The higher score

## Mathematics



## Trevor Dixon

\& Sarah-Anne Fernandes
RISING ${ }^{\text {STARS}}$

Every effort has been made to trace all copyright holders, but if any have been inadvertently overlooked, the Publishers will be pleased to make the necessary arrangements at the first opportunity.
Although every effort has been made to ensure that website addresses are correct at time of going to press, Rising Stars cannot be held responsible for the content of any website mentioned in this book. It is sometimes possible to find a relocated web page by typing in the address of the home page for a website in the URL window of your browser.

Hachette UK's policy is to use papers that are natural, renewable and recyclable products and made from wood grown in sustainable forests. The logging and manufacturing processes are expected to conform to the environmental regulations of the country of origin.

Orders: please contact Bookpoint Ltd, 130 Park Drive, Milton Park, Abingdon, Oxon OX14 4SE. Telephone: (44) 01235400555. Email primary@bookpoint.co.uk

Lines are open from 9 a.m. to 5 p.m., Monday to Saturday, with a 24 -hour message answering service. Visit our website at www.risingstars-uk.com for details of the full range of Rising Stars publications.

Online support and queries email: onlinesupport@risingstars-uk.com

ISBN: 9781510442702
© Rising Stars UK Ltd 2018
This edition published in 2018 by Rising Stars UK Ltd.
First published in 2015 by Rising Stars UK Ltd.
Rising Stars UK Ltd part of Hodder Education Group
An Hachette UK Company
Carmelite House
50 Victoria Embankment
London EC4Y ODZ
www.risingstars-uk.com
Impression number 10987654321
Year 20222021202020192018

All rights reserved. Apart from any use permitted under UK copyright law, no part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or held within any information storage and retrieval system, without permission in writing from the publisher or under licence from the Copyright Licensing Agency Limited. Further details of such licences (for reprographic reproduction) may be obtained from the Copyright Licensing Agency Limited, https://www.cla.co.uk/

Authors: Trevor Dixon and Sarah-Anne Fernandes
Educational Adviser: Steph King
Series Editor: Sarah-Anne Fernandes
Accessibility Reviewer: Vivien Kilburn
Cover design: Burville-Riley Partnership
Illustrations by Ann Paganuzzi
Typeset in India
Printed in Slovenia

## Contents

Introduction ..... 4
How to use this book ..... 6
NUMBER AND PLACE VALUE
Place value ..... 8
Roman numerals ..... 9
NUMBER - ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION
Addition and subtraction ..... 10
Squares and cubes ..... 11
Common multiples ..... 12
Common factors ..... 13
Prime numbers and prime factors ..... 14
Multiplying and dividing by 10, ..... 15
100 and 1,000
Long multiplication ..... 16
Long division ..... 17
Correspondence ..... 18
Order of operations ..... 19
NUMBER - FRACTIONS, DECIMALS AND PERCENTAGESOrdering fractions20
Adding and subtracting fractions ..... 21
Multiplying fractions ..... 22
Dividing fractions ..... 23
Changing fractions to decimals ..... 24
Rounding decimals ..... 25
Adding and subtracting decimals ..... 26
Multiplying decimals ..... 27
Percentages ..... 28
RATIO AND PROPORTION
Ratio ..... 29
Proportion ..... 30
Scaling problems ..... 31
Unequal sharing ..... 32
ALGEBRA
Algebra ..... 33
Using formulae ..... 34
Solving equations ..... 35
Linear number sequences ..... 36
MEASUREMENT
Measures ..... 37
Converting metric units ..... 38
Metric units and imperial measures ..... 39
Perimeter and area ..... 40
Area of parallelograms and triangles ..... 42
Volume ..... 44
GEOMETRY - PROPERTIES OF SHAPES
Angles and degrees ..... 46
Circles ..... 47
GEOMETRY - POSITION AND DIRECTION Coordinates ..... 48
Translations ..... 50
Reflections ..... 52
STATISTICS
Tables ..... 54
Timetables ..... 55
Pictograms ..... 56
Bar charts ..... 58
Pie charts ..... 59
Line graphs ..... 60
Averages ..... 61
Glossary ..... 62
Answers ..... 64

## Welcome to Achieve Mathematics: The Higher Score - Revision

In this book you will find lots of practice and information to help you achieve the higher score in the Key Stage 2 Mathematics tests. You will look again at some of the same key knowledge that was in Achieve Mathematics: The Expected Score, but you will use it to tackle trickier questions and apply it in more complex ways.

