Lesson plan: MATHS KS3

MISSING THE POINT

Getting the decimal point in the right place is a key skill, says **Colin Foster**

In this lesson, students are asked to create and solve some puzzles involving decimal calculations where the decimal points have been omitted. The task is to work out where the decimal points need to go to make the calculations correct. This lesson provides a lot of practice at performing simple operations with decimal numbers and also encourages students to improve their estimation skills and gain a sense of size. The aim is for students to develop their confidence and facility with handling decimal numbers.

STARTER ACTIVITY

Q *What is 0.3 multiplied by 0.3?*

Students often think that the answer is 0.9. If someone says that, without saying that it is wrong, ask them: *What is 0.3 multiplied by 3?*

On the other hand, if the correct answer (0.09) is given, ask students what common **incorrect** answer someone might give.

This could lead to a discussion about how dividing **either** number in a product by 10 divides the whole **product** by 10:

$$3 \times 3 = 9$$

Divide by 10 ↓ ↓ Divide by 10

$$0.3 \times 3 = 0.9$$

Divide by 10 ↓ ↓ Divide by 10

$$0.3 \times 0.3 = 0.09$$

DOWNLOAD

a FREE set of KS3 place value problem cards for decimals at **teachwire.net/pvaluecards**

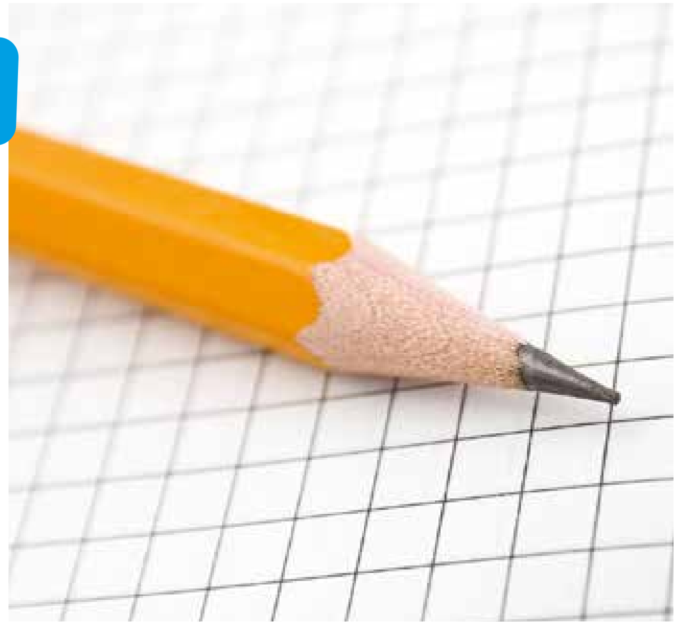
WHY TEACH THIS?

Good knowledge of place value in relation to decimals is essential in the modern world.

KEY CURRICULUM LINKS

+ understand and use place value for decimals

Q Where does the decimal point need to go to make the calculations correct?



MAIN ACTIVITY

Q Here is a puzzle. Can you work out what is missing from this calculation?

$234 + 173 + 658 + 907 = 100$

There are many possible responses to this question. For example, a student might suggest replacing 100 by 1972, or replacing the = sign with ≠. After students have given some ideas, close the question down by asking:

Q Can you correct this statement by just adding decimal points? You can put as many as you need, wherever you need them. You're not allowed to change the numbers (other than putting in zeroes)!

There are many possible solutions, but perhaps the simplest (using 4 decimal points and no extra zeros) is:

$23.4 + 1.73 + 65.8 + 9.07 = 100$

Others would be:

$234 + 17.3 + 658 + 90.7 = 1000$

or

$0.234 + 0.0173 + 0.658 + 0.0907 = 1$

Students will need to look at the final digits of each number, and realise that the 3 and the 7 are a natural choice for being in the same column as each other, so as to add to make a 10.

Q Now I want you to invent a sum of 4 decimal numbers that makes 100. Then take out the decimal points and see if your neighbour can work out where they must have been. Can you invent an easy one and a difficult one?

There is much potential for students to invent and solve problems for each other. Confident pairs of students could try a more difficult total on the right-hand side, a subtraction or even a multiplication. The trial and error involved should give students extensive practice at handling decimals and thinking about their size.

DISCUSSION

Q *What calculations did you invent? Which ones were easy to solve? Why? Which ones were harder? Why? How did you decide where the decimal points had to go? What clues were there in the calculations?*

A good strategy is to estimate the size of each number in the calculation to 1 significant figure. One way to discuss students' work is to project the **Gattegno Chart** shown below (a PDF of this chart can be downloaded at teachwire.net/gattegno).

Q *What patterns can you see in this chart? How do we get from one column to the next column? What happens to a number when we move* ***two*** *columns to the right/left? What happens to a number when we move one/two columns up/down?*

Q *Which number on the chart is closest to each number in your calculation? How do you know? Which number is closest to your answer? Why?*

0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	2	3	4	5	6	7	8	9
10	20	30	40	50	60	70	80	90
100	200	300	400	500	600	700	800	900
1000	2000	3000	4000	5000	6000	7000	8000	9000
10000	20000	30000	40000	50000	60000	70000	80000	90000

ADDITIONAL RESOURCE

A task on ordering decimals is available at nrich.maths.org/10326.

GOING DEEPER

Confident students could create more complicated calculations including multiplication and even division. These can get very difficult!

BACK TO BASICS

If your KS3 learners are still struggling with understanding the foundations of place value, you may like to direct them to this list of video clips; although the explanations are pitched for primary school learners, they can act as a useful, and quick, 'refresher': tinyurl.com/tsplacevalue

ABOUT OUR EXPERT

Colin Foster is a Reader in the Mathematics Education Centre at Loughborough University. He has written many books and articles for mathematics teachers (see www.foster77.co.uk).