MINISTRY OF EDUCATION, YOUTH & SPORT

MATHEMATICS PRESCRIPTION

FIJI SCHOOL LEAVING CERTIFICATE EXAMINATION

MINISTRY OF EDUCATION, YOUTH & SPORT

FIJI SCHOOL LEAVING CERTIFICATE EXAMINATION PRESCRIPTION

MATHEMATICS

(Prescription effective in 1988 and to examined in 1989 and subsequent years.)

PREAMBLE

1. The prescription has the general aims of defining a level of mathematical understanding and a body of knowledge appropriate for developing the pupil's capacity to live effectively in a culture that is being shaped in many of its significant aspects by mathematics and providing a course that will also be appropriate for pupils proceeding to higher study in mathematics.

This general aim is expressed in the following specific objectives:

(a) To provide mathematical experiences which enables pupils to make observations, to discover patterns and relationships, to develop concepts, to draw logical conclusions, to express thoughts accurately, and to form generalisations;

(b) To develop an understanding of the principles of mathematics, so that pupils may acquire an ability to apply these principles to unfamiliar or new situations;

(c) To develop mental alertness and a spirit of inquiry, a liking for and a lasting interest in mathematics;

(d) To develop the basic mathematical knowledge and skills (including the ability to perform mathematical computations with understanding and efficiency) necessary to everyday living and effective citizenship;

(e) To help pupils appreciate that mathematics does underlie the modern technological society and that mathematics will increasingly affect every vocation;

(f) To consolidate and extend the work of the Fiji Junior Certificate prescription in mathematics;

(g) To provide opportunities for pupils to gain further experience in the use of graphical and computational techniques, including the use of calculators and computers (optional).

CONTENT YEAR I	CONTENT YEAR II
TOPIC 2 : ALGEBRA	
The application of the distributive property to the product of two polynomials and corresponding factorization.	Simplification and division of rational algebraic expression. Application of the remainder theorem to factorising polynomials.
Solution of quadratic equations by factors. Solution of polynomial equation in factored form.	Solution of quadratic equation by general formula; use of the formula with arbitrary numerical coefficient; nature of the roots of a quadratic equation; the discriminant.
Simplification and multiplication of rational algebraic expressions. Addition and subtraction of fractions with linear denominators.	Solution of pairs of simultaneous equations in two unknowns, with either both equations linear or one linear and one quadratic. Problems leading to quadratic equations and to simultaneous equations of the above types.
Order of a matrix; addition of matrices; multiplication of a matrix by a scalar; multiplication of matrices; properties of matrix multiplication; determinant and inverse of a 2 by 2 matrix; vectors as 2 by 1 matrices.	Sequences and series; the evaluation of the terms of a sequence from an expression for the general term; numerical summation of a finite series; formulae for the sum of finite number of terms in an arithmetic or geometric series; the sum of an infinite geometric series.
TOPIC 3 : RELATION FUNCTIONS AND GRAPHS	
Cartesian products; relations in two variables as sets of ordered pairs; domain and range; the inverse of a relation. Graphs of relations and their intersections. Relations expressed as equations and inequations in two variables; solution of simultaneous linear equations by graphical methods.	The form of the graph and simplest properties of the following particular functions: $y = ax^2 + bx + c$; $y = ax^2$; $y = a/(x + b)$; $y = ax^{\frac{1}{2}}$; $y = \lvert x \rvert$. $y = a^x$; $y = \log_a x$. $y = a \sin(bx + c)$; $y = a \cos(bx + c)$; $y = \tan x$. Cubic polynomials in factored form.
Functions (mapping) as special types of relations. Domain, range, graph of a function. Graphs of union and intersection of functions.	Behaviour of the above functions under translations $y = f(x + a)$, $y = f(x) + b$, changes of scale $y=f(ax)$ $y = af(x)$, and reflections $y = f(-x)$, $y = -f(x)$. Accurate plotting of more general functions from a given formula. Recognition from the plotted function of qualitative features such as symmetry, periodic behaviour, maxima and minima, behaviour for large values of x and -x, discontinuities and infinites.
The following relations and their graphs: (i) Linear functions in the forms of $ax + by + c = o$, $y = mx + c$. (ii) Quadratic functions $y = ax^2$ leading to $y - k = a(x - h)^2$ (iii) Cubic function in the form $y = (x - a)(x - b)(x - c)$. (iv) The circle $x^2 + y^2 = a^2$ and the rectangular hyperbola $xy = c$. (v) The exponential law of growth, $y = a^x$, $a > 0$.	

