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Revise Mathematics GCSE

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and
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*To Alice and Marjorie and
to the memory of John*

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About this book

This book was written to help you to revise for ‘**Intermediate**’ or ‘**Higher**’ Tier examinations in **GCSE/Key Stage 4 Mathematics**. It covers the topics you need in **Number**, **Algebra**, **Shape and space** and **Handling data** for levels 5–10 in the National Curriculum.

Revising with this book will help you to achieve the best result you can in your GCSE/Key Stage 4 Mathematics.

How to use this book

You can use this book in different ways at different stages in your Mathematics course.

Throughout your course you can use it:

- to remind you of what you have been taught,
- to sort out things you didn’t quite follow in class,
- to help you with your homework assignments and coursework,
- to do some extra practice.

You can also use it:

- to find out what you are expected to know, do and understand for your examinations,
- to focus on the essential points in each topic,
- to see how each topic develops logically,
- to organize your revision and your preparation for your final examinations,
- to practise answering the kind of questions you will meet,
- to check your progress and to get an impression of the level(s) you have reached.

To make the *best use* of this book, don’t rush into simply looking up topics. Spend some time finding out what is in it and how it is arranged. Doing this will also give you some ideas of your own about how this book can help you.

Contents

To get to know your way around the book, start by looking at the **Contents** on the inside front cover. This shows you the overall structure of the book.

You can see that basically the book is made up of an *Introduction*, *Units* on topics, *Questions* and *Answers* and it ends with the *Index*.

Units on topics

Unlike an ordinary textbook, this book has been *organized* to make your revision easier.

The mathematics for ATs 2–5 at levels 5–10 has been arranged into **Units**. These units have been grouped into four sections, under the AT headings:

Number	N units, e.g. N1 Know your calculator
Algebra	A units, e.g. A1 Basic algebra
Shape and space	S units, e.g. S1 Angle facts
Handling data	D units, e.g. D1 Collecting data

If you are preparing for ‘*Intermediate*’ Tier examinations, you do *not* have to cover all the units in this book. You can ignore the units labelled ‘Higher Tier only’.

If you are preparing for ‘*Higher*’ Tier examinations, you will cover the work in *all* the units in this book.

Each unit in this book contains comprehensive **notes** and explanations. The notes are arranged under clear *side-headings* and key words and phrases are in **bold**. This use of side-headings splits the unit into sensible ‘chunks’. It also makes it easier to spot the information you want and helps you to plan your revision.

Get into the habit of making your own notes as you work through the unit. Use the side-headings and key words to help you organize these notes.

There are several ways to work through the units in this book. You may work through the units you need to study *in the order they are given*, but you are more likely to want to *select* what you need at each stage in your course. You may want to work through:

- the unit covering the topic you are currently studying,
- the first few units in each AT,
- all your units in one AT, such as Algebra, and so on . . .

Whichever way you work, keep a record of the units you have tried. Use the notes you make in later revision sessions.

Alternatively you may want simply to dip into the book at first for key points as they arise. Then you can use it for more *structured revision* later on.

The units are *not* labelled with the level(s) they cover. Some units cover just *one* main idea/topic at just one level. For example, *3-d coordinates* is at level 7 only. Other units cover *several* levels. They show the progression of a topic through these levels. For example, *Number patterns and sequences* includes the work on this topic at levels 5, 6 and 7.

Questions and Answers

There are numerous **worked examples** in the units. Each example has a clearly labelled ‘**QUESTION**’ and ‘**ANSWER**’ in blue. The Answers show how to set down important points in the working, step by step. Use the comments in *italics* to help you to understand the working. You do not have to write these down. They describe how to work out the answer and/or give background information.

Here is an example from ‘A7 Simultaneous equations’ in AT3 ALGEBRA.

QUESTION

The sum of two numbers, a and b , is 62. Their difference is 12.

- (a) Write down two equations in a and b .
- (b) Find the values of a and b .

ANSWER

$$(a) \quad a + b = 62 \quad \text{Sum is 62}$$

$$a - b = 12 \quad \text{Difference is 12}$$

(b) Choose two easy numbers that add up to 62, and use them to work out $a - b$. Compare the result with 12. Keep trying until you get $a + b = 62$ and $a - b = 12$.

	a	b	$a+b$	$a-b$	
Try	32	30	62	2	Compare with 12 Too small
Try	42	20	62	22	Too big

Try a number between 32 and 42 for a .

	a	b	$a+b$	$a-b$	
Try	36	26	62	10	Just too small
Try	37	25	62	12	That's it

$a = 37$ and $b = 25$

Always try to answer these questions yourself as you work through a unit. You may be convinced that you can 'think them through', but the real test is whether you can do them 'on paper'. Cover the Answer and see what you can do. Compare your working with that given. Then look up anything you couldn't do or didn't understand.

The symbol shows that a **calculator** was used for the calculation in an Answer.

Many worked examples also have **key codes** to show you at least one way to do the working on a calculator. This example comes from 'N7 Fractions and quantities' in AT2 NUMBER.

QUESTION

Sarah earns £120 a week. She receives a pay rise of 7%. How much does she earn each week after the pay rise?

ANSWER

Sarah's wage is 100%

Sarah's new wage = $100\% + 7\% = 107\%$

New wage = 107% of £120
= £128.40

1 0 7 ÷ 1 0 0 × 1 2 0 =

or try:

1 2 0 × 1 0 7 %

Don't just look at these. Always try them on *your* calculator. Make a note of which key codes work on your calculator. Work out the best way to do the working on your calculator. Keep a record of this with the worked example for future reference.

In addition to the 'Questions' and 'Answers' in each unit, **GCSE/KS4 sample questions** follow the units for each AT. These have been supplied by the Examining Groups to show what kind of questions are likely to appear in the examinations. **Answers** are given at the *back* of the book.

In this book the questions have been placed into groups based on levels. As in the examination a question may cover more than one level. It is placed under the heading showing the highest level in the question. So a question covering levels 6, 7 and 8 is under 'Level 8'.

If you are entered for 'Intermediate' Tier examinations, you need to be able to do the questions for *levels 5–8*. Ignore the questions for levels 9 and 10.

If you are entered for 'Higher' Tier examinations, you need to be able to do the questions for *all* levels. Your examinations will focus on *Levels 7–10*.

Two *references* are given *below* each question. You can see examples of these on this Level 8 sample question for AT5 HANDLING DATA.

On the *right* are the initials of the *Examining Group* that set the question. You can do questions for *your* Tier for *all* the Examining Groups, not just your own.

On the *left* is the code for the *unit* or *units* in this book, relevant to the work in that question. If you get stuck on a question, this shows you where to turn to for help.

Hints on answering written questions are on pp. xi–xii. Use them to help you to do these 'practice questions'.

Check your answers with those given at the back of the book.

Check your working with work in the relevant unit(s).

Re-do any questions you answer incorrectly. File all of your answers carefully. You will find them useful in your later revision.

