

## *Steps into Numeracy*

# Division by Chunking

***Division is one of the four fundamental skills of arithmetic. This guide describes a simple division method called chunking which solves many division problems without the need for long division.***

## Introduction

Division is probably the most difficult of the four basic numeracy skills to understand. It is also the one which causes the most concern. Many people were taught long division at school and although it is true that long division can perform any division, it can over complicate many problems. Usually you can use other, more simple, strategies to divide and so not have to employ long division. One such strategy is called **chunking**. This works by breaking a division down into more manageable, smaller divisions called **chunks**. Adding the answers to each chunk provides the answer to the original problem. This guide explains how chunking works and gives advice on how to perform the simpler divisions on which it relies. Reading the study guide: [Rules for Dividing Whole Numbers](#) will help you make the most of this guide as it explains some of the rules which govern division of large numbers by smaller numbers. The first part of this guide will concentrate on divisions which give a whole number result and the second part will show you how you can extend the method to help with *all* divisions.

## The connection between division and fractions

Fractions are an alternative way of representing division of one whole number by another. Take the piece of mathematics 154 divided by 7. You may be used to writing this using the division sign:

$$154 \div 7 \quad \text{which is also the same as the fraction} \quad \frac{154}{7}$$

and the latter notation is used in chunking. It is important to use a **horizontal** line rather than a diagonal slash when writing a fraction as this helps you to line your fractions up neatly and reduces the chance of ambiguity in your working. Chunking takes advantage of how fractions add together. For example the fraction which represents 154 divided by 7 can be split into smaller fractions so long as the numerators of the fractions add up to 154 and the denominator remains as 7. So:

$$\frac{154}{7} = \frac{140}{7} + \frac{14}{7} \quad \text{or} \quad \frac{154}{7} = \frac{70}{7} + \frac{70}{7} + \frac{14}{7} \quad \text{and so on.}$$

What is happening here is that you are breaking the numerator 154 down into smaller chunks which may help you perform the division more easily. This is how chunking works. Take the two cases above.

$$1^{\text{st}} \text{ case: } \frac{154}{7} = \frac{140}{7} + \frac{14}{7} \quad \text{you may know that } 140 \div 7 = 20 \text{ and } 14 \div 7 = 2$$

$$\text{so } \frac{154}{7} = \frac{140}{7} + \frac{14}{7} = 20 + 2 = 22$$

therefore 154 divided by 7 is 22.

$$2^{\text{nd}} \text{ case: } \frac{154}{7} = \frac{70}{7} + \frac{70}{7} + \frac{14}{7}$$

If you cannot see case 1, you continue to break the numerator into smaller and smaller chunks until you can work out the answer. Here 140 has been **chunked** into  $70 + 70$ . Since  $70 \div 7 = 10$  and  $14 \div 7 = 2$ :

$$\frac{154}{7} = \frac{70}{7} + \frac{70}{7} + \frac{14}{7} = 10 + 10 + 2 = 22$$

As before 154 divided by 7 is 22. It does not matter how you chunk your numerator, you should get the same answer. If you find this difficult or confusing reading the study guides: [Types of Fractions](#) and [Adding and Subtracting Fractions](#) may help.

## Using chunking to halve numbers

As with many aspects of mathematics, you should practise new skills on relatively easy examples before moving on to more difficult cases. Although many of you may be comfortable with halving a number, it is a good place to learn chunking when you remember that halving is dividing a number by 2. To use chunking, chunk the number you are halving into units, tens, hundreds and so on. The advantage of this is that halving each of *these* numbers in turn should be easier. To find the answer you add together the results of the simpler divisions.

*Example:* What is half of 4756?

This is 4756 (which you chunk into thousands, hundreds, tens and units) divided by 2 so:

$$\frac{4756}{2} = \frac{4000}{2} + \frac{700}{2} + \frac{50}{2} + \frac{6}{2}$$

You now look at the new divisions to decide if you can perform them, if not you can chunk them further. However halving is fairly straightforward and:

$$\frac{4756}{2} = \frac{4000}{2} + \frac{700}{2} + \frac{50}{2} + \frac{6}{2}$$

$$\begin{array}{ccccccc} & & \downarrow & & \downarrow & & \downarrow & & \downarrow \\ & & 2000 & + & 350 & + & 25 & + & 3 \\ & & & & & & & & \end{array}$$

$$= 2000 + 350 + 25 + 3 = 2378$$

Using arrows and lining the answers up, like in the example above, keeps your answer clear and helps you keep your place in the calculation

*Example:* Calculate  $334 \div 2$ .

