Plan of Work

Mathematics(9709)

Grade 12

For examination from 2025

Contents

Introduction

PRESCRIBED TEXTBOOKS:

- Pure Mathematics for Higher School Certificate by Mahadea [Code: PMM]
- Classified Past Papers by Ujoodah [Code: UJO]

Reference book:

- GCE O Level Mathematics (TOPICAL) Worked Solutions {Redspot}
- Pure Mathematics p2, p3 for Cambridge International A level L.Bostok

Students are STRONGLY advised to look for these reference books and to make judicious use of it.

PRE-REQUISITES

Recommended prior knowledge

Learners beginning this course are expected to have knowledge of the following topics:

Please refer to the Cambridge International AS & A level Mathematics Syllabus [code: 9709] for exams in 2020 where the learning objectives of each topic are clearly described. In order to gain the most from this Grade 12 P3 course, it is assumed that students are already familiar with Unit P1.

	Topic
1	Inequalities
2	Algebraic fractions
3	Trigonometry 1
4	Differentiation 1
5	Integration 1
6	Vectors

It is expected that students have already come across these topics (mentioned in the above table) during their Grade 12 course. Knowledge of the content of unit P1 is assumed, and candidates may be required to demonstrate such knowledge in answering questions. Students are STRONGLY advised to revise the said topics on a regular basis as they will be tested on these topics during the Modern College Internal Examinations. Use suitable revision guide(s)/book(s) in this endeavour.

Websites and videos

This plan of work includes website links providing direct access to internet resources. Modern College is not responsible for the accuracy or content of information contained in these sites. The inclusion of a link to an external website should not be understood to be an endorsement of that website or the site's owners (or their products/services).
The website pages referenced in this plan of work were selected when the plan of work was produced. Other aspects of the sites were not checked and only the particular resources are recommended.

SECOND TERM [28/04/2025 – 18/07/2025]

Topic: 3.1 :Algebra

Learning Objectives	Worked Examples	Classwork & Homework	Extra Work	Resources
Students should be able to a) understand the meaning of |x|, sketch the graph of y = |ax+b| and use relations such as $\|a\| = \|b\| \Leftrightarrow a^2 = b^2$ and $\|x-a\| < b \Leftrightarrow a - b < x < a + b$ when solving equations and inequalities	**[Book MAH2]:** To study notes & worked examples (pg 1 – 4).	**[Book MAH2]:** pg 4 ex 1.1 , Misc Ex , Harder Qus , Cambridge past Examinations Questions	**[BOOK UJO]:** pg 191 – pg 195	Modulus inequalities (https://www.youtube.com/watch?v=ShwfKY0gIX0) (https://www.youtube.com/watch?v=P6ocMT0JePg
b) divide a polynomial, of degree not exceeding 4, by a linear or quadratic polynomial, and identify the quotient and remainder (which may be zero)	**[Book MAH2]:** To study notes & worked examples(Pg 10 – 11)	**[Book MAH2]:** pg 12 ex 2.1	**[BOOK UJO]:**	Long division (https://www.youtube.com/watch?v=SbUiZx5a0Ok (https://www.youtube.com/watch?v=u0ep4v_bweQ)
c) use the factor theorem and the remainder theorem, e.g. to find factors, solve polynomial equations or evaluate unknown coefficients	**[Book MAH2]** pg 13	**[Book MAH2]:** pg 14 ex 2.2 , Misc Ex ,Harder Qu, Cambridge past	**[BOOK UJO]:** pg 196 – pg 207	● Solving Polynomials (https://www.youtube.com/watch?v=qclU7iHjA_w)

		Examinations Questions		• Finding Unknowns (https://www.youtube.com/watch?v=HMZJITtP8Y4)
d) recall an appropriate form for expressing rational functions in partial fractions, and carry out the decomposition, in cases where the denominator is no more complicated than: – (ax + b)(cx + d)(ex + f) – (ax + b)$(cx + d)^2$ – (ax + b)(x^2 +c^2) and where the degree of the numerator does not exceed that of the denominator • use the expansion of $(1 + x)^n$, where n is a rational number and |x|<1 (finding a general term is not included, but adapting the standard series to expand e.g $(2 - \frac{1}{2}x)^{-1}$ is included)	**[Book MAH2]:** To study notes & worked examples (pg 19 – 20)(pg 22 – 28)	**[Book MAH2]** pg 21 ex 3.1; pg 29 ex 3.2, Misc Ex , Harder Qus , Cambridge past Examinations	**[BOOK UJO]:** pg 208 – pg 215	• Partial fractions{https://www.youtube.com/watch?v=FYSIEebZOGE) (https://www.youtube.com/watch?v=XCdRJOe-suU the expansion of $(1 + x)^n$ **(https://www.youtube.com/watch?v=XI2wyZu4VJ8**