Make your own **progress chart** to show how well you do on these questions. Use them to help you to decide what you need to revise. Try the questions again later to check you can still do and understand the work.

LEVEL	5	6
QUESTION		
1	✓	✓
2	✓	✓
3	✓	✗
4	✓	✓
5		

The Index

There is an extensive **Index** at the end of the book. This is designed to help you to look up specific words and topics. When you turn to the given page(s) use the sideheadings and words in bold to show you *exactly* where the information you want is situated. Try looking up some words you know to test the way it works.

GCSE/KS4 Mathematics

GCSE is the **General Certificate of Secondary Education**. It is designed mainly for 16 year olds, but anyone, of any age, can take it. Students may study for it at school, college or privately.

From Summer 1994, GCSE mathematics examinations are used also to assess students' achievements in mathematics in the National Curriculum. This assessment takes place at or near the end of **Key Stage 4 (KS4)** of a student's compulsory 'school life', i.e. om School Year 11.

Your Examining Group

GCSE is run by six groups of Examining Boards. There are four groups in England, one group in Northern Ireland, and one group in Wales.

Here are their names and the abbreviations usually used for them.

Midland Examining Group (MEG)

Northern Examinations and Assessment Board (NEAB)

Southern Examining Group (SEG)

University of London Examinations and Assessment Council (ULEAC)

Northern Ireland Schools Examinations and Assessment Council (NISEAC)

Welsh Joint Education Committee (WJEC)

You should know the name of your *Examining Group*. If you don't know it already, ask your teacher what it is.

Your Tier

The Examining Groups offer three *Tiers* of assessment for most GCSE mathematics syllabuses. They are known generally as: *Foundation*, *Intermediate*, and *Higher*.

Some Examining Groups give them different names. Here are the names used by each group:

MEG	Basic	Central	Further
NEAB	Tier P	Tier Q	Tier R
SEG	Foundation	Intermediate	Higher
ULEAC	Foundation	Intermediate	Highest
NISEAC	Foundation	Intermediate	High
WJEC	Tier C	Tier B	Tier A

You can be entered for only *one* Tier. So you need to know which is 'your Tier'. Check with your teacher if you are not sure which it is. Each Tier covers a range of National Curriculum levels.

Tier	Target levels						
Foundation	4	5	6				
Intermediate		5	6	7	8		
Higher				7	8	9	10

This book covers the mathematics for *Intermediate* and *Higher* Tiers, i.e. levels 5–10.

Your topics

GCSE Mathematics syllabuses are now designed to meet the requirements of the National Curriculum. So every GCSE mathematics syllabus contains the same '*topics*'. They are described under the five National Curriculum headings called *Attainment Targets* (ATs). These are:

AT1: *Using and applying mathematics*

AT2: *Number*

AT3: *Algebra*

AT4: *Shape and space*

AT5: *Handling data*

For each AT there is a list of what a student is expected to know, do and understand. These lists are ordered into levels, up to level 10 (the hardest).

The '*mathematics topics*' you have to study for GCSE are in ATs 2–5. However you may not have to study them all.

For *Intermediate Tier* you have to study only the topics *up to (and including) level 8*.

For *Higher Tier* you have to study *all* the topics up to (and including) level 10.

Your assessment

For your GCSE assessment, you may have to do:

- *terminal* examination papers, i.e. examinations at the end of your course,
- *modular* examination papers, i.e. examinations on *part of your course* during your course,
- *coursework* tasks, i.e. investigations, problem-solving . . .
- *aural* tests, i.e. tests you have to listen to.

What you have to do depends on your *syllabus*. You can look up some information about your syllabus in the Schemes of Assessment on pp. v–vi.

Your results

In 1994 GCSE results will continue to be graded on an A to G scale, with U for unclassified. A new A* grade (above grade A) may be used to show outstanding achievement. This table shows how these letter grades match up with National Curriculum levels.

Grade	Level
A*	10
A	9
B	8
C	7
D	
E	6
F	5
G	4

After 1994 GCSE results may be given using National Curriculum levels.

Schemes of Assessment

The following information has been obtained from the 1994 GCSE/KS4 syllabuses. For more details (and copies of past GCSE papers) you can write to the address given for your Examining Group.

The percentages show the proportion of the total possible marks allocated to each part of the assessment.

MIDLAND EXAMINING GROUP (MEG)

c/o University of Cambridge Local Examinations Syndicate, Syndicate Buildings, Hills Road, Cambridge CB1 2EY

Syllabus 1660 (without coursework)

100% terminal examination papers

You take the **two terminal papers** (50% each) for your Tier.

Tier	Paper	Type of answer	Time
Central (levels 7–8)	2	Short-and-longer	2½ h
	5	Structured/extended	2½ h
Further (levels 9–10)	3	Short-and-longer	2½ h
	6	Structured/extended	2½ h

You have no choice of questions on either paper. On each paper Section A covers ATs 2–5, Section B covers AT1.

Syllabus 1661 (with coursework)

80% terminal examination papers (ATs 2–5)

20% coursework (AT1)

You take the **two terminal papers** (40% each) for your Tier. Each paper is the same as Section A of the matching paper for Syllabus 1660 (see above for details) and is two hours long.

Your final **coursework** assessment consists of *two extended 'tasks'*.

Syllabus 1663 (SMP 11–16): offered by MEG and ULEAC.

80% terminal examination papers (ATs 2–5)

20% coursework (AT1)

Unlike most syllabuses there are *five Tiers*. You do the **two examinations** and **coursework** for your Tier.

Tier	Papers	Target NC levels
Green	1 and 2	4, 5
Blue	2 and 3	4, 5, 6
Red	3 and 4	5, 6, 7
Yellow	4 and 5	6, 7, 8, 9
Yellow Extension	5 and 6	7, 8, 9, 10

Papers 1, 3, 5 and 6 have written questions only. Papers 2 and 4 have some questions presented orally. You have no choice of questions on any paper.

Paper	1	2	3	4	5	6
Oral:	–	20 min	–	20 min	–	–
Written:	1½ h	1½ h	1½ h	1½ h	2 h	2½ h

For your **coursework**, you do *practical* and *investigational* open-ended work.

Syllabus 1665 (MEI)

This assessment scheme is produced by The Mathematics in Education and Industry project. It is a modular scheme. If you are entered for this scheme, ask your teacher to show you a copy of the syllabus, *or* obtain your own copy from MEG.

Syllabus 1666 (SMP Graduated Assessment)

50% terminal paper } (ATs 2–5)
30% stage assessments }
20% open-ended work (AT1)

There are *five Tiers* as in Syllabus 1663 (SMP 11–16) above. You take the **terminal paper** for your Tier.

For Green Tier, this paper lasts 1 h 45 min.

For Blue, Red and Yellow Tiers, this paper lasts 2 h.

For Yellow Extension Tier, this paper lasts 2½ h.

There is no choice of questions on any paper.

You take the **stage assessments** tests for your Tier at the end of each *module* of work. Your teacher will tell you about these modules.

Your **open-ended work** includes practical work and investigations.

