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IGCSE

Mathematics A

Teacher's guide

Edexcel IGCSE in Mathematics (Specification A) (4MA0)

First examination 2011

Issue 3

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This is an Issue 3 of the Teacher's guide. Substantial changes have been made to the Teacher's guide through including; Differences in assessments, Appendices, A/A* notes/tips and Textbook references.

Acknowledgements

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Introduction

The Edexcel International General Certificate of Secondary Education (IGCSE) in Mathematics (Specification A) is designed for schools and colleges. It is part of a suite of IGCSE qualifications offered by Edexcel.

About this Teacher's guide

This Teacher's guide is for teachers who are delivering, or planning to deliver, the Edexcel IGCSE in Mathematics (Specification A) qualification. The guide supports you in delivering the course content and explains how to raise the achievement of your students.

This guide:

- provides details of Assessment Objectives (AO)
- provides additional material on sets, functions and calculus
- provides a course planner showing how all the specification content could be taught over two years
- offers you suggestions for a range of textbooks and other resources.

Contents

Why choose this qualification?

The Edexcel IGCSE in Mathematics (Specification A) includes:

- tiers of entry that allow students to be entered for a level appropriate to them
- questions that are accessible to students of all abilities within that tier
- papers that are balanced in terms of topics and difficulty
- standards that are equivalent to Edexcel's UK GCSE in Mathematics
- a full range of teacher support and resources
- a solid basis for students wishing to progress to Edexcel AS and Advanced GCE Level, or equivalent qualifications.

Go to www.edexcel.com/igcse2009 for more information about this IGCSE and related sources.

Support from Edexcel

We are dedicated to giving you exceptional customer service. Details of our main support services are given below. They will all help you to keep up to date with this qualification.

Mathematics Emporium

This is an exceptional service run by our in-house subject expert Graham Cumming.

- To stay ahead of all the latest developments sign-up to the IGCSE or Certificate mailing list by emailing your details to mathsemporium@edexcel.com
- To access and download the specification, past papers, mark schemes and much more register at www.edexcelmaths.com
- For any queries regarding this qualification, email mathsemporium@edexcel.com

Website

Our dedicated microsite www.edexcel.com/igcse2009 is where you will find all the information, support materials and resources you need to successfully deliver IGCSE qualifications.

Ask Edexcel & Ask the Expert

To make it easier for you to raise a query with us, we have merged **Ask Edexcel** and **Ask the Expert** into one online service. You can use it to ask any question about the delivery or teaching of Edexcel qualifications. Search the database for frequently asked questions or submit your enquiry directly to us using the easy-to-use online enquiry form. You'll receive a personal response sent to the email address you provide from one of our administrative or teaching experts.

Visit http://www.edexcel.com/iwantto/Pages/ask-edexcel.aspx for more information

Regional offices

If you are an international centre interested in offering other Edexcel qualifications your Regional Development Manager can help you. Go to www.edexcel.com/international for details of our regional offices.

UK Customer Services

If you have a question about this qualification call our Customer Services Team on 0844 576 0027

Training

A programme of professional development and training courses, covering various aspects of the specification and examination will be available. Go to www.edexcel.com/training for details.

ResultsPlus

The ResultsPlus service is our online exam results analysis tool and is available to all Edexcel centres for free. ResultsPlus will provide head teachers with clear information demonstrating how their centre has performed and teachers how students have performed in each subject and or question paper. In addition, Edexcel is offering students the opportunity to receive detailed results information online via ResultsPlus. Centres may choose to opt into this service. To find out more visit www.edexcel.com/resultsplus

Section A: Qualification content

Key subject aims

- To develop knowledge and understanding of mathematical concepts and techniques.
- To give students a foundation of mathematical skills for further study in the subject or related areas.
- To enable students to enjoy using and applying mathematical techniques and concepts, and become confident in using mathematics to solve problems.
- To give students an appreciation of the importance of mathematics in society, employment and study.

Unique features and benefits of the qualification

- Tiers of entry that allow students to be assessed at the appropriate level.
- Standards that are equivalent to Edexcel's UK GCSE in Mathematics.
- A full range of teacher support and resources.

Assessment and progression

- Two tiers – two papers accessible for all abilities within the appropriate tier.
- Grades A*-G available.
- Assessment opportunities in both January and June examination series. First assessment in June 2011.
- Gives a foundation for Edexcel AS and Advanced GCE Level, or equivalent qualifications.

Content summary

The Edexcel IGCSE in Mathematics (Specification A) gives students the opportunity to develop their knowledge, understanding and skills in the areas of number, algebra, geometry, and statistics.

The table below shows where the mathematical topics can be found in the specification.

Mathematical topic	Specification reference
Number, set notation and language	Section 1.1 – Integers Section 1.5 – Set language and notation
Squares, square roots and cubes	Section 1.4 – Powers and roots
Directed numbers	Section 1.1 – Integers
Fractions, percentages, mixed and improper fractions, decimals	Section 1.2 – Fractions Section 1.3 - Decimals
Ordering	Section 1.1 – Integers Section 2.8 – Inequalities
Standard form	Section 1.9 – Standard form
The four rules	Section 1.1 – Integers Section 1.2 – Fractions
Estimation	Section 1.8 – Degree of accuracy Section 1.10 – Applying number
Limits of accuracy	Section 1.8 – Degree of accuracy
Ratio, proportion, rate	Section 1.7 – Ratio and proportion Section 2.5 - Porportion
Percentages	Section 1.6 – Percentages
Use of electronic calculator	Section 1.11 – Electronic calculators
Measures	Section 4.4 – Measures
Time	Section 4.4 – Measures
Money	Section 1.10 – Applying number
Personal and household finance	Section 1.10 – Applying number
Graphs in practical situations	Section 3.3 – Graphs
Graphs of functions	Section 3.3 – Graphs
Straight line graphs	Section 3.3 – Graphs
Algebraic representation and formulae	Section 2.1 – Use of symbols Section 2.3 – Expressions and formulae

Mathematical topic	Specification reference
Algebraic manipulation	Section 2.2 – Algebraic manipulation
Sequences	Section 3.1 - Sequences
Functions	Section 3.2 – Functional notation
Indices	Section 1.4 – Powers and roots
Solutions of equations and inequalities	Section 2.4 – Linear equations Section 2.6 – Simultaneous linear equations Section 2.7 – Quadratic equations Section 2.8 – Inequalities
Linear programming	Section 2.8 – Inequalities
Geometrical terms and relationships	Section 4.1 – Angles and triangles Section 4.2 – Polygons Section 4.6 – Circle properties Section 4.11 – Similarity
Geometrical constructions	Section 4.4 – Measures Section 4.5 – Constructions
Symmetry	Section 4.3 – Symmetry Section 4.6 – Circle properties
Angle properties	Section 4.1 – Angles and triangles Section 4.2 – Polygons Section 4.6 – Circle properties Section 4.7 – Geometrical reasoning
Mensuration	Section 4.9 – Mensuration of 2-D shapes Section 4.10 – 3-D shapes and volume
Trigonometry	Section 4.8 – Trigonometry and Pythagoras's Theorem
Statistics	Section 6.1 – Graphical representation of data Section 6.2 – Statistical measures
Probability	Section 6.3 – Probability
Vectors in two dimensions	Section 5.1 – Vectors
Transformations	Section 5.2 – Transformation geometry

The topics shown below can be found in the *Edexcel IGCSE in Mathematics (Specification B) (4MB0)* specification content section.

Mathematical topic	Specification
Loci	Section 6 – Geometry
Matrices	Section 5 – Matrices

Section B: Assessment

This section provides all the information you need to understand the assessment requirements of this qualification.

Assessment overview

The table below gives you an overview of the assessment for this course. We recommend that you make this information available to students to help ensure they are fully prepared and know exactly what to expect in each assessment.

Paper 1F	**Percentage**	**Marks**	**Time**	**Availability**
Foundation tier 4MA0/1F	50	100	2 hours	January and June series First assessment June 2011
Paper 2F	**Percentage**	**Marks**	**Time**	**Availability**
Foundation tier 4MA0/2F	50	100	2 hours	January and June series First assessment June 2011
Paper 3H	**Percentage**	**Marks**	**Time**	**Availability**
Higher tier 4MA0/3H	50	100	2 hours	January and June series First assessment June 2011
Paper 4H	**Percentage**	**Marks**	**Time**	**Availability**
Higher tier 4MA0/4H	50	100	2 hours	January and June series First assessment June 2011

This is a linear qualification. Students must take both papers, (1F and 2F) or (3H and 4H), in the same series. Calculators are allowed for all papers.

Assessment Objectives and weightings

	% in IGCSE
AO1: demonstrate their knowledge, understanding and skills in number and algebra: • numbers and the numbering system • calculations • solving numerical problems • equations, formulae and identities • sequences, functions and graphs.	55%
AO2: demonstrate their knowledge, understanding and skills in shape, space and measures: • geometry • vectors and transformation geometry.	25%
AO3: demonstrate their knowledge, understanding and skills in handling data: • statistics.	20%
TOTAL	**100%**

Assessment summary

Paper 1F	Description	Knowledge and skills
Foundation tier 4MA0/1F	• Each paper is assessed through a 2-hour examination set and marked by Edexcel. • The total number of marks for each paper is 100. • Each paper will have approximately equal marks available for each targeted grade. • Each paper will assess the full range of targeted grades at Foundation tier, C-G. • There will be some common questions targeted at grades C and D, across papers 1F and 3H and 2F and 4H, to aid standardisation and comparability of award between the tiers. • The Foundation tier papers contain slightly more number than algebra. In all examination papers: • diagrams will not necessarily be drawn to scale and measurements should not be taken from diagrams unless instructions to this effect are given • students may need to use mathematical instruments, for example a pair of compasses, ruler and protractor • calculators and tracing paper may be used • formulae sheets will be provided.	The Assessment Objectives covered in this assessment are: AO1: 55% AO2: 25% AO3: 20% This information is available in the specification. Overview of content: • number • algebra • geometry • statistics.
Paper 2F	**Description**	**Knowledge and skills**
Foundation tier 4MA0/2F	Same as above	Same as above

Paper 3H	Description	Knowledge and skills
Higher tier 4MA0/3H	• Each paper is assessed through a 2-hour examination set and marked by Edexcel. • The total number of marks for each paper is 100. • Each paper will have approximately equal marks available for each targeted grade. • Each paper will assess the full range of targeted grades at Higher tier, A*-D. • Questions will assume knowledge of the Foundation tier subject content. • There will be some common questions targeted at grades C and D, across papers 3H and 1F and 4H and 2F, to aid standardisation and comparability of award between the tiers. • The Higher tier papers contain considerably more algebra than number. In all examination papers: • diagrams will not necessarily be drawn to scale and measurements should not be taken from diagrams unless instructions to this effect are given • students may need to use mathematical instruments, for example a pair of compasses, ruler and protractor • calculators and tracing paper may be used • formulae sheets will be provided.	The Assessment Objectives covered in this assessment are: AO1: 55% AO2: 25% AO3: 20% This information is available in the specification. Overview of content: • number • algebra • geometry • statistics.
Paper 4H	**Description**	**Knowledge and skills**
Higher tier 4MA0/4H	Same as above	Same as above

Using the mark scheme

The mark scheme gives the responses expected from students. Indicative answers are given but during the standardisation of examiners process, the mark scheme is updated and expanded to cover unexpected, correct student responses.

Tiers of entry

Students are entered for either Foundation tier or Higher tier.

Foundation tier papers are designed for students who are unlikely to achieve a high grade but whose achievement can still be recognised with a grade at the appropriate level. The highest grade Foundation tier students can be awarded is grade C. Students who fail to achieve grade G will be awarded 'Ungraded'.

Higher tier papers are designed for students who are likely to achieve at least a grade C. Knowledge of all Foundation tier content is assumed, but material related to grades below the range of the Higher tier will not be the focus of assessment. Some questions are common to both tiers, but the remaining questions in these papers test topics which are aimed at Higher tier students only, and are obviously more demanding.

The highest grade which can be awarded on the Higher tier is A* – for the highest achievers at the top of grade A. Questions in the Higher tier are targeted at grades A* to D, but there is a 'safety net', grade E, for those students who are within a few marks of grade D. Students who fail to achieve the safety net grade E will be awarded 'Ungraded'.

Foundation and Higher tier papers are sat at the same time and students cannot be entered for both examinations. This means that you need to ensure that a student is entered for the appropriate tier. Students who consistently achieve grade C in practice tests could be entered for the Higher tier, where they have the opportunity to achieve the higher grades. However, they would need to be taught the Higher tier material.

Because of the overlap between the two tiers at grades C and D, there are some questions common to both tiers. In this qualification, the overlap accounts for about 40% of the marks on a paper.

Formulae sheets

Formulae sheets are provided for each tier on the inside front cover of each question/answer booklet. The formulae sheets appear as appendices in the specification.

Calculators

- Students will be expected to have access to a suitable electronic calculator for all examination papers.
- Electronic calculators used by students sitting the Foundation tier examination papers
  (1F and 2F) should have the following functions as a minimum:

  +, −, ×, ÷, x^2, √*x*, memory, brackets, x^y, $x^{\frac{1}{y}}$ sine, cosine, tangent and their inverses.
- Electronic calculators used by students sitting Higher tier examination papers (3H and 4H) should have the following functions as a minimum:

  +, −, ×, ÷, x^2, √*x*, memory, brackets, x^y, $x^{\frac{1}{y}}$, $\bar{x}$, Σ*x*, Σ*fx*, standard form, sine, cosine, tangent and their inverses

Calculators with any of the following facilities are **not** allowed in any examination:

- databanks
- retrieval of text or formulae
- QWERTY keyboards
- built-in symbolic algebraic manipulations
- symbolic differentiation or integration.

See Appendix 3 for more extensive notes on the use of the calculator.

Section C: Support for centres switching from GCSE Mathematics

Differences in Assessment

The table below gives an overview of the differences in the assessment models of GCSE Mathematics (Specification A) and IGCSE Mathematics (Specification A)

GCSE Mathematics (Specification A) (1MA0) Assessment model	**IGCSE Mathematics (Specification A) (4MA0) Assessment model**
• Externally assessed • Two written papers • Each paper lasts: – 1 hour 45 minutes (F) – 1 hour 45 minutes (H). • Each paper contains 100 marks • Papers 1F and 1H: Non-Calculator • Papers 2F and 2H: Calculator • Tiered papers • Foundation Tier**:** – Grades C-G available – Each paper will assess the full range of targeted grades at Foundation Tier – There will be some common questions targeted at grades C and D across papers 1F and 3H, and papers 2F and 4H, to aid standardisation and comparability of award between tiers**.**	• Externally assessed • Two written papers • Each paper lasts: – 2 hours (F) – 2 hours (H). • Each paper contains 100 marks • Papers 1F, 2F, 3H and 4H: Calculator • Tiered papers • Foundation Tier: – Grades C-G available – Each will have approximately equal marks available for each of the targeted grades – Each paper will assess the full range of targeted grades at Foundation Tier – There will be some common questions targeted at grades C and D across papers 1F and 3H, and papers 2F and 4H, to aid standardisation and comparability of award between tiers.

GCSE Mathematics (Specification A) (1MA0) Assessment model	IGCSE Mathematics (Specification A) (4MA0) Assessment model
• Higher Tier**:** – Grades A*-D available (E allowed) – Each will have approximately equal marks available for each of the targeted grades – Each paper will assess the full range of targeted grades at Higher Tier • Each paper assesses the functional elements of mathematics: – 30-40% on F tier papers – 20-30% on H tier papers**.**	• Higher Tier: – Grades A*-D available (E allowed) – Each will have approximately equal marks available for each of the targeted grades – Each paper will assess the full range of targeted grades at Higher Tier – Questions will assume knowledge from the Foundation Tier subject content – There will be some common questions targeted at grades C and D across papers 1F and 3H and papers 2F and 4H, to aid standardisation and comparability of award between tiers.
Assessment Objectives and Weightings	**Assessment Objectives and Weightings**
AO1: Recall and use their knowledge of the prescribed content (45-55%)	**AO1:** Demonstrate their knowledge, understanding and skills in number and algebra: (55%) • numbers and numbering system • calculations • solving numerical problems • equations, formulae and identities • sequences, functions and graphs.

