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 6 will provide challenges for middle years students.

You can use this book to:

- **provide alternative, and more demanding, tasks for more able children during the daily maths lesson;**
- **provide 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. For some lessons a photocopiable resource sheet is also provided. 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

- Compare and order numbers.
- Multiply a whole number by 10, 100 and 1000.
- Explain methods and reasoning about numbers.

Resources

'Greatest product'

Teacher's notes

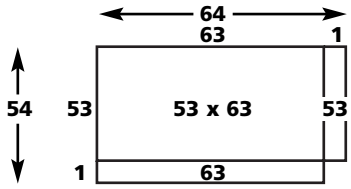
In this activity students are asked to find the greatest product of three, four and five digits using multiplication and diagrams.

The **greatest product** of numbers made using the digits, 1, 2, 3 is 3 x 21 = **63**.

The following system could be tried with the digits 1, 2, 3, 4.
Four one-digit numbers: 1 x 2 x 3 x 4 = 24
Two one-digit numbers and one two-digit number; the greatest is 4 x 3 x 21 = 252
One one-digit number and one three-digit number; the greatest is 4 x 321 = 1284
Two two-digit numbers; the greatest is 41 x 32 = 1312
The **greatest product** of numbers made using the digits, 1, 2, 3, 4 is 41 x 32 = **1312**.

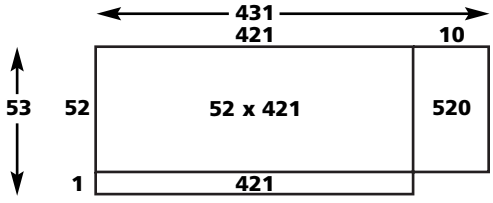
Use the diagram to work out that 52 x 43 is greater than 53 x 42. The diagram shows the rectangle for 53 x 42 as the sum of the rectangles 52 x 42 and 1 x 42 and it shows the rectangle for 52 x 43 as the sum of the rectangles 52 x 42 and 1 x 52.
It can be seen that **the rectangle for 52 x 43 is bigger than that for 53 x 42**.

This diagram shows that **54 x 63 is greater than 53 x 64**.



Students could try the following system, similar to the one above, with the digits 1, 2, 3, 4, 5.
Five one-digit numbers: 1 x 2 x 3 x 4 x 5 = 120
Three one-digit numbers and one two-digits number; the greatest is 5 x 4 x 3 x 21 = 1260
Two one-digit numbers and one three-digit number; the greatest is 5 x 4 x 321 = 6420
One one-digit number and two two-digit numbers; the greatest is 5 x 42 x 31 = 6510
One two-digit number and one three-digit number; the greatest is 52 x 431 = 22 412
One one-digit number and one four-digit numbers; the greatest is 5 x 4321 = 21 605

Students who have reflected on their findings so far should not need to work out all the possibilities. For example, this diagram shows that 431 x 52 is greater than 421 x 53.



The **greatest product** of the numbers made using the digits, 1, 2, 3, 4, 5 is 52 x 431 = **22 412**.

Name: Date:

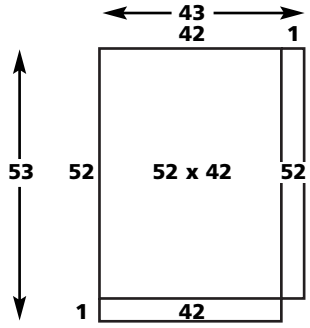
Greatest product

- Use the digits 1, 2, 3 exactly once each to make two or more numbers, for example 2 and 13.
  Multiply these numbers together, for example 2 x 13 = 26.

  Try other arrangements of the digits 1, 2, 3.
  What is the **greatest product** that can be made?

- Solve the same problem with the digits 1, 2, 3, 4.

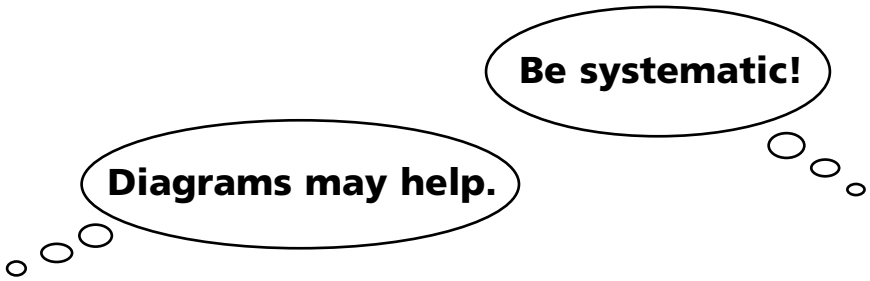
- Which is greater: 53 x 42 or 52 x 43?
  Explain how this diagram shows the answer to the question above.



- Which is greater: 54 x 63 or 53 x 64?
  Draw a diagram that shows the answer.

- Use the digits 1, 2, 3, 4, 5 once each to make two or more numbers, for example 4, 21, 53.
  Multiply these numbers together, for example 4 x 21 x 53 = 4452.

  Try other arrangements of the digits 1, 2, 3, 4, 5.
  What is the **greatest product** that can be made?



  Write up your findings.

- If you have time you could investigate the greatest products for the digits 1 to 6, 1 to 7 and so on.

Multiplication and division

Learning objectives

- Use written methods to find the quotient of two numbers.
- Develop written methods for dividing numbers involving decimals.
- Select an appropriate division method to find an answer.
- Explain methods and reasoning about numbers.
- Recognise and explain patterns and relationships, generalise and predict.
- Make and investigate a general statement about familiar numbers by finding examples that satisfy it.

Resources

'Repeat numbers'

Teacher's notes

Any six-digit 'repeat' number, **abc abc** is 1001 x **abc**. For example, 237 237 = 1001 x 237. Because 7 x 11 x 13 = 1001, dividing first by 7, then by 11 and then by 13 has the same effect as dividing by 1001. This is why the original three-digit number is always obtained. Thus, in the example given:

237 237	÷	7	=	33 891
33 891	÷	11	=	3 081
3 081	÷	13	=	237

Students will get plenty of practice with long division. However, the explanation is the important part. The aim is to get them thinking why the final answer has to be the original three-digit number.

Having arrived at a generalisation by trying examples, the real mathematical demand is to understand and to write, in their own words, a proof of that generalisation.

Name: Date:

Repeat numbers

- Write a three-digit number, for example 237.
  Repeat it to make a six-digit 'repeat' number, 237 237.

  Divide the repeat number by 7: 237 237 ÷ 7 = (**first answer**).
  Now divide the first answer by 11: (**first answer**) ÷ 11 = (**second answer**).
  Now divide the second answer by 13: (**second answer**) ÷ 13 = (**final answer**).

  What happens?

- Start with a different six-digit repeat number and again divide first by 7, then by 11 and then by 13.

  What happens?

- Investigate several other six-digit repeat numbers.

Finding an explanation
Now that you have seen what happens, can you be sure that the same thing will always happen?

Think about what you were dividing by each time and what these numbers have to do with the repeat number and one other special number.

- Try to write an explanation of why the same thing will always happen. Your explanation should be clear enough for anyone to understand.