## FOREWORD

The Botswana Examinations Council is pleased to authorise the publication of the revised assessment procedures for the Junior Certificate Examination programme. According to the Revised National Policy on Education, the main intentions of the three year Junior Secondary programme are to provide the learners with opportunities for pre-vocational preparation and to enable the learners to take advantage of further education and training. These goals are reflected in the current Junior Secondary curriculum and accordingly, were taken into account when the assessment procedures were revised.

The range of ability of the learners has also influenced the design and revision of the assessment procedures. As a result of the ten year basic education policy, the ability range of the learners in Junior Secondary schools is much greater than previously. The revised assessment procedures are designed to ensure that all learners, regardless of their ability, have the opportunity of demonstrating what they know, understand and can do.

Another important aspect of assessment meant to be fostered through this revision is the alignment of assessment with the specific requirements of the teaching programme. This has been addressed through the restructuring of the scheme of assessment for individual subjects, whilst ensuring the reliability of the outcomes. The revised procedures use a standardised format across all subjects, whilst meeting the specific requirements of each subject.

The revised procedures are not intended to replace the existing teaching syllabuses. Rather, they provide a specification of the knowledge and skills which are to be assessed in each subject. Through the scheme of assessment, the procedures provide information on: the number of question papers in each subject, the marks allocated to each paper, paper and section weightings, etc.

These procedures are the outcome of the efforts of many professionals in the education system, and I wish to extend my thanks to all those who made their contribution. I would also like to encourage a continuation of this valuable collaboration.

**Executive Secretary**

## 1. INTRODUTION

As part of the Botswana Junior Secondary Education Programme, the Mathematics Assessment Procedures are designed to provide a framework for assessing candidates who have completed a three-year course based on the Junior Secondary Mathematics Education Teaching Syllabus.

The Mathematics examination aims to assess the knowledge and skills acquired through instruction in the content prescribed for the Junior Secondary Mathematics programme. The assessment will be designed in a way that encourages candidates to show what they know and can do, and their level of understanding. Furthermore, the procedures offer a general framework for syllabus content representation in examination papers and assure comparability of sampled content from year to year.

The outcome of instruction in the content prescribed by the Mathematics Teaching Syllabus will be assessed through **two** written papers.

## 2. DIMENSIONS

For purposes of assessment, the behavioural outcomes of instruction in the prescribed content have been classified into two broad skill areas called dimensions. Brief descriptions of the dimensions are given below.

**Dimension 1: Knowledge and Understanding**

**Candidates will be assessed on their ability to:**

- perform calculations with and/or without a calculating aid;
- recall definitions, vocabulary, units, facts, procedures, notations and concepts;
- recognise, understand and use mathematical procedures, properties of shapes, transformations, and mathematical relationships;

- estimate, approximate and use appropriate degrees of accuracy;
- collect, process, present (e.g. in tabular, graphical or diagrammatic form) and interpret data;
- read scales and use geometrical instruments;
- classify numbers, shapes and expressions.

**Dimension 2: Application and Reasoning**

**Candidates will be assessed on the ability to:**

- select and apply rules, relationships, methods, concepts and procedures to solve routine mathematical, including real-life, problems;
- present information in different forms;
- formulate methods, procedures, equations, diagrams, algorithms to solve routine and non-routine problems;
- investigate patterns and sequences;
- generalise patterns, make conclusions and evaluate mathematical ideas and formulate problem solving strategies;
- apply mathematical procedures and problem solving strategies in unfamiliar or complex contexts.

## 3. THE STRUCTURE OF THE EXAMINATION

The syllabus will be assessed by two written papers. Subject grades will be reported on a five-point scale of A to E.

| | | | |
|---|---|---|---|
| **Paper 1** | **Multiple-Choice** | **Marks** | **40** |
| **Time** | **1 Hour 30 Minutes** | **Weighting** | **40%** |

This paper will consist of forty multiple-choice questions assessing mainly knowledge and understanding. **No calculating aid will be allowed in this paper**.

| | | | |
|---|---|---|---|
| **Paper 2** | **Short-Answer and Structured** | **Marks** | **100** |
| **Time** | **2 Hours** | **Weighting** | **60%** |

This paper will focus mainly on application and reasoning, including problems solving ability.

