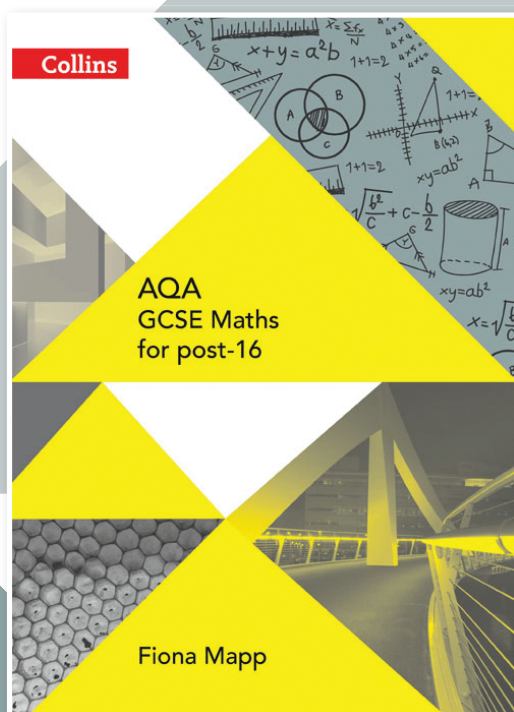


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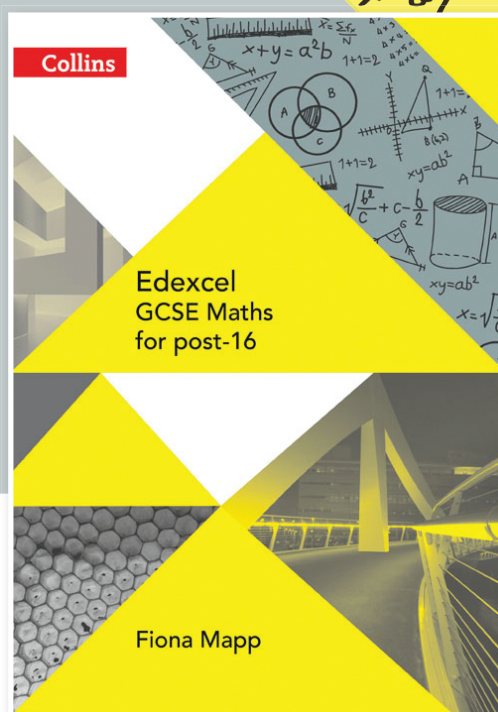
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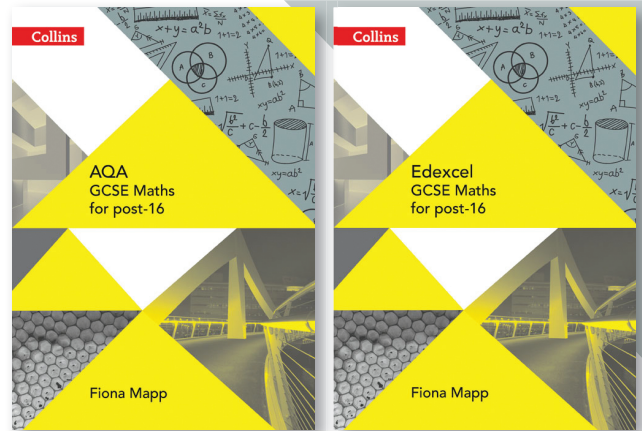
# GCSE Maths for post-16

A one-year course

AUTHOR: **FIONA MAPP**

## STUDENT BOOK

- ◆ **Covers all of the key topics** that learners need to succeed at GCSE, with plenty of focused practice.
- ◆ **Targets Grade 5 at new GCSE 9-1** but provides support to get there and stretch and deepen opportunities to go beyond.
- ◆ **Helps students to pick up smart marks** and be ready for assessment with board-specific exam tips and techniques.
- ◆ **Diagnostics** make it easy teachers to identify skills gaps, track progress and provide a personalized learning journey for students.
- ◆ Can be used for a fast-track resit or a full year course.



