Mathematics

JAMB UTME Syllabus: topics and objectives

Aim. This syllabus prepares you for the UTME in Mathematics. It tests whether you can: (1) build computational and manipulative skills; (2) develop precise, logical and formal reasoning; (3) develop deductive skills in reading graphs, diagrams and data; and (4) apply mathematical ideas to everyday problems. It has five sections: Number and Numeration, Algebra, Geometry and Trigonometry, Calculus, and Statistics.

How to use it. The left column lists what the topic covers. The right column lists what you should be able to do after studying it. Tick each objective off as you master it, and practise past questions on each topic.

SECTION I: NUMBER AND NUMERATION

1. NUMBER BASES AND MODULAR ARITHMETIC

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Operations in number bases from 2 to 10 • Converting from one base to another, including fractional parts • Modular arithmetic	1. Perform the four basic operations in different bases 2. Convert from one base to another 3. Perform operations in modular arithmetic

2. FRACTIONS, DECIMALS, APPROXIMATIONS AND PERCENTAGES

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Fractions and decimals • Significant figures and decimal places • Percentage errors • Simple interest; profit and loss per cent • Ratio, proportion and rate • Shares and value added tax (VAT)	1. Perform the four basic operations on fractions and decimals 2. Write numbers to a given number of significant figures and decimal places 3. Calculate simple interest, profit and loss per cent, ratio, proportion, rate and percentage error 4. Solve problems on shares and VAT

3. INDICES, LOGARITHMS AND SURDS

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Laws of indices; equations involving indices • Standard form • Laws of logarithms; logarithm of any positive number to a given base • Change of base and its uses • Relationship between indices and logarithms • Surds	1. Apply the laws of indices in calculations and solve equations involving indices 2. Use the relationship between indices and logarithms to solve problems, including change of base 3. Simplify and rationalise surds 4. Perform the basic operations on surds

4. SETS

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Types of sets • Algebra of sets • Venn diagrams and their uses	1. Identify types of sets: empty, universal, complement, subset, finite, infinite and disjoint 2. Solve problems on the cardinality of sets 3. Solve set problems using symbols 4. Use Venn diagrams to solve problems with not more than 3 sets

SECTION II: ALGEBRA

1. POLYNOMIALS

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Change of subject of a formula • Addition, subtraction, multiplication and division of polynomials • Factorisation of polynomials of degree not above 3; roots of polynomials of degree not above 3 • Factor and remainder theorems • Simultaneous equations (one linear, one quadratic) • Graphs of polynomials of degree not above 3	1. Change the subject of a formula 2. Use the factor and remainder theorems to factorise expressions 3. Multiply and divide polynomials of degree not more than 3 and tell defined from undefined values 4. Factorise by regrouping, difference of two squares, perfect squares and cubic expressions 5. Solve simultaneous equations with one linear and one quadratic 6. Interpret graphs of polynomials, including maximum and minimum values

2. VARIATION

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Direct, inverse, joint and partial variation • Percentage increase and decrease	1. Solve problems on direct, inverse, joint and partial variation 2. Solve problems on percentage increase and decrease in variation

3. INEQUALITIES

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Analytical and graphical solutions of linear inequalities • Quadratic inequalities with integral roots only	1. Solve linear and quadratic inequalities 2. Interpret graphs of inequalities

4. PROGRESSION

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• nth term of a progression • Sum of an A.P. and a G.P.	1. Find the nth term of a progression 2. Calculate the sum of an A.P. and a G.P. 3. Find the sum to infinity of a G.P.

5. BINARY OPERATIONS

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Closure, commutativity, associativity and distributivity • Identity and inverse elements (simple cases only)	1. Solve problems on closure, commutativity, associativity and distributivity 2. Solve problems on identity and inverse elements

6. MATRICES AND DETERMINANTS

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Algebra of matrices not above 3 x 3 • Determinants of matrices not above 3 x 3 • Inverses of 2 x 2 matrices (no quadratic or higher-degree equations)	1. Perform the basic operations on matrices 2. Calculate determinants 3. Find inverses of 2 x 2 matrices