There will be three sections in this paper and candidates must answer **ALL** questions. **Candidates will be allowed to use a calculating aid in this paper.**

Section A will have short-answer questions worth 30 marks. Each question will have a maximum of 4 marks.
Section B will have structured questions worth 50 marks. The marks for each question will range between 5 and 10.
Section C will have short-answer and/or structured questions assessing problem-solving ability and will be worth 20 marks.

## 4. ASSESSMENT GRID

The table below shows percentage representation of the examined major content areas by paper.

| COMPONENTS | MAJOR CONTENT AREAS | | | | | | TOTAL |
|---|---|---|---|---|---|---|---|
| | Number | Measures | Algebra | Geometry | Statistics and Data Handling | Problem Solving | |
| **PAPER 1** | 30% | 20% | 10% | 27% | 8% | 5% | **100%** |
| **PAPER 2** | 24% | 12% | 12% | 20% | 12% | 20% | **100%** |

## 5. WEIGHTING OF PAPERS BY DIMENSIONS

The table below shows percentage representation of dimensions by paper.

| COMPONENT | DIMENSIONS | | TOTAL |
|---|---|---|---|
| | Knowledge and Understanding | Application and Reasoning | |
| **PAPER 1** | 25% | 15% | **40%** |
| **PAPER 2** | 15% | 45% | **60%** |
| **TOTAL** | **40%** | **60%** | **100%** |

## 6. GRADE DESCRIPTIONS

Grade descriptions are provided to give a general indication of the skill acquisition expected of candidates for the award of particular grades.

**GRADE A**

**The candidate should be able to:**

A1. Approximate sums, products, quotients and differences;
A2. Express numbers as product of prime factors;
A3. Apply the concepts of commutativity and associativity;
A4. Work with mixed operations in fractions;
A5. Work with self-defined operations;
A6. Investigate fractional patterns;
A7. Investigate and use the concept of identity and inverse elements in fractions;
A8. Investigate and use the concept o0f identity and inverse elements in directed numbers;
A9. Add, subtract, multiply and divide fractions and decimals;
A10. Simplify ratios (fractional terms);
A11. Apply ratios to real life situations (fractional terms);
A12. Solve problems involving indirect proportions;
A13. Express a positive integer as a product of its prime factors using indices;
A14. Work with zero and negative indices;
A15. Express numbers in standard form;
A16. Calculate the square root of any number (decimal, fraction), using a calculating aid;
A17. Use matrices to store information;
A18. Multiply two matrices of up to 2 x 2;
A19. Investigate commutativity and associativity in 2 x 2 matrices;
A20. Convert units of area;
A21. Calculate length of arc;
A22. Calculate area of composite shapes, sector or circle;

A23. Read and interpret scales.
A24. Calculate distance on the map, actual distance, and scale of a map.
A25. Make simple scale drawing.
A26. Calculate surface area and volume of prism.
A27. Convert units of area, density, and speed.
A28. Calculate average speed using distance-time graphs.
A29. Draw simple distance-time graphs;
A30. Simplify binomial products;
A31. Form a formula corresponding to a given situation;
A32. Draw graphs to represent quadratic relationships;
A33. Find the equation of a straight line;
A34. Use laws of indices to simplify algebraic expressions;
A35. Work with zero and negative indices;
A36. Factorise expressions containing powers with index more than 1;
A37. Simplify algebraic fractions;
A38. Solve linear equations including fractional equations and negative solutions;
A39. Factorise simple quadratic expressions;
A40. Solve quadratic equations using graphical and factorisation method;
A41. Solve simultaneous equations using elimination method;
A42. Calculate the specified angle of a polygon and the sum of interior and exterior angles of a polygon;
A43. Draw the image of an object under a rotation, find the centre and angle of rotation;
A44. Draw the image of an object under enlargement, find the centre and the scale factor of enlargement;
A45. Describe a transformation fully;
A46. Identify and differentiate between transformation;
A47. Construct regular polygons;
A48. Determine whether a triangle is right-angled;
A49. Find the distance between two points;
A50. Apply Pythagoras Theorem to a real life situation;
A51. Calculate the three ratios in a right-angled triangle.
A52. Calculate missing sides and angles in a given triangle;
A53. Solve problems involving reversed percentages;