GCSE Mathematics (Specification A) (1MA0) Assessment model	IGCSE Mathematics (Specification A) (4MA0) Assessment model
Assessment Objectives and Weightings	**Assessment Objectives and Weightings**
AO2: Select and apply mathematical methods in a range of contexts (25-35%)	**AO2:** Demonstrate their knowledge, understanding and skills in shape, space and measures: (25%) • geometry • vectors and transformation geometry.
AO3: Interpret and analyse problems and generate strategies to solve them (15-25%)	**AO3:** Demonstrate their knowledge, understanding and skills in handling data: (20%) • statistics.

Differences in content

Most of the content of this IGCSE Mathematics qualification is covered in the GCSE Mathematics content. However, there are some differences in content between the two qualifications.

There are some **omitted** topics; content that is included in GCSE Mathematics content, but **not** in the content of the IGCSE Mathematics (Specification A).

There are also some **additional** topics included in the content of the IGCSE Mathematics (Specification A) which are **not** in the GCSE Mathematics content.

Omitted topics

These topics are included in the GCSE, but are **not** included in the IGCSE.

- Exponential growth
- Checking by estimation
- Completing the square
- Trial and improvement
- Gradients of perpendicular lines
- Exponential functions
- Transformations of graphs
- Equation of a circle
- Side-angle-side triangles (SAS), Angle-angle-side triangles (AAS)
- Proofs of circle theorems
- Trigonometry graphs
- Angles greater than 180^{o}
- Frustum of a cone
- Construct a perpendicular from a point to a line
- Loci
- Negative scale factor
- Plans and elevations
- Metric/imperial conversion
- Collecting data
- Two-way tables
- Seasonality and trends
- Scatter graphs, including lines of best fit
- Correlation
- Box plot
- Stem and leaf.

Additional topics

There are three major topics **not** included in Edexcel's UK GCSE which feature in the IGCSE in Mathematics A. These are:

- set language and notation (1.5 in the specification)
- function notation (3.2 in the specification)
- calculus (3.4 in the specification).

There are notes and sample assessment questions, for these three major topics, on the following pages, which give supplementary information about how these topics will be assessed.

These examples are not exhaustive. They are intended as an indication of the level of difficulty and the types of questions which can be expected.

A few smaller topics have also been included in the IGCSE:

- The intersecting chords theorem
- Finding the gradient of a curve at a point by drawing a tangent
- Quadratic inequalities
- Simple conditional probability
- Modulus of a vector.

Notes and sample assessment questions on the three major additional topics

Notes on Set language and notation (1.5 in the specification)

1. Foundation and Higher tiers

Definition

In words, for example {Cats}, {Positive integers less than 10},

{Multiples of 3}, or as a list of members, for example {2, 4, 6, 8}, {chairs, tables}.

Typical questions

- Given the definition of a set, list all the elements (or members).
- Given a list of all the elements of a set, write the definition.

Symbols: $\mathcal{E}$, Ø, $\in$, $\cup$, $\cap$

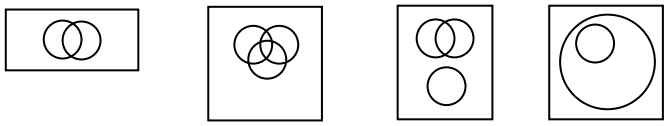
Typical questions

- Given defined sets $\mathcal{E}$, A and B
  - describe $A \cap B$
  - list the members of $A \cup B$
  - what is meant by '6 $\in A$'?
  - is it true that $A \cap B$ = Ø? Explain your answer.

2. Higher tier only

Definition: Algebraic, for example $\{\mathcal{E}$ = Integers$\}$, $P = \{x: 0 \leq x < 10\}$

Venn diagrams: Different cases, for example



Symbols: A' (the complement of A), $\subset$ ('is a sub-set of')

Typical questions

- Given defined sets $\mathcal{E}$, A, B, and C
  - draw a Venn diagram
  - shade $A \cup B \cap C'$
  - list the members of $B' \cap C$
  - is it true that $A \subset B$?
- Describe a given, shaded region in a Venn diagram.
- Draw a Venn diagram in which certain conditions are true.

Symbols: $\mathrm{n}(A)$ (the number of members in A)

Typical questions

- Given a Venn diagram (for example black animals, cats, dogs) with numbers inserted
  - how many black cats are there?
- Given two or three defined sets, find $\mathrm{n}(A \cup B')$.
- Given $\mathrm{n}(\mathcal{E}) = 23$, $\mathrm{n}(A) = 16$, $\mathrm{n}(B) = 10$, $\mathrm{n}(A \cup B) = 20$
  - draw a Venn diagram
  - show the number of members in each region.
- Questions involving three sets, where an equation needs to be set up. See *Question 16* in the following sample questions.

Sample assessment questions on set language and notation

Foundation and Higher tiers

1. List the members of the following sets.

(a) {Days of the week}

(b) {Even numbers between 1 and 9}

(c) {Factors of 18}

(d) {Colours of the rainbow}

(e) {Square numbers less than 100}

2. $\mathcal{E}$ = {Positive integers less than 20}

P = {11, 13, 15, 17}

Q = {12, 14, 16}

R = {Multiples of 4}

(a) List the members of

(i) R

(ii) $P \cup Q$

(iii) $Q \cap R$

(b) What is the set $P \cap R$?

3. $\mathcal{E}$ = {The books in St John's library}

M = {Mathematics books}

P = {Paperback books}

T = {Travel books}

(a) Describe the set $M \cap P$

(b) What is the set $M \cap T$?

(c) One book in St John's library has the title '*Explore'*.

Given that '*Explore*' $\in M \cup T$, what can you say about the book '*Explore*'?

4. $\mathcal{E}$ = {Polygons}

A = {Three-sided shapes}

B = {Shapes with two equal sides}

C = {Shapes with two parallel sides}

(a) What is the mathematical name for the members of $A \cap B$?

(b) Which of the following are true?

(i) Kite $\in A$

(ii) Trapezium $\in C$

(iii) $A \cap C = \emptyset$

5. R = {Positive odd numbers less than 10}

S = {Multiples of 3 between 4 and 20}

T = {Prime numbers}

(a) List the elements of

(i) $R \cup S$

(ii) $R \cap S$

(b) You are told that $x \in R \cap T$

Write down all the possible values of x

(c) Is it true that $S \cap T = \emptyset$?

Explain your answer

See Appendix 2 for references to past paper questions on this content.

Higher tier only

6. $\mathcal{E}$ = {Positive integers less than 20}

A = {x: 0 < x ≤ 9}

B = {Even numbers}

C = {Multiples of 5}

(a) List the members of $A \cap B'$

(b) Find the value of $n(A \cup C)$

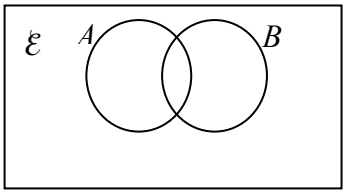
(c) Complete the statement $A \cap B \cap C$ = . . .

(d) Is it true that $(A \cap C') \subset B$? Explain your answer.

7. There are 30 people in a group. 17 own a car. 11 own a bicycle.
5 do not own a car or a bicycle.
How many people in this group own a car but not a bicycle.

8. Draw a Venn diagram with circles representing three sets, A, B and C.
Shade the region representing $A \cap (B \cup C')$.

9.



Make two copies of this Venn diagram.

(a) On one diagram draw a circle to represent set C, such that

$C \subset A$ and

$C \cap B' = C$

(b) On the other diagram draw a circle to represent set D, such that

$D \subset A'$

$D \cap B \neq \emptyset$ and

$D \cup B \neq D$

10. Draw a Venn diagram with circles representing three sets, *A*, *B* and *C,* such that all the following are true:

$A \cap C \neq \emptyset$, $A \cap C' \neq \emptyset$ and $B \subset (A \cup C)'$

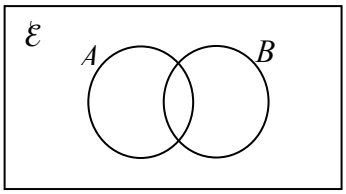
11. $\mathcal{E} = \{ x: x \text{ is an integer and } 1 \leq x \leq 30 \}$

A = {Multiples of 3}

B = {Multiples of 4}

(a) Find the value of $\text{n}(A \cap B)$.

Sets A and B are represented by circles in the Venn diagram.



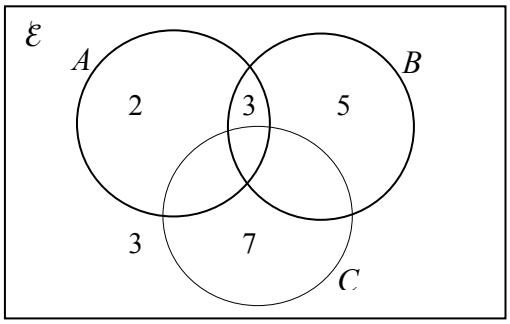
(b) C = {Odd numbers}

(i) Copy the Venn diagram, and draw a circle on it to represent set C.

(ii) Shade the region $A \cap (B \cup C)'$.

(ii) Write down all the values of x such that $x \in A \cap (B \cup C)'$.

12. In the Venn diagram, the numbers of elements in several regions are shown.



You are also given that $\text{n}(\mathcal{E}) = 25$, $\text{n}(B) = 12$ and $\text{n}(A) = 8$.

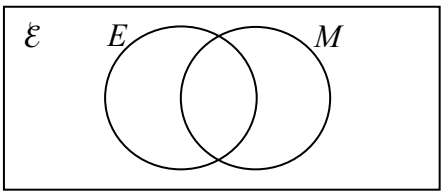
(a) Find $\text{n}(B \cap C)$

(b) Find $\text{n}(A \cap C \cap B')$

13. $\mathcal{E}$ = {Positive integers less than 15}

E = {Even numbers}

M = {Multiples of 3}



(a) Copy the Venn diagram and fill in each member of $\mathcal{E}$ in the correct region.

(b) Write down the value of $\mathrm{n}(E \cap M')$.

14. $\mathcal{E}$ = {Quadrilaterals}

P = {Parallelograms}

K = {Kites}

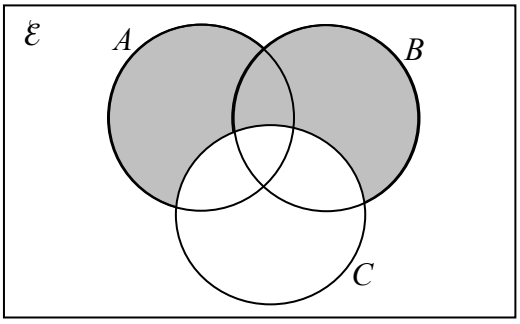
S = {Squares}

(a) What is the mathematical name for a member of $P \cap K$?

(b) Complete the statement $P \cup S$ = . . .

(c) Draw a Venn diagram showing sets P, K and S.

15.



Use set notation to describe the shaded region.

16. There are 40 members in a sports club. Two play all three sports. 23 play squash. 24 play tennis. 18 play golf. 14 play squash and tennis. Eight play tennis and golf. One member makes the refreshments and does not play any sport. How many members play squash and golf?

See Appendix 2 for references to past paper questions on this content.

Answers

1. (a) Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday

(b) 2, 4, 6, 8

(c) 1, 2, 3, 6, 9, 18

(d) Red, orange, yellow, green, blue, indigo, violet

(e) 1, 4, 9, 16, 25, 36, 49, 64, 81

2. (a) (i) 4, 8, 12, 16 (ii) 11, 12, 13, 14, 15, 16, 17 (iii) 12, 16

(b) Ø

3. (a) Paperback mathematics books in St John's library.

(b) Ø

(c) It is either a mathematics or travel book.

4. (a) Isosceles triangles

(b) ii and iii

5. (a) (i) 1, 3, 5, 6, 7, 9, 12, 15, 18 (ii) 9

(b) 3, 5, 7

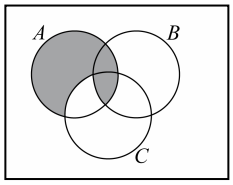
(c) Yes. No members of *S* are prime.

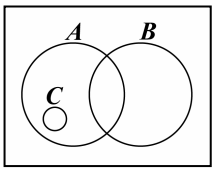
6. (a) 1, 3, 5, 7, 9

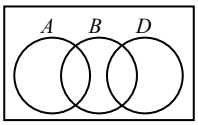
(b) 11

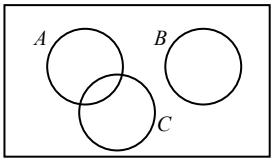
(c) Ø

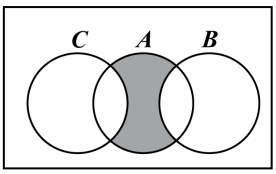
(d) No. For example 3, 7 or 9

7. 14 **8**. 

9. (a) 

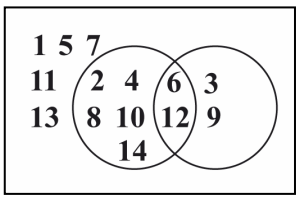
(b) 

10. 

11.(a) 2 (b)(i), (ii) 

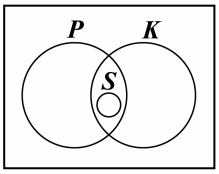
(iii) 6, 18, 30 **12.** (a) 4 (b) 1

13.(a)



(b) 5

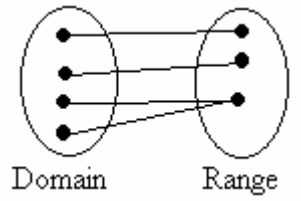
14. (a) Rhombus (b) P (c)



15. $(A \cap B) \cap C'$ or $(A \cap C') \cup (B \cap C')$ **16**. 6

Notes on function notation (3.2 in the specification)

Notation and definitions: $f(x) = x^2$ $f: x \to x^2$



Notation for particular sets (eg $\mathbb{Z}$ is the set of integers, R is the set of real numbers) is not required.

Domain is all values of x to which the function is applied.

Range is all values of $f(x)$

Vocabulary such as 'One to one' and 'Many to one' is not required.

Domain and/or range may be given in words, as a list, or algebraically, for example $0 \leq x < 10$

If the domain is not given, it is assumed to be $\{ x: x \text{ is any number}\}$.

Co-domain is not required.

Which functions?

Usually, for example, linear, quadratic, cubic, $\sqrt{x}$, 1/linear.
Sometimes harder functions, for example, √linear, 1/√linear, linear/linear, √quadratic,
1/quadratic, $a + \frac{b}{x}$, $ax + \frac{b}{x}$, trigonometrical

Note: '√' indicates the positive value of the square root.

Typical questions

- Given a function and its domain, find the range
- Given a function applied to all numbers, find the range
- Given a function, which values cannot be included in the domain?
- Given $f(x)$, find $f(-2)$
- Given $f(x) = 3$, find the value(s) of x
- Composite functions

  $fg(x)$ means $f(g(x))$, ie do g first followed by f

Typical questions

- Given functions f and g, find $fg(-3)$, $gf(2)$
- Given functions f and g, find fg in the form $fg: x \mapsto \ldots$ or $fg(x) = \ldots$
- Given functions f and g, and the domain of f, find the range of gf
- Given functions f and g, which values need to be excluded from the domain of gf?

Inverse functions

Functions required:

Usually, for example, linear, 1/linear, $\sqrt{x}$ or x^2 (with domain restricted to positive numbers)

Sometimes harder functions, for example, √linear, 1/√linear, linear/linear, $a+\frac{b}{x}$, $1/\sqrt{x}$

Any method for finding f^{-1} is acceptable, for example

- Algebraic: write as y = . . . ; rearrange to make x the subject; interchange x and y
- Flow chart: reverse each operation, in reverse order.

