the answers (for example, SEEM = 19 × 5 × 5 × 13 = 6175). Say that all the numbers are factors of the word's value and we know all the factors are prime numbers. Explain that the word's value is represented as the product of its prime factors. Write for SEEM its value: $6175 = 5 \times 5 \times 13 \times 19 = 5^2 \times 13 \times 19$. **Q: If we wanted to find a word with a value of 50, what letters that all have prime values could we use?** Establish first that the letters must have values that are factors of 50 and these are 1, 2, 5, 10, 25, therefore the letters represented are A, B, E, J and Y. Write these letters on the board. **Q: Why can we not use the letters A, J and Y?** Establish that all the letters used have to be prime numbers and that A, J and Y do not have prime number values. Cross out these letters. **Q: What is the value of BE?** Agree it is 2 × 5 = 10.	**Q: What prime number will multiply this number up to 50?** Establish that the prime is 5, represented by the letter E. Confirm that the value of the word BEE is 50 and is the product of the primes 2, 5 and 5. Let the children work in pairs to find the set of 'prime letters' to make the totals 230, 330, 2185 and 3575. They should use short division to find the factors, then try to make a word from the letters. Collect words and check answers. Explain that the activities they have been working on represent an important topic of mathematics. In trying to find words with particular values they have been trying to express a number as the product of its prime factors. Write on the board: **'Every whole number apart from 1 can be expressed as a product of primes – true or false?'** **Q: How can we express 90 as a product of primes?** Get the children to list all the factors of 90. Remind them that they come in pairs. 1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, 90 Underline the prime numbers 2, 3 and 5. **Q: How can we use the numbers 2, 3 and 5 to make a multiplication statement equal to 90?** Establish that 90 = $2 \times 3 \times 3 \times 5 = 2 \times 3^2 \times 5$. Say that this is how 90 is expressed as a product of its primes. Confirm that it will always be possible to do this and the above statement is true.	Write the following list on the board. 1, 2, 4, 5, 8, 10, 16, 20, 25 Remind children that these are the factors of 1 000 000 that are less than 26. **Q: Which of these numbers are prime?** Establish that only 2 and 5 are prime and that the letters represented by these numbers are B and E. **Q: If a 'hit a million' word could be made up only of Bs and Es, how many Bs and Es would there be in the word?** Let the children work in pairs to find how many Bs and Es are required. Establish that six Bs and six Es would be needed. Write on the board: $1\,000\,000 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 = 2^6 \times 5^6$ **Assessment** Ask the children to refer to their 'My Mathematics' Self-assessment sheet 1. Explain that you want them to do the second multiplication question (multiply 456 by 12, 23, 54 or 67). Remind the children of the choice of numbers they have and give them time to work on the question and to discuss the answer with a friend. Again, ask them to record whether they did the calculation on their own or with help. Give out answers and discuss.

Day 4 Calculation and problem solving

Oral and mental		Main teaching			Plenary
Objectives, vocabulary and resources	**Teaching activities**	**Objectives, vocabulary and resources**	**Teaching activities**		**Teaching activities and assessment**
Objectives ■ Carry out short division of numbers ■ Use tests of divisibility **Resources** OHP calculator **Vocabulary** exact remainder	Write on the board: A 168 ÷ 2 B 168 ÷ 6 C 168 ÷ 4 D 168 ÷ 3 E 168 ÷ 5 F 168 ÷ 10 G 168 ÷ 8 H 168 ÷ 9 Ask the children to work in pairs to decide which calculations: ■ they can do mentally or with jottings ■ require a written method. Discuss their responses and ensure that children can carry out at least A, C, and F mentally. Remind the children of the tests of divisibility and discuss how they can be used to establish if each division is exact. A: Yes – 168 is even B: Yes – the digits 1, 6 and 8 sum to 15 (a multiple of 3) and 168 is even C: Yes – the last two digits are divisible by 4 D: Yes – the digits 1, 6 and 8 sum to 15 (a multiple of 3) E: No – 168 does not end in zero or 5 F: No – 168 does not end in zero G: Yes – repeated halving will show this H: No – the sum of the digits 15 is not divisible by 9 Let the children work in pairs, using a written method, or mental, if appropriate, to work out B, D, E, G and H, giving any remainders that occur. Use an OHP calculator to confirm answers interpreting the display carefully. Check all answers with a multiplication, explaining how to deal with the remainders.	**Objectives** ■ Carry out short multiplication and division of numbers involving decimals ■ Carry out multiplication of a two-digit number by a two-digit number **Vocabulary** dimensions **Resources** OHT 2 OHT 3 'My Mathematics' Self-assessment sheet 1 Class set of calculators	Present the following problem. **Jane has a square cake and wants to share it equally among three children. Jane likes squares and decides that all the pieces given to the three children will be square.** **Q: How could Jane give each of the three children a square piece of cake?** Discuss children's suggestions and solutions. **Q: How should Jane cut the cake so that each child gets the biggest square possible?** Agree that cutting into four squares ensures that each child could receive the largest square piece and that there would be one square piece left over. Show OHT 2 and say that the area of the cake is 324 cm^2. **Q: How can we work out the area of each piece of cake the children would get if they were given one of the squares?** Establish that the required calculation is 324 4 4. Ask the children to do the short division to confirm that the area of each square is 81 cm^2. **Q: Is there another way we could find the area of one of the squares?** Remind the children that the area is found by multiplying the length by the breadth. Since the cake is square, the length and breadth of the cake will be the same. **Q: How can we find a number that, multiplied by itself, gives 324?** Explore different ways of finding the dimensions of the cake. Confirm that the cake is 18 cm by 18 cm. Agree that the dimensions of each piece of cake are 9 cm by 9 cm so the area of each piece is 81 cm^2.	**Jane has decided to take the remaining piece of cake and cut it into squares to give the three children.** **Q: How will the remaining square piece of cake be cut into four squares?** On OHT 2, demonstrate how the remaining square is cut into four smaller squares. **Q: What will be the area of each of the smaller squares?** Establish that the calculation is 81 ÷ 4. Ask the children to do the short division to confirm that the area of each piece is 20.25 cm2. Agree that the dimensions of the smaller squares are 4.5 cm by 4.5 cm and ask the children to carry out a multiplication to confirm that the area of each small square is 20.25 cm^2. **Q: How much cake will each child have altogether now?** Ask the children to add the area of the two squares. 81 + 20.25 = 101.25 cm^2 Explain that Jane keeps dividing the remaining square into four smaller squares, and giving out three squares. Show OHT 3. Explain that this table shows the calculations for the first and second cuts. Give out calculators. Ask the children to work out the calculation for the third cut, using a calculator. Collect answers and record on OHT 3. Repeat for the fourth and fifth cuts. **Q: How many rows do you think there will be in this table?** Discuss children's responses and explore the idea of infinity and convergence.	**Q: Is there a way that we can calculate the total area of cake for each child by looking at the problem another way?** Establish that eventually there will be no cake left so all of the cake will have been shared among the three children. Ask the children to carry out the calculation 324 ÷ 3. Record the answer on OHT 3. Compare this answer of 108 cm^2 with the answer following the fourth and fifth cuts to confirm that after five cuts there is very little of the cake left to be shared. Collect in the calculators. **Assessment** Ask the children to take out their 'My Mathematics' Self-assessment sheet 1 and to work on the third multiplication question (multiply 34.8 by 2, 4, 6, 7 or 9) and the division question (£31.68 ÷ 2, 4, 6 or 8). Remind them that their choice of number should show how well they can perform each calculation. Give out answers and discuss. Say, 'Tomorrow we shall be looking at the 3p and the 5p problem.' Remind the children about the work that they did on Day 1 and how they thought about their reasons for the answers they gave. Tell them that they will have the chance to look at the question tomorrow but they should refer back to their work on the problem for homework.