A54. Use simple interest;
A55. Calculate and use compound interest;
A56. Understand the concept of inflation;
A57. Transform information from one chart to another;
A58. Compare charts;
A59. Calculate mean from a frequency table, bar chart;
A60. Calculate median from a bar chart;
A61. Calculate the probability of single events;
A62. Describe a position using bearings;

**GRADE C**

**The candidate should be able to:**

C1. Express numbers less than 10 000 000 in words or figures;
C2. Multiply and divide: (without using a calculator)
- Whole numbers less than 100 000;
- Fractions (denominators up to two digits);
- Decimals (with up to three decimal places);
- Directed numbers(with up to two digits);

C3. Describe and generate a sequence of whole numbers and fractions;
C4. Approximate whole numbers less than 100 000 and round off numbers less than 100 000 to a specified value;
C5. Classify whole numbers as primes, square, rectangle, triangle, and cube;
C6. Express numbers as products of their prime factors;
C7. Follow a correct order of operations and solve problems involving mixed operations on:
- Whole numbers;
- Directed numbers;

C8. Add and subtract:
- Fractions (denominators of up to two digits);
- Decimals(up to three decimal places);
- Directed numbers (up to two digits);

C9. Use <, > and = to compare:

- Fractions (two fractions);
- Directed numbers ( two directed numbers);
- Decimals (up to three decimals of three decimal places);

C10. Order:

- Fractions (up to 10 fractions);
- Decimals;

C11. Relate directed numbers to real life situations;

C12. Round off decimals and approximate their sums, differences, products and quotients to a specified place value;

C13. Convert between decimals, fractions and percentages;

C14. Find the percentage of a quantity and express one quantity as a percentage of the other

C15. State number of significant figures in whole numbers and decimals, and round off to a given number of significant figures;

C16. Solve word problems involving decimals, fractions and percentages;

C17. Express ratios in lowest terms and apply them to plans, maps, recipes, mixtures, money and other situations;

C18. Solve problems involving direct proportion;

C19. Use laws of indices to solve problems;

C20. Calculate squares, of whole numbers, fractions and decimals without using a calculating aid;

C21. Calculate squares of any integer number using a calculating aid;

C22. Find square root of perfect squares less than 1 000 without a calculating aid;

C23. State the order of matrix, add and subtract the matrices and multiply up to a two by two matrix by a scalar;

C24. Measure area, circumference and diameter, draw and measure angles (up to 360°);

C25. Convert units of length, mass volume and time;

C26. Approximate measures and measure to a given level of accuracy;

C27. Estimate measures of area, angles, time and volume;

C28. Calculate the perimeter and area (triangles and quadrilaterals), circumference, density, speed, surface area (cube, cuboid), volume (cube, cuboid);

C29. Calculate the actual measurement given the scale, excluding maps;

C30. Identify and draw cross sections of prisms;

C31. Solve simple life problems involving speed, time taken and distance traveled;
C32. Read and interpret distance time-graph;
C33. Collect like terms up to 6 terms;
C34. Factorise linear algebraic expressions;
C35. Substitute in linear algebraic expressions and evaluate the value of the specified variable;
C36. Form and solve linear equations including equations from real life situations;
C37. Calculate value of the specified variable;
C38. Interpret graphs and charts;
C39. Describe in words a situation represented by a graph;
C40. Draw graphs to represent linear relationship;
C41. Use laws of indices to simplify algebraic expressions excluding zero, fractional and negative indices;
C42. Solving linear equations involving variables on both sides of the brackets;
C43. Solve simultaneous equations graphically;
C44. Change the subject of a simple formula to a specified variable;
C45. Differentiate between leap year and normal year;
C46. Calculate time;
C47. Interpret and use timetables;
C48. Understand time difference;
C49. Calculate angles using concept of vertically opposite angles, corresponding angles, alternate and interior angles;
C50. Name polygons;
C51. Describe line and rotational symmetry;
C52. Draw the image of an object under a reflection and find the line of reflection;
C53. Draw the image under a translation and find the translation vector;
C54. Identify a rotation.
C55. Sketch 3-d figures (cube, cuboid, cylinder, and triangular prism);
C56. Name a 3-D figure given its net;
C57 Draw the net of a 3-D figure;
C58. Represent a situation on a map using bearings and calculate bearings;
C59. Mention real life examples relating to transformation;
C60. Construct parallel and perpendicular lines, triangles, quadrilaterals;
C61. Identify, hypotenuse, adjacent and opposite;

