# Contents

# Introduction

This series of six photocopiable books provides additional challenges for more able children. The materials enable you to meet the needs of able mathematicians without developing completely separate topics.

**Book 5 will provide challenges for children in Years 4–6.**

## You can use this book to:

- **provide alternative and more demanding tasks for more able children during the daily maths lesson;**
- **provide more challenging homework tasks for the more able mathematicians in your class;**
- **broaden the range of mathematical experience for a range of children.**

Many of the tasks in this book are of an investigative or puzzle-solving variety. In addition to mathematical knowledge, some logical thinking will often be required. The children should enjoy the level of challenge the activities provide, and also the opportunity to choose their own ways of working. This is fundamental to development in mathematics, and you should therefore allow children to decide what aids they will use to help them solve the problems. More able children are often comfortable with abstract tasks, but most of them will at some stage want to use practical apparatus, and this should be allowed.

### The activity sheets

Photocopiable activity sheets for the children to work on are provided for the lessons and can be used to support group work. It is assumed that all the children will take part in the whole-class introduction to the lesson before tackling the task from this book.

The teacher notes will guide you in introducing the tasks to the children and in effective ways of working, as well as providing the solutions. These notes will help you to support children appropriately as they work.

# Place value, ordering and rounding

## Learning objectives

- Sort numbers and put them in ascending and descending order.
- Read and write numbers with up to seven digits.

## Resources

'Rearrange the digits'

## Teacher's notes

In this activity the digits in a number are rearranged to make new numbers. The aim is to make a new number that is as close as possible to that specified.

In the example, the digits 1, 2, 3 are rearranged to make a new number that is about 100 greater than 123. The closest that can be achieved is 231. Ensure that the pupils understand the example. Ask them to carry out the necessary calculations without using a calculator.

**1.** The first number has four digits: 3579.
The aim is to rearrange the digits 3, 5, 7, 9 to make a number that is about 2000 greater than 3579.
Start with the first digit; this will probably be 5.
Then move on to the next digit.
The number is **5739**, which is 2160 greater than 3579 (160 more than the 2000 specified).
The next closest is 5397, which is 1818 greater than 3579 (172 less than the 2000 specified).

In order to have a number that is 4000 greater than 3579, start with the digit 7. The new number is **7593**, which is 4014 greater than 3579.

**2.** The next number has five digits: 21 084.
Pupils will need to begin with the digit 1 to find a number that is half of 21 084.
The nearest number is **10 428**. Half of 21 084 is 10 542, so the new number is 114 less.

Pupils will need to begin with the digit 4 to find a number that is twice as big as 21 084.
The nearest number is **42 180**. Double 21084 is 42168, so the new number is only 12 more.

The pupils will need to begin with the digit 8 to find a number that is four times bigger than 21 084. The nearest number is **84 210**. Four times 21 084 is 84 336, so the new number is 126 less.

**3.** The final number has six digits: 135 920.
Pupils will need to begin with the digit 9 to find a number that is seven times greater than 135 920. The nearest number is **951 320**. Seven times 135 920 is 951 440, so the new number is 120 less.

This activity can be extended to seven-digit numbers. For example, rearrange the digits 1, 2, 3, 4, 5, 6, 7 to make a number that is twice or three times as big.

Pupils can write their own number and rearrange the digits to make fractions (quarter, half, three-quarters) or multiples of their original number.


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# Rearrange the digits

Here is a three-digit number: **123**.

The digits can be moved around, or rearranged, to make different numbers, such as 132, 312 and 231.
Can a second number be made that is about 100 greater than 123?
The closest is 231. The difference between 231 and 123 is 108, which is 8 more than 100.
The next closest is 213. The difference between 213 and 123 is 90, which is 10 less than 100.

**1.** Here is a four-digit number: **3579**.

Rearrange the digits to make a number that is about 2000 greater than 3579. ______________

Rearrange the digits to make a number that is about 4000 greater than 3579. ______________

**2.** Here is a five-digit number: **21 084**.

Rearrange the digits to make a number that is about half of 21 084. ______________

Rearrange the digits to make a number that is about twice as big as 21 084. ______________

Rearrange the digits to make a number that is about four times bigger than 21 084. ______________

**3.** Here is a six-digit number: **135 920**.

Rearrange the digits to make a number that is about seven times bigger than 135 920. ______________

# Multiplication and division, money and real-life situations

## Learning objectives

- Use brackets to simplify calculations.

## Resources

'Multiplying in Ancient Egypt'

## Teacher's notes

This method of multiplying works because any number can be expressed by numbers that are powers of 2.
Any number to the power of 0 is equal to 1. For example, $5^0 = 1$ and $10^0 = 1$.
Any number to the power of 1 is equal to the number itself. For example, $8^1 = 8$ and $12^1 = 12$.

$2^0 = 1$   $2^1 = 2$   $2^2 = 4$   $2^3 = 8$   $2^4 = 16$   $2^5 = 32$   $2^6 = 64$ and so on.

So 25 = 16 + 8 + 1 and 99 = 64 + 32 + 2 + 1.

An example is provided and then there is a partially completed calculation.

Since 19 = 1 + 2 + **16**, 35 x 19 = (35 x **1**) + (35 x **2**) + (35 x **16**).
So 35 x 19 = **35 + 70 + 560 = 665**.

When calculating 31 x 25 it is easier to double 25.
With 31 x 25 or 25 x 31

| | | |
|---|---|---|
| 25 x | 1 = | 25 |
| 25 x | 2 = | 50 |
| 25 x | 4 = | 100 |
| 25 x | 8 = | 200 |
| 25 x | 16 = | 400 |
| | 31 | 775 |

So **25 x 31 = 25 + 50 + 100 + 200 + 400 = 775**.

When calculating 90 x 64 it is easier to double 90. Furthermore, the doubling continues to exactly 64.
With 90 x 64

| | | |
|---|---|---|
| 90 x | 1 = | 90 |
| 90 x | 2 = | 180 |
| 90 x | 4 = | 360 |
| 90 x | 8 = | 720 |
| 90 x | 16 = | 1440 |
| 90 x | 32 = | 2880 |
| 90 x | 64 = | 5760 |

So **90 x 64 = 5760**.

Try using this method with larger numbers, such as 150 x 97 and 279 x 742.
Ask pupils which numbers they would double.

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# Multiplying in Ancient Egypt

In Ancient Egypt, two numbers were multiplied by a method of doubling and then adding.

**Example: 20 x 12**

| | |
|---|---|
| Start by multiplying by 1: | 20 x 1 = 20 |
| Double this number: | 20 x 2 = 40 |
| Double again: | 20 x 4 = 80 |
| Double again: | 20 x 8 = 160 |

Stop here because the next step would be 20 x 16, and 16 is greater than 12.

Since 12 = 4 + 8, then 20 x 12 = (20 x 4) + (20 x 8).
Look again at the example to see the answers to 20 x 4 and 20 x 8. Then add together the two products, 80 + 160.
Therefore, 20 x 12 = 80 + 160 = 240.

- Try this method with **35 x 19**.

| | |
|---|---|
| Start by multiplying by 1: | 35 x 1 = |
| Double this number: | 35 x 2 = |
| Double again: | 35 x 4 = |
| Double again: | 35 x 8 = |
| Double again: | 35 x 16 = |

Stop here. Why?

_______________________________________________

- 19 = 1 + 2 + ______ so 35 x 19 = (35 x ______) + (35 x ______) + (35 x ______).

Add the three products to get the answer.

_______________________________________________

- On a blank sheet of paper, use this method to calculate these products: 31 x 25 and 90 x 64.

## Challenge

- Explain how this method of multiplying works.