Using chunking into hundreds, tens and units:

$$\frac{334}{2} = \frac{300}{2} + \frac{30}{2} + \frac{4}{2}$$

$$\begin{array}{ccc} & \downarrow & \downarrow & \downarrow \\ & 150 & 15 & 2 \\ & + & + & + \\ & 167 & & \end{array}$$

$$= 150 + 15 + 2 = 167$$

## Chunking with other numbers

Many people have a good understanding of how to divide a number by 2 and using chunking to break numerators down until you are comfortable with the division may not be necessary. However dividing by other numbers is not usually as intuitive. Also, breaking numbers down into units, tens, hundreds and so on **does not work for division by a majority of numbers**. However chunking can still be used, in conjunction with multiplication tables. If you are dividing by a number, for example 3, you should make a note of its times table (up to 9 times) somewhere on your page. This serves as a reference for your chunking (it also helps to practice the times table by writing it down).

There is a neat property of times tables involving multiplying by powers of 10 which helps you when you are chunking. For example as  $7 \times 3 = 21$  if you multiply both sides of this equation by 10 you get  $70 \times 3 = 210$  and by 10 again to get  $700 \times 3 = 2100$  and so on. It follows that  $21 \div 3 = 7$ ,  $210 \div 3 = 70$ ,  $2100 \div 3 = 700$  and so on. You can write these divisions as fractions as:

$$\frac{21}{3} = 7 \qquad \frac{210}{3} = 70 \qquad \frac{2100}{3} = 700 \quad \text{and so on}$$

This property is very useful as, by adding zeroes to the left and right hand sides of times tables, you can make numbers which can help in your chunking. Therefore, by writing down the times table of the number you are dividing by for reference you can chunk the number you are dividing more effectively.

*Example:* What is  $471 \div 3$ ?

To chunk this question you use the three times table on the right to find numbers which divide by 3 and add to give 471. To start you take the biggest chunk you can out of 471 **which you definitely know divides by 3**. Add zeroes to any of the 3 times table to make the biggest number you can but which is smaller than 471. In this case by adding two zeroes to 3 you can make 300. By taking this chunk out of 471 you are left with 171, you now repeat the method and take the biggest chunk you can out of 171 which is 150. This leaves 21 which is part of your list and so you are done. You can write it like this:

3	1
6	2
9	3
12	4
15	5
18	6
21	7
24	8
27	9

$$\begin{array}{r} \textcircled{171} \quad \textcircled{21} \\ \frac{471}{3} = \frac{300}{3} + \frac{150}{3} + \frac{21}{3} \\ \downarrow \quad \downarrow \quad \downarrow \\ = 100 + 50 + 7 = 157 \end{array}$$

It is useful to make a note of what you have left as you go along (here the 171 and 21 are shown in bubbles above the calculation). You can also check that the numerators add to the required number. Here  $300 + 150 + 21 = 471$ .

*Example:* What is  $8262 \div 3$ ?

The biggest chunk you can take out of 8262 is 6000 which leaves 2262, then take out a chunk of 2100 to leave 162, then take out a chunk of 150 leaving 12 (which is part of the three times table). You can write it like this:

$$\begin{array}{r} \textcircled{2262} \quad \textcircled{162} \quad \textcircled{12} \\ \frac{8262}{3} = \frac{6000}{3} + \frac{2100}{3} + \frac{150}{3} + \frac{12}{3} \\ \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ = 2000 + 700 + 50 + 4 = 2754 \end{array}$$

3	1
6	2
9	3
12	4
15	5
18	6
21	7
24	8
27	9

So  $8262 \div 3 = 2754$ . (Check:  $6000 + 2100 + 150 + 12 = 8262$ )

This method can be easily extended to division by other numbers. You make a note of the relevant times table to help you and use the chunking method as shown in the previous examples.

Example: What is  $1883 \div 7$  ?

