

Unit 2

Multiplication and division, mental methods

Five daily lessons

National
Numeracy Strategy

Year 6
Autumn term

Unit Objectives

Year 6

- Use the relationship between multiplication and division.
- Use related facts and doubling and halving.
- **Identify and use appropriate operations (including combinations of operations) to solve word problems.**
- Approximate first.

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This Unit Plan is designed to guide your teaching.

You will need to adapt it to the needs of your class.

Resources needed to teach this unit:

- Resource sheet 2.1
- Resource sheet 2.2
- Resource sheet 2.3
- Counting stick
- Whiteboards
- Set of 0 to 9 digit cards
- Related Key Stage 2 national test questions

Link Objectives

Year 5

- Use the relationship between multiplication and division.
- Use doubling and halving starting from known facts.
- Use closely related facts.
- **Use all four operations to solve simple word problems, involving numbers and quantities.**
- Approximate first.

Year 7

- Understand addition, subtraction, multiplication and division as they apply to whole numbers and decimals; know how to use the laws of arithmetic and inverse operations.
- Consolidate the rapid recall of number facts.

(Key objectives in bold)

department for
education and skills

Planning sheet	Day One	Unit 2 <i>Multiplication and division, mental methods</i>	Term: <i>Autumn</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
<p>Recall multiplication and division facts to 10×10. Use and understand related vocabulary.</p> <p>VOCABULARY multiply multiplied by product divide divided by</p> <p>RESOURCES Whiteboards</p>	<ul style="list-style-type: none"> Write 4, 6, and 24 on the board and ask children to say number sentences about the relationships between these numbers. e.g. 6 multiplied by 4 equals 24. The product of 4 and 6 is 24. 24 shared between 6 is 4. There are four 6s in 24. Stress the use of vocabulary relating to \times and \div. Write several other trios on the board and ask children to discuss these with a partner and write them down on whiteboards. Collect responses and ask additional questions relating to the statements such as: <div>Q If $4 \times 6 = 24$ what is 40×6?</div> <div>Q If $24 \div 6 = 4$ what is $2400 \div 6$?</div>	<p>Understand and use the relationships between \times and \div as inverse operations.</p> <p>VOCABULARY multiply multiplied by product divide divided by Inverse</p>	<ul style="list-style-type: none"> Write on the board a range of number sentences which children can complete by using mental calculation strategies, such as: $17 \times \square = 34$ $\square \div 5 = 90$ $\square \times 4 = 1\ 600$ $20 \times \square = 8\ 000$ $\square \times 0.5 = 35$ $640 \div \square = 32$ Ask children to solve them individually and then to explain to a partner how they found which numbers went into the boxes. Collect answers and ask for their methods. <div>Q What operations did you use?</div> <div>Q How can you check your answers?</div> <p>Work through how the children might have used inverse operations, for example multiplying 90 by 5 to complete $\square \div 5 = 90$, or estimating what they might multiply 32 by to find 640 in the last example.</p> <ul style="list-style-type: none"> Now write on board the number sentence: $0.3 \times \square = 2.4$ Ask children to work out the answer. Explain that they may think of this as 'how many 0.3s are there in 2.4?' $\square = 2.4 \div 0.3$ Count in 0.3s to 2.4 to get the answer 8. Demonstrate by checking that putting 8 in the box makes the number sentence true. Explain that the answer to this is the same as saying 'how many 3s are there in 24?' Ask children for a calculation that is the same as $0.6 \times \square = 3.6$ and check the results. Ask them for other examples of their own. Point out that you have used division to solve the problem. Write other number sentences on the board such as: $\square \times 5 = 3.5$ $\square \times 9 = 18.9$ $38 \times \square = 190$ $132 \times \square = 6\ 072$ Encourage children to estimate the answers first and then use mental strategies, jottings, or written methods to find which numbers go in the boxes. Encourage them to check afterwards. Ask children to work in pairs to write in their books more questions with the answers. Get them to mark each other's work and discuss how they solve each one. 	<ul style="list-style-type: none"> Write the following number sentences on the board and ask children to discuss in pairs what the child may have done wrong: $10 \div 0.5 = 2$ (child has halved 10 rather than thinking how many halves might be in 10) $32 \div 2 = 64$ (child has multiplied the two given numbers together) $0.6 \times 0.4 = 2.4$ (child may have ignored decimal points and then put point in wrongly at the end. The product of these decimals could not be > 1). Write down $8 \times \square = 560$ and $\square \div 9 = 11$ $\square \times 0.2 = 6$ and $12 \div \square = 24$ Ask the children to solve each problem. <div>Q What strategies did you use to solve each problem?</div> <div> <p>By the end of the lesson children should know that:</p> <ul style="list-style-type: none"> Multiplication and division are the inverse of each other and be able to use this to check results. <p>(Refer to supplement of examples, section 6, pages 53 and 55.)</p> </div>

Planning sheet	Day Two	Unit 2 <i>Multiplication and division, mental methods</i>	Term: <i>Autumn</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
Multiply and divide decimals by 10 or 100. 				

