

# Types of number 1

## This chapter is about:

- integers, even and odd numbers
- factors and multiples
- prime numbers
- squares and square roots
- cubes and cube roots
- index notation
- negative numbers.

## You should already know:

- how to add, subtract, multiply and divide simple numbers.

## Numbers

The counting numbers, 1, 2, 3, 4, ... are all whole numbers. Fractions and decimals are not whole numbers. You will learn more about fractions and decimals later in the course.

Another word for the counting numbers is **natural numbers**.

The **even** numbers are 2, 4, 6, 8, 10, ... They are numbers that can be divided by 2.

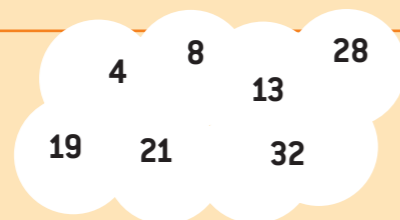
The **odd** numbers are 1, 3, 5, 7, 9, ... They are numbers that cannot be divided exactly by 2.

A number is made up of digits. For example, the number 547 is a three-digit number. The 7 is the units digit, the 4 is the tens digit and the 5 is the hundreds digit.

### EXAMPLE 1

From the numbers in the bubble, write down all the

- a even numbers
- b odd numbers.



### SOLUTION

a The even numbers are 4, 8, 28 and 32.

b The odd numbers are 13, 19 and 21.

You only need to look at the last digit. All even numbers end in 0, 2, 4, 6 or 8.

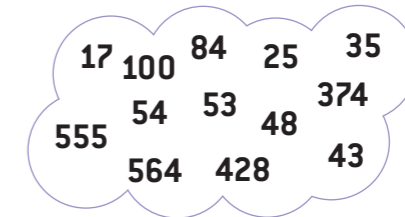
Again, you only need to look at the last digit. All odd numbers end in 1, 3, 5, 7 or 9.



### Exercise 1.1

- 1 Write down all the even numbers from the following list.  
2, 25, 37, 56, 345, 180
- 2 Write down all the odd numbers from the following list.  
531, 81, 84, 56, 67, 788, 265

- 3 From the numbers in the bubble, write down
  - a the largest even number
  - b the largest odd number
  - c an even number between 40 and 50
  - d an odd number greater than 500.



- 4 Evan says to his friend, 'The sum of an even number and an odd number is always even.' Is this statement true or false?

## Factors, multiples and prime numbers

The **factors** of a number are those whole numbers that divide into the number exactly. For example, the factors of 20 are 1, 2, 4, 5, 10 and 20.

A **common factor** is a factor that is shared by two or more numbers.

### EXAMPLE 2

- a List the factors of 24.
- b List the factors of 18.
- c List the common factors of 24 and 18.

### SOLUTION

- a The easiest way to find factors is to choose pairs of numbers that multiply together to give that number. To make sure you don't miss any out, start at 1 and check each number in turn.

$$1 \times 24 = 24$$

$$2 \times 12 = 24$$

$$3 \times 8 = 24$$

$$4 \times 6 = 24$$

So the factors of 24 are 1, 2, 3, 4, 6, 8, 12 and 24.

$$b \quad 1 \times 18 = 18$$

$$2 \times 9 = 18$$

$$3 \times 6 = 18$$

So the factors of 18 are 1, 2, 3, 6, 9 and 18.

- c The common factors of 24 and 18 are 1, 2, 3 and 6.

Every number can be divided by 1 and itself. Don't forget to include these.

5 doesn't divide into 24. The next number to test is 6. You have already listed 6 because 4 and 6 multiply together to give 24. So you do not need to test any more numbers.

It is usual to list the factors in order of size.

4 doesn't divide into 18. 5 doesn't divide into 18. You have already tested 6 so you don't need to go any further.

Look at the lists of factors and choose the ones that appear in both lists.

The **multiples** of a number are those numbers which can be divided exactly by it. The 'times tables' are lists of multiples. For example, the multiples of 4 are 4, 8, 12, 16, 20, ...

It is easy to recognise certain multiples:

- The multiples of 2 always end in 0, 2, 4, 6 or 8. They are the even numbers.
- The multiples of 10 always end in 0.
- The multiples of 5 always end in 0 or 5.
- The multiples of 3 are always made up of digits that add up to a multiple of 3. For example, adding the digits of 15 gives  $1 + 5 = 6$  which is  $2 \times 3$ , and adding the digits of 39 gives  $3 + 9 = 12$  which is  $4 \times 3$ .
- The multiples of 9 are always made up of digits that add up to a multiple of 9. For example, adding the digits of 18 gives  $1 + 8 = 9$  which is  $1 \times 9$ , and adding the digits of 459 gives  $4 + 5 + 9 = 18$  which is  $2 \times 9$ .

For large numbers, it is useful to know that when the last two digits can be divided exactly by 4 the number is a multiple of 4. For example, 1964 is a multiple of 4 because  $64 \div 4 = 16$ . Similarly, 2048 is a multiple of 4 because  $48 \div 4 = 12$ .

### EXAMPLE 3

From the numbers in the bubble, write down those that are multiples of:

- |     |      |
|-----|------|
| a 2 | b 10 |
| c 5 | d 4  |
| e 3 | f 9  |

860 34 524 563  
154 760 453  
122 67 190 45

### SOLUTION

- a 34, 122, 154, 190, 524, 760, 860  
b 190, 760, 860  
c 45, 190, 760, 860  
d 524, 760, 860  
e 45, 453  
f 45

Look at each number in turn and use the rules you know to write down the required numbers.

All multiples of 4 are even so you only need to check the even numbers.

Prime numbers are numbers that have only two factors, the number itself and 1. Note that 1 is not a prime number. The first six prime numbers are 2, 3, 5, 7, 11 and 13.

### EXAMPLE 4

From the numbers in the bubble, list all the

- a even numbers  
b odd numbers  
c prime numbers.

23 4 8 15  
31 22 19 64 25

### SOLUTION

- a The even numbers are 4, 8, 22 and 64.  
b The odd numbers are 15, 19, 23, 25 and 31.  
c The prime numbers are 19 and 31.



