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Ric Pimentel
Terry Wall

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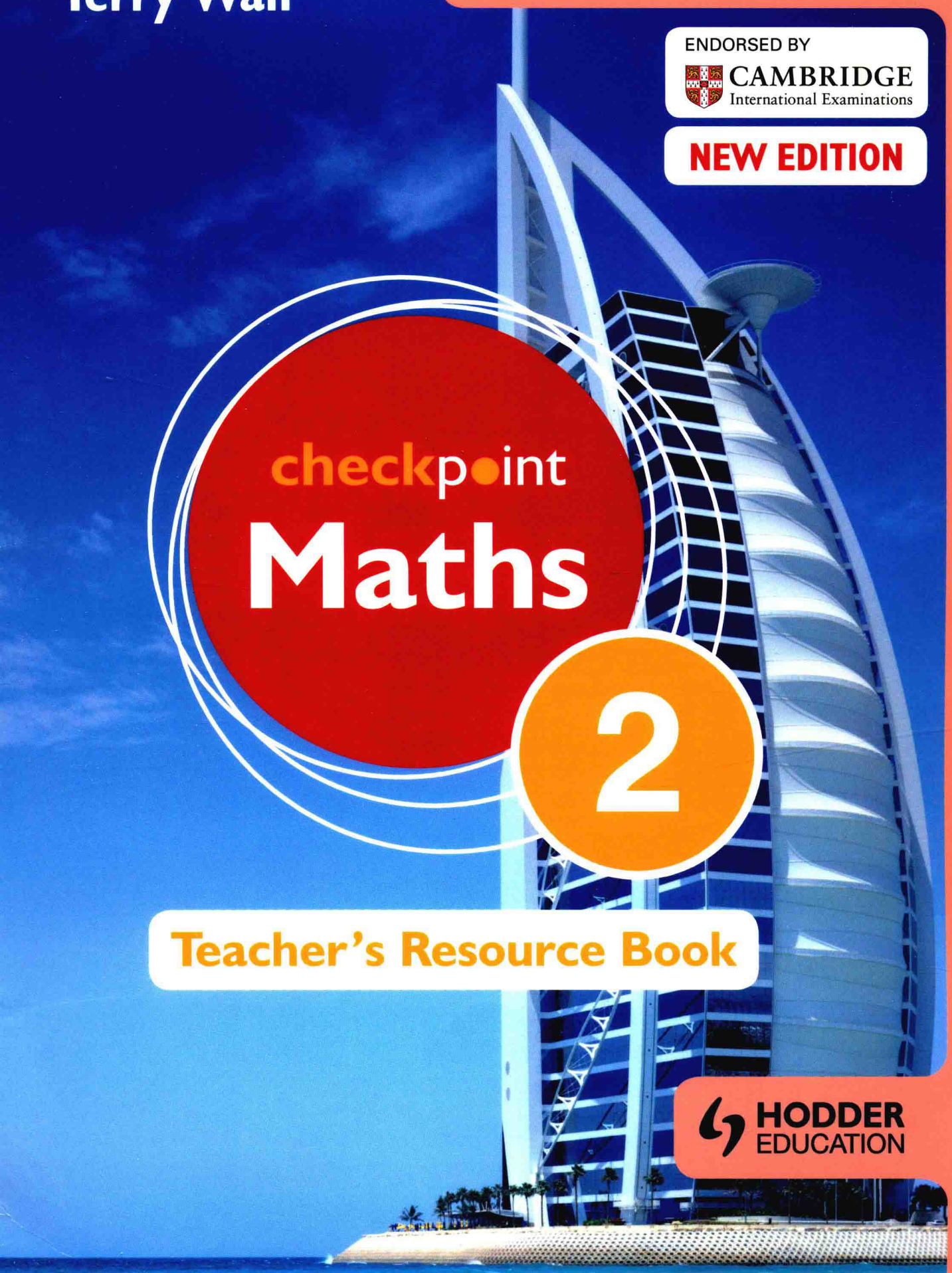

