Lesson One

The Number System

Aims

The aims of this lesson are to help you:

- recognise numbers when they are written as words
- recognise the place value of numbers
- work with positive and negative numbers
- place numbers on a 'number line'
- use addition in everyday situations

Why am I studying this?

In this first lesson we are going to look at what numbers are and how they are made up. Once we understand that, it will make it easier to put them together in various ways – by adding and subtracting them, for instance. Let's start with addition as this is the easiest.

Oxford Home Schooling

Introduction

One, two, three, four, five,
Once I caught a fish alive,
Six, seven, eight, nine, ten,
Then I let it go again.

Numbers are important all through our lives, from the time we learn to count as toddlers to the time when we need to work out what something costs and whether we have enough pocket money to pay for it … and beyond!

Place Value

1	One
10	Ten
100	One hundred

Each of these numbers has a very different *value*, although the first **digit** (1) in each number is the same. A digit is any one single figure within a larger number:

1 only has one digit – one (1)

10 has two digits – one and zero (1 and 0)

100 has three digits – one and zero and zero (1 and 0 and 0)

To say that something has a different **value** means that it is either a larger or a smaller number. So 1 is smaller than 10. And 100 is larger than 10.

To show that the values are different, we place the digits in **columns**. This helps us quickly and easily work out the value of the different digits, by checking which column they are in.

The first three columns we are interested in are the Hundreds column, the Tens column and the Units column.

HTU	
1	One
10	Ten
100	One hundred

How many hundreds, tens and units are there in the number 435?

HTU	
435	4 hundreds
	3 tens
	5 units

Counting in Tens and Hundreds

This system lets you count in tens and hundreds in a very simple way. If you add 10 to a number (or take 10 away), normally it is only the tens digit that changes.

For example

$$\begin{array}{r} 812 \\ +\ 10 \\ \hline 822 \end{array}$$

The hundreds digit can change, if adding or subtracting 10 takes you into the hundred above or below the one you are in.

$$\begin{array}{r} 599 \\ +\ 10 \\ \hline 609 \end{array} \qquad \begin{array}{r} 305 \\ -\ 10 \\ \hline 295 \end{array}$$

But if you add or subtract 10, the units digit doesn't change.

When you add or subtract 100, the hundreds digit changes but the tens and units do not. For example:

$$\begin{array}{r} 741 \\ -\ 100 \\ \hline 641 \end{array}$$

Odd and Even Numbers

Every whole number that you can think of (1, 2, 3, 4, 5 *etc*) is either **odd** or **even**.

Odd numbers are numbers like 1, 7, 21, 183 and 205. They are called "odd" because they can't be divided exactly by two. If you try to divide an odd number by two you will always get a number left over.

So if we try to divide 7 by 2, for example:

$7 \div 2 = 3$ with 1 left over.

Even numbers are numbers that *can* be divided exactly by two, such as 12, 38, 76 and 104, which leave no remainder.

If, for example, we try to divide 12 by 2, we can do this with nothing left over as 2 divides into 12 exactly:

$12 \div 2 = 6$

Greater Than and Less Than

Because numbers differ in value we often use symbols to show the *relationship* between different numbers – whether a number if bigger or smaller than another number.

> is the symbol for **greater than** (or bigger than)

< is the symbol for **less than** (or smaller than)

So if you want to say that 21 is greater than 18, you could write

$21 > 18$

Or if you want to say that 841 is less than 952, you could write

$841 < 952$.

It's easy to remember which way round these signs go, because the 'wide side' always faces towards the higher-value number. If in any doubt, check this with the examples immediately above and you should very soon get the hang of it.

Activity 1

Copy and complete this table. The first one has been completed for you.

27	Two tens and seven units	20 + 7
84		
91		
35		
132	One hundred, three tens and two units	100 + 30 + 2
453		
287		
915		
346		

Activity 2

Copy and complete this table. The first one has been completed for you.

Two hundred and fifty four	200	50	4	254
One hundred and forty eight				
Six hundred and ninety seven				
Three hundred and thirty three				
Five hundred and twenty six				
Eight hundred and seventeen				
Twenty five				
Five hundred and one				
Nine hundred and eighty two				

The Place Value of Larger Numbers

You have now learnt about the place value of hundreds, tens and units. But there are numbers with values even bigger than that!