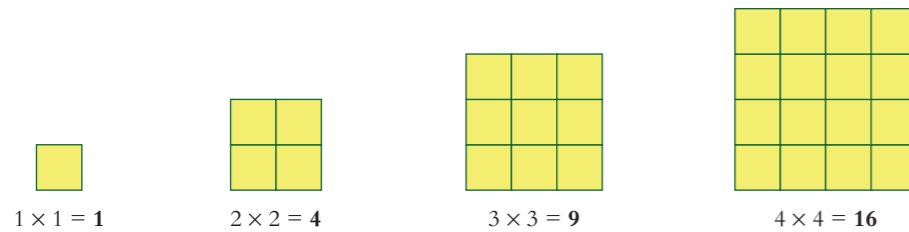
### Exercise 1.2

- In order of size, write down the factors of each of these numbers.  
a 9            b 15            c 28            d 32  
e 48            f 50            g 75            h 72
- Write down the pair of factors that makes each of these numbers.  
a 26            b 33            c 40            d 30
- Ann buys 36 plants. Show all the different ways she can arrange them in rectangular trays.
- Find the first five multiples of each of these numbers.  
a 7            b 3            c 8  
d 5            e 11            f 12
- Find:  
a three multiples of 6 that are greater than 50 but less than 70.  
b three multiples of 20 that are between 25 and 90  
c three multiples of 15 that are between 10 and 50.
- From the numbers in the bubble, write down those that are  
a multiples of 4  
b factors of 21  
c multiples of 6  
d factors of 30.
- 'I am less than 10. I am a multiple of 5. Who am I?'
- List all the prime numbers that lie between 15 and 30.
- Give a reason why the following are not prime numbers.  
a 15            b 18            c 24
- Find two prime numbers that add up to  
a 8            b 12            c 24

6 7 21  
1  
60 5 44

## Squares and square roots

**Square numbers** are obtained by multiplying one number by itself. These are the first four square numbers.



So, for example, 4 squared is 16. You can write this as  $4^2 = 16$ .

The **square root** of a number is the number which, when multiplied by itself, produces that number.

Squaring and square rooting are inverse operations. Since  $4 \times 4 = 16$ , the square root of 16 is 4. You can write this as  $\sqrt{16} = 4$ .

You should learn the square numbers up to  $10 \times 10$ .

Number	1	2	3	4	5	6	7	8	9	10
Square	1	4	9	16	25	36	49	64	81	100

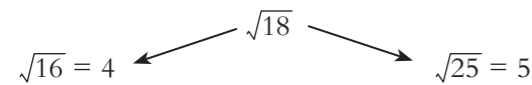
It is also useful to know the square numbers from  $11 \times 11$  to  $15 \times 15$ .

Number	11	12	13	14	15
Square	121	144	169	196	225

### EXAMPLE 5

Between which two consecutive numbers does  $\sqrt{18}$  lie?

#### SOLUTION



Find the two square numbers which 18 lies between. These are 16 and 25.

So  $\sqrt{18}$  lies between 4 and 5.

## Squares and square roots on your calculator

You can calculate squares and square roots using special function keys on your calculator.

You can calculate the square of a number using the  $\times^2$  button but, if it has many digits, if it is possible that you may make a mistake keying the number in twice. Look for the 'square' button on your calculator. It probably looks like this  $x^2$ .

If a number is a square number then you may recognise its square root. To calculate the square root of a number that is not a square number, you need to use the 'square root' key on your calculator. It probably looks like this  $\sqrt{\square}$ .

### EXAMPLE 6

Use your calculator to find the square root of 343.

#### SOLUTION

Key in  $\sqrt{\square}$  3 4 3 =

Your calculator should show the answer 18.520259...

Your calculator may show a different number of digits.

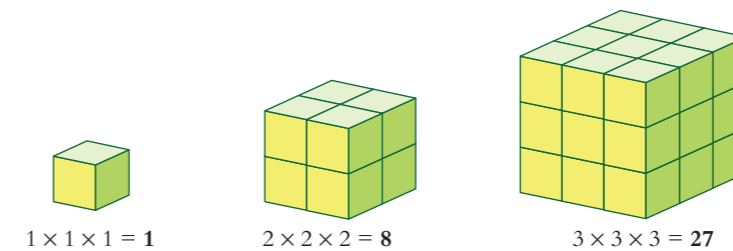
This is about 18.5.

You will learn how to write the answer using fewer digits later in the course.

## Cubes and cube roots

**Cube numbers** are obtained by multiplying one number by itself, and then by itself again.

These are the first three cube numbers.



So, for example, 2 cubed is 8. You can write this as  $2^3 = 8$ .

The **cube root** of a number is the number which, when multiplied by itself and then by itself again, produces that number.

Cubing and cube rooting are inverse operations. Since  $2 \times 2 \times 2 = 8$ , the cube root of 8 is 2. You can write this as  $\sqrt[3]{8} = 2$ .

You should learn these cube numbers.

Number	1	2	3	4	5	10
Cube	1	8	27	64	125	1000

## Cubes and cube roots on your calculator

As for squares and square roots, you can calculate cubes and cube roots using special function keys on your calculator. The 'cube' key probably looks like this  $x^3$ .

Find out how to use your calculator to work out cubes and cube roots. You might have to use the  $\text{SHIFT}$  key.

### Exercise 1.3

You must not use your calculator for questions 1 to 6.

- Write down the next three square numbers in this sequence.  
1, 4, 9, ..., ..., ...
- Find the square of each of these numbers.  
a 5            b 7            c 20            d 25
- Joe wants to arrange apples in different size trays.  
Which of these numbers of apples can be arranged in square trays?  
a 35            b 64            c 90            d 121
- Find the square root of each of these numbers.  
a 81            b 169            c 144            d 196
- Between which two consecutive numbers does each of these lie?  
a  $\sqrt{32}$             b  $\sqrt{40}$             c  $\sqrt{50}$             d  $\sqrt{70}$
- Write down the next three cube numbers in this sequence.  
1, 8, 27, ..., ..., ...

You may use your calculator for questions 7 to 11.

- Use your calculator to find the square root of each of these numbers and check your answers to question 5.  
a  $\sqrt{32}$             b  $\sqrt{40}$             c  $\sqrt{50}$             d  $\sqrt{70}$
- Work out these.  
a  $\sqrt{23}$             b  $\sqrt{45}$             c  $\sqrt{84}$             d  $\sqrt{150}$
- Find the cube of each of these numbers.  
a 8            b 9            c 10            d 15.2
- Find the cube root of each of these numbers.  
a 64            b 343            c 1331            d 216
- Work out these.  
a  $\sqrt[3]{15}$             b  $\sqrt[3]{69}$             c  $\sqrt[3]{453}$             d  $\sqrt[3]{643}$

## Index notation

In the previous section you saw that you could write 4 squared as  $4^2$ .

$4^2$  is called a **power** and it is written using **index notation**.

Index notation is a form of mathematical shorthand.

The 4 is called the **base** and the 2 is called the **index** or **power**.

Writing  $4^2$  means that you multiply 4 by itself 2 times.

$$4^2 = 4 \times 4$$

If you are asked to find the value of (or to evaluate) a power you need to do the multiplications.

$$4^2 = 4 \times 4 = 16$$

The index can be any number.

$$4^3 = 4 \times 4 \times 4 = 64 \quad \leftarrow \text{4 cubed}$$

$$4^4 = 4 \times 4 \times 4 \times 4 = 256 \quad \leftarrow \text{4 to the power 4}$$

$$4^5 = 4 \times 4 \times 4 \times 4 \times 4 = 1024 \quad \leftarrow \text{4 to the power 5}$$

### EXAMPLE 7

Find the value of each of these.

a  $5^3$             b  $2^5$             c  $1^7$

### SOLUTION

a  $5^3 = 5 \times 5 \times 5 = 125$

b  $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

c  $1^7 = 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 = 1$

## Powers on your calculator

As for squares, you can evaluate a power of a number using the  $x^{\square}$  button on your calculator but the chance of making a mistake is even greater if you are entering the number many times. On your calculator, look for the key that lets you enter numbers as powers. It probably looks like this  $\wedge$  or  $x^{\square}$ .