CONTENT YEAR I	CONTENT YEAR II
TOPIC 7 : GEOMETRY	
Vertically opposite angles; angle sum of adjacent angles on a straight line. Angle properties of the circle; cyclic quadrilaterals; angle tests for concyclic points. Angle properties of parallel lines. Angle sums of triangles and polygons. Line symmetry and rotational symmetry. Properties of isosceles triangles, equilateral triangle, square, rectangle, rhombus, parallelogram, trapezium, kite, regular polygons. Similar figures, including scale factors applied to their areas. Similar triangles, equal angles test; proportionality of corresponding sides. Tangents to a circle. The property of chords intersecting inside or outside a circle, including the case of the square on the tangent. Constructions: line parallel to a given line; bisector of a line segment; bisector of an angle; line perpendicular to a given line; circles, triangles and quadrilaterals from given data; accurate scale drawing; inscribed and circumscribed circles of a triangle.	Applications of 2 by 2 matrices to transformations. Geometry of the plane based on the transformations: reflection, rotation, translation, enlargement, shear. Properties that are invariant under these transformations. Combinations of transformations. The determinant as scale factor for area. Simple deductions based on the properties of these transformations.
TOPIC 8 : CALCULUS	
	The concept of a limit (informal treatmen only) The derivative as the slope of the tangent at a point on a curve. The interpretation of derivative as rate of change. The derivative of a polynomial and of ax^n for real values of n. Applications of the derivative to the determination of intervals over which functions are increasing or decreasing; stationary points; problems on maxima and minima: problems on rate of change, including velocities and accelerations. Antiderivatives. The definite integral notation for the area under a curve; evaluation of definite integrals by antiderivatives; integrals of polynomial functions.

(b) Binary operations with addition subtraction, multiplication and division could be extended to the following type:

If $a * b = 3a - b$, evaluate $2 * 7$.

Understand and use of commutativity and Associativity in simple examples of arithmetic and algebra need to be dealt with. The application of these laws to be extended to other topics such as vector operation or matrices later in the course. Simple treatment of distributive law as a preparation to the work on algebra. The use of identity and inverse elements as arise in arithmetic (e.g. fractions).

Understanding of the following properties of zero.

$b \times 0$; if $a \neq 0$ then $\frac{0}{a} = 0$ and $\frac{a}{0}$ is undefined

Use of order of priority of operation in arithmetic. (BEDMAS etc.)

B = brackets (parentheses)

E = exponentiation

D = Division
M = multiplication } in order from left to right

A = addition
S = subtraction } in order from left to right.

(c) The section on measurement is a revision of work in Forms 3 and 4. However, the skills involved need constant reinforcement and as far as possible question should be given which relate to practical situations such as: length, area, volume, mass, capacity, money and time.

2. ALGEBRA

(a) Distributive property to be extended from simple cases as $-x(2x + 3)$ and $q(p + r)$ to product of two polynomials such as $(px + a)(x + b)$; $(a + b)(c + d)$ or $(px + q)(rx + s)$ where p, q, r and s, $\in$ I. Understand the terms: "remove brackets", "expand" or "write as sum" to mean basically the same thing.

Factorisation in simple cases such as $5a - 10b$; $x^2 - 2x$; $3x^2 + 9x$, $3x + 6y + 12$ to be extended to factorization of quadratics with three terms. Coefficient of x^2 at this level to be restricted to 1.

