Dawood Public School
Course Outline 2019-20
Cambridge O LevelMathematics (Syllabus D) 4024
Grade XI

Books:

- Seng, T.et al, 2006, New Syllabus Mathematics 1 (6th Edition), Singapore; Oxford University Press
- Seng, T.et al, 2006, New Syllabus Mathematics 2 (6th Edition), Singapore; Oxford University Press
- Seng, T.et al, 2008, New Syllabus Mathematics 3 (6th Edition), Singapore; Oxford University Press

Introduction:

This syllabus provides a comprehensive set of progressive learning objectives for mathematics. The objectives detail what the learner should know or what they should be able to do in each year of education. The learning objectives provide a structure for teaching and learning and a reference against which learners' ability and understanding can be checked.

This syllabus is designed to promote continuity, coherence and progression within the study of Mathematics. The syllabus builds on the knowledge, understanding and skills developed within the Key Stage of Study for Mathematics.

This syllabus has been designed to meet the requirements of the GCSE regulations.

In studying a course based on this specification, students should be encouraged to make appropriate use of Information and Communications Technology (ICT), for example, spreadsheets and databases.

It has been designed to be as free as possible from ethnic, gender, religious, political or other forms of bias.

Assessment:

All candidates take two papers: Paper 1 and Paper 2.

Each paper may contain questions on any part of the syllabus and questions will not necessarily be restricted to a single topic.

Paper 1: 2 hours
Paper 1 has approximately 25 short answer questions.
• Candidates should show all working in the spaces provided on the question paper. Omission of essential working will result in loss of marks. • **No calculators are allowed for this paper.** • **80** marks weighted at 50% of the total

Paper 2: 2 hours 30 minutes
Paper 2 has approximately 11 structured questions.
• Candidates should answer all questions. • **Electronic calculators may be used and candidates should have access to a calculator for this paper.** • Candidates should show all working in the spaces provided on the question paper. • Omission of essential working will result in loss of marks. • **100** marks weighted at 50% of the total

Assessment at a Glance

Additional materials for examinations:

For both Paper 1 and Paper 2, candidates should have these geometrical instruments:

- a pair of compasses
- a protractor
- a ruler

Tracing paper may be used as an additional material for both of the written papers.

For Paper 2, candidates should have an electronic calculator – see below for details.

Paper 1 – the use of all calculating aids is prohibited.
Paper 2 – all candidates should have a silent electronic calculator. A scientific calculator with trigonometric functions is strongly recommended.
• Unless stated otherwise within an individual question, three figure accuracy will be required. This means that four figure accuracy should be shown throughout the working, including cases where answers are used in subsequent parts of the question. Premature approximation will be penalised, where appropriate. • In Paper 2, candidates with suitable calculators are encouraged to use the value of π from their calculators. • The value of π will be given as 3.142 to 3 decimal places for use by other candidates. This value will be given on the front page of the question paper only.

Units

SI units will be used in questions involving mass and measures: the use of the centimetre will continue. Both the 12-hour clock and the 24-hour clock may be used for quoting times of the day. In the 24-hour clock, for example, 3.15 a.m. will be denoted by 03 15; 3.15 p.m. by 15 15, noon by 12 00 and midnight by 24 00.

Students will be expected to be familiar with the solidus notation for the expression of compound units, e.g. 5 cm/s for 5 centimetres per second, 13.6 g/cm3 for 13.6 grams per cubic centimetre.

Mathematical Instruments:

Apart from the usual mathematical instruments, candidates may use flexi curves in this examination.

Syllabus Aims and Assessment:

The syllabus demands understanding of basic mathematical concepts and their applications, together with an ability to show this by clear expression and careful reasoning.

In the examination, importance will be attached to skills in algebraic manipulation and to numerical accuracy in calculations.

Aims

The course should enable students to:

- develop their mathematical knowledge and oral, written and practical skills in a manner which encourages confidence;
- read mathematics, and write and talk about the subject in a variety of ways;
- develop a feel for number, carry out calculations and understand the significance of the results obtained;
- apply mathematics in everyday situations and develop an understanding of the part which mathematics plays in the world around them;
- solve problems, present the solutions clearly, check and interpret the results;
- develop an understanding of mathematical principles;
- recognise when and how a situation may be represented mathematically, identify and interpret relevant factors and, where necessary, select an appropriate mathematical method to solve

problems;
- use mathematics as a means of communication with emphasis on the use of clear expression;
- develop the abilities to reason logically, to classify, to generalise and to prove;

Assessment objectives:
The two assessment objectives in Cambridge O Level Mathematics are:

AO1 Mathematical techniques
AO2 Applying mathematical techniques to solve problems