C62. Apply the Pythagorean Theorem;
C63. Estimate costs;
C64. Calculate discount, percentage discount, percentage profit/loss, buying price or selling price;
C65. Cross- – Check bills and invoices;
C66. Calculate appreciation, depreciation, percentage appreciation and percentage depreciation;
C67. Calculate the cost of sending telegram, electricity, water and telephone charges;
C68. Estimate the cost of activities;
C69. Convert currency;
C70. Calculate commission, hire-purchase cost;
C71. Identify advantage and disadvantage of hire purchase;
C72. Interpret tax – tables, calculate income tax;
C73. Calculate customs duty;
C74. Calculate the cost of registering a vehicle;
C75. Calculate insurance benefit;
C76. Draw pie chart, line-graph;
C77. Calculate range from bar chart;
C78. Calculate mean from a distribution;
C79. Calculate median from a distribution, frequency table;
C80. Determine possible outcomes;
C81. Write a repeated multiplication as a power (numbers and variables);
C82. Estimate length and mass;
C83. Conduct simple surveys;
C84. Calculate simple interest;

**GRADE D**

**The candidate should be able to**:

D1. Express numbers less than 10 000 in words or figures;
D2. Add and subtract whole numbers with a maximum of six digits without using a calculator;

D3. Multiply a whole number up to two digits by another number up to two digits whole number and divide a whole number up to four digits by one digit whole number;

D4. Continue a simple sequence of whole numbers;

D5. Round off numbers less then 1000 to the nearest 100;

D6. Classify whole numbers less than 100 as odd/even;

D7. List factors of numbers less than 200 and multiples of numbers less than 100;

D8. Compare two decimals up to one decimal place using the symbols: <,> and =;

D9. Add and subtract decimals up to one decimal place when vertically arranged without using a calculator;

D10. Simplify ratios with whole number terms;

D11. Write a repeated multiplication as a power(numbers only);

D12. Calculate squares of whole numbers up to 10 without using a calculator;

D13. Multiply a one by two and/or a two by one matrix by a scalar;

D14. Measure length, volume (in $mm^3$, $cm^3$, ml and l), mass (in mg, g, kg and tonnes), angles (up to $180^0$) and time;

D15. Convert unit of length (cm to mm, km to m, m to cm and vice versa) and time (hours to minutes, days to hours, weeks to days, years to months and months to weeks and vice versa);

D16. Read and interpret scales of instruments like gauges, thermometers, voltmeters, ammeter etc;

D17. Draw angles up to $180^0$;

D18. Collect like terms up to 3 terms;

D19. Substitute in simple algebraic expressions with two terms and coefficient 1;

D20. Solve linear equations of the form $x + a = L$;

D21. Expand algebraic powers (positive indices only);

D22. State the number of days in a month;

D23. Use proper notation to record time;

D24. Convert time from 12 hour to 24-hour clock and vice versa;

D25. Identify angles (acute, obtuse, right angle, straight and reflex angle);

D26. Name square, rectangle and triangle;

D27. Add and subtract column vectors;

D28. Multiply a column vector by a scalar

D29. Work out money problems involving the four basic operations;

D30. Calculate the profit and loss, buying or selling price given profit or loss;

D31. Draw a pictograph;

D32. Read charts;

D33. Find mode from a distribution, frequency table or bar-chart;

D34. Calculate perimeter and area of square and rectangle;

D35. Draw a simple line of symmetry.