Planning sheet	Day Three	Unit 2 <i>Multiplication and division, mental methods</i>	Term: <i>Autumn</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
<p>Factorise numbers to 100 into prime factors.</p> <p>VOCABULARY factor prime</p>	<ul style="list-style-type: none"> Write 72 on the board. Ask the children to work in pairs and write down as many pairs of factors of 72 as they can. Take feedback and write the factors on the board. <div>Q Which of these numbers are prime?</div> <ul style="list-style-type: none"> Write other numbers on the board and repeat the work. <p>RESOURCES Whiteboards</p>	<p>Use related facts and doubling or halving.</p> <p>VOCABULARY double factors multiple</p>	<ul style="list-style-type: none"> Write the following facts on the board. $1 \times 32 = 32$ $2 \times 32 = 64$ $\square \times 32 = 128$ $8 \times 32 = \square$ $\square \times 32 = 512$ <div>Q What are the missing numbers?</div> <p>Explain that you were doubling each time. Ask the children to discuss in pairs how they could find the other numbers in the 32 times table without carrying out any further multiplication. Draw out that they could add the multiples together to work out other facts, such as finding 6×32 by adding the answers to 2×32 and 4×32 together.</p> <ul style="list-style-type: none"> Give the children another two-digit number e.g. 26 and ask them to work out all its multiples up to 16 using the same strategy, then to fill in the gaps by combining facts. Check that their answers are correct and ask: <div>Q For which of these multiples could you use a more efficient strategy? (e.g. 10, 5, 9, 11.)</div> <ul style="list-style-type: none"> Now demonstrate how you could use the multiples of 32 to generate other multiples of 32 by identifying and multiplying factors. Discuss 18×32, listing the factors of 18. Explain that 18×32 could be found by multiplying the answer to 9×32 by 2 or by multiplying the answer to 6×32 by 3. Explain that here you are using the factors of 18 to help multiplication by 18. Record on the board to show this: 18×32 $= 2 \times 9 \times 32$ $= 3 \times 6 \times 32$ <p>Set the children the task of finding 18×26 using the table in their books. Discuss the answers with the class and ask how they would use this factor method to find 80×26, 24×26. Get children to work though these on the board.</p> <ul style="list-style-type: none"> Give the children another number e.g. 43 and ask them to generate the multiplication table and then use the factor method to work out other multiples of this number e.g. 56×43, 25×43, 120×43, 54×43. Draw the class together to look for a variety of methods e.g. for 25×43 pupils might use $5 \times 5 \times 43$ or halved $5 \times 10 \times 43$ or halved and halved again 100×43. 	<ul style="list-style-type: none"> Remind children of the strategies they have been using to multiply: <ul style="list-style-type: none"> halving one number and doubling the other; multiplying by 100 or 1000, then dividing by 4; repeated doubling; using multiplication facts from their tables and finding factors. Remind them too that they have learned other methods in the past that they might also use. Write the following multiplications on the board and ask the children how they might do the calculations <ul style="list-style-type: none"> 39×25 ($\times 100, \div 4$ or $\times 40$ and adjust) 42×12 (write 12 as 2×6 or 3×4) 36×8 (repeated doubling) 35×42 (double 35 and halve 42) 64×25 ($\times 100 \div 4$) 450×60 (double 450 and halve 60) <div>Q How do you decide which method to use? Which is the most efficient strategy for which calculation?</div> <div>By the end of the lesson children should be able to: <ul style="list-style-type: none"> Use combinations of facts to find other multiples of 32; Use factors. (Refer to supplement of examples, section 6, page 61.)</div>