AO1: Mathematical techniques
Candidates should be able to:
- recognise the appropriate mathematical procedures for a given situation
- perform calculations by suitable methods, with and without a calculator
- understand systems of measurement in everyday use and make use of them in the solution of problems
- estimate, approximate and work to degrees of accuracy appropriate to the context and convert between equivalent numerical forms
- organise, interpret and present information accurately in written, tabular, graphical and diagrammatic forms
- use mathematical and other instruments to measure and to draw to an acceptable degree of accuracy
- recognise and use spatial relationships in two and three dimensions, particularly when solving problems
- interpret, transform and make appropriate use of mathematical statements expressed in words or symbols
- recall, apply and interpret mathematical knowledge in the context of everyday situations

AO2: Applying mathematical techniques to solve problems
In questions which are set in context and/or which require a sequence of steps to solve, candidates should be able to:
- recognise patterns and structures in a variety of situations and form and justify generalisations
- make logical deductions from given mathematical data
- respond to a problem relating to a relatively unstructured situation by translating it into an appropriately structured form
- analyse a problem, select a suitable strategy and apply an appropriate technique to obtain its solution
- apply combinations of mathematical skills and techniques in problem solving
- set out mathematical work, including the solution of problems, in a logical and clear form using appropriate symbols and terminology

Relationship between assessment objectives and components

The weightings allocated to each of the assessment objectives (AOs) are summarised below:
The table shows the assessment objectives as an approximate percentage of each component and as an approximate percentage of the overall Cambridge O Level Mathematics qualification.

Component	AO1 (%)	AO2 (%)	Weighting of component in overall qualification (%)
Paper 1	55–65	35–45	50
Paper 2	28–38	62–72	50
Weighting of AO in overall qualification	40–50	50–60	

Breadth of Study:

During the key stage, students should be taught the knowledge, skills and understanding through:

a. activities that ensure they become familiar with, and confident using, standard procedures for the range of calculations appropriate to this level of study;
b. solving familiar and unfamiliar problems in a range of numerical, algebraic and graphical contexts and in open-ended and closed form;
c. using standard notations for decimals, fractions, percentages, ratio and indices;
d. activities that show how algebra, as an extension of number using symbols, gives precise form to mathematical relationships and calculations;
e. activities in which they progress from using definitions and short chains of reasoning to understanding and formulating proofs in algebra and geometry;
f. a sequence of practical activities that address increasingly demanding statistical problems in which they draw inferences from data and consider the uses of statistics in society;

Mathematical Notations:

The list which follows summarize the notation used:

Mathematical Symbols

=	is equal to
≠	is not equal to
≡	is identical to or is congruent to
≈	is approximately equal to
<; <<	is less than, is much less than
<	is less than or equal to
>; >>	is greater than, is much greater than
>	is greater than or equal to
∞	infinity

Operations

a+b	a plus b
a-b	a minus b
a×b, ab, a.b	a multiplied by b
a÷b, a, a/bb	a divided by b

Functions

f	function f
f (x)	the value of the function f at x
f :$A \rightarrow B$	f is a function under which each element of set A has an image in set B
f :$x \rightarrow$a	y the function f maps the element x to the element y
f^{-1}	the inverse of the function f
sin, cos, tan, cosec, sec, cot }	the circular functions
$\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, cosec^{-1}, $\sec^{-1}$, $\cot^{-1}$ }	the inverse circular relations

Set Notation

$\in$	is an element of
$\notin$	is not an element of
$\{x_1, x_2,\ldots\}$	the set with elements $x_1, x_2,\ldots$
{x: …}	the set of all x such that…
n (A)	the number of elements in set A
$\emptyset$	the empty set
ε	universal set
A´	the complement of the set A
N	the set of positive integers, {1, 2, 3, …}
z	the set of integers {0, ± 1, ± 2, ± 3, }
Z+	the set of positive integers {1, 2, 3, …}
Q	the set of rational numbers
Q+	the set of positive rational numbers, {x ∈ n: x > 0}
R	the set of real numbers
R+	the set of positive real numbers {x ∈ o: x > 0}
$\subseteq$	is a subset of
$\subset$	is a proper subset of
$\nsubseteq$	is not a subset of
$\not\subset$	is not a proper subset of
$\cup$	union
$\cap$	intersection
[a, b]	the closed interval {x ∈ R: a ≤ x ≤ b}
[a, b)	the interval {x ∈ R: a ≤ x < b}

Resource List:

Supplementary Text Books:

- Sang, T.et al, 2008, New Syllabus Mathematics Work book 1, 2 & 3 (6th Edition), Singapore; Oxford University Press
- Bostock, L, S Chandler, A Shepherd, E Smith ST(P) Mathematics Books 1A to 5A (Stanley Thornes)

