

# MATHEMATICS SYLLABUS (SEC Exam 2022 and Annual 2022 only)

## Forms 4 and 5 Track 3

### Contents

#### Pages

- |                                      |         |
|--------------------------------------|---------|
| • <u>Form 4 Track 3</u>              | 2       |
| • <u>Number and Applications</u>     | 3       |
| • <u>Algebra</u>                     | 4 - 6   |
| • <u>Shape Space and Measurement</u> | 7 - 9   |
| • <u>Data Handling</u>               | 10      |
| • <u>Form 5 Track 3</u>              | 11      |
| • <u>Number and Applications</u>     | 12      |
| • <u>Algebra</u>                     | 13 - 14 |
| • <u>Shape Space and Measurement</u> | 15 - 16 |
| • <u>Data Handling</u>               | 17      |

*Mathematics Syllabus*  
*Form 4 Track 3*

Form IV – Track 3: Number and Applications

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
4	NN31	i. Understand and use powers.	32		Ext	<ul style="list-style-type: none"> <li>• Use positive, negative and zero indices.</li> <li>• Find the Lowest Common Multiple and Highest Common Factor.</li> <li>• Include integral indices only.</li> </ul>
	NN31	ii. Use prime factorisation.				
	NN31	iii. Understand the rules for multiplying and dividing powers.				
9	NN32	i. Understand and use successive percentage changes.	81		Ext	<ul style="list-style-type: none"> <li>• Compound interest, appreciation and depreciation.</li> <li>• Use the calculator and the <del>spreadsheet</del> spreadsheet to investigate the factors affecting appreciation and depreciation: rate and number of years.</li> <li>• For compound growth and decay.</li> <li>• Revise: Simple Interest, reverse percentages, and common applications like VAT, commission etc.</li> </ul>
	NN32	ii. Determine, by trial and error the number of years by means of a calculator				
	NN32	iii. Periodical Borrowing and Repayment				
12	NN33	i. Write ordinary numbers in standard form and vice versa.	116		Core	<ul style="list-style-type: none"> <li>• Learn to use the ‘EXP’ key on the calculator.</li> </ul>
	NN33	ii. Work with numbers in standard form without using a calculator.				

Form IV - Track 3: Algebra (i)

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
4	AL24	i. Use and interpret positive and negative integral indices, including zero.	32	Core	Core	E.g. $3^x = 81$ , $2^x = \frac{1}{16}$
	AL24	ii. Use the index laws in simple instances.				
	AL24	iii. Solve simple exponential equations by inspection.				
5	AL25	i. Solve linear equations in one unknown.	43	Core	Core	<ul style="list-style-type: none"> <li>• Include the use of brackets and simple fractions with numerical denominators.</li> </ul>
	AL25	ii. Solve problems leading to solution of linear equations in one unknown.				
8	AL26	i. Change the subject of a formula.	71	Core	Core	<ul style="list-style-type: none"> <li>• Include formulae with fractions, squares and square roots.</li> </ul>
13	AL27	i. Understand, interpret and calculate the gradient of a line from the coordinates of two points on the line.	128	Core	Core	<ul style="list-style-type: none"> <li>• Students should be given opportunities to use a spreadsheet and/or a CAS to explore algebraic relationships both symbolically and graphically. For example, by representing the relationship of the form <math>y = mx</math> graphically using a CAS, pupils can appreciate that by changing values of <math>m</math>, the gradient of the line changes accordingly.</li> </ul>
	AL27	ii. Use straight-line graphs to find the value of one coordinate given the other.				
	AL27	iii. Know and understand that parallel lines have equal gradient.				
	AL27	iv. Understand the relationship between the equation of a straight line, its gradient and y-intercept.				
	AL27	v. Plot and interpret graphs of simple linear functions arising from real-life situations.				
6	AL27	vi. Understand the relationship between speed, time and distance	54	Core	Core	<ul style="list-style-type: none"> <li>• Rearrange linear equations into the form <math>y = mx + c</math>.</li> </ul> E.g. Distance – Time, Volume – Time and conversion graphs.
18	AL28	i. Solve two simultaneous linear equations graphically.	179	Core	Core	

Form IV – Track 3: Algebra (ii)

