BOTSWANA EXAMINATIONS COUNCIL

JUNIOR CERTIFICATE EXAMINATION

ASSESSMENT SYLLABUS

MATHEMATICS
CODE 013

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FOREWORD

The Botswana Examinations Council is pleased to release the assessment syllabus for the revised Junior Secondary Education curriculum implemented in January 2010.

The purpose of this assessment syllabus is to guide schools, teachers and other educational institutions on what will be assessed in the subject area and how the assessment will be carried out for certification of students completing the Junior Secondary Education.

The curriculum at junior secondary level, puts emphasis on understanding and application of concepts; development of high order thinking skills (HOTS) such as inquiry, decision making, reasoning, creative, analytical, problem solving and process skills. It also calls for the acquisition of hands on experience that should increase the participation and performance of all groups e.g. groups of different abilities, learners with special needs, girls and boys.

All these skills entail more practical and challenging content and tasks that require higher levels of engagement of a learner's cognitive ability. The assessment syllabus has been designed to allow these higher order thinking skills to be assessed. It assesses what candidates know, understand and can do, enabling them to demonstrate their full potential.

The assessment syllabus is intended to promote a variety of styles of teaching, learning and assessment to enable candidates to progress to higher levels of learning. Therefore, teachers must be proficient in planning and directing a variety of learning activities. They should be conscious of the need for the students to be accountable and responsible for their own learning to some extent. They must also take into account the widening different levels of achievement which they aspire to. This implies active participation by both students and teachers, the creation of rich and diverse learning environments and the use of relevant assessment procedures to monitor the development of each learner.

It is important then that we value the student's own experiences, build upon what they know and reward them for positive achievement. This assessment syllabus is the outcome of a great deal of professional consultation and collaboration. On behalf of the Botswana Examinations Council, I wish to express my sincere gratitude to all those who contributed to the development and production of this assessment syllabus.

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Executive Secretary

ACKNOWLEDGEMENTS

The Botswana Examinations Council wishes to acknowledge the contributions of the following Advisory Committee Members for their valuable contributions in the development of this Mathematics Assessment syllabus.

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1.   Introduction

As part of the Botswana Junior Secondary Education Programme, this Mathematics syllabus is designed to provide a framework for the assessment of candidates who have completed the three-year course based on the revised Junior Secondary Mathematics teaching syllabus.

The Junior Secondary Education Mathematics Assessment Syllabus aims to afford the candidate an opportunity to fully demonstrate their potential and exhibit the knowledge and skills they possess through a variety of assessment modes. The syllabus also aims at providing information on what will be assessed and how it will be assessed with the intention of achieving comparable standards from year to year.

Candidates will be assessed on a scale of A – E. Candidates who fail to meet the minimum requirement will be awarded a U.

This syllabus should be read in conjunction with:

(a)   the Junior Secondary School Mathematics Teaching syllabus;

(b)   the specimen question papers and marking schemes.

This syllabus is available for both school and private candidates.

The outcome of instruction in the content prescribed by the Mathematics teaching syllabus will be assessed through a multiple-choice paper and a written paper.

2.   General Aims of Assessment

The syllabus embraces the subject aims defined in the Mathematics teaching syllabus.

The assessment syllabus has the following additional aims:

- To ensure proper assessment of all the important skills in the curriculum.
- To enable both teaching and assessment to cater for all ability levels.
- To provide an efficient evaluative mechanism of the curriculum.
- To encourage an investigative approach to learning.
- To provide internationally recognised standards.
- To enable the students to realise their full potential.
- To reinforce candidates' ability to handle and interact meaningfully with given materials.
- To encourage candidates to apply learned skills to manipulate life.

3.   Assessment Objectives

For purposes of assessment, the behavioural outcomes of instruction in the prescribed content have been classified into two broad skill areas known as assessment objectives. A brief description of the assessment objectives is given below.