checkpoint Maths 2

Teacher's Resource Book

HODDER EDUCATION

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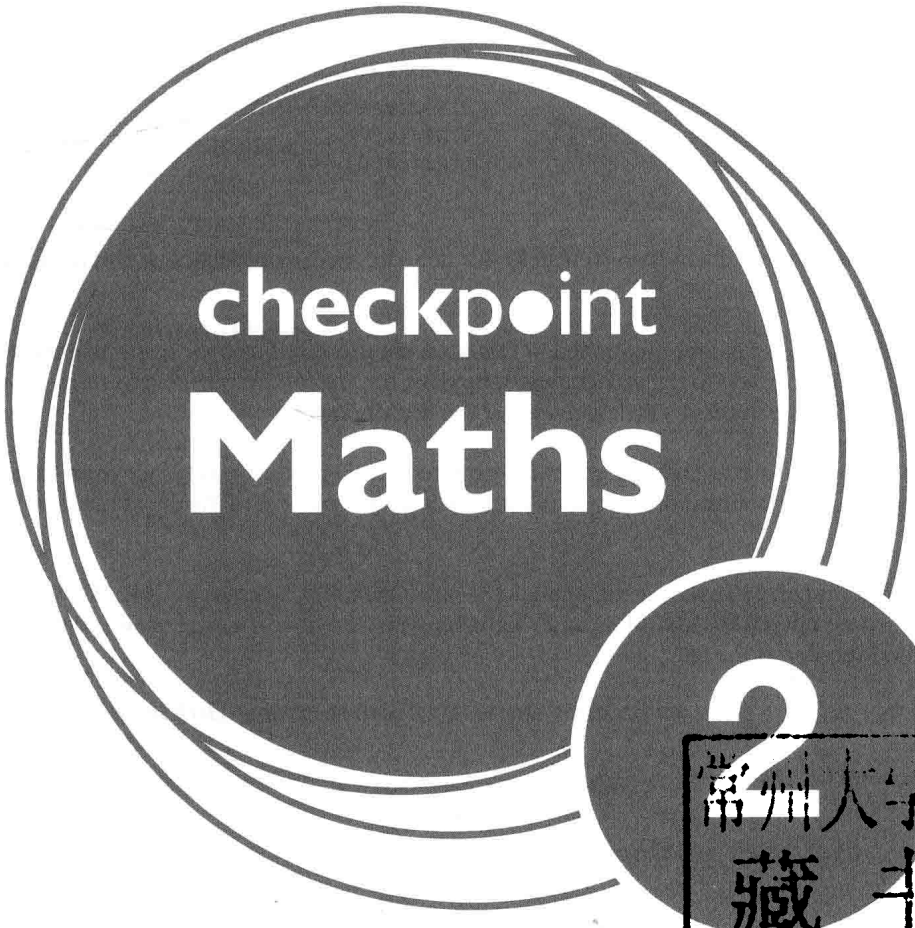

Teacher's Resource Book

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EDUCATION
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Titles in this series

Cambridge Checkpoint Maths Student's Book 1	9781444143959
Cambridge Checkpoint Maths Teacher's Resource Book 1	9781444143928
Cambridge Checkpoint Maths Workbook 1	9781444144017
Cambridge Checkpoint Maths Student's Book 2	9781444143973
Cambridge Checkpoint Maths Teacher's Resource Book 2	9781444143935
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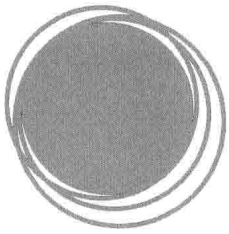


Introduction

This series of books has been written specifically for students in schools following the revised University of Cambridge International Examinations Secondary 1 Curriculum Framework for Mathematics. The authors are experienced classroom teachers of mathematics at secondary and sixth-form level.

We consulted widely with teachers in many countries, who had used our *Checkpoint Maths* series, *IGCSE Mathematics* and *Core Mathematics for IGCSE*, to ask them what they needed to help them to teach the new curriculum framework successfully. We have incorporated their suggestions into this new series of books.

The major points on which most teachers agreed were:

- That each book in the series should cover all the content as outlined in the Cambridge Secondary 1 Curriculum Framework for Mathematics.
- That each student's book should be set out in sections covering Number, Algebra, Geometry, etc. and that each section would contain exercises and reviews to reinforce learning.
- That there should be further exercises in a separate workbook which could be used as homework or further class work. This workbook would then provide a record of progress for the benefit of the teacher, act as a revision guide for students, and allow parents to see easily how their child was progressing.
- That problem solving and investigations should be integrated into the book as suggested in the curriculum framework.
- That Information and Communication Technology (ICT) should form an integrated part of the course from stage 7 onwards.