Topic 3.2: Logarithmic and Exponential Functions

Learning Objectives	Worked Examples	Classwork & Homework	Extra Work	Resources
Students should be able to a) understand the relationship between logarithms and indices, and use the laws of logarithms (excluding change of base) b) understand the definition and properties of e^x and lnx, including their relationship as inverse functions and their graphs c) use logarithms to solve equations of the form a^x = b, and similar inequalities	**[Book MAH2]:** To study notes&worked examples (pg 36 – 41)	**[Book MAH2]:**pg 41 Ex4.1	**[BOOK UJO]:** pg 216- pg 230 no 2,3,4,5,6,8,9,10 – 13, 15 – 23, 31 – 33, 34 – 39, 41 – 43, 45, 46, 52, 53, 56, 57, 59 - 63, 70 – 72, 74, 76, 77	The functions y=e^x and y=ln x (https://www.youtube.com/watch?v=DX56wL66B3c) Solving Logarithmic Equations (https://www.youtube.com/watch?v=59j0ALU3N7k) Solving Logarithmic inequalities (https://www.youtube.com/watch?v=LUI0guz4od4)
d) use logarithms to transform a given relationship to linear form, and hence determine unknown constants by considering the gradient and/or intercept.	**[Book MAH2]:** To study notes&worked examples (pg 36 – 41), (Pg 44 – 46)	**[Book MAH2]:**pg 41 Ex4.1 ; pg 47 Ex 4.2 Misc Ex ,Harder Qus , Cambridge past Examinations Questions	**[Book UJO]** Pg 216 – 230 no 1, 7, 14, 24, 26, 28, 30, 40, 44, 48, 51, 55, 58, 64, 73, 75	Linear Law (https://www.youtube.com/watch?v=ZxZbof6jXO8)

Topic 3.3: Trigonometry

Learning Objectives	Worked Examples	Classwork & Homework	Extra Work	Resources
Students should be able to understand the relationship of the secant, cosecant and cotangent functions to cosine, sine and tangent, and use properties and graphs of all six trigonometric functions for angles of any magnitude	**[Book MAH2]:**To study notes & worked examples (pg 79– 83)	**[Book MAH2]:** pg 84 Ex6.1		Secant (sec), cosecant (csc) and cotangent (cot) (https://www.youtube.com/watch?v=Q7htxHDN8LE) (https://www.youtube.com/watch?v=T9iaBr-YV60
use trigonometrical identities for the simplification and exact evaluation of expressions and, in the course of solving equations, select an identity or identities appropriate to the context, showing familiarity in particular with the use of:	**[Book MAH2]:** To study notes & worked examples **(**pg85-86),(pg89-90),(pg92-94)	**[Book MAH2]:** pg 87 Ex6.2 ;pg 90 Ex6.3 ; pg94 Ex 6.4	**[BOOK UJO]:** pg 231 – pg 247	