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
20	AL29	i. Simplify algebraic expressions by collecting like terms.	198		Ext	<ul style="list-style-type: none"> <li>• Include use of brackets.</li> <li>• Of the form <math>(x + a)(x + b)</math> and <math>(x + a)^2</math> *</li> <li>• Of the form <math>x^2 + bx + c</math> *</li> <li>• Of the form <math>x^2 + bx + c = 0</math>. * Include rearranging terms to this form.</li> </ul> <p>* <math>a, b</math> and <math>c</math> are real numbers.</p>
	AL29	ii. Multiply a single term over a bracket.				
	AL29	iii. Factorise expressions by taking out a common factor.				
	AL29	iv. Expand the product of two linear expressions.				
	AL29	v. Factorise quadratic expressions including difference of two squares.				
	AL29	vi. Solve quadratic equations by factorisation.				
	AL29	vii. Solve problems leading to quadratic equations.				
26	AL30	i. Draw quadratic graphs and identify maxima/minima.	257		Ext	<ul style="list-style-type: none"> <li>• Use quadratic graphs to find the value of one coordinate given the other.</li> </ul> <p>E.g. Parabolic paths and other quadratic models.</p>
	AL30	ii. Draw and use quadratic graphs to solve quadratic equations.				
	AL30	iii. Solve graphically problems leading to quadratic equations.				
	AL30	iv. Solve graphically two simultaneous equations: one linear and one quadratic.				
27	AL31	i. Evaluate algebraic fractions by substitution.	269		Core	<ul style="list-style-type: none"> <li>• Include substitution with fractions.</li> </ul> <p>E.g. <math>\sqrt{(p^{-4}q^6)}</math> and <math>\sqrt{\frac{25p^2q^{10}}{r^4}}</math></p>
	AL31	ii. Simplify algebraic expressions involving square roots.				
	AL31	iii. Simplify algebraic fractions with numerical denominators.				
	AL31	iv. Simplify algebraic fractions with single term algebraic denominators.				
30	AL32	i. Change the subject of a formula where the new subject appears more than once.	303		Ext	
	AL32	ii. Form and manipulate more complex formulae.				

Form IV – Track 3: Algebra (iii)

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	Sec	Notes
34	AL33	i. Expand the product of two linear expressions.	341		Ext	<ul style="list-style-type: none"> <li>• Of the form <math>(ax + b)(cx + d)</math> and <math>(ax + b)^2</math>*</li> <li>• Of the form <math>ax^2 + bx + c</math> *</li> <li>• Of the form <math>ax^2 + bx + c = 0</math> *</li> <li>• Refer also to pages 419-420</li> </ul> <p>* <math>a, b</math> and <math>c</math> are real numbers.</p>
	AL33	ii. Factorise quadratic expressions including difference of two squares.				
	AL33	iii. Solve quadratic equations by factorisation.				
	AL33	iv. Solve quadratic equations <del>by completing the square and</del> by formula.				
	AL33	v. Use quadratic graphs to solve quadratic equations.				
	AL33	vi. Solve problems leading to quadratic equations.				
36	AL34	i. Extend patterns and sequences of numbers.	370		Core	<ul style="list-style-type: none"> <li>• Students should be given opportunities to use a <del>spreadsheet</del> spreadsheet to generate sequences of numbers that they can describe both verbally and symbolically.</li> </ul> <p>E.g. Find the 4<sup>th</sup> term given that the <math>n^{\text{th}}</math> term is <math>2n + 5</math>.</p>
	AL34	ii. Generate terms of a sequence using term definitions of the sequence.				
	AL34	iii. Use expressions to describe the $n^{\text{th}}$ term of a simple sequence.				
	AL34	iv. Recognize geometric and number patterns.				

Form IV – Track 3: Shape, Space and Measurement (i)

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
2	GG21	i. Use the tangent ratio to find: a. the opposite side given an angle and its adjacent side; b. the adjacent side given an angle and its opposite side, c. an angle given two sides other than the hypotenuse.	18		Core	
	GG22	ii. Solve practical problems involving isosceles triangles and other shapes.				
10	GM22	i. Use the formula for the area of a triangle to find the base/height.	91		Core	
	GM22	ii. Use algebra to find expressions for the area of simple shapes.				
	GM22	iii. Derive and use the formula for the area of a trapezium by dividing it into two triangles.				
	GM22	iv. Find the volume/area of cross section/length of a prism using $V = a \times l$ .				<ul style="list-style-type: none"> <li>Where <math>a</math> is the area of uniform cross-section and <math>l</math> is the length perpendicular to the cross-section.</li> </ul>
	GM22	v. Solve problems using 1 litre = 1000 cm <sup>3</sup> and 1 m <sup>3</sup> = 1000 litres.				
	GM22	vi. Solve problems involving the volume and surface area of simple compound solid shapes.				<ul style="list-style-type: none"> <li>Restrict to shapes made up of cubes, cuboids and other prisms.</li> </ul>
	GM22	vii. Convert units of area and volume.				
11	GG23	i. Use the sine and cosine ratios to find: a. the opposite side given an angle and the hypotenuse; b. the adjacent side given an angle and the hypotenuse; c. an angle given the opposite side or the adjacent side and the hypotenuse; d. the hypotenuse given an angle and the opposite or the adjacent side.	102		Core	
	GG23	ii. Solve practical problems involving isosceles triangles and other shapes.				
	GG23	iii. Use the trigonometrical ratios to solve problems involving angles of elevation/depression and bearings.				

