

Mathematics

Aims

Mathematics contributes to the development of young people as:

- Good citizens of South Sudan
- Successful life-long learners
- Creative and productive individuals
- Environmentally aware members of society

Rationale

Mathematics is a logical subject which deals with numbers and symbols and their relationships expressed in rules. It is reflected in all subjects and particularly sciences.

Mathematics equips learners with knowledge, skills and attitude in computation, constructions and model-making, enabling them to contribute to rapid technological growth and socio-economical development through their confidence in problem-solving in real life situations.

Mathematics within the Framework

Mathematics contributes to learners' development with respect to all four of the Framework competencies.

Critical thinking lies at the heart of Mathematics. Understanding of mathematical concepts and techniques requires thought processes which differ from those used in other subjects. Effective communication is essential so that problem-solving strategies and solutions can be clearly explained. Mathematics is a subject with applications across the curriculum and in life. Learners are encouraged to work cooperatively and make use of mathematics to solve real-life problems. Furthermore the subject is taught in such a way its relevance to learners is emphasised through a focus on South Sudanese culture and heritage.

Teaching and Learning Mathematics

All learners need a level of competence in Mathematics such that they can operate as effective members of society. Hence they need to be able to count, to estimate, to measure, to calculate, to handle and manage money and to understand statistics, probabilities and graphs. Those intending to study Mathematics to a higher standard or to pursue a career in finance or specialist branches of business or industry need to develop deeper learning in school. Competence in Mathematics also makes an important contribution to progress in other subjects.

Mathematics is a compulsory subject for all learners, regardless of their ambitions with respect to Mathematics, from the start of primary to the end of secondary school.

Learning is applied through the use of practical problem-solving activities with opportunities for learners to plan their own investigations and develop their confidence as Mathematicians.

In the overview below, the subject is set out in five strands: Number, Measurement, Geometry, Algebra and Statistics.

Many of the learning experiences will reflect just one of these strands but, where possible, learners should face problem-solving challenges calling for a range of Mathematics skills and knowledge from across the strands. The Units of Study detail some of these real-life challenges which enable learners to deepen their learning. Detailing the requirements under each strand separately ensures that all essential learning in Mathematics is covered.

The impact of new technologies on all aspects of life has been extraordinary in recent years and particularly so in relation to numerical data and processes. For this reason, wherever possible, learners should gain experience of a range of ICT equipment and applications.

Strands

There are **six** strands in Mathematics:

- Number
- Measurement
- Geometry
- Algebra
- Statistics
- Calculus(Secondary only).

Mathematics is an ideal context for learners to develop ICT skills whilst studying the subject. Every opportunity should be taken for learners to use calculators, computers and other devices as part of their learning. The programme of ICT appropriate for each stage is set out in Annex 2.

Number	Know how to read, write, compare and order numbers, how to carry out basic operations involving numbers and how to solve problems involving fractions, decimals, percentages, ratios and proportions
Measurement	Estimate and measure to an appropriate degree of accuracy and express measurements with the correct units
Geometry	Explore shape, size space and relative position; represent real objects or positional relationships with scale drawings
Algebra	Use reasoning to solve problems involving unknown quantities and variables through the use of expressions, equations and formulae
Statistics	Manipulate, interpret, and represent statistical data and draw valid conclusions; understand risk by defining, interpreting and devising probabilities
Calculus (S3&4 only)	Explore changing quantities e.g. gradient of curves and finding areas under curves