$sec^2\theta \equiv 1 + tan^2\theta$ and $cosec^2\theta \equiv 1 + cot^2\theta$	**[Book MAH2]:** To study notes & worked examplespg 83	**[Book MAH2]:**pg 84 no. 1 – 15	**[Book UJO]:**pg 231 - 247**no.**9,99,31,103	
the expansions of sin(A ± B), cos(A ± B) and tan(A ± B)	**[Book MAH2]:** To study notes & worked examplespg 85 – 86	**[Book MAH2]:**pg 87 – 88 no.1 – 15	**[Book UJO]:**pg 231 - 247**no.**1,2,12,17,19,20,37,98	
the formulae for sin2A, cos2A and tan2A	**[Book MAH2]:** To study notes & worked examplespg 89 – 90	**[Book MAH2]:**pg 90 – 91 no. 1 – 12	**[Book UJO]:**pg 231 - 247**no.** 3,5,7,10,13,14,21,100	
the expressions of a sin θ + b cos θ in the forms R sin(θ ± α) and R cos(θ ± α).	**[Book MAH2]:** To study notes & worked examplespg 92 – 94	**[Book MAH2]:**pg 94 – 95 no. 1 – 10 Misc Ex ,Harder Qus , Cambridge past Examinations Questions	**[Book UJO]:**pg 231 - 247**no**.4,6,11,15,16,18,22,101	Simplifying Trigonometric Expressions Using Identities (https://www.youtube.com/watch?v=FS6iQX7jY-s) Using Double Angle Identities to Solve Equations (https://www.youtube.com/watch?v=7Eo-fuy0f7g) The identity Asin(x) + Bcos(x) = Rsin(x+a) (https://www.youtube.com/watch?v=Tr8ck6qSXgc)

Mid Term Assessment

Time Allocation	Type	Maximum Mark

1 hour	structured questions	50

Students are expected to use calculator for this paper. Candidates are expected to cover the proposed syllabus. The paper may contain questions on any part of the syllabus covered till the assessment. Questions will not necessarily be restricted to a single topic.

Topic 3.4: Differentiation

Learning Objectives	Worked Examples	Classwork & Homework	Extra Work	Resources
Students should be able to ***a)*** use the derivatives of e^x , lnx, sinx, cos x, tanx, $\tan^{-1}$ x, together with constant multiples, sums, differences and composites b) differentiate products and quotients	**[Book MAH2]:** To study notes &worked examples (pg 54 – 57),(pg59),(pg61)	**[Book MAH2] :** pg 57 Ex 5.1 ;pg 60 Ex 5.2 ;pg 62 Ex 5.3	**[BookUJO]:**pg 248 – 291 no22.26,140,136,154 **[Book UJO]:** pg248–291 no.5,41,122,145,164	(https://www.intmath.com/differentiation-transcendental/1-derivative-sine-cosine-tangent.php) Derivatives: Product and Quotient rule (https://www.youtube.com/watch?v=G_Ib8V4L9mA)
c) find and use the first derivative of a function which is defined parametrically or implicitly.	**[Book MAH2]:** To study notes &worked examples (pg63,64),(pg66-68)	**[Book MAH2] :** pg 65 Ex 5.4 ; pg 69 Ex 5.5 Misc Ex ,Harder Qus , Cambridge past Examinations Questions	**[Book UJO]:**pg 248 – 291 no8,9,23,126,128,134 ,135,161	Derivatives of Parametric Functions (https://www.youtube.com/watch?v=k5QnaGVk1JI) (https://www.khanacademy.org/math/ap-calculus-ab/ab-differentiation-2-

				new/ab-3-2/v/implicit-differentiation-1)

Topic 3.5: Integration

Learning Objectives	Worked Examples	Classwork & Homework	Extra Work	Resources
Students should be able to a) extend the idea of 'reverse differentiation' to include the integration of ,e^{ax+b} , $\frac{1}{ax+b}$,sin(ax + b), cos(ax + b) and sec^2 (ax + b) and $\frac{1}{x^2+a^2}$	**[Book MAH2]:** To study notes &worked examples (pg 102 – 103)	**[Book MAH2]:**pg 102 Ex 7.1	**[Book UJO]:** pg 303 no 35, 37, pg 307 no 50, 54, pg 311 no 66 a, pg 321 no 104 a	Integration : sin(ax+b), cos(ax+b), sec^2(ax+b) types (https://www.youtube.com/watch?v=uoXt1s_l1eo)
b) use trigonometrical relationships in carrying out integration	**[Book MAH2]:** To study notes &worked examples(pg 104, 105)	**[Book MAH2]:** pg 105 Ex 7.2	**[Book UJO]:** pg 293 no 4, pg 294 no 7, 8, 15, 26, 28, 33, 37, 47, 51, 58, 148	Integral of cos^2(x) using the Half Angle Formula (https://www.youtube.com/watch?v=kgzRuIilP_A) Integral of sin^2(x) (https://www.youtube.com/watch?v=9BHC0VLf5-4)
c) integrate rational functions by means of decomposition into partial fractions (restricted to the types of partial fractions specified in paragraph 1 above)	**[Book MAH2]:** To study notes &worked examples (pg 109)	**[Book MAH2]:**pg 110 Ex 7.4 **[Book MAH2]:**pg 108 Ex 7.3	**[Book UJO]:** pg 296 no 13, pg 304 no 40 , pg 305 no 44, pg 307 no 50, pg 309 no 59, pg 310 no 61, pg 327	Integration By Partial Fractions (https://www.youtube.com/watch?v=r5MIraVUVUA)