NORTHERN EXAMINATION AND ASSESSMENT BOARD (NEAB)

c/o Joint Matriculation Board, Oxford Road, Manchester M15

Syllabus A: 20% coursework (AT1)

80% terminal examination (ATs 2–5)

You take the **two written papers** for your Tier.

For Tier Q (levels 5/8), you sit Papers Q1 and Q2. Each examination is 2 hours long.

For Tier R (levels 7/10), you sit Papers R1 and R2. Each examination is 2¼ hours long.

You should build up a portfolio of your **coursework** over the course. At the end of the course, a *minimum of four pieces of work* is selected for final assessment.

Syllabus B: 100% terminal examination (ATs 1–5)

You take the **three written papers** for your Tier.

Papers 1 and 2 are the same as for Syllabus A.

Paper 3 assesses AT1 and is 1½ hours long. Questions on Paper 3 include *investigations* of real-life situations where *explanations* and *reasoning* will be expected.

Syllabus C: 20% coursework (AT1)

50% terminal examination } (ATs 2–5)
30% modular examination }

You take the **one terminal written paper** for your Tier.

For Tier Q (levels 5/8), you sit Paper Q (2 h long).

For Tier R (levels 7/10), you sit Paper R (2¼ h long).

You also take **four 1 hour module papers** for your Tier.

Module	AT covered	Time taken
Designing: Shape and Space	AT 4	January
Patterns and Functions	AT 3	January
Planning: Number	AT 2	April
Decision Making: Data Handling	AT 5	April

You should build up a portfolio of your **coursework** over the course. At the end of the course a *minimum of four pieces of work* is chosen for final assessment.

SOUTHERN EXAMINING GROUP (SEG)

c/o The Associated Examining Board, Stag Hill House,
Guildford, Surrey GU2 5XJ

Syllabus 2410 (Versions T, A, X, S, E)

80% terminal written papers (ATs 2–5)

20% coursework or coursework paper (AT1)

All versions have **three terminal papers** for each Tier: two written papers (35% each) and an aural test (10%).

For Intermediate Tier, you sit written Papers 3 and 4 (each 1½ h) and aural Paper 9 (about 20 min).

For Higher Tier, you sit written Papers 5 and 6 (each 2 h) and aural Paper 10 (about 20 min).

Each written paper has *short* questions, *structured* questions and *non-directed* questions in question-and-answer booklets. You have no choice of questions on either paper.

AT1 is assessed on one short and one long ‘task’. These are done as **coursework** for versions T, A, S and E and set as a ‘**coursework examination**’ (Paper 7) for version X.

Syllabus 2411: Modular Mathematics

This syllabus is designed for students over 16 years old (‘post-16’). It has a modular assessment and results are reported at the end of each module. If you are entered for this syllabus, ask your teacher to show you a copy or obtain your own from SEG.

UNIVERSITY OF LONDON EXAMINATIONS AND ASSESSMENT COUNCIL (ULEAC)

University of London Publications Office, 52 Gordon Square,
London EC1E 6EE

Syllabus 1384 (Options A, B and C)

80% terminal examination (ATs 2–5)

20% coursework (AT1)

The **terminal examinations** are the same for all options: two written papers (40% each) for each Tier.

For Intermediate Tier (levels 5–8), you sit Papers 3 and 4.

Each examination is 1 h 45 min long.

For Highest Tier (levels 8–10), you sit Papers 5 and 6.

Each examination is 2 h long.

These papers have both shorter and longer questions in Question/Answer books. You have no choice of questions on either paper.

For **Option A**, your **coursework** is set and assessed by your Examination Centre *during* your course.

For **Option B**, your **coursework** assessment consists of ‘*final tasks*’ set by ULEAC but assessed by your Examination Centre.

For **Option C**, your **coursework** assessment consists of ‘*final tasks*’ set and assessed by ULEAC.

Syllabus 1396 (Kent Mathematics Project)

80% terminal examination (assessing all ATs)

20% coursework

You take the **two written papers** for your Tier.

For Intermediate Tier (levels 5–8), you sit Papers 3 and 4.

Each examination is 1½ h long.

For Highest Tier (levels 8–10), you sit Papers 5 and 6. Each examination is 2 h long.

You have no choice of questions on either paper. Each paper is a Question/Answer booklet.

Your **coursework** is assessed by your teacher.

Syllabus 1663 (SMP 11–16). See MEG (SMP 11–16) above.

NORTHERN IRELAND SCHOOLS EXAMINATIONS AND ASSESSMENT COUNCIL (NISEAC)

Examinations Office, Beechill House, Beechill Road, Belfast
BT9 4RS

80% terminal papers

20% teacher assessment

You take the **three terminal papers** for your Tier: two written papers (35% each) and an Aural and Computation Test (10%).

For Intermediate Tier, you sit Papers 3 and 4 (2 h each).

For High Tier, you sit Papers 5 and 6 (2½ h each).

The Aural and Computation Test for each Tier lasts about ½ hour.

Each **written paper** will have *short* answer questions and *long* questions (most of which will be *structured*). You have no choice of questions on any paper.

Your coursework is assessed by your teacher.

Assignments (15%) and Oral work (5%).

WELSH JOINT EDUCATION COMMITTEE (WJEC)

245 Western Avenue, Cardiff CF5 2YX

Syllabus A: Coursework Option

80% terminal written papers : 200 marks

20% coursework : 50 marks

You take the **two written papers** for your Tier (100 marks each).

Paper 1 covers ATs 2 and 3. Paper 2 covers ATs 4 and 5.

For Tier A (levels 7–10), each paper is 2½ h long.

For Tier B (levels 5–8), each paper is 2 h long.

You have no choice of questions on either paper. Each paper is a Question/Answer booklet.

Your coursework assessment consists of two short ‘tasks’ (22 marks), one longer ‘task’ (22 marks) and ‘continuous assessment’ by your teacher during the course (6 marks).

Syllabus B: Non-coursework option

100% terminal written paper : 250 marks

You take the **three written papers** for your Tier:

Papers 1 and 2 are the same as for Syllabus A (100 marks each);

Paper 3 (2 hours long and 50 marks) replaces the coursework on Syllabus A and assesses AT1.

Assessment of AT1

Attainment Target 1 (AT1) is **Using and applying mathematics**. 20% of your assessment for GCSE tests your achievement in this AT. The final level you reach is assessed by some form of *coursework* or an *examination*. Your teacher will have told you which you have to do.

Coursework

All Examining Groups have at least one syllabus which uses *coursework* or *coursework tasks* to assess AT1.

This ‘*coursework*’ is *not* the day-to-day *work* you have done in lessons or for homework during your *course*. For this ‘*coursework*’ you are set, or have to choose, specific tasks to do and to report on. These tasks must match the AT1 targets in the National Curriculum. They may be *mathematical investigations*, *problem-solving*, *practical work*, *extended project work* . . .

