

## MATHEMATICS

## GENERAL OBJECTIVES

The aim of the Unified Tertiary Matriculation Examination (UTME) syllabus in Mathematics is to prepare the candidates for the Board's examination. It is designed to test the achievement of the course objectives which are to:

- (1) acquire computational and manipulative skills;
- (2) develop precise, logical and formal reasoning skills;
- (3) develop deductive skills in interpretation of graphs, diagrams and data; (4) apply mathematical concepts to resolve issues in daily living.

This syllabus is divided into five sections:

- I. Number and Numeration
- II. Algebra
- III. Geometry/Trigonometry
- IV. Calculus
- V. Statistics DETAILED SYLLABUS

TOPICS/CONTENTS/NOTES	OBJECTIVES
<p><b>SECTION I: NUMBER AND NUMERATION</b></p> <p><b>1. Number bases:</b></p> <ol style="list-style-type: none"> <li>(a) operations in different number bases from 2 to 10;</li> <li>(b) conversion from one base to another including fractional parts.</li> </ol> <p><b>2. Fractions, Decimals, Approximations and Percentages:</b></p> <ol style="list-style-type: none"> <li>(a) fractions and decimals;</li> <li>(b) significant figures;</li> <li>(c) decimal places;</li> <li>(d) percentage errors;</li> <li>(e) simple interest;</li> <li>(f) profit and loss percent;</li> <li>(g) ratio, proportion and rate;</li> <li>(h) shares and valued added tax (VAT).</li> </ol> <p><b>3. Indices, Logarithms and Surds:</b> (a) laws of indices;</p> <ol style="list-style-type: none"> <li>(b) equations involving indices;</li> <li>(c) standard form;</li> </ol>	<p>Candidates should be able to:</p> <ol style="list-style-type: none"> <li>i. perform four basic operations (<math>\times</math>, <math>+</math>, <math>-</math>, <math>\div</math>);</li> <li>ii. convert one base to another;</li> <li>iii. perform operations in modulo arithmetic.</li> </ol> <p>Candidates should be able to:</p> <ol style="list-style-type: none"> <li>i. perform basic operations (<math>\times</math>, <math>+</math>, <math>-</math>, <math>\div</math>) on fractions and decimals;</li> <li>ii. express to specified number of significant figures and decimal places;</li> <li>iii. calculate simple interest, profit and loss per cent; ratio proportion, rate and percentage error;</li> <li>iv. solve problems involving share and VAT.</li> </ol> <p>Candidates should be able to:</p> <ol style="list-style-type: none"> <li>i. apply the laws of indices in calculation;</li> </ol>