We need to use these large numbers when dealing with lots and lots of things – like how many people make up the population of a country, or how many people watch *X Factor* on a Saturday. When we discuss such big numbers we often need to talk in 'thousands', 'ten thousands', 'hundred thousands' and 'millions'.

Sometimes you will come across the term 'billion', which means a thousand million. This is a *huge* number so you will come across it less often than some of the other numbers we have already met. But you'll find it used by astronomers, for example, when they talk about how many stars there are in a galaxy, or how many galaxies in the Universe. A billion is a very, very big number!

Addition

Addition is a very useful skill, and you should try to practise your adding skills as often as you can. You will need to add numbers when you are in the shops to see much it will cost to buy a number of different items. You will also need it in cafés, for example, if you want to check your bill is correct. The more you can practise doing addition sums in your head, the more confident you will be when it comes to adding numbers in different situations. As you work your way through this course, you will be given advice about how to practise your mental arithmetic.

Mental Arithmetic Practice

When you are adding either rows or columns of numbers, you will find It easier If you can pair them off as far as possible to make 'bundles' of ten:

E.g. 6 + 3 + 5 + 7 + 4 + 8 + 2

In this problem I would take 6 + 4 to make 10,
3 + 7 make another 10,
8 + 2 make another 10.

So I can quickly see that the total is 35. This is a much easier process than taking the numbers In order.

You may say that this is all very well as long as the numbers you have to deal with can be paired off so easily.

But if the numbers in your problem cannot be paired off straight away, you can easily reorganise them so that they do.

So for example: 7 + 8 = ?

What I would do here would be to say:

I need 3 to go with 7 to make it up to 10 – therefore I think of 8 as 3 + 5. The sum then becomes 7 + 3 + 5, which we can quickly see gives a total of 15.

The more you practise this technique, the easier you will find it to use.

You might like to try it out, using any handy bunch of digits such as your telephone number.

Activity 3

This exercise should be done in your head. Try using the methods we've just been studying.

1. Add 2, 7, 9, 11 and 13.
2. What is the total of 8 and 9?
3. Work out 3 + 5 + 7 + 9.
4. Find the sum of 6, 4, 3, 5, 15 and 7.
5. Add 5, 9, 8 and 7.
6. Add 8, 4, 7 and 10.
7. Work out 3 + 8 + 5 + 7 + 12.

Positive and Negative Numbers

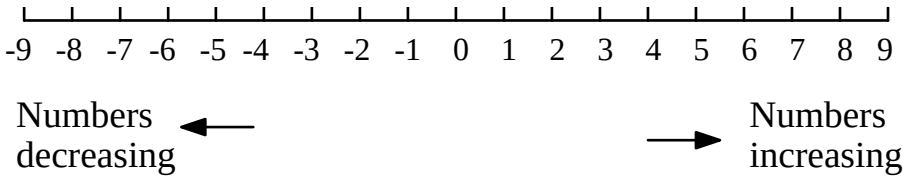
Positive numbers are those whose value is greater than zero. Sometimes they are written with no sign in front of them, and sometimes a positive sign is written, e.g. +2, +11, 15, +7 are all positive numbers.

Numbers less than zero are called negative numbers and they are *always* written with the negative sign in front of them.

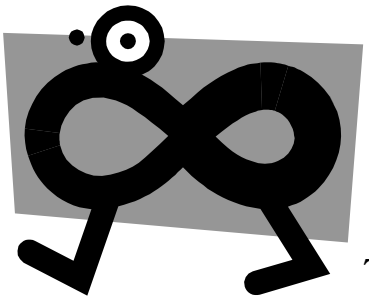
For example –3, –5, –8, –12 are all negative numbers.

We often hear negative numbers in winter when the weather is cold. If the weather forecaster tells us that we can expect temperatures around –4 degrees we know that it is time to get our thermal underwear on!

We can arrange all these numbers on a line – called the *number line* – so that the larger the number, the further to the right it lies. The smaller a number is, the further to the *left* it goes.



The Number Line



I have drawn part of the number line but we can imagine it going on for ever in either direction.