The biggest chunk you can take out of 1883 is 1400 which leaves 483, then take out a chunk of 420 to leave 63 (which is part of the seven times table).

$$\begin{array}{r} 1883 \\ \underline{7} \\ \hline \end{array} = \frac{1400}{7} + \frac{420}{7} + \frac{63}{7}$$

$\overset{\textcircled{483}}{\phantom{00}}$ 
 $\overset{\textcircled{63}}{\phantom{00}}$

$$= 200 + 60 + 9 = 269$$

7	1
14	2
21	3
28	4
35	5
42	6
49	7
56	8
63	9

So  $1883 \div 7 = 269$ .

## Extending the method to account for remainders

The examples so far have all had whole number answers. This is not always the case and the answer to many division problems involve a whole number part with something left over, this is called the **remainder**. If you know some simple fraction to decimal conversions you can extend the chunking method to help with question which have a remainder. The following table gives some basic fraction to decimal conversions.

$\frac{1}{2} = 0.5$	$\frac{1}{3} = 0.\dot{3}$	$\frac{2}{3} = 0.\dot{6}$	$\frac{1}{4} = 0.25$	$\frac{2}{4} = \frac{1}{2} = 0.5$
$\frac{3}{4} = 0.75$	$\frac{1}{5} = 0.2$	$\frac{2}{5} = 0.4$	$\frac{3}{5} = 0.6$	$\frac{4}{5} = 0.8$
$\frac{1}{6} = 0.1\dot{6}$	$\frac{2}{6} = \frac{1}{3} = 0.\dot{3}$	$\frac{3}{6} = \frac{1}{2} = 0.5$	$\frac{4}{6} = \frac{2}{3} = 0.\dot{6}$	$\frac{5}{6} = 0.8\dot{3}$
$\frac{1}{8} = 0.125$	$\frac{2}{8} = \frac{1}{4} = 0.25$	$\frac{3}{8} = 0.375$	$\frac{4}{8} = \frac{1}{2} = 0.5$	$\frac{5}{8} = 0.625$
$\frac{6}{8} = \frac{3}{4} = 0.75$	$\frac{7}{8} = 0.875$	$\frac{1}{9} = 0.\dot{1}$	$\frac{2}{9} = 0.\dot{2}$	$\frac{3}{9} = \frac{1}{3} = 0.\dot{3}$
$\frac{4}{9} = 0.\dot{4}$	$\frac{5}{9} = 0.\dot{5}$	$\frac{6}{9} = \frac{2}{3} = 0.\dot{6}$	$\frac{7}{9} = 0.\dot{7}$	$\frac{8}{9} = 0.\dot{8}$
$\frac{1}{10} = 0.1$	$\frac{2}{10} = \frac{1}{5} = 0.2$	$\frac{3}{10} = 0.3$	$\frac{4}{10} = \frac{2}{5} = 0.4$	$\frac{5}{10} = \frac{1}{2} = 0.5$
$\frac{6}{10} = \frac{3}{5} = 0.6$	$\frac{7}{10} = 0.7$	$\frac{8}{10} = \frac{4}{5} = 0.8$	$\frac{9}{10} = 0.9$	

Note: A dot above a number means that the number is recurring so  $0.\dot{3} = 0.333\dots$

*Example:* Calculate  $817 \div 4$ .

Using the chunking method. The first chunk is 800 leaving 17, then a chunk of 16 which leaves 1 left over:

$$\begin{aligned} \frac{817}{4} &= \frac{800}{4} + \frac{17}{4} + \frac{1}{4} \\ &= 200 + 4 + 0.25 = 204.25 \end{aligned}$$

4	1
8	2
12	3
16	4
20	5
24	6
28	7
32	8
36	9

Where you can use the table to find that the remainder is  $\frac{1}{4} = 0.25$ .

*Example:* Calculate  $3651 \div 8$ .

Using the chunking method.

$$\begin{aligned} \frac{3651}{8} &= \frac{3200}{8} + \frac{451}{8} + \frac{51}{8} + \frac{3}{8} \\ &= 400 + 50 + 6 + 0.375 = 456.375 \end{aligned}$$

8	1
16	2
24	3
32	4
40	5
48	6
56	7
64	8
72	9

Where you can use the table to find that the remainder is  $\frac{3}{8} = 0.375$ .

## Want to know more?

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