For your **final GCSE assessment**, you may have to:

- build up a portfolio of coursework, then submit some or all of it to the examiner,
 - do some special tasks in the final year of your course,
 - do a ‘coursework paper’ near the end of your course.
- (Check with your teacher what you have to do.)

You are expected to write a **report** on your work for each task. You may also have to answer questions about it.

Whatever kind of task you do, the examiner wants to know how you approached the task and how well you can communicate your findings to other people. These are more important than the final ‘result’ you get.

These are some key points the examiner considers when assessing your written reports:

Did you . . .

- understand the task?
- plan the work carefully?
- use a suitable method?
- use the right information?
- choose suitable equipment?
- do the work accurately?
- need to change your strategy after you obtained some early results?
- look for and find any patterns?
- manage to find a general result?
- test any results you found?
- carry the task through to a suitable point?
- explain your findings clearly using appropriate mathematical language, symbols, tables, graphs, etc. as necessary?
- evaluate your results?
- suggest any other possibilities for further study?
- use and apply mathematics you have learnt already?

Check that your reports cover the appropriate points from this list. When you do each task, keep a record of what you do and why as you go along. It’s easy to forget things if you don’t make a note of them. This record gives you a ‘diary of events’ to help you with your report.

Also make sure that you can answer questions about your coursework if you need to. You may have to discuss it with the examiner. If you can, try explaining your work to someone else. See if they and you understand it and what you have done.

You may have to do your final coursework on *fixed days* set by the Examining Group or by a *fixed deadline*. These dates can change from year to year. Find out what they are *for you* from your teacher. Mark them clearly on your calendar. Make sure that you do your work on or by the required date(s).

Investigations

An investigation is a ‘*search for information*’. In a **mathematical investigation** you search for *mathematical* information about an idea or situation.

To find out more about it:

- you *ask* your own questions about it,
- you try to *answer* some of them.

You may be given a *starting point* for an investigation. This gives you clues about some questions to consider. From the same starting point, different students may undertake the investigation in many different ways. By asking different questions each may explore different ideas or the same idea from different points of view. They may report many different findings. Some questions may lead to even more questions and further investigations. Others may lead to dead-ends.

An investigation usually does not have a ‘definite’ finishing point or a final right or wrong answer. How much you can find out often depends on how much time you have to spend on it.

You usually start an investigation by exploring **what** happens. Always try to find out **why** and **how** it happens also. Use all the *resources*, both mathematical and practical, you need to do this.

The *mathematical resources* may be things you have learnt for ATs 2–5. You can look them up in this book to help you. They may be new mathematical ideas you have to learn on your own. Some may be at higher levels in this book. Others you will need to go to your library to investigate.

The *practical resources* may be simple items such as squared paper, drawing instruments, your calculator, models. Or they may be more elaborate, such as computers or cameras. They can be anything that your Examining Group allows and makes the work easier to do and explain.

This is an example of an ‘investigation task’.

INVESTIGATION TASK: Tables and diners

A school uses square-topped tables in the hall for school dinners. No more than four children can sit at one table. Sometimes the tables are put together to make bigger surfaces. Investigate the number of children who can sit around different table arrangements.

The following is an *outline* of some work on this investigation 'in progress'. **Key strategies** are in **bold**, step by step. Some points that the student considered when doing it are given also.

Read the task carefully

Identify the key facts . . .

square-topped tables

no more than 4 children at one table

tables put together

Try to imagine the situation

Use diagrams to help you to show what happens . . .

Try some simple cases

Start with tables in a single row.

Eight can sit at this arrangement.

Try another.

Fourteen can dine at this one.

Working like this isn't getting me anywhere!

Squared paper would help.

Be logical and systematic

Choose a simple 'starting point'.

Build up from it logically and systematically.

1 table:				•					
				•					
				•					
2 tables:				•	•				
				•	•				
				•	•				
3 tables:				•	•	•			
				•	•	•			
				•	•	•			
4 tables:				•	•	•	•		
				•	•	•	•		
				•	•	•	•		

This looks like a good start, but I still can't see any pattern.

Make a table of results

Number of tables	1	2	3	4
Number of diners	4	6	8	10

This looks more promising.

Look for patterns

Number of tables	1	2	3	4	?
Number of diners	4	6	8	10	?
		+1	+1	+1	+1
		+2	+2	+2	+2

I predict that the next one should be:

5 tables seat 12 children.

Let's try it.

5 tables

12 diners ✓

That works! Perhaps there is a rule?

Try to find a rule

The number of diners seems to be:

double the number of tables and add 2.

In symbols this would be:

$$d = 2t + 2$$

Where d = number of diners,

t = number of tables.

Now I need to check if it always works!

Test the rule

Test the rule for another single row arrangement.

Predict: for 8 tables

$$\begin{aligned} \text{number of diners} &= (2 \times 8) + 2 \\ &= 18 \end{aligned}$$

Check:

The rule seems to work for 'single row' arrangements. Test it with some more to be sure.

Try the rule for new situations

I wonder if the rule works for all rectangular arrangements.

Let's try the rule for a 'double row'.

For a 2×5 table arrangement:

Predict:

$$\begin{aligned} \text{diners} &= (2 \times \text{tables}) + 2 \\ &= (2 \times 10) + 2 \\ &= 20 + 2 \\ &= 22 \end{aligned}$$

Check:

10 tables, 14 diners

But only 14 can sit down! Oh! I see what's happened! Children can sit around the outside but not down the middle!
So the rule needs to be changed.

Try to find a rule for all rectangular cases

Try a rectangular arrangement of $m \times n$ tables.

m children can sit along each length of the rectangle.
Total: $2m$ children.

n children can sit along each 'width' of the rectangle.
Total: $2n$ children.

So the total number of diners d is:

$$d = 2m + 2n$$

$$= 2(m + n)$$

This is a general rule for all rectangular arrangements.

Are there any other arrangements?

What happens if . . . ?

What happens if the arrangements are *not* rectangular?

The tables could be put into:

T - shapes

L - shapes

E - shapes

and so on.

What happens if the tables are *not* square topped?

The tops might be other shapes, such as . . .

rectangles

isosceles trapeziums

equilateral triangle

regular hexagons

and so on.

Investigate some of these if you have time.

Problem-solving

You may be given a **problem** to solve using your mathematical knowledge as a coursework task. Basically the problem is a question or questions you have to answer.

You may be given the information you need to solve the problem, or you may have to find the information yourself.

There are often many different ways to solve a problem, but usually they all lead to the same answer(s). To solve a problem, always start by asking yourself:

What does the problem ask me?

What does it tell me?

What else do I need to find out?

What equipment/materials will help me?

As with an investigation, use any mathematical and practical resources you need to help you.

Many problems look difficult at first. Looking at simpler forms of a problem often helps you to see what to do. This may show you a pattern you can use to solve the actual problem set.

Here is an example of a short 'problem-solving task' . . .

PROBLEM-SOLVING TASK	Chessboard Squares
<p>A chessboard contains 64 small squares.</p> <p>How many squares altogether can you see drawn on a chess board?</p>	

. . . and one way to tackle it.