### EXAMPLE 8

Evaluate  $7^5$ .

### SOLUTION

Key in  $7$   $x^{\square}$   $5$   $=$

Your calculator should show the answer 16 807.

So  $7^5 = 16\,807$ .

### Exercise 1.4

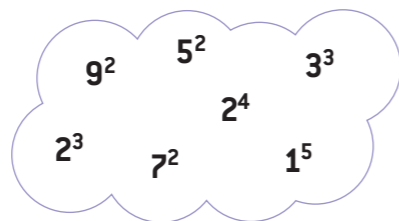
You must not use your calculator for questions 1 to 3.

- 1 Write each of these in simpler form using index notation.  
(For example  $2 \times 2 \times 2 = 2^3$ .)
- |   |   |
|---|---|
| a $2 \times 2 \times 2 \times 2 \times 2 \times 2$          | b $3 \times 3 \times 3 \times 3$          |
| c $5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5$ | d $9 \times 9 \times 9 \times 9$          |
| e $3 \times 3 \times 3 \times 3 \times 3$                   | f $7 \times 7 \times 7 \times 7$          |
| g $8 \times 8 \times 8 \times 8$                            | h $1 \times 1 \times 1 \times 1 \times 1$ |

2 For each pair of numbers, which is the greater?

- a  $3^2$  or  $2^3$     b  $3^4$  or  $4^3$     c  $2^8$  or  $8^2$     d  $6^2$  or  $3^6$

3 The numbers in the bubble are all less than 100. Arrange them in order of size, starting with the smallest.



You may use your calculator for question 4.

4 Work out these.

- |         |         |          |         |          |
|---------|---------|----------|---------|----------|
| a $4^4$ | b $5^4$ | c $11^3$ | d $7^4$ | e $1^6$  |
| f $8^2$ | g $9^3$ | h $15^2$ | i $6^4$ | j $14^4$ |

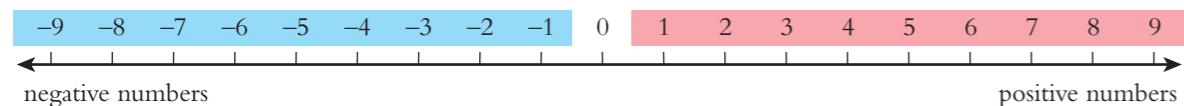
## Negative numbers

Earlier in this chapter you met the counting numbers, 1, 2, 3, 4, ... . These are all the whole numbers, or **integers**, greater than zero.

Numbers greater than zero are called **positive** numbers.

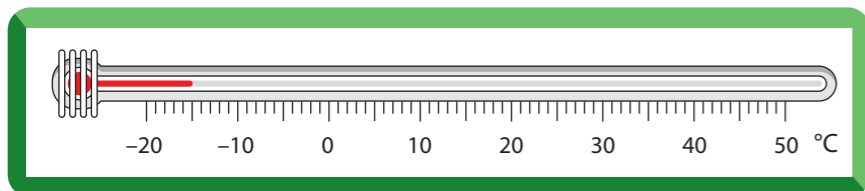
Numbers less than zero are called **negative** numbers.

You can show positive and negative numbers on a number line.



The most common example of negative numbers in use is in temperatures.

This thermometer shows that the temperature is  $-15^\circ\text{C}$ . This means  $15^\circ\text{C}$  below freezing or  $15^\circ\text{C}$  below zero.



### EXAMPLE 9

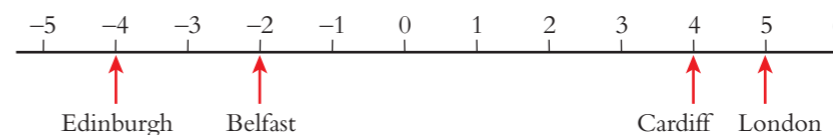
This map shows the average midnight temperatures in December for some cities.



- a Which is the coldest city?  
b What is the difference in temperature between London and Edinburgh?  
c The temperature in Cardiff drops  $6^\circ\text{C}$  between midnight and 6 a.m. What is the temperature in Cardiff at 6 a.m.?

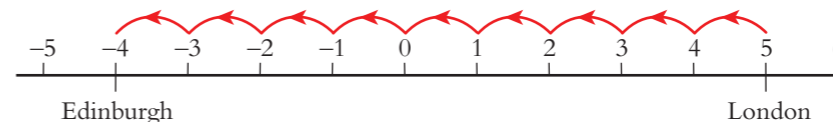
### SOLUTION

It is helpful to use a number line when dealing with negative numbers.



a Edinburgh.

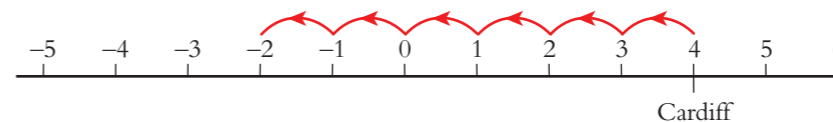
b



On the number line, count from  $5^\circ\text{C}$  to  $-4^\circ\text{C}$ .

The difference between the temperatures in London and in Edinburgh is  $9^\circ\text{C}$ .

c

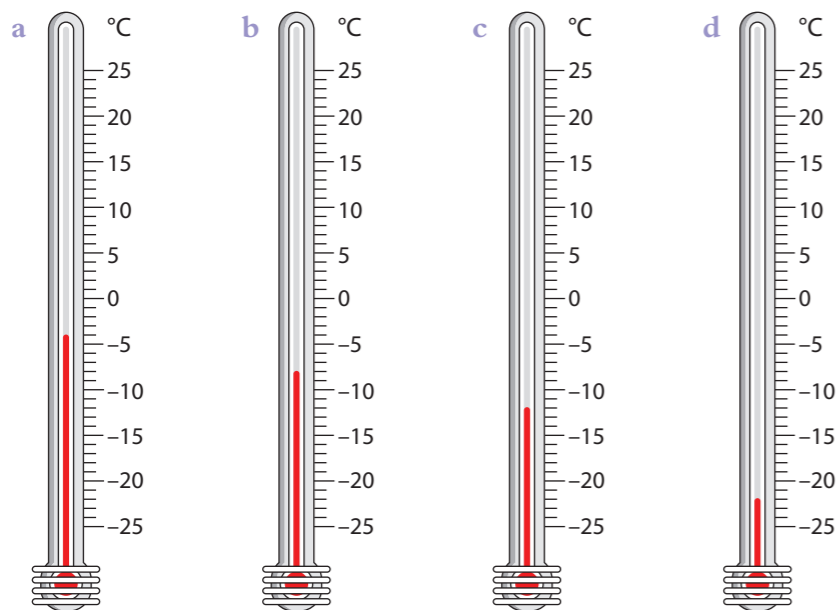


From  $4^\circ\text{C}$  count down along the number line by 6 degrees.