<p>(d) laws of logarithm;</p>	<ul style="list-style-type: none"><li>ii. establish the relationship between indices and logarithms in solving problems;</li><li>iii. solve equations involving indices;</li><li>iv. solve problems in different bases in logarithms;</li></ul>
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TOPICS/CONTENTS/NOTES	OBJECTIVES
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<p>(e) logarithm of any positive number to a given base;</p> <p>(f) change of bases in logarithm and application;</p> <p>(g) relationship between indices and logarithm; (h) Surds.</p> <p><b>4. Sets:</b></p> <p>(a) types of sets</p> <p>(b) algebra of sets</p> <p>(c) Venn diagrams and their applications.</p> <p><b>SECTION II: ALGEBRA</b></p> <p><b>1. Polynomials:</b></p> <p>(a) change of subject of formula;</p> <p>(b) multiplication and division of polynomials;</p> <p>(c) factorization of polynomials of degree not exceeding 3;</p> <p>(d) roots of polynomials not exceeding degree 3;</p> <p>(e) factor and remainder theorems;</p> <p>(f) simultaneous equations including one linear one quadratic;</p> <p>(g) graphs of polynomials of degree not greater than 3.</p> <p><b>2. Variation:</b></p> <p>(a) direct;</p> <p>(b) inverse;</p> <p>(c) joint;</p> <p>(d) partial;</p> <p>(e) percentage increase and decrease.</p> <p><b>3. Inequalities:</b></p> <p>(a) analytical and graphical solutions of linear inequalities;</p> <p>(b) quadratic inequalities with integral roots only.</p> <p><b>4. Progression:</b></p> <p>(a) nth term of a progression (b) sum of A. P. and G. P.</p>	<p>v. simplify and rationalize surds; vi. perform basic operations on surds.</p> <p>Candidates should be able to:</p> <p>i. identify types of sets, i.e. empty, universal, complements, subsets, finite, infinite and disjoint sets;</p> <p>ii. solve problems involving cardinality of sets;</p> <p>iii. solve set problems using symbols; iv. use Venn diagrams to solve problems involving not more than 3 sets.</p> <p>Candidates should be able to:</p> <p>i. find the subject of the formula of a given equation;</p> <p>ii. apply factor and remainder theorem to factorize a given expression;</p> <p>iii. multiply, divide polynomials of degree not more than 3 and determine values of defined and undefined expression;</p> <p>iv. factorize by regrouping difference of two squares, perfect squares and cubic expressions; etc.</p> <p>v. solve simultaneous equations – one linear, one quadratic;</p> <p>vi. interpret graphs of polynomials including applications to maximum and minimum values.</p> <p>Candidates should be able to:</p> <p>i. solve problems involving direct, inverse, joint and partial variations;</p> <p>ii. solve problems on percentage increase and decrease in variation.</p> <p>Candidates should be able to:</p> <p>i. solve problems on linear and quadratic inequalities; ii. interpret graphs of inequalities.</p> <p>Candidates should be able to:</p> <p>i. determine the nth term of a progression;</p> <p>ii. compute the sum of A. P. and G.P; iii. sum to infinity of a given G.P.</p>
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TOPICS/CONTENTS/NOTES	OBJECTIVES
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<p><b>5. Binary Operations:</b></p> <ul style="list-style-type: none"> <li>(a) properties of closure, commutativity, associativity and distributivity;</li> <li>(b) identity and inverse elements (simple cases only).</li> </ul> <p><b>6. Matrices and Determinants:</b></p> <ul style="list-style-type: none"> <li>(a) algebra of matrices not exceeding <math>3 \times 3</math>;</li> <li>(b) determinants of matrices not exceeding <math>3 \times 3</math>;</li> <li>(c) inverses of <math>2 \times 2</math> matrices; [excluding quadratic and higher degree equations].</li> </ul>	<p>Candidates should be able to:</p> <ul style="list-style-type: none"> <li>i. solve problems involving closure, commutativity, associativity and distributivity;</li> <li>ii. solve problems involving identity and inverse elements.</li> </ul> <p>Candidates should be able to:</p> <ul style="list-style-type: none"> <li>i. perform basic operations (<math>\times</math>, <math>+</math>, <math>-</math>, <math>\div</math>) on matrices;</li> <li>ii. calculate determinants; iii. compute inverses of <math>2 \times 2</math> matrices.</li> </ul>
<p><b>SECTION III: GEOMETRY AND TRIGONOMETRY</b></p>	
<p><b>1. Euclidean Geometry:</b></p> <ul style="list-style-type: none"> <li>(a) Properties of angles and lines</li> <li>(b) Polygons: triangles, quadrilaterals and general polygons;</li> <li>(c) Circles: angle properties, cyclic quadrilaterals and intersecting chords; (d) construction.</li> </ul> <p><b>2. Mensuration:</b></p> <ul style="list-style-type: none"> <li>(a) lengths and areas of plane geometrical figures;</li> <li>(b) lengths of arcs and chords of a circle;</li> <li>(c) Perimeters and areas of sectors and segments of circles;</li> <li>(d) surface areas and volumes of simple solids and composite figures;</li> <li>(e) the earth as a sphere: longitudes and latitudes.</li> </ul> <p><b>3. Loci:</b> locus in 2 dimensions based on geometric principles relating to lines and curves.</p> <p><b>4. Coordinate Geometry:</b></p> <ul style="list-style-type: none"> <li>(a) midpoint and gradient of a line segment;</li> </ul>	<p>Candidates should be able to:</p> <ul style="list-style-type: none"> <li>i. identify various types of lines and angles;</li> <li>ii. solve problems involving polygons;</li> <li>iii. calculate angles using circle theorems; iv. identify construction procedures of special angles, e.g. <math>30^\circ</math>, <math>45^\circ</math>, <math>60^\circ</math>, <math>75^\circ</math>, <math>90^\circ</math> etc.</li> </ul> <p>Candidates should be able to:</p> <ul style="list-style-type: none"> <li>i. calculate the perimeters and areas of triangles, quadrilaterals, circles and composite figures;</li> <li>ii. find the length of an arc, a chord, perimeters and areas of sectors and segments of circles;</li> <li>iii. calculate total surface areas and volumes of cuboids, cylinders, cones, pyramids, prisms, spheres and composite figures;</li> <li>iv. determine the distance between two points on the earth's surface.</li> </ul> <p>Candidates should be able to: identify and interpret loci relating to parallel lines, perpendicular bisectors, angle bisectors and circles.</p> <p>Candidates should be able to:</p>