**Self-diagnostic charts** help students to identify gaps in knowledge and skills, taking control of their own learning.

# 1

## Numbers

**Objectives**

Before you start this chapter, mark how confident you feel about each of the statements below:

I can use and compare positive and negative numbers.	▶	▶▶	▶▶▶
I can order positive and negative integers			
I can add, subtract, multiply and divide integers including negatives			
I can use negative numbers in context			
I can use index notation for squares and cubes			
I can find squares, cubes and roots with and without a calculator			
I can write a number as a product of its prime factors			
I can use prime factors to find HCF and LCM of two numbers **			
I can find the HCF and LCM of two numbers using other methods			
I can use index notation for powers of 10, including negative powers.			
I can use the law of indices.			
I can covert large and small numbers into standard form			
I can add, subtract, multiply and divide number sin standard form			
I can interpret a calculator display using standard form.			

**Check in questions**

- Complete these questions to assess how much you remember about each topic. Then mark your work using the answers at the back of the book.
- If you score well on all sections, you can go straight to the Revision Checklist and Exam-style Practice questions at the end of the chapter. If you don't score well, go to the chapter section indicated and work through the examples and practice questions there.

**1** Arrange these numbers in order of size, starting with the smallest:

a 3603 33060 33 36 363  
b 521 1250 2501 12005 120  
c 64 46 -640 -406 4060 6004  
d 7340 -437 3047 -73 407

[SEE 1.2](#) ▶

**2** Calculate the value of:

a  $\sqrt{25}$     b 83    c  $\sqrt[3]{343}$     d 492    [SEE 1.2](#) ▶

**3** Write these numbers as products of their prime factors:

a 50    b 360    c 16    [SEE 1.3](#) ▶

**4** Decide whether these statements are true or false.    [SEE 1.3](#) ▶

a The HCF of 20 and 40 is 4.  
b The LCM of 6 and 8 is 24.  
c The HCF of 84 and 360 is 12.  
d The LCM of 24 and 60 is 180.

**5** Simplify the following, leaving your answers in index form.    [SEE 1.4](#) ▶

a  $6^3 \times 6^2$     b  $12^{10} \div 12^{-3}$     c  $(5^7)^3$     d  $64^{\frac{1}{3}}$

**6** Write in standard form:    [SEE 1.5](#) ▶

a 64000    b 0.00046

**7** Work out the following calculations. Leave in standard form.    [SEE 1.5](#) ▶

a  $(3 \times 10^4) \times (4 \times 10^6)$     b  $(6 \times 10^{-5}) \div (3 \times 10^{-4})$

**8** Work these out on a calculator:    [SEE 1.5](#) ▶

a  $(4.6 \times 10^{12}) \div (3.2 \times 10^{-6})$     b  $(7.4 \times 10^0)2 + (4.1 \times 10^{11})$

## 1.1 Positive and negative numbers

**Place Value**

Each digit in a number has a **place value**. The value of the digit depends on its place in the number. The place value changes by a factor of 10 as you move from one column to the next.

Ten thousands	Thousands	Hundreds	Tens	Units
6	7	1	4	5

This number would be read as sixty seven thousand, one hundred and forty five.

**Example** Write these numbers in words.

001 a 538    b 2371    c 6 352 740

a five hundred and thirty-eight  
b two thousand, three hundred and seventy-one  
c six million, three hundred and fifty-two thousand, seven hundred and forty

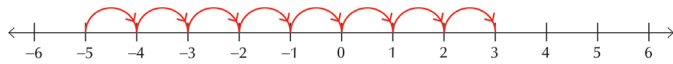
When ordering whole numbers:

- put the numbers into groups with the same number of digits
- for each group, arrange each number in order of size depending on the place value of the digits.

## Adding and subtracting directed numbers

Look at the following:

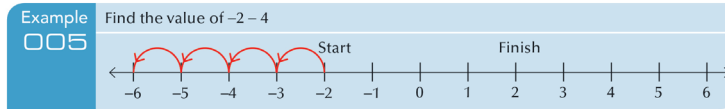
The temperature at 6am was  $-5^{\circ}\text{C}$ .  
By 10am it had risen 8 degrees.



$$-5 + 8 = 3$$

So the new temperature was  $3^{\circ}\text{C}$ .

