

Uganda UACE Principal Mathematics (P425) proposed elements of construct.

Mathematics Department

(Based on NCDC/UNEB Curriculum Contents, expanded with subtopics, key concepts, and applications)

Algebra

Chapters	Key Concepts	Applications
Numerical concepts	Laws of indices, simplification of surds, properties of logarithms, expressing numbers in standard form, accuracy with significant figures	Scientific notation in physics, compound interest in finance, exponential growth/decay
Equations & inequalities	Solving linear, quadratic, and simultaneous equations; representing inequalities graphically; absolute value equations	Budgeting constraints, projectile motion, optimization in farming or economics
Permutations & combinations	Difference between arrangements and selections; counting principles with/without repetition	Sampling methods, business scheduling, lottery probabilities
Series (AP & GP)	Understanding sequences, sums of progressions, convergence, proof by induction	Loan repayments, savings plans, depreciation, population growth
Complex numbers	Operations with complex numbers, graphical representation on Argand diagram, modulus and argument, polar form, loci	AC circuits, oscillations, wave functions, signal processing

Calculus

Chapters	Key Concepts	Applications
Partial fractions	Breaking down rational expressions into simpler parts	Simplifying integrals in physics/engineering
Differentiation (basic)	Rate of change, tangent to a curve, rules of differentiation	Velocity in physics, marginal cost in economics
Integration (basic)	Accumulation, area under curves, antiderivatives	Work done by force, distance from velocity
Differentiation (advanced)	Implicit and parametric differentiation, maxima/minima, curve sketching, related rates	Optimization in business, beam deflection in engineering
Integration (advanced)	Integration by parts, trigonometric identities, areas and volumes of revolution	Volumes of tanks, consumer surplus in economics

Chapters	Key Concepts	Applications
Differential equations	Solving first-order separable and linear equations, applying initial conditions	Population growth, radioactive decay, cooling laws
Trapezium rule	Numerical approximation of integrals, error estimation	Surveying, displacement from irregular velocity graphs
Error analysis	Absolute, relative, and percentage errors; propagation of errors	Measurement in experiments, engineering tolerances
Iterative methods	Approximating roots using Newton-Raphson and fixed-point iteration	Solving non-linear equations in finance and engineering
Flow charts	Algorithm design, representation of numerical methods	Programming simulations, business process modeling

Geometry

Chapters	Key Concepts	Applications
Coordinate geometry (lines)	Equations of lines, gradients, intercepts, distance and midpoint	Mapping, trajectories in physics
Trigonometry	Fundamental identities, sine and cosine rules, solving triangles, graphs of trig functions	Surveying, navigation, wave analysis
Coordinate geometry (circles)	Equations of circles, tangents, intersections, loci	Design of arches, optics, reflective paths
Vectors	Vector operations, equations of lines and planes, intersections, volumes	Forces in physics, 3D modeling, aviation paths

Data Analysis & Probability

Chapters	Key Concepts	Applications
Statistics & data collection	Types of data, sampling methods, measures of central tendency and dispersion	Surveys, market analysis
Correlation & regression	Scatter plots, correlation coefficients, regression lines	Economics (price-demand), biology (height-weight)
Probability theory	Rules of probability, conditional probability, independence, mutually exclusive events	Risk assessment, games of chance
Random variables	Discrete and continuous random variables, expectation, variance	Predicting outcomes in experiments
Probability distributions	Binomial, Poisson, Normal distributions, approximations	Quality control, traffic modeling
Sampling distributions	Central Limit Theorem, confidence intervals, standard error	Polling, quality assurance

Mechanics

Subtopics	Key Concepts	Applications
Dynamics	Kinematics equations, variable acceleration, motion analysis	Vehicle motion, sports performance
Vectors/forces	Resultant and resolution of forces, equilibrium, Lami's theorem	Structural engineering, bridges
Moments/couples	Turning effects of forces, equilibrium of rigid bodies, center of gravity	Balancing loads, cranes
Motion (graphs, free fall)	Interpreting velocity/displacement-time graphs, acceleration due to gravity	Elevators, parachutes
Newton's laws & friction	Laws of motion, frictional forces, connected particles	Vehicles on slopes, pulley systems
Work, energy, power, momentum	Work-energy principle, conservation of momentum, collisions	Accident reconstruction, machine efficiency
Projectiles	Independence of horizontal and vertical motion, trajectory analysis	Sports (javelin, football), artillery
Relative motion	Relative velocity, closest approach	Aviation (wind drift), river crossing
SHM & elasticity	Simple harmonic motion, Hooke's law, oscillations	Springs, pendulums
Circular motion	Centripetal force, angular velocity, banking angles	Road design, satellites
Coplanar forces	Equilibrium conditions, reactions at supports	Construction scaffolding, ladders

Paper Structure (UNEB)

Paper	Duration	Sections	Questions	Attempt
Paper 1: Pure Mathematics	3 hours	A: Algebra (2 items) B: Geometry (1 items) C: Calculus (3 items)	6 total	4 (1 from A, 1 from B, 2 from C)
Paper 2: Applied Mathematics	2¼ hours	A: Data Analysis & Probability (2 items), B: Mechanics (2 items)	4 total	3 (at least 1 from each section)

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