The temperature in Cardiff at 6 a.m. is  $-2^\circ\text{C}$ .

### Exercise 1.5

1 What is the temperature on each of these thermometers?



2 Write each set of temperatures in order, starting with the coldest.

- a  $7^{\circ}\text{C}$ ,  $-2^{\circ}\text{C}$ ,  $-7^{\circ}\text{C}$ ,  $0^{\circ}\text{C}$ ,  $8^{\circ}\text{C}$ ,  $-5^{\circ}\text{C}$   
 b  $-6^{\circ}\text{C}$ ,  $3^{\circ}\text{C}$ ,  $-15^{\circ}\text{C}$ ,  $21^{\circ}\text{C}$ ,  $-8^{\circ}\text{C}$ ,  $2^{\circ}\text{C}$   
 c  $-8^{\circ}\text{C}$ ,  $11^{\circ}\text{C}$ ,  $0^{\circ}\text{C}$ ,  $-5^{\circ}\text{C}$ ,  $2^{\circ}\text{C}$ ,  $5^{\circ}\text{C}$

3 Use a number line to work out the rise in temperature for each of these.

- a from  $4^{\circ}\text{C}$  to  $7^{\circ}\text{C}$       b from  $3^{\circ}\text{C}$  to  $8^{\circ}\text{C}$   
 c from  $-2^{\circ}\text{C}$  to  $7^{\circ}\text{C}$       d from  $-4^{\circ}\text{C}$  to  $7^{\circ}\text{C}$   
 e from  $-7^{\circ}\text{C}$  to  $-2^{\circ}\text{C}$       f from  $-10^{\circ}\text{C}$  to  $-1^{\circ}\text{C}$   
 g from  $-9^{\circ}\text{C}$  to  $2^{\circ}\text{C}$       h from  $-9^{\circ}\text{C}$  to  $9^{\circ}\text{C}$

4 Use a number line to work out the fall in temperature for each of these.

- a from  $10^{\circ}\text{C}$  to  $2^{\circ}\text{C}$       b from  $6^{\circ}\text{C}$  to  $4^{\circ}\text{C}$   
 c from  $6^{\circ}\text{C}$  to  $-2^{\circ}\text{C}$       d from  $7^{\circ}\text{C}$  to  $-3^{\circ}\text{C}$   
 e from  $-1^{\circ}\text{C}$  to  $-10^{\circ}\text{C}$       f from  $-4^{\circ}\text{C}$  to  $-6^{\circ}\text{C}$   
 g from  $0^{\circ}\text{C}$  to  $-10^{\circ}\text{C}$       h from  $8^{\circ}\text{C}$  to  $-10^{\circ}\text{C}$

5 Find the new temperature for each of these.

- a The temperature is  $5^{\circ}\text{C}$  and falls by  $9^{\circ}\text{C}$ .  
 b The temperature is  $-7^{\circ}\text{C}$  and falls by  $4^{\circ}\text{C}$ .  
 c The temperature is  $-5^{\circ}\text{C}$  and rises by  $10^{\circ}\text{C}$ .  
 d The temperature is  $-8^{\circ}\text{C}$  and rises by  $4^{\circ}\text{C}$ .

6 The temperatures in three freezers are  $2^{\circ}\text{C}$ ,  $-5^{\circ}\text{C}$  and  $-1^{\circ}\text{C}$ .

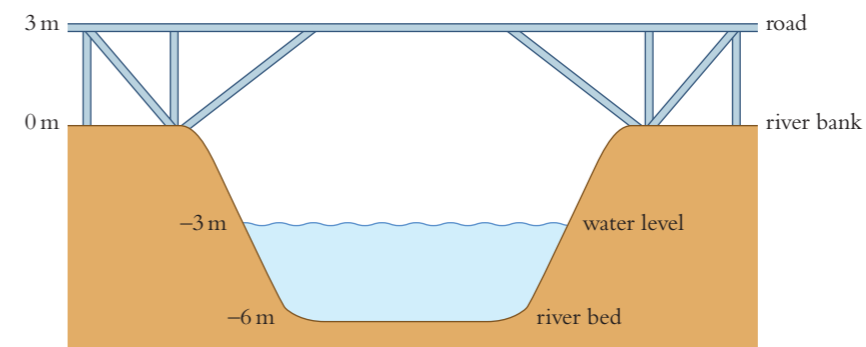
- a Write these temperatures in order, with the coldest first.  
 b What is the difference between the coldest and the warmest temperatures?

7 At 6 a.m. one morning the temperature was  $-3^{\circ}\text{C}$ , by noon it had risen by  $12^{\circ}\text{C}$  and by midnight the temperature was  $-1^{\circ}\text{C}$ .

- a What was the temperature at noon?  
 b What was the difference in temperature between noon and midnight?  
 c What was the difference in temperature between 6 a.m. and midnight?

8 A submarine is at a depth of 500 m below sea-level and a plane is 2000 m above sea-level. How far are they apart in height?

9 A road over a river crosses a bridge as shown in the diagram.



- a How deep is the water?  
 b How high is the road above water level?  
 c If the water level rises by 2 metres, how far will it now be below the river bank?

10 Here is part of a bank statement.

DATE	DEBITS	CREDITS	BALANCE
2 March	Brought forward		£34.00
3 March		£62.00	£96.00
4 March	£150.00		.....
5 March		£120.00	.....

What was the balance in the account on

- a 4th March  
 b 5th March?

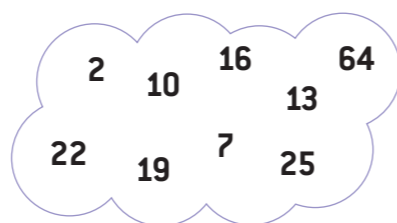
#### You should now:

- understand and be able to use the language of number, e.g. odd, even, multiple, factor, prime, square, cube, square root, cube root
- understand and be able to use index notation
- understand and be able to use negative numbers in familiar contexts.

## Summary exercise 1

You must not use your calculator for questions 1 to 6.

- 1 From the numbers in the bubble, write down:
- a the even numbers
  - b the odd numbers
  - c the multiples of 5
  - d the factors of 26
  - e the square numbers
  - f a cube number
  - g a prime number.



2 'I am a factor of 24. I am an odd number. I am bigger than 1. Who am I?'