It is useful to draw a number line to help when answering questions of this type.



When the number to be added (or subtracted) is negative, the normal direction of movement is reversed.

$$-4 - (-3) \text{ is the same as } -4 + 3 = -1$$

When two + signs or two - signs are together, these rules are used:

$\oplus \oplus = \oplus$	} Like signs give an addition	$\ominus \oplus = \ominus$	} Unlike signs give a subtraction
$\ominus \ominus = \oplus$		$\oplus \ominus = \ominus$	
$-2 \oplus (-3) = -2 \oplus 3$		$-3 \oplus (-5) = -3 \oplus 5$	
$= -5$		$= -8$	
		$6 \oplus (-4) = 6 \oplus 4$	
		$= 10$	
		$5 \oplus (-2) = 5 \oplus 2$	
		$= 3$	

## Multiplying and dividing directed numbers

Multiply and divide directed numbers as normal and then find the sign for the answer using the following rules.

- Two like signs (both + or both -) give a positive answer
- Two unlike signs (one + and the other -) give a negative answer.

$$\oplus \times \oplus = \oplus$$

$$\ominus \times \ominus = \oplus$$

**Example** Try these.

**006**

a $-6 \times 3$	b $-4 \times (-2)$	c $\frac{-20}{-2}$	d $\frac{9}{-3}$
a $-18$	b $8$	c $10$	d $-3$

**Exam tips** It is really important to remember the rules of multiplication, because they are also used in algebra.

**Exam tips** help students get the most out of each type of question.

**Self-mark questions** test recall of the topic and link to relevant teaching content.

**Clear worked examples** reinforce learning.

Check your students are ready for assessment with **graduated exam style questions**.

## Exam-style Questions

- Sam uses these cards to make 3-digit numbers. Write down a number she could make which is less than 300. 8 2 5
- Which of these has a value which is equal to the value of  $-13 + 8$ ? Tick all the boxes which are equal to this value.  
 $5 - 10$       $-11 + 6$       $-8 - -3$       $10 - 5$
- Simplify  $5 \times 5 \times 5 \times 5$ . Give your answer in index form.
- Circle the square numbers. -4    13    120    9    1
- Write down the value of  $(-7)^{-3}$
- What is the reciprocal of  $3\frac{1}{8}$ ?
- Jess simplifies  $8^4 \times 8^3$  and gives the answer as  $8^{12}$ . Is she correct? Give a reason for your answer.
- Find the highest common factor of 28 and 60.
- Write 116 as a product of prime factors. Give your answer in index notation.
- Find the lowest common multiple of 12 and 30
- Write down the value of  $125^{\frac{1}{3}}$
- What is the value of  $16^0$ . Circle your answer. 0    1    4    -4    16
- Which of these are surds? Tick a box or boxes to show your answer.  
 $\sqrt{25}$       $5\frac{1}{8}$       $\frac{1}{3}$       $\sqrt{48}$       $\sqrt[3]{2}$
- Which of these is not a number in standard form? Circle your answer.  
10 \times 10^{-5}    8 \times 10^{-6}    6.2 \times 10^{13}    4.9 \times 10^3    1.01 \times 10^{14}
- The light on Tom's smoke alarm flashes every 50 seconds. The light on Tom's house alarm flashes every two minutes. They flash together at 2am. What is the next time they flash together?
- Written as a product of prime factors,  $70 = 2 \times 5 \times 7$ . Find the value of  $a$  if  $700 = 2a \times 5a \times 7$
- Work out  $(8 \times 10^3) + (6 \times 10^5)$ . Give your answer in standard form.
- Find the value of  $(9 \times 10^5) + (3 \times 10^3)$ . Give your answer as an ordinary number.
- The population of Iceland is  $3 \times 10^5$ . The population of Scotland is  $5.4 \times 10^6$ . How many times larger is the population of Scotland than the population of Iceland?
- Write down the value of  $(\frac{2}{3})^{-2}$ .

Now go back to the list of objectives at the start of this chapter. How confident do you now feel about each of them?

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