<p>(b) distance between two points; (c) parallel and perpendicular lines; (d) equations of straight lines.</p>	<p>i. determine the midpoint and gradient of a line segment; ii. find the distance between two points;</p>
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TOPICS/CONTENTS/NOTES	OBJECTIVES
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<p><b>5. Trigonometry:</b></p> <p>(a) trigonometrical ratios of angles;  (b) angles of elevation and depression;  (c) bearings;  (d) areas and solutions of triangle; (e) graphs of sine and cosine; (f) sine and cosine formulae.</p> <p style="text-align: center;"><b>SECTION IV: CALCULUS</b></p> <p><b>1. Differentiation:</b></p> <p>(a) limit of a function  (b) differentiation of explicit algebraic and simple trigonometrical functions – sine, cosine and tangent.</p> <p><b>2. Application of differentiation:</b></p> <p>(a) rate of change;  (b) maxima and minima.</p> <p><b>3. Integration:</b></p> <p>(a) integration of explicit algebraic and simple trigonometrical functions;  (b) area under the curve.</p> <p style="text-align: center;"><b>SECTION V: STATISTICS</b></p> <p><b>1. Representation of data:</b></p> <p>(a) frequency distribution;  (b) histogram, bar chart and pie chart.</p>	<p>iii. identify conditions for parallelism and perpendicularity;  iv. find the equation of a line in the two-point form, point-slope form, slope intercept form and the general form.</p> <p>Candidates should be able to:</p> <p>i. calculate the sine, cosine and tangent of angles between <math>-360^\circ \leq \theta \leq 360^\circ</math>;  ii. apply these special angles, e.g. <math>30^\circ</math>, <math>45^\circ</math>, <math>60^\circ</math>, <math>75^\circ</math>, <math>90^\circ</math>, <math>105^\circ</math>, <math>135^\circ</math> to solve simple problems in trigonometry;  iii. solve problems involving angles of elevation and depression;  iv. solve problems involving bearings;  v. apply trigonometric formulae to find areas of triangles;  vi. solve problems involving sine and cosine graphs.</p> <p>Candidates should be able to:</p> <p>i. find the limit of a function  ii. differentiate explicit algebraic and simple trigonometrical functions.</p> <p>Candidates should be able to:  solve problems involving applications of rate of change, maxima and minima.</p> <p>Candidates should be able to:</p> <p>i. solve problems of integration involving algebraic and simple trigonometric functions;  ii. calculate area under the curve (simple cases only).</p> <p>Candidates should be able to:</p> <p>i. identify and interpret frequency distribution tables;  ii. interpret information on histogram, bar chart and pie chart.</p> <p>Candidates should be able to:</p>
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**2. Measures of Location:**

(a) mean, mode and median of ungrouped and grouped data – (simple cases only); (b) cumulative frequency.

i. calculate the mean, mode and median of ungrouped and grouped data (simple cases only);

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<p><b>3. Measures of Dispersion:</b> range, mean deviation, variance and standard deviation.</p> <p><b>4. Permutation and Combination:</b></p> <p>(a) Linear and circular arrangements; (b) Arrangements involving repeated objects.</p> <p><b>5. Probability:</b></p> <p>(a) experimental probability (tossing of coin, throwing of a dice etc); (b) Addition and multiplication of probabilities (mutual and independent cases).</p>	<p>ii. use ogive to find the median, quartiles and percentiles.</p> <p>Candidates should be able to: calculate the range, mean deviation, variance and standard deviation of ungrouped and grouped data.</p> <p>Candidates should be able to: solve simple problems involving permutation and combination.</p> <p>Candidates should be able to: solve simple problems in probability (including addition and multiplication).</p>

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**RECOMMENDED TEXTS**

Adelodun A. A. (2000) *Distinction in Mathematics: Comprehensive Revision Text, (3<sup>rd</sup> Edition)*  
Ado –Ekiti: FNPL.

Anyebe, J. A. B. (1998) *Basic Mathematics for Senior Secondary Schools and Remedial Students in  
Higher Institutions*, Lagos: Kenny Moore.

Channon, J. B. Smith, A. M. (2001) *New General Mathematics for West Africa SSS 1 to 3*, Lagos:  
Longman.

David –Osuagwu, M. et al. (2000) *New School Mathematics for Senior Secondary Schools*, Onitsha:  
Africana - FIRST Publishers.

Egbe. E et al (2000) *Further Mathematics, Onitsha*: Africana – FIRST Publishers

Ibude, S. O. et al.. (2003) *Algebra and Calculus for Schools and Colleges*: LINCEL Publishers.

Tuttuh – Adegun M. R. et al. (1997) *Further Mathematics Project Books 1 to 3*, Ibadan: NPS Educational

Wisdomline Pass at Once JAMB.