Day 5 Calculation and problem solving

Oral and mental		Main teaching			Plenary
Objectives, vocabulary and resources	**Teaching activities**	**Objectives, vocabulary and resources**	**Teaching activities**		**Teaching activities and assessment**
Objectives ■ Carry out multiplication of three-digit by two-digit numbers	Write on the board: □□□ × □□ **= 4340** **Q: Using the digits 1, 2, 3, 4 and 5, how can we complete this multiplication statement?** Help children by presenting the problem in a formal compact form or using a missing digits grid method. Discuss the different strategies that the children used and explain key points such as where the 5 must go. (124 x 35) Write on the board: □□□ × □□ **= 4928** **Q: How have the numbers been rearranged?** Explain that, again, they may only use 1, 2, 3, 4 and 5 once. Discuss children's strategies. Point out the only way to get 8 is 4 x 2 and that, as the answer is about the same size as in the previous question, the 3 and the 1 must have been swapped. (352 x 14) Give the final rearrangement. □□□ × □□ **= 12 312** **Q: What information can we use to find the numbers in this rearrangement?** Discuss the children's answers and reasoning. (513 × 24)	**Objectives** ■ Identify and use appropriate operations (including combinations of operations) to solve problems involving numbers and quantities, and explain methods and reasoning **Resources** Resource sheet 2 Resource sheet 3 OHT 4 'My Mathematics' Self-assessment sheet 1 'My Mathematics' Self-assessment sheet 2	Give the children Resource sheet 2 and ask them to read through the problem, in pairs, and think about how they might solve it. Suggest that they jot down their methods of tackling the problem in the box on the sheet. Stop the class and discuss the problem with the children and the methods they propose using. Ask questions to help them. **Q: How much money will be given by the children who gave the minimum amount?** **Q: How much is given by those giving 12p extra?** Set children to work, in pairs, to calculate how much money will be collected altogether. Tell them that they should record all their working and make a note of any partial solutions such as the answers to the questions above. Collect answers and discuss their methods.	Show OHT 4. Explain that the table is a way of recording how much money will be collected. Discuss what the headings might be for each column and, with the children, complete the group sizes and the 'money to be collected' row. Discuss how to find the total money to be collected for one month. Work through the table with the children and establish the required calculation for each cell. Record the calculations on OHT 4. Give out Resource sheet 3 and ask the children to fill in the amounts, using the calculations recorded on OHT 4. **Q: How do we calculate the amount of money to be collected in one year?** Set the children to undertake the calculations and record their answers, using the statements on Resource sheet 3.	**Assessment** Give out 'My Mathematics' Self-assessment sheet 2. Allow time for the children to consider the question on the sheet. Ensure that they are able to recall the context of the problem presented on the first day. Work with individual children to discuss their reasons and explanations. Ask the children to say whether they needed help in deciding if Luke was right or wrong, and why. Discuss the solution to the problem, with the class. Explain that the table on the bottom half of the sheet is for the children to summarise how well they have been able to answer each question. Ask the children to look at the statements in the left-hand column. The questions alongside each statement are intended to remind the children what each statement means. Ask the children to look back on their work to help them fill in the table. Encourage the children to complete each statement by putting a tick in one box and to put a circle around the number they chose for their calculation. Ask the children to think about all the different calculations and reasoning strategies they have been working on. Ask them to complete the target statement by choosing an area that they think they need to improve. For those children who were able to answer all the questions without any help, discuss the learning objectives for Year 7 shown on the front page of the unit. Get the children to stick 'My Mathematics' Self-assessment sheets 1 and 2 in their books under their work.