## About the Key Stage 2 Mathematics National Tests

The tests will take place in the summer term in Year 6. They will be done in your school and will be marked by examiners - not by your teacher.

There are three papers to the tests:

## Paper 1: Arithmetic - 30 minutes ( 40 marks)

- These questions assess confidence with a range of mathematical operations.
- Most questions are worth 1 mark. However, 2 marks will be available for long multiplication and long division questions.
- It is important to show your working - this may gain you a mark in questions worth 2 marks, even if you get the answer wrong.


## Papers 2 and 3: Reasoning - 40 minutes ( 35 marks) per paper

- These questions test mathematical fluency, solving mathematical problems and mathematical reasoning.
- Most questions are worth 1 or 2 marks. However, there may be one question with 3 marks.
- There will be a mixture of question types, including multiple-choice, true/ false or yes/no questions, matching questions, short responses such as completing a chart or table or drawing a shape, or longer responses where you need to explain your answer.
- In questions that have a method box it is important to show your method this may gain you a mark, even if you get the answer wrong.

You will be allowed to use: a pencil/black pen, an eraser, a ruler, an angle measurer/protractor and a mirror. You are not allowed to use a calculator in any of the test papers.

## Test techniques

Before the tests - Try to revise little and often, rather than in long sessions.

- Choose a time of day when you are not tired or hungry.
- Choose somewhere quiet so you can focus.
- Revise with a friend. You can encourage and learn from each other.
- Read the 'Top tips' throughout this book to remind you of important points in answering test questions.
- Make sure that you know what the bold key words mean.


## During the tests • READ THE QUESTION AND READ IT AGAIN.

- If you find a question difficult to answer, move on; you can always come back to it later.
- Always answer a multiple-choice question. If you really can't work out an answer, try to think of the most sensible response and read the question again.
- Check to see how many marks a question is worth. Have you written enough to 'earn' those marks in your answer?
- Read the question again after you have answered it. Make sure you have given the correct number of answers within a question, e.g. if there are two boxes for two missing numbers.
- If you have any time left at the end, go back to the questions you have missed.

Where to get help

- Pages 8-9 practise number and place value.
- Pages 10-19 practise number - addition, subtraction, multiplication and division.
- Pages 20-28 practise number - fractions, decimals and percentages.
- Pages 29-32 practise ratio and proportion.
- Pages 33-36 practise algebra.
- Pages 37-45 practise measurement.
- Pages 46-47 practise geometry - properties of shapes.
- Pages 48-53 practise geometry - position and direction.
- Pages 54-61 practise statistics.
- Pages 62-63 provide definitions of all the key words.
- Pages 64-65 provide the answers to the 'Try this' questions.


## How to use this book

1 Introduction - each content strand in the mathematics National Curriculum has been broken down into smaller topics. This introduction tells you what you need to be able to do for this topic.
2 What you need to know - summarises the key information for the topic. Words in bold are key words and those in lilac are also defined in the glossary at the back of the book.


3 Let's practise - a practice question is broken down in a step-by-step way to help you to understand how to approach answering a question and get the best marks that you can.

## NUMBER - ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION

## Prime numbers and prime factors

To achieve the higher score, you need to:
$\star$ identify and use prime numbers up to 100

* recognise and use prime factors.

- A prime factor is a factor that is a prime number.
- The prime factors of a number are the prime numbers that multiply to give that number.


Read the question and read it again. What is it asking?

Use a tree diagram to help you find the answer. Find a pair of factors of 24, e.g. 2 and 12. Only 2 is prime, so continue with a pair of factors for 12.
Again 2 is prime, so continue with a pair of factors for 6 .

What is your answer?

Check the prime factors multiply to give 24 .


List the prime numbers that multiply to give 24.


The prime factors of 24 are 2,2,2 and 3.
$2 \times 2 \times 2 \times 3=24$
This can be written as $2^{3} \times 3$.

## Try this

1 Write the following numbers as a product of their prime factors.
a) 18
b) 28

2 Write the next four prime numbers after 75 $\square$

$\square$
$\square$
$\square$ Top tip

4 Try this - this is where you get the chance to practise answering questions for yourself. There are a different number of questions for each topic.

Top tips - these give you further reminders about answering test questions or help you to understand a tricky topic.

## Adding and subtracting decimals

To achieve the higher score, you need to:

* add and subtract decimals with up to three decimal places, and numbers with different numbers of decimal places.