Assessment Objective 1:   Knowledge and Understanding

Candidates will be assessed on their ability to;

1.1   perform calculations with and or without calculating aid;

1.2   estimate, approximate and use appropriate degrees of accuracy

1.3   classify numbers;

1.4   process, present in tabular, graphical and diagrammatic forms and interpret data;

1.5   use geometrical instruments;

1.6   recognise and justify generalizations of patterns and structures in a variety of situations and forms;

1.7   use common systems of units;

Assessment Objective 2:   Application and Reasoning

Candidates will be assessed on their ability to;

2.1   recognise, understand and apply properties of shapes, positions, movements and transformations in two and/or three dimensions;

2.2   recognise, understand and apply appropriate mathematical procedures in a given situation;

2.3   understand and apply relationships and their representations;

2.4   formulate problems in mathematical terms;

2.5   select, apply and communicate appropriate techniques of solutions and interpret the solutions in terms of the problem e.g. investigations;

2.6   apply mathematical concepts in addressing emerging issues.

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4.   Scheme of Assessment

The JCE Mathematics syllabus will be assessed through a multiple-choice paper and a written paper.

Paper 1	**Multiple-Choice Items**	
Time **1 hour 30 minutes**	**Marks** **40**	
Weighting **40%**		

This will be a 40 item multiple choice paper assessing knowledge, understanding and application of mathematical concepts. Each item will have four options.

Note: No calculating aid will be allowed in this paper.

Paper 2	Short-Answer and Structured Items

Time	2 hours	Marks	100
Weighting	60%		

This will be a written paper assessing knowledge, understanding and application of mathematical concepts, including critical thinking and problem solving skills. There will be **three** sections in the paper, that is, Sections **A, B** and **C.**

Section A: This section will present short-answer items assessing candidates' ability to express themselves mathematically while demonstrating in-depth knowledge and understanding of concepts. Candidates will answer **all** questions. This section will be worth **30 marks.**

Section B: This section will present structured items focusing on assessing candidates' ability to apply mathematical concepts to real life situations. Candidates will answer all questions This section will be worth **50 marks.**

Section C: This section will present non-routine items to assess the candidates' problem solving skills. Candidates will answer **all** questions. This section will be worth **20 marks**.

Note: A calculating aid will be allowed in this paper.

5. Assessment Grid

The grid below shows the coverage of content areas that will be mainly assessed in each paper.

	Numbers & Operations	Measure	Geometry	Algebra	Statistics & Probability
Paper 1	20%	25%	25%	20%	10%
Paper 2	15%	20%	25%	25%	15%

The grid below shows assessment objectives that will be mainly assessed in each paper.

	Knowledge and Understanding	Application and Reasoning	Total Marks	Weight
Paper 1	75%	25%	40	40%
Paper 2	50%	50%	100	60%

6.   Grade Descriptors

The descriptions below provide a general indication of the skill acquisition expected of candidates for the award of key grades A, C and E.

GRADE A

Candidates should be able to;

A1.   Approximate sums, products, quotients and differences;

A2.   Apply the concepts of commutativity and associativity;

A3.   Work with mixed operations in fractions and identities;

A4.   Work with self-defined operations;

A5.   Simplify and apply ratios including fractional terms;

A6.   Solve problems involving indirect proportions;

A7.   Prepare bills and invoices and calculate VAT;

A8.   Work with positive fractional indices

A9.   Solve problems involving numbers expressed in standard form;

A10.   Calculate the square root of any number (decimal, fraction), using a calculating aid; use a scientific calculator efficiently;

A11.   Investigate and use identity commutativity, associativity and inverse elements in a 2 x 2 matrices;

A12.   Calculate area of composite shapes, sector or circle;

A13.   Calculate surface area and volume of prism;

A14.   Solve problems involving applications of ratio and proportion on surface areas and volumes of 3 - dimensional objects;

A15.   Calculate average speed using distance-time graphs;

A16.   Draw and interpret velocity time graphs;

A17.   Solve problems including use of average speed and velocity time graphs;

A18.   Solve problems in quadratic equations as applied in real life situations;