Year 6

OHT 1

Resource sheet 1

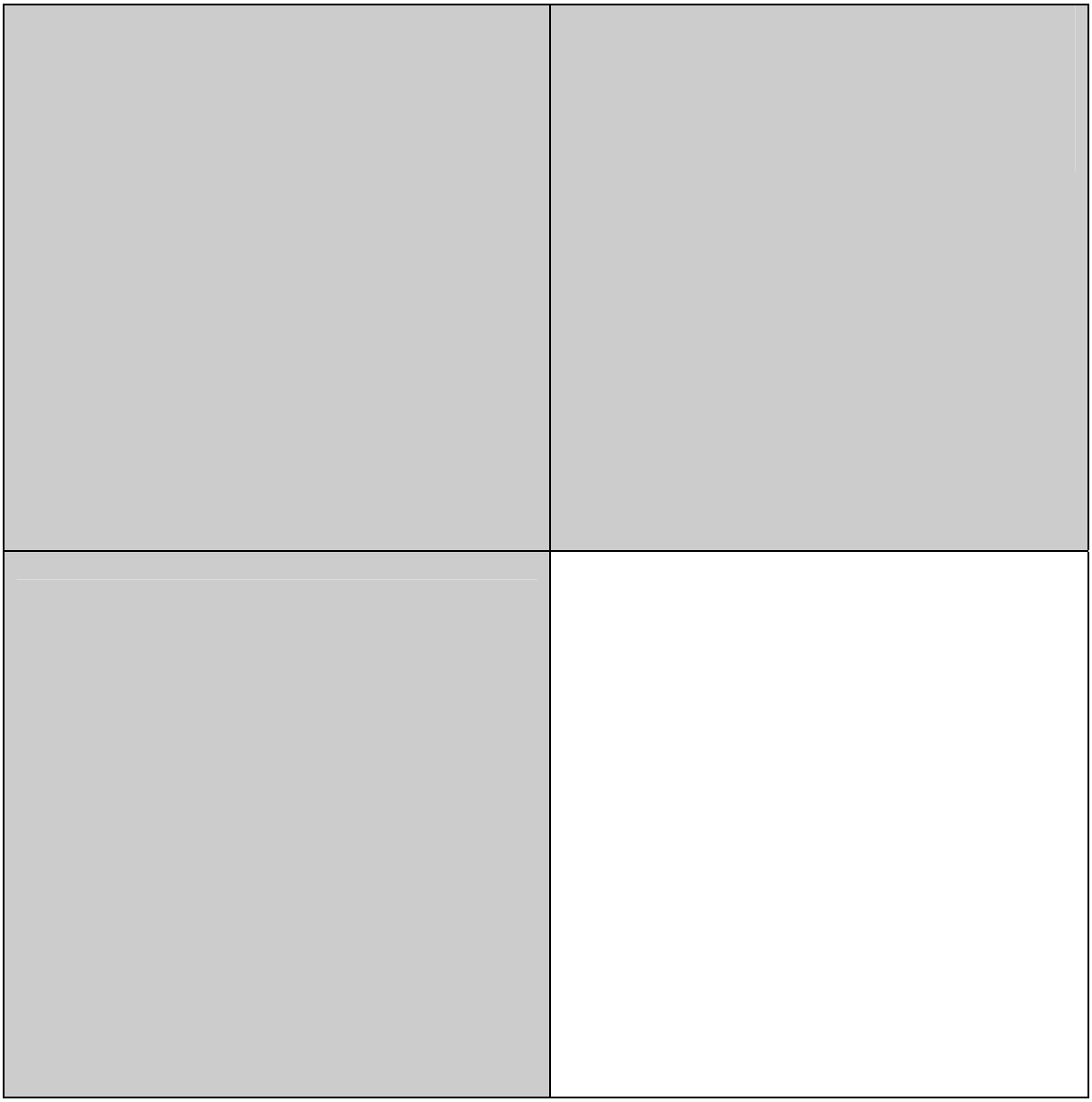
A	B	C	D	E	F	G	H	I
1	2	3	4	5	6	7	8	9

J	K	L	M	N	O	P	Q	R
10	11	12	13	14	15	16	17	18

S	T	U	V	W	X	Y	Z
19	20	21	22	23	24	25	26

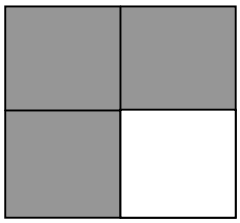
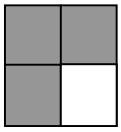
Year 6

OHT 2



Year 6

OHT 3

Cut	Area of each piece of cake	Total area of cake for each child
First cut 	$324 \div 4 = 81\text{cm}^2$	81cm^2
Second cut 	$81 \div 4 = 20.25\ \text{cm}^2$	$\begin{array}{r} 81 \\ +\ 20.25 \\ \hline 101.25\ \text{cm}^2 \end{array}$
Third cut 		
Fourth cut 		
Fifth cut		

Year 6

OHT 4

Group	Number in group	Money to be collected per month					
A							
B							
C							
D							
E							
F							

Year 6

Resource sheet 2

A class of 32 children decide to save for charity for one year. The children agree that the minimum amount to be given by each child every month is 35p. Eight children agree to give the minimum amount. Nine children agree they will each give the minimum amount plus an extra 12p. Seven children agree they will each give the minimum amount plus 24p. Five children agree they will each give twice the minimum amount. The rest of the class each give 75p. The teacher gives £1. How much will the class collect for charity in one year?

Space for jottings and ideas

Year 6

Resource sheet 3

Group	Number in group	Money to be collected per month					
		35p					£1
A							
B							
C							
D							
E							
F							1 × £1 = £1

Statements

Group A The eight children will give:

Group B The nine children will give:

Group C The seven children will give:

Group D The five children will give:

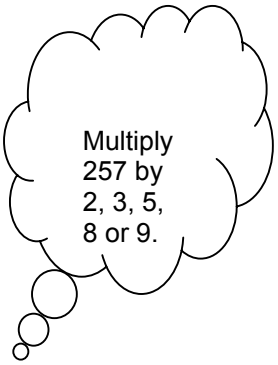
Group E The three children will give:

Group F The one teacher will give:

Total for the year is: £

Year 6

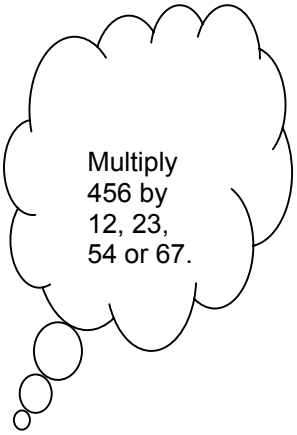
My Mathematics
Self-assessment sheet 1



My calculation

Show or discuss with a friend.

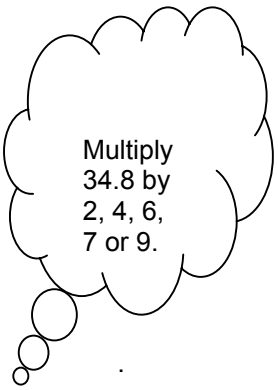
I did this calculation:
on my own ☐
with some help ☐



My calculation

Show or discuss with a friend.

I did this calculation:
on my own ☐
with some help ☐



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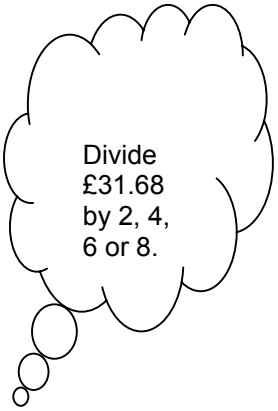
My calculation

Show or discuss with a friend.

I did this calculation:
on my own ☐
with some help ☐



My calculation

Show or discuss with a friend.

I did this calculation:
on my own ☐
with some help ☐

Year 6

My Mathematics
Self-assessment sheet 2

The money problem

The Government wants to issue only 2p and 6p coins. Luke says, "You can buy items of any price."
He explains:

10p = 2p + 2p + 6p
So you can buy items costing 10p, 20p, 30p, and so on, for ever.
You can also buy items costing 2p, 4p, 6p and so on, for ever, so you can pay for

Is Luke right or wrong?

I think Luke is right/wrong because:

Show or discuss with a friend.