A chessboard is an 8×8 board, i.e. 8 squares by 8 squares. It's difficult to see or imagine all the squares drawn on it.

Let's try looking at smaller boards.

You can start with a 1×1 board:

It has 1 square only.

Then a 2×2 board:

It has: 4 squares
this size . . .

this size . . .

So $4 + 1 = 5$ altogether.

Next a 3×3 board:

It has:

9 squares
this size . . .

4 squares
this size . . .

1 square
this size . . .

So $9 + 4 + 1 = 14$ altogether.

Look for a pattern in the number of squares of each size.

Use it to predict the next number.

Check it on the board.

Now try to solve the problem yourself.

The answer is 204 squares.

Explain to a friend how you worked it out.

Practical work

A **practical** coursework task may be designed to assess:

- your *practical skills* in mathematics and drawing, for example, your ability to use measuring and drawing instruments
- your ability to *use* the mathematics you know in 'real-life' *practical situations*

for example, in planning a kitchen.

Your teacher or Examining Group will suggest topics suitable for practical tasks. Here are some examples:

- 1 Model making.
- 2 Packaging.
- 3 Measuring heights and weights.
- 4 Costing the running of a car or motorbike.
- 5 Seating arrangements in theatres.
- 6 Shopping surveys.
- 7 Traffic-light siting.
- 8 Design of gear wheels.
- 9 Tessellations and patterns.
- 10 Navigation.

Extended pieces of work

Some coursework tasks are intended to be **extended pieces of work** or projects which you do over a *longer* period of time. The tasks will usually be investigations or practical work. Topics for these tasks will usually be chosen after discussions with your teacher. Here are a few ideas:

- 1 Planning a holiday.
- 2 Redecorating a room.
- 3 Surveying school meals.
- 4 Organizing the school sports day.
- 5 Designing a car park.

Assessment of ATs 2–5

ATs 2–5 are **Number, Algebra, Shape and space** and **Handling data**. To find out which level you have reached in each of these ATs, your Examining Group sets **written examination papers** for you to sit. It may also set an **Aural test** for you to do. Your teacher will have told you what sort of papers you will sit. You can also look it up in the notes on your syllabus in Schemes of Assessment, p. v–vi.

80% of the total marks available to you are provided by these examinations. So it is important that you can give good answers to questions on the topics covered by your course. Studying the units on ATs 2–5 in this book will help you to do this. Knowing what types of questions to expect and how to tackle them will also produce better answers.

Types of written questions

The three main types of written questions used in GCSE mathematics examinations are:

- short-answer questions,
- structured questions,
- other long questions.

A **short-answer question** is generally straightforward. It usually tests just one or two basic points. Normally you can quickly spot the topic(s) being tested.

Here is an example:

This Week Only!
5% discount!
for Cash

Write the percentage discount as a fraction. Give your answer in its simplest form.

(2 marks)

You have to change 5% to a fraction : $\frac{5}{100}$

$$\frac{5}{100} = \frac{1}{20}$$

Then you cancel it to its simplest form:

This type of question is normally given only a few marks. In this case there is 1 mark for a correct *method*, and 1 mark for an *accurate* answer.

A **structured question** usually has several parts, all related to one situation. It often breaks down solving a problem into several smaller, easier steps. This gives you the *structure* to solve the problem. In some structured questions you use the answer to one part to work out the answer to the next part and so on. In others, the answers to the earlier parts are the ‘basic ingredients’ needed to answer the final question.

To give you full credit for your working the examiner must be able to see exactly what you have done. He or she may be

able to give you ‘follow-through’ marks. If you give an incorrect answer to one part, the examiner will ‘follow-through’ all your working to the other parts. This means that you may lose only 1 or 2 Accuracy marks if all your other working and answers are correct (using your incorrect answer).

Here is an example of a structured question.

This sketch shows a plan of the rear garden ABCD of Mr. Hughes's new house.

(a) Calculate, to the nearest 0.01 m, the length of: i) BD ii) BC iii) CD

Mr. Hughes wants to cover the entire garden area with lawn.

(b) Calculate, to the nearest square metre the area of Mr. Hughes' rear garden.

Lawnseed is sold in 3 kg bags, the instructions say ‘use 50 g per square metre’.

(c) How many bags of lawnseed does Mr. Hughes need to buy to make the lawn?

To answer part (a), you use Pythagoras' Theorem in triangle ABD and sine and cosine in triangle BCD.

To answer part (b), you use the lengths from (a) to find the area of each triangle.

To answer part (c), you use the area from (b).

Other **long questions** do not show you how to break down your working into smaller steps. They do not give you these extra clues to obtaining the answer. You have to work out what to do yourself.

Here is the last question again, but not in a structured form.

This sketch shows a plan of the rear garden ABCD of Mr. Hughes's new house.

Mr. Hughes wants to cover the entire garden with lawn. Lawnseed is sold in 3 kg bags. The instructions say ‘use 50 g per square metre’.

How many bags of lawnseed does Mr. Hughes need to buy to make the lawn?

Compare the two versions of the same question.

To answer this version, you have to recognize that:

- you need to find the area of each triangle,
- to do this you need to find the lengths of BD, BC and CD first.

The structured version tells you this. And it puts the working in the correct order for you. Your working for this version must explain clearly what you are trying to do at each step. (Try answering this question yourself. The final answer is 6 bags.)

Hints on answering written questions

Getting started

- *Read the whole question carefully.*
Don't just skim through it. Make sure that you understand it.
- *Focus on key points in the question.*
Underline key words/facts in pencil (if the question sheet belongs to you)
Jot down relevant facts and formulas.
Draw a sketch, if it helps.
Doing something positive helps you to concentrate.
- *Identify the topic(s) the question is about.*
In exercises you often do questions all on the same topic.
In your examination you have to do questions on different topics, one after the other. This may seem harder to do.
You know that each topic is part of your course.
To focus your attention on it, write down a 'topic name' or 'topic heading' for each part of the question.
- *Decide what you have to do. And then do it.*

Your working

- *Show all your working towards the answer.*
You will get marks for correct answers. But most marks are given for correct methods shown in your working. So show what you have done at each step.
If your answer is incorrect, then 'no working' will mean 'no marks'. However, if you show a correct method in your working, then you will get 'Method mark(s)' and only lose an Accuracy mark for an incorrect answer.
- *Do what the question says.*
Do not do things you are not asked for.
For example, do not use a scale drawing if the question tells you to 'calculate' an answer.
- *State any formula you use.*
Make sure you remember it accurately or copy it down correctly from the given formula list.
- *Give clear reasons for your answers if asked to do so.*
You need to write explanations in 'good English'. Make sure that words are spelled and used precisely.
In your examination, your 'English' and 'spelling' may be taken into account.
- *Always estimate the answer to any calculation.*
Use this estimate to check that your answer is 'about the right size'.
- *Show all calculator work clearly.*
Work out and write down a key code for each calculation if it helps. Label your 'calculator answer' clearly.
- *Do not use approximations until the end of your working (unless the question tells you to do so).*
- *Work in and state any units of measure correctly.*
Use the proper symbols such as cm, m², kg, s.
Make sure the units match the units asked for in the question.
For example, don't give a time in minutes, if it asks for it in seconds.
- *Always draw a sketch before doing an accurate drawing.*
- *Leave all construction lines on accurate drawings.*
For instance, constructions or scale drawings.

