N5.5 Word problems involving decimals

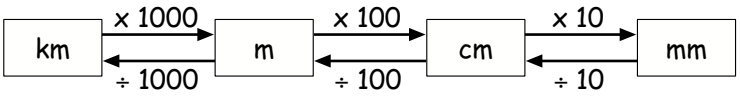
objectives

- Convert one metric unit of length to another.
- Solve word problems.
- Estimate calculations.
- Use a calculator effectively; enter numbers into a calculator and interpret the display in different contexts.
- Round up or down after division, depending on the context.
- Check whether a result is the right order of magnitude.

starter

Vocabulary
metric
kilometre
metre
centimetre
millimetre

Remind pupils how to convert metric units of length. Draw this diagram on the board.



Ask pupils to work mentally to convert these measurements.

Q What is 25 millimetres in centimetres?
Q What is 2.75 metres in centimetres?
Q What is 6.5 metres in millimetres?
Q What is 103 centimetres in metres?

Read the statements below to the class, one by one. Ask pupils to hold up a hand if they think the statement is sensible.

- The classroom is 10 metres long.
- I am 3 metres tall.
- The book is 21 centimetres wide.
- The pen is 100 millimetres long.
- The classroom is 1000 millimetres high.
- Patrick cycles 45 kilometres to school.
- Laura walks 200 metres to school.
- The swimming pool is 2500 centimetres long.

main activity

Vocabulary
problem
calculation

Resources
OHP calculator
OHT N5.5a

Enter 2.5 on the OHP calculator.

Q This is the answer to a calculation. What might the calculation be?

Encourage them to consider all four operations, such as:

$1.25 + 1.25$ $20 - 17.5$ 0.5×5 $10 \div 4$

Write their suggested calculations on the board. Work with the class to do the calculation, either mentally or with the OHP calculator, as appropriate. Now point in turn to each suggestion.

Q What money problem or measurement problem would require you to do that calculation?

Discuss their responses, including sticking points, such as that 0.5 represents 50p in the context of money.

Show the first part of the first two-part problem on **OHT N5.5a**.

Some children do a sponsored walk.
Jason is sponsored for £3.45 for each lap.
He does 23 laps.
How much money does he raise?

Read the problem aloud and clarify the vocabulary. Ask the class:

Q What do you think the problem is asking you to do?

Q What information do we get from the problem? What are the key words? What are the key numbers?

Q What calculation do you need to do?

Ask pupils to record the calculation: 3.45×23.

Q How will you do that calculation: in your head, using a written a method, or using a calculator?

Q Approximately, what do you think the answer will be? ($4 \times 20 = 80$)

Q What is the answer to the question? Are there any units to put in?

Q Does the answer make sense and feel 'about right'?

Q How can you check the answer?

Show the second part of the problem, or write it on the board.

Lynne wants to raise £100.
She is sponsored for £6.50 for each lap.
What is the least number of whole laps she must do?

Work through the questions again and establish that the calculation required is $100 \div 6.5$. Discuss whether the calculator answer of 15.384 615 should be rounded up or down in the context of the problem. Get pupils to put the rounded answer in a sentence, such as: 'The least number of whole laps that Lynne must do is 16.'

Repeat with the second two-part problem on **OHT N5.5a**.

Some children go camping.
It costs £2.20 for each child to camp each night.
They go for 6 nights.
How much will each child have to pay for the 6 nights?

There are 70 children.
Each tent takes up to 6 children.
What is the least number of tents they will need?

Give pupils a selection of problems to solve, working in pairs. After a suitable time, take feedback, inviting a pair to explain their solution to the class.

other tasks

Springboard 7
Units 6 and 15

Unit 6 section 4: Subtraction
Star challenge 8: Money problems page 229

Unit 15 section 4: Division – written methods
Star challenge 7: Choose the method page 486

Unit 15 section 6: Money and 'real life' problems
1 In the real world page 491
Star challenge 9: Money problems page 492

plenary

Write on the board the statement: 'A ride at the fair costs £3.50.'

Q What questions can you ask using this information?

Encourage varied questions, drawing attention to key words and phrases, such as:

- What is the cost of 4 rides?
- How much change from £10 do you get for 2 rides?
- How many rides can you get for £20?

Get pupils to identify the calculation they would need to make to answer each question, and then to calculate the answer mentally.

Now write on the board the statement: 'The fairground takes over £1000 for the rides it sells on a Friday night.' Ask pupils again to suggest the questions they could ask about this information. Select a question along the lines of:

- What is the least number of rides that were sold?

Establish that the calculation needed is 1000 ÷ 3.5, and that the answer of 285.71428 needs to be rounded up in the context of the question.

Remember

- Read the question carefully. Look for key words in the question to help decide what operation to use and what calculations to do.
- Decide what information you need for your calculations.
- Use the calculation method that you understand.
- If a question asks you to 'show your working', write out the calculation you did.

N5.6 Reasoning about numbers (× and ÷ problems)

objectives

- Solve word problems and investigate in number.
- Carry out calculations with more than one step.
- Enter numbers into a calculator and interpret the display in different contexts.

starter

Vocabulary
product
problem
calculation
inverse operation

Resources
mini-whiteboards
calculators
OHP calculator
OHT N5.6a

Show the first problem on **OHT N5.6a**.

I multiply by number by 27. The product is 702. What is my number?

Remind the class of the meaning of 'product'. Ask pupils to write an equation that represents the problem.

Write on the board $\square \times 27 = 702$.

Q What strategies would you use to solve this problem using a calculator?

If necessary, prompt pupils about using inverse operations. Establish that:

$\square \times 27 = 702$ is equivalent to $\square = 702 \div 27$.