The numbers –8, –5, –1, +2, +6, +10 are written in order of *increasing* size.

Activity 4	1. Write these numbers in order with the lowest first: +9, –7, –10, +2, +6, +1, –3
	2. Write these numbers in order, beginning from the highest (*i.e.* the number line would be running in reverse): –6, +11, –4, –1, +4, +7, –3, +6

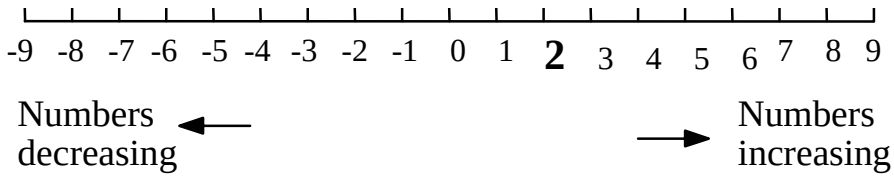
Another View of Addition

We can think of addition as a process of movement – a move to the right is a *positive* movement while a move to the left is a *negative* movement.

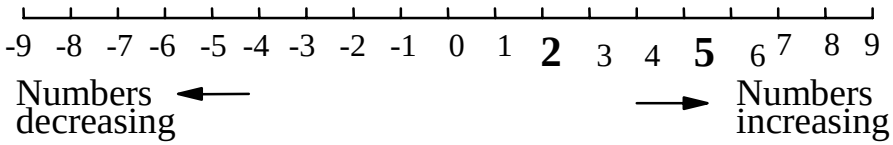
So if we say "Add 2 + 3" we can think of it like this:

Start at zero on the number line.

Now move 2 places to the right



Now if we move 3 more places to the right……



…… we have moved a total of **5** places to the right.

So 2 + 3 = 5

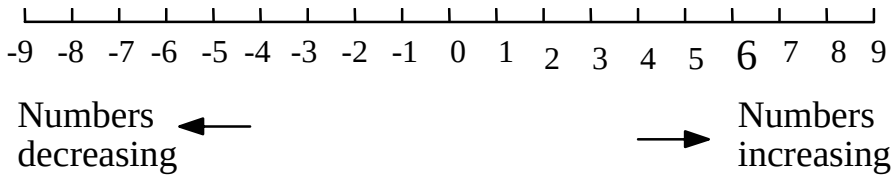
But what if we want to add a negative number to a positive number?

For example

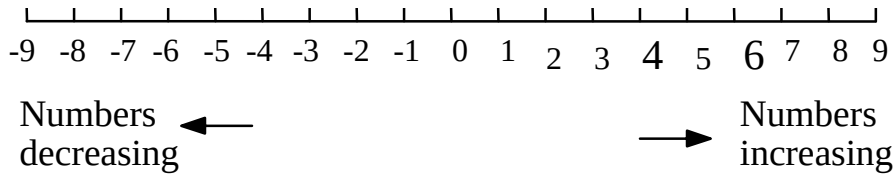
+6 + (–2)

Well we use a similar method.

First we move six to the right…..



…. And then we move 2 to the left.



So 6 + (–2) = 4

Activity 5	Now try to work these out.
	(a) 4 + (–6) (b) 6 + 4 (c) (–13) + 8 (d) (–6) + 3 (e)(–6) +(–8) + 12 (f) 4 +(–10) +12

In the examples of addition we've looked at so far, the numbers have been quite small. But when adding larger numbers, it may be easier to look at the position of each digit as we did in the first exercise.

Example 1

246 + 312 means that we want to add

200 + 40 + 6 to 300 + 10 + 2

which gives

500 + 50 + 8

which is ***558.***

Example 2

359 + 237 means

300 + 50 + 9 + 200 + 30 + 7

which gives

500 + 80 + 16

and this is the same as

500 + 90 + 6

which is ***596***.

Example 3

468 + 284
= 400 + 60 + 8 + 200 + 80 + 4
= 600 + 140 + 12
= 600 + 100 + 40 + 10 + 2
= 700 + 50 + 2
= ***752***

This is a slightly long way to write out the problem but it does describe the way you should be thinking about it: gathering the hundreds, then the tens, then the units.