- *In questions involving π ,*
 - if a value is given for π , then you must use it,
 - otherwise use the π key on your calculator.

Writing and presentation

- *Write legibly.*
Make sure that you, your teacher and the examiner can read your writing easily. It's no use if people cannot read your answers.
You may make mistakes (and lose marks) if *you* cannot read it. You can't get any marks if *your teacher* and the *examiner* can't read it.
Be honest with yourself. Decide whether your writing could be a problem.
Look out for things that may be misread in your work.
Take extra care with letters and symbols that 'look alike':
2 and z, 6 and b, 5 and s, for example.
- Write +, −, ×, ÷ signs very clearly.
Show positive and negative signs + − plainly.
Put decimal points in boldly: 5.7 not 5·7.
Make indices small and 'at the top': 4² not 42
Write fractions with a — not a /: 2½ not 2 1/5 (which could be 2⅓)
And so on . . .
You may have to exaggerate some things at first. But it's worth it.
Get a 'second opinion'. Ask someone you know who doesn't do mathematics to look at some samples of your work. He or she will not know what it should say. Find out what cannot be read easily. Then try to make it legible in future.
- *Write your answers neatly and carefully.*
Remember someone has to mark them. Make it easy for your teacher or the examiner to give you marks.
Correct answers are easier to spot in neat work than in a jumble.
- *Present your work logically step-by-step.*
This makes it plain what you are trying to do.
Look at the Answers to the Questions given in each topic in this book. Use these as 'basic models'.
Write each step in your working on a line of its own.
Space your work well: not too cramped, not too spread out.
- *Make clear alterations if you need to change something.*
Cross out the mistake with a single line.
Write the correction clearly near to it.

$$\cancel{4x - 7} \quad 4x - 1 = 7$$

Do not cross out any work until you have replaced it by something that is correct. Part of it may be correct and you may get marks for it. If you cross it out and don't replace it you cannot be given any marks.

- *Do not alter something by writing on top of it.*

Changed figures and signs cannot be marked correct. Cross them out. Write the correct symbol nearby. Do not use white correction fluid in the examination. You may forget to write over it when dry. Or you may write over it too soon and the new writing may not be visible later.

- *Draw diagrams, graphs, scale drawings, etc. as carefully as you can.*
Use the correct equipment and paper.
Label all diagrams clearly. But do not waste time colouring in diagrams in the examination.

Your final answer

- *When you finish a question, state the answer clearly.*
It is a good idea to underline it.
On many examination papers there is a space or box for each final answer. Make sure you write your answers in these places.
- *Give your final answer to the required degree of accuracy.*
You may show your ‘calculator’ answer in your working, but label it clearly as such. Do not leave this as your final answer. Some questions will tell you how to give your answer, for example, ‘to 3 decimal places’, ‘to 2 significant figures’. Make sure that you round your answer in this way.
Other questions will leave you to decide what to do. Choose a sensible degree of accuracy for the information in the question. State in your working what you have done.
- *Don’t forget the units of measure in measurement answers.*
Without them the answers are incorrect.

Checking

- *Check that you have answered the actual question set,*
... not the one you ‘thought’ it was,
... not the one you would like it to be.
Read the question again to make sure.
- *Check that your answer is ‘sensible’.*
Use your common sense. Try to avoid ‘silly answers’.
Think about what you are saying in the answer.
Mathematics questions are set so that the answers are reasonable and realistic. If your answer gives an annual salary of £5, or an angle in a triangle of 200° , then you know something is wrong. Go through your working to find the mistake and correct it.
- *Check that you have given the correct unit of measure (if any).*
- *Check that you have used the required degree of accuracy.*
- *Check that numerical answers are about the right size.*
- *Check that you have not missed out any parts of the question.*
- *Check for mistakes that you know you often make.*
Be aware of these and you can learn to avoid them.
- *Check that your working is easy to follow.*

Doing these checks may sound boring. But they can help you to avoid making careless mistakes and losing marks. Do them at the end of each question, while it is fresh in your mind. They are quick and easy to do then. After a short time you will start to do them automatically.

If you get stuck . . .

Don’t give up too soon if you get stuck on a question. There are lots of things you can try, to sort out the problem. Here are some of them.

- *Reread the question.*
Read it more slowly and carefully. It’s easy to misread or misunderstand a question if you’re in a rush. This is one of the most common mistakes students make. Reading *everything* it says often shows you that you can do it.
- *Make two checklists.*
List the facts you are given in the question and what it asks you to find out.

This may show you some important information you missed at first. Or you may spot that you copied something incorrectly earlier.

- *Draw a sketch diagram if appropriate.*
Label it with ‘what you know’. Mark on it ‘what you have to find’. Use two different colours. This may help you to ‘see’ what to do.
- *Change a ‘difficult’ question into a simpler one.*
To make it simpler, try changing ‘hard’ numbers to easier ones, letters to numbers, and so on. Work out how to answer this simpler question. Then use the same method to do the actual question.
- *Read all parts of the question.*
Don’t stop reading the question when you get stuck. Just reading the next part(s) may give you an idea of what to do. You may be able to do the other part(s) more easily. If you can, do them. Then go back to where you got stuck and try again.
- *Break down a ‘long question’ into smaller parts.*
Think about how a structured question sorts out the key steps you need and puts them in order. Try to work out these steps yourself for other long questions. Write down a checklist of the things you have to do. Then do them systematically.
- *Try to recall questions like it you have done before.*
Think about the key points you had to use then. See whether you can use them now.
- *Leave that question for the moment.*
Have a break. Do something different. Return to it later.
- *Look up the relevant topic(s) in this book.*
Work through the notes in the text and the worked examples. Use them to help you to try again.
- *Ask your teacher for help.*
To make the best use of your teacher’s time, don’t just say ‘I can’t do it!’. Try to explain exactly what the difficulty is. Keep a record of what you have tried. Do not cross out any working you have done already. It may show your teacher where things are going wrong for you. He or she will also see that you are trying to help yourself.

After you have sorted out the problem, make a note of what you didn’t understand. Write out a full answer to the question. File it carefully for future reference. Return to the question a few days later. Make certain that you still understand what to do. Sort out any difficulties you come across. Don’t just leave it and hope for the best.

Help yourself to study and revise

There is no one 'correct' way to study and revise that suits everyone. But most successful students organize **when**, **where** and **how** they work. They do not leave it to chance.

This section contains some ideas and techniques to help you to organize your study and revision. These have been shown to be effective, both by research and by students in the past. Some, if not all, will work for you too.