A19.   Draw graphs to represent quadratic relationships;

A20.   Use laws of indices to simplify algebraic expressions;

A21.   Factorise expressions containing powers with index more than 1;

A22.   Simplify algebraic fractions;

A23.   Change the subject of the formula including squares and square roots given values of the variables;

A24.   Solve linear equations including fractional equations;

A25.   Factorise quadratic expressions;

A26.   Solve quadratic equations using graphical and factorization method;

A27.   Solve simultaneous linear equations including in real life situations;

A28.   Calculate specified angles in triangles and quadrilaterals;

A29.   Draw the image of an object under a rotation; find the centre and angle of rotation;

A30.   Draw the image of an object under enlargement; find the centre and the scale factor of enlargement;

A31.   Describe a transformation fully;

A32.   Solve problems involving combined transformations;

A33.   Construct regular polygons;

A34.   Solve problems involving properties of congruent triangles and similar triangles;

A35.   Use knowledge of distance between two points and mid- point to solve problems;

A36.   Calculate missing sides and angles in a right angled triangle;

A37.   Solve problems involving reversed percentages;

A38.   Calculate and use compound interest;

A39.   Understand the concept of inflation;

A40.   Transform information from one chart to another;

A41.   Calculate the median and the mean from a frequency table;

A42.   Calculate the probability of up to two events;

A43.   Draw and interpret data from a scatter graph;

A44.   Draw elevations of front, side and the plan of 3 dimensional;

A45.   Interpret a histogram and a frequency polygon with equal intervals;

A46.   Draw and use a cumulative frequency curve;

A47.   Describe a position using bearings;

GRADE C

Candidates should be able to;

C1.   Multiply and divide without using a calculator; whole number less than 100 000, fractions with denominators up to two digits, decimals with up to three decimal places and directed numbers with up to two digits

C2.   Approximate whole numbers less than 100 000 and round off numbers less than 100 000 to a specified value;

C3.   Describe and generate a sequence of whole numbers, fractions, decimals, directed numbers and percentages.

C4.   Classify whole numbers as primes, square, rectangle, triangle and cube;

C5.   Express numbers and products of their prime factors using indices;

C6.   Add and subtract; fractions with denominators of up to two digits; decimals up to three decimal places and directed numbers up to two digits.

C7.   Relate directed numbers to real life situations;

C8.   Round off decimals and approximate their sums, differences, products and quotients to a specified place value;

C9.   Convert between decimals, fractions and percentages;

C10. Find the percentage of a quantity and express one quantity as a percentage of the other and calculate percentage increase/decrease;

C11. State number of significant figures in decimals and round off to a given number of significant figures;

C12. Express ratios in lowest terms and apply them in real life situations;

C13. Use laws of indices to solve problems with integral indices; express numbers in standard form;

C14. Calculate squares, of whole numbers, fractions and decimals without using a calculating aid;

C15. Find square root of perfect squares less than 1000 without a calculating aid;

C16. State the order of a matrix; add and subtract the matrices and multiply up to a 2 by 2 matrix by a scalar;

C17. Convert units of volume and time;

C18. Identify and draw cross sections of prisms; calculate: circumferences, the perimeter and area of triangles and quadrilaterals, surface area and volume of cubes and cuboids;

C19. Solve real life problems involving speed, time taken and distance travelled;

C20. Read and interpret displacement time graphs;

C21. Simplify expressions of up to 4 terms of degree and factorise linear algebraic expressions;

C22. Substitute in linear algebraic expressions and evaluate the value of the specified variable;

C23. Form and solve linear equations including equations from real life situations;

C24. Interpret graphs and find the equation of a straight line;

C25. Use laws of indices to simplify algebraic expressions;

C26. Solving linear equations and simultaneous linear equations

C27. Change the subject of formula to a specified variable;

C28. Interpret and use timetables and understand time differences;

C29. Calculate angles using concept of vertically opposite angles, corresponding angles, alternate and interior angles;

C30. Describe line and rotational symmetry;

