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CDU 51 Mathématique

Dezimalklassifikation
DK 51 Mathematik

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Foreword

The English version of the Universal Decimal Classification (UDC) is being prepared and published as BS 1000 by the British Standards Institution (BSI) at the original joint request of the British Society for International Bibliography (BSIB) and the Association of Special Libraries and Information Bureaux (ASLIB), now amalgamated as Aslib. It has the approval of the Lake Placid Education Foundation, New York, proprietors of the Dewey Decimal Classification, from which the UDC derives. The English Full Edition of the UDC is authorized by the International Federation for Documentation (FID), The Hague, Netherlands.

This section is part of the English Full Edition. It should be used in conjunction with the Abridged English Edition, BS 1000A, which refers to many other subjects of interest not listed in this schedule,

and provides a conspectus of the whole scheme, together with an introduction to its use. For further practical information about the principles, application and utilization of the scheme, users should refer to BS 1000C.

This edition of UDC 51, which replaces the 1943 edition published as part of BS 1000 : Vol. 2, Part 1 : 1943 (later known as BS 1000 [50/53] : 1943), includes modifications authorized in 'Extensions and Corrections to the UDC' up to and including Series 10, No. 3, dated June 1980.

Subsequent issues of 'Extensions and Corrections to the UDC' should be consulted to keep the schedule up to date. Further information about this and other UDC publications is given on page 44. British standards related to this part of BS 1000 are listed on the inside back cover.

Scope

Under 51 is classed information about the theoretical aspects of mathematics and mathematical sciences, including number theory, algebra, geometry,

topology, analysis, combinatorics, graphs, statistics, probability, numerical analysis, programming, cybernetics and operational research.

Related subjects

(083)	Special types of production, technical and normative documents.
001	Science and knowledge in general.
002	Organization of intellectual work
	Documentation. Books. Writings.
	Authorship
003	Writing symbols and scripts. Signs and symbols. Codes. Graphic representations.
007	Activity and organizing. Information. Communication and control theory generally (cybernetics), including 'human engineering'
16	Logic. Theory of knowledge etc
31	Statistics
330	Science of economics in general.
389	Metrology. Weights and measures
52	Astronomy. Astrophysics. Space research. Geodesy.
53	Physics
54	Chemistry. Crystallography. Mineralogy
621.391	General questions of electrical communication engineering. Cybernetics, information theory, signal theory in relation to electrical communications
681.3	Data processing equipment.
681.5	Automatic control engineering
793.73	Puzzle games. Riddles. Conundrums
794	Board and table games (of thought, skill and chance)
80	Linguistics. Philology. Languages

Auxiliary signs and subdivisions

Full information about the common and special auxiliary signs and subdivisions (often abbreviated to 'common and special auxiliaries') will be found in BS 1000A and BS 1000C.

Colon sign of relation. For the classification of information for the public, as in abstracts and bibliographies, maximum use of colon combinations rather than of common or special auxiliaries is recommended. The use of the colon sign of relation is preferable for multiple entry systems, as it will help prevent the concealment of information. This usually results in longer notation, however, and for information for more restricted use, the application of auxiliaries, where available, may be simpler and more convenient provided that there is an adequate alphabetical subject index.

Common auxiliaries. The common auxiliaries of language = . . . , form (0 . . .), place (1/9), race and nationality (= . . .), time " . . . ", point of view .00 . . . , materials -03 . . . and persons -05 . . . are applicable throughout the UDC. However, they should be used mainly to express concepts not otherwise provided for in the schedules.

Special auxiliaries. The -3/-8 special auxiliaries listed at 51 are applicable throughout the schedule. They may be detached and applied to any subdivision of 51 where the result forms a meaningful combination (see example at 51-33). Special .0 auxiliaries are provided under 512.54, 514 and 519.66; these may be applied to any subdivision of the number at which they are listed.

Typographic presentation

Small type is used for cancelled numbers and text.

The arrow → means either 'see' or 'see also' according to the context.

The symbol $\cong$ 'subdivide as' means that the number preceding it may be subdivided in the same way as, and with meanings analogous to the subdivisions of, the number which follows it.