When to study and revise

Your time is important to you so you want to use it well. Planning your time can save you time. You are used to having a timetable at school. Your teachers made this for your school time. You can make one for your own study time and revision time. This helps you to organize your work sensibly, so you can have, and enjoy, your free time too! Your plan/timetable can remind you of deadlines for homework, coursework, etc., . . . and help you to keep them.

► Your study plan/timetable

Psychologists have worked out the best way to use study time. They advise you to put your study time into fixed study sessions, say one to two hours long. Then you should split these up into three or four short periods with planned breaks of about five minutes between. In this way you will help yourself to keep concentrating. Follow each study session by a slightly longer break for recreation and relaxation.

Study Periods
(about 30 minutes long)
Set a 'target' for your work each period.

Short planned breaks
(about 5 – 10 minutes long)
Do something different in them, e.g. get up, make a drink

Long break after 2 hours study
(at least 20 minutes long)
Do something to relax, e.g. listen to a radio, CD, watch TV

Make your own study plan/timetable with this advice in mind. Be realistic! List the things you have to do and want to do. Put in deadlines if necessary. Remember to fit in free time for hobbies, sports, etc. Relaxation is an important part of your plan.

Think about when you work well. Try to fit these times into your study plan. Some people work well early in the morning. If you do, then get up early and do some planned study before you go to school or college. Some people work well straight after school or college. Others need a break before starting again.

If you are working in the evening, begin as early as possible. You study best when you feel fresh. Leave yourself time to relax and do something different before going to bed.

► Your revision plan/timetable

During your mathematics course you study many topics. You cannot expect to remember them all without revising them.

You may think that revision is something you do just before your final examinations. But, in fact, your revision really starts after the first lesson of your course.

Research has shown that revising your topics regularly throughout your course will help you to understand and remember them more easily. If you revise a topic after the lesson, after a week, after a month, after a term . . . then you will have revised it at least four times before you revise it again at the end of the year. Your final revision before the examination will then be mainly going over things you have already understood and practising things you need to be able to do.

Of course you will need a final revision plan/timetable for the few months before your actual examination. Make your revision plan/timetable in the same way as you made your study plan/timetable. But it will need to be much more concentrated! You will probably have time available during lessons and holidays to revise in. Remember to include these times in your timetable too.

Where to study and revise

Try to make somewhere your **study place**. This can have a good psychological effect on you. It can help you to settle down to work more easily. It can also help your friends and family to know that you are studying there, then with luck they will not disturb you unnecessarily.

Your study place should be a quiet room, away from distractions. It needs to be comfortable to work in; not too warm and well ventilated.

A table or desk is best to work on. It makes it easier to spread out and organize your books and work. You need good lighting too. A reading lamp is ideal but not essential.

Have a clock or watch handy so that you can plan your time. Keep all your books, paper, calculator and other essential equipment at hand in one place. This will save you time during your study periods.

How to study and revise

You cannot study or revise mathematics by simply reading. You have to 'do mathematics' to understand and remember it. So when studying and revising, you need to have a pen or pencil and some paper with you as well as this book.

► Work through your topics

Working through the notes and questions on 'your topics' in this book will remind you of the important facts, words, formulae, mathematical skills, etc., you need. You can do this just after you have studied each topic in class, at other times

throughout your course and during your final revision programme.

► Make notes

Making notes helps you to concentrate and understand what you are studying. Your notes will be helpful during your final revision programme.

- As you work on each of 'your units' in this book, jot down notes and try to do the mathematics yourself. Make sure that your notes are organized and easy to read and understand. Use this book to help you.
- Clearly label your notes. Keep your mathematics notes together. To make them easy to spot, mark them with the same colour. Do this with your mathematics exercise books if you can.
- Make special 'mini' revision notes on cards for quick reference. You can keep them in your pocket or bag and use them in spare moments.
- Make charts giving definitions, formulae, etc. Use colours, underlining, capital letters, etc., to make the information stand out. Hang the charts in your study place and/or bedroom.
- Make your own **formulae checklist**.
- Make your own **calculator checklist**. Keep a record of how to use the keys on *your* calculator. Remember not all calculators are the same. Practise using your calculator efficiently.
- Make your own **mathematics dictionary**. Throughout this book key words and phrases are in **bold** type. You need to know the meaning of these for 'your topics'. One way to learn them, and any other mathematical words you meet, is to make your own mathematical dictionary. Use a small notebook for this. Letter each page. Put them in alphabetical order. Write the words you meet on the correct page. Give their meaning. Use your own words if you can. Draw diagrams and pictures if it helps.

► Do questions

In mathematics you have to be able to use and apply your mathematical knowledge and skills. One way to practise this is by doing questions.

- **Hints on answering written questions** are given on p. xi–xii. Use these to help you to produce good answers to questions.
- In each unit in this book, there are **Worked examples**. When you come to a 'Question', cover the given 'Answer' and try to answer the question yourself. Then compare your working with that given.

Each Answer shows you what you need to write down in your working. Check that you have covered these important points. Comments in *italics* give background information and describe how the answer was worked out. You do not have to write these down. Use them to help you to understand the working.

- Answer all the **GCSE/KS4 sample questions** for your Tier in this book. These questions follow each AT on pages 69, 158, 258, 310. Try to answer *all* questions on the topics you have studied, whether they were set by your Examining Group or not.

Below each question is a reference to the unit(s) in this book which are relevant to it. If you have difficulty answering a question, you can look up these unit(s). Work through them again if you need to.

When you have answered a question, first check your answer with that given in the Answers at the back of the book. Then look back to the relevant unit(s) to check that your method was correct too. File your answers carefully for later revision. Correct any answers which are incorrect. Don't just leave them.

► Check your progress regularly

Testing yourself regularly will help you to check your progress. You may think that you understand or remember something; this checks whether you really do. It helps you to pin-point the ideas, topics, etc., which you need to study or practise again. Test yourself on a topic immediately after revising that topic and again at regular intervals. Here are some ways to test yourself.

- Jot down key points for your units. Check them with the notes in the text.
- See what level(s) you can reach using the GCSE/KS4 sample questions. Make your own progress chart.
- Re-do questions you have answered before, without looking at your previous working. Then check your answers.
- Try questions that you have not looked at before.
- Set up 'mini-tests' for yourself and do them. To make them cover different ATs, units and levels take the questions at random from the Sample GCSE/KS4 questions.
- Try questions in mock examination conditions. Allow yourself only the equipment you are allowed in the examination. Practise using a formula list.
- Try working without a break and uninterrupted for the same length of time as your examination. Practise maintaining your concentration for that time.
- Do some complete examination papers if you can. Ask your teacher about these. Practise working against the clock and in examination conditions.
- Get a friend or relative to test you by asking you questions as in an aural test. Practise both writing and saying your answers. Also practise working them out in your head and against the clock.

► Talk about mathematics

Talking about your mathematics can help you to understand it better. It can show you where there are gaps in your knowledge and may help you to fill them. You have to sort out your own mathematical ideas to talk about them. The people you discuss your work with do not have to be experts to help. But experts are helpful too!