To try to meet all of the objectives set for us by teachers we have set out the student's books in four clear sections. Within each section are seven chapters, on the following areas:

- Number
- Algebra
- Geometry
- Measures
- Handling data
- Calculation and mental strategies
- ICT, investigations and problem solving.

Each chapter contains a detailed explanation of the topic with worked examples and exercises. Contained in some of the exercises are questions marked with a star ✪. These questions cover extension material providing a challenge for more able students.

The separate 'write-in' workbook, which accompanies each book in the series, provides further exercises that can be set for homework or further class work. The teacher's resource books also contain additional exercises, intended for both consolidation and extension.

We have written this series of books to respond to the needs of class teachers. The books are rigorous and thorough, and will interest students in mathematics as a way of solving real problems and give them the tools to do so. A strong knowledge of mathematics and an enthusiasm for the subject are, we feel, central to the progress of a modern society.

Contents

Cambridge Checkpoint Secondary 1 Curriculum Framework

Calculation and mental strategies

The *Cambridge Secondary 1 Mathematics: Key changes from 2011* document includes the following statement:

> 'The largest change in the new framework is the inclusion of a new set of mental mathematics objectives at each stage, called 'mental strategies'. ...
>
> Its intent is to allow students to develop a range of strategies to aid quick recall of number facts and solve problems. Students should be encouraged to explain their strategies and invent ways of recording their actions so they build up a network of associated skills and knowledge ... .
>
> By the end of stage 9, students should have a repertoire of known facts, have developed a range of mental strategies and be able to use efficient and effective written strategies for calculation. This should provide a smoother transition towards IGCSE and O Level.
>
> ... From 2012 the new approach will be reflected in the Cambridge Checkpoint Tests.'

To meet this change, each *Cambridge Checkpoint Maths* student's book has a separate chapter in each section devoted to calculation and mental strategies, before the chapter on ICT, investigations and problem solving. These, and the parallel exercises in the workbook, will give your students the opportunity to practise their mental strategies and further mental tests can be found in this teacher's resource book. Other chapters, particularly those on algebra and measures, also contain many questions that can be tackled mentally, but we felt that teachers would welcome a dedicated chapter in each section of the books.

The *Cambridge Secondary 1 Mathematics: Key changes from 2011* document also contains the following recommendations:

> 'Teachers are advised to discuss the merits of various strategies to encourage students' understanding of the most practical and efficient strategy for each problem.'
>
> 'The correct approach depends on your school's context, though one possible approach would be to include a short period of mental mathematics as a 'warm up' at the beginning of each lesson. It is suggested that in the delivery of the programme, mental and informal methods are first laid down for students and then more formal methods are built up afterwards.'

We agree. It is not intended that these chapters should be studied page by page, but rather that they should be accessed regularly as part of a lesson.

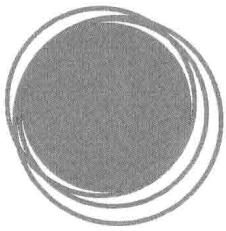
Assessment

On pages 77–104 there are four end of section tests and two Practice Tests for you to photocopy and use with students when you feel it is appropriate. You can check the students' answers against the marking guidance on pages 105–118.

The tests are designed to assess the progress students are making during stage 8. Teachers can use the tests in several ways.

1. As a straightforward summative test to measure student performance at the end of each section, and over the complete stage.
2. Peer marking can be used for students to assess each other.
3. Discussing the marking guidance with the students will provide useful feedback for the students on how to access the higher marks.

For information regarding the Cambridge Checkpoint Tests, please visit www.cie.org.uk where you can also find specimen papers and mark schemes. The Cambridge Secondary 1 Progressions Tests are available to registered Centres on the dedicated Cambridge Secondary 1 website.



ICT, investigations and problem solving

At the end of each of the four sections which make up *Cambridge Checkpoint Student's Book 2*, there is a chapter on ICT, investigations and problem solving.

We hope that teachers will already be familiar with work in these areas, but for those who would like some suggestions as to how to incorporate it into their class teaching we outline below some suggestions as to how we have approached this type of work with our own students.