Typical questions

- Given the function f, find f^{-1} (3)
- Given the function f, find f^{-1} in the form f^{-1}: $x \mapsto \ldots$ or $\mathrm{f}^{-1}(x) = \ldots$
- Without working, write down the value of $\mathrm{ff}^{-1}(5)$
- Given functions f and g, find the function $\mathrm{f}^{-1}\mathrm{g}$
- Given functions f and g, solve the equation $\mathrm{f}(x) = \mathrm{g}^{-1}(x)$

Sample assessment questions on function notation

1. Here are three functions:

$f(x) = 3 - 2x$ $\quad g(x) = \dfrac{1}{x-2}$ $\quad h(x) = \sqrt{3x+1}$

(a) Find (i) $f(-1)$ (ii) $f(\frac{3}{4})$ (iii) $g(4.5)$ (iv) $g(-2)$ (v) $h(5)$
(vi) $h\left(2\frac{2}{3}\right)$

(b) (i) Given that $f(x) = -7$, find x
(ii) Given that $g(x) = 2$, find x
(iii) Given that $h(x) = 5$, find x

2. Three functions, p, q and r, are defined as follows:

$p(x) = x^2 - 3x + 4$ $\quad q(x) = \dfrac{2x-3}{x+1}$ $\quad r(x) = \sin x^\circ$

(a) Find (i) $p(-4)$ (ii) $p(\frac{3}{4})$ (iii) $q(4)$ (iv) $q(-2)$ (v) $r(45)$ (vi) $r(180)$

(b) (i) Find the values of x for which $p(x) = 2$
(ii) Find the value of x for which $q(x) = \frac{3}{4}$
(iii) Find the values of x, in the domain $0 \leq x \leq 180$, for which $r(x) = 0.5$

3. State which values of x cannot be included in the domain of these functions:

(i) f: $x \mapsto \sqrt{5-x}$ $\quad$ (ii) g: $x \mapsto \dfrac{5}{2x-7}$ $\quad$ (iii) h: $\mapsto \dfrac{1}{\sqrt{x+3}}$

(iv) j: $x \mapsto \sqrt{(x^2-4)}$ $\quad$ (v) l: $x \mapsto 2x + \dfrac{1}{x}$ $\quad$ (vi) k: $x \mapsto \dfrac{1}{(3x+2)^2}$

(vii) l: $x \longrightarrow \sqrt{\dfrac{x-3}{6-x}}$

4. f: $x \mapsto x^3$ g: $x \mapsto \dfrac{1}{x+8}$

(a) Find (i) fg(–4), (ii) gf(5)

(b) Find (i) gf(x), (ii) fg(x)

(c) What value(s) must be excluded from the domain of (i) gf(x), (ii) fg(x)?

(d) Find and simplify gg(x)

5. Three functions are defined as follows:

p(x) = $(x + 4)^2$ with domain $\{x: x$ is any number$\}$

q(x) = $8 - x$ with domain $\{x: x > 0\}$

r(x) = cos x^o with domain $\{x: 0 \leq x \leq 180\}$

(a) Find the range of each of these functions

(b) Find the values of x such that p(x) = q(x)

6. Find the inverse function of each of the following functions:

(a) f(x) = $2x - 3$ (b) g(x) = $5 - x$ (c) h(x) = $\dfrac{1}{3x+4}$ (d) j(x) = $3 - \dfrac{2}{x}$

(e) k(x) = $\dfrac{2x+1}{5-x}$

7. Find the inverse function of each of the following functions.

(a) p: $x \mapsto \sqrt{3x-2}$ (for $x \geq \frac{2}{3}$) (b) q: $x \mapsto \dfrac{1}{\sqrt{x+2}}$ (for $x > -2$)

(c) r: $x \mapsto x^2 + 5$ (for $x \geq 0$) (d) s: $x \mapsto (x - 3)^2$ (for $x \geq 3$)

8. The function $f(x)$ is defined as $f(x) = \frac{2}{x+1}$.

Solve the equation $f(x) = f^{-1}(x)$

9. Here are two functions:

$f(x) = \frac{2}{5+x}$ $g(x) = x^2 + 3$

(a) Calculate $g(-2)$

(b) Given that $f(z) = \frac{1}{8}$, calculate the value of z

(c) Which value of x must be excluded from the domain of $f(x)$?

(d) Find the inverse function, f^{-1}, in the form $f^{-1} : x \mapsto \ldots$

(e) Calculate $f^{-1}g(1)$

10. Functions f and g are defined as follows:

$f: x \mapsto 4 + \sqrt{x}$ $g: x \mapsto \frac{1}{(x+2)^2}$

(a) Calculate (i) $f(25)$ (ii) $g(0.5)$ (iii) $fg(-1)$

(b) Given that $fg(x) = 4.04$, find the value of x

(c) Find the function $f^{-1}(x)$

(d) Calculate $gf^{-1}(4)$

11. $p(x) = \frac{2-x}{3+x}$ $q(x) = \frac{2-3x}{1+x}$

(a) Find the function $pq(x)$

(b) Describe the relationship between the functions p and q

(c) Write down the exact value of $pq(\sqrt{2})$

See Appendix 2 for references to past paper questions on this content.

Answers

In the examination equivalent answers are acceptable, for example, appropriate decimal instead of fraction.

1. (a)(i) 5 (ii) $1\frac{1}{2}$ (iii) $\frac{2}{5}$ (iv) –0.25 (v) 4 (vi) 3 (b)(i) 5 (ii) 2.5 (iii) 8

2. (a)(i) 32 (ii) $2\frac{5}{16}$ (iii) 1 (iv) 7 (v) 0.707 (vi) 0(b)(i) 1 or 2 (ii) 3 (iii) 30 or 150

3. (i) $x > 5$ (ii) $x = 3.5$ (iii) $x \leq -3$ (iv) $-2 < x < 2$ (v) $x = 0$ (vi) $x = -\frac{2}{3}$ (vii) $x < 3$ or $x \geq 6$

4. (a)(i) $\frac{1}{64}$ (ii) $\frac{1}{133}$ (b)(i) $\frac{1}{x^3+8}$ (ii) $\frac{1}{(x+8)^3}$

(c)(i) $x = -2$ (ii) $x = -8$ (d) $\frac{x+8}{8x+65}$

5. (a) p: ≥ 0; q: < 8; r: –1 to 1 (b) –8 or –1

6. (a) $\frac{x+3}{2}$ (b) $5 - x$ (c) $\frac{1-4x}{3x}$ (d) $\frac{2}{3-x}$ (e) $\frac{5x-1}{2+x}$

7. (a) $\frac{x^2+2}{3}$ (b) $\frac{1-2}{x^2}$ (c) $\sqrt{x-5}$ (d) $\sqrt{x}+3$

8. 1 or –2

9. (a) 7 (b) 11 (c) –5 (d) $\frac{2}{x}-5$ (e) $-4\frac{1}{2}$

10. (a)(i) 9 (ii) 0.16 (iii) 5 (b) 23 (c) $(x - 4)^2$ (d) $\frac{1}{4}$

11. (a) $\mathrm{pq}(x) = x$ (b) Inverses of each other (c) $\sqrt{2}$

Notes on calculus (3.4 in the specification)

Basic concepts and notation

Ideas of gradient of tangent and gradient of curve.

$y = x^n \Rightarrow$ grad $= \frac{dy}{dx} = nx^{n-1}$,

firstly for positive integer n; then also $n = 0, -1, -2$

Differentiation of polynomials.

Usually no rearrangement will be required.

If rearrangement is required, this will usually be asked for explicitly.

Differentiation from first principles is not required.

If you wish to give an introduction to the concept of a limiting gradient, the following is adequate, but it will **NOT** be tested:

On the curve $y = x^2$,

$P(3, 3^2)$; $Q_1(3.1, (3.1)^2)$; $Q_2(3.01, (3.01)^2)$; etc

Find gradients of PQ_1, PQ_2, PQ_3 . . .

Typical questions

- Differentiate $x^5 - 3x^2 + 5$ or $x^2 + 3x - 4$
- Given $y = \frac{5x+3}{2}$, find $\frac{dy}{dx}$
- Given $y =$ . . . , find the gradient for a given x
  find x for a given gradient
- $y = (x + 3)^2$. Expand and find $\frac{dy}{dx}$

The notation $f'(x)$ and the terms 'derivative' and 'derived function' are not required.

Turning points (TPs)

The language used will be 'turning points', 'maximum', 'minimum'; not 'stationary points'.

At turning points, $\frac{dy}{dx} = 0$

Find TPs for quadratic, cubic, $ax \pm \frac{b}{x}$.

Distinguish maximum/minimum by rough shape, for example shape of $y = ax^2 + bx + c$ is $\cap$ when $a < 0$.

For $ax \pm \frac{b}{x}$ if distinguishing maximum/minimum is required, the question will ask for the curve to be drawn first.

Consideration of the gradient on either side is not required.

$\frac{d^2y}{dx^2}$ is not required.

But students may use these methods if they wish.

Typical questions

- y = quadratic or cubic. Find the turning points(s). State, with a reason, whether each is a maximum or a minimum.
- $y = ax + \frac{b}{x}$. See *Question 13*

Rate of change

Know that $\frac{\mathrm{d}y}{\mathrm{d}x}$ is the rate of change of y with respect to x.

Typical question

See *Question 14*

Kinematics

Quadratic, cubic, $at \pm \frac{b}{t}$ only. Notation $\frac{\mathrm{d}s}{\mathrm{d}t}$ and $\frac{\mathrm{d}y}{\mathrm{d}t}$

not $\frac{\mathrm{d}^2 s}{\mathrm{d}t^2}$

Typical questions

- Given s in terms of t, find v and/or a at time t or at given time.
- Find maximum distance from starting point.
- Find t for given s, v, or a (only requiring solutions of equations within the specification).

Practical problems

Typical questions

- Easier type – See *Question 12*
- Hardest type – See *Question 16*

Applications to coordinate geometry

Only very simple applications will be tested, possibly requiring understanding of $y = mx + c$

Usually, students will be led through step by step. See *Questions 7 and 15*

Sample assessment questions on calculus (3.4 in the specification)

1. Differentiate

(a) $x^3 + x^2 - 5x - 4$ (b) $2x^4 - 5x^2 + 2x - 3$ (c) $3x^5 + 7x^3 - x + 2.5$

(d) $5 - 2x + 4x^2 - 2x^3$ (e) $\frac{x^3}{6} + \frac{3x^2}{4} - \frac{2x}{3}$ (f) $\frac{7 - x^2}{2}$

2. Find $\frac{dy}{dx}$ for the following.

(a) $y = 2x^3 + 4x^2 + x^{-1}$ (b) $y = 6x + 3 - 4x^{-1} + 3x^{-2}$ (c) $y = \frac{2}{x} - \frac{6}{x^2}$

3. Find an expression for the gradient of each of these curves.

(a) $y = x^5 - 3x^3 + 2x - 4$ (b) $y = 3x + \frac{4}{x^2}$ (c) $y = \frac{3x^2 + 2x - 4}{3}$

4. Find the gradient of the tangent at the given point on each of the following curves.

(a) $y = x^2 - 5x - 6$, at the point where $x = 2$

(b) $y = x^3 - 2x^2 - 3x$, at the point $(-4, -52)$

(c) $y = 3x - \frac{4}{x^2}$, at the point where $x = \frac{1}{2}$

(d) $y = \frac{x^2 + 3x}{12}$ at the point (3, 1.5)

5. Expand and differentiate

(a) $(x + 3)^2$ (b) $(2x - 3)(x + 5)$ (c) $(4 - x)(2 + 3x)$ (d) $x^2(4 - 2x)$

6. A curve has equation $y = x^2 - 3x + 5$

(a) Find $\frac{dy}{dx}$

(b) Find the gradient of the curve at the point with coordinates (2, 3)

(c) Find the coordinates of the point on the curve where the gradient = –5

7. A curve has equation $y = x^3 - 6x^2 + 9x - 2$

(a) Find the coordinates of the point on this curve at which the tangent is parallel to the line $y = -3x + 5$

(b) Find the coordinates of the two turning points on this curve.

8. For the curve with equation $y = x^2 - 4x + 5$

(a) Find $\frac{dy}{dx}$

(b) Find the turning point.

(c) State, with a reason, whether this turning point is a maximum or a minimum.

9. Find the maximum value of y where $y = 3 + 6x - 2x^2$. Explain how you know that it is a maximum.

10. A publisher has to choose a price, £x, for a new book.

The total amount of money she will receive from sales is £y, where

$y = 20\,000x - 5000x^2$.

(a) Find the price which gives the maximum amount of money from sales.

(b) Find the maximum amount of money from sales.

11. The temperature, T °, of a liquid at time t seconds is $t^2 - 6t + 9$

(a) Find the rate of change of the temperature after 2 seconds.

(b) Find the time when the rate of change of temperature is –3 °/second.

12. A car is moving along a straight road. It passes a point O.

After t seconds its distance, s m, from O is given by

$s = 10t - t^2$ for $0 \leq t \leq 10$

(a) Find the time when the car passes through O again.

(b) Find $\frac{ds}{dt}$

(c) Find the maximum distance of the car from O.

(d) Find the speed of the car 3 seconds after passing O.

(e) Find the acceleration of the car.

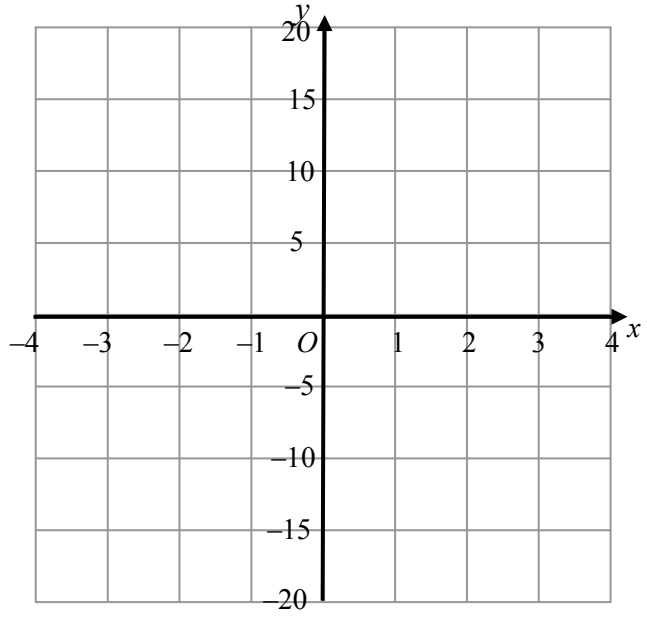
13. A curve has equation $y = 2x + \frac{8}{x}$

(a) Find the turning points.

(b) Copy and complete the table of values for $y = 2x + \frac{8}{x}$.

x	–4	–3	–2	–1	1	2	3	4
y		–8.7	–8		10			

(c) Copy the grid and draw the curve for $-4 \leq x \leq 4$.



(d) State which of the turning points is a maximum.

14. A curve has equation $y = x^3 - 3x^2 + 2x$.

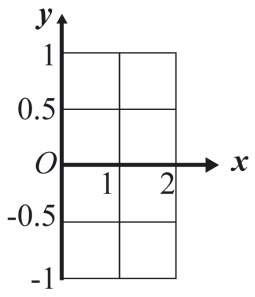
(a) Find $\frac{dy}{dx}$

(b) Find the x coordinates of the turning points, giving your answers correct to 2 decimal places.

(c) Copy and complete the table of values for $y = x^3 - 3x^2 + 2x$.

x	0	1	2
y			

(d) Copy the grid and draw the graph of $y = x^3 - 3x^2 + 2x$ for $0 \leq x \leq 2$.



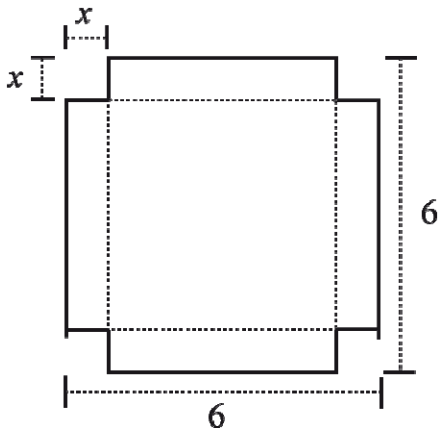
15. A curve has equation $y = x^2 + 3x + 2$

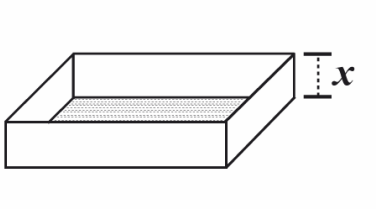
(a) Find $\frac{dy}{dx}$

The curve cuts the y axis at A.