Form IV – Track 3: Shape, Space and Measurement (ii)

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
14	GG24	i. Use ruler and compasses only to construct the locus of points which are: <ul style="list-style-type: none"> <li>a. at a fixed distance from a given point;</li> <li>b. equidistant from a straight line;</li> <li>c. equidistant from two given points;</li> <li>d. equidistant from two intersecting straight lines.</li> </ul>	143		Ext	
	GG24	ii. <del>Solve problems involving the above constructions using intersecting loci and regions.</del>				<ul style="list-style-type: none"> <li>• To include the construction of triangles, quadrilaterals, regular hexagons and circles.</li> </ul>
16	GG25	Draw and describe	157		Ext	
	GG25	i. Translations.				<ul style="list-style-type: none"> <li>• Use a given column vector.</li> <li>• Use <math>y = \pm c</math>, <math>x = \pm c</math>, <math>y = \pm x</math> as mirror lines.</li> </ul>
	GG25	ii. Reflections.				<ul style="list-style-type: none"> <li>• Use angles of rotation in multiples of <math>90^\circ</math>.</li> <li>• Find the centre of rotation for rotations through <math>90^\circ</math>. (by inspection and/or by construction)</li> </ul>
	GG25	iii. Rotations.				<ul style="list-style-type: none"> <li>• Use a positive integer or a fraction as scale factor.</li> <li>• Recognise that enlargements preserve angle but not length.</li> <li>• Understand and use the effect of enlargement on the perimeter of 2D shapes.</li> </ul>
	GG25	iv. Enlargements.				
	GG25	v. <del>Use negative scale factors of enlargement.</del>				
	GG25	vi. Transform 2D shapes by a combination of transformations.				<ul style="list-style-type: none"> <li>• Recognise that reflections, rotations and translations preserve length and angle, so that any figure is congruent to its image under any of these transformations.</li> </ul>
	GG25	vii. Identify and use appropriate language to describe fully the transformation.				



Form IV – Track 3: Shape, Space and Measurement (iii)

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
25	GM26	i. Understand the terms arc, sector and segment of a circle.	244		Ext	
	GM26	ii. Work out the length of arc and area of sector as fractions of a circle.				
	GM26	iii. Work out the area of segments in a circle.				
	GG26	iv. Work out the area of composite shapes by dividing them into simple shapes including circles, sectors and segments.				
	GM26	v. Derive and use the formulae for the volume and surface area of a cylinder.				
	GM26	vi. Work out the surface area and volume of a pyramid, right circular cone and sphere.				
	GM26	vii. Work out the volume of a frustum of a pyramid/right circular cone.				
	GM26	viii. Rearrange formulae for surface area/volume of solids to find radius, height and slant height.				
29	GG27	i. Prove the following circle theorems:	286		Ext	
		a. the angle at the centre is twice the angle at the circumference				<ul style="list-style-type: none"> <li>• Understand that equal arcs/chords subtend equal angles at the centre and at the circumference.</li> </ul>
		b. the angles in the same segment are equal				
		c. the angle in a semicircle is a right angle				
		d. the opposite angles of a cyclic quadrilateral are supplementary				
		e. the exterior angle of a cyclic quadrilateral is equal to the interior opposite angle.				
	GG27	ii. Understand the meaning of the term tangent to a circle.				<ul style="list-style-type: none"> <li>• Understand and use the property that the angle between the tangent and the radius of a circle at the point of contact is a right angle.</li> </ul>
	GG27	iii. Prove that the angle formed by a chord and a tangent at the point of contact is equal to the angle in the alternate segment.				
	GG27	iv. Give reasons to justify the use of these angle facts in geometric riders.				