SECTION III: GEOMETRY AND TRIGONOMETRY

1. EUCLIDEAN GEOMETRY

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Properties of angles and lines • Polygons: triangles, quadrilaterals and general polygons • Circles: angle properties, cyclic quadrilaterals and intersecting chords • Construction	1. Identify types of lines and angles 2. Solve problems on polygons 3. Calculate angles using circle theorems 4. Identify the construction steps for special angles such as 30, 45, 60, 75 and 90 degrees

2. MENSURATION

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Lengths and areas of plane figures • Lengths of arcs and chords of a circle • Perimeters and areas of sectors and segments • Surface areas and volumes of simple solids and composite figures • The earth as a sphere: longitudes and latitudes	1. Calculate perimeters and areas of triangles, quadrilaterals, circles and composite figures 2. Find arc lengths, chord lengths, and perimeters and areas of sectors and segments 3. Calculate total surface areas and volumes of cuboids, cylinders, cones, pyramids, prisms, spheres and composite figures 4. Find the distance between two points on the earth's surface

3. LOCI

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Locus in 2 dimensions based on geometric principles of lines and curves	1. Identify and interpret loci relating to parallel lines, perpendicular bisectors, angle bisectors and circles

4. COORDINATE GEOMETRY

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Midpoint and gradient of a line segment • Distance between two points • Parallel and perpendicular lines • Equations of straight lines	1. Find the midpoint and gradient of a line segment 2. Find the distance between two points 3. State the conditions for parallel and perpendicular lines 4. Find the equation of a line in two-point, point-slope, slope-intercept and general forms

5. TRIGONOMETRY

TOPICS / CONTENTS	OBJECTIVES: candidates should be able to
• Trigonometric ratios of angles • Angles of elevation and depression • Bearings • Areas and solutions of triangles • Graphs of sine and cosine • Sine and cosine formulae	1. Calculate the sine, cosine and tangent of angles from -360 to 360 degrees 2. Use special angles (30, 45, 60, 75, 90, 105, 135 degrees) to solve simple problems 3. Solve problems on angles of elevation and depression, and on bearings 4. Apply the trigonometric formulae to find areas of triangles 5. Solve problems on sine and cosine graphs

SECTION IV: CALCULUS

1. DIFFERENTIATION	
TOPICS / CONTENTS	**OBJECTIVES: candidates should be able to**
• Limit of a function • Differentiation of explicit algebraic and simple trigonometric functions (sine, cosine, tangent)	1. Find the limit of a function 2. Differentiate explicit algebraic and simple trigonometric functions

2. APPLICATION OF DIFFERENTIATION	
TOPICS / CONTENTS	**OBJECTIVES: candidates should be able to**
• Rate of change • Maxima and minima	1. Solve problems on rate of change, maxima and minima

3. INTEGRATION	
TOPICS / CONTENTS	**OBJECTIVES: candidates should be able to**
• Integration of explicit algebraic and simple trigonometric functions • Area under the curve	1. Solve integration problems on algebraic and simple trigonometric functions 2. Calculate the area under a curve (simple cases only)

SECTION V: STATISTICS

1. REPRESENTATION OF DATA	
TOPICS / CONTENTS	**OBJECTIVES: candidates should be able to**
• Frequency distribution • Histogram, bar chart and pie chart	1. Identify and interpret frequency distribution tables 2. Interpret information on histograms, bar charts and pie charts

2. MEASURES OF LOCATION	
TOPICS / CONTENTS	**OBJECTIVES: candidates should be able to**
• Mean, mode and median of ungrouped and grouped data (simple cases only) • Cumulative frequency	1. Calculate the mean, mode and median of ungrouped and grouped data 2. Use an ogive to find the median, quartiles and percentiles

3. MEASURES OF DISPERSION	
TOPICS / CONTENTS	**OBJECTIVES: candidates should be able to**
• Range, mean deviation, variance and standard deviation	1. Calculate the range, mean deviation, variance and standard deviation of ungrouped and grouped data

4. PERMUTATION AND COMBINATION	
TOPICS / CONTENTS	**OBJECTIVES: candidates should be able to**
• Linear and circular arrangements • Arrangements involving repeated objects	1. Solve simple problems on permutation and combination

5. PROBABILITY	
TOPICS / CONTENTS	**OBJECTIVES: candidates should be able to**
• Experimental probability (tossing a coin, throwing a die, etc.) • Addition and multiplication of probabilities (mutually exclusive and independent cases)	1. Solve simple probability problems, including addition and multiplication of probabilities