Occasionally you may need to 'carry' (*e.g.* 60 + 70 = 130, so you would need to bump-up your 100s by another one), but you should quickly find you can take this in your stride.

Frequent practice is the key, until this becomes second nature!

Activity 6	Work these out without using a calculator.
	1. 34 + 28 2. 142 + 359 3. 487 + 192 4. 2845 + 1984 5. 1988 + 1066 6. 482 + 1948

Other ways in which you may be asked to add numbers together are:

'Find the sum of …' or 'Find the total of …'

When the question is asked in this way, the plus sign (as such) may be left out. The sense of the question should still make it obvious enough that this will be an 'adding operation'.

Self-Assessment Test

The lesson concludes with a self-assessment test to test your grasp of the lesson as a whole.

You should work through these questions without using a calculator.

1. Write the following numbers in numeral form:
   (a) Four hundred and eighty seven
   (b) Fifty two
   (c) Seven thousand, three hundred and ten
   (d) Thirty-six million

2. Write the following numbers in word form:
   (a) 68 (c) 150
   (b) 200 000 (d) 9891

3. Write the following using mathematical symbols:
   (a) 45 is less than 98
   (b) 507 is greater than 186

4. While queueing in a shop, you are trying to work out how much your items will cost altogether. In your basket are:

   A carton of milk (50p)
   A loaf of bread (65p)
   A newspaper (41p)
   A chocolate bar (55p)
   A can of soup (£1.75)

   What will the total cost be?

Answers to Lesson Activities

Activity One

27	Two tens and seven units	20 + 7
84	Eight tens and four units	80 + 4
91	Nine tens and one unit	90 + 1
35	Three tens and five units	30 + 5
132	One hundred, three tens and two units	100 + 30 + 2
287	Two hundreds, eight tens and seven units	200+80+7
915	Nine hundreds, one ten and five units	900+10+5
346	Three hundreds, four tens and six units	300+40+6

Activity Two

Two hundred and fifty four	200	50	4	254
One hundred and forty eight	100	40	8	148
Six hundred and ninety seven	600	90	7	697
Three hundred and thirty three	300	30	3	333
Five hundred and twenty six	500	20	6	526
Eight hundred and seventeen	800	10	7	817
Twenty five		20	5	25
Five hundred and one	500		1	501
Nine hundred and eighty two	900	80	2	982

Activity Three

1. 42
2. 17
3. 24
4. 40
5. 29
6. 29
7. 35

Activity Four

1. −10, −7, −3, +1, +2, +6, +9

2. +11, +7, +6, +4, −1, −3, −4, −6

Activity Five

1. (a) −2
   (b) +10
   (c) −5
   (d) −3
   (e) −2
   (f) +6

Activity Six

1. 34 + 28
   = 30 + 4 + 20 + 8
   = 50 + 12

   = 62

2. 142 + 359 = 100 + 40 + 2 + 300 + 50 + 9
   = 400 + 90 + 11 = 400 + 100 + 1
   = *501*
3. 487 + 192 = 400 + 80 + 7 + 100 + 90 + 2
   = 500 + 170 + 9

= *679*

4. 2845 + 1984
   = 2000 + 800 + 40 + 5 + 1000 + 900 + 80 + 4
   = 3000 + 1700 + 120 + 9
   = *4829*
5. 1988 + 1066
   = 1000 + 900 + 80 + 8 + 1000 + 60 + 6
   = 2000 + 900 + 140 + 14
   = 2000 + 900 + 100 + 40 + 10 + 4
   = 3000 + 50 + 4
   = *3054*
6. 482 + 1948
   = 400 + 80 + 2 + 1000 + 900 + 40 + 8
   = 1000 + 1300 + 120 + 10
   = 1000 + 1000 + 300 + 100 + 20 + 10
   = 2000 + 400 + 30
   = *2430*

Answers to Self-Assessment Test

1. (a) 487 (b) 52 (c) 7,310 (d) 36,000,000

2. (a) Sixty eight (b) Two hundred thousand (c) One hundred and fifty (d) Nine thousand eight hundred and ninety one.

3. (a) 45<98 (b) 507 >186

4. £3.86