I explained my reasons:
on my own ☐
with some help ☐

Name:	**School:**
What I can do	
I can multiply and divide numbers involving decimals: on my own ☐ with some help ☐	Multiply 34.8 by 2, 4, 6, 7, or 9. Divide £31.68 by 2, 4, 6, or 8.
I can multiply a 3-digit number by a 1-digit and 2-digit number : on my own ☐ with some help ☐	Multiply 257 by 2, 3, 5, 8 or 9. Multiply 456 by 12, 23, 54, or 67.
I can use operations to solve problems, and explain my methods and reasoning: on my own ☐ with some help ☐	The money problem: (2p) (6p)

My next target:

I want to get better at _____

_____

_____

Year 7 transition unit: calculation and problem solving

Unit objectives

The objectives for this unit are:

A Understand and use decimal notation and place value; multiply and divide integers and decimals by 10, 100, 1000, and explain the effect.

B Understand negative numbers as positions on a number line; order, add and subtract positive and negative integers in context.

C Consolidate the rapid recall of number facts, including positive integer complements to 100 and multiplication facts to 10 × 10, and quickly derive associated division facts.

D Use standard column procedures to add and subtract whole numbers and decimals with up to two places.

E Multiply and divide three-digit by two-digit whole numbers; extend to multiplying and dividing decimals with one or two places by single-digit whole numbers.

F Enter numbers in a calculator and interpret the display in different contexts (decimals, money, metric measures).

G Solve word problems and investigate in the context of number; compare and evaluate solutions.

These objectives build on key objectives in Year 6. It is important that pupils practise and extend their calculation strategies in Year 7 and become more efficient and proficient and that they are taught to select methods appropriate to the context. Calculator skills will have been introduced to pupils in Year 6; they are expected to use calculators effectively.

Pupils attaining at least level 4 in Key Stage 2 are expected to:

- extend written methods to:
  - column addition and subtraction of numbers involving decimals
  - short multiplication and division of numbers involving decimals
  - long multiplication of a three-digit by a two-digit integer

- identify and use the appropriate operations (including combinations of operations) to solve word problems involving numbers and quantities, and explain methods and reasoning.

Differentiation

The notes for the unit indicate possible support and extension ideas, referencing *Springboard 7* and the Framework's supplement of examples which provides extension examples across Years 7, 8 and 9. Examples can be chosen as appropriate.

Resources

Lesson 1: Counting stick, number fans or mini-whiteboards, two large double-sided cards for demonstration (one card with the 7 on one side and –2 on the other and the other card with 5 on one side and –3 on the other), three or four smaller versions of these double-sided cards per pair of pupils

Lesson 2: Resource sheet 1 *Number cards*, three or four of the double-sided cards (as for lesson 1) per pair of pupils

Lesson 3: OHT 1 *Target number grid*, OHT 2 *Equivalent products*, Resource sheet 2 *Calculations,* Resource sheet 3 *Errors in calculations*

Lesson 4: OHP calculator, set of calculators (one per pair of pupils), Resource sheet 4 *Problems in the millions!*

Lesson 5: Resource sheet 5 *Largest calculations*, Resource sheet 6 *Largest product*

Key mathematical terms and notation

difference, explain, integer, minus, negative (e.g. – 6), plus, positive (e.g. + 6), reasoning, sum, systematic

Year 7 transition unit: calculation and problem solving

Autumn term **Unit objectives** **Five daily lessons**

- Understand and use decimal notation and place value; multiply and divide integers and decimals by 10, 100, 1000, and explain the effect.
- Understand negative numbers as positions on a number line; order, add and subtract positive and negative numbers in context.
- Consolidate the rapid recall of number facts, including positive integer complements to 100 and multiplication facts to 10 3 10, and quickly derive associated division facts.
- Use standard column methods to add and subtract whole numbers and decimals with up to two places.
- **Multiply and divide three-digit by two-digit whole numbers; extend to multiplying and dividing decimals with one or two places by single digit whole numbers.**
- Enter numbers in a calculator and interpret the display in different contexts (decimals, money, metric measures).
- **Solve word problems and investigate** in the context of number; compare and evaluate solutions.

Link objectives

- **Carry out short multiplication and division of numbers involving decimals.**
- **Carry out long multiplication of a three-digit by a two-digit number.**
- **Identify and use appropriate operations (including combinations of operations) to solve problems involving numbers and quantities, and explain methods and reasoning.**
- Choose and use appropriate number operations to solve problems and appropriate ways of calculating.
- Develop calculator skills and use a calculator effectively.

- **Add, subtract, multiply and divide integers.**
- **Multiply and divide integers and decimals such as 0.6 and 0.06; understand where to position the decimal point by considering equivalent calculations.**
- Recall known facts, including fraction to decimal conversions; use known facts to derive unknown facts, including products such as 0.7 and 6, and 0.03 and 8.
- Give solutions to an appropriate degree of accuracy.

Key objectives are in **bold**

Lesson 1 Recap on Year 6 work

Oral and mental

Objectives
- Understand and use decimal notation and place value.
- Understand negative numbers as positions on a number line; order negative numbers.
- Consolidate the rapid recall of number facts, including multiplication facts to 10 × 10, and quickly derive associated division facts.

Framework examples pp 36, 40, 48, 88

Counting on and back from different starting numbers in steps of different sizes including decimals

Establish that pupils are familiar with negative numbers and can continue patterns below 0, for example:

- counting back from 20 in steps of 3, 7, 11, …
- counting on from –11 in steps of 5, 20, 13, …
- counting back from 10 in steps of 0.2, 0.7, …

using a counting stick or an empty number line.

3p and 5p coins

Remind pupils of the work they did in Year 6, finding amounts of money they could make using 3p and 5p coins.

Reinforce quick calculations involving 3s and 5s by asking pupils questions such as:

- I have seven 3p coins. How much is that?
- I have 60p. How many 5p coins is that?
- I have 6000p. How many 3p coins is that?

Ensure maximum participation by asking pupils to use number fans or mini-whiteboards to display answers.

Main teaching

Objectives
- Understand negative numbers as positions on a number line; order and add positive and negative numbers.
- Consolidate the rapid recall of number facts, including multiplication facts to 10 × 10, and quickly derive associated division facts.
- **Solve word problems and investigate** in the context of number; compare and evaluate solutions

Framework examples p 48

Coins

Remind pupils of the coin problems they were set in Year 6:

Imagine the Government has decided to issue only 3p and 5p coins.

Using only 3p and 5p coins, you can pay for goods of any price.

TRUE or FALSE?

What other sets of coins could the Government introduce? What about 7p and 10p?

Discuss with pupils the way they approached the problems, reminding them that they could receive change. Pose questions for them to consider then answer in pairs:

- **How did you pay for an item costing 39p? Is there more than one way of paying 39p?**
- **Were you able to make any value using 3p and 5p coins?**
- **What about 7p and 10p coins?**

Model some possible solutions and approaches to the problems, establishing what were important steps in finding the answers and whether the pupils were able to produce convincing arguments.