Book 1A	Book 2A	Book 3A	Book 4A
Book 1B	Book 2B	Book 3B	Book 4B

- Buckwell, Geoff Mastering Mathematics (Macmillan Education Ltd) 0 333 62049 6
- Collins, J, Warren, T and C J Cox, Steps in Understanding Mathematics (John Murray) Book 1 Book 2 and Book 3
- National Mathematics Project (NMP) Mathematics for Secondary Schools Red Track Books 1 to 5 (Longman Singapore Publishers Pte Ltd); Book 1 Book 2 eme or t, Book 3 and Book 4.
- Cox, C J and D Bell Understanding Mathematics Books 1–5 (John Murray) Book 1 Book2 and Book 3
- MSM Mathematics Group MSM Mathematics Books 1, 2, 3Y, 4Y, 5Y (Nelson) Murray, Les Progress in Mathematics Books 1E to 5E (Stanley Thornes; Book 1E, Book 2E, Book 3E, Book 4E and Book 5E

Websites:

- www.nrich.com
- www.hoddereducation.com
- www.collinseducation.com
- www.pearsonschoolsandfecolleges.co.uk
- www.hoddereducation.com
- www.lettsandlonsdale.com
- www.counton.org
- www.math.com
- www.maths-help.co.uk
- www.mathsnet.net

Monthly Course Distribution

MONTH	CHAPTERS	DURATION
AUGUST	• Sets • Application of Sets to Problems	1 Week 2 Weeks
SEPTEMBER	• Loci and Construction • Vectors	3 Weeks 1 Weeks
OCTOBER	• Vectors • Geometrical Transformation	2 Weeks 2 Weeks
NOVEMBER	Revision for Mid-Year Examination	
DECEMBER	**Mid-Year Examination**	
JANUARY	• Revision Exercises • Past Papers	2 Weeks 2 Weeks
FEBRUARY	• Past Papers	2 Weeks 2 Weeks
MARCH	**Mock Examination**	

SYLLABUS CONTENT

August

Topic	Learning Objectives	Notes/Examples
Introduction to Sets Book 2 Chapter 10 Pages 287-308	• Use set language, set notation, and Venn diagrams to describe sets and represent relationships between sets as follows: ➢ Definition of sets, e.g. A = {x : x is a natural number} B = {(x, y): y = mx + c} C = {x : a ≤ x ≤ b} D = {a, b, c...} ➢ Notation: ○ Union of A and B - A U B ○ Intersection of A and B - A ∩ B ○ Number of elements in set A - n(A) ○ " . . . is an element of . . . "€ ○ Complement of set AA' ○ The empty set Ø ○ Universal setε ○ A is a subset of B	Includes using Venn diagrams to solve problems. Notation: Number of elements in set A n(A) "… is an element of …" ∈ "… is not an element of …" ∉ Complement of set A A' The empty set Ø Universal set Ɛ A is a subset of B A ⊆ B A is a proper subset of B A ⊂ B A is not a subset of B A ⊈ B A is not a proper subset of B A ⊄ B Union of A and B A ∪ B Intersection of A and B A ∩ B
Application of Sets Book 3 Addendum Chapter 1 Pages 1-19	• A ⊆ B A is a proper subset of B A ⊂ B A is not a subset of B A ⊄ B • A is not a proper subset of B A ⊄ B	

Learning Resources: Textbook

Online:

- www.mathsisfun.com/sets/venn-diagrams.html
- Set notation, Chapter 1: http://assets.cambridge.org/0521539021/sample/0521539021WS.pdf

Other:

- Large hoops can be marked with string or chalk to create human Venn diagrams.

4024 past examination papers:

- Jun 12 Paper 21 Q 1
- Jun 12 Paper 22 Q 6
- Nov 12 Paper 11 Q 21
- Nov 12 Paper 12 Q 14
- Jun 13 Paper 11 Q 24
- Jun 13 Paper 12 Q 10
- Nov 13 Paper 11 Q 14
- Nov 13 Paper 22 Q 5
- Jun 14 Paper 12 Q 11
- Jun 15 Paper 12 Q 8
- Nov 15 Paper 12 Q 15

September

Topic	Learning Objectives	Notes/Examples
Loci and Construction Book 4 Addendum Chapter 4 Pages 40-61	• Use the following loci and the method of intersecting loci: ➢ sets of points in two or three dimensions: a. which are at a given distance from a given point b. which are at a given distance from a given straight line, c. which are equidistant from two given points ➢ sets of points in two dimensions which are equidistant from two given intersecting straight lines	

Learning Resources: Textbook

Online:

- Work on loci and transformations: www.cimt.plymouth.ac.uk/projects/mepres/allgcse/bkc14.pdf
- BBC Bite size has work on loci: www.bbc.co.uk/schools/gcsebitesize/maths/geometry/

Other:

- Chalk, string and a metre ruler could be used to mark out a locus

4024 past examination papers:

- Jun 21 Paper 12 Q 8 b iii and 8 b iv
- Jun 12 Paper 22 Q 11 b
- Nov 12 Paper 11 Q 26
- Nov 12 Paper 12 Q 27
- Jun 13 Paper 11 Q 15
- Jun 13 Paper 12 Q 12
- Nov 13 Paper 12 Q 24
- Nov 13 Paper 21 Q 2
- Jun 14 Paper 22 Q 1
- Nov 14 Paper 12 Q 24
- Jun 15 Paper 12 Q 14
- Jun 15 Paper 22 Q 8

September/October

Topic	Learning Objectives	Notes/Examples
Vectors Book 4 Chapter 3 Pages 75-130	• Describe a translation by using a vector represented by AB or **a**. • Add vectors and multiply a vector by a scalar. • Calculate the magnitude of a vector as $\sqrt{x^2+y^2}$. • Represent vectors by directed line segments; use the sum and difference of two vectors to express given vectors in terms of two coplanar vectors; use position vectors.	Vectors will be printed as $\overrightarrow{\boldsymbol{AB}}$ or $\boldsymbol{a}$ and their magnitudes denoted by modulus signs, e.g. $\lvert\overrightarrow{\boldsymbol{AB}}\rvert$ or $\lvert\boldsymbol{a}\rvert$. In their answers to questions candidates are expected to indicate $\boldsymbol{a}$ in some definite way, e.g. by an arrow $\overrightarrow{\boldsymbol{AB}}$ or by underlining as follows $\underline{\boldsymbol{a}}$.

Learning Resources: Textbook

Online:

- Vector snakes and ladders provides an introduction to column vectors and practice in their use:
  - www.tes.co.uk/teaching-resource/Vector-snakes-and-ladders-Vector-game-6030422/
- An online version of LOGO is available at: http://turtleacademy.com/playground/en
- Scratch software can be downloaded from: http://scratch.mit.edu/
- www.cimt.plymouth.ac.uk/projects/mepres/allgcse/bkc19.pdf
- BBC Bite size has work on simple vectors: www.bbc.co.uk/schools/gcsebitesize/maths/geometry/
- Don Steward has a starter activity based on a tangram to develop use of vector notation: http://donsteward.blogspot.co.uk/2010/01/vectors.html

4024 past examination papers:

- Jun 12 Paper 12 Q 12
- Nov 12 Paper 21 Q 11
- Nov 12 Paper 22 Q 11 a
- Nov 12 Paper 12 Q 22
- Jun 13 Paper 12 Q 5
- Nov 14 Paper 12 Q 16
- Nov 14 Paper 22 Q 7 (a)
- Jun 15 Paper 12 Q 25

October

Topic	Learning Objectives	Notes/examples
Geometrical Transformation Book 2, Addendum Chapter 1 Pages 1-19 Book 4, Addendum Chapter 5 Pages 64-70, 86-93	• Use the following transformations of the plane: ➢ reflection (M) ➢ rotation (R) ➢ translation (T) ➢ enlargement (E) ➢ and their combinations • Identify and give precise descriptions of transformations connecting given figures. • Describe transformations using coordinates and matrices.	Example 1 If M(a) = b and R(b) = c the notation RM(a) = c will be used. Invariants under these transformations may be assumed. Singular matrices are excluded

Learning Resources:

Online:

- 'Mathplanet 'has an introduction to transformations using matrices:
  - ➢ www.mathplanet.com/education/geometry/transformations/transformation-using-matrices
- Work on transformations is included in (aimed at A Level learners, but the early sections are suitable for learners studying at this level): www.cimt.plymouth.ac.uk/projects/mepres/alevel/fpure_ch9.pdf

Other:

Matrix transformations are often used in computer animations. If any of your learners are enthusiastic coders or animators, they may be able to share their experiences of using transformations.

4024 past examination papers:

- Jun 12 Paper 21 Q 6
- Jun 12 Paper 22 Q 9
- Nov 12 Paper 11 Q 16
- Nov 12 Paper 12 Q 21
- Jun 13 Paper 11 Q 22
- Jun 13 Paper 21 Q 8
- Nov 13 Paper 12 Q 20
- Nov 13 Paper 21 Q 11

November

Revision for Mid-Year Examination

December

Mid-Year Examination

Assessment and Home Work:

Students will be assessed by taking test of each and every chapter. Home Work shall be given on a daily basis.

Continuous ongoing revision will continue till Mock Examination