Planning sheet	Day Four	Unit 2 <i>Multiplication and division, mental methods</i>	Term: <i>Autumn</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
<p>Recall multiplication and division facts to 10×10. Derive quickly corresponding division facts.</p> <p>VOCABULARY multiply multiplied by product divide divided by</p> <p>RESOURCES Counting stick</p>	<ul style="list-style-type: none"> Write the following multiplication facts on the board. Explain that many people find these difficult to remember: $6 \times 8 = 48$ (and $8 \times 6 = 48$) $6 \times 7 = 42$ (and $7 \times 6 = 42$) $7 \times 8 = 56$ (and $8 \times 7 = 56$) Point out that they all involve multiplication by 7 or 8. Quickly count up in 8s and using a counting stick, point to the marker points on the stick as the numbers progress. Repeat and count backwards. Point to different marker points on the stick and ask the children <div>Q What number would this be?</div> <div>Q How do you know which number this would be?</div> <p>Point regularly to 48 and 56 and build up speed, reintroducing the counting forwards and backwards as necessary.</p> <ul style="list-style-type: none"> Tell the children that this time when you point to the markers on the stick the children are to identify the multiple of 8 and say the division fact that gives 8, e.g. at 56 the children say 56 and $56 \div 7 = 8$. Repeat these activities for the 7 times table. 	<p>Identify and use appropriate operations (including combinations of operations) to solve word problems.</p> <p>VOCABULARY operation approximate</p> <p>RESOURCES Resource sheet 2.1, 2.3</p>	<ul style="list-style-type: none"> Explain that the children are going to solve word problems using the methods of multiplication they have been learning. On the board write the problem: There are 35 rows of 18 chairs. How many chairs are there altogether? <p>Remind the children that the first thing to do is read the question and to decide what calculations they need to do. Establish that this is 35×18.</p> <p>Show children Resource sheet 2.1 and tell them to use the step-by-step guide when solving word problems.</p> <ul style="list-style-type: none"> Ask the class what method they know for multiplying by two-digit numbers ending in 5. Establish that answer is approximately $35 \times 20 = 700$. Get children to work through the calculation on the board. Compare the answer to the estimate and discuss how the children have recorded their working. <p>Emphasise that when the Key Stage 2 national test paper asks them to show their working, listing the calculations is enough to get the mark.</p> <p>Emphasise too that clear recording will help the children to check a calculation if they think their answer is wrong or if they make a mistake. On the board write the answer</p> $\begin{array}{r} 35 \times 18 \\ = 70 \times 9 \\ = 630 \text{ chairs.} \end{array}$ <p>Add that it is important to include any units, in this case chairs.</p> <ul style="list-style-type: none"> Use another Resource sheet 2.3 to choose another multiplication problem. Write it on the board for pairs of children to solve. Discuss the stages and methods of solution with the class and record this on the board. Display the step-by-step guide to solving problems and discuss this with the class. Set the class other problems from Resource sheet 2.3 that involve multiplication. Tell them to set out the work in their books in the way they have been shown and to follow the guide. Later draw the class together to discuss the answers. 	<ul style="list-style-type: none"> Explain that today's problems have only involved one calculation and that these are called single-step problems. <p>Write on the board:</p> <p>There are 25 rows of 18 stamps on a sheet. How many would there be on 40 sheets?</p> <div>Q How would you solve this problem?</div> <p>Record the steps on the board, e.g.</p> $\begin{array}{l} 25 \times 18 \\ = 50 \times 9 \\ = 450 \text{ stamps on one sheet.} \end{array}$ <p>And on 40 sheets:</p> $\begin{array}{l} 450 \times 40 \\ = 900 \times 20 \\ = 18\,000 \text{ stamps in total.} \end{array}$ <div>Q Is this the best way to solve this problem?</div> <ul style="list-style-type: none"> Remind the class the methods are the same but there are two steps to work through. <p>HOMEWORK – Give the children problems to solve based on KS2 national test questions.</p> <div> <p>By the end of the lesson children should be able to:</p> <ul style="list-style-type: none"> Solve problems about numbers in real life, choosing the appropriate operation and method of calculation. <p>(Refer to supplement of examples, section 6, page 83.)</p> </div>

Planning sheet	Day Five	Unit 2 <i>Multiplication and division, mental methods</i>	Term: <i>Autumn</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
<p>Consolidate rounding an integer to the nearest 10, 100 or 1000.</p> <p>VOCABULARY round multiple of 10 100</p> <p>RESOURCES Class set of whiteboards Resource sheet 2.2</p>	<ul style="list-style-type: none"> Give each child a whiteboard. Ask the children to choose five multiples of 10 and mark them down on their boards. <p>Use Resource sheet 2.2 to make a pack of 0 to 9 digit cards.</p> <p>Using the pack of 0 to 9 digit cards, pick two cards at random, write the two numbers on the board. If you pick say, 2 and 6, the children can choose to make this one of the two numbers 26 or 62. They round the chosen number to the nearest ten, and if this matches one of their five multiples of 10 they put a cross through the 10s number on their whiteboard. Repeat picking pairs of numbers.</p> <p>The first child to have numbers rounded to each of their chosen multiples of 10 is the winner.</p> <ul style="list-style-type: none"> Repeat with pupils choosing five multiples of 100. This time pick three cards from the 0 to 9 digits pack. 	<p>Identify and use appropriate operations (including combinations of operations) to solve word problems.</p> <p>RESOURCES Resource sheet 2.1 Calculators</p>	<p>Review last night's homework.</p> <div>Q What strategies did you use to solve the problems?</div> <div>Q What method of calculation did you use?</div> <p>Use Resource sheet 2.3 enlarged to A3. The children can work in pairs. For each problem, work through the following format.</p> <div>Q What are the important words and numbers in the question?</div> <div>Q How can we approximate the answer?</div> <div>Q What operation/s will you use to solve the problem?</div> <div>Q How will you decide to calculate; mental, pencil and paper or the calculator?</div> <div>Q How will you check your answer?</div> <p>Allow the children to work through numbers 3, 4 and 5 of the problems.</p>	<ul style="list-style-type: none"> Discuss each of the problems with the children. Use the key questions from the main part of the lesson as the basis for the discussion. Give the children this problem. <p>If you add 3 consecutive numbers, the sum is 3 times the middle number.</p> <div>Q Is this true or false? Justify your answer.</div> <div> <p>By the end of the lesson children should be able to:</p> <ul style="list-style-type: none"> Solve 'story' problems about numbers in real life, choosing the appropriate operation and method of calculation; Explain and record using numbers, signs and symbols, how the problem was solved. <p>(Refer to supplement of examples, section 6, page 83.)</p> </div>