Highlight some important things to think about when solving problems, for example:

- being systematic
- keeping a careful record of their findings as they go along
- identifying patterns in their findings and drawing on these to come to some conclusions that they can explain and justify.

Explain that these are important skills that they will be expected to use in Year 7.

No change

Explore with pupils what would happen if they had to give an 'exact amount' and could not receive any change.

- **Could you still make every value?**

Ask them to discuss this quickly, in pairs, considering either 3p and 5p coins or 7p and 10p coins. Draw out some responses, asking pupils to explain their answers. Summarise which values are not possible, and why.

Double-sided cards

Extend the problem to considering double-sided cards with positive and negative integers. Use some large cards, some with 7 on one side and –2 on the other, and others with 5 on one side and –3 on the other. Demonstrate the different values you can make.

e.g. using one of each card you can make:

$\boxed{7} + \boxed{-3} = 4$

Confirm that, using one of each card, these values are possible:

12, 4, 3, –5

Ask pupils to work in pairs to establish how many different values they can find if they use two of each of these cards.

Notes

Support

If any pupils have not previously done the Year 6 activity, introduce it and allow time for them to consider the problem; they may need support in tackling it systematically.

Support

Use double-sided cards with positive values on each side.

Extension

Ask pupils to establish how many different values they can obtain if they use two of one card and one of the other, three of each of the cards, …

Plenary and homework

Plenary

Question pupils about what they have found, asking them to explain what they recorded, what conclusions they came to, and how.

Pose questions such as:

- **How did you know you had found all the possible values?**
- **How could you convince someone else that you had found all the possible values?**
- **Were there any values you couldn't make? Can you explain why?**

Summarise.

Homework

Set the following problem:

- **I have two double-sided cards and, using both cards, I can make the following values: 7, 10, –1, –4 What integers are on each side of the two cards?**

(2 and –1, 8 and –3)

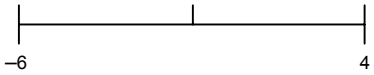
Lesson 2 Extending to negative values

Oral and mental

Objective
- Understand negative numbers as positions on a number line; order negative numbers.

Framework examples pp 40, 48

Mid-points
Draw an empty number line and write a number at each end. Put a mark or a cross half-way along the line and ask pupils what number will be at the mid-point. For example:



Ask them how they found the mid-point.

Discuss the methods they used, using the number line to model their thinking.

Quickly model another two examples, e.g. the mid-point between:

- –11 and 5
- –3.5 and –1

Ask pupils if their strategies change when they are dealing with different types of number, or when the end numbers are close/far apart.

Ask pairs of pupils to practise finding mid-points, using a set of number cards (Resource sheet 1). Pupils each choose a card and then they find the number half-way between the numbers they have chosen, using an empty number line if they wish.

Main teaching

Objectives
- Understand negative numbers as positions on a number line; order, add and subtract negative numbers.
- **Solve word problems and investigate** in the context of number; compare and evaluate solutions.

Framework examples pp 48, 92, 94

Adding and subtracting positive and negative integers
Using empty number lines (horizontal and vertical) or by extending number patterns (Framework examples page 48), model addition and subtraction of positive and negative integers.

Ensure that pupils can record their number statements consistently.

More double-sided cards
Extend the double-sided card problem to adding and subtracting integers to make different values.

- **Using any number of double-sided cards, some with 7 on one side and –2 on the other and others with 5 on one side and –3 on the other, what values could you find?**

Discuss some of the possible values using both addition and subtraction.

$\boxed{5} + \boxed{-2} + \boxed{-2} + \boxed{-2} = -1$

$\boxed{7} + \boxed{-3} - \boxed{5} = -1$

$\boxed{-3} - \boxed{-2} = -1$

Ask pupils:

- **Can you find every value from –5 to 5?**

Discuss responses, acknowledging different ways of obtaining the same value.

Notes

Support
In the oral and mental starter, numbers can be selected to make the task easier e.g. choose integers (positive and negative) to give an even difference, or numbers that are close together.

The main teaching activity can be simplified by using only positive values, by allowing the use of any number of cards or by using addition only.

Links to *Springboard 7*, Unit 2.

Extension
In the main teaching activity, pupils could be asked to consider whether values are impossible to find.

Could they find integers that would produce all the values from –25 to 25?

Would this mean that any value could be found?

How could they justify their answer?

Plenary and homework

Plenary
Discuss results and strategies, for example by asking pairs:

- **Is it possible to make –6?**
- **How many different ways are there to make –6?**
- **Is it possible to make every value from –10 to 10?**
- **How can you convince someone that this is true?**

Summarise the results and, if possible, get a pupil to demonstrate a systematic way of recording them.

Homework
Set the following problem:

- **Fill in the missing numbers so that each row, each column and each diagonal adds up to 3.**

–2		
3	**1**	
2		**4**

Lesson 3 Calculation methods

Oral and mental

Objectives
- Understand and use decimal notation and place value.
- Consolidate the rapid recall of number facts, including positive integer complements to 100 and multiplication facts to 10 × 10, and quickly derive associated division facts.

Framework examples pp 88, 96

Target numbers
Practise mental calculation skills and recall of number facts using a target number grid e.g. OHT 1. Ask questions such as:

- What is the complement to 100 of this number?
- What is this number multiplied by 100?
- What is the sum of these two numbers?
- What is this number divided by 4?
- Which two numbers add to make 10?
- What is double this number?
- What is this number multiplied by 70?

Equivalent products
Use OHT 2 *Equivalent products* or write

6.2 × 100

in the middle of the board.

Invite pupils to give equivalent products, for example:

62 × 10, 3.1 × 200, 62 000 × 0.01, …

Main teaching

Objectives
- Use standard column procedures to add and subtract whole numbers and decimals with up to two decimal places.
- Multiply and divide three-digit by two-digit whole numbers; extend to multiplying and dividing decimal with one or two places by single-digit whole numbers.

Framework examples pp 48, 104, 106

Calculation methods
Emphasise the importance of being able to calculate mentally and to use efficient written calculation methods.

Acknowledge that you know the sorts of calculations they can already do from their teachers' assessments and from the pupils' own self-assessments from Year 6, but you would like to find out more about the methods they use.

Ask one or two pupils to model examples of calculation methods they can use. Ask them to explain how they would estimate and check their answers.

Note: By the age of 11, pupils are expected to use a formal written method for calculations such as 460 – 237 or 23 × 17. The most common methods expected of 11-year-olds are column addition and subtraction, long multiplication or 'grid' multiplication, short division or 'chunking' – see Framework examples pp 104, 106.

Distribute Resource sheet 2 *Calculations* and ask pupils to work through the examples, making a decision for each one whether they would do it:

- mentally (with or without jottings)
- using a formal written method.