3 Find each of these.

- a  $\sqrt{25}$       b  $\sqrt{121}$       c  $\sqrt[3]{64}$       d  $\sqrt[3]{125}$

4 Write each of these in simpler form using index notation.

- a  $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$   
 b  $4 \times 4 \times 4 \times 4$   
 c  $5 \times 5 \times 5$

5 Work out each of these.

- a  $2^2$       b  $7^2$       c  $3^3$       d  $1^3$

6 These maps show the temperatures at midday and at midnight on 29 December in five different cities.

- a Which place was the coldest at midnight?  
 b How much colder was Edinburgh than Belfast at midnight?  
 c Which place had the greatest drop in temperature from midday to midnight?  
 d The next day the temperature in Liverpool at midday was  $2^\circ\text{C}$  higher. What was the new temperature?



You may use your calculator for question 7.

7 Find each of these.

- a  $\sqrt{73}$       b  $\sqrt{42}$       c  $\sqrt[3]{86}$

## Examination questions

Questions 1 to 3 are from examination papers where you may not use a calculator.

- 1 In a quiz, each player starts with a score of 0. Each player is asked one question in each round.  
 A player gains 1 point for a correct answer.  
 A player loses 1 point for an incorrect answer.

Use 'Topic Tracker' at [www.ccea.org.uk](http://www.ccea.org.uk) to find more exam questions.

After three rounds, the scores are:

Player A	1
Player B	-3
Player C	3
Player D	-1

- a Which player:  
 i answered all 3 questions correctly?  
 ii answered 1 question correctly and 2 incorrectly?  
 b In the next three rounds Player A answers 2 questions incorrectly and 1 question correctly. What will his score be after the six rounds?

2 Below is a list of numbers.

8      9      21      25      27      32      35

From the list write down those numbers which are:

- a even  
 b multiples of 5  
 c cube numbers  
 d factors of 54.

3 Calculate:

- a  $4^3$   
 b  $\sqrt{25} + \sqrt[3]{27}$

Questions 4 to 6 are from examination papers where you may use a calculator.

4 The table below gives the morning temperature at 8 a.m. and afternoon temperature at 4 p.m. for five days in January.

Date	8 a.m.	4 p.m.
3 January	$-4^\circ\text{C}$	$9^\circ\text{C}$
4 January	$-3^\circ\text{C}$	$7^\circ\text{C}$
5 January	$0^\circ\text{C}$	$11^\circ\text{C}$
6 January	$-3^\circ\text{C}$	$10^\circ\text{C}$
7 January	$-2^\circ\text{C}$	$9^\circ\text{C}$

- a Which temperature was the lowest?  
 b On two of the days the temperature had increased from morning to afternoon by  $13^\circ\text{C}$ . What were the dates of these two days?  
 c By how much had the temperature dropped from the afternoon of 5 January to the morning of 6 January?  
 5 Which is the first whole number which when squared gives an answer larger than 1000?  
 6 Calculate:  
 a the cube of 5  
 b  $3^4$



# Working with whole numbers

## This chapter is about:

- reading, writing and ordering whole numbers
- adding and subtracting whole numbers
- multiplying and dividing whole numbers by 10, 100, 1000, ...
- multiplying and dividing whole numbers by any number.

## You should already know:

- number bonds to 10
- the times tables to  $10 \times 10$ .

## Place value and ordering whole numbers

The value of a digit in a number depends on its position in the number. This is called its **place value**. Here is a place value table showing some examples of different numbers.

Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Units
				3	5	6
			5	9	4	8
		1	2	0	4	5
	2	3	4	5	4	5
5	2	3	0	4	6	0

From the table you can see that in the number 5948 (five thousand, nine hundred and forty-eight):

- the 5 stands for 5 thousands or 5000
- the 9 stands for 9 hundreds or 900
- the 4 stands for 4 tens or 40
- the 8 stands for 8 units.

Similarly, in the number 5230460 (five million, two hundred and thirty thousand, four hundred and sixty):

- the 5 stands for 5 millions or 5 000 000
- the 2 stands for 2 hundred thousands or 200 000
- the 3 stands for 3 ten thousands or 30 000
- the 0 in the thousands column shows there are no (unit) thousands
- the 4 stands for 4 hundreds or 400
- the 6 stands for 6 tens or 60
- the 0 in the units column shows there are no units.

### EXAMPLE 1

Rewrite these numbers in order of size, starting with the largest.

7031    3982    3423    246    12    45 622

### SOLUTION

45 622    7031    3982    3423    246    12

The size of a whole number depends on the number of digits – the more digits, the bigger the number. 45 622 is the only five-digit number so it is the biggest.

If there are the same number of digits then look at the digit in the largest place value column. This is the first digit – the digit furthest to the left. In this case it represents thousands. 7031 has 7 thousands, and 3982 and 3423 each have 3 thousands. So 7031 is the biggest of the 4-digit numbers.

If the numbers have the same number of digits and the digit with the largest place value is the same, then look at the next digit to the right. Here this represents hundreds. 3982 has 9 hundreds and 3423 has 4 hundreds, so 3982 is larger than 3423.



### Exercise 2.1

1 Write down the value of the underlined digit in each of these numbers.

- a 375    b 218    c 3833    d 21728  
 e 39383    f 926    g 29992    h 1273373  
 i 534564    j 8484    k 2383805    l 830

2 Write down the value of the 6 in each of these numbers.

- a 683    b 8296    c 6898  
 d 62245    e 602464    f 45690

3 Write each of these numbers in words.

- a 73    b 89    c 272    d 707  
 e 2833    f 5603    g 5007    h 107260  
 i 126800    j 756848    k 9231187    l 4200000

4 Write each of these numbers in figures.

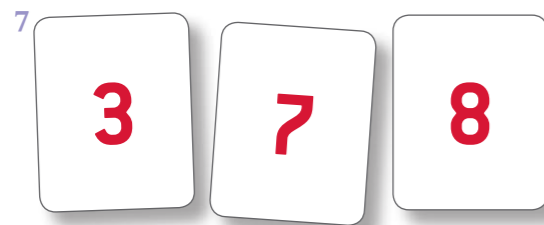
- a sixty-three    b eight hundred and twenty-two  
 c five thousand    d one thousand, five hundred and sixty  
 e two thousand, seven hundred and four    f nine thousand and fifty-seven  
 g seven million    h fifty million  
 i one hundred thousand, three hundred and seventy-two    j one million, three hundred thousand

5 Write each set of numbers in order of size, starting with the largest.

- a 4, 223, 929, 18, 910, 683      b 310, 86, 219, 67, 99, 1200  
 c 357, 740, 2053, 888, 4366, 92      d 86, 56, 345, 828, 156, 6767  
 e 734, 345, 63, 876, 36, 1452

6 Write each set of numbers in order of size, starting with the smallest.

- a 4000, 4003, 400, 420, 40, 4044  
 b 5000, 550, 55 050, 505, 5055, 55 555  
 c 450, 4550, 45, 4555, 45 050, 4505  
 d 123, 12 032, 1332, 1304, 12 232, 1203



You can use these three digit cards to make 3-digit numbers:

- a Write all the 3-digit numbers that can be made.  
 b What is the smallest 3-digit number that can be made?  
 c Which of the 3-digit numbers are larger than 700?