First, it is important that students accept that this type of work is a central part of the course. Leaving it until Friday afternoon – or, even worse, until the end of term – will give the impression that this work is merely 'bolted on' at the end. The opposite is true: the preceding chapters should be preparation for solving problems by applying mathematics. We suggest that teachers incorporate these activities into the lesson when it is appropriate.

Problem solving

The exercises within some chapters contain questions which could be described as 'problems'. However, we have specifically put longer problems into the last chapter of each section.

It may be worth giving your students the following ideas on how to approach problems, possibly through a class discussion. Some teachers make and display a poster with these ideas written down.

- Read the question twice. Mistakes are often made by solving the wrong problem.
- Write down in a few words exactly what you have to do. This helps you to focus.
- Note down the information you are given. Remove any 'extra' words.
- Decide on a method of solving the problem. Try to explain this in words.
- Start to solve the problem.
- Check that your method is likely to work. If it looks likely to be unproductive, go back to the first step.
- Complete the solution.
- Check that the answer you arrive at does answer the question you were given.

Investigations

Investigations are often problems that lead to the production of a general solution which can be applied to other examples. Starting simply, collecting data, and making and testing hypotheses are central to investigative work.

A list of suggested steps is given below.

- Read the question carefully and start with simpler cases than the problem you have been set.
- Draw simple diagrams to help.
- Enter the results from the simple cases into an ordered table.
- Look for patterns in your results.
- Try to spot a general rule, expressing it in words first.
- Express your rule algebraically.
- Test the rule for a new example.
- Check that the original question has been answered.
- Extend your investigation.

Extension work

The problems and investigations suggested in the students' book can be used as starting points for more challenging work to extend more able students. Some suggestions are given below.

Chapter 7

- *1 Estimating angles* This investigation can be extended or varied by looking at the accuracy of other estimates, for example of the length of a line, the circumference of a circle or the mass of an object which students pick up.
- *2 Test scores* This can be extended by comparing any two sets of similar data, for example the heights of students in two classes, either in the same year or in different years, or how far students in different years travel to school. With some help from the teacher, more able students could work on simple correlation by comparing two sets of data for the same group, for example the heights and weights of students in the same class.

Chapter 14

- *1 Four, three, two, one* This investigation can be extended by using different numbers or by allowing the use of division or indices. Students could also set each other the problem of making chosen totals.
- *2 Chessboards* This can be extended to rectangular 'chessboards' or by using triangles rather than unit squares.

Chapter 21

- *1 Cut corners* The extension to cutting off other right-angled triangles, which are not isosceles, is suggested in the student's book. More able students may be able to consider a cube with tetrahedrons cut from its corners. Even if this work does not progress very far, students will learn from the discussions.
- *2 ICT (circumcircles)* This can be extended by bisecting the sides of other shapes, particularly regular polygons. More able students may extend the investigation to incircles if they are shown how to use the geometry package to bisect an angle.

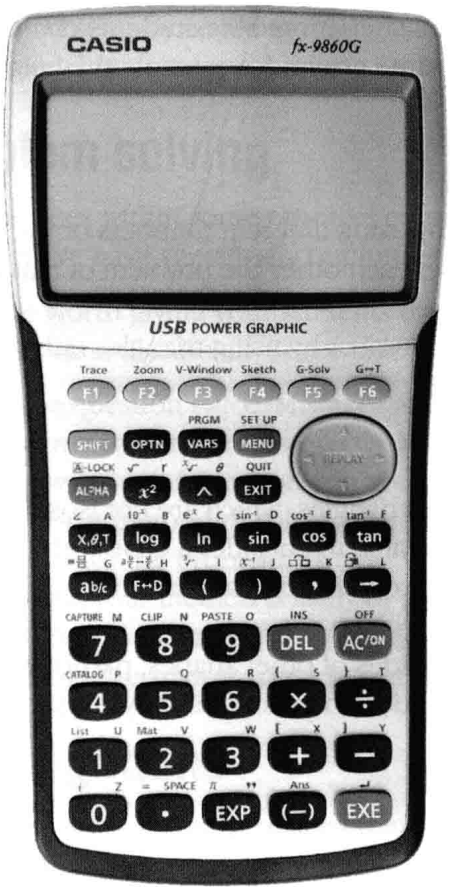
Chapter 28

- *1 Nets of a cube* This can be extended to drawing the nets of other prisms. More able students may be able to look at plans and elevations. Multi-link cubes can be used to make simple shapes and then the front, end and plan views of these can be drawn.
- *2 Packaging* This can be extended to packages which are in the shape of other prisms, for example triangular prisms.
- *3 Experimental probability of heads* Work on experimental probability can be extended to look at other cases, for example the result of rolling two dice and recording the total. Experiments could be done in which a number of different coloured counters are put into a bag and the results of picking one out, recording its colour and replacing it are considered. What do the results tell us about the proportions of each colour?