SCHEDULE

51 MATHEMATICS

Special auxiliary subdivisions for 51

51-3	EXPLICIT COMPUTATION TECHNIQUES, CALCULATIONS, PROGRAMS AND DEVICES IN MATHEMATICS <i>For computational mathematics</i> →519.6	51-73	In the physical sciences <i>Further particulars may be denoted by colon combination, e.g.</i>
-32	Calculation without mechanical aids	51-73:535	In optics
-33	Use of tables <i>e.g.</i> 511-33 Use of tables in number theory →519.66 Mathematical tables and their compilation	:537	In electricity and magnetism
-35	Use of mechanical, graphical and other devices, <i>e.g.</i> slide rules, nomograms →519.67 Machine, graphical and other methods of computational mathematics	:548	In crystallography
-37	Use of computers in mathematics <i>For computer details</i> →681.3	-74	In engineering and technology <i>Further particulars may be denoted by colon combination, e.g.</i>
51-7	MATHEMATICAL STUDIES OR METHODS IN OTHER FIELDS OF KNOWLEDGE →514.8 Geometric study of objects of mechanics and physics <i>For combinatorics, graph theory, probability, mathematical statistics, computational mathematics, mathematical cybernetics and operational research</i> →subdivisions of 519	-75	In the actuarial field. Actuarial mathematics
-71	In space/time fields, astronomy etc <i>Further particulars may be denoted by colon combination, e.g.</i>	-76	In the life sciences, biometrics →57.087 Methods and techniques for parameter estimation and recording of biological data
-72	In mechanics and structural physics <i>Further particulars may be denoted by colon combination, e.g.</i>	-77	In the behavioural and social sciences, econometrics etc →330.115 Econometrics
	51-72:530.145 In quantum mechanics	-78	In the arts, music, recreation etc <i>Further particulars may be denoted by colon combination, e.g.</i>
	:531/533 In classical mechanics	51-8	51-78:74 In drawing, design
	:539.12 In elementary particle theory		:781 In music
			MATHEMATICAL GAMES AND RECREATIONS
			→519.6 Computational mathematics, numerical analysis and programming (computer science)
			519.813 Games of chance.
			Experimental games
			793.73 Puzzle games. Riddles.
			Conundrums
			794 Board and table games (of thought, skill and chance)
		51.01	Philosophy of mathematics [<i>cancelled</i>] →510.21

Principal divisions

510 FUNDAMENTAL AND GENERAL CONSIDERATIONS OF MATHEMATICS. FOUNDATIONS, LOGIC ETC

510.2	FOUNDATIONS OF MATHEMATICS	510.5	ALGORITHMS. COMPUTABLE FUNCTIONS
.21	General philosophical considerations.	.51	Theory of algorithms : general considerations
.22	Critical aspects. Logical antinomies	→519.712	Cybernetic problems of the theory of algorithms
.222	Set theory. Set theoretic approach	.52	Algorithmic complexity
.223	Naive set theory	.53	Algorithmic problems
.225	Axiomatic set theory. Axiomatization of analysis	→512.54.05	Algorithmic problems in group theory. The word problem
	Descriptive set theory	.532	Theories of hierarchies
	→515.128 Descriptive set theory of topological spaces	.54	Algorithmic set theory
	517.517 Descriptive theory of functions	.56	General theory of calculi
.227	Theory of order types and of ordinal and cardinal numbers	.57	Computable (recursive) functions
.23	Formalism (mathematical aspects)		
.24	Intuitionism (mathematical aspects)		
.25	Constructive approach. Constructive mathematics		
.252	Languages of constructive mathematics	510.6	MATHEMATICAL LOGIC
.254	Specific constructive mathematical theories	→16	Logic. Theory of knowledge.
.26	Logical positivism		Epistemology. Methodology of logic. Hodogenics
	→165.731 Positivism—Philosophy		Logical and logico-object languages
.27	Logical semantics. Semantic antinomies	.62	Syntax of logical languages
	→519.767 Semantics of a language	.622	

510.624	Semantics of logical languages →519.76 Semiotics. Mathematical linguistics	510.647	Probabilistic logic →519.21 Probability theory. Stochastic processes
.63	Logical and logico-object theories. Classical (traditional) logical systems <i>The corresponding calculus may be denoted by adding the digit 2 to 510.63 or its subdivisions</i>	.649	Other formal logical systems
.633	Propositional logic (and calculus) →512.563 Boolean rings and algebras	.65	Logico-mathematical theories
.635	Predicate logic (and calculus)	.652	Formal arithmetic. Formal number theory →511.34 Additive theory of numbers. Forms and systems of forms over the ring of rational integers
.3	Higher-order predicate calculus		Inference search and decision problems in logical and logico-mathematical calculi →519.226 Inference and decision theory
.32	Theories of types	519.816	Theory of decision making
.64	Non-classical, formal systems of logic <i>The corresponding calculus may be denoted by adding the digit 2 to 510.64 or its subdivisions</i>	.662	Inference search
.643	Modal logics (and calculi)	.665	Decision problems
.644	Many-valued logics (and calculi) →519.716.32 Finite-valued logics	.67	Theory of models →512.54.01 Axiomatizable classes of groups
.645	Formalization of traditional logics	512.57	Universal algebras. Free algebras
.3	Syllogistics	519.766	Models for languages and language structures
.646	Inductive logic →162.3 Inductive conclusions. Induction—Philosophy	519.86	Theory of economic-mathematical models
		510.8	GENERAL MATHEMATICAL SYSTEMS

