

# To infinity and beyond

If you want to spark their interest in numbers, impress them with sheer scale, says **Colin Foster**

Million, billion, trillion, zillion. We are always coming across big numbers in the news – numbers of people or amounts of money. But, for most people, £2 billion is not much different from £2 million in the impression that it makes.

When I look at the powers of 10 in maths lessons with Year 7 pupils, I ask them to tell me a big number or write it on a mini-whiteboard. Words such as million, billion, trillion and sometimes zillion (and their multiples) are common answers, with pupils often trying to outdo the last answer by going bigger, perhaps by using a lot of nines.

Sometimes someone has heard of a googol or a googolplex, or some wag develops a plus one strategy for bettering the last person's answer. Sooner or later, infinity rears its head and we debate whether it counts as a number.

After discussing exactly how big some of these numbers are, what I often do next is draw a horizontal numberline on the board and put zero at the left end and a billion (written simply as b) at the right.

Pupils are invited to come to the board and mark with an X, as accurately as they can, where they think a million ought to go.

After five or six marks have been placed, there is usually very little of the numberline left empty. Then, in groups or as a whole class,

we try to justify or criticise the various locations. "A million is, like, loads, so it must be down the billion end."

"Compared with a billion, a million is quite small, but compared with nothing, it's quite big, so I put it in the middle."

"I think it could be basically anywhere along there, but not too near the ends."

If an incorrect consensus is reached, the question can usually be recast by asking where two million would be, and the discussion then takes off again.

Even those who realise that a million belongs nearer the left end than the right are often surprised when they eventually reason that if the numberline is 1 metre long, a million belongs only 1 millimetre from the left end (since there are 1,000 millimetres in 1 metre and 1,000 million equals 1 billion – by the most commonly used, US reckoning, at least (Americans increase in multiples of 1,000, so a billion Stateside would be 1,000 million here, where a billion was traditionally a million millions).

It is then fun to imagine where a trillion (1,000 x 1 billion) would come on the line – 1 kilometre away, in the middle of town ■

Colin Foster teaches mathematics at King Henry VIII school, Coventry

**Sometimes someone has heard of a googol or some wag develops a plus one strategy for bettering the last person's answer**

## Do you measure up?

Q Here are 10 different names for factors, designed to make working with big numbers easier: zetta, peta, kilo, mega, giga, deka, tera, exa, yotta, hecto. Can you put them in ascending order?

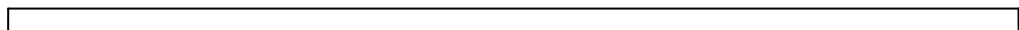
The answer is...  
 A deka, hecto, kilo, mega, giga, tera, peta, exa, zetta, yotta

## How Big? Colin Foster

We are always coming across ‘big numbers’ in the news – numbers of people or amounts of money, for instance – and for many people ‘£ 2 billion’, say, is not much different from ‘£ 2 million’ in the impression that it makes.

I have sometimes begun working on powers of ten by asking pupils to put up their hands and tell me ‘a big number’ or write it on a mini-whiteboard. Words such as ‘million’, ‘billion’, ‘trillion’ and sometimes ‘zillion’ (and their multiples) are common answers, with pupils often trying to outdo the last answer by going bigger, perhaps by using lots of nines. Sometimes someone has heard of a googol or a googolplex or discovers, humorously, a ‘plus one’ strategy for bettering a previous person’s answer. Sooner or later, ‘infinity’ rears its head and we debate whether it counts as ‘a number’.

After discussing exactly how big some of these numbers are, what I often do next is draw a horizontal numberline on the board and put zero at the left end and ‘a billion’ (written just as ‘b’) at the right end:



Pupils are then invited to come to the board and mark with an ‘X’, as accurately as they can, where ‘a million’ ought to go.<sup>1</sup> After five or six marks have been placed there is usually very little of the numberline left empty! Then in groups or as a whole class we try to justify or criticise the various locations:

“A million is, like, loads, so it must be down the billion end.”

“Compared with a billion, a million is quite small, but compared with nothing it’s quite big, so I put it in the middle.”

“I think it could be basically anywhere along there but not too near the ends.”

If an incorrect consensus is reached, it can usually be disturbed by asking where ‘two million’ would be, and the discussion then takes off again. Even those who realise that a million belongs nearer the left end than the right end are often surprised when they eventually reason that if the numberline is 1 metre long a million belongs only 1 mm from the left end (since 1000 million = 1 billion).<sup>2</sup> It is then fun to imagine where ‘a trillion’ would come on the line: 1 kilometre away, in the middle of town.

### Notes

1 I don’t know where this idea originated – certainly not with me.

2 It seems that pretty much the only definition of billion in use in the English-speaking world today is  $10^9$ .

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