Form IV - Track 3: Data Handling

SMP Interact Mathematics for Malta : Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
7	DH10	i. Draw a histogram ( <b>frequency chart</b> ) with equal intervals from a frequency table.	61		Ext	<ul style="list-style-type: none"> <li>• Include un/grouped discrete and continuous data.</li> </ul>
	DH10	ii. Use and interpret different class intervals to draw a frequency chart for the same data				
7	DH11	i. For a grouped frequency distribution: a. calculate an estimate for the mean b. identify the modal class c. identify the class interval in which the median lies	61		Ext	<ul style="list-style-type: none"> <li>• Include discrete and continuous data.</li> </ul>
17	DH12	i. Work out the probability of mutually exclusive events occurring.	168		Ext	
	DH12	ii. Work out the probability of independent/dependent events occurring.				
	DH12	iii. Compile and use a probability tree.				

# *Form 5 Track 3*

Form V – Track 3: Number and Applications

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
31	NN34	i. Understand and use limits of accuracy.	314		Ext	
	NN34	ii. Give appropriate upper and lower bounds for data given to a specified accuracy.				E.g. Measured lengths and weights.
	NN34	iii. Obtain appropriate upper and lower bounds to solutions of simple problems.				<ul style="list-style-type: none"> <li>• Include problems involving addition and multiplication, subtraction and division.</li> </ul> E.g. The calculation of the perimeter/area of a rectangle and speed, given data to a specified accuracy.
39	NN35	i. Use the index laws for positive and negative fractional indices.	397		Ext	<ul style="list-style-type: none"> <li>• Use a calculator to evaluate powers and roots.</li> </ul>

Form V – Track 3: Algebra (i)

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
19	AL35	i. Solve simple linear inequalities in one variable.	192		Ext	<ul style="list-style-type: none"> <li>Recognise, understand and use integers. E.g. <math>2x - 3 &gt; 7</math> and <math>x - 1 \leq 2x \leq 4</math></li> </ul>
	AL35	ii. Represent the solution set on a number line.				
22	AL36	i. Use direct variation.	213		Ext	<ul style="list-style-type: none"> <li>Use <math>c \propto L</math> and <math>c = kL</math></li> </ul>
	AL36	ii. Use inverse variation.				<ul style="list-style-type: none"> <li>Use <math>A \propto \frac{1}{n}</math> and <math>A = \frac{1}{n}k</math> or <math>An = k</math>.</li> </ul>
	AL36	iii. Solve problems involving direct and inverse variation to determine unknown quantities.				<ul style="list-style-type: none"> <li>Restrict to <math>y \propto x^n</math>, where <math>n = \pm 1, \pm 2, 3</math>.</li> </ul>
23	AL37	<del>i. Graph and interpret inequalities in one and two variables.</del>	<del>227</del>		<del>Ext</del>	<ul style="list-style-type: none"> <li><del>Include the solution of problems. E.g. <math>y \geq 3x</math>, <math>y \leq 5</math> and <math>x + y &gt; 4</math>.</del></li> </ul>
	AL37	<del>ii. Determine the solution to an inequality or set of inequalities on a graph by shading the appropriate regions.</del>				
28	AL38	i. Construct tables of values for cubic functions and reciprocal functions of the type $f(x) = a/x$ to generate points and plot the graphs	276		Ext	<ul style="list-style-type: none"> <li>Use pencil and paper, a spreadsheet or a graphing package. E.g. find graphically common solutions for <math>y = 2x - 1</math> and <math>y = x^3</math>.</li> </ul>
	AL38	ii. Solve graphically linear, quadratic, cubic and reciprocal functions simultaneously.				E.g. $x^3 - x = 80$
	AL38	iii. Use trial and improvement methods involving calculator and computer to find approximate solutions of equations for which there is not a simple method of solution.				
	AL38	iv. Use curve sketches to identify graphs.				
	AL38	v. Sketch curves by determining values of $x$ and $y$ at the points of intersection with the axes.				
	AL38	vi. Use graphs to solve problems.				
	AL38	vii. Interpret and understand rates of change presented in a variety of linear and non-linear graphs.				<ul style="list-style-type: none"> <li>To include positive and negative gradients. E.g. distance-time and velocity-time graphs, conversion graphs, graphs of height against age.</li> </ul>

Form V – Track 3: Algebra (ii)