(b) (i) Write down the coordinates of A.
(ii) Find the gradient of the tangent at A.
(iii) Write down the equation of the tangent at A.

16. Square corners, with side x cm, are cut from a square card with side 6 cm. Then the edges are folded up to make a box.





(a) Show that the volume of the box is V cm^3 where $V = 36x - 24x^2 + 4x^3$

(b) Find $\frac{dV}{dx}$

(c) Find the maximum possible volume of the box.

See Appendix 2 for references to past paper questions on this content.

Answers

1. (a) $3x^2 + 2x - 5$ (b) $8x^3 - 10x + 2$ (c) $15x^4 + 21x^2 - 1$ (d) $-2 + 8x - 6x^2$

(e) $\frac{x^2}{2} + \frac{3x}{2} - \frac{2}{3}$ (f) $-x$

2. (a) $6x^2 + 8x - x^{-2}$ (b) $6 + 4x^{-2} - 6x^{-3}$ (c) $-\frac{2}{x^2} + \frac{12}{x^3}$

3. (a) $5x^4 - 9x^2 + 2$ (b) $3 - \frac{8}{x^3}$ (c) $2x + \frac{2}{3}$

4. (a) –1 (b) 61 (c) 67 (d) 0.75 **5**. (a) $2x + 6$ (b) $4x + 7$ (c) $10 - 6x$ (d) $8x - 6x^2$

6. (a) $2x - 3$ (b) 1 (c) (-1, 9) **7**. (a) (2, 0) (b) (1, 2) (3, –2)

8. (a) $2x - 4$ (b) (2, 1) (c) Minimum as quadratic with positive coeff of x^2

9. 7.5 Maximum because quadratic with negative coeff of x^2

10. (a) £2 (b) £20 000 **11**. (a) – 2 °/sec (b) 1.5 secs

12. (a) 10s (b) $10 - 2t$ (c) 25m (d) 4m/s (e) – 2 m/s^2

13. (a) (–2, –8) (2, 8) (b) –10, –10, 8, 8.7, 10 (c) graph (d) (–2, –8)

14. (a) $3x^2 - 6x + 2$ (b) 0.42, 1.58 (c) 0, 0, 0

(d) 

15. (a) $2x + 3$ (b)(i) (0, 2) (ii) 3 (iii) $y = 3x + 2$

16. (b) $36 - 48x + 12x^2$ (c) 16 cm^3

Section D: Planning and teaching

Course planner

This course planner lists the main teaching points which have to be covered to meet the requirements of the specification.

For each tier, the planner is divided into three **Assessment Objectives (AO)**:

- Number and algebra
- Shape, space and measures
- Handling data.

These Assessment Objectives are sub-divided into **teaching modules**. Some of these are standalone whilst others must be preceded by earlier modules. The order of these modules are linked directly to the order that the content appears in the specification, therefore it may be unlikely that the topics would be taught in this order. In addition many teachers will not cover topics consecutively in some of the modules.

The course planner has been structured to include the following features (features in **bold** have been explained further below):

- **Content summary pages**
- Module number
- **Estimated teaching time**
- Target grades
- Content
- Prior knowledge
- Notes – where appropriate
- **A/A* notes/tips for Higher tier where appropriate**
- **Resources**.

Content summary pages

The content summary pages give an overview of the modules in both the Foundation tier and the Higher tier course planners. It is important to note that much of the knowledge of the Foundation tier content is assumed for the Higher tier content.

Estimated teaching time

This is an approximation, and it is given for guidance only, as the time allocated for the teaching and learning of each topic area is determined by the needs and abilities of the students. It can be adapted according to individual requirements.

A/A* notes/tips

This guidance is aimed at students preparing for the top grades in their examinations. Students working at this level should be encouraged to develop an appropriate working knowledge of the Higher tier topics, together with the foundation tier topics. In order to access questions at the top grades, students need to have methods of solution at their immediate disposal, and this means that they need to ensure that they do not neglect the learning aspect of the subject. This should enable students to develop an appreciation of mathematics as a unified whole, rather than a series of discrete topics or facts. It is also important that students set their work out clearly, through maintaining the appropriate structure of their solutions.

Resources

The textbook references are from the Edexcel two-book series written for students following the IGCSE Higher tier specification (see titles in the table below). It comprises of a Student's Book for each year of the course. For Foundation tier, it is advisable to use additional resource materials, although the non-starred exercises in these textbooks are designed for students working towards IGCSE grades B/C.

Edexcel IGCSE Mathematics A Student Book 1 D A Turner, I A Potts, W R J Waite, B V Hony ISBN 978-0 435966 91 1
Edexcel IGCSE Mathematics A Student Book 2 D A Turner, I A Potts, W R J Waite, B V Hony ISBN 978-0 435966 92 8

It is important to note that specific issues, such as the sequence in which topics are covered, the time allocated to each one and the extent to which a calculator is used for arithmetic, will depend on the needs and abilities of students.

Foundation tier content summary

The table below is a summary of modules in the IGCSE Mathematics Foundation tier course planner.

Teachers should be aware that the estimated teaching hours are approximate and should only be used as a guideline.

Module number		Title	Estimated teaching hours
Number	1	Integers	4
	2	Decimals	4
	3	Special numbers and powers	7
	4	Fractions	7
	5	Percentages	5
	6	Ratio and proportion	7
	7	Approximation	5
	8	Set language and notation	5
Algebra	1	Algebraic manipulation	5
	2	Expressions and formulae	5
	3	Linear equations and simultaneous linear equations	7
	4	Coordinates and graphs	5
	5	Linear graphs	5
	6	Integer sequences	5
	7	Inequalities	5
	8	Indices	5
Shape, space and measures	1	Measures	5
	2	2-D shapes	4
	3	Symmetry	5
	4	Construction	5
	5	Geometry	7
	6	Transformations	7
	7	Circles	5
	8	Area and perimeter	5
	9	3-D shapes and volume	7
	10	Pythagoras' theorem	5
	11	Trigonometry	7
	12	Similar shapes	5
Handling data	1	Graphical representation of data	7
	2	Statistical measures	7
	3	Probability 1	7
	4	Probability 2	6
		Total	**180 hours**

Foundation tier

NUMBER

Module 1 — Integers Time: 3 – 5 hours

Target grades: E/F/G

Content	Area of specification
Understanding place value in whole numbers	1.1
Reading, writing and ordering whole numbers	1.1
Addition, subtraction, multiplication and division of whole numbers	1.1
Problems involving the four rules with whole numbers	1.1
Calculations involving time	1.10
Order of operations (excluding powers)	1.1
Using a calculator efficiently	1.11
Interpreting a calculator display	1.11
Directed numbers in context	1.1
Understanding integers both as positions and as translations on a number line	1.1
Using the four rules with directed numbers	1.1

Prior knowledge

The ability to order numbers

Appreciation of place value to at least 1000s

Experience of the four rules of whole numbers

Notes

Present all working out clearly, emphasise that all working is to be shown

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Number 1 page 2 Unit 1: Number 1 page 117-119

Module 2 — Decimals

Time: 3 – 5 hours

Target grades: E/F/G

Content	Area of specification
Understanding place value in decimal numbers	1.3
Ordering decimals	1.3
Applying the four rules with decimals	1.10
Writing decimal numbers to the nearest whole number and to one or two decimal places	1.8
Writing decimal numbers to one, two or three significant figures	1.8
Converting simple fractions to decimals, including recurring decimals	1.2
Converting terminating decimals to fractions	1.3

Prior knowledge

Number: Module 1

Experience of the four rules of whole numbers

The basic concepts of a fraction and a decimal

Notes

Present all working out clearly with decimal points in line, and emphasise that all working is to be shown

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Number 1 page 7

Module 3 — Special numbers and powers Time: 6 – 8 hours

Target grades: C/D/E

Content	Area of specification
Even and odd numbers	1.1
Factors and multiples, including common factors and common multiples	1.1
Prime numbers and prime factors	1.1
Square and cube numbers	1.4
Squares and square roots	1.4
Cubes and cube roots	1.4
Using a calculator effectively to evaluate powers and roots	1.11
Powers of numbers – using index notation	1.4
Order of operations including powers (BIDMAS)*	1.1
Expressing a number as the product of powers of its prime factors	1.4
Using laws of indices for multiplication and division of positive integer powers	1.4
Simplifying expressions using the laws of indices	1.4

*__BIDMAS__ = __B__rackets, __I__ndices, __D__ivision, __M__ultiplication, __A__ddition, __S__ubtraction

Prior knowledge

Basic number bonds and multiplication/division facts

Ability to recognise basic number patterns

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 3: Number 3 page 114 Unit 1: Number 1 page 2 Unit 1: Number 2 page 60 Unit 3: Number 3 page 117-119 Unit 2: Algebra 2 page 73-74

Module 4 — Fractions

Time: 6 – 8 hours

Target grades: C/D/E

Content	Area of specification
Using diagrams to find equivalent fractions	1.2
Simplifying (cancelling) fractions	1.2
Simplest form (lowest terms)	1.2
Conversion between improper fractions and mixed numbers (vulgar fractions)	1.2
Conversion between fractions and decimals	1.2
Ordering fractions using common denominators or by conversion to decimals	1.2
Adding and subtracting fractions using common denominators	1.2
Multiplying and dividing fractions by an integer, by a unit fraction and by a general fraction	1.2
Using fractions in problems	1.2
Calculating a fraction of a quantity	1.2
Expressing one quantity as a fraction of another	1.2

Prior knowledge

Number: Modules 1, 2 and 3

A basic understanding of fractions as 'parts of a whole'

Notes

An understanding of equivalent fractions is fundamental to this module. This topic needs to be constantly revisited. Every working stage should be shown

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Number 2 page 57-58 Unit 1: Number 1 page 1

Module 5 — Percentages — Time: 4 – 6 hours

Target grades: C/D/E

Content	Area of specification
Understanding that percentage means 'number of parts per hundred'	1.6
Converting between percentages, fractions and decimals	1.6
Calculating percentages of quantities	1.6
Increasing or decreasing quantities by a given percentage	1.6
Expressing one quantity as a percentage of another	1.6
Finding 100% when another percentage is given	1.6
Calculating percentage increases or decreases (percentage profit or loss)	1.6
Understanding the multiplicative nature of percentages as operators	1.6
Efficient use of a calculator to solve problems involving percentages, for example simple interest	1.6

Prior knowledge

Number: Modules 1, 2 and 4

An awareness that percentages are used in everyday life

A basic understanding of the concept of a percentage

An understanding of the concept of interest in a financial context

Notes

All workings should be shown

Applications of percentages to solve real-world problems

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Number 1 page 3

Module 6 — Ratio and proportion — Time: 6 – 8 hours

Target grades: C/D/E

Content:	Area of specification
Basic ideas of ratio	1.7
Simplifying ratios including simplest form	1.7
Expressing a ratio in the form 1 : n	1.7
Relating ratio to fractions	1.7
If one of the two quantities in a given ratio is known, finding the other, including the use of the unitary method	1.7
Dividing a quantity in a given ratio into two or three parts	1.7
Problems involving ratio, including scale diagrams and maps	1.7
Using direct proportion, including recipes and currency conversion	1.7

Prior knowledge

Number: Modules 1, 2 and 4

Basic number skills and ability to recognise common factors

Calculator skills

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Number 2 page 59 Unit 2: Number 2 page 61

Module 7 — Approximation — Time: 4 - 6 hours

Target grades: C/D/E/F/G

Content	Area of specification
Rounding numbers to the nearest 10, 100 and 1000 and use for estimating	1.8
Rounding numbers to one significant figure and use for estimating	1.8
Rounding numbers to two or three significant figures	1.8
Rounding numbers to one, two or three decimal places	1.8
Carrying out rounding appropriate to a context	1.8
Expressing a calculator display to an appropriate degree of accuracy	1.8
Finding upper and lower bounds, ie maximum and minimum values for rounded values	1.8

Prior knowledge

Number: Modules 1 and 2

Notes

To ensure they achieve marks for correct calculations, even if there is a rounding, error students should be encouraged to include more accurate answers in their working before rounding.

Students should be aware that correct rounding will give a number of the same order of magnitude as the original.

The need to round to an appropriate level of accuracy should be emphasised throughout this module.

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 4: Number 4 page 169-172

Module 8 – Set language and notation — Time: 4 – 6 hours

Target grades: C/D/E

Content	Area of specification
Meaning of 'set'	1.5
Defining sets of numbers by describing, for example {first four odd numbers}, $\{x : x$ is a factor of 12}or by listing, eg {1, 3, 5, 7}	1.5
Understanding the meaning of the universal set $\mathcal{E}$	1.5
Understanding the meaning of the null or empty set Ø or { }	1.5
Membership of a set including the notation $\in$ and $\notin$	1.5
Intersection and union of sets including the notation $\cap$ and $\cup$	1.5

Prior knowledge

Number: Module 3

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Sets 1 page 39-41

ALGEBRA

Module 1 — Algebraic manipulation — Time: 4 - 6 hours

Target grades: C/D/E/F

Content	Area of specification
Using letters to represent numbers	2.1
Collecting like terms	2.2
Simplifying products	2.1
Multiplying a single term over a bracket	2.2
Factorising by taking out a single common factor	2.2
Finding and simplifying the product of two simple linear expressions, ie of the form $(x + a)(x + b)$, where a and b are integers	2.2

Prior knowledge

The concept that letters can be used instead of numbers

Notes

Emphasise importance of using the correct symbolic notation, for example $3a$ rather than 3 x a or $a3$

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book1	Unit 1: Algebra 1 page 9-11 Unit 1: Algebra 1 page 11-12 Unit 3: Algebra 3 page 121-122 Unit 5: Algebra 5 page 241-243

Module 2 — Expressions and formulae — Time: 4 - 6 hours

Target grades: C/D/E/F/G

Content	Area of specification
Substituting positive and negative integers, then fractions and decimals, into expressions, word formulae and algebraic formulae	2.3
Using formulae from mathematics, and other subjects, expressed initially in words or diagrammatic form and converting to variables or algebraic form	2.3
Deriving formulae	2.3

Prior knowledge

Number: Modules 1, 2, 3 and 4

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 4: Algebra 4 page 180-181

Module 3 — Linear equations and simultaneous linear equations

Time: 6 - 8 hours

Target grades: C/D/E/F

Content	Area of specification
Inverse operations	2.4
Understanding and use of 'balancing' methods	2.4
Solving simple linear equations	2.4
Solving linear equations:	
• with two or more operations	2.4
• with the unknown on both sides	2.4
• with brackets	2.4
• with negative or fractional coefficients	2.4
• with combinations of these	2.4
Setting up and solving simple linear equations to solve problems, including finding the value of a variable which is not the subject of a formula	2.4
Solving simple simultaneous linear equations, either by elimination or by substitution	2.6

Prior knowledge

Algebra: Modules 1 and 2

The idea that some operations are 'opposite' to each other.