Step-by-step guide to solving problems

1. **Read** the question. Underline key words that help you solve the problem.
2. **Decide** what operation(s) to use.
3. **Write down** the calculation(s) you are going to do. Use brackets if you need to.
4. **Work** out the approximate answer.
5. **Decide** how you will work out the calculation: mental, pencil and paper or calculator.
6. **Do the calculation** and **interpret** the answer.
7. **Include** any units such as kg, cm, £, pencils, tables.
8. **Check** that the answer makes sense.

Remember: if you are stuck, try to:

- **Describe** the problem in your own words to a partner.
- **Talk through** what you have done so far.
- Break the problem up into **smaller steps**.
- Try it with **simpler or fewer** numbers.
- **Draw** something to help you such as a picture, a table or number line.
- Make a **guess**, see if it works, and if not try to **improve** it.

0

1

2

3

4

5

6

7

8

9

1. There is space in the multi-storey car park for 17 rows of 30 cars on each of 4 floors.
How many cars on each of the 4 floors?
2. 196 children and 15 adults went on a school trip.
Coaches seat 57 people.
How many coaches were needed?
3. 960 marbles are put into 16 bags.
There is the same number of marbles in each bag.
How many marbles are there in 3 of these bags?
4. In a dance there are 3 boys and 2 girls in every line.
42 boys take part in the dance.
How many girls take part?
5. I think of a number, add 3.7 and multiply by 5.
The answer is 22.5.
What was my number?

Related Key Stage 2 national test questions:

2000 Test A

1

Each card on the left matches one on the right.

Draw lines to match the cards which are **equal** in value.

One has been done for you.



3×6	2×25
10×5	9×2
5×8	50×2
9×10	3×30
5×20	10×4

23

Leila knows that

$$65 \times 3 = 195$$

Explain how she can **use this information** to find the answer to this multiplication:

$$165 \times 3$$



.....

.....

.....



1

2 marks



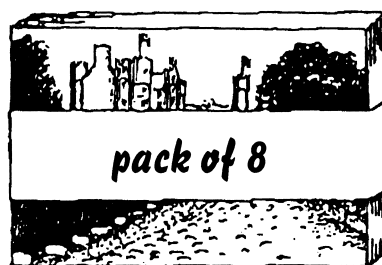
23

1 mark

2000 Test B

5

A shop sells postcards in **packs of 6** and **packs of 8**.



Alan bought **4 packs of 8 cards**.

How many cards did he get?



5a

1 mark

Shereen bought some **packs of 6 cards**.

Altogether she has **30 cards**.

How many **packs of 6** did she buy?



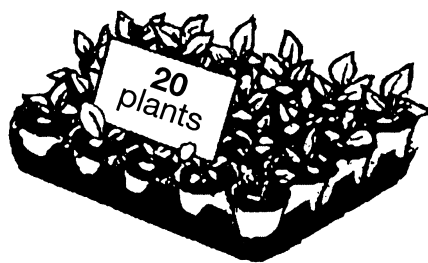
5b

1 mark

2001 Test B

5

Plants are sold in trays of **20**.



Ivana buys **7 trays** of plants.

How many plants is this?



1 mark

5a

David wants **240 plants**.

How many trays does he need to buy?



1 mark

5b

2001 Test B

2

Write in the **missing** number.



$$8 \times \boxed{} = 400$$

1 mark

2

2001 Test A

5

Write in the **missing** numbers.

 $45 + \boxed{} = 110$

1
1 mark

$(4 \times 5) - \boxed{} = 12$

1
1 mark

$60 \times 3 = \boxed{}$

1
1 mark

2001 Test B

23

Write the **three prime numbers** which multiply to make **231**

 $\boxed{} \times \boxed{} \times \boxed{} = 231$

23
1 mark