- Line up the decimal points when adding or subtracting decimal numbers.


```
                                    78.537+6.85=
```



Read the question and read it again. What is it asking?

I have to add the two decimal numbers.
 points. Gaps beyond the decimal point should be filled with zeros.


5 What is your answer? Remember to include the decimal point in your answer.


Check your answer against your estimate.

## Place value

To achieve the higher score, you need to:

* know the place value of numbers up to $10,000,000$ with up to three decimal places.


## What you need to know

- The place value of each digit in a number depends on its position.
- One million has six zeros: 1,000,000.
- Ten million has seven zeros: 10,000,000.
- Numbers following the decimal point are fractions, showing tenths, hundredths and thousandths.


## Let's practise



What is the value of the 7 in each of these numbers?
694.7
582.974 9,706,453
45.967

1 Read the question and read it again.
What is it asking?
2 Think of the value of the columns.
Place each number in the place value table.

Identify the value of 7 in each number.


4 Check your answer.

## Try this

1 What is the value of the 3 in each of these numbers?

Top tip

- Use the decimal point as a marker to help identify the value of each column.
a) 698.39
b) 894.738
c) 5.043
d) $7,093,528$
e) $5,632.879$


## Addition and subtraction

To achieve the higher score, you need to:

* solve multi-step addition and subtraction problems, deciding which operations and methods to use and why.


## What you need to know

- Key words in a problem help you to make sense of the operations that have been used or that you will need to use:
- The words total of, increase by, plus or altogether relate to addition.
- The words difference between, reduce by, minus or less relate to subtraction.
- Think carefully about more than and less than questions as the operation will depend on the problem.


## Let's practise

$$
5,632+\square+329=9,802
$$



1) Read the question and read it again. What is it asking?

2 Write the first part of the calculation you have to do.
3 Do the calculation. Find the missing number in an addition calculation. I need to use addition and subtraction to solve this problem.

$$
5,632+329=
$$

$$
\begin{array}{r}
5632 \\
+\quad 329 \\
\hline 5961
\end{array}
$$

9,802-5,961

My answer is 3,841 .
$5,632+3,841+329=9,802$

- Check your answer by doing the inverse operation.


## Ordering fractions

To achieve the higher score, you need to:
$\star$ compare and order fractions, including fractions greater than 1.

## What you need to know

- A fraction is used to express part of a whole. Unit fractions (e.g. $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$ ) all have a numerator of 1. Proper fractions (e.g. $\frac{3}{4}$ and $\frac{5}{6}$ ) are less than or equal to 1 whole.
- Fractions greater than 1 are called improper fractions and can also be written as a mixed number (e.g. $\frac{9}{8}=1 \frac{1}{8}$ ).


## Let's practise

Write these fractions in order, starting with the smallest.

$2 \frac{1}{6} \quad \frac{5}{8} \quad 2 \frac{2}{3}$
smallest $\qquad$
 largest


1 Read the question and read it again. What is it asking?

2 First check if any fractions do not have whole numbers. These will be the smallest.

3 Now check the numbers that have whole numbers. Use common multiples to compare fractions with different denominators.

Now the fractions can be put in order.

Check your answer. Make sure you started with the smallest.

Write the fractions in order. I have to start with the smallest.

Only $\frac{5}{8}$ doesn't have any whole numbers and it is less than 1 , so it must be the smallest.

Two mixed numbers have 2 as a whole number, so I need to compare their two fractions. $\frac{2}{3}=\frac{4}{6}$, so $2 \frac{1}{6}$ must be less than $2 \frac{2}{3}$.

$$
\begin{array}{lll}
\frac{5}{8} & 2 \frac{1}{6} \quad 2 \frac{2}{3}
\end{array}
$$

## Try this

## Top tip

- Use equivalent fractions to make the denominators equal.

1 Put these fractions in order, starting with the largest.
a) $\frac{2}{3} \quad \frac{3}{5} \quad \frac{7}{10}$
b) $4 \frac{2}{3} \quad 4 \frac{7}{12} \quad 3 \frac{5}{6} \quad 4 \frac{5}{8}$
largest $\square$
$\square$ smallest
largest $\square \square$
$\square$ smallest

## Ratio

To achieve the higher score, you need to:

* solve ratio problems where missing values can be found by using multiplication and division facts.


## What you need to know

- Ratio compares the relative sizes of quantities or numbers.


## Let's practise

Read the question and read it again. What is it asking?