d) recognise an integrand of the form $\frac{kf^1(x)}{f(x)}$, and integrate, for example, $\frac{x}{x^2+1}$ or tanx	**[Book MAH2]:** To study notes &worked examples (pg106-107)		no 130, pg 329 no 141	(https://www.youtube.com/watch?v=6qVgHWxdlZ0)
e) recognise when an integrand can usefully be regarded as a product, and use integration by parts to integrate, for example, x sin2x, x^2e^x or lnx	**[Book MAH2]:** To study notes &worked examples (pg111-114)	**[Book MAH2]:** pg 114 Ex 7.5;	**[Book UJO]:**pg 293 no 3, 6; pg294 no 9; pg 295 no 12; pg 298 no 19; pg 299 no 24; pg 314 no 78;pg 328 no 134; pg 331 no 149	Integration by parts (https://www.youtube.com/watch?v=KKg88oSUv0o)
f) use a given substitution to simplify and evaluate either a definite or an indefinite integral	**[Book MAH2]:** To study notes &worked examples (pg116-117).	**[Book MAH2]:** pg 118 Ex 7.6 Misc Ex ,Harder Qus , Cambridge past Examinations Questions	**[Book UJO]:**pg 322no 109;pg 325 no 122; pg 327 no 129;pg 328 no 135;pg 329 no 142; pg 331 no 50	Trigonometry substitution (https://www.youtube.com/watch?v=KKg88oSUv0o)

Revision

The following Maths exam papers will be discussed in class and students are expected to do the questions and submit them for correction & feedback: June 2019 p1 and p3;

Assessment

November Examinations

Component	Time Allocation	Type	Maximum Mark
Paper 1	1 hour 50 minutes	structured questions	75

Paper 3	1 hour 50 minutes	structured questions	75

Please note that students will be allowed to use calculator in both papers. Omission of essential working will result in loss of marks. Candidates are expected to cover the PROPOSED syllabus. Each paper may contain questions on any part of the syllabus and questions will not necessarily be restricted to a single topic.

THIRD TERM [11/08/2025 – 31/10/2025]

Topic 3.6: Numerical solution of equations

Learning Objectives	Worked Examples	Classwork & Homework	Extra Work	Resources
Students should be able to ***a)*** Locate approximately a root of an equation, by means of graphical considerations and/or searching for a sign change ***b)*** understand the idea of, and use the notation for, a sequence of approximations which converges to a root of an equation	**[Book MAH2]:** To study notes &worked examples (pg 133 – 138).	**[Book MAH2]:**pg pg 139 Ex 8.2;Misc Ex ,Harder Qus , Cambridge past Examinations Questions	**[Book UJO]:** pg 332 – 369 no 1 – 92	Locating Roots by Looking for a Change of Sign (https://www.youtube.com/watch?v=s1KiJviFCvQ) Fixed Point Iteration (https://www.youtube.com/watch?v=OLqdJMjzib8)

c) understand how a given simple iterative formula of the form x_{n+1} = F(x_n) relates to the equation being solved, and use a given iteration, or an iteration based on a given rearrangement of an equation, to determine a root to a prescribed degree of accuracy (knowledge of the condition for convergence is not included, but candidates should understand that an iteration may fail to converge).				