8 The table shows data on road traffic accidents and casualties in Northern Ireland from 2000 to 2005.

Year	Number of accidents	People killed	People seriously injured	People slightly injured
2000	8361	163	1801	12 620
2001	7133	153	1638	10 812
2002	6569	158	1487	9901
2003	6109	142	1258	9022
2004	5240	140	1128	7478
2005	5098	134	1115	7128

In which year were:

- a the smallest number of people seriously injured?  
 b the largest number of people killed?  
 c there more than 8000 accidents?  
 d between 10 000 and 11 000 slightly injured?

## Adding and subtracting whole numbers

There are different ways of writing  $10 + 13$ . We can say:

- Find the **sum of** 10 and 13.
- Find the **total** of 10 and 13.
- **Add** 10 and 13

There are different ways of writing  $26 - 13$ . We can say:

- **Subtract** 13 from 26.
- Find the **difference** between 13 and 26.
- **Take** 13 away from 26.

When adding or subtracting it is important to make sure that the thousands, hundreds, tens and units are always lined up.

### EXAMPLE 2

Work out  $247 + 42$ .

#### SOLUTION

$$\begin{array}{r} 247 \\ + 42 \\ \hline \end{array}$$

Work from right to left.  
First add the units:  $7 + 2 = 9$ .

$$\begin{array}{r} 247 \\ + 42 \\ \hline 89 \end{array}$$

Next, the tens:  $4 + 4 = 8$ .

$$\begin{array}{r} 247 \\ + 42 \\ \hline 289 \end{array}$$

Finally, deal with the hundreds:  $2 + 0 = 2$

### EXAMPLE 3

Work out  $365 + 127$ .

#### SOLUTION

$$\begin{array}{r} 365 \\ + 127 \\ \hline \end{array}$$

Work from right to left.  
Add the units:  $5 + 7 = 12$ .  
The 2 is written in the units column and the 1 is carried to the next column.

$$\begin{array}{r} 365 \\ + 127 \\ \hline 92 \end{array}$$

Next, add the digits in the tens column, including the carried digit:  $6 + 2 + 1 = 9$ .

$$\begin{array}{r} 365 \\ + 127 \\ \hline 492 \end{array}$$

Finally, add the digits in the hundreds column:  $3 + 1 = 4$ .

One way of checking the answer to an addition is to subtract one of the numbers from the answer. For example, you can check  $365 + 127 = 492$  by subtracting 127 from 492 or by subtracting 365 from 492.

#### EXAMPLE 4

Work out  $759 - 225$ .

#### SOLUTION

$$\begin{array}{r} 759 \\ - 225 \\ \hline 4 \end{array}$$

Again, start at the right with the units column:  $9 - 5 = 4$ .

$$\begin{array}{r} 759 \\ - 225 \\ \hline 34 \end{array}$$

Then work out the tens:  $5 - 2 = 3$ .

$$\begin{array}{r} 759 \\ - 225 \\ \hline 534 \end{array}$$

Finally work out the hundreds:  $7 - 2 = 5$ .

#### EXAMPLE 5

Work out  $647 - 372$ .

#### SOLUTION

$$\begin{array}{r} 647 \\ - 372 \\ \hline 5 \end{array}$$

For the units:  $7 - 2 = 5$ .

For the tens:  $4 - 7$  cannot be done directly.

$$\begin{array}{r} 5 \quad 1 \\ \cancel{6} \quad 4 \quad 7 \\ - 3 \quad 7 \quad 2 \\ \hline 2 \quad 7 \quad 5 \end{array}$$

Exchange 10 from the 64 to give 50 and 14. Now  $14 - 7 = 7$  and  $5 - 3 = 2$ .

One way of checking this answer is to add 647 to 275 or to add 372 to 275.



### Exercise 2.2

- Work out these.
 

a	$23 + 56$	b	$346 + 451$	c	$562 + 121$	d	$345 + 57$
e	$657 + 34$	f	$342 - 121$	g	$457 - 23$	h	$674 - 467$
i	$786 - 78$	j	$4576 - 504$	k	$1032 + 289$	l	$1262 - 547$
- Find the sum of 12, 24 and 45.
- Work out the difference between 56 and 457.
- Copy and complete these.
 

a	$\square + 23 = 45$	b	$67 + \square = 543$
c	$\square = 43 + 78$	d	$123 - \square = 62$
- George scores 15, 19, 17 and 12 in four English tests. What was his total number of marks?
- Nathan is 145 cm tall. He stands on a chair which is 56 cm high. How high is Nathan now, measured from the floor?
- During a darts game Andrew scores 120 with his three darts, Barry scores 97 and Cecil scores 112.
  - What is the difference between Andrew's and Cecil's scores?
  - How many more would Barry have to score to get the same score as Andrew?
- In 2004 a car was valued at £17 000. By 2005 the value of the car had decreased by £2995. What was the value of the car in 2005?
- Sally sells her television for £100 and her video for £45. She has to give £34 of the money to her sister. How much money does Sally have left?
- Work out these.
 

a	add 6 units to 7 tens	b	9 hundred add 1 thousand
c	1 thousand subtract 1 hundred	d	2 thousand minus 5 tens.
e	the sum of 8 thousand and 3 hundred		
- What calculation would you use to check if each of these answers was correct?
 

a	$4782 - 4544 = 238$	b	$382 + 4721 = 5103$
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## Multiplying and dividing whole numbers

### Multiplying and dividing by 10, 100, 1000, ...

There are different ways of writing  $10 \times 13$ . We can say:

- Find the **product** of 10 and 13.
- Multiply** 10 by 13.
- Find 10 **times** 13.

Earlier in this chapter you learnt about place value. When you multiply or divide a number by 10, 100, 1000, ... you only change the place value of its digits.

- To multiply a whole number by 10 the digits are moved one place to the left so a zero must be added in the units column.
- To multiply a whole number by 100 the digits are moved two places to the left so zeros must be added in the units and the tens columns.
- To multiply a whole number by 1000 the digits are moved three places to the left so zeros must be added in the units, the tens and the hundreds columns.

### EXAMPLE 6

Work out these.

a  $623 \times 10$       b  $623 \times 100$       c  $623 \times 1000$

### SOLUTION

#### Method 1

You can use a place value table to help you.

Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Units
			6	2	3
		6	2	3	0
	6	2	3	0	0
6	2	3	0	0	0

a  $623 \times 10 = 6230$   
 b  $623 \times 100 = 62300$   
 c  $623 \times 1000 = 623000$

#### Method 2

You can think of multiplying by 10 as simply adding a zero to the end of the number.

