

Core-Plus Mathematics 2nd Edition

Course 4—Preparation for Calculus

Part A

Unit 1	<p>Families of Functions extends student understanding of linear, exponential, quadratic, power, and trigonometric functions to model data patterns whose graphs are transformations of basic patterns; and develops understanding of operations on functions useful in representing and reasoning about quantitative relationships.</p> <p><i>Topics include</i> linear, exponential, quadratic, power, and trigonometric functions; data modeling; translation, reflection, and stretching of graphs; and addition, subtraction, multiplication, division, and composition of functions.</p>
Unit 2	<p>Vectors and Motion develops student understanding of two-dimensional vectors and their use in modeling linear, circular, and other nonlinear motion.</p> <p><i>Topics include</i> concept of vector as a mathematical object used to model situations defined by magnitude and direction; equality of vectors, scalar multiples, opposite vectors, sum and difference vectors, dot product of two vectors, position vectors and coordinates; and parametric equations for motion along a line and for motion of projectiles and objects in circular and elliptical orbits.</p>
Unit 3	<p>Algebraic Functions and Equations reviews and extends student understanding of properties of polynomial and rational functions and skills in manipulating algebraic expressions and solving polynomial and rational equations, and develops student understanding of complex number representations and operations.</p> <p><i>Topics include</i> polynomials, polynomial division, factor and remainder theorems, operations on complex numbers, representation of complex numbers as vectors, solution of polynomial equations, rational function graphs and asymptotes, and solution of rational equations and equations involving radical expressions.</p>
Unit 4	<p>Trigonometric Functions and Equations extends student understanding of, and ability to reason with, trigonometric functions to prove or disprove trigonometric identities and to solve trigonometric equations; to geometrically represent complex numbers and complex number operations and to find powers and roots of complex numbers expressed in trigonometric form.</p> <p><i>Topics include</i> fundamental trigonometric identities, sum and difference identities, double-angle identities; solving trigonometric equations and expression of periodic solutions; secant, cosecant, and cotangent functions; absolute value and trigonometric form of complex numbers, De Moivre's Theorem, and roots of complex numbers.</p>

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Unit 5	<p>Exponential Functions, Logarithms, and Data Modeling extends student understanding of exponential and logarithmic functions to the case of natural exponential and logarithmic functions, solution of exponential growth and decay problems, and use of logarithms for linearization and modeling of data patterns.</p> <p><i>Topics include</i> exponential functions with rules in the form $f(x) = Ae^{kx}$, natural logarithm function, linearizing bivariate data and fitting models using log and log-log transformations.</p>
Unit 6	<p>Surfaces and Cross Sections extends student ability to visualize and represent three-dimensional shapes using contours, cross sections, and reliefs, and to visualize and represent surfaces and conic sections defined by algebraic equations.</p> <p><i>Topics include</i> using contours to represent three-dimensional surfaces and developing contour maps from data; sketching surfaces from sets of cross sections; conics as planar sections of right circular cones and as loci of points in a plane; three-dimensional rectangular coordinate system; sketching surfaces using traces, intercepts and cross sections derived from algebraically-defined surfaces; and surfaces of revolution and cylindrical surfaces.</p>
Unit 7	<p>Concepts of Calculus develops student understanding of fundamental calculus ideas through explorations in a variety of applied problem contexts and their representations in function tables and graphs.</p> <p><i>Topics include</i> instantaneous rates of change, linear approximation, area under a curve, and applications to problems in physics, business, and other disciplines.</p>
Unit 8	<p>Counting Methods and Induction extends student ability to count systematically and solve enumeration problems, and develops understanding of, and ability to write, proofs by mathematical induction.</p> <p><i>Topics include</i> systematic listing and counting, counting trees, the Multiplication Principle of Counting, Addition Principle of Counting, combinations, permutations, selections with repetition; the binomial theorem, Pascal's triangle, combinatorial reasoning; the general multiplication rule for probability; and the Principle of Mathematical Induction.</p>