2 Think of ratio as shares.
School dinners are 7 shares because the ratio is 2 (packed lunch): 7 (school dinner)

Packed lunches are 2 shares.
4
What is your answer?

Check your answer.

## Work out how many children have a packed lunch and add it to the number of children who have a school dinner.

168 children have a school dinner.
$168 \div 7=24$
Each share is worth 24.
$24 \times 2=48$
$168+48=216$

216 children eat at school altogether.

## Try this

1 The ratio of boys to girls at a school is 5:4 There are 165 boys.
How many children are in the school? $\square$
2 The ratio of dogs to cats in an animal shelter is 4:3 There are 23 more dogs than cats. How many cats are there?

## Top tip

- 7:2 is not the same as 2:7. Read the question twice to make sure you are using the correct numbers in your calculation and providing the answer in the order required.


## Algebra

To achieve the higher score, you need to:

* express missing number problems using algebra.


## What you need to know

- In algebra, words or symbols are used to represent the amounts in a problem, instead of actual numbers.
- An equation with letters can help to solve a missing number problem (e.g. $x+5=9$, so $x=4$ ).


## Let's practise



Jessica thinks of a number. She multiplies it by 4 and adds 7; her answer is 31

Write an algebraic equation that shows this.
$\square$


1 Read the question and read it again. What is it asking?

2 Use $y$ for the number Jessica thought of. (Any letter can be used.)

In algebra, write $y \times 4$ as $4 y$.

Check the equation you have written matches the question.

Write an equation for Jessica's missing number calculation.

$$
y \times 4+7=31
$$

$4 y+7=31$

| a number is multiplied by 4 | $4 \times y=4 y$ |
| :--- | :--- |
| 7 is added | $4 y+7$ |
| the answer is 31 | $4 y+7=31$ |

## Try this

## Top tip

For each of these problems, write an equation and solve it.
1 Georgie thinks of a number.
She multiplies it by 2 , then subtracts 7 and gets 51

- To solve algebra problems, work backwards and use inverse operations.
a) Write an algebraic equation that shows this. $\square$
b) What was her number? $\square$
2 Lottie thinks of a number.
She divides it by 2 , then multiplies by 3 and gets 27
a) Write an algebraic equation that shows this. $\square$
b) What was her number? $\square$


## Measures

To achieve the higher score, you need to:
$\star$ solve problems involving the calculation and conversion of units of measure, using up to three decimal places.

## What you need to know

- Metric conversion facts are useful when solving measures problems (e.g. $1 \mathrm{~km}=1,000 \mathrm{~m}$, $1 \mathrm{~m}=100 \mathrm{~cm}, 1 \mathrm{~m}=1,000 \mathrm{~mm}, 1 \mathrm{I}=100 \mathrm{cl}, 1 \mathrm{I}=1,000 \mathrm{ml}, 1 \mathrm{~kg}=1,000 \mathrm{~g})$.


## Let's practise



Jug $B$ is empty and jug $A$ has some water in it. Jug $A$ is used to fill jug $B$ to the top of its measure. How much is left in jug A?


Read the question and read it again. What is it asking?

2 Be systematic. Start with jug A. How much water is in it?

3 Now read jug B.
4 Change the units to be the same.

5 Do the calculation.

6 What is your answer?
7
Check your answer.

I have to work our how much is left in jug A after filling up jug $B$.

The level in jug A shows 2.25 litres.

## Jug B can hold 1,500 ml.

Jug A: $2.25 \mathrm{I}=2,250 \mathrm{ml}$
Jug B: 1,500 ml
$2,250-1,500=750$

My answer is 750 ml .

## Try this

Look at the jugs on this page.

## Top tip

- Always double check what each increment stands for on the scale.

1 Jug A already has 2.25 litres in it. If 625 ml of water is added to jug A, how much more water can jug $A$ hold? $\square$ ml

## Angles and degrees

To achieve the higher score, you need to:
$\star$ recognise angles and find missing angles where they meet at a point or are on a straight line or are vertically opposite
$\star$ find unknown angles in any triangle, quadrilateral or regular polygon.

## What you need to know

- Angles that meet at a point add to $360^{\circ}$.
- Angles on a straight line add to $180^{\circ}$.
- Angles within a triangle add to $180^{\circ}$.
- Angles within a quadrilateral add to $360^{\circ}$.
- Angles that are vertically opposite are equal in size.