Similarly, you can think of multiplying by 100 as adding two zeros and multiplying by 1000 as adding three zeros.

a  $623 \times 10 = 6230$   
 b  $623 \times 100 = 62300$   
 c  $623 \times 1000 = 623000$

- To divide a number by 10 the digits are moved one place to the right so a zero must be taken off the right-hand end of the number.
- To divide a whole number by 100 the digits are moved two places to the right so two zeros must be taken off the right-hand end of the number.
- To divide a whole number by 1000 the digits are moved three places to the right so three zeros must be taken off the right-hand end of the number.

This only works when the number has enough zeros at the end.

### EXAMPLE 7

Work out these.

a  $623000 \div 10$       b  $623000 \div 100$       c  $623000 \div 1000$

### SOLUTION

#### Method 1

Again, you can use a place value table to help you.

Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Units
6	2	3	0	0	0
	6	2	3	0	0
		6	2	3	0
			6	2	3

a  $623000 \div 10 = 62300$   
 b  $623000 \div 100 = 6230$   
 c  $623000 \div 1000 = 623$

#### Method 2

You can think of dividing by 10 as taking a zero off the end of the number.

Similarly, you can think of dividing by 100 as taking two zeros off and dividing by 1000 as taking three zeros off.

a  $623000 \div 10 = 62300$   
 b  $623000 \div 100 = 6230$   
 c  $623000 \div 1000 = 623$

### Multiplication and division by multiples of 10, 100, 1000

You need to know your times tables up to  $10 \times 10$ . Knowing these allows you to multiply and divide any number by numbers such as 20, 300 or 4000.

For example, to multiply by 50, first you multiply by 5 and then you multiply by 10. Or, to divide by 600, first you divide by 100 and then you divide by 6.

### EXAMPLE 8

Work out these.

a  $27 \times 300$       b  $42 \times 2000$       c  $86000 \div 400$       d  $7200 \div 60$

### SOLUTION

$$\begin{array}{ll} \text{a} & 27 \times 300 = 27 \times 3 \times 100 \\ & = 81 \times 100 \\ & = 8100 \\ \text{b} & 42 \times 2000 = 42 \times 2 \times 1000 \\ & = 84 \times 1000 \\ & = 84000 \\ \text{c} & 86000 \div 400 = 86000 \div 100 \div 4 \\ & = 860 \div 4 \\ & = 215 \\ \text{d} & 7200 \div 60 = 7200 \div 10 \div 6 \\ & = 720 \div 6 \\ & = 120 \end{array}$$

### Multiplying and dividing by single-digit numbers

Using your times tables and your knowledge of place value allows you to multiply or divide any number by a single-digit number.

#### EXAMPLE 9

Work out these.

$$\text{a } 35 \times 6 \qquad \text{b } 273 \div 3$$

### SOLUTION

$$\begin{array}{l} \text{a } 35 \times 6 = (30 \times 6) + (5 \times 6) \\ = (3 \times 6 \times 10) + 30 \\ = (18 \times 10) + 30 \\ = 180 + 30 \\ = 210 \end{array}$$

Split 35 into 3 tens and 5 units.

$$\text{b } 273 \div 3 = 3 \overline{)273}$$

Write the calculation using a division bracket. Start from the left: 3 does not go into 2. Take the 2 with the next digit: 3 into 27 goes 9 times.

$$\begin{array}{r} 9 \\ 3 \overline{)273} \end{array}$$

Write 9 above the 7.

Then look at the next digit in the number to be divided: 3 into 3 goes 1 time.

$$\begin{array}{r} 91 \\ 3 \overline{)273} \end{array}$$

Write 1 above the 3.

So  $273 \div 3 = 91$ .



### Exercise 2.3

Work out the answers to these calculations.

- 1 **a**  $21 \times 10$     **b**  $31 \times 100$     **c**  $28 \times 1000$
- 2 **a**  $320 \div 10$     **b**  $6300 \div 100$     **c**  $23000 \div 1000$
- 3 **a**  $23 \times 20$     **b**  $63 \times 30$     **c**  $28 \times 40$   
**d**  $63 \times 200$     **e**  $13 \times 300$     **f**  $380 \times 60$
- 4 **a**  $280 \div 20$     **b**  $390 \div 30$     **c**  $4500 \div 50$   
**d**  $6200 \div 20$     **e**  $3800 \div 200$     **f**  $550 \div 50$
- 5 **a**  $12 \times 4$     **b**  $765 \times 2$     **c**  $722 \times 3$     **d**  $834 \times 4$   
**e**  $611 \times 3$     **f**  $82 \div 2$     **g**  $575 \div 5$     **h**  $477 \div 3$   
**i**  $2202 \div 6$     **j**  $3164 \div 7$     **k**  $936 \times 6$     **l**  $5152 \div 8$

- 6 Mrs Brown needs 75 cm of tape for the top of a curtain. How much does she need for four curtains?
- 7 126 cm of wood is cut into six equal pieces. What is the length of each piece of wood?
- 8 Eight identical books weigh a total of 2480 g. What is the weight of one book?
- 9 These are the prices for a pantomime at the local theatre.

Theatre Royal		Theatre Royal		Theatre Royal		Theatre Royal	
Area	Balcony	Area	Upper Circle	Area	Dress Circle	Area	Stalls
Seat	HH4	Seat	Y33	Seat	R15	Seat	B44
Price	£8.00	Price	£11.00	Price	£14.00	Price	£17.00

- What is the total cost for
- a** four people sitting in the balcony
  - b** five people sitting in the stalls
  - c** three people sitting in the dress circle and two people sitting in the balcony?
- 10 Glasses are packed in boxes of six. How many boxes are needed for 330 glasses?
  - 11 Philip bought four identical boxes of chocolates with 20 sweets in each box. Philip ate 14 chocolates and then shared the rest equally amongst his six friends.
    - a** How many chocolates did Philip buy altogether?
    - b** When shared equally, how many chocolates did reach of his friends receive?
  - 12 A school ordered five buses for a trip to the zoo. Each bus holds 52 people. How many people could go on the trip?

## Long multiplication and division

Knowing your times tables is also the key to success with long multiplication and long division. There are various methods for multiplying and dividing by larger numbers. The examples show some of these. Use the method you feel most comfortable with.

### EXAMPLE 10

Work out  $43 \times 27$ .

#### SOLUTION

##### Method 1: Long multiplication

The calculation can be broken into  $(43 \times 7) + (43 \times 20)$  and so can be carried out as follows.

$$\begin{array}{r} 43 \\ \times 27 \\ \hline 301 \\ 860 \\ \hline \end{array}$$

First, multiply by 7.

$$\begin{array}{r} 43 \\ \times 27 \\ \hline 301 \\ \hline \end{array}$$

Next, prepare to multiply by 20 by writing a zero in the units column. This ensures you are multiplying by 20, not just by 2.

$$\begin{array}{r} 43 \\ \times 27 \\ \hline 301 \\ 860 \\ \hline \end{array}$$

43 times 2 is 86.

$$\begin{array}{r} 43 \\ \times 27 \\ \hline 301 \\ + 860 \\ \hline 1161 \end{array}$$

Finally, add 301 and 860 to find the total for the complete multiplication.