Notes

Students need to realise that not all linear equations can be solved easily by either observation or trial and improvement; a formal method is often needed

Students should leave their answers in fractional form where appropriate

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Algebra 1 page 12-18 Unit 3: Algebra 3 page 126

Module 4 — Coordinates and graphs Time: 4 – 6 hours

Target grade: D/E/F

Content	Area of specification
Drawing and interpreting linear conversion graphs	3.3
Plotting or stating the coordinates of points in all four quadrants	3.3
Determining the coordinates of points identified by geometrical information	3.3
Determining the coordinates of the midpoint of a line segment, given the coordinates of the two end points	3.3
Drawing and interpreting linear graphs representing real-life situations, including speed/time and distance/time graphs	3.3
Drawing and interpreting non-linear graphs representing real-life situations	3.3

Prior knowledge

Experience of plotting points

Directed numbers

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 3: Graphs 3 page 134, 137

Module 5 — Linear graphs **Time: 4 - 6 hours**

Target grades: C/D/E

Content	**Area of specification**
Recognising that equations of the form $x = a$ and $y = b$ correspond to straight line graphs parallel to the y-axis and to the x-axis respectively	3.3
Completing tables of values and drawing graphs with equations of the form $y = mx + c$, where the values of m and c are given and m may be an integer or a fraction	3.3
Recognising that graphs with equations of the form $y = mx + c$ are straight lines	3.3
Having an informal understanding of the concept of gradient as the steepness of a line, and recognising the link with m in $y = mx + c$	3.3
Drawing straight line graphs with equations in which y is given implicitly in terms of x, for example $x + y = 7$	3.3

Prior knowledge

Algebra: Modules 1, 2, 3 and 4

Notes

Axes should be labelled on graphs and a ruler should be used to draw linear graphs

Science experiments or work can provide results which give linear graphs

Resources

Textbook	**References**
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Graphs 1 page 19-27

Module 6 — Integer sequences

Time: 4 - 6 hours

Target grades: E/F/G

Content	Area of specification
Continuing diagrammatic sequences	3.1
Continuing number sequences	3.1
Describing the terms of a sequence in words	3.1
Finding rules to describe sequences	3.1
Using term-to-term and position-to-term definitions to generate the terms of a sequence	3.1

Prior knowledge

Algebra: Modules 1 and 2

Some experience of sequences of numbers which follow a rule, for example even and odd numbers

The ability to follow a series of instructions

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 5: Sequences 5 page 254-255

Module 7 — Inequalities

Time: 4 – 6 hours

Target grade: B/C/D

Content	Area of specification
Understanding and using the symbols >, <, ≥ and ≤	2.8
Understanding and using the convention for open and closed intervals on a number line	2.8
Solving simple linear inequalities in one variable, including 'double-ended' inequalities	2.8
Representing on a number line the solution set of simple linear inequalities	2.8
Finding the integer solutions of simple linear inequalities	2.8
Using regions to represent simple linear inequalities in one variable	2.8
Using regions to represent the solution set to several linear inequalities in one or two variables	2.8

Prior knowledge

Algebra: Modules 3 and 5

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Algebra 2 page 74-77 Unit 2: Graphs 2 page 81-86

Module 8 — Indices

Time: 4 - 6 hours

Target grades: C/D/E

Content	Area of specification
Using index notation for positive integer powers	2.1
Substituting positive and negative numbers into expressions and formulae with quadratic and/or cubic terms	2.1
Completing tables of values and drawing graphs of quadratic functions	3.3
Using laws of indices with positive integer powers to simplify expressions	2.1
Substituting positive and negative numbers into expressions and formulae with quadratic and/or cubic terms	2.3

Prior knowledge

Algebra: Modules 2 and 4

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Algebra 2 page 73 Unit 2: Algebra 2 page 74 Unit 4: Graphs 4 page 185-188

SHAPE, SPACE AND MEASURES

Module 1 — Measures — Time: 4 - 6 hours

Target grades: C/D/E/F/G

Content	Area of specification
Choosing and using appropriate metric units of measure	4.4
Making sensible estimate of lengths, capacities and weights	4.4
Interpreting scales and dials on a range of measuring instruments	4.4
Telling the time from digital and analogue clocks	4.4
Converting between times, and calculating time intervals in 12-hour and 24-hour clocks, for example reading timetables	4.4
Understanding and using the relationship between average speed, distance and time	4.4

Prior knowledge

Number: Module 2

Basic concepts of units, for example height in metres, weight in kilograms

Notes

Measurement is essentially a practical activity. Use a range of everyday objects to make the lesson more relevant

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 4: Number 4 page 172

Module 2 — 2-D shapes

Time: 3 – 5 hours

Target grades: E/F/G

Content	Area of specification
Estimating the size of an angle in degrees	4.1
Recognising and naming acute, obtuse, reflex and right angles	4.1
Recognising and giving the names of different types of triangle (right-angled, isosceles and equilateral)	4.1
Recognising and giving the names of different types of quadrilateral (parallelogram, rectangle, square, rhombus, trapezium, kite)	4.2
Recognising and giving the names of different types of polygon (pentagon, hexagon, octagon)	4.2
Recognising regular polygons	4.2
Understanding congruence as meaning the same shape and size	4.2
Understanding that two or more polygons with the same shape and size are said to be congruent to each other	4.2

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Shape and space 1 page 28 Unit 1: Shape and space 1 page 29

Module 3 — Symmetry

Time: 4 – 6 hours

Target grades: E/F/G

Content	Area of specification
Recognising line symmetry and rotational symmetry	4.3
Identifying and drawing lines of symmetry for a 2-D shape	4.3
Stating the order of rotational symmetry of a 2-D shape	4.3
Recognising all the symmetries of a 2-D shape	4.3

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Shape and space 1 page 28

Module 4 — Construction

Time: 4 – 6 hours

Target grades: C/D/E/F/G

Content	Area of specification
Measuring and drawing lines to the nearest millimetre	4.5
Measuring and drawing angles to the nearest degree	4.4
Constructing triangles and other 2-D shapes using a ruler, protractor and compasses	4.5
Using three-figure bearings to specify direction	4.4
Using scale drawings to solve problems in 2-D or 3-D	4.5
Using straight edge and compasses to construct	
(i) the perpendicular bisector of a line segment	
(ii) the bisector of an angle	4.5

Prior knowledge

An understanding of angle as a measure of turn; experience of drawing and measuring using a ruler

Notes

Encourage students to use sharp pencils to improve the neatness and accuracy of their drawings

A tolerance of 2° is reasonable for angles

A sturdy pair of compasses is essential

When measuring angles larger than 90° on a diagram. students are often confused about the direction from which a bearing is measured

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1 Edexcel IGCSE Mathematics A Student Book 2	Unit 1: Shape and space 1 page 32 Unit 4: Shape and space 4 page 292

Module 5 — Geometry

Time: 6 – 8 hours

Target grades: C/D/E/F/G

Content	Area of specification
Calculating angles on a straight line and at a point	4.1
Recognising vertically opposite angles	4.1
Recognising parallel and perpendicular lines	4.1
Using parallel lines, alternate angles and corresponding angles	4.1
Using the angle sum of a triangle to calculate angles in triangles	4.1
Using angle properties of isosceles, equilateral and right-angled triangles	4.1
Understanding that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices	4.1
Using the angle sum of a quadrilateral to calculate angles in quadrilaterals	4.2
Understanding and using the properties of the parallelogram, rectangle, square, rhombus, trapezium and kite	4.2
Calculating and using the sums of the interior angles of polygons	4.2
Calculating and using the sum of the exterior angles of polygons	4.2
Calculating the interior and exterior angles of regular polygons	4.2
Giving informal reasons, where required, when arriving at numerical solutions to geometrical problems	4.7

Prior knowledge

Shape, space and measures: Modules 1 and 2

Understanding the concept of parallel lines

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Shape and space page 28 Unit 1: Shape and space page 29 Unit 1: Shape and space page 31

Module 6 — Transformations Time: 6 – 8 hours

Target grades: C/D/E/F/G

Content	Area of specification
Understanding that rotations are specified by a centre and an angle	5.2
Rotating a shape about a point, measuring the angle of rotation in right angles, degrees or simple fractions of a turn	5.2
Understanding that an anti-clockwise rotation is a positive angle rotation and a clockwise rotation is a negative angle rotation	5.2
Understanding that reflections are specified by a mirror line, for example $x = 1$, $y = x$ on a coordinate grid	5.2
Reflecting shapes in a mirror line	5.2
Constructing a mirror line, given a shape and its reflection	5.2
Understanding that translations are specified by a distance and direction	5.2
Translating a shape, given the distance and direction of the translation	5.2
Recognising that rotations, reflections and translations preserve length and angle so that a transformed shape under any of these transformations is congruent to the original shape	5.2
Understanding that enlargements are specified by a centre and a scale factor, including fractions	5.2
Constructing enlargements of shapes with positive scale factors	5.2
Identifying the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments	5.2
Recognising that enlargements preserve angle but not length	5.2
Describing transformations in full	5.2

Prior knowledge

Shape, space and measures: Module 2

The ability to recognise the symmetries in a shape

Notes

Students often lose marks as in the examination they do not give a complete description of a transformation. For example, the centre of rotation is often omitted and the name of the transformation itself left out

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 5: Shape and space 5 page 265-278

Module 7 — Circles

Time: 4 – 6 hours

Target grades: C/D/E/F/G

Content	Area of specification
Understanding the terms centre, radius, chord, diameter, circumference, tangent, arc, sector and segment of a circle	4.6
Knowing and using these circle properties:	
• two tangents from a point to a circle are equal in length	4.6
• tangents are perpendicular to the radius at the point of contact	4.6
• the line from the centre of a circle which is perpendicular to a chord bisects the chord (and the converse is true)	4.6

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 4: Shape and space 4 page 194-199, 207

Module 8 — Area and perimeter — Time: 4 - 6 hours

Target grades: D/E/F/G

Content	Area of specification
Finding the perimeter of rectangles and triangles and shapes made from them	4.9
Finding area by counting squares	4.9
Finding the areas of rectangles, triangles, parallelograms and trapezia, using relevant formulae	4.9
Finding circumferences and areas of circles, using relevant formulae	4.9
Finding the areas of compound shapes made from rectangles and triangles	4.9
Converting between units of length and of area within the metric system, for example m^2 and cm^2	4.9

Prior knowledge

Shape, space and measures: Module 2

Some concept of area as the amount of surface covered

Notes

Ensure that students can distinguish between perimeter and area

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Algebra 2 page 69-71

Module 9 — 3-D shapes and volume — Time: 6 – 8 hours

Target grades: C/D/E/F/G

Content	Area of specification
Recognising and giving the names of solids (cube, cuboid, prism, pyramid, cylinder, cone, sphere)	4.9
Understanding the terms face, edge and vertex in the context of a 3-D solid	4.9
Finding volumes by counting cubes	4.9
Finding the volumes of right prisms, including cuboids and cylinders, using appropriate formulae	4.9
Finding the surface areas of solids with rectangular and triangular faces	4.9
Finding the surface area of a cylinder	4.9
Converting between units of volume within the metric system, for example, cm^3 and litres	4.9

Prior knowledge

Shape, space and measures: Module 8

Some concept of the volume of a solid as the amount of space it occupies

Notes

Many students have little real understanding of perimeter, area and volume. Practical experience is essential in order to clarify these concepts

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: Number 2 page 63 Unit 2: Shape and space 2 page 112-113, 117

Module 10 — Pythagoras's theorem — Time: 4 – 6 hours

Target grade: B/C/D

Content	Area of specification
Identifying the hypotenuse of a right-angled triangle	4.8
Understanding and using Pythagoras' theorem in 2-D to find the length of the hypotenuse or that of one of the shorter sides of a right-angled triangle	4.8
Using Pythagoras' theorem to solve problems	4.8

Prior knowledge

Shape, space and measures: Modules 2, 5 and 8

Knowledge of different types of triangle

Ability to use a calculator to find squares and square roots.

Notes

Students will avoid making mistakes if they remember that the hypotenuse is the longest side

Some students find questions on this topic much more difficult if the orientation of the triangle is unusual

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 4: Shape and space 4 page 212-214

Module 11 — Trigonometry — Time: 6 – 8 hours

Target grade: B/C/D

Content	Area of specification
Identifying the various sides of a right-angled triangle as the hypotenuse, opposite and adjacent	4.8
Understanding and using sine, cosine and tangent of acute angles to find lengths and angles in a right-angled triangle	4.8
Using trigonometry to solve problems, including bearings	4.8
Using Pythagoras' theorem and trigonometry to solve problems	4.8

Prior knowledge

Shape, space and measures: Modules 2, 5 and 10

Knowledge of the basic concept of ratio (Number: Module 6)

Ability to use a calculator to convert fractions to decimals (Number: Module 4)

Notes

Students should ensure that their calculators are in 'degree mode' before tackling trigonometry questions

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Shape and space 2 page 87-94 Unit 3: Shape and space 3 page 142-153

Module 12 – Similar shapes

Time: 4 – 6 hours

Target grade: B/C/D

Content	Area of specification
Understanding that, if two shapes are similar their corresponding angles are equal and all their corresponding lengths are in the same ratio	4.10
Using similarity to find lengths of sides	4.10

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 4: Shape and space 4 page 205-209

HANDLING DATA

Module 1 — Graphical representation of data Time: 6 – 8 hours

Target grades: E/F/G

Content	Area of specification
Grouping data in tally tables and frequency tables including grouped data	6.1
Obtaining data from a list, a table (including two way) or a database	6.1
Drawing and using bar charts	6.1
Drawing and using pictograms	6.1
Drawing pie charts	6.1
Using pie charts to calculate:	
• the fraction, percentage or decimal of the total represented by each sector	6.1
• the number of items represented by each sector	6.1

Prior knowledge

Shape, space and measures: Module 5

Measuring and drawing angles (Shape, space and measures: Module 4)

Fractions of simple quantities (Number: Module 4)

Notes

Students should label axes of pictograms and bar charts, and sectors of pie charts

The need for accurate drawing skills, particularly for pie charts, should be emphasised

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Handling data 2 page 99-103

Module 2 — Statistical measures — Time: 6 – 8 hours

Target grades: C/D/E/F/G

Content	Area of specification
Understanding the concept of average as a value which is representative of a set of data	6.2
Finding the mean, median, mode and range for a discrete data set either from a list or frequency table	6.2
Selecting the most appropriate average	6.2
Finding the modal class for grouped data	6.2
Calculating an estimate for the mean for grouped data, using halfway values	6.2

Notes

Students often understand techniques used to find mean, median and mode but confuse the three names

It should be emphasised that the range is a single value

Students sometimes identify the modal class by the frequency instead of the class description

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Handling data 2 page 97-98

Module 3 — Probability 1 **Time: 6 – 8 hours**

Target grades: E/F/G

Content	**Area of specification**
Using the language of probability, informally, for example 'likely' and then technical terms such as 'outcomes', 'equal likelihood', 'events' and 'random'	6.3
Using a probability scale from 0 to 1	6.3
Understanding that an impossible event has a probability of 0 and one which is certain has a probability of 1	6.3
Writing probabilities as numbers (fractions, decimals or percentages only)	6.3
Estimating probabilities from previously collected data	6.3
The probability of an event happening or not happening	6.3
Understanding and using estimates or measures of probability from theoretical models	6.3

Prior knowledge

Some concept of 'chance' and the likelihood of an event occurring and recognition that some events are more likely to occur than others

Notes

Where possible, introduce practical work to support theoretical work

Students can be unsure of the relationship P(not n) = 1 – P(n)

Resources

Textbook	**References**
Edexcel IGCSE Mathematics A Student Book 1	Unit 4: Handling data 4 page 218-226

Module 4 — Probability 2 Time: 5 – 7 hours

Target grades: C/D/E/F

Content	Area of specification
Understanding sample spaces and using them to find the probability that an event will occur	6.3
Listing all the outcomes for single events systematically, or for two successive events, and using lists to find the probability that an event will occur	6.3
Using the sum of probabilities of all possible outcomes equalling one	6.3
Understanding the meaning of 'equally likely' and 'mutually exclusive'	6.3
Using the addition rule for probability for mutually exclusive events	6.3
Understanding and using expected frequency to calculate an estimate for the number of times an event will occur	6.3

Prior knowledge

Handling data: Module 3

Notes

You may need to remind students that only fractions, decimals and percentages can be used for probability. Answers like '2 in 3', '2 out of 3' and '2 : 3' would be penalised in the examination

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 4: Handling data 4 page 315-316

Higher tier content summary

The table below is a summary of modules in the IGCSE Mathematics Higher tier course planner.

Teachers should be aware that the estimated teaching hours are approximate and should only be used as a guideline.