## Let's practise

$$
\text { Calculate angle } a \text { and angle } b .
$$



Calculate the sizes of angles $a$ and $b$.

Angle $a$ is one of three angles on a straight line. One of these angles is also a right angle $\left(90^{\circ}\right)$. They add up to $180^{\circ}$. They sum to $180^{\circ}$ so $90^{\circ}+$ $35^{\circ}+a=180^{\circ}$.
Or simply: $35^{\circ}+a=90^{\circ}$
Angle $a=55^{\circ}$

It is one of three angles on a straight line, but it is also vertically opposite the angle labelled $35^{\circ}$. They are equal in size so angle $b=35^{\circ}$.

Angle $a=55^{\circ}$ Angle $b=35^{\circ}$
Angles $a+b$ must also equal $90^{\circ}$ as they are on a straight line with a right angle.

## Try this

1 Calculate the sizes of angles $x$ and $y$.
$x=\square \quad 0 \quad{ }^{\circ} \quad \circ$


## Reflections

To achieve the higher score, you need to: $\star$ reflect shapes in different orientations.

## What you need to know

- Reflections change the position of a shape but don't change its size.
- With reflections, the mirror line shows where the shape is reflected.


## Let's practise



Using the $y$ axis as the mirror line, draw a reflection of the pentagon.
Write the new coordinates in the boxes below.


1 Read the question and read it again. What is it asking?

2 Notice where each corner is positioned. In the reflected shape, each corner will be the same distance from the $y$ axis but on the other side of it. When reflecting in the $y$ axis, the $x$ coordinate changes sign.

3 Use a ruler to join the corners.
Check that the sides are all the same length as in the original shape.

Reflect the shape using the $y$ axis as the mirror line.

Corner A is at $(-3,5)$. The reflected point A will be at $(3,5)$.
Corner $B$ is at $(-1,3)$. Its reflection will be $(1,3)$. Corner $C$ is at $(-4,0)$. Its reflection will be $(4,0)$. Corner $D$ is at $(-6,0)$. Its reflection will be $(6,0)$. Corner $E$ is at $(-6,2)$. Its reflection will be $(6,2)$.


## Try this

1 Shade two more squares to make shape 2 a reflection of shape 1 in the mirror line.
Shape 1


2
Reflect the shape in the mirror line.


3 Reflecting in the $y$ axis has the effect of changing the sign of the $x$ coordinate.
How does reflection in the $x$ axis affect the coordinates?
$\qquad$
$\qquad$

## Top tip

The reflection of a point is always on a line perpendicular to the mirror line, an equal distance the other side.

## STATISTICS

## Tables

To achieve the higher score, you need to:
$\star$ complete missing data in tables using problem-solving skills.

## What you need to know

- Tables provide a way of presenting data, in rows and columns.



## Let's practise

There are 380 children at Park School.
They can choose from four types of lunch.


| Meal | Hot meal | Salad | Vegetarian | Sandwich | Total |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Girls | 72 | 15 |  | 23 | 175 |
| Boys |  |  | 26 | 20 |  |
| Total | 105 |  |  |  |  |

Complete the missing data in the table.

Read the question and read it again. What is it asking?

2 Which can you complete with the data already given? Be systematic - look for columns or rows that have one missing number.

3 Do your calculations help you to work out more numbers?

4 Read the question again. Note that the total number of children is 380 .

5
Check your answers by adding up the rows and columns.

Fill in the missing numbers in the table.

The number of boys having a hot meal $=$ $105-72=33$. The number of girls having vegetarian lunch $=175-72-15-23=65$. The total having a sandwich is $23+20=43$.

Yes, I can now work out the total for vegetarian. $65+26=91$

Now I can complete the rest of the numbers.

| Meal | Hot meal | Salad | Vegetarian | Sandwich | Total |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Girls | 72 | 15 | 65 | 23 | 175 |
| Boys | 33 | 126 | 26 | 20 | 205 |
| Total | 105 | 141 | 91 | 43 | 380 |

## Try this

1 The table below shows the sizes and colours of T-shirts sold in a shop. Complete the table.

| Size Colour | White | Blue | Red | Green | Yellow | Total |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Small |  | 6 | 3 |  | 9 | 43 |
| Medium | 12 |  | 7 | 11 |  |  |
| Large | 5 | 14 |  | 3 |  | 45 |
| Total |  | 33 | 28 | 24 | 19 |  |

## Top tip

- Make sure all the rows and columns add up to the correct total.