Topic 3.7: Vectors

Learning Objectives	Worked Examples	Classwork &Homework	Extra Work	Resources
Students should be able to a) Use standard notation for vectors, ie, $(x\ y)$, **xi + yj,** $(x\ y\ z)$**, xi + yj + zk,** $AB\rightarrow$ **, a**	**[Book MAH1]:** To study notes &worked examples(pg 108 – pg 111)	**[Book MAH1]:** Pg 112 Ex 6.1.	**[Book UJO]:**pg 86 no 3(i) (ii) pg 87 no 3 (i) (iii), 5; pg 88 no 7(i); pg 95 no 24(i);pg 97 no 32(ii); pg 101 no 43(i);	Understanding multiplying vectors by scalars

b) Carry out addition and subtraction of vectors and multiplication of a vector by a scalar, and interpret these operations in geometrical terms c) Calculate the magnitude of a vector , and use unit vectors , displacement vectors and position vectors				(https://www.youtube.com/watch?v=JuTvjQgpUMQ)
d) understand the significance of all the symbols used when the equation of a straight line is expressed in the form r = a + tb and find the equation of a line , given sufficient information	**[Book MAH2]:** To study notes &worked examples(pg 172 – 174)	**[Book MAH2]:** pg 174 Ex 10.1	**[Book UJO]:** pg 370 no 2 (i), 4; pg 371 no 5(i), 7(i)(ii);pg 372 no 10	(https://www.youtube.com/watch?v=PyPp4QvQY3Q&t=14s)
e) determine whether two lines are parallel, intersect or are skew and find the point of intersection of two lines when it exists	**[Book MAH2]:** To study notes &worked examples (pg 178, 179)	**[Book MAH2]:** 179 Ex 10.3	pg 372 no 11; pg 373 no 14; pg 374 no 16(i)(ii); pg 376 no 27 (i)(ii);pg 379 no 39,40	(https://www.youtube.com/watch?v=nKVCvY-FW5Q)
f) Use formulae to calculate the scalar product of two vectors, and use scalar products in problems involving lines and points.	**[Book MAH1]:** To study notes &worked examples (pg 114 - pg116) **[Book MAH2]:** To study notes &worked examples (pg176)),(pg180-181)	**[Book MAH1]:** Pg 117 Ex 6.2, Misc Ex ,Harder Qus , Cambridge past Examinations Questions **[Book MAH2]:** 177 Ex 10.2, pg 181 Ex 10.4;Misc Ex ,Harder Qus ,	Pg 86 no 1,2; pg 87 no 3 (ii),(iii),4,6;pg 88 no 7(Ii);pg 89 no 10, 11; pg 104 no 53pg 105 no 55	(https://www.youtube.com/watch?v=LyZ_xe-0HMI) (https://www.youtube.com/watch?v=MtI8cB6Z0ds&t=98s)

		Cambridge past Examinations Questions		

Mid Term Assessment

Time Allocation	Type	Maximum Mark
1 hour	structured questions	50

Students are expected to use calculator for this paper. Candidates are expected to cover the proposed syllabus. The paper may contain questions on any part of the syllabus covered till the assessment. Questions will not necessarily be restricted to a single topic.

Topic 3.8: Differential Equations

Learning Objectives	Worked Examples	Classwork &Homework	Extra Work	Resources
Students should be able to ***a)*** formulate a simple statement involving a rate of change as a differential equation, including the introduction if necessary of a constant of proportionality ***b)*** find by integration a general form of solution for a first order differential equation in which the variables are separable	**[Book MAH2] :** To study notes &worked examples (pg 152 – 154),(pg157-161).	**[Book MAH2]:**pg 155Ex 9.1; pg 161 Ex 9.2;Misc Ex ,Harder Qus , Cambridge past Examinations Questions	**[Book UJO]:**pg382-396 no 1 – 50 .	Introduction to Time Rate of Change (https://www.youtube.com/watch?v=yhklHobbuyg) (https://www.youtube.com/watch?v=C7nuJcJriWM&t=27s) (https://www.youtube.com/watch?v=nNHlSB6b1HU)

c) use an initial condition to find a particular solution ***d)*** interpret the solution of a differential equation in the context of a problem being modelled by the equation				