	P1	P2	P3	P4
Number	Sorting, matching and arranging groups of objects Counting, reading and writing numbers from 0-99 Even and odd numbers Addition of whole numbers up to 2 digits Subtraction of whole numbers up to 2 digits Ordinal numbers 1 st , 2 nd up to 10 th	Read, write, compare and order numbers up to 3 digits Rounding off numbers to the nearest tens and hundreds Addition involving one carrying Subtraction without borrowing. Recall multiplication facts up to 10x10 Know division facts for- numbers up 100 by numbers not exceeding 10 Fractions (half and quarter as a part of a whole)	Read, write, compare and order numbers up to 4 digits Subtraction with and without borrowing Divisibility test (by 2, 5 and 10) Fractions (simple) Comparing simple equivalent fractions	Read, write, compare and order numbers up to 5 digits. Rounding off numbers to the nearest thousands Multiples and factors of whole numbers Addition and subtraction of fractions with the same denominators Compare equivalent fractions Recognizing percentage Use ratio as a way of comparing quantities
Measurement	Estimate and compare length, capacity and weights Solving simple problems involving money Time of the day & days of the week Days of the week and month of the year Reading clock in hours	Estimating and measuring length using different objects and capacity using different containers Comparison of weight using beam balance Recognizing currency in shopping (correct balance) and activities Time in hours, half past, quarter past, quarter to the hour	Estimating and measuring length in centimeters, meters; capacity in liters, milliliters and deciliters; weight in kgs and grams Operations involving length, capacity and weight Converting hours to minutes, seconds and vice-versa Operations on currencies	Measuring and drawing length to the nearest cm Solving problems using cm, and meters Find the area of squares and rectangles in cm ² and m ² , and volume by counting cubes Estimate capacity, estimating weight, time in hours and minutes, simple calculation of money Tell time using the 24-hour system.
Geometry	Recognize geometrical lines and identification of simple geometrical shapes Making patterns and models of triangular and square base pyramids	Making patterns using geometrical shapes Types and properties of triangles, rectangles and squares Use patterns to recognize geometrical shapes	Sketch and draw accurately geometrical shapes	Identify intersecting, parallel and perpendicular lines Comparing angles, drawing right angle using corners Measurement of angles using degrees
Algebra			Inequalities and symbols, use of <, >	Using symbols for numbers, like and unlike terms, addition and subtraction of simple algebraic expressions
Statistics			Interpreting simple pictograms Interpreting and making block graphs	Data collection and recording, graphs of data (bar & line graphs)

	P5	P6	P7	P8
Number	<p>Read, write, compare and order numbers up to 6 digits</p> <p>Divisibility tests of 3,4,6 and 9</p> <p>Prime numbers.</p> <p>HCF and LCM</p> <p>Roman numerals up to 50.</p> <p>Add and subtract fractions using LCM</p> <p>Simplification of fractions by cancelling</p> <p>Conversion of fractions to decimals and vice versa</p>	<p>Read, write, compare and order numbers up to a million</p> <p>Divisibility tests of 8 and 11.</p> <p>Squares and square roots of perfect squares up to 3 digits</p> <p>Conversion of decimals and fractions into percentage and vice- versa</p> <p>Proportion as relationship between two quantities</p>	<p>Squares and square roots of perfect square numbers</p> <p>Squares and square roots of fractions (perfect squares) and simple decimals.</p> <p>Cubes of numbers</p> <p>Solving problems using ratios and proportions using the unitary method</p> <p>Percentage increase and decrease</p>	<p>Multiples and factors including fractions and decimals</p> <p>Finding square roots of mixed numbers involving perfect squares</p> <p>Recurring decimals</p> <p>Finding square roots of decimals</p> <p>Expressing fractions and decimals as percentages and vice-versa</p>
Measurement	<p>Convert meter into kilometer and vice-versa</p> <p>Calculate areas of rectangles and squares</p> <p>Formula for volume of cuboids ($V=l \times b \times h$)</p> <p>Units of volume</p> <p>Find the volume of cubes and cuboids</p> <p>Convert milliliters to liters and vice-versa</p> <p>Solve problems involving money</p> <p>Tell time in a.m. and p.m.</p> <p>Solve problems involving temperature in degrees Celsius</p>	<p>Millimeters as units of length</p> <p>Know the parts of a circle: <i>circumference and diameter</i></p> <p>Calculate the value of π</p> <p>Units of area in acres and hectares</p> <p>Find the area of triangles</p> <p>Solve problems involving units of capacity</p> <p>Conversion of liters to milliliters and vice-versa</p> <p>Conversion of tonnes to kilograms and kilograms to grammes</p> <p>Solve problems involving tones, kilograms and grammes</p> <p>Finding profit and loss</p>	<p>Calculate circumferences and areas of circle, parallelogram, rhombus, trapezium, and surface area of common solids.</p> <p>Calculations involving discount, percentages, simple interest, commission and hire purchase</p> <p>Problems involving units of time, converting km/h into m/s and average speed.</p> <p>Problems involving units of weight.</p> <p>Problems involving temperature</p>	<p>Solving problems involving length, perimeter and circumference</p> <p>Solving problems involving areas of given shapes; triangles, quadrilaterals, circles and combined shapes.</p> <p>Solving problems involving surface area and volumes of cuboids</p> <p>Converting m^3 to cm^3 and vice-versa</p> <p>Solving problems involving capacity</p> <p>Solving problems involving; commissions and discounts, hire purchase, profit and loss, simple interest and compound interest</p> <p>Solving problems involving speed, time and distance</p> <p>Speed as a distance covered in unit time (<i>m/s and km/h</i>)</p>
Geometry	<p>Identify and construct parallel lines using ruler and protractor and compasses</p> <p>Use linear scale and draw lines to a given scale</p> <p>Identify different sorts of angles (<i>acute, obtuse, reflex etc</i>) and relate this to turns.</p>	<p>Constructing and bisecting lines</p> <p>Identifying vertically opposite and supplementary angles</p> <p>Constructing a circle of a given radius</p> <p>Making patterns with circles</p> <p>Making cubes and cuboids.</p> <p>Conversion of scale and length,</p> <p>Writing scale in ratio form</p> <p>Making scale drawing.</p>	<p>Identifying transversal lines and angles of parallel lines.</p> <p>Constructing equilateral, isosceles and right-angled triangles</p> <p>Inscribing and circumscribing triangles</p> <p>Pythagoras theorem (2D)</p> <p>Construction of parallelogram, rhombus and trapezium</p> <p>Drawing, interpreting and using a range of linear scale</p>	<p>Constructing, inscribing and circumscribing triangles of given sides and angles</p> <p>Applying Pythagoras relationships length and areas of triangles</p> <p>Making curved patterns from straight lines and nets for envelopes, pyramids and prisms</p> <p>Solving problems involving scale</p> <p>Use of co-ordinates</p>