Module number		Title	Estimated teaching hours
Number	1	Decimals	3
	2	Powers and roots	4
	3	Fractions	2
	4	Percentages	3
	5	Ratio and proportion	3
	6	Standard form	4
	7	Degree of accuracy	6
	8	Set language and notation	6
Algebra	1	Algebraic manipulation	4
	2	Expressions and formulae	6
	3	Linear equations and simultaneous linear equations	6
	4	Coordinates and graphs	5
	5	Linear graphs	5
	6	Integer sequences	4
	7	Quadratic equations	7
	8	Inequalities	5
	9	Indices	5
	10	Proportion	5
	11	Function notation	7
	12	Harder graphs	7
	13	Calculus	7
Shape, space and measures	1	Average speed	3
	2	Construction	4
	3	Geometry	4
	4	Transformations	5
	5	Circle properties	7
	6	Area and perimeter	5
	7	3-D shapes and volume	5
	8	Pythagoras' theorem	4
	9	Trigonometry	4
	10	Similar shapes	7
	11	Advanced trigonometry	7
	12	Vectors	6
Data Handling	1	Graphical representation of data	5
	2	Statistical measures	4
	3	Probability	6
		Total	**180 hours**

Higher tier

It is assumed that students being prepared for the Higher tier will have knowledge of all of the Foundation tier content.

NUMBER

Module 1 — Decimals **Time: 2 – 4 hours**

Target grades: A/B/C/D

Content	Area of specification
Applying the four rules of operation with decimals	1.10
Using a calculator efficiently	1.11
Interpreting a calculator display	1.11
Writing decimal numbers to the nearest whole number and to one or two decimal places	1.8
Writing decimal numbers to one, two or three significant figures	1.8
Converting simple fractions to decimals including recurring decimals	1.2
Converting terminating decimals to fractions	1.3
Converting recurring decimals to fractions	1.3

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 5: Number 5 page 238 Unit 5: Number 5 page 239 Unit 1: Number 1 page 7 Unit 3: Number 3 page 117-119
Edexcel IGCSE Mathematics A Student Book 2	Unit 1: Number 1 page 5-7

Module 2 — Powers and roots — Time: 3 – 5 hours

Target grades: A*/A/B/C

Content	Area of specification
Squares and square roots	1.4
Cubes and cube roots	1.4
Using a calculator effectively to evaluate powers and roots	1.1
Powers of numbers – using index notation	1.4
Order of operations including powers (BIDMAS*)	1.1
Expressing a number as the product of powers of its prime factors	1.4
Using prime factors to evaluate Highest Common Factors (HCF) and Lowest Common Multiples (LCM)	1.4
Understanding and using powers which are zero, negative or fractions	1.4
Recognising the relationship between fractional powers and roots	1.4
Using laws of indices to simplify and evaluate numerical expressions involving integer, fractional and negative powers	1.4
Understanding the meaning of surds	1.4
Manipulating surds, including rationalising the denominator	1.4

*__BIDMAS__ = __B__rackets, __I__ndices, __D__ivision, __M__ultiplication, __A__ddition, __S__ubtraction

A/A* notes/tips

- In order for students to aspire to the top grades, it is essential that they are able to use algebraic manipulation and index notation confidently
- Remind students that when writing fractions, it is not usual to write surds in the denominator, because without a calculator, it is not always easy to work out the value of the fraction, eg $\frac{1}{\sqrt{2}}$, but 'rationalising' the denominator will help clear the surds from the denominator

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 3: Number 3 page 117 Unit 3: Number 3 page 114-116
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: Number 2 page 66-70

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 3 — Fractions **Time: 1 – 3 hours**

Target grades: B/C/D

Content	Area of specification
Converting between fractions and decimals	1.2
Ordering fractions using common denominators or by conversion to decimals	1.2
Adding and subtracting fractions using common denominators	1.2
Multiplying and dividing fractions by an integer, by a unit fraction and by a general fraction	1.2
Using fractions in problems	1.2
Calculating a fraction of a quantity	1.2
Expressing one quantity as a fraction of another	1.2

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Number 2 page 57-58
Edexcel IGCSE Mathematics A Student Book 2	Unit 5: Number 5 (Revision) page 334, 339-345 (selected questions)

Module 4 — Percentages

Time: 2 - 4 hours

Target grades: A*/A/B/C/D

Content	Area of specification
Understanding that percentage means 'number of parts per hundred'	1.6
Converting between percentages, fractions and decimals	1.6
Calculating percentages of quantities	1.6
Increasing or decreasing quantities by a given percentage	1.6
Expressing one quantity as a percentage of another	1.6
Finding 100 per cent when another percentage is given	1.6
Calculating percentage increases or decreases (percentage profit or loss)	1.6
Understanding the multiplicative nature of percentages as operators	1.6
Efficient use of a calculator to solve problems involving percentages, for example simple interest and compound interest, including depreciation	1.6
Solving reverse percentage problems by carrying out an appropriate division	1.6
Solving problems involving repeated percentage change	1.6

Prior knowledge

Number: Modules 1 and 3

Notes

All working out should be shown

A/A* notes/tips

- This is an opportunity to focus on financial arithmetic through using simple and compound interest through using:
  - Simple interest $A = P(1 + \frac{Rn}{100})$
  - Compound interest $A = P(1 + \frac{R}{100})^n$
- Questions which involve savings, credit and loans, inflation and exchange rates offer many opportunities to ensure that the students have a confident working knowledge of this material

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 3: Number 3 page 110-113 Unit 4: Number 4 page 167-169 Unit 5: Number 5 (Revision) page 345 (selected questions)

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 5 — Ratio and proportion

Time: 2 – 4 hours

Target grades: B/C/D

Content	Area of specification
Basic idea of ratio	1.7
Simplifying ratios including simplest form	1.7
Expressing a ratio in the form 1 : n	1.7
Relating ratio to fractions	1.7
If one of the two quantities in a given ratio is known, find the other, including using the unitary method	1.7
Dividing a quantity in a given ratio into two or three parts	1.7
Problems involving ratio, including scale diagrams and maps	1.7
Using direct proportion, including recipes and currency conversion	1.7

Prior knowledge

Number: Modules 1 and 3

Calculator skills

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Number 2 page 59 Unit 2: Number 2 page 61-63
Edexcel IGCSE Mathematics A Student Book 2	Unit 5: Number 5 (Revision) page 338, 339-345 (selected questions)

Module 6 — Standard form

Time: 3 – 5 hours

Target grades: A/B/C

Content	Area of specification
Expressing numbers in standard form	1.9
Writing numbers expressed in standard form as ordinary numbers	1.9
Calculating with numbers in standard form	1.9
Solving problems involving standard form	1.9

Notes

Although students can, where appropriate, use their calculators for questions involving standard form, their answers should be expressed in conventional standard form, for example 2.3×10^5, not as a calculator display such as 2.5^{05}

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Number 1 page 5-6 Unit 2: Number 2 page 55-57
Edexcel IGCSE Mathematics A Student Book 1	Unit 5: Number 5 (Revision) page 335, 339-345 (selected questions)

Module 7 — Degree of accuracy — Time: 5 – 7 hours

Target grades: A*/A/B/C/D

Content	Area of specification
Rounding numbers to one significant figure and use for estimating	1.8
Rounding numbers to two or three significant figures	1.8
Rounding numbers to one, two or three decimal places	1.8
Carrying out rounding appropriate to a context	1.8
Expressing a calculator display to an appropriate degree of accuracy	1.8
Finding upper and lower bounds, ie maximum and minimum values for rounded values	1.8
Solving problems using upper and lower bounds where values are given to a degree of accuracy	1.8
Selecting and justifying appropriate degrees of accuracy	1.8

Notes

Students should be encouraged to include more accurate answers in their working before rounding to ensure they receive marks for correct calculations even if there is a rounding error.

Students should be aware that correct rounding will give a number of the same magnitude as the original.

Rounding to a level of accuracy should be emphasised continually.

A/A* notes/tips

- Remind students that upper and lower bounds can be worked out for quantities that have been rounded to a given level of accuracy
- Students should be reminded that typically questions involving degrees of accuracy often require careful analysis, as information is often given that is not exact
- It is helpful for students to know that least value is the same as lower bound or minimum value. Similarly greatest value is the same as upper bound or maximum value
- Remind students that sometimes the prolem is less straightforward when working with compound measures involving division

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 4: Number 4 page 170-172
Edexcel IGCSE Mathematics A Student Book 2	Unit 5: Number 5 (Revision) page 334

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 8 — Set language and notation

Time: 5 – 7 hours

Target grades: A/B/C/D

Content	Area of specification
Meaning of 'set'	1.5
Defining sets of numbers by describing, for example {first four odd numbers}, $\{x:$ x is a factor of 12 or by listing, eg {1, 3, 5, 7}	1.5
Understanding the meaning of the universal set $\mathcal{E}$	1.5
Understanding the meaning of the null or empty set Ø or { }	1.5
Membership of a set including the notation $\in$ and $\notin$	1.5
Intersection and union of sets including the notation $\cap$ and $\cup$	1.5
Understanding sets defined in algebraic terms	1.5
Understanding and using subsets, including $\subset$ notation	1.5
Understanding and using the complement of a set (A')	1.5
Using Venn diagrams to represent sets and the number of elements in sets	1.5
Using the notation $\mathrm{n}(A)$ for the number of elements in the set A	1.5
Using sets in practical situations	1.5

Notes

Inequality notation may be used, {eg x: $2 \leq x < 5$}

A/A* notes/tips

- Students should recognise that to score all the marks in Venn diagram problems, the layout of the sets needs to be correct, and appropriately labelled
- Common mistakes occur when students do not fully understand or know set theory notation, in particular the meaning of n

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Sets 1 page 39-47
Edexcel IGCSE Mathematics A Student Book 2	Unit 1: Sets 1 page 45-53

ALGEBRA

Module 1 — Algebraic manipulation Time: 3 - 5 hours

Target grades: A*/A/B/C/D

Content	Area of specification
Multiplying a single term over a bracket	2.2
Factorising by taking out a single common factor	2.2
Finding and simplifying the product of two linear expressions, eg $(2x + 3)(3x - 1)$, $(3x - 2y)(5x + 3y)$	2.2
Factorising quadratic expressions, including the difference of two squares	2.2
Adding and subtracting algebraic fractions, including simplifying algebraic fractions by cancelling common factors	2.2
Numerator and/or the denominator may be numeric, linear or quadratic	2.2

Notes

Emphasise importance of using the correct symbolic notation, for example $3a$ rather than
$3\,x\,a$ or $a3$. Students should be aware that there may be a need to remove the numerical HCF of a quadratic expression before factorising it in order to make factorisation more obvious

A/A* notes/tips for Higher tier

- Students need to be reminded that they should always factorise algebraic expressions completely, setting their work out clearly
- In order for students to work towards to the top grades, it is essential that they are confidently able to manipulate algebraic expressions in a variety of situations
- When simplifying algebraic fractions, students should be encouraged to fully factorise both the numerator and the denominator, where possible
- A typical common error is for students to 'cancel out' the terms in x
- Simplifying algebraic fractions is usually a challenging topic for many students. A key point is that algebraic fractions are actually generalised arithmetic, and that the same rules apply

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Algebra 1 page 11-12 Unit 2: Algebra 2 page 65-67 Unit 3: Algebra 3 page 121-123
Edexcel IGCSE Mathematics A Student Book 2	Unit 5: Algebra 5 (Revision) page 346-347

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 2 — Expressions and formulae Time: 5 – 7 hours

Target grades: A*/A/B/C/D

Content	Area of specification
Substituting positive and negative numbers, then fractions and decimals, into expressions, word formulae and algebraic formulae	2.3
Using formulae from mathematics, and other subjects, expressed initially in words or diagrammatic form and converting to variables or algebraic form	2.3
Deriving formulae	2.3
Manipulating formulae to change the subject, including cases where the subject occurs twice or where a power of the subject appears	2.3

A/A* notes/tips

- Students need to be reminded that changing the subject of the formula is identical to the process of solving an equation
- Students should be encouraged to set their work out clearly, in particular, keeping a careful check on the substitution of negative numbers into expressions and formulae, and to make use of brackets where necessary

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Algebra 2 page 69-72 Unit 4: Algebra 4 page 177-184

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 3 — Linear equations and simultaneous linear equations

Time: 5 - 7 hours

Target grades: B/C/D

Content	Area of specification
Inverse operations	2.4
Understanding and use of 'balancing' methods	2.4
Solving simple linear equations	2.4
Solving linear equations:	
• with two or more operations	2.4
• with the unknown on both sides	2.4
• with brackets	2.4
• with negative or fractional coefficients	2.4
• with combinations of these	2.4
Setting up and solving simple linear equations to solve problems, including finding the value of a variable which is not the subject of the formula	2.4
Solving simple simultaneous linear equations, including cases where one or both of the equations must be multiplied	2.6
Interpreting the equations as lines and their common solution as the point of intersection	2.6

Prior knowledge

Algebra: Modules 1 and 2

The idea that some operations are 'opposite' to each other

Notes

Students need to realise that not all linear equations can be solved easily by either observation or trial and improvement; a formal method is often needed

Students should leave their answers in fractional form where appropriate

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Algebra 1 page 12-17 Unit 2: Graphs 2 page 79-80 Unit 3: Algebra 3 page 126-130

Module 4 — Coordinates and graphs — Time: 4 – 6 hours

Target grade: C/D/E

Content	Area of specification
Determining the coordinates of points identified by geometrical information	3.3
Determining the coordinates of the midpoint of a line segment, given the coordinates of the two end points	3.3
Drawing and interpreting linear graphs representing real-life situations, including speed/time and distance/time graphs	3.3
Drawing and interpreting non-linear graphs representing real-life situations	3.3

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 3: Graphs 3 page 134-141

Module 5 — Linear graphs

Time: 4 - 6 hours

Target grades: A/B/C/D

Content	Area of specification
Recognising that equations of the form $x = a$ and $y = b$ correspond to straight line graphs parallel to the y-axis and to the x-axis respectively	3.3
Completing tables of values and drawing graphs with equations of the form $y = mx + c$ where the values of m and c are given and m may be an integer or a fraction	3.3
Drawing straight line graphs with equations in which y is given implicitly in terms of x, for example $x + y = 7$	3.3
Calculating the gradient of a straight line given its equation of the coordinates of two points on the line	3.3
Recognising that graphs with equations of the form $y = mx + c$ are straight line graphs with gradient m and intercept (0, c) on the y-axis	3.3
Finding the equation of a straight line given the coordinates of two points on the line	3.3
Finding the equation of a straight line parallel to a given line	3.3

Prior knowledge

Algebra: Modules 1, 2, 3 and 4

Notes

Axes should be labelled on graphs and a ruler should be used to draw linear graphs

Science experiments/work could provide results which give linear graphs

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Graphs 1 page 19-27

Module 6 — Integer sequences

Time: 3 – 5 hours

Target grades: B/C/D

Content	Area of specification
Using term-to-term and position-to-term definitions to generate the terms of a sequence	3.1
Finding and using linear expressions to describe the nth term of an arithmetic sequence	3.1

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book1	Unit 5: Sequences 5 page 254-264

Module 7 — Quadratic equations — Time: 6 – 8 hours

Target grade: A*/A/B/C

Content	Area of specification
Solving quadratic equations by factorisation	2.7
Solving quadratic equations by using the quadratic formula	2.7
Setting up and solving quadratic equations from data given in a context	2.7
Solving exactly, by elimination of an unknown, two simultaneous equations in two unknowns, one of which is linear in each unknown and the other is linear in one unknown and quadratic in the other	2.7
Solving exactly, by elimination of an unknown, two simultaneous equations in two unknowns, one of which is linear in each unknown and the other is linear in one unknown and the other is of the form $x^2 + y^2 = r^2$	2.7

Prior knowledge

Algebra: Modules 1 and 3

Notes

Remind students that they should factorise a quadratic before using the formula

A/A* notes/tips

- Remind students that it is important to always factorise completely before resorting to using the quadratic formula
- When applying the quadratic formula, students must substitute the correct values into the formula. They should be reminded that rounding or truncating during the process leads to inaccurate solutions
- Often solving equations with algebraic fractions is a challenge for most students, however they should be encouraged to show their working out through using a few lines of correct algebra. Remind students of the value of retaining the structure of the equation throughout their working, rather than merely treating the algebra as an expression to be simplified