Emphasise that you are particularly interested in how they calculate, not just the accuracy of their answers. You are also keen to know how they estimate what might be a reasonable answer and how they check their answers after they do the calculation.

Circulate to observe and note the different calculation strategies being used. Use the assessments you have received from Y6 to probe pupils' understanding and to help them extend and refine their strategies.

When pupils have completed all the questions they can tackle, say that you would like them to help you identify errors pupils have made in the past. Give out Resource sheet 3 *Errors in calculations* and ask them to work in pairs to estimate an answer for each calculation, to identify what has gone wrong in each example and to correct the calculation.

Notes

Support
Select some more simple examples, initially with whole numbers, from *Springboard 7*, Unit 2 (sections 4, 5) and Unit 6 (sections 5, 6).

Extension
Give examples involving multiplication and division by numbers with up to two places of decimals.

Plenary and homework

Plenary
Review the errors pupils have identified and establish important points for them to remember when doing calculations. These could be written on a sheet of sugar paper so that they can be referred to at a later stage.

Explain that, in the next lesson, they will be looking at some word problems that involve calculations.

Write the following word problem on the board and ask pupils to think about how they would tackle it:

- **A shop sells sheets of sticky labels. On each sheet there are 36 rows and 18 columns of labels.**

  How many labels are there altogether on 9 sheets?

Model a sensible way to approach the problem, for example:

- underline the important information
- decide what operation(s) is (are) needed
- estimate, do and check the calculation
- write the answer as a sentence, checking that it makes sense.

Solve the problem together and ask pupils to try to use a similar approach to the problem set for homework.

Homework
Set this word problem:

- **A teacher needs 220 booklets. The booklets are sold in packs of 16. How many packs must the teacher order?**

Lesson 4 Solving calculation problems

Oral and mental

Objectives
- Enter numbers in a calculator and interpret the display in different contexts (decimals, money, metric measures).
- **Solve word problems and investigate** in the context of number; compare and evaluate solutions.

Framework examples pp 2, 108

Using a calculator
Put this calculation on the board.

950.4 ÷ □ = 49.5

Give pupils 30 seconds to agree, in pairs, an estimate for the answer. Take some feedback and establish a sensible estimate.

Now tell pairs they can use a calculator to find the missing number. Give them a couple of minutes, then invite someone to use an OHP calculator to demonstrate how they calculated the answer.

Ask if anyone tackled it in a different way. If so, ask them to demonstrate on the OHP calculator.

Ask pupils how they would check the answer. Establish how this can be done.

Interpreting calculator answers
Ask pupils to calculate 136 ÷ 32 on their calculators. Ask them to write the answer on a mini-whiteboard or piece of paper and hold it up.

Now pose the question:

- **Jim took part in a charity cycle ride. He cycled 136 kilometres at 32 kilometres per hour. How long did he take to complete the cycle ride?**

Confirm that the calculation is the same (136 ÷ 32). Ask pupils to discuss the answer, in pairs, and to decide how to interpret the answer displayed on the screen.

Establish how to interpret the answer. Set some other questions, involving money and measures, that illustrate the need to interpret calculator answers.

Main teaching

Objectives
- Understand and use decimal notation and place value; multiply and divide integers and decimals by 10, 100, 1000, and explain the effect.
- Enter numbers in a calculator and interpret the display in different contexts (decimals, money, metric measures).
- **Solve word problems and investigate** in the context of number; compare and evaluate solutions.

Framework examples pp 2, 6, 108

More problem solving
Review the problem set for homework:

- **A teacher needs 220 booklets. The booklets are sold in packs of 16. How many packs must the teacher order?**

Ask two or three pupils to explain:
- how they tackled the problem
- what calculation they did
- how they did the calculation (mentally? formal written calculation? using a calculator?)
- how they interpreted the answer on the calculator screen.

Ask pupils to work in pairs on the word problems on Resource sheet 4 *Problems in the millions!*

Ask pupils to read through each problem, in pairs, estimate the answer and think about how they might solve it. Encourage pupils to jot down their methods of tackling the problem.

After about 5 minutes, check on progress and discuss the approaches pupils are adopting. If possible, draw on pupils' own strategies, highlighting effective approaches to tackling the problems.

Give pupils time to work on some more examples, encouraging them to make sensible use of calculators and to take care in interpreting the calculator display.

Notes

Support
Links to *Springboard 7*, Unit 2 (section 6), calculating with money.

Extension
Select more demanding problems from *Framework examples pp 3, 7, 109.*

Plenary and homework

Plenary
Collect answers and discuss pupils' approaches, using the OHP calculator to illustrate methods.

Round off the lesson by setting two number puzzles for pupils to solve, using a calculator. Ask pupils first to estimate each missing number, then use a calculator to work it out.

□ × 24.3 = 400.95

24 × 16.5 ÷ □ = 79.2

Homework
Ask pupils to make up a similar number puzzle for someone in their class to solve.

Lesson 5 Exploring calculation methods

Oral and mental

Objectives
- Understand and use decimal notation and place value.
- Enter numbers in a calculator and interpret the display in different contexts (decimals, money, metric measures).
- **Solve word problems and investigate** in the context of number; compare and evaluate solutions.

Framework examples p 6

Missing digits
Remind pupils that in Year 6 they solved puzzles where they had to put numbers into boxes.

Ask pupils to work as quickly as they can, using the digits 2, 3, 7 and 8 as often as they like, to make these number sentences correct.

□□ + □□ = 54

155 – □□ = □□

Discuss the different strategies used by pupils and clarify key points such as the difference between a digit (numeral) and a number (made up of digits or numerals), the need to have a sense of place value, the need to have a sense of the number as a whole.

Set the following examples.

□□ + □□ = 69 **105 – □□ = □□**

□□ + □□ = 99 **□□ + □□ = 110**

Main teaching

Objectives
- Understand and use decimal notation and place value; multiply and divide integers and decimals by 10, 100, 1000, and explain the effect.
- Enter numbers in a calculator and interpret the display in different contexts (decimals, money, metric measures).
- **Solve word problems and investigate** in the context of number; compare and evaluate solutions.

Framework examples pp 6, 36

Largest calculation
Give pairs of pupils one minute to discuss the following problem and to decide how they would tackle it.

- **Using each of the digits 1, 2, 3, 4, 5 only once, what is the largest addition calculation you can make?**

  □□□ + □□

Take feedback and establish that they would use what they know about place value and addition to make a decision. Which digit would they place first? Which one next? …

Acknowledge that addition is relatively easy. What if they used a different operation, while still looking for the highest result? For subtraction, for example, would they approach the problem in the same way? What about multiplication and division?