(b) Simplification of rational algebraic expressions of the type:

$$\frac{ab}{a} \; ; \quad \frac{15h^3p}{9hp} \; ; \quad \frac{4(x-3)}{2} \; ; \quad \frac{(x+2)(x-3)}{x-2}$$

Multiplication and simplification of the type.

$$3p \times \frac{4q}{p}; \quad \frac{2ab}{a^2} \quad \frac{3a^3}{4b}$$

need to be covered.

4. COORDINATE GEOMETRY

Extension of work from linear function. Length of a line segment joining two points by use of right angle triangle. Mid point of a line segment. Finding equation of a straight line given.

(i) Y-intercept and gradient (or a point on the line) by use of $y = mx + c$

(ii) two points on the line.

(iii) angle with x-axis and y-intercept.

5. TRIGONOMETRY

(a) Identify angles using the coordinate axes. Sketch angles using anti-clockwise direction and clockwise direction and see the relationship between them. Calculate complementary and supplementary angles. Understand and use the definition of sine, cosine and tangent in relation to right-angled triangle. Find sine, cosine and tangent of angles in the domain 0° to 360°.

(b) Sketch the graphs of sine, cosine, tangent functions in the domain 0° to 360°. Prove and use the identities $\cos^2\theta + \sin^2\theta = 1$ $\sec^2\theta = \tan^2\theta + 1$. Solve problems in three dimensions reducible to right angled triangles.

(c) Use vectors to represent displacement and velocity. Add and subtract vectors. Resolve vectors into its components at right angles. Simple vector application.

6. STATISTICS AND PROBABILITY

(a) Understand the terms: data, statistics, population, random sample, random numbers, tallying, frequency, sampling and biased. Represent ungrouped data in a form of pictograph, linegraph, bar graph and pie chart and interpret these graphs.

(b) Appreciate the effect of a change of scale on a graph.

Represent grouped data in a form of histogram, frequency polygon and cumulative frequency graph or polygon (ogive). Interpret these graphs.

(c) Understand that mean, median, mode are the measure of central tendency. Calculate mean, median and mode for ungrouped data. Use of formulas

$$\bar{X} = \frac{\Sigma X}{N} \quad \text{and} \quad \bar{X} = \frac{\Sigma fx}{\Sigma f} \quad \text{for mean.}$$

Advantages and disadvantages of mean, median and mode. Properties of mean. Range and interquartile range as a measure of spread.

For this part of the section it is important that the students carry out a survey and organise work using some or all of the techniques studied above.

(c) The properties $\log ab = \text{Log } a + \log b$, $\log \frac{a}{b} = \log a - \log b$, $\log a^{\pm x} = \pm x \log a$ of the logarithm should be known, and candidates should be able to relate them to the corresponding rules for indices. The numerical evaluation of logarithms will be restricted to form available on the calculator (logarithms to base 10 and to base e), and to forms directly derivable from the definition ($3 = \log_2 8$). Knowledge of the properties of number e is not required.

2. ALGEBRA

(a) Simplification of rational fraction should include extraction and cancellation of like terms.

(b) Method of long division to divide polynomials. Candidates should be able to show that if $x - a$ is a factor of $P(x)$, then $P(a) = 0$, be familiar with the converse of this result, and able to apply it to the solution of cubic equation.

(c) The evaluation of expressions based on the sum and product of the roots will not be examined. Candidates should be aware that a quadratic equation may have two real roots, one repeated root, or no real roots; be able to interpret these facts graphically, and to relate them to the value of the discriminant. Equations such as $7.6x^2 - 3.2x - 0.7 = 0$ should be handled by first checking the nature of the roots and then substituting into the general formula, using calculators.

(d) In the treatement of simultaneous linear and quadratic equations, only quadratic equations of the special forms $y = ax^2 + bx + c$, $x^2 \pm y^2 = a^2$, $xy = c$ will be examined.