511 NUMBER THEORY

	→519.6 Computational mathematics, numerical analysis and programming (computer science) <i>Number theory applied to other fields of mathematics may be denoted by colon combination with other subdivisions of 51</i>	511.147	Imaginaries Arithmetical use of logarithms [<i>cancelled</i>] use 511–33; →519.66
511.1	ELEMENTARY ARITHMETIC Notation [<i>cancelled</i>] use 003.6:511	511.16	OPERATIONS WITH SPECIFIED MEASURES AND UNITS →389 Metrology. Weights and measures 531.7 Measurement of geometrical and mechanical quantities. Instruments. Methods. Units 511.161/.168 <i>may each be subdivided by adding the following digits:</i> .1 Metric system .2 More complex systems. Non-metric systems .3 Conversion of units Money Method of aliquot parts Length Area Volume Capacity Weight Time Physical and other scientific or technical units Tables of such quantities
.11/.118.5			
511.12	INTEGERS AND THEIR MANIPULATION		
.122	Addition of integers		
.123	Subtraction of integers		
.124	Multiplication of integers. Simple powers		
.125	Division of integers		
.2/.4	Short division. Long division [<i>cancelled</i> , <i>superfluous</i>]	.161	
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511.13	FACTORS. FRACTIONS. RATIOS →511.2 Elementary number theory	.163	
.132	Factors. Power indices	.164	
.3/.7	Rules of divisibility by smaller primes. Notation of power indices. Simple powers of numbers [<i>cancelled</i>]	.5	
.133	Fractions generally and their conversions, simplifications etc	.165	
134	Numerator-denominator fractions	.166	
.2/.7	Lowest terms. Addition, subtraction, multiplication, division of fractions. Conversion to decimals and vice versa [<i>cancelled</i>]	.167	
.135	Decimal fractions, binary fractions and analogues	.168	
.2/.7	Addition, subtraction, multiplication, division of decimals. Approximations and shortened methods. Binary fractions and other analogues of decimal fractions [<i>cancelled</i>]	511.2	ELEMENTARY NUMBER THEORY →511.3 Analytical, additive and other number theory problems 511.5 Diophantine equations 511.6 Algebraic number fields 511.9 Geometry of numbers Elementary properties and methods Integers : multiplicative structure (GCD, LCM etc), congruences, power residues, quadratic residues etc →511.12 Integers and their manipulation 511.13 Factors. Fractions. Ratios 511.14 Roots and their extraction. Irrationals, imaginaries etc 511.6 Algebraic number fields Elementary prime number theory →511.333 Distribution of primes and divisors in number fields 511.345 Additive problems with prime numbers
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.2/.5	Percentages. Simple interest. Stocks and shares. Brokerage. Foreign exchanges. Compound interest [<i>cancelled</i>]	.212	
.137	Ratio. Proportion		
.2/.7	Simple and compound proportion. Clock problems [<i>cancelled</i>]		
.138	Continued fractions		
511.14	ROOTS AND THEIR EXTRACTION. IRRATIONALS, IMAGINARIES ETC →512 Algebra		
.141	Integral roots. Simple methods		
.142	Square roots		
.143	Higher roots	.213	
.144	Horner's method [<i>cancelled</i>] →512.622		
.145	Surds. Rationalization		
.146	Other incommensurables. Elementary treatment		

511.213.2/3	Decomposition of a number into prime factors : various procedures. Mersenne numbers <i>[cancelled, superfluous]</i>	511.343	Forms of higher degree. Fermat's last theorem
.214	Number theoretic functions. Inversion formula, phi-functions etc	.345	Additive problems with prime numbers →511.213 Elementary prime number theory
.215	Algorithms and expansions : digital properties →510.5 Algorithms. Computable functions		511.333 Distribution of primes and divisors in number fields
.216	Number sequences, e.g. Farey. Recurrence sequences		
.217	Special numbers and polynomials, e.g. Bernoulli →512.622 Polynomials (including binomials and prime factors)	511.36	DIOPHANTINE APPROXIMATIONS →511.6 Algebraic number fields 519.65 Approximation. Interpolation
.218	Partitions (elementary methods) →519.116 Partitions	.361	Linear Diophantine approximations
.22/.264	Congruences and indeterminate analysis of the first degree. Quadratic residues. Complex numbers. Quaternions with integral coefficients. Residues of powers and binomial congruences <i>[cancelled]</i> →511.212, 511.61/.62	.362	Non-linear Diophantine approximations
.27/.274	Division of the circle <i>[cancelled]</i> →511.622, 512.622	.364	Approximations of algebraic and transcendental numbers →517.524 Continued fractions
.28/.284	Theory of prime numbers <i>[cancelled]</i> →511.213, 511.333	.368	Diophantine approximations in local fields
.29/.292	Partition of numbers. Additive theory of numbers <i>[cancelled]</i> →511.218, 511.34	511.37	METRIC AND PROBABILISTIC THEORY OF NUMBERS Forms and systems of forms <i>[cancelled]</i> →511.34 Linear forms and systems of linear forms <i>[cancelled]</i> →511.341 Various quadratic forms <i>[cancelled]</i> →511.342 Forms of any degree <i>[cancelled]</i> →511.343 Systems of forms. Forms from the genus point of view <i>[cancelled]</i> →511.341/.343
511.3	ANALYTICAL, ADDITIVE AND OTHER NUMBER THEORY PROBLEMS, INCLUDING DIOPHANTINE APPROXIMATIONS →511.5 Diophantine equations 511.6 Algebraic number fields	4/.493 41/.412 42/.466 47/.473 48/.493	DIOPHANTINE EQUATIONS Algebraic Diophantine equations →512.75 Arithmetic problems of algebraic varieties Linear, quadratic and bilinear equations Cubic and quartic equations Diophantine equations of higher degree Fermat's last theorem <i>[cancelled]</i> →511.343 Non-algebraic Diophantine equations. Exponential equations etc Diophantine inequalities →511.36 Diophantine approximations
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512 ALGEBRA