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
34	AL39	i. Solve algebraically two simultaneous equations, one linear and one quadratic.	352		Ext	
38	AL40	i. Simplify algebraic fractions by factorising and cancelling.	386		Ext	<ul style="list-style-type: none"> <li>Denominators to include linear and quadratic expressions.</li> </ul>
	AL40	ii. Add and subtract algebraic fractions with linear denominators.				
	AL40	iii. Add and subtract algebraic fractions with quadratic denominators.				
	AL40	iv. Solve equations and problems involving fractions with algebraic denominators.				
	AL40	v. Rearrange harder formulae with fractions.				
39	AL41	i. Use and interpret fractional indices.	397		Ext	
41	AL42	i. Understand and use function notation.	425		Ext	E.g. $f(x) = 3x - 5$
	AL42	ii. Understand and use inverse function notation				E.g. if $f(x) = 3x - 5$ then $f^{-1}(x) = \frac{x + 5}{3}$

Form V - Track 3: Shape, Space and Measurement (i)

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
33	GG28	i. Understand the notion of similar shapes through enlargement.	325		Ext	<ul style="list-style-type: none"> <li>• Appreciate that any two circles and any two squares are mathematically similar, whereas in general, two rectangles are not.</li> <li>• <math>\frac{L_2}{L_1} = k \quad \left  \quad \frac{A_2}{A_1} = k^2 \quad \left  \quad \frac{V_2}{V_1} = k^3</math></li> <li>• Use map ratios as a scale factor.</li> </ul>
	GG28	ii. Prove triangles similar by showing that: <ul style="list-style-type: none"> <li>a. corresponding angles are equal</li> <li>b. the corresponding sides of each triangle are in the same ratio which is equal to the scale factor (k) of the enlargement</li> <li>c. there is one pair of equal angles and the sides containing these angles are in the same ratio.</li> </ul>				
	GG28	iii. Solve problems involving similarity.				
	GG28	iv. Understand and use the relationship between length, area and volume of similar shapes.				
42	GG29	i. Understand the notion of congruent shapes.	437		Ext	<ul style="list-style-type: none"> <li>• Appreciate that all congruent shapes are similar but similar shapes are not necessarily congruent.</li> <li>• <del>Appreciate that the converse is also true.</del></li> <li>• <del>Appreciate that the converse is also true.</del></li> </ul>
	GG29	ii. Understand and use SSS, SAS, ASA/AAS and RHS conditions to prove the congruence of triangles.				
	GG29	iii. Solve problems involving congruency.				
	GG29	iv. Understand and prove through congruent triangles that: <ul style="list-style-type: none"> <li>a. <del>the perpendicular bisector of a chord passes through the centre</del></li> <li>b. <del>equal chords are equidistant from the centre</del></li> <li>c. tangents drawn to a circle from a point outside the circle are equal.</li> </ul>				
46	GM30	i. Work out the area of any triangle.	474		Ext	<ul style="list-style-type: none"> <li>• Extend the use of the sine and cosine functions to angles between <math>90^\circ</math> and <math>180^\circ</math>.</li> <li>• Use of the formula <math>\frac{1}{2} ab \sin C</math> for an acute or obtuse angle.</li> </ul>
	GG30	ii. Use sine and cosine formulae to solve any triangle.				
	GG30	iii. Solve problems involving sine and cosine formulae.				

Form V - Track 3: Shape, Space and Measurement (ii)

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
47	GG31	i. Use Pythagoras Theorem in 3D. ii. Solve simple trigonometrical problems in 3D. iii. Solve problems on bearings and angles of elevation and depression in 3D	485		Ext	E.g. to determine lengths in 3 D shapes. <del>E.g. to find the angle between a line and a plane and the angle between two planes.</del> • Additional exercises are necessary.



Form V - Track 3: Data Handling

SMP Interact Mathematics for Malta: Higher Level

Ch	Mod	Learning Outcome:	Pg	Level	SEC	Notes
15	DH13	i. Compile a cumulative frequency table and use it to draw a cumulative frequency graph.	148		Ext	
	DH13	ii. Use a cumulative frequency graph to estimate the median, the quartiles and the inter-quartile range for grouped data.				
	DH13	iii. Draw and interpret a box-and-whisker plot to illustrate or compare distributions with large data sets.				
37	DH14	<del>i. Understand and use histograms with unequal class intervals.</del>	380		Ext	<ul style="list-style-type: none"> <li>• <del>Learn to label the vertical axis as frequency density and make use of the formula:</del></li> <li><del>frequency = length of interval × frequency density.</del></li> </ul>