Give out Resource sheet 5 *Largest calculations* for pupils to work on, in pairs. Ask them to think carefully about how they will tackle the problem and how they can draw on what they already know about numbers and number operations.

Take feedback on answers, the ways pupils have thought about the problem and the prior knowledge and understanding that they have used.

Ask how the problem could be extended. For example:

What if …
- **you could use any five digits from 1 to 9**
- **you could group the digits in different ways e.g.**

  □□□□ × □

  or □□ × □□ × □
- **you could use a decimal point**
- **you were trying to find the smallest result?**

Ask each pair to decide upon the question they will pursue and give them 5 minutes to get started. Bring the class together to share their thinking so far and to establish their lines of investigation.

Notes

Support
Simplify questions in the oral and mental starter by, for example, giving some of the digits or providing number cards to support the activity. Links to *Springboard* 7, Unit 2 (sections 2, 4, 5) and Unit 10 (section 2).

Plenary and homework

Plenary
To emphasise the importance of place value, play this game.

Team A: □ □ □ × □ □

Team B: □ □ □ × □ □

Divide the class into two teams. Explain that the aim is for each team to make the largest possible product.

Roll a dice, call out the number (say, 3) and give each team 10 seconds to decide what they think is the most advantageous position for the digit represented by the number on the dice. Both teams place their digit and play continues until each team has placed all five digits. The team with the larger product wins.

Ask pairs to play the same game, using Resource sheet 6 *Largest product.*

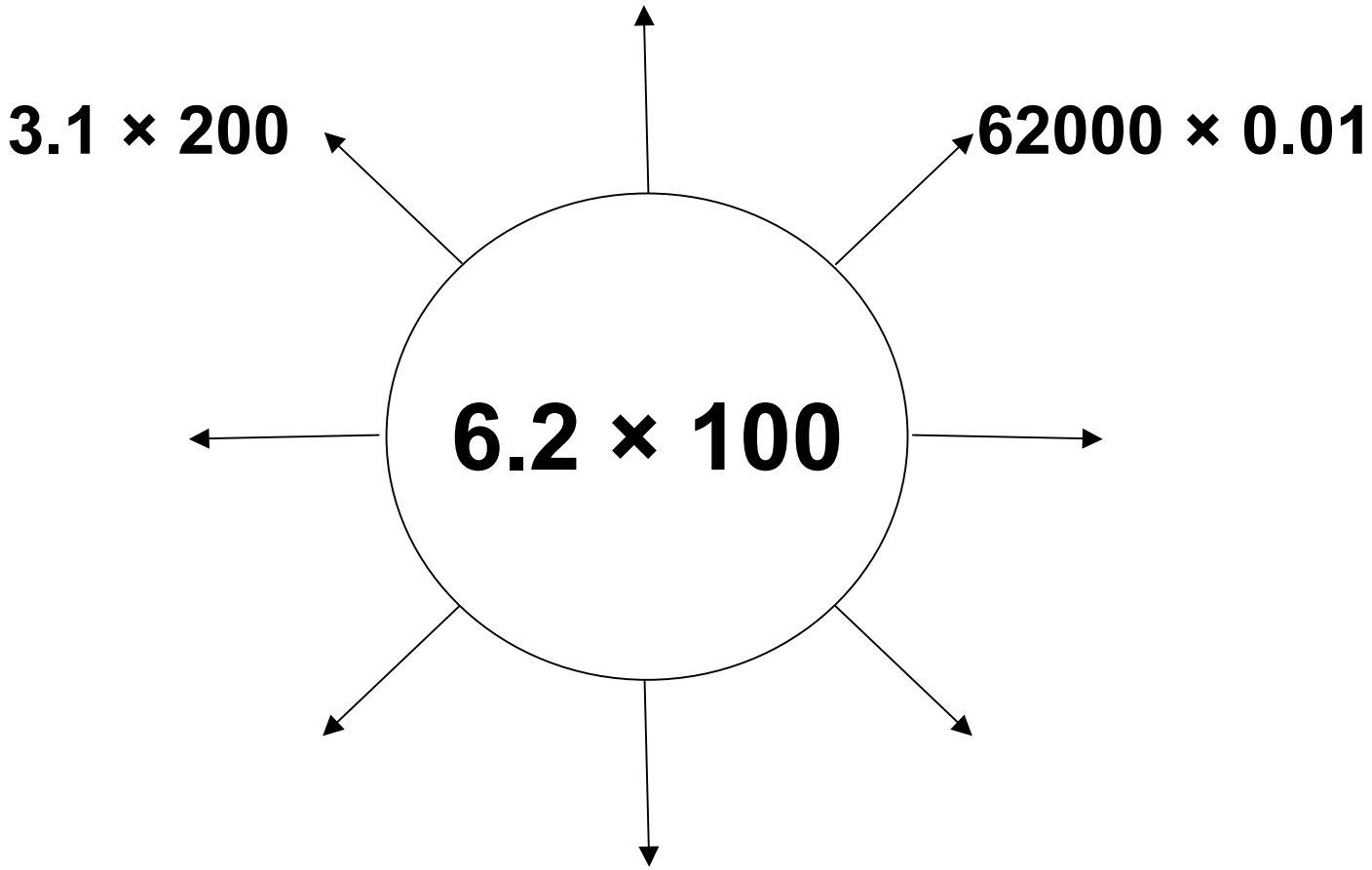
Homework
Ask pupils to play this game with someone at home.

Year 7

OHT 1 Target number grid

65	702	1.5	23
720	0.3	27	3.5
7.3	56	2.7	91
11	8.6	1200	38
850	46	125	8

OHT 2 Equivalent products



Year 7

Resource sheet 1 Number cards

$^{-}10$	$^{-}19$
$^{-}8$	$^{-}17$
$^{-}6$	$^{-}15$
$^{-}4$	$^{-}13$
$^{-}2$	$^{-}11$

Year 7

Resource sheet 1 Number cards *cont*

1	**12**
3	**14**
5	**16**
7	**18**
9	**20**

Year 7

Resource sheet 2 Calculations

A 91 + □ + 48 = 250	B 421.36 + 25.7 = □	C □ + 1457 = 6924
D Find the total of 42 64 78 3 4681	E Subtract 2250 from 8500	F 7.65 – 6.85 = □
G □ – 1457 = 2924	H What must I add to 5.4 to make 9.3?	J 1040.6 – 89.09 = □
K 38 × □ = 190	L Calculate 673 × 24	M 9.9 ÷ □ = 1.1
N Divide 109.6 by 8	P 0.3 × □ = 2.4	Q 428 ÷ 3.4 = □

Year 7

Resource sheet 3 Errors in calculations

A	B
$\begin{array}{r} 238 \\ +\ 1487 \\ \hline 3867 \end{array}$	$\begin{array}{r} 720 \\ -196 \\ \hline 536 \end{array}$
C	**D**
$\begin{array}{r} 234 \\ \times\ 52 \\ \hline 468 \\ 1170 \\ \hline 1638 \end{array}$	$7 \overline{)\ 123.2}$ 176 $123.2 \div 7 = 176$

Year 7

Resource sheet 4 Problems in the millions!

