[ MATHS PROBLEM ]

# STANDARD FORM WITH NUMBERS LESS THAN 1

Students often get confused when putting numbers less than 1 into standard form, says Colin Foster

**In this lesson, students discover how to be confident when converting numbers of less than 1 into standard form.**

## THE DIFFICULTY

*Which of the numbers below are equal to 0.0071?*

$71 \times 10^{-4}$ $71 \times 10^{-3}$ $71 \times 10^{-2}$

$7.1 \times 10^{-4}$ $7.1 \times 10^{-3}$ $7.1 \times 10^{-2}$

$0.71 \times 10^{-4}$ $0.71 \times 10^{-3}$ $0.71 \times 10^{-2}$

*Which number is 0.0071 in **standard form**?*

The three numbers on the leading diagonal ($71 \times 10^{-4}$, $7.1 \times 10^{-3}$ and $0.71 \times 10^{-2}$) are all equal to 0.0071, and, of those, $7.1 \times 10^{-3}$ is expressed in standard form, because the first factor (7.1) is greater than 1 and less than 10.

Students are often very unsure about this kind of thing, so if they can't confidently do this yet, then that is the purpose of the lesson.

| $10^2$s | $10^1$s | $10^0$s | $10^{-1}$s | $10^{-2}$s | $10^{-3}$s | $10^{-4}$s | $10^{-5}$s |
|---|---|---|---|---|---|---|---|
| 7 | 1 | 0 | | | | | |
| | 7 | 1 | | | | | |
| | | 7 | 1 | | | | |
| | | 0 | 7 | 1 | | | |
| | | 0 | 0 | 7 | 1 | | |
| | | 0 | 0 | 0 | 7 | 1 | |
| | | 0 | 0 | 0 | 0 | 7 | 1 |

## THE SOLUTION

*Look at the chart below.*

*The left column shows the hundreds. Why is it labelled '$10^2$s'?*
Because the second power of 10, which is $10^2$, is equal to 100.

*How would you read the other column headings?*
Tens, ones, tenths, hundredths, thousandths, ten-thousandths and hundred-thousandths. Students might need reminding that $10^0$ is equal to 1, and not zero. $10^0$ has to be equal to 1 in order to fit the pattern.

*What pattern is there as you move to the right?*
Each time we move one column to the right, we divide by 10. This is reflected in the indices reducing by 1 each time.

Practise reading the numbers aloud in more than one way on each row. For example, the first row is '710 ones' or '7.1 hundreds' or '7100 tenths', etc. The last row could be read as '0.71 thousandths', or '0.0071 tenths', etc.

Students find this very difficult at first, but with practice they become confident at reading the same number in multiple different ways. After a while, they will see that wherever the 1s digit comes in the number that we say will give us the column that we are referring to. For example, in the first row, the number 71 has its 1s digit in the $10^1$ column – so we would say '71 tens'.

It's worth spending time on this, because once students can do this, writing numbers in power-of-ten notation is easy. For example, '7.1 thousandths' becomes $7.1 \times 10^{-3}$.

### Checking for understanding

Make up a question like the one we started with, using digits of your own choice, and with $10^{-1}$, $10^{-2}$ and $10^{-3}$ as the different powers of 10. See if your partner can answer it.


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