Demonstrate finding the answer on an OHP calculator. Check the answer by substituting it back in the box and confirming that $27 \times 26 = 702$.

Q What if you had no calculator? What strategies would you use?

Give pupils a couple of minutes to discuss their possible strategies in pairs. They should recognise that the units digits of the unknown number must be 6, since 6×7 is the only multiple of 7 in the seven times table that ends in 2.

Discuss some approximations for the product. For example, 27×16 is less than $30 \times 20 = 600$, so 16 is too small. 27×36 is more than $25 \times 30 = 750$, so 36 is too big. The unknown number must be 26.

Check by multiplying 27 by 26 using a written method.

Give pupils the second and third problems on **OHT N5.6a** to solve using their calculators.

$1053 \div \square = 39$ $\square \div 19.2 = 14.5$

main activity

Vocabulary
factor

Resources
calculators
OHT N5.6a

Write on the board $\square\square \times 8 = 14\square$, or show the fourth problem on **OHT N5.6a**. Explain that, unlike the previous problem, this time each box stands for a single digit, so that $\square\square$ is a two-digit number.

Q Explain the problem in your own words.

Establish that the task is to find a two-digit number which, when multiplied by 8, results in a 'one hundred and forty-something' number.

Q How could we begin to solve this problem?

Q What could the last digit of the three-digit number be?

Establish that this digit can be only 0, 2, 4, 6 or 8, since a number multiplied by 8 must be even.

Q What could the first digit of the two-digit number be? Could it be 5? (no, the product would be at least 400) **Could it be 2?** (still too big)

Discuss ways of finding the answer by working systematically. For example, they could multiply every number between 10 and 19 by 8 in turn to see which one produces a solution.

Q Is there another way of representing the problem in an equation?

Prompt them to think of the inverse, and invite a pupil to the board to write:

$14\square \div 8 = \square\square$

By working systematically, they could try each of the numbers 140, 142, 144, 146, 148 to see which are divisible by 8. This second way involves fewer trials, and so is preferable.

Ask pupils to use one method or the other find the solution (144). Then ask:

Q Is this the only solution? How do you know? (we have worked systematically through all the possibilities)

Q What is the next multiple of 8 after 144? (152) **And the multiple of 8 before 144?** (136)

Write on the board $\square\square \times \square = 371$, or show the fifth problem on **OHT N5.6a**. Ask the class to explain the problem in their own words. Confirm that they are looking for a pair of factors of 371, one two-digit and one single-digit number, each of which divides exactly into 371.

Q How else could we write the equation? ($371 \div \square = \square\square$)

Q How could we begin to solve this problem?

Establish that they might consider the possibilities for the units digits.

Ask pupils to work in pairs to find a solution to the problem. When they have a solution ($53 \times 7 = 371$), invite a pair to the board to explain their method.

Q Is this the only solution? (yes)

Q How do you know? (the only possible pairs of units digits are 3 and 7, 1 and 1, or 9 and 9; $371 \div 3$ is too big, as is $371 \div 1$, and $371 \div 9$ is not a whole number)

Show the last problem on **OHT N5.6a**, $(1 + \square) \times \triangle = 100$. Explain that this time the boxes represent whole numbers not digits.

Q Explain the problem in your own words.

Remind the class that the contents of the brackets are worked out first. The sum of 1 and $\square$ is then multiplied by $\triangle$, to make a product of 100.

Q How can we tackle this problem? What information can we use?

Establish that $\triangle$ is a factor of 100, and that $(1 + \square)$ is the other factor, since factors occur in pairs. Draw the outline of a table on the board. Work through the pairs of factors of 100 and enter them into the table.

1 + □	△
100	1
50	2
25	4
20	5
10	10
5	20
4	25
2	50
1	100

Use the left-hand column to work out the possible values of □, and the nine possible solutions to the problem. Substitute a (□, △) pair into the original equation to check that the numbers work: (1 + 19) × 5 = 100.

other tasks

Springboard 7
Units 2 and 15

Unit 2 section 2: Multiplying and dividing by 10 and 100

Star challenge 3: × and ÷ problems page 73

Unit 15 section 6: Money and 'real life' problems

Star challenge 10: Clock sums page 493
Star challenge 11: Every which way you turn page 493
Star challenge 12: Number jigsaw page 494

plenary

Invite pairs of pupils to the board to demonstrate their solutions to the problems that they have worked on in the lesson.

Q Did anyone have a different way of tackling this problem?
Q Would your method be different if you had used a calculator?
Q Are there any other solutions?
Q How can you be sure that you have found all the solutions?

Remember

- When finding missing numbers, use the inverse operation to rewrite the equation.
- Look at the last digits to see if you can use your knowledge of number facts to eliminate possible values.
- Try out values that you can work out quickly in your head.
- Work systematically.

OHT N5.5a

1a. Some children do a sponsored walk.
Jason is sponsored for £3.45 for each lap.
He does 23 laps.

How much money does he raise?

b. Lynne wants to raise £100.
She is sponsored for £6.50 for each lap.

What is the least number of whole laps she must do?

2a. Some children go camping.
It costs £2.20 for each child to camp each night.
They go for 6 nights.

How much will each child have to pay for 6 nights?

b. There are 70 children.
Each tent takes up to 6 children.

What is the least number of tents they will need?

OHT N5.6a

Problem 1

I multiply my number by 27.
The product is 702.
What is my number?

Problem 2

1053 ÷ □ = 39

Problem 3

□ ÷ 19.2 = 14.5

Problem 4

□□ × 8 = 14□

Problem 5

□□ × □ = 371

Problem 6

(1 + □) × △ = 100