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 5: Algebra 5 page 248-251
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: Algebra 2 page 71-80 Unit 3: Algebra 3 page 176-182

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 8 — Inequalities

Time: 4 - 6 hours

Target grades: A/B/C

Content	Area of specification
Understanding and using the symbols >, <, ≥ and ≤	2.8
Understanding and using the convention for open and closed intervals on a number line	2.8
Solving simple linear inequalities in one variable, including 'double-ended' inequalities	2.8
Representing on a number line the solution set of simple linear inequalities	2.8
Finding the integer solutions of simple linear inequalities	2.8
Using regions to represent simple linear inequalities in one variable	2.8
Using regions to represent the solution set to several linear inequalities in one or two variables	2.8
Solving quadratic inequalities in one unknown and representing the solution set on a number line	2.8

Prior knowledge

Algebra: Modules 3, 5 and 7

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Algebra 2 page 74-78, 81-86
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: Algebra 2 page 81-84 Unit 5: Algebra 5 page 356

Module 9 — Indices

Time: 4 - 6 hours

Target grades: A/B/C/D

Content	Area of specification
Using index notation for positive integer powers	2.1
Substituting positive and negative numbers into expressions and formulae with quadratic and/or cubic terms	2.1
Completing tables of values and drawing graphs of quadratic functions	3.3
Using index notation with positive, negative and fractional powers to simplify expressions	2.1

Prior knowledge

Algebra: Modules 2 and 4

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Number 2 page 60, 73-74 Unit 4: Graphs 4 page 185-190
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: Number 2 page 66-70

Module 10 — Proportion Time: 4 - 6 hours

Target grade: A*/A/B

Content	Area of specification
Setting up and using equations to solve problems involving direct or inverse proportion	2.5
Relating algebraic solutions to graphical representation of the equations	2.5

Prior knowledge

Algebra: Modules 1, 2 and 3

A/A* notes/tips

- Students need to be reminded that precision is required when setting up the formula. It is essential that they take note of the key words used in the question
- Common errors tend to be confusing direct and indirect (inverse) proportionality, leading to using the wrong formulae. This is indicative of mathematical misunderstanding rather than misreading, and no credit will be received

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Number 2 page 61-63 Unit 5: Number 5 page 233-238
Edexcel IGCSE Mathematics A Student Book 2	Unit 1: Number 1 page 8-18 Unit 5 Number 5 page 338-345 (selected questions)

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 11 — Function notation Time: 6 - 8 hours

Target grades: A*/A/B

Content	Area of specification
Understanding the concept that a function is a mapping between elements of two sets	3.2
Using function notation of the form $f(x) = \ldots$ and $f : x \mapsto \ldots$	3.2
Understanding the terms domain and range	3.2
Understanding which parts of the domain may need to be excluded	3.2
Understanding and using composite function fg and inverse function f^{-1}	3.2

Prior knowledge

Algebra: Modules 1, 2 and 3

A/A* notes/tips

- This tends to be demanding topic for students and in order to deepen their understanding of how to apply their knowledge of functions in different types of questions, they should be given plenty of practice
- Students may need to be reminded that $f(x) = y$
- When solving $f(x) = g(x)$, given the graphs of both functions, remind students that they should give their answers as solutions of x
- Remind students that when one function is followed by another, the result is a composite function, eg $fg(x)$ means do f first followed by g, where the domain of f is the range of g
- Students need to understand, and be able to, use the concepts of domain and range, as this will enable them to develop an appropriate working knowledge of functions. In particular, students must be familiar with the concept that division by zero is undefined, eg for $g(x) = \frac{1}{x-2}$, $x - 2 \neq 0$, which means $x = 2$ must be excluded from the domain of g
- For inverse functions, remind students that the inverse of $f(x)$ is the function that 'undoes' whatever $f(x)$ has done, and that the notation $f^{-1}(x)$ is used
- It is helpful to remind students that if the inverse function is not obvious then:
  - Step 1: write the function as $y =$…
  - Step 2: change any x to y, and any y to x
  - Step 3: make y the subject, giving the inverse function

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 3: Algebra 3 page 183-197

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 12 — Harder graphs **Time: 6 – 8 hours**

Target grades: A*/A/B

Content	**Area of specification**
Plotting and drawing graphs with equation $y = Ax^3 + Bx^2 + Cx + D$ in which (i) the constants are integers and some could be zero (ii) the letters x and y can be replaced with any other two letters	3.3
Plotting and drawing graphs with equation $y = Ax^3 + Bx^2 + Cx + D + \frac{E}{x} + \frac{F}{x^2}$ in which (i) the constants are integers and at least three of them are zero (ii) the letters x and y can be replaced with any other two letters	3.3
Finding the gradients of non-linear graphs by drawing a tangent	3.3
Finding the intersection points of two graphs, one linear (y_1) and one non-linear (y_2) and recognising that the solutions correspond to $y_2 - y_1 = 0$	3.3

Prior knowledge

Algebra: Modules 1, 2, 3, 5 and 9

Notes

Students should be made aware that they should not use rulers to join plotted points on
non-linear graphs

When plotting points or reading off values from a graph, the scales on the axes should be checked carefully

A/A* notes/tips

- Remind students that when finding an estimate for the gradient of a graph $y = f(x)$ at given point, a tangent drawn at this point is helpful, although a related, correct division, to find the gradient, is required to gain top marks in a question
- Students should recognise that cubic graphs have distinctive shapes that depend on the coefficient of x^3
- Students should recognise that reciprocal graphs have x as the denominator, and that they produce a type of curve called a hyperbola. An awareness of the concept of the smallest (minimum) value of y, and the value of x where this happens on the graph, is helpful

- Students should appreciate that an accurately drawn graph can be used to solve equations that may prove difficult to solve by other methods. They should also appreciate that most graphs of real-life situations are curves rather than straight lines. Information on rates of change can still be found by drawing a tangent to a curve, and using this to estimate the gradient of the curve at this point
- Students should recognise that the algebraic method is more accurate than the graphical method of solving simultaneous equations, in particular when one equation is linear and the other equation is nonlinear

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 1: Graphs 1 page 19-27 Unit 3: Graphs 3 page 198-209

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 13 — Calculus **Time: 6 – 8 hours**

Target grades: A*/A/B

Content	Area of specification
Understanding the concept of a variable rate of change	3.4
Differentiating integer powers of x	3.4
Determining gradients, rates of change, maxima and minima by differentiation and relating these to graphs	3.4
Applying calculus to linear kinematics and to other simple practical problems	3.4

Prior knowledge

Algebra; Modules 1, 2, 5, 9 and 12

Notes

When applying calculus to linear kinematics, the reverse of differentiation will not be required

A/A* notes/tips

- Student should understand that the process of finding the gradient of a curve is called differentiation, where the result is the derivative or the gradient function, and that the gradient of a curve can also be represented by $\frac{dy}{dx}$
- Students should be encouraged to set their work out appropriately, maintaining the structure of their solution, as this will aid their understanding, and revision, of the topic, particularly as it increases in complexity
- Students need to understand the turning points are points on the curve where the gradient is zero. They should also be able to distinguish between a minimum turning point and a maximum turning point
- Students need to be able to apply their knowledge of differentiation to the motion of a particle in a straight line, including speed and acceleration

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 4: Graphs 4 page 268-287

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

SHAPE, SPACE AND MEASURES

Module 1 — Average speed — Time: 2 - 4 hours

Target grades: B/C/D

Content	Area of specification
Understanding and using the relationship between average speed, distance and time	4.4

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 5: Graphs 5 page 365

Module 2 — Construction Time: 3 – 5 hours

Target grades: B/C/D

Content	Area of specification
Constructing triangles and other 2-D shapes using a ruler, protractor and compasses	4.5
Using three-figure bearings to specify direction	4.4
Using scale drawings to solve problems	4.5
Using straight edge and compasses to construct the perpendicular bisector of a line segment the bisector of an angle	4.5

Notes

Encourage students to use sharp pencils to improve the neatness and accuracy of their drawings

A tolerance of 2° is reasonable for angles

A sturdy pair of compasses is essential

Students often confuse

(i) the direction from which a bearing is measured

(ii) measuring angles larger than 90° on a diagram

Resources

Text book title	Text book ref
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Shape and space 1 page 32-33, 52 Unit 2: Shape and space 2 page 91

Module 3 — Geometry Time: 3 – 5 hours

Target grades: B/C/D

Content	Area of specification
Using parallel lines, alternate angles and corresponding angles	4.1
Using the angle sum of a triangle to calculate angles in triangles	4.1
Using angle properties of isosceles, equilateral and right-angled triangles	4.1
Understanding that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices	4.1
Using the angle sum of a quadrilateral to calculate angles in quadrilaterals	4.2
Understanding and using the properties of the parallelogram, rectangle, square, rhombus, trapezium and kite	4.2
Calculating and using the sums of the interior angles of polygons	4.2
Calculating and using the sum of the exterior angles of polygons	4.2
Calculating the interior and exterior angles of regular polygons	4.2
Providing reasons, using standard geometrical statements to support numerical values for angles obtained in any geometrical context involving lines and polygons	4.7

Notes

Students should be made aware that given diagrams will not be drawn to scale and that they should not assume geometrical facts that are not given in the question

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Shape and space 1 page 28-30 Unit 1: Shape and space 1 page 31

Module 4 — Transformations Time: 4 – 6 hours

Target grades: A/B/C/D

Content	Area of specification
Understanding that rotations are specified by a centre and an angle	5.2
Rotating a shape about a point, measuring the angle of rotation in right angles, degrees or simple fractions of a turn	5.2
Understanding that an anti-clockwise rotation is a positive angle rotation and a clockwise rotation is a negative angle rotation	5.2
Understanding that reflections are specified by a mirror line, for example $x = 1$, $y = x$ on a coordinate grid	5.2
Reflecting shapes in a mirror line	5.2
Constructing a mirror line, given a shape and its reflection	5.2
Understanding that translations are specified by vectors	5.2
Translating a shape, given the vector	5.2
Recognising that rotations, reflections and translations preserve length and angle so that a transformed shape under any of these transformations is congruent to the original shape	5.2
Understanding that enlargements are specified by a centre and a scale factor	5.2
Constructing enlargements of shapes with positive and fractional scale factors	5.2
Identifying the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments	5.2
Recognising that enlargements preserve angle but not length	5.2
Describing transformations in full	5.2
Describing a single transformation which is equivalent to a combination of transformations	5.2

Notes

Students often lose marks in the examination because they do not give a complete description of a transformation. For example, the centre of rotation is often omitted and the name of the transformation itself left out

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 5: Shape and space 5 page 265-278
Edexcel IGCSE Mathematics A Student Book 2	Unit 5: Shape and space 5 (Revision) page 378

Module 5 — Circle properties Time: 6 – 8 hours

Target grades: A*/A/B/C/D

Content	Area of specification
Knowing and using these circle properties:	
• two tangents from a point to a circle are equal in length	4.6
• tangents are perpendicular to the radius at the point of contact	4.6
• the line from the centre of a circle which is perpendicular to a chord bisects the chord (and the converse is true)	4.6
Recognising the term *cyclic quadrilateral*	4.6
Understanding and using angle properties of the circle including:	
• an angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the remaining part of the circumference	4.6
• an angle subtended at the circumference by a diameter is a right angle	4.6
• angles in the same segment are equal	4.6
• the sum of the opposite angles of a cyclic quadrilateral is 180°	4.6
• the alternate segment theorem	4.6
Understanding and using the internal and external intersecting chord properties	4.6
Providing reasons, using standard geometrical statements, to support numerical values for angles obtained in any geometrical context involving circles	4.7

Notes

Students should be made aware that diagrams on examination papers will not be drawn to scale and that they should not assume geometrical facts that are not given in the question

A/A* notes/tips

- Student should be encouraged to always draw a neat diagram, using all the given facts. They should remember to use the basic geometrical facts to help them move through the problem
- Students should know that a figure is cyclic if a circle can be drawn through its vertices, and that the vertices are the concyclic points
- It is helpful if students are familiar with the terminology associated with circle theorems
- Students should develop the habit of giving a reason, in brackets, after each geometrical statement

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 4: Shape and space 4 page 194-204
Edexcel IGCSE Mathematics A Student Book 2	Unit 1: Shape and space 1 page 28-44 Unit 5: Shape and space 5 (Revision) page 379

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 6 — Area and perimeter Time: 4 – 6 hours

Target grades: A/B/C/D

Content	Area of specification
Finding the areas of rectangles, triangles, parallelograms and trapezia, using relevant formulae	4.9
Finding circumferences and areas of circles using relevant formulae	4.9
Finding the areas of compound shapes made from rectangles and triangles	4.9
Finding perimeters and areas of sectors of circles	4.9
Converting between units of length and of area within the metric system, for example m^2 and cm^2	4.9

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: shape and space page 98-139 Unit 2: Number 2 page 60-62

Module 7 — 3-D shapes and volume Time: 4 – 6 hours

Target grades: A/B/C/D

Content	Area of specification
Understanding the terms face, edge and vertex in the context of a 3-D solid	4.9
Finding the volumes of right prisms, including cuboids and cylinders, using appropriate formulae	4.9
Finding the surface areas of solids with rectangular and triangular faces	4.9
Finding the surface area and/or volume of a sphere and of a right circular cone using relevant formulae	4.9
Converting between units of volume within the metric system, for example cm^3 and litres, m^3 and cm^3	4.9

Prior knowledge

Shape, space and measures: Module 6

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: Number 2 page 63 Unit 2: Shape and space page 112-123

Module 8 — Pythagoras' theorem Time: 3 – 5 hours

Target grade: B/C/D

Content	Area of specification
Understanding and using Pythagoras' theorem in 2-D to find the length of the hypotenuse or that of one of the shorter sides of a right-angled triangle	4.8
Using Pythagoras' theorem to solve problems	4.8

Notes

When producing their answers students should remember that:

- the hypotenuse is the longest side
- the hypotenuse is less than the sum of the lengths of the other two sides

Some students find questions on this topic much more difficult if the orientation of the triangle is unusual

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 4: Shape and space 4 page 212-215
Edexcel IGCSE Mathematics A Student Book 2	Unit 5: Shape and space 5 (Revision) page 380

Module 9 — Trigonometry Time: 3 – 5 hours

Target grade: B/C/D

Content	Area of specification
Identifying the various sides of a right-angled triangle as the hypotenuse, opposite and adjacent	4.8
Understanding and using sine, cosine and tangent of acute angles to find lengths and angles in a right-angled triangle	4.8
Using trigonometry to solve problems, including bearings	4.8
Using Pythagoras' theorem and trigonometry to solve problems	4.8

Notes

Students should ensure that their calculators are in 'degree mode' before tackling trigonometry questions

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Shape and space 2 page 87-94 Unit 3: Shape and space 3 page 142-153

Module 10 — Similar shapes Time: 6 – 8 hours

Target grade: A*/A/B/C

Content	Area of specification
Understanding that, if two shapes are similar their corresponding angles are equal and all their corresponding lengths are in the same ratio	4.10
Using similarity to find lengths of sides	4.10
Understanding that areas of similar figures are in the ratio of the square of corresponding sides	4.10
Understanding that the volumes of similar figures are in the ratio of the cube of corresponding sides	4.10
Using areas and volumes of similar figures in solving problems	4.10

Notes

Some students have difficulty in identifying correct ratios of quantities (lengths, areas, volumes) particularly when an area or a volume ratio of similar figures is given

A/A* notes/tips

- When working with similar shapes, a common error is the use of the slant height of a 3-D shape, instead of the vertical height, when calculating volumes

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 4: Shape and space 4 page 205-212
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: Shape and space 2 page 112-139

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 11 — Advanced trigonometry Time: 6 – 8 hours

