1.3 Multiplying and Dividing by Powers of 10

- Some pupils see this as completely different from "normal" multiplying; it isn't, it's still repeated addition. Ten of every digit moves it one more column to the left.
- It may be better to think of the **digits** all shifting rather than the decimal point leaping (although calculator displays give the opposite impression).
  So the key question is "What happens to all the digits when we multiply/divide by 10/100/1000?" "They move" "Which way?" "How far?" Need to see that × 100 is × 10 followed by × 10, etc.

1.3.1 It may be helpful to draw place value columns or use pre-printed sheets (see sheets).
Diagonal arrows can show the movement of the digits to the left or the right.
e.g., one question could be 0.045 × 10
Each question has two lines: on the 1st line write 0.045 in the correct columns; then on the 2nd line write 0.450 in the correct columns – diagonal arrows show that each digit has moved 1 place to the left.

units 1's	•	tenths 0.1's	hundredths 0.01's	thousandths 0.001's
0	•	0	4	5
0	•	4	5	0

A5 sheets work well; the A4 one is suitable either for a pupil who needs more space or for putting onto an acetate.

Write questions on the board or use ones from a textbook.

You can use different coloured diagonal arrows for multiplying (shifts to the left) and dividing (shifts to the right).

Some pupils won't need to use the sheets for long; some not at all. But others will see them as a resource and ask for them again and again, or they can draw their own.

1.3.2 Use questions such as 3.4 × ? = 34000

Pupils can make up their own and check using a calculator.

Answer 10 000
This can lead in to standard form; 3.4×10^{5} *means* 3.4 *× 10 "five times";* 3.4×10^{-5} *means* 3.4 *÷ 10 "five times".*

1.3.3 "To multiply by 10, add a zero onto the right-hand end of the number."
When does this rule work and when doesn't it?

Answer: Fine for integers, but not for decimals. The corresponding rule for dividing by 10 (take off a zero) works only for multiples of 10; i.e., when the answer *is an integer.*

This is an example of a rule that is appropriate in certain contexts but not in others (as most rules are).

The Decimal System

	thousands 1000's	hundreds 100's	tens 10's	units 1's	•	tenths 0.1's	hundredths 0.01's	thousandths 0.001's
1					•			
					•			
2					•			
					•			
3					•			
					•			
4					•			
					•			
5					•			
					•			
6					•			
					•			
7					•			
					•			
8					•			
					•			
9					•			
					•			

	thousands 1000's	hundreds 100's	tens 10's	units 1's	•	tenths 0.1's	hundredths 0.01's	thousandths 0.001's
1					•			
					•			
2					•			
					•			
3					•			
					•			
4					•			
					•			
5					•			
					•			
6					•			
					•			
7					•			
					•			
8					•			
					•			
9					•			
					•			

	thousands 1000's	hundreds 100's	tens 10's	units 1's	•	tenths 0.1's	hundredths 0.01's	thousandths 0.001's
1					•			
					•			
2					•			
					•			
3					•			
					•			
4					•			
					•			
5					•			
					•			
6					•			
					•			
7					•			
					•			
8					•			
					•			
9					•			
					•			