Talk about your mathematics with friends who are doing the same course. You can often help each other to sort out difficulties you are having. Your problem may be clear to a friend.

Talk about your mathematics with your parents or other people you know who have not followed your course. They may have followed a different mathematics course or never have studied the subject at all. Try to explain something that you think you understand to them. Do they understand your explanation? Can you answer their questions? If not, then you need to think about the mathematics again.

Your final examination strategy

Before the day

► Your examination details

Sort out the details about your actual examination well in advance. You do not want to worry about them on the day. Make sure you know:

- the **date, day, time** and **place** for each paper of your examination,
- how to get to your **examination centre** if it is not your school or college,
- your **candidate number**,
- your **examination centre number**,
- the **telephone number** of your examination centre, in case of emergencies.

It is a good idea to put this information on a small card. Keep this card with you in your pocket or bag. Make another copy for home.

► Equipment you need

Put together an 'exam pack' of the equipment you need. Keep it in a clear plastic bag for easy checking. Here is a checklist for your mathematics equipment:

- **Pens** which are comfortable to use (and spare ink and cartridges if you use them).
- Sharp **pencils, pencil sharpener, rubber**.
- Some **coloured pencils**.
- **Ruler, pair of compasses, protractor, set square**.
- **Scientific calculator** you know how to use (and spare batteries if it uses them).

Make sure that each item is in good condition. Replace or repair anything that you need to well before the examinations. If your calculator uses batteries, check that you know how to change them quickly.

There should be a clock in the examination room but it is a good idea to have your own **watch** or **small clock**. Make sure that it works properly. Check its batteries are working if it is battery operated. Do not forget to wind it up if it isn't!

The night before

► Last minute revision

Set yourself a time-limit for last minute revision. Do not try to do too much. Concentrate on the key points on topics. Remind yourself of the strategies you have used to answer questions. Think about ways to check answers.

► Calculator skills

Do some final practice with your calculator. Go through your calculator checklist of what keys to use and how. Remind

yourself about using the memory and bracket facilities. Try planning some calculations step by step with key codes.

► Your 'exam kit'

Get everything you need ready for the next day. You don't want to be running round at the last minute.

- Check your 'exam pack' of equipment and your watch or clock.
- Double-check your examination timetable, especially if you think your examination is in the afternoon. Put your card with examination details on it with your 'exam pack'.
- Sort out what you are going to wear. Plan to take a jacket/jumper/cardigan with you, even if it is hot. Examination rooms can be chilly.

► Relaxation

Try not to get over-tired. You need to be mentally alert and able to concentrate in the examination. Plan some relaxation time. Do something you enjoy. Get some fresh air and exercise.

Do not go to bed too late. Get a good night's sleep.

On the day

► In the morning

- Get up *early*. You don't want to be late. Try not to rush around, getting flustered.
- Have some *breakfast*. You are going to need the energy.

► Before the examination

- Allow yourself plenty of time to get to the examination. Make sure you take everything you need with you. If you are delayed, contact your examination centre to explain what has happened. Remember you have the telephone number on your card.

- Make a final visit to the toilet before going to the examination room.

- Get to the examination room early, but not too early. Avoid standing around chatting before the examination. It may upset your concentration.

► In the examination room

- Find your examination place quickly. Get yourself organized. Lay out your pen, pencils, ruler, etc. Set up your watch/clock. Make this place 'your own' for the time of the examination.

- Settle yourself down. Take a deep breath and keep calm.

- Listen carefully to the invigilator. There may be some changes or special instructions which you were not expecting or some errors in the paper.

Fill in any details such as your candidate number and examination centre number when the invigilator tells you to do so.

- Note the time shown on your watch/clock when you are told to start. Work out and write down the finishing time.
- Ask the invigilator if you need anything during the examination. Put up your hand and wait for him or her to come to you. Do not leave your place unless you are told to do so.

The examination itself

Your success in the examination depends on how well you have prepared for it. Having studied and revised sensibly, you can be confident that you know, can do and understand the topics it covers. However you may not do yourself justice if you have a poor **examination technique**.

Use the following hints to help you to tackle the examination itself with greater confidence.

► Reading the instructions

- Read the instructions very carefully. Do not just skim through them. You have a good idea of what they will say but they can change without notice. Take care to read what they *actually* say, not what you expect them to say.
- Check it is the correct examination paper. Make sure it is the correct subject *and* the correct Tier. Sounds obvious, but mistakes can happen. There may be several different examinations going on in the same place at the same time.
- Make sure you note these details:
 - the number of questions and sections you have to do,
 - how much time you have to do them in,
 - which questions are compulsory,
 - what choice of questions, if any, you have,
 - where to write your answers (on the question paper or on separate paper),
 - where you are given formulae,
 - any special instructions, such as the value to use for π , the degree of accuracy to use.

► Answering the questions

The Hints on Answering questions on p. xi–xii give you advice on:

- Getting started
- Your working
- Writing and presentation
- Your final answer
- Checking
- If you get stuck . . .

You have practised using the strategies suggested when doing questions. So you *know* what to do. Now you can use these strategies ‘for real’ in the examination.

► Organizing your time

- Try not to rush into the first few questions. Work through them at a steady speed. They are likely to be fairly straightforward. So do not throw away ‘easy marks’. Give yourself a chance to build up some confidence.
- Spend a sensible proportion of your time on each question. Do not be tempted to spend too long on any one question. Use the number of marks given for the question and/or the amount of space left for your working to help you to judge what is sensible. Obviously a question with just 1 mark and 1 ‘line’ of space should not take longer than one with 5 marks and half a page of working space.

You can work out an average time for each mark if you like. For example, if your examination lasts 2 hours (120 minutes) and has 100 marks, then the average time for 1 mark is 1.2 minutes (i.e. $120 \div 100$) and for 5 marks is 6 minutes (i.e. 5×1.2). Some people find this helpful but do not adhere to it too slavishly. You can end up wasting time if you are not careful. Use it simply as a guideline if it helps.

► Final checking

- Always go back over the paper if you get to the end of it before the end of time. Do not be tempted to leave early even if you are allowed to do so. You will nearly always find something extra you can do.
- First of all, go back to any questions you missed out earlier. A fresh look at them often helps. They may not be as difficult as you thought at first.
- Check your other answers for careless mistakes. Do not cross out any working before you replace it correctly. You cannot get marks for it once it is crossed out. Remember your ‘checking strategy’ for ‘answering questions’ on p. xii.

► At the end

Before handing in your answers, check that you have:

- filled in your examination number and other details correctly in the appropriate places,
- numbered any ‘extra pages’ clearly as instructed,
- fastened all your work together in the correct order.

After the examination

- Do not join in lengthy ‘post-mortems’ of the paper. It does not help. Leave the examiner to judge how well you have done. What matters is that you have tried your best.
- Try to forget the examination you have just done. Focus on what you have to do next . . .
 - the next examination, if you have one,
 - what you plan to do until the results come out,
 - what you hope to do after that . . .

. . . **Think ahead to your future.**