C31. Draw the image of an object under a reflection and/or translation and find the line of reflection and translation vectors;

C32. Name and Sketch 3-D figures and nets (cubes, cuboids, cylinders, and triangular prisms);

C33. Identify rotations and calculate bearings;

C34. Construct bisectors and, parallel and perpendicular lines, triangles, quadrilaterals;

C35. Identify similar triangles and their properties; identify congruent triangles and quadrilaterals and their corresponding measures;

C36. Apply the Pythagorean Theorem;

C37. Calculate discount, percentage discount, percentage profit/loss, buying price or selling price;

C38. Calculate appreciation, depreciation, percentage appreciation and percentage depreciation;

C39. Calculate the cost of utilities using the given rates;

C40. Convert currency, calculate and interpret commission, hire-purchase cost; simple interest;

C41. Calculate and interpret tax – tables, calculate income tax; customs duty; the cost of registering a vehicle; and insurance benefit;

C42. Draw pie chart, line graph;

C43. Calculate mean and median from a distribution and /or frequency table;

C44. Interpret ungrouped data and bar charts;

C45. Construct a histogram with equal intervals;

C46. Find the median class from frequency table and a histogram;

C47. Determine possible outcomes of up to two events in probability

C48. Plot scatter graph;

GRADE E

Candidates should be able to;

E1.   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;

E2.   Continue a sequence of whole numbers;

E3.   Classify numbers as odd/even;

E4.   List factors of numbers less than 200 and multiples of numbers less than 100;

E5.   Add and subtract decimals up to one decimal place when vertically arranged without using a calculator;

E6.   Simplify ratios with whole number terms;

E7.   Solve problems involving direct proportion;

E8.   Write a repeated multiplication as a power (numbers only);

E9.   Calculate squares of whole numbers up to 10 without using a calculator;

E10.   Use matrices to store information;

E11.   Multiply a one by two and/or a two by one matrix by a scalar;

E12.   Convert units of time

E13.   Draw line segments, parallel lines and perpendicular lines

E14.   Draw angles up to 180°

E15.   Simplify expressions with up to 3 terms;

E16.   Substitute algebraic expressions with two terms and coefficient 1;

E17.   Solve linear equations of the form $X + a = L$;

E18.   Expand algebraic powers (positive indices only);

E19.   Convert time from 12 hour to 24 hour clock and vice versa;

E20.   Identify angles (acute, obtuse, right angle, straight and reflex angle);

E21.   Construct line segments and angles;

E22   Name polygons

E23.   Draw and interpret column vectors;

E24.   add and subtract column vectors;

E25.   Multiply a column vector by a scalar;

E26.   Work out money problems involving the four basic operations;

E27.   Calculate the profit and loss, buying or selling price given profit or loss;

E28.   Plot points in a Cartesian plain and join them to form shapes

E29.   Read charts;

E30.   Find mode from a distribution, frequency table or bar-chart;

E31   Calculate range from bar chart;

E32.   Calculate perimeter and area of a square and rectangle;

E33.   Draw a line of symmetry;

E34.   Identify hypotenuse, adjacent and opposite;

E35.   Present both ungrouped data and grouped date on a frequency table;

E37.   Find the modal class from a frequency table and a histogram;

7.   Inclusive Assessment

BEC intends to ensure that all assessment is inclusive of all candidates regardless of their ability or challenges. This will afford all candidates the opportunity to display what they know without fear or prejudice. The assessment will therefore ensure that in the written papers items cater for all ability levels. Special needs candidates will be catered for through modification of assessments to suit visually challenged candidates, learners with hearing impairment as well as learners with learning disabilities.

Centres are however requested to;

- inform BEC of any candidates who need special arrangements by March every year;
- ensure familiarity with the BEC special arrangements manual;
- make the necessary accommodations for learners with disabilities during the teaching and learning;
- modify learners assessments according to their various needs during the teaching and learning.

This will ensure that the special arrangements carried out by BEC do not come as a shock to candidates during examination time.