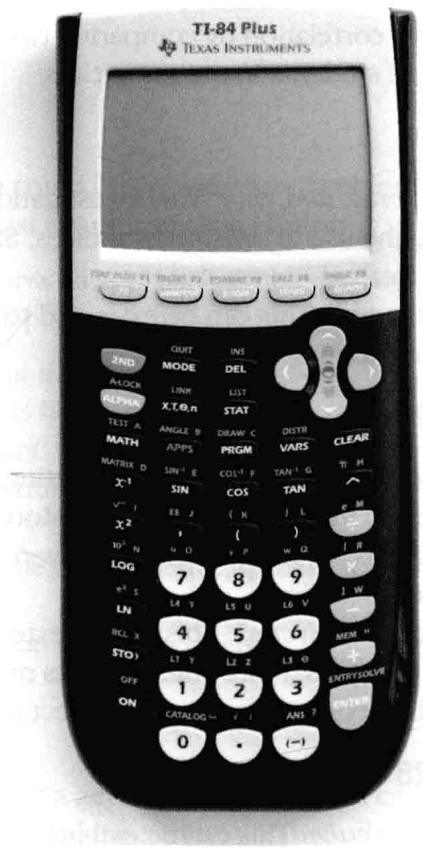
Using a graphics calculator

Graphics calculators are a powerful tool used for the study of mathematics in the modern classroom. However, as with all tools, their effectiveness is only apparent when used properly. This section is only meant as an introduction to their potential and will look at the key features of the graphics calculator that can be used with some of the topics in *Cambridge Checkpoint Student's Book 2.*

Two models used are the Casio *fx*-9860G and the Texas TI-84 Plus. Many graphics calculators have similar capabilities to these; however, if the calculator used by your students is different, it is important that they take the time to familiarise themselves with it.

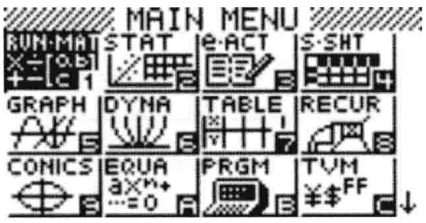


Casio *fx*-9860G



Texas TI-84 Plus

The home screen of each calculator is shown in the table on the next page, with a description of how to access the key features.

Casio	Texas
 The modes are selected by using the arrows key and then pressing EXE or by pressing the number or letter in the bottom right-hand corner of an icon. Brief descriptions of seven of the modes are given below.	 The main features are accessed by pressing the appropriate key. Some are explained below.
1 RUN.MAT is used for arithmetic calculations. **2** STAT is used for statistical calculations and for drawing graphs. **4** S.SHT is a spreadsheet and can be used for calculations and graphs. **5** GRAPH is used for entering the equations of graphs and plotting them. **6** DYNA is a dynamic graph mode which enables a family of curves to be graphed simultaneously. **7** TABLE is used to generate a table of results from an equation. **A** EQUA is used to solve a variety of different types of equations.	 is used for statistical calculations and for drawing graphs of the data entered.  is used to access numerical operations.  is used for entering the equations of graphs.  is used for graphing functions.

Basic calculations

The aim of Exercise 1 is to familiarise students with some of the keys dealing with basic mathematical operations. It is assumed that they will already be familiar with the mathematical content.

Exercise 1

Using your calculator, evaluate the following.