	P5	P6	P7	P8
Algebra	Solving simple equations	Simple equations with one unknown Simplification of algebraic expressions with and without brackets	Finding values of algebraic expression by substitution Formation of algebraic expression from mathematical statements Sets, members of a set, set notation and equal and equivalent sets	Formation, simplification and evaluation of algebraic expressions Sets, union of sets, empty, unequal and intersection of sets Understand and produce Venn diagrams (up to 2 sets)
Statistics	Representation and interpretation of collected data	Reading and interpretation of data from tables Recognizing and interpreting picture, line and circle graphs and their interpretation	Drawing frequency tables of grouped data Understand and use mean (average), mode and median Drawing using appropriate scale Interpret and draw bar graphs, pie charts and travel graphs Solving problems involving arithmetic mean, mode and median Introduction to Probability (chance)	Collecting and recording of data: representation and interpretation Probability: Calculating possible outcomes of simple events.

		S1	S2	S3	S4
Numbers	Numerical concepts	Understand natural numbers, prime factors, multiples, GCD, HCF and LCM Know types of fractions Calculating squares and square roots of numbers Solving problems involving direct and indirect proportion Understand reciprocals of numbers	Indices (Know rules, evaluating fractional, zero and negative indices) Understand and use surds Explain rational and irrational numbers	Understand logarithms Know laws of logarithms and apply in calculation Logarithmic equations	Complex numbers Operations on complex numbers, graphical representation of complex numbers, polar form of complex numbers
	Commercial Arithmetic	Understand profit and loss Understand percentage discount and commission as percentage	Foreign exchange Simple and compound interest, compound interest formula, Depreciation and appreciation, Hire purchase and income tax		
Measurement		Calculate length, area and volume of common solids Solving problems involving surface area and volumes of cylinders Calculate Capacity of containers	Calculate areas of geometrical figures Surface areas of solids	Computation using calculators Estimation and approximation of surface area and volume of irregular objects Understand significant figures	Approximation of area of irregular object by counting Use of trapezium rule, mid- ordinate rule
Geometry	Geometry	3D Coordinates Angles of plane figures Geometrical constructions Scale drawing and bearing Angles of depression and elevation. Reflection, congruency and rotation.	Understand and use equations of straight lines. Pythagoras theorem and application of the theorem	Three dimensional figures Proof of Pythagoras theorem Understand and use loci Know and understand the equation of a circle is $(x-a)^2 + (y-b)^2 = r^2$	The circle: explain the equation of a circle passing through two points touching x-axis.
	Trigonometry	Trigonometry (I): Explain relationship between sine, cosine, tangent and special angles	Trigonometry (II): Explain trigonometric ratios from the unit circle, angle property of circle		Trigonometry (III): Plot graphs of trigonometrical ratios