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		.35/.37	Roots etc <i>[cancelled]</i> →512.544, 512.64
		.38/.394	Transformation and reduction of equations. Various equations <i>[cancelled, superfluous]</i>
		4/.45	Galois's group theory. Solution of equations by radicals <i>[cancelled]</i> →512.623.3

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.66	Factorizations of finite groups	.4	Representations of topological groups
.68	Normal complements in finite groups		→517.986.4 Infinite dimensional representations of groups
.7	Permutation groups	.6	Relations between subgroups in topological groups. Finiteness and related conditions
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.52	Free products	.214	Characters of representations
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.27	Minimal and maximal conditions	.552	Associative rings and algebras
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.32	Generalized solvable groups and finiteness	.12	Ideals in rings. Radicals
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.37	Radicals in groups	.16	Automorphisms, endomorphisms and derivations of rings
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.42	Groups of automorphisms and representations of groups as groups of automorphisms of algebraic systems	.2	Rings with chain conditions
.43	Automorphisms and groups of automorphisms of concrete groups	.22	Finite-dimensional algebras
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.5	Locally finite groups	.23	Rings with descending chain conditions. Artinian rings
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.1	General theory of topological groups	.332	Matrix rings over skew fields
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.14	Homomorphisms of topological groups		
.15	Operations on topological groups. Products		
.17	Embedding theorems for topological groups		
.18	Local properties of topological groups		
.2	Abelian topological groups		
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512.552.34	Prime and semi-prime rings	512.56	LATTICES, INCLUDING BOOLEAN RINGS AND ALGEBRAS
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.5	Operations over rings		Partially ordered sets
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.8	Semigroup and group rings		Representations of Boolean algebras
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.73	Self-injective rings	.5	Lattices related to universal algebra
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.383	Lie triple systems		
.5	Alternative rings and rings closely related to them		
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.2	Linearly ordered rings		515.14 Algebraic topology
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.556	General theory of topological rings and modules	.2	Structure questions in category theory
	→515.122.4 Topological properties of spaces with supplementary structure and topological transformation groups	.3	Brandt groupoids. Ringoids
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.558	Generalizations of rings	.6	Direct and inverse limits
		.583	Representations of categories

512.585	Abelian categories	512.643	Matrices and linear mappings. Matrix theory
	→512.664.1 Homological algebra in	.2	Determinants and their generalizations
	Abelian categories	.4	Matrix equations
.3	Representations of Abelian categories	.5	Eigenvalues of matrices
.587	General theory of species of structures	.8	Special types of matrix
	(according to Ehresmann)	.644	Systems of linear equations and inequalities
		.647	Multilinear algebra. Forms
512.6	SPECIAL BRANCHES OF ALGEBRA	→511.34 Additive theory of numbers.	Forms and systems of forms
			over the ring of rational integers
512.62	FIELDS. POLYNOMIALS	.2	Bilinear and quadratic forms
	→511.6 Algebraic number fields		
.622	Polynomials (including binomials and	512.66	HOMOLOGICAL ALGEBRA
	prime factors)	→512.72 Structure and variations of	algebraic varieties, fibre
	→511.217 Special numbers and		bundles, fibrations
	polynomials, <i>e.g.</i> Bernoulli		
	517.518.8 Approximation of functions	.662	Chain complexes
	by polynomials and their	.1	Homology theory of chain complexes
	generalizations	.12	Künneth theorem. Universal coefficient
.623	General field theory		formulae
.2	Extensions of fields	.5	Homotopy theory of chain complexes
.22	Algebraic extensions of fields	.7	Chain complexes with a diagonal
.23	Transcendental extensions	.8	Filtrations, exact couples, spectral sequences
.24	Separable and non-separable extensions	.664	Derived functors
.26	Derivations in fields		→512.582 Functors
.27	Normal extensions. Galois extensions	.1	Homological algebra in Abelian categories
.3	General Galois theory		→512.585 Abelian categories
.32	Problem of embedding	.2	Homology theory of associative rings and
.35	Constructions of fields with given Galois group		modules
.4	Valuations of fields	.3	Homology of Lie algebras and Hopf algebras
.42	Archimedean and non-Archimedean valuations	.4	Homology of groups and semigroups
.43	Discrete valuations	.8	Deformations of algebraic structures
.44	Nondiscrete valuations		→515.179 Deformations of structures.
.46	Extension of valuations to a field extension		Pseudogroups
.48	Generalizations of valuations	.82	Deformation of discrete subgroups of Lie
.5	Ordered fields		groups
.52	Formally real fields	.667	Algebraic analogues of various
.6	Topological fields		constructions from topology and
.7	Special classes of fields	.2	algebraic geometry
.8	Generalizations of fields	.3	Homotopy groups in categories
.624	Finite fields	.5	Algebraic analogues of the K-functor.
.2	Polynomials over finite fields		Whitehead group
.3	Equations and systems of equations over a		General theory of topologies and sheaves on
	finite field		categories
.5	Linear sequences over a finite field		→512.737 Grothendieck cohomology and
.7	Perfect difference sets		topology
.625	Local fields	.7	General theory of coalgebras and Hopf algebras
.2	Extension of local fields		
.3	Ramification theory		
.5	p-adic analysis		
	→512.78 Analytic spaces over arbitrary	512.7	ALGEBRAIC GEOMETRY INCLUDING
	complete normed fields		COMMUTATIVE RINGS AND ALGEBRAS
.7	Forms over local fields		
.626	Fields of algebraic numbers and	512.71	COMMUTATIVE RINGS AND ALGEBRAS,
	algebraic functions		LOCAL THEORY AND FOUNDATIONS OF
	→511.6 Algebraic number fields	.711	ALGEBRAIC GEOMETRY
.1	Divisors and completions		General commutative ring theory
.2	Different and discriminant		→512.55 Rings and modules
.3	Quadratic fields. Cyclotomic fields	.712	512.62 Fields. Polynomials
.32	Quadratic fields		Valuations on commutative rings and theory of
.35	Cyclotomic fields	.713	divisibility
.4	Units of algebraic number fields	.714	Arithmetic rings. Dedekind and Prüfer rings
.5	Divisor class group	.715	Polynomial rings
.6	Idèles and adèles		Modules over commutative rings
.7	Forms over number fields	.717	→512.553 Modules
.8	Arithmetic questions of orders in semisimple	.718	Local algebra. Local theory
	algebras		Foundations of algebraic geometry
.627	Class field theory		
.5	Local class field theory		
.628	Differential algebra. Difference algebra	512.72	STRUCTURE AND VARIATIONS OF
.2	Differential algebra		ALGEBRAIC VARIETIES, FIBRE BUNDLES,
.4	Difference algebra		FIBRATIONS
			→515.179 Deformations of structures.
512.64	LINEAR AND MULTILINEAR ALGEBRA,		Pseudogroups
	INCLUDING MATRIX THEORY	.721	Moduli of algebraic varieties
.642	Vector spaces. Vector space theory	.722	Structure of families. Picard varieties
.2	Vector spaces over skew fields		