1 a) $\sqrt{144}$ **b)** $\sqrt{361}$ **c)** $2\sqrt{7} \times 5\sqrt{3}$

Casio	Texas
	

2 a) 15^2 **b)** $8^2 \div 4^2$ **c)** $\sqrt{6^2 + 8^2}$

Casio	Texas
	

3 a) 7^3 **b)** $9^4 \div 27^2$ **c)** $3^4 \div 9^2$

Casio	Texas
	

Use of the memory channels

Graphics calculators also have a large number of memory channels. These should be used to store answers which are needed for subsequent calculations; this will minimise rounding errors.

Casio	Texas
→ ALPHA followed by a letter of the alphabet	STO› ALPHA followed by a letter of the alphabet

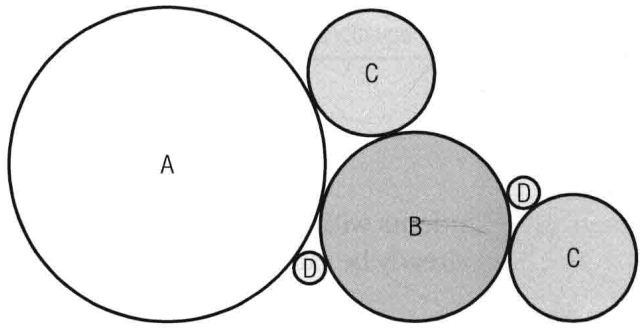
Exercise 2

1 In the following expressions, $a = 5$, $b = 4$ and $c = 2$.
Enter these values in memory channels A, B and C, respectively, of your calculator and work out the value of each of the following expressions.

a) $a + b + c$ **b)** $a - (b+c)$ **c)** $(a+b)^2 - c$

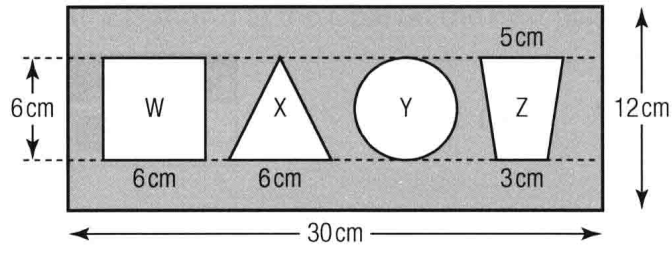
d) $\dfrac{2(b+c)^3}{(a-c)}$ **e)** $\dfrac{4\sqrt{a^2-b^2}}{c}$ **f)** $\dfrac{(ac)^2 + ba^2}{a+b+c}$

2 Circles A, B, C and D have radii 10 cm, 6 cm, 4 cm and 1 cm respectively.



a) Calculate the area of circle A and store your answer in memory channel A.
b) Calculate the area of circle B and store your answer in memory channel B.
c) Calculate the area of each of the circles C and D, storing the answers in memory channels C and D respectively.
d) Using your calculator, evaluate A + B + 2C + 2D.
e) What does the answer to part **d)** represent?

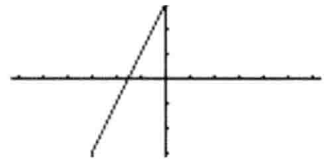
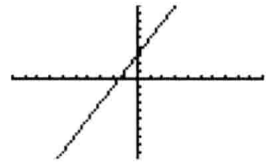
3 The diagram shows a child's shape-sorting toy. The top consists of a rectangular piece of wood of dimensions 30 cm by 12 cm. Four shapes W, X, Y and Z are cut out of it.



a) Calculate the area of triangle X. Store the answer in your calculator's memory.
b) Calculate the area of trapezium Z. Store the answer in your calculator's memory.
c) Calculate the total area of shapes W, X, Y and Z.
d) Calculate the area of the rectangular piece of wood left once the shapes have been cut out.

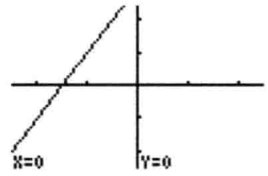
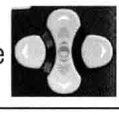
Plotting graphs

One of a graphics calculator's principal features is to plot graphs of functions. This helps to visualise what the function looks like. This section aims to show how to plot graphs of basic functions. For example, to plot the graph of the function $y = 2x + 3$, use the following key sequences.

