# Repeating decimals

Up to now, we've been dealing with only finite decimal numbers (numbers with a finite number of decimal places). For example, $32.18476$ is a finite decimal number, because it ends at the $6$. In contrast, there are two kinds of decimal numbers that go on forever and ever. Some decimals that go on forever eventually get to a point where a certain digit (or sequence of digits) repeats infinitely, but some decimal number that go on forever don't repeat.

A decimal number where a digit or sequence of digits repeats infinitely is called a repeating decimal. An example is

$$32.184766666666...$$

The ... means that the $6$ repeats forever. We can rewrite a repeating decimal in compact form by writing the repeating digit/sequence just once and putting a bar over it. For example, we can write $32.184766666666...$ as

$$32.1847\overline{6}$$

An example of the other kind of infinite decimal is $\pi$, whose decimal representation goes on forever but never repeats. Here are the first $46$ digits of $\pi$.

$$3.14159265358979323846264338327950288419716939 9$$

What we want to focus on are decimals that go on forever but eventually repeat. We'll set these non-repeating decimals like $\pi$ aside for now.

**Example**

Rewrite the repeating decimal.

$$0.5454545454...$$

What we have in this decimal number is a two-digit sequence, $54$, that repeats over and over. Therefore $0.5454545454...$ can be rewritten as

$$0.\overline{54}$$