Topic 3.9: Complex Numbers

Learning Objectives	Worked Examples	Classwork &Homework	Extra Work	Resources
Students should be able to a) understand the idea of a complex number, recall the meaning of the terms real part, imaginary part, modulus, argument, conjugate, and use the fact that two complex numbers are equal if and only if both real and imaginary parts are equal carry out operations of addition, subtraction, multiplication and division of two complex numbers expressed in cartesian form x + iy b) find the two square roots of a complex number	**[Book MAH2]:** To study notes & worked examples (pg 210 – 214),	**[Book MAH2]**: pg 215 Ex 11.1	**[Book UJO]:** pg 397 no 2(i), 4(i);pg 398 no 8(i); pg 399 no 10(a(i), b);pg 401 no 19(ii) pg 407 no 42(i);Pg 408 no 46(a)pg 409 no 50(ii);	COMPLEX NUMBER -Real,imaginary part,magnitude,conjugate ,argument (https://www.youtube.com/watch?v=gDwJK2w5NYc) Complex numbers : Finding Square roots of (https://www.youtube.com/watch?v=k4z7gMDvqKs)

c) use the result that, for a polynomial equation with real coefficients, any non-real roots occur in conjugate pairs	**[Book MAH2]:** To study notes & worked examples (pg 227)	**[Book MAH2]**: pg228 Ex 11.4;	Pg 397 no 3(i) (iii); pg 398 no 5(i), 6(i) (ii); pg 400 no 13(i), 14(i)(ii); Pg401 no 23(i)(iii); Pg 408 no 47 (a);Pg 409 no 49(i)	(https://www.youtube.com/watch?v=BhhMRxBl1Zc)
d) represent complex numbers geometrically by means of an Argand diagram, Find the modulus and Argument of a complex number.	**[Book MAH2]:** To study notes & worked examples (pg 217 - 220)	**[Book MAH2]**: pg222 Ex 11.2 no 1;	**[Book UJO]:** Pg397 no2(ii),4(ii);Pg398 no 5,8(ii);Pg399 no9(i),10(a)(ii); Pg400 no 13(ii)(iii);pg 401 no 16(i),19(i);Pg 409 no 50(i)	(https://www.youtube.com/watch?v=V7mECV0M1ys)
e) carry out operations of multiplication and division of two complex numbers expressed in polar form r(cos θ + i sin θ) ≡ $re^{i\theta}$	**[Book MAH2]:** To study notes & worked examples (pg 220 - 222)	**[Book MAH2]**: pg222 Ex 11.2 no 2 – 10.	**[Book UJO]:** Pg 406 no 36; pg 408 no 45 (b)	(https://www.youtube.com/watch?v=in_dAlpjUKk)
f) understand in simple terms the geometrical effects of conjugating a complex number and of adding, subtracting, multiplying and dividing two complex numbers	**[Book MAH2]:** To study notes & worked examples (pg 224 - 225)	**[Book MAH2]**: pg222 Ex 11.3;	**[Book UJO]:** Pg397 no 1,4(iii)(iv);pg 398 no 7; pg 399 no 12;pg	https://www.youtube.com/watch?v=HyTYaotTdU8

			400 no 15; pg 408 no 44;pg 409 no 48;	
g) illustrate simple equations and inequalities involving complex numbers by means of loci in an Argand diagram, e.g. $\|z-a\| < k$, $\|z-a\| = \|z-b\|$, arg(z – a) = α .	**[Book MAH2]:** To study notes & worked examples (pg 229 - 236)	**[Book MAH2]:**pg 237 Ex 11.5;;Misc Ex ,Harder Qus , Cambridge past Examinations Questions	**[Book UJO]:** pg 398 no 8(iii)(iv);pg 399 no 11;pg 400 no 14(iv); pg 401 no 16 (ii)(iii);pg 402 no 21; pg 408 no 46 (b)(ii);	(https://www.youtube.com/watch?v=WMQkqJtwwbg)

Revision

The following Maths exam papers will be discussed in class and students are expected to do the questions and submit them for correction & feedback: June 2018 p1 and p3; Nov 2018 p1 and p3;

March Examinations

Component	Time Allocation	Type	Maximum Mark
Paper 1	1 hour 50 minutes	structured questions	75
Paper 2	1 hour 50 minutes	structured questions	75

Please note that students will be allowed to use calculator in both papers. Omission of essentiall working wil lresult in loss of marks.Candidates are expected to cover the PROPOSED syllabus.Each paper may contain questions on any part of the syllabus and questions will not necessarily be restricted to a single topic.

Much may be done in those little shreds and patches of time which every day produces and which most of us throw away