1 What is the smallest number you can subtract from a million to make the answer exactly divisible by 7893?
What is the smallest number you can add to a million to make the answer exactly divisible by 9821?

2 How long in days, hours, minutes and seconds is one million seconds? Are you a million seconds old?
How old are you in seconds?

3 Sharman is trying to get as close as she can to a million. She can use each of the digits 1 to 9, once and once only, any of the operations +, –, × and ÷, and brackets.

She has tried two examples and has started recording her answers and how far they are from a million.

Calculation	**Answer**	**How far from a million?**
(953 + 721) × 864	1 446 336	446 336
12345 × 678 ÷ 9	929 990	70 010

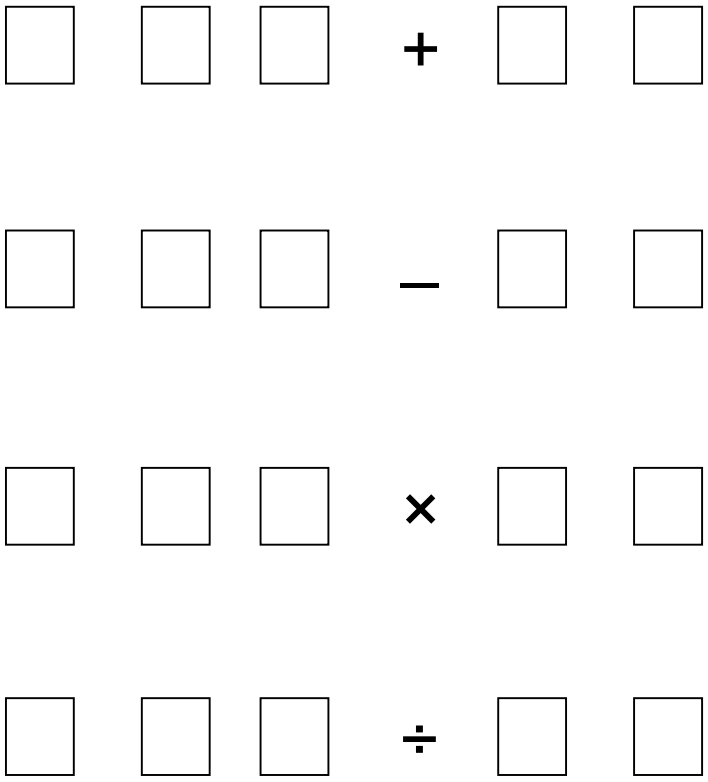
How close can you get to one million?

4 Seven sisters were left £1 million by a rich aunt. How much will each of them receive?

Year 7

Resource sheet 5 Largest calculations

Using the digits 1, 2, 3, 4 and 5 what is the largest result you can find for each calculation?



Year 7

Resource sheet 6 Largest product

Rules

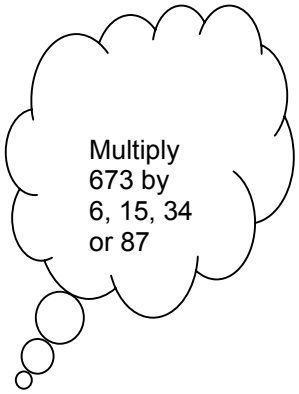
The aim of the game is to make the largest product. Each player takes it in turn to roll a dice and decide which position to place the number in their calculation. After each player completes their calculation, the player with the largest product wins.

Game	Player A	Player B
1	□□□ × □□	□□□ × □□
2	□□□ × □□	□□□ × □□
3	□□□ × □□	□□□ × □□
4	□□□ × □□	□□□ × □□

Try a few games and see if you can improve your strategy!

Year 7

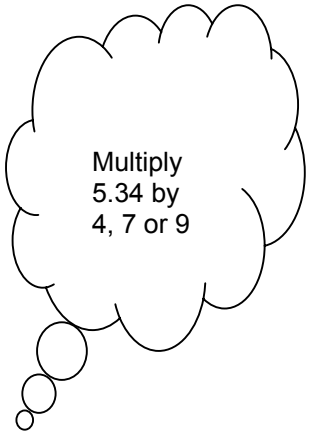
My Mathematics
Self-assessment sheet 1



My calculation

Show or discuss with a friend.

I did this calculation:
on my own ☐
with some help ☐



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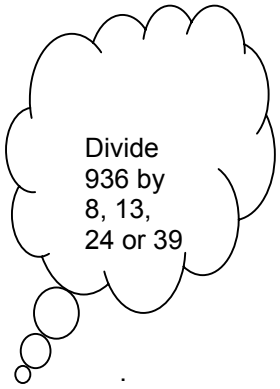

My calculation

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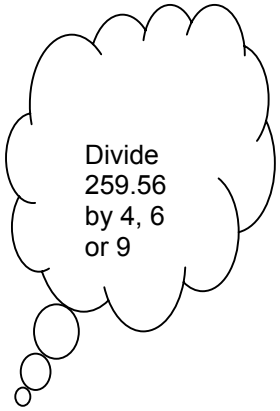
with some help ☐



My calculation

Show or discuss with a friend.

I did this calculation:
on my own ☐
with some help ☐

Year 7

My Mathematics
Self-assessment sheet 2

The booklet problem

A teacher needs 275 booklets. The booklets are sold in packs of 15 and each pack costs £3.75. How much will the booklets cost altogether?

Clare says:

I divided £3.75 by 15 in my head and worked out that each booklet costs 25p. I multiplied 25 by 275 to get the total cost as £68.75.

Is Clare right or wrong?

I think Clare is right/wrong because:

Show or discuss with a friend.

I explained my reasons:
on my own ☐
with some help ☐

Name:	**Class:**
What I can do	
I can multiply and divide a 3-digit number by a 2-digit number: on my own ☐ with some help ☐	Multiply 673 by 6, 15, 34 or 87. Divide 936 by 8, 13, 24 or 39.
I can multiply and divide decimals with one or two places by single-digit whole numbers: on my own ☐ with some help ☐	Multiply 5.34 by 4, 7 or 9. Divide 259.56 by 4, 6 or 9.
I can solve word problems and investigate in the context of number; I can compare and evaluate my solutions: on my own ☐ with some help ☐	The booklet problem

My next target:

I want to get better at _____

_____

_____

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