

Adding and subtracting fractions is not always straightforward. Most people can add $\frac{1}{2} + \frac{1}{2}$ in their heads, but adding $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5}$ is likely to induce a migraine. In order to add or subtract fractions, the fractions must all have a common denominator—in other words, the numbers on the bottom of the fractions must be the same. If your fractions do not conveniently come with common denominators, you will have to do a bit of work before you can add or subtract them.

To give each of your fractions a common denominator, you must multiply both the numerator, or top number, and denominator,

or bottom number, of at least one of the fractions by the same number so that the denominators of the fractions will match. For instance, if you want to subtract $\frac{1}{4}$ from $\frac{1}{2}$, you will have to multiply both the numerator and denominator of $\frac{1}{2}$ by 2 to give you $\frac{2}{4}$. Then both fractions will have 4 as the common denominator.

Once you have a denominator that is common to all the fractions, you simply add or subtract the numerators, writing the result over the common denominator.

It is estimated that there are 2 quadrillion (2,000,000,000,000,000) grains of sand on the world's beaches. As you can see, large numbers like 2 quadrillion take up a lot of space. Working with large numbers in long form would quickly become tiresome and use up a forest of paper in no time.

Fortunately for the trees, mathematicians use a kind of shorthand for writing very large or very small numbers, which is called scientific notation. Scientific notation uses exponents to express large and small numbers in a more compact form. Remember that exponents are those small numbers that appear above and to the right of a number

that indicate the number of times that number is multiplied by itself.

Scientific notation expresses numbers as a single, non-zero digit, often followed by a decimal place and multiplied by a power of 10. Using scientific notation, 2 quadrillion can be written as 2×10^{15} . Small numbers, such as .000000034 are expressed as being multiplied by negative powers of ten, like 3.4×10^{-9} .

When writing a number in scientific notation, do not include any 0s at the end of the number being multiplied by the power of 10. For example, you should write 7.53×10^4 instead of 7.5300×10^4 .

$$\frac{1}{2} + \frac{3}{5} = \frac{5}{10} + \frac{6}{10}$$

$$2 + \frac{2}{3} + \frac{4}{6} = \frac{2}{1} + \frac{2}{3} + \frac{4}{6} \\ = \frac{12}{6} + \frac{4}{6} + \frac{4}{6}$$

$$\frac{3}{4} - \frac{1}{2} = \frac{3}{4} - \frac{2}{4}$$

$$\frac{1}{2} + \frac{3}{5} = \frac{5}{10} + \frac{6}{10} = \frac{11}{10}$$

$$2 + \frac{2}{3} + \frac{4}{6} = \frac{2}{1} + \frac{2}{3} + \frac{4}{6} \\ = \frac{12}{6} + \frac{4}{6} + \frac{4}{6} = \frac{20}{6} = \frac{10}{3}$$

$$\frac{3}{4} - \frac{1}{2} = \frac{3}{4} - \frac{2}{4} = \frac{1}{4}$$

Write Large Numbers in Scientific Notation

$$70000 = 7 \times 10^4$$

$$600000 = 6 \times 10^5$$

$$2350000 = 2.35 \times 10^6$$

$$83900000 = 8.39 \times 10^7$$

$$325000 = 3.25 \times 10^5$$

Write Small Numbers in Scientific Notation

$$0.0009 = 9 \times 10^{-4}$$

$$0.00004 = 4 \times 10^{-5}$$

$$0.00000356 = 3.56 \times 10^{-6}$$

$$0.000051 = 5.1 \times 10^{-5}$$

$$0.0079 = 7.9 \times 10^{-3}$$

1 Write the fractions with their least common denominator, so that each fraction has the same denominator.

Note: The denominator is the bottom number in a fraction. To write fractions with their least common denominator, see page 50.

• When adding or subtracting a fraction with a whole number, you can write the number as a fraction. All whole numbers have an invisible denominator of 1. For example, you can write 2 as $\frac{2}{1}$.

2 Add or subtract only the numerators of the fractions, writing the result over the common denominator.

Note: The numerator is the top number in a fraction.

3 Make sure the resulting fraction is written in simplified form.

Note: A fraction is considered to be in simplified form when you cannot find a number that evenly divides into both the numerator and the denominator of the fraction. For more information on simplifying fractions, see page 45.

1 To write a large number in scientific notation, start at the end of the number and move the decimal place to the left, counting each number you pass, until only one number remains to the left of the decimal place.

2 Write the remaining number(s) followed by $\times 10^n$, where n is the number of numbers you passed.

• For example, for the number 70000, you would pass 4 numbers, so you would write this number in scientific notation as 7×10^4 .

1 To write a small number in scientific notation, start at the decimal place and move the decimal place to the right, counting each number you pass, until one number that is greater than 0 is to the left of the decimal place.

2 Write the remaining number(s) followed by $\times 10^{-n}$, where n is the number of numbers you passed.

• For example, for the number 0.0009, you would pass 4 numbers, so you would write this number in scientific notation as 9×10^{-4} .