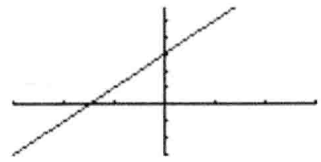
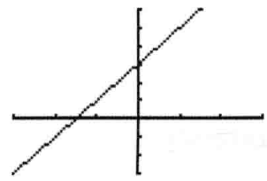
Casio	
MENU 5 2 X,θ,T + 3 EXE F6	
Texas	
Y= 2 X,T,Θ,n + 3 ENTER GRAPH	

Occasionally it may be necessary to change the scale on the axes in order to change how much of the graph, or what part of the graph, can be seen. This can be done in several ways, including by using the zoom facility and by changing the scale manually, as shown in the tables below.

Using the zoom facility

Casio	
SHIFT F2 F4 EXE to zoom out or, SHIFT F2 F3 EXE to zoom in.	
It is possible to reposition the graph by using the  key.	
Texas	
ZOOM 2 ENTER to zoom in or, ZOOM 3 ENTER to zoom out.	
It is possible to reposition the centre of enlargement by using the  keys before pressing  .	

Changing the scale manually

Casio		
SHIFT F3 EXE after values are entered	View Window Xmin :-3 max :3 scale:1 dot :0.04761904 Ymin :-3 max :6 INIT TRIG STO STO RCL	
Xmin = minimum value on the *x*-axis Xmax = maximum value on the *x*-axis Xscale = spacing of the *x*-axis increments Xdot = value that relates to one *x*-axis dot (this is set automatically)		
Texas		
WINDOW GRAPH after values are entered	WINDOW Xmin=-3 Xmax=3 Xscl=1 Ymin=-3 Ymax=6 Yscl=1 Xres=1	
Xmin = minimum value on the *x*-axis Xmax = maximum value on the *x*-axis Xscale = spacing of the *x*-axis increments		

Exercise 3

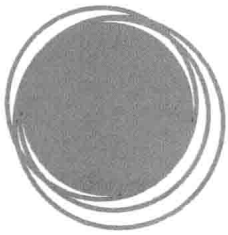
Using your calculator, plot a graph of each of the following functions.

1 $y = x - 4$

2 $y = 2x + 2$

3 $y = \frac{1}{2}x + 1$

4 $y = -x - 3$



Additional exercises

These additional exercises are intended to both consolidate and extend the work from the student's book. They are intended for the more able students who are capable of working either unsupervised or with little help from their teacher. Access to more advanced maths books would be beneficial.

Additional exercise 1

1 A train journey takes 2 hours 15 minutes. Complete the timetable below.

Depart	0600	0815		1308		
Arrive			1235		1805	2120

2 Use a calculator to work out these calculations.

a) $-8.3 - 7.9 + 4.6$ _____

b) 4.8×-3.5 _____

c) $46 \div -2.3$ _____

3 Write in brackets to make each of these calculations correct.

a) $4 + 2 \times 6 = 36$

b) $8 + 2 \times 5 - 3 = 20$

c) $5 - 3 \times 9 + 2 \div 2 = 11$

4 Without using a calculator, work out the following.

a) $8 + 4 \div 4$ _____

b) $16 + 10 \div (7 - 2)$ _____

c) $(15 + 25) \div (2 \times 5)$ _____

5 Draw a circle and on it label:

a) a radius

b) a tangent

c) a minor arc

d) a sector.

ADDITIONAL EXERCISES

6 Construct a regular hexagon of side 5 cm.

7 Draw a line 9 cm long and construct its perpendicular bisector.

8 Write four questions that could be used in a survey to find out about the reading habits of students in your class.

Additional exercise 2

1 Convert these to metres.

a) 8950 cm _____

b) 0.7 km _____

c) 45 cm _____

2 Convert these to kilograms.

a) 3 tonnes _____

b) 0.05 tonne _____

c) 750 g _____

3 Convert these to millilitres.

a) 0.06 litre _____

b) 4.2 litres _____

c) 0.008 litre _____

4 Solve these equations.

a) $4 + 3a = 19$ **b)** $4b - 2 = 2b + 8$ **c)** $5(c - 3) = c + 1$

5 Calculate the circumference of a circle of radius:

a) 8 cm _____

b) 3.6 cm _____

6 Calculate the circumference of a circle of diameter:

a) 12 cm _____

b) 14.4 cm _____

7 Calculate the area of a circle of radius:

a) 5 cm _____

b) 3.8 cm _____

8 Calculate the shaded area of this disc.