Can I make use of my understanding of place value to explain how to mentally multiply or divide a decimal number by an integer?

Teaching guidance

Key vocabulary

place value, digit, column, decimal point, tenth, hundredth, thousandth, partition, integer

Models and images and resources

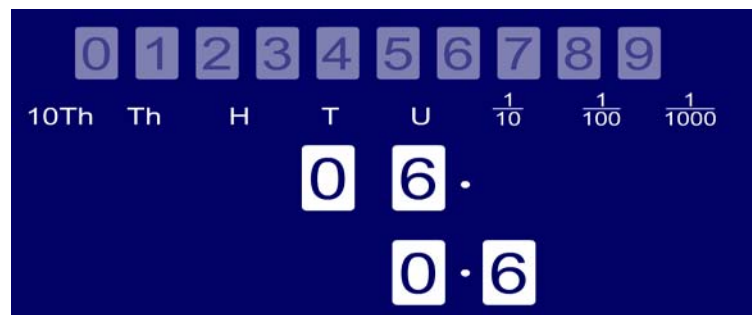#### Counting stick or Counting stick with further options spreadsheet

Use a counting stick to create related sequences, for example count in sixes and then in 0.6s. Ask children to comment on the patterns and relationships between the numbers in the two counts and to use this to predict and explain future terms. Alternatively use the spreadsheet *Counting stick with further options*, showing one sequence above the counting stick and a related one below.

0	6	12	18	24	30	36	42	48	54	60
0	0.6	1.2	1.8	2.4	3	3.6	4.2	4.8	5.4	6
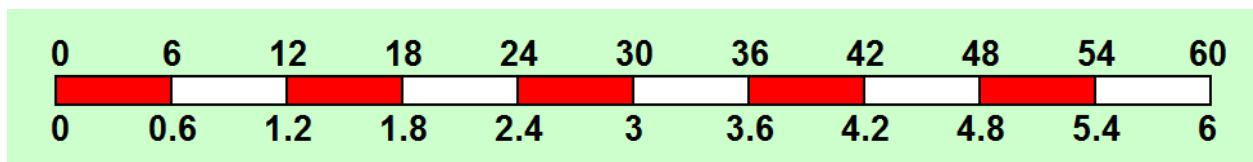
Moving digits ITP

Ensure that children are confident in understanding the effect of multiplying and dividing numbers by 10, 100 and 1000.

Children need to appreciate that 0.6 is six divided by ten, in other words that it is ten times smaller than six.

0 1 2 3 4 5 6 7 8 9

10Th   Th   H   T   U $\frac{1}{10}$ $\frac{1}{100}$ $\frac{1}{1000}$

0 6 ·

0 · 6

Place-value cards

0 . 1   0 . 0 5

X 3   0.3   0.15

Carry out multiplication calculations involving decimals by partitioning the decimal number using place-value cards and then multiplying each part separately before recombining to get the answer.

Teaching tips

- Ensure that children understand the effect of multiplying or dividing whole numbers and decimals numbers by 10, 100 and 1000. Reinforce understand by using visual images:

    o Put place value or column labels (..., tens, units, tenths, hundredths, ...) onto cards and stick these onto the wall. Include a decimal point. Ask a group of children to create a given number, for instance 1.35, by taking the necessary digit cards and standing in the appropriate places. Ask what will happen when this number is multiplied by ten. Discuss the effect on each digit – each child should jump a column to the left to show the effect of multiplying by ten.

    o Use the ITP Moving digits. Ask children to predict the answer when a given number is multiplied or divided by ten, 100 or 1000, before using the program to check.

- Check that children fully understand the relationship between the values of digits in different columns in decimal numbers. For example, children need to appreciate that ten hundredths is equivalent to one tenth, so 0.13 can be thought of as one tenth + three hundredths or as 13 hundredths.

- Give children opportunities to identify missing operations and numbers in calculations. Ask them to explain how they identified the missing number(s) or operation, for instance in:

    $5 \square \ \square = 0.05$ $0.6 \times \square = 5.4$

- Give children experience in creating whole number then decimal sequences:

    6, 12, 18, 24, 30, 36, ...   0.6, 1.2, 1.8, 2.4, 3, 3.6, ...

- Encourage them to explain the relationship between corresponding numbers in the sequences, in other words to recognise that each number in the second sequence is ten times smaller than the equivalent number in the first sequence. They should use this information to answer related calculation questions, for example: If $7 \times 6 = 42$, what is 7×0.6?

- Spider diagrams are useful for rehearsing how to use known facts to work out unknown ones:

$42 \div 6 =$ $0.7 \times 6 = 4.2$ $0.07 \times 6 =$

$4.2 \div 6 =$ $7 \times 6 = 42$ $0.007 \times 6 =$
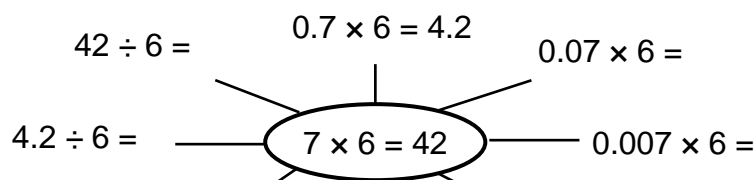
- When asked to multiply or divide a decimal by a whole number, children need to identify a linked whole number fact that can help them. For example, for $2.1 \div 3$, they need to recognise that it is linked to the fact $21 \div 3 = 7$ and use this to help them. Encourage them to explain their reasoning. For example: $21 \div 3 = 7$, and 2.1 is ten times smaller than 21, so the answer will be ten times smaller than seven, in other words $2.1 \div 3 = 0.7$. Or $21 \div 3 = 7$, so 21 tenths divided by three is seven tenths, that is 0.7

- In order to multiply decimal numbers with two or more digits, partition them and multiply each part before recombining answers. The grid method is a clear way to record this thinking:

×	1	0.3
4	4	1.2

so $1.3 \times 4 = 4 + 1.2$
     $= 5.2$

- Always ask children to check that the size of their answer sounds reasonable. For example, children should recognise that $0.18 \div 2 = 0.9$ cannot be correct. Using a number line to locate numbers such as 0.18 and then thinking about dividing by two could help children to check the reasonableness of an answer.