512.723	Algebraic vector bundles	512.745.2	Geometric theory of invariants of algebraic groups of transformations
	→512.732 Algebraic sheaves and cohomology with coefficients therein	.4 .747	Infinite dimensional algebraic groups
	512.772.3 Vector bundles over a curve		Pro-algebraic groups and group schemes
	514.762.32 Geometry of vector bundles	512.75	ARITHMETIC PROBLEMS OF ALGEBRAIC VARIETIES
.725	Algebraic fibrations with degenerate fibres		→511.51 Algebraic Diophantine equations
.2	Families of fibrations		512.742.7 Arithmetic of Abelian varieties
.4	Variations of embeddings		512.772.7 Arithmetic problems of algebraic curves
			512.774.7 Arithmetic problems of algebraic surfaces
512.73	COHOMOLOGY THEORY OF ALGEBRAIC VARIETIES AND SCHEMES		Rationality questions. Rational points on algebraic varieties
	→512.66 Homological algebra		Zeta-functions and related questions
	515.165.4 Topology of Kähler and algebraic varieties	.752	Ground fields (finite, p-adic, global)
.732	Algebraic sheaves and cohomology with coefficients therein	.754 .757	BIRATIONAL GEOMETRY. MAPPINGS, ETC
	→512.723 Algebraic vector bundles	512.76	→512.774.2 Birational transformations and minimal models
	515.142.21 Homology and cohomology groups of spaces		Singularities. Singular points of algebraic varieties
	515.171.3 General theory of coherent analytic sheaves and their cohomology	.761	→512.772.1 Singular points of curves
.2	General properties of algebraic sheaves		512.774.1 Singular points of surfaces
.6	Riemann-Roch theorem for algebraic varieties and related questions	.2	Resolution of singularities
	→515.171.36 Riemann-Roch theorem for complex manifolds and related problems	.3 .5	Structure of a variety near singular points
.734	Cycles: intersection theory, equivalence	.763	Numerical invariants and classification of singularities
	→512.774.17 Intersection theory on singular surfaces	.765	Linear systems and rational mappings
.2	Intersection theory foundations		Modifications and the problem of minimal models
.3	Chow varieties and algebraic systems. Parametrization	512.77	ALGEBRAIC CURVES, SURFACES AND THREE-DIMENSIONAL VARIETIES
.5	Rational equivalence of cycles	.772	Algebraic curves
.7	Algebraic and numerical equivalence	.1	Singular points of curves
.736	Serre cohomology, K-theory	.3	Vector bundles over a curve
	→515.171.22 Serre analytic spaces		→512.723 Algebraic vector bundles
.737	Grothendieck cohomology and topology	.5	Moduli of algebraic curves
	→512.667.5 General theory of topologies and sheaves on categories		→515.179.25 Theory of moduli of Riemann surfaces
		.7	Arithmetic problems of algebraic curves
512.74	ALGEBRAIC GROUPS, INCLUDING ABELIAN VARIETIES	.774	Algebraic surfaces
	→512.54 Groups. Group theory	.1	Singular points of surfaces
	512.81 Lie groups	.17	512.774.1 $\cong$ 512.761
.741	Formal groups		Intersection theory on singular surfaces
	→512.817 Discrete subgroups and discrete transformation groups	.2	→512.734.2 Intersection theory foundations
.1	Commutative formal groups		Birational transformations and minimal models
.2	Non-commutative formal groups	.3	→512.765 Modifications and the problem of minimal models
.5	p-adic analytic groups		Algebraic and linear systems on algebraic surfaces
.742	Abelian varieties and schemes	.4	Algebraic geometry of various classes of surfaces
.1	General theory of Abelian varieties		Algebraic geometry of rational and ruled surfaces
.2	Rings of endomorphisms of Abelian varieties	.42	Surfaces with a pencil of elliptic curves
.3	Moduli of Abelian varieties	.44	Algebraic surfaces of basic type
.4	Principal homogeneous spaces of Abelian varieties	.46	Moduli of algebraic surfaces
.7	Arithmetic of Abelian varieties	.5	→515.179.25 Theory of moduli of Riemann surfaces
	→512.75 Arithmetic problems of algebraic varieties		Arithmetic problems of algebraic surfaces
.72	Arithmetic of elliptic curves	.7	Three-dimensional algebraic varieties
.743	Linear algebraic groups	.776	
.2	Adèle groups and Tamagawa numbers		ANALYTIC SPACES OVER ARBITRARY COMPLETE NORMED FIELDS
.3	Groups of units	512.78	→515.17 Analytic spaces
.4	Approximation theorems	.8	Higher algebra [cancelled, superfluous] →512.5/.81
.5	p-adic linear groups		LIE GROUPS
.7	Linear representations of linear algebraic groups	512.81	→512.54 Groups. Group theory
	→512.547 Linear representations of abstract groups.		512.554.3 Lie rings
	Group characters		514.747 Geometric objects
	512.814 Continuous subgroups of Lie groups		514.765 Geometry of homogeneous spaces. Lie group geometry
.745	Algebraic groups of transformations		