##### Method 2: Grid method

×	40	3
20		
7		

43 is  $40 + 3$ .

27 is  $20 + 7$ .

×	40	3
20	800	60
7	280	21

Multiply the parts of each number in turn:  $40 \times 20 = 800$ .

$$\begin{array}{r} 800 \\ + 280 \\ + 21 \\ \hline 1161 \end{array}$$

Add the numbers in the body of the table to find the total for the complete calculation.

### EXAMPLE 11

Work out  $3178 \div 14$ .

#### SOLUTION

##### Method 1: Long division

$$14 \overline{)3178}$$

Set up the calculation using the division bracket notation. Take each digit in turn, as you did for division by a single-digit number. 14 into 3 doesn't go so try 14 into 31. 14 into 31 goes 2 times with remainder 3.

$$\begin{array}{r} 2 \\ 14 \overline{)3178} \\ - 2800 \\ \hline 378 \end{array}$$

$14 \times 2 = 28$  but since 2 represents 2 hundreds,  $14 \times 200 = 2800$ .

$$\begin{array}{r} 22 \\ 14 \overline{)3178} \\ - 2800 \\ \hline 378 \\ - 280 \\ \hline 98 \end{array}$$

Subtract 2800 from the remainder.

$$\begin{array}{r} 227 \\ 14 \overline{)3178} \\ - 2800 \\ \hline 378 \\ - 280 \\ \hline 98 \\ - 98 \\ \hline 0 \end{array}$$

$14 \times 2 = 28$  but since the 2 represents 2 tens,  $14 \times 20 = 280$ .

$14 \times 7 = 98$  and the 7 represents 7 units.

So  $3178 \div 14 = 227$ .

##### Method 2: Long division with the remainder carried down

$$14 \overline{)3178}$$

As in method 1, set up the calculation using the division bracket notation.

$$\begin{array}{r} 2 \\ 14 \overline{)3178} \\ - 28 \\ \hline 3 \end{array}$$

14 will not divide into 3, so divide 14 into 31. This goes 2 times with remainder 3.

$$\begin{array}{r} 2 \\ 14 \overline{)3178} \\ - 28 \\ \hline 37 \end{array}$$

Bring down the next digit, 7 in this case, to give 37.

$$\begin{array}{r} 22 \\ 14 \overline{)3178} \\ - 28 \\ \hline 37 \\ - 28 \\ \hline 9 \end{array}$$

14 divides into 37 twice, with remainder 9.

$$\begin{array}{r}
 14 \overline{)3178} \\
 \underline{-28} \phantom{0} \\
 37 \phantom{0} \\
 \underline{-28} \phantom{0} \\
 98 \\
 \underline{-98} \\
 0
 \end{array}$$

Bring down the digit 8 to make 98. 14 divides into 98 seven times, with remainder 0.

So  $3178 \div 14 = 227$ .

### Method 3: Using factors

Another way of doing this calculation would be to divide the number in turn by two of numbers that multiply together to give 14.

$$14 = 2 \times 7$$

So divide by 2 and then divide the answer by 7.

$$\begin{array}{r}
 1589 \\
 2 \overline{)3178} \\
 \underline{227} \\
 7 \overline{)1589}
 \end{array}$$



### HINT

Dividing using factors only works when there is no remainder.

## Exercise 2.4

1 Work out these.

- a  $75 \times 21$       b  $32 \times 32$       c  $192 \times 13$   
 d  $249 \times 15$       e  $228 \times 913$       f  $614 \times 321$

2 Work out these.

- a  $2431 \div 13$       b  $4437 \div 17$       c  $2128 \div 14$   
 d  $5016 \div 19$       e  $14145 \div 23$       f  $4972 \div 11$

3 Work out these using factors.

- a  $10944 \div 24$       b  $12397 \div 49$       c  $18018 \div 42$   
 d  $20898 \div 81$       e  $9175 \div 25$       f  $4305 \div 35$

4 Find the product of 43 and 72.

5 One packet contains 22 biscuits. How many biscuits are there in 15 packets?

6 Disks are packed in boxes of 12. How many boxes are needed for 324 disks?

7 A mini-bus holds 16 people when full. How many buses are needed for 240 people?

8 A shopkeeper buys rolls of tape in packs of 15. A box contains 4860 rolls of tape. How many packs are in the box?

### You should now:

- understand place value and be able to order whole numbers
- be able to add and subtract whole numbers
- be able to multiply and divide whole numbers by any number
- know how to complete long multiplication and division.

### Summary exercise 2



- Write each of these numbers in words.
  - 100 500
  - 2 500 000
- Write each of these numbers in figures.
  - three thousand seven hundred
  - three and a half thousand
  - a quarter of a million
- The table shows the population of some local government districts in Northern Ireland in 2002.
  - Rewrite these populations in numerical order, starting with the smallest.
  - Which district had between 50 000 and 60 000 people in 2002?
  - Which district had a population less than 35 000?

Local government district	Population
Ards	74 100
Ballymena	59 678
Cookstown	33 123
Newtownabbey	80 200
Craigavon	81 500

4 What is the place value of the 6 in the answer to each of these calculations?

- a  $5630 \times 10$       b  $5630 \div 10$

5 The table shows the numbers of boys and girls in Years 11 and 12 at South High School.

	Boys	Girls
Year 11	123	164
Year 12	177	154

- How many boys are there in total in Years 11 and 12?
- How many more boys than girls are there in Year 12?
- What is the difference between the total number of students in Year 11 and the total number in Year 12?

6 Here are six cards with different numbers printed on them.



Select two of these cards which have:

- a a total of 110      b a difference of 72      c a product of 90

- 7 The distance from Clare's house to work is 18 kilometres. She makes the journey 12 times a week.  
How far does she travel in a week?
- 8 14 people share a lottery win of £20 300 equally.  
How much does each person receive?

## Examination questions

These questions are from examination papers where you may not use a calculator.

- Write the number twenty-seven thousand and forty-two in figures.
- Find the difference between 4236 and 329.
- Find the sum of 147 and 23 and 2097.
- Select two numbers from the grid whose sum is 100.

12	15	29
36	49	53
64	81	90

- Find the difference between 6209 and 583.
- 1342 eggs are to be packed in trays. Each tray holds 24 eggs.
  - How many trays are needed?
  - How many eggs will be in the last tray?
- From the numbers on the grid, which **two** numbers have a product of 26?

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

Use 'Topic Tracker' at [www.ccea.org.uk](http://www.ccea.org.uk) to find more exam questions.