		S1	S2	S3	S4
Algebra		Understand and apply: Simplification, brackets, substitution Factorization and expansion, Simultaneous linear equations Formation and solution of inequalities Formulae and equations Functions Relation and mapping Translation as a transformation	Quadratic expressions and equations (1): Expansion, Identification, Factorization Vectors (I): vectors and scalar quantities, column, position and equivalent vectors, operation on vectors, vector translation Sets: set notation, Venn diagrams and solving problems up to three sets Matrices (I): Understand determinant, inverse, transposition of matrices, similarities and enlargement Functions: Papy gram, functional notation, inverse of simple functions, composite functions and their inverses	Quadratic equations (II): Binomial expansion Compound proportion Mixtures and rate of work Vectors (II): vector algebra, mid-point of vector in algebraic expression Sequences and series Explain arithmetic and geometric progression Derivation of the formulae for A.P. and G.P. Matrices (II): Transformation on the Cartesian plane Identity and inverse; Determinant of matrices, shear and stretch, Isometric and non isometric transformation and their application	Forming inequalities find maximum and minimum values of linear inequalities and apply linear programming. Permutation and combination, definition Ways of arrangement of objects, factorial notation and its application Vectors (III): Understand coordinates in two and three dimension systems, column and position vectors in three dimensions
Statistics	Statistics	Statistics (I): Collection of statistical data, construction of frequency tables, understand grouped data average, mode and median Interpretation and representation of data	Statistics (II): Understand assumed mean Interpret cumulative frequency tables, Explain ogives, median, quartiles, depression		
	Probability	Understand probability of events, use of tree diagram	Calculations involving probability		
Calculus				Differentiation: gradient of the curve at a point, gradient of $y = x^n$	Derivative of polynomial, equations of tangents and normals, maxima and minima points, application of differentiation to kinematics. Integration: application of integration, integration of polynomials, finding area under a curve

ADDITIONAL MATHEMATICS Overview 2013

		S3	S4
Pure mathematics	Functions	Domain and range, modulus of a function, inverse (or no inverse) of a function, composite function	Limits (rational numbers)
	Trigonometry	Identities, equation with more than one function Addition formulae and the tangents of compound angles (A±B) Derivation of three trigonometrical identities, secant, cosecant and cotangent The double angle formulae and half angle formulae	Simplification of trigonometrical ratios and solutions of trigonometrical equations Sum and differences of two angles (A±B) Functions, $a\cos\theta + b\sin\theta$ The equation, $a\cos\theta + b\sin\theta = c$
	Calculus 1	Derivatives of a polynomials The composite (combined) function The 2 nd derivative coefficient Application of differentiations Tangent, normal, maximum, minimum, velocity and acceleration Small increments: Approximate changes-connected rates of change	Differentiation of product of two functions, quotient and implicit function Differential of trigonometric functions $\sin x$, $\cos x$ and $\tan x$
	Calculus II	Definition of integration Integration as opposite of differentiation Indefinite integration Integration by substitution and by parts	Application of integration- Area under the curve Integration of powers of linear function $Ax+b$ Integration of trigonometric functions
	Algebra	3x3 Matrices Determinants Cramer's rule	Partial fractions. Introduction, identify denomination or with only linear factors, with quadratic factors and with repeated factors Vectors in terms of i , j and k , application of vector method in geometry
	Complex numbers	Concepts (introduction) and definition. Addition and subtraction of complex number Multiplication and division of complex numbers	Graphical representation and polar form of complex numbers The powers and De-Moivre's theorem The roots of complex numbers and solution of quadratic equation in complex numbers

		S3	S4
Pure mathematics	The Circle	Equation of the circle at the origin General form of equation of the circle Equation of a circle that satisfies special condition: Equations of the circle passing 3 points, Equation of a circle when ends of diameter in it are given Equation of a circle passing through two points and its centers lies on a given straight line The equation of tangent to a circle at a point on it Length of tangent drawn to a circle from an external point	
Mechanics	Kinematics	Graph: Area under velocity –time graph Straight line motion with constant acceleration Vertical motion under gravity	
	Velocity	Composition of velocities Resolution of velocities	
	Projectiles		Velocity components, coordinates, greatest height, time of flight and horizontal range
	Force	Unit of force Types of forces-weight, reaction, tension, friction, thrust Composition of two forces Resolution of forces Coplanar forces acting on a point Equilibrium of a particle Triangle of forces; Lami's theorem; polygons of forces	Explain why friction is a force, calculations of friction
	Laws of motion		Understand Newton's laws of motion Explain the difference between mass and weight Connected particles
	Work, Power and Energy		Explain kinetic energy, potential energy, work and power
	Momentum	Understand the conservation of momentum	