512.812	General Lie group theory, properties, structure and generalizations	512.816.4 (<i>contd.</i>)	514.765 Geometry of homogeneous spaces. Lie group geometry
.2	Correspondence between Lie groups and Lie algebras. Exponential mapping	.5	Homogeneous spaces of solvable Lie groups
.4	Structure of Lie groups and Lie algebras	.52	Homogeneous spaces of nilpotent Lie groups
.6	Relevant questions of topological group theory	.7	Differential operators invariant under Lie transformation groups
	→512.546 Topological groups	.8	Invariant integration
.8	Generalizations of Lie groups	.817	Discrete subgroups and discrete transformation groups
.813	Special classes of Lie groups		→515.178 Automorphic functions
.3	Compact Lie groups and Lie algebras	.1	General properties of discrete transformation groups and discrete subgroups of Lie groups
.4	Semisimple Lie groups and Lie algebras	.2	Discrete groups of linear-fractional transformations
.5	Solvable Lie groups and Lie algebras	.3	Discrete subgroups of semisimple Lie groups
.52	Nilpotent Lie groups and Lie algebras	.5	Discrete subgroups of solvable and nilpotent Lie groups
.814	Continuous subgroups of Lie groups	.6	Arithmetically defined discrete subgroups
.1	General properties of subgroups and subalgebras	.62	Modular groups
.2	Maximal subgroups and subalgebras	.7	Discrete groups of isometric transformations
.3	Compact and semisimple subgroups	.73	Discrete groups generated by reflections
.5	Solvable subgroups and subalgebras	.818	Theory of continuous pseudogroups (infinite Lie groups)
.52	Cartan subgroups		→512.554.32 Infinite-dimensional Lie algebras
	→512.818.5 Cartan subgroups in infinite Lie groups	.1	General considerations of the theory of topological and Lie pseudogroups
.54	Maximal tori	.2	Formal Lie groups methods in the theory of pseudogroups
.7	Decomposition of Lie groups into a product of subgroups	.3	Cartan pseudogroups
.815	Linear representations of Lie groups	.4	Infinite dimensional Lie algebras with filtration and gradation
	→514.747 Geometric objects	.5	Cartan subgroups in infinite Lie groups
	517.986.5 Infinite dimensional representations of Lie algebras		→512.814.52 Cartan subgroups
.1	Finite dimensional linear representations of Lie groups and Lie algebras	.83/.835	Determinants [<i>cancelled</i>] →512.643.2
.2	Equivariant embeddings of spaces with a Lie transformation group in Euclidean space	.86/.866	Linear substitutions [<i>cancelled</i>] →512.54, 512.643
.3	Representative functions. Duality theorems	.87/.875.2	Elimination [<i>cancelled</i>] →512.622, 512.718
.4	Invariants of linear representations	.88/.889.4	General theory of invariants and covariants of a form [<i>cancelled</i>] →512.745.2
.6	Linear Lie groups and Lie algebras	.89/.898.42	Various forms [<i>cancelled</i>] →511.34, 512.622, 512.647
.7	Algebraic linear Lie groups	.9/.99	General theory of imaginaries and of complex quantities.
.8	Linear representations of groups in theoretical physics	.91/.935	Universal algebra [<i>cancelled</i>] →512.55, 512.71, 514.74
.816	Lie transformation groups	.94/.975	Imaginaries. Calculation. Geometric interpretations.
	→514.747 Geometric objects	.98	Equipollences. Complex quantities from the algebraic point of view [<i>cancelled</i>] →512.55, 512.71
	514.765 Geometry of homogeneous spaces. Lie group geometry	.99	Quaternions. Biquaternions. Nonions. Multenions [<i>cancelled</i>] →512.552.2, 512.642, 514.74
	515.177 Complex spaces with a group of automorphisms	513	Theory of operations [<i>cancelled</i>] →517.984, 512.58
.1	General theory of Lie transformation groups	.0/.059	Other systems of complex numbers [<i>cancelled</i> , <i>superfluous</i>]
.2	Orbits and quotients of Lie transformation groups	.1/.283.3	Application of the vector calculus to physical sciences [<i>cancelled</i>] →514.742
.3	Transitive Lie groups	.3/.494	Geometry [<i>cancelled</i>] →514, 515.1
.4	Homogeneous spaces of semisimple Lie groups. Symmetric homogeneous spaces	.5/.598.3	Generalities. Principles of geometry [<i>cancelled</i>] →514.01, 514.1, 514.7
	→514.764.227 Symmetric Riemannian spaces and their generalizations	.6/.68	Plane geometry [<i>cancelled</i>] →514.112
		.7/.766	Solid geometry [<i>cancelled</i>] →514.113, 514.172
		.8/.882	Conics. Quadrics [<i>cancelled</i>] →514.122/.124, 514.14
			Algebraic curves, surfaces and varieties. Special transcendental curves, surfaces and varieties [<i>cancelled</i>] →512.7, 514.122/.123, 514.142/.144
			Complexes and congruences. Connexes. Infinitesimal geometry and kinematic geometry. Transformation [<i>cancelled</i>] →514.142/.144, 514.75
			Various geometries [<i>cancelled</i>] →511.9, 514.12/.14, 515.1