(e) Candidates should be able to establish the formulae for the sum of a finite number of terms for the arithmetic and geometric series and use these with particular numerical examples. Applications should include some discussion of compound interest and the effects of inflation.

(f) Candidates should be able to handle simple numerical examples of more general series using calculators, for example, to illustrate the approach to a limit in simple cases.

(g) Order of matrix, Addition of Matrix, Multiplication of matrix by a scalar and multiplication of Matrices should extend to higher order than just 2 x 2. Understand the property of matrix. Additive identity and multiplicative identity of 2 x 2 matrix. Determinant and Inverse of 2 x 2 matrix. Application of matrix in solution to simultaneous equations in two unknowns with both equations linear.

3. Functions and Graphs

(a) The main aims of this section are to provide practice in evaluating and plotting functions (although candidates may also be required to sketch graphs), to increase pupils' familiarity with a range of different function types, and to establish the importance of graphical techniques as a means of illustrating and interpreting functional relationships.

of the binomial distribution, and sampling with and without replacement, but always with reference to a complete listing of the possible outcomes.

(c) In relation to the properties of random number tables, candidates should know that successive digits are uniformly distributed over the integers 0-9, and are independent.

(d) The emphasis in the section on the display of data will be on the choice of an appropriate form of display, with possible graphs types including broken-line graphs, histograms with equal intervals, bar graphs, pie-charts and the cumulative frequency curve. The role of mean and median as measures of location, and of standard deviation, interquartile range and range as measures of dispersion, should be clearly understood.

(e) Candidates will be expected to have some appreciation of the fact that the normal distribution commonly arises where a large number of individually negligible random components are added together, and hence is to be expected in dealing with the distribution of the sample mean.

(f) It will be assumed that candidates will have done some practical work on sampling, for example in relation to class experiments of projects, or in discussions of published results for sample surveys or opinions polls.

7. Geometry

(a) The section applies 2 x 2 matrices to transformation. Candidates should find matrix for a given transformation Transformation by a singular matrix.

(b) Geometry for the plane based on transformations: reflection, rotation, translation, enlargement, shear.

(c) Combination of transformations, and inverse transformations.

(d) Properties of Transformations. Application of Transformation properties to Mathematical systems.

(e) Candidates may be required to offer reasons for geometrical conclusions. An acceptable reason is a sentence or phrase which clearly indicates to the examiner the geometrical principle on which the conclusion is based.

8. Calculus

(a) The aim of this section is to provide a simple informal introduction to the calculus, with the emphasis on differentiation.

(b) Although the formal definition of a limit and associated $(\varepsilon-\delta)$ notation is not part of the prescription, candidates should be able to obtain the derivative of $y = x^2$ from a consideration of the ratio $((x + a)^2 - x^2)/a$, and associate it with the slope of the tangent. The results for other powers and polynomials may be assumed. Candidates should be familiar with the notations dy/dx, $f'(x)$, and the terms derivative (at a point) and derived function.

RECOMMENDED TEXTBOOKS

Form Five

1. Nightingale D. et al Gray, Smith. Mathematics : A study in Pattern 3. Jacaranda.

2. Begg, MacKintosh, Thomson. Moving with Mathematics Books 5 and 6. Nexus Books.

3. Murray Britt and Peter Hughes Making Senses with Mathematics Books 3A and 3B. Heinemann.

4. Begg, Mackintosh, Thomson. Working with Mathematics Books 1 & 2 Nexus Books.

Form Six

1. Sealy J. R. and Agnew A.W. Senior Mathematics Longman Paul.

2. Nightingale D. et al. Mathematics : A Study in Pattern Book 4. Jacaranda.

3. Begg A.J.C., et al. Advancing with Mathematics, Books 1, 2. Longman Paul.

4. Barrett J.R., Form 6 Mathematics Revision ESA Books.