Target grade: A*/A/B/C

Content	Area of specification
Understanding and using sine, cosine and tangent of obtuse angles	4.8
Understanding and using angles of elevation and depression	4.8
Using Pythagoras' theorem in 3-D	4.8
Understanding and using $\frac{1}{2}ab\sin C$ for the area of a triangle	4.8
Understanding and using the sine rule and the cosine rule for any triangle	4.8
Applying trigonometrical methods to solve problems in 3-D, including finding the angle between a line and a plane but not the angle between two planes	4.8

Prior knowledge

Shape, space and measures: Modules 8 and 9

Notes

The concept that angles of elevation and depression are measured from the horizontal should be emphasised

Arithmetical methods in handling the cosine rule, particularly with obtuse angles, should be emphasised

A/A* notes/tips

- Student will need to recognise when to use trigonometry, in particular they need to recognise when it is more appropriate to use the cosine rule, rather than the sine rule. In these instances, this skill is essential when tackling the more non-routine questions aimed at the top grades
- Often students recognise that using the cosine rule is the more appropriate problem-solving technique; however a common error is misquoting it. Students should be able to confidently use the cosine rule, in terms of both sides and angles
- In order to access the top grades, students should appreciate the need to analyse the question carefully and then choose the appropriate method of solution first time.
- This means that students need to develop the skill of manipulating the cosine rule with confident ease. They should set out their solutions clearly, maintaining the correct structure of their solutions, as this will assist with developing this important skill
- Students also need to develop an awareness of the value of an 'exact' value, and they need to be able to demonstrate this awareness in their working out, and not assume that by writing down all the decimal points from their calculator display that this indicates exactness. They should be confident to use functions, surds or algebra to show their working out, and they should be able to retain values written as $\sin(a)$ or $\cos(b)$

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 4: Shape and space 4 page 288-314

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 12 — Vectors Time: 5 – 7 hours

Target grade: A*/A/B

Content	Area of specification
Understanding that a vector has both magnitude and direction	5.1
Understanding and using vector notation	5.1
Multiplying vectors by scalar quantities	5.1
Adding and subtracting vectors	5.1
Calculating the modulus (magnitude) of a vector	5.1
Finding the resultant of two or more vectors	5.1
Applying vector methods for simple geometrical proofs in 2-D	5.1

A/A* notes/tips

- It is usual for students to find the initial stages of a vector question quite straightforward, with the last stage rather more challenging
- Students should be encouraged to use geometrical properties to enable them to solve the more demanding aspects of vector questions. Students should develop the habit of maintaining the structure of their solutions, and applying simple algebraic manipulations where necessary
- Students should be able to make use of the result of adding a set of vectors, as well as the use of geometrical properties and algebraic manipulation, in order to solve the more demanding aspects of the questions. At this level, it is about analysing the question, combined with an awareness of selecting the most appropriate methods of solution

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 3: Shape and space page 210-225

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

HANDLING DATA

Module 1 — Graphical representation of data Time: 4 - 6 hours

Target grades: A*/A/B

Content	Area of specification
Constructing cumulative frequency diagrams from tabulated data	6.1
Using cumulative frequency diagrams	6.1
Constructing and interpreting histograms for unequal class intervals	6.1

Notes

Students need to be aware that the upper bound of the class interval is used to plot points in a cumulative frequency diagram

A/A* notes/tips

- Student need to understand that in a histogram, frequency is proportional to the area of the bar
- When working with histograms, students should be encouraged to work with the most successful and shortest method, which is to calculate and then mark on the vertical axis, the frequency densities. This approach often leads onto using efficient methods for working with histograms

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 5: Handling data 5 page 282-291
Edexcel IGCSE Mathematics A Student Book 2	Unit 3: Handling data 3 page 226-235

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Module 2 — Statistical measures

Time: 3 – 5 hours

Target grades: B/C/D

Content	Area of specification
Understanding the concept of average as a value which is representative of a set of data	6.2
Finding the mean, median, mode and range for a discrete data set from a frequency table	6.2
Selecting the most appropriate average	6.2
Finding the modal class for grouped data	6.2
Calculating an estimate for the mean for grouped data, using halfway values	6.2
Estimating the median from a cumulative frequency diagram	6.2
Understanding the concept of a measure of spread	6.2
Estimating the quartiles and the interquartile range from given data or from a cumulative frequency diagram	6.2

Notes

Students need to be aware that the median and quartiles are read off as values from the y-axis

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Handling data 2 page 97-98, 107, 164 Unit 3: Handling data 3 page 154-160 Unit 5: Handling data 5 page 279-281

Module 3 — Probability Time: 5 – 7 hours

Target grades: A*/A/B/C/D

Content	Area of specification
Understanding sample spaces and using them to find the probability that an event will occur	6.3
Listing all the outcomes for single events systematically, or for two successive events, and using lists to find the probability that an event will occur	6.3
Using the sum of probabilities of all possible outcomes equalling one	6.3
Understanding the meanings of 'equally likely' and 'mutually exclusive'	6.3
Using the addition rule for probability for mutually exclusive events	6.3
Understanding and using expected frequency to calculate an estimate for the number of times an event will occur	6.3
Determining the probability that two or more independent events will both occur	6.3
Knowing when to add or multiply probabilities	6.3
Using simple conditional probability when combining events	6.3
Drawing tree diagrams to show the outcomes of two or more successive events and related probabilities	6.3
Using tree diagrams to solve probability problems	6.3

Notes

You may need to remind students that only fractions, decimals and percentages can be used for probability. Answers such as '2 in 3', '2 out of 3' and '2 : 3' would be penalised in the examination

A/A* notes/tips

- Student should be able to handle the 'at least' situation through using efficient methods, eg by using P(E) + P($\overline{E}$) = 1
- Students should recognise when it is necessary to consider additional combinations when solving problems. A common error tends to be considering only one combination instead of all the necessary combinations
- Students need to be able to use tree diagrams, with confidence. If tree diagrams are used, students need to include the necessary labels and appropriate values

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: Handling data 2 page 140-151 Unit 4: Handling data 4 page 315-325

See Appendix 1 for references to past paper questions for students aiming for top grades in this module

Resources

Student and Practice Books

Edexcel's own Student Books and Practice Books published specifically for the following specifications

- **IGCSE 2009 Mathematics A**
- **The Edexcel Level 1/Level 2 Certificate in Mathematics**

provide complete coverage of the specification and plenty of exercises and practice exam questions in addition to a FREE ActiveBook CD.

- *Edexcel IGCSE Mathematics A Student Book 1*
  D A Turner, I A Potts, W R J Waite, B V Hony
  ISBN 978-0 435966 91 1
- *Edexcel IGCSE Mathematics A Student Book 2*
  D A Turner, I A Potts, W R J Waite, B V Hony
  ISBN 978-0 435966 92 8
- *Edexcel IGCSE Mathematics A Practice Book 1*
  D A Turner, I A Potts
  ISBN 978-0 435044 16 9
- *Edexcel IGCSE Mathematics A Practice Book 2*
  D A Turner, I A Potts
  ISBN 978-0 435044 15 2

Visit www.pearsonglobalschools.com/igcse for more information and to order your copies now.

These texts are the updated versions of the *Longman Mathematics for IGCSE* resources below which were published in 2005-2007.

- Turner D, Potts I, Waite W and Hony V – *Longman Mathematics for IGCSE Book 1* ISBN 9781405802116
- Turner D, Potts I, Waite W and Hony V – *Longman Mathematics for IGCSE Book 2* ISBN 9781405802123
- Turner D and Potts I – *Longman Mathematics for IGCSE Practice Book 2* ISBN 9781405865043
- Turner D and Potts I – *Longman Mathematics for IGCSE Practice Book 1* ISBN 9781405865036
- Turner D, Potts I, Waite W and Hony V – *Longman Mathematics for IGCSE ActiveTeach 1* ISBN 9781405865876
- Turner D, Potts I, Waite W and Hony V – *Longman Mathematics for IGCSE ActiveTeach 2* ISBN 9781405865883

Endorsed books

For the Edexcel IGCSE Mathematics A specification, the additional titles below have been endorsed by Edexcel and could be used as teaching aids. The internet is also valuable as a tool for research and learning.

Please note that while resources are checked at the time of publication, materials may be withdrawn from circulation and website locations may change at any time.

There are no content changes between the IGCSE Mathematics A and the Edexcel Certificate in Mathematics specifications. This means that the following titles are also suitable for the Certificate.

- Appleton M, Demetriou D, Huby D and Kranat J – *IGCSE Mathematics for Edexcel* (Oxford University Press, 2007) ISBN 9780199152629
- Johnson T and Clough T – *Edexcel IGCSE Mathematics Practice* (Hodder Murray 2008) ISBN 9780340966273
- Metcalf P – *IGCSE Mathematics for Edexcel* (Collins Education, 2006) ISBN 9780007755486
- Smith A – *IGCSE Mathematics for Edexcel* (Hodder Murray 2008) ISBN 9780340945414
- *Revision Guide for IGCSE Maths Higher Tier* (ZigZag Education)

Appendices

Appendix 1: References to past paper questions for students aiming for top grades

The table below gives references to past papers. The questions can be used to focus on the more demanding topics for the students aiming at the top grades.

Module number		Topic area	Past question references IGCSE (4400)
Number	2	Powers and roots	November 2009 3H Q25 May 2010 3H Q 16
	7	Degrees of accuracy	May 2009 3H Q20 November 2009 3H Q23
Algebra	1	Algebraic manipulation	November 2009 3H Q19 May 2010 3H Q18
	2	Expressions and formulae	November 2004 3H Q 18 May 2006 3H Q20
	7	Quadratic expressions	May 2009 4H Q16 May 2009 4H Q21
	10	Proportion	November 2009 3H Q21 November 2009 4H Q20 May 2010 3H Q15
	11	Function notation	November 2009 3H Q24 May 2010 4H Q15
	12	Graphs of functions	November 2009 3H Q15
	13	Calculus	May 2009 4H Q17 November 2009 4H Q19
Shape, space and measures	5	Circle properties	November 2008 3H Q20 November 2009 4H Q21
	10	Similar shapes	May 2007 3H Q18 May 2009 3H Q16
	11	Advanced trigonometry	November 2009 3H Q22 May 2010 4H Q18
	12	Vectors	May 2009 4H Q18 May 2010 4H Q21
Data handling	1	Graphical representation of data	May 2009 4H Q19 May 2010 4H Q15
	3	Probability	November 2009 3H Q20 November 2009 4H Q16 May 2009 3H Q17 May 2010 3H Q19

Appendix 2: References to past paper questions for content not currently assessed at GCSE Mathematics

These topics are **not** included in GCSE Mathematics, but are included in IGCSE Mathematics.

Module number		Topic area	Past question references IGCSE (4400)
Number	8	Set language and notation	November 2010 1F Q20 November 2010 3H Q7 May 2010 4H Q6
Algebra	8	Quadratic inequalities	November 2005 3H Q15
	11	Function notation	November 2009 3H Q24 November 2010 3H Q21 June 2010 4H Q20
	12	Finding the gradient of a curve at a point by drawing a tangent	May 2008 3H Q21
	13	Calculus	November 2009 4H Q19 November 2010 3H Q16
Shape, space and measures	5	Intersecting chord theorem	May 2008 4H Q18 November 2010 4H Q19
	12	Modulus of a vector	May 2008 4H Q21
Data handling	3	Simple conditional probability	November 2010 1F Q13 November 2010 3H Q17 November 2010 4H Q14

Appendix 3: The use of the calculator

The range of functions on calculators is increasing all the time. Current models can be used to answer questions on a number of topics including fractions, surds, standard form, recurring decimals and equations. It would clearly be unfair if sophisticated calculators gave candidates an advantage in the examination.

In addition to ensuring fairness to candidates, another of our aims as examiners is to encourage good classroom practice. Appropriate and efficient use of calculators is desirable but reliance on them at the expense of understanding and learning mathematical techniques is not.

The style of some questions on certain topics and the way in which they are marked help us achieve these aims. To assist teachers preparing students for the examination, examples of such questions are given below; model solutions, which are not unique, are also provided.

Fractions

Example 1 (*Foundation*/*Higher*)

Show that $\frac{2}{3}+\frac{3}{4}=1\frac{5}{12}$

(2 marks)

Solution $(\frac{2}{3}+\frac{3}{4}) = \frac{8}{12}+\frac{9}{12}$

$= \frac{17}{12}$

$= (1\frac{5}{12})$

Comment

The marks would be awarded for the unbracketed steps of the solution. Obviously, when the answer is given, candidates must give every necessary step in the working and it is better for them to err on the side of giving too much working rather than too little.

Surds

Example 2 *(Higher)*

Show that $(2+\sqrt{3})^2 = 7+4\sqrt{3}$

(2 marks)

Solution
$$(2+\sqrt{3})^2 = 4+2\sqrt{3}+2\sqrt{3}+(\sqrt{3})^2$$
$$= 4+4\sqrt{3+3}$$
$$(= 7+4\sqrt{3})$$

Comment

$\sqrt{3}\times\sqrt{3}$ and $\sqrt{9}$ would be acceptable alternatives to $(\sqrt{3})^2$ in the expansion but, as the answer is given, 3 would not.

Standard form

Example 3 *(Higher)*

$x = 4\times10^n$ where n is an integer.

Find an expression, in standard form, for x^2

Give your expression as simply as possible.

(3 marks)

Solution
$$x^2 = (4\times10^n)^2$$
$$= 16\times(10^n)^2$$
$$= 16\times10^{2n}$$
$$= 1.6\times10\times10^{2n}$$
$$= 1.6\times10^{2n+1}$$

Equations

"Spotting" a solution and showing, by substitution, that it satisfies an equation will not, in general, qualify as "sufficient working". The example below shows two possible methods and there will often be more than one acceptable method. We advise teachers to consult past mark schemes for more examples of different methods.

Example 4 *(Higher)*

Solve $\frac{7y-2y}{4}=2y+3$

(4 marks)

Solution 1

Step	Notes
$4\times\frac{7-2y}{4}=4(2y+3)$ or $7-2y=4(2y+3)$	Demonstrates clear intention to multiply both sides by 4 or a multiple of 4, for example, $4\times\frac{7-2y}{4}$ or $7-2y$
	= 4 × 2y + 3 or 8y + 3 or 2y + 3 × 4 or 2y + 12
$7-2y=8y+12$ **or simpler**	Correct expansion of brackets (usually $8y+2y=7-12$) or correct rearrangement of correct terms eg 8y + 2y = 7 − 12
$10y=-5$ **or** $-10y=5$	Reduction to correct equation of form $ay = b$
$y=\frac{1}{2}$	$-\frac{5}{10}$ and −0.5 are acceptable equivalents but not −5 ÷ 10 etc

Solution 2

Step	Notes
$\frac{7}{4}-\frac{2y}{4}=2y+3$	Division of both terms on LHS by 4
$\frac{7}{4}-3=2y+\frac{2y}{4}$	Correct rearrangement of correct terms
$\frac{10y}{4}=-\frac{5}{4}$ or equivalent	Reduction to correct equation of form $ay = b$
$y=-\frac{1}{2}$	$-\frac{5}{10}$ and −0.5 are acceptable equivalents but not −5 ÷ 10 etc

Example 5 *(Higher)*

Solve $3x^2 - 8x + 2 = 0$

Give your solutions correct to 3 significant figures.

(3 marks)

Solution

Step	Notes
$x = \frac{8 \pm \sqrt{(-8)^2 - 4 \times 3 \times 2}}{2 \times 3}$	Correct substitution in the quadratic formula
$x = \frac{8 \pm \sqrt{64 - 24}}{6}$ $x = \frac{8 \pm \sqrt{40}}{6}$	Correct simplification of the quadratic formula
$x = 2.39$ or $x = 0.279$	Statement of solutions correct to 3 significant figures

2 Geometrical Reasoning

Centres should ensure that candidates are aware that the terms *F* angles, *Z* angles and *C* angles will receive no credit when given in geometrical reasons. The terms accepted are corresponding angles, alternate angles and allied (or co-interior) angles respectively, although knowledge of only the first two of these is required by the specification.

3 Set Language and Notation

Centres should also ensure that candidates are aware that, in lists of the members of the union of sets, the repetition of members is penalised.

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