514 GEOMETRY

For topology→515.1

Special auxiliary subdivision for 514

514.01	Foundations of geometry. Axiomatics	514.11
	e.g. 514.12.01 Axiomatics of Euclidean geometry	.112
	514.132.01 Axiomatics of Lobachevsky geometry	.3
	514.135.01 Axiomatics of elliptic geometry	.4
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Principal divisions (continued)

514.1	GENERAL GEOMETRY	
	→514.7 Differential geometry, including algebraic and analytic methods in geometry	.115
		.116

514.11	ELEMENTARY GEOMETRY, TRIGONOMETRY AND POLYGONOMETRY
.112	Plane geometry. Planimetry
.3	Geometry of the triangle
.4	Geometry of polygons, rectangles etc
.6	Elementary geometry of circles
.113	Solid geometry
.4	Geometry of tetrahedra
.5	Geometry of polytopes, polyhedra
.6	Geometry of spheres and cylinders
.114	Elementary geometry in multidimensional spaces
	→514.124 Analytic geometry in multi-dimensional Euclidean space
.115	Theory of geometric constructions
.116	Trigonometry. Polygonometry

514.116.2	Plane trigonometry	514.152	Conformal geometry and its analogues
.3	Spherical trigonometry		→514.756.2 Differential geometry in conformal and pseudo-conformal spaces
514.12	EUCLIDEAN AND PSEUDO-EUCLIDEAN GEOMETRIES. ANALYTIC GEOMETRY	.2	Conformal geometry
	→512.7 Algebraic geometry including commutative rings and algebras	.4	Laguerre geometry
		.6	Lie geometry of spheres
.122	Analytic geometry in the Euclidean plane	.8	Other generalizations of conformal geometry
.1	Analytic geometry of straight lines	.154	Symplectic geometry
.2	Analytic geometry of curves of second order		→514.164 Symplectic spaces
.3	Analytic geometry of algebraic curves of higher order	.2	514.756.4 Differential geometry in symplectic spaces
.4	Analytic geometry of transcendental curves	.4	Affine-symplectic geometry
.123	Analytic geometry in three-dimensional Euclidean space	.157	Projective-symplectic geometry
.1	Of straight lines and planes	.2	Biaxial geometry and its generalizations
.2	Of surfaces of second order	.3	Elliptic biaxial geometry
.3	Of algebraic curves and surfaces	.4	Hyperbolic biaxial geometry
.4	Of transcendental curves and surfaces	.7	Parabolic biaxial geometry
.124	Analytic geometry in multidimensional Euclidean space	514.16	Biplanar geometry
.1	Analytic geometry of linear varieties	.161	GEOMETRIES OVER ALGEBRAS
.2	Analytic geometry of algebraic varieties		Affine and projective spaces over algebras
.125	Pseudo-Euclidean spaces		→514.146 Algebraic theory of affine and projective geometries
.126	Galilean spaces	.2	Over the algebra of double numbers
.127	Semi-Euclidean spaces	.4	Over quaternions and their analogues
.128	Flag spaces	.6	Over matrices
		.8	Over octaves
514.13	NON-EUCLIDEAN METRIC GEOMETRIES	.9	Over other algebras
.132	Lobachevsky geometry	.162	Quadratic Euclidean and non-Euclidean spaces
.133	Other hyperbolic geometries		Complex quadratic spaces
.135	Elliptic geometries	.1	Quadratic spaces over the algebra of double numbers
.136	Quasielliptic and quasihyperbolic spaces	.2	Quadratic spaces over the algebra of dual numbers
.137	Semielliptic and semihyperbolic spaces	.3	Quadratic Euclidean and non-Euclidean spaces over other algebras
514.14	AFFINE GEOMETRY. PROJECTIVE GEOMETRY	.9	Hermitian, Euclidean and non-Euclidean spaces
.142	Affine geometry	.163	514.163.1/.3≅514.162.1/.3
.1	Synthetic geometry in affine space	.4	Over quaternions and their analogues
.2	Analytic geometry in affine space	.6	Over matrices
.23	Geometry of linear varieties	.8	Over octaves
.24	Geometry of curves and surfaces of second order	.9	Over other algebras
.25	Geometry of equiaffine and centroaffine space	.164	Symplectic spaces
.144	Projective geometry		514.164~514.163
.1	Synthetic geometry in projective space		→514.154 Symplectic geometry
.11	Theory of projective correspondences		514.756.4 Differential geometry in symplectic spaces
.12	Theory of configurations		Geometry of other spaces over algebras
.13	Geometry of systems of linear varieties	.169	
.14	Geometry of curves and surfaces of second order	514.17	CONVEX SETS. GEOMETRIC FIGURE ARRANGEMENTS. GEOMETRIC INEQUALITIES
.15	Geometry of algebraic varieties. Arithmetization	.172	Convex sets
.2	Analytic geometry in projective space	.2	Convex curves and surfaces
.23	Geometry of linear varieties	.4	Convex bodies
.24	Geometry of curves and surfaces of second order	.45	Convex polygons and polytopes
.25	Geometry of algebraic subvarieties of projective space	.174	Arrangements of geometric figures: packing, covering etc
.146	Algebraic theory of affine and projective geometries		→511.9 Geometry of numbers
	→514.161 Affine and projective spaces over algebras	.2	Packings
.2	Based on lattice theory	.3	Coverings
	→512.56 Lattices, including Boolean rings and algebras	.5	Partitions
.3	Over skew fields	.6	Grids
	→512.552.32 Skew fields	.177	Geometric inequalities
.5	Finite projective spaces and other generalizations	.2	Extremal problems in geometry
.7	Nondesarguesian geometries	514.18	DESCRIPTIVE GEOMETRY
514.15	GEOMETRY IN SPACES WITH OTHER FUNDAMENTAL GROUPS	.181	Theoretical questions of descriptive geometry
	→514.756 Differential geometry in spaces with other fundamental groups	.2	Descriptive geometry of curves and surfaces
		.22	Kinematic generation of curves and surfaces
		.24	Framework problem of surfaces
		.25	Topographic surfaces

514.181.4	Affine and projective foundations of methods of descriptive geometry	514.747	Geometric objects
.6	Theoretical questions of parallel and central axonometry	→512.815	Linear representations of Lie groups
.8	Theory of accuracy of graphic constructions	514.762.3	Spaces and fields of geometric objects in fibre spaces
.182	Practical methods of descriptive geometry	514.763	Infinitesimal structures and fields of geometric objects on differentiable manifolds
	<i>For computational mathematics</i> →519.6		
.2	Methods of diagram transformations	.2	Representations of Lie groups and geometric objects
.3	Perspective constructions and the theory of shadows	.3	Representations of infinite Lie pseudogroups and differential geometric objects
.5	Use of instruments and nomograms	.4	Extensions of geometric objects
.7	Computational methods in descriptive geometry	.6	Lie differentiation
.185	Generalizations of descriptive geometry	.748	Differential geometric methods in the study of immersed manifolds
.2	Multidimensional descriptive geometry		Moving frame of a manifold
.4	Descriptive geometry of non-Euclidean spaces	.2	Canonical form of the moving frame
.7	Nonlinear descriptive geometry	.22	Geometric objects on immersed manifolds
2/.6	(trigonometric) Multiplication, division. Relations between the trigonometric functions of several angles. Formulae and questions relative to plane triangles. Spherical trigonometry [<i>cancelled</i>] →514.116	.4	Fundamental objects of an immersed manifold
		.42	Geometric objects invariantly connected to an immersed manifold
		.44	
514.7	DIFFERENTIAL GEOMETRY, INCLUDING ALGEBRAIC AND ANALYTIC METHODS IN GEOMETRY		
514.74	ALGEBRAIC AND ANALYTIC METHODS IN GEOMETRY	514.75	DIFFERENTIAL GEOMETRY IN SPACES WITH FUNDAMENTAL GROUPS
	→515.14 Algebraic topology	.752	Differential geometry in Euclidean and pseudo-Euclidean spaces
.742	Vector algebra. Vector analysis	.2	Theory of curves
.2	Vector algebra	.22	Plane curves
.23	Of three-dimensional Euclidean space	.23	Curves in three-dimensional space
.24	In space with quadratic metric	.24	Curves in multidimensional space
.26	In linear spaces with fundamental group (biaffine, symplectic etc)	.3	Theory of surface strips
.28	Screw calculus	.4	Theory of surfaces
.4	Vector analysis (vector field theory)	.43	Surfaces in three-dimensional space
	→514.752.7 Differential geometry of vector fields	.432	Curves on a surface
	514.754.7 Affine differential geometry of vector fields	.433	Nets and webs on surfaces
	517.43 Operations of vector calculus (symbolism of Hamilton)	.434	Intrinsic geometry of surfaces
.43	In three-dimensional Euclidean space	.435	Bending and mapping of surfaces
.44	In affine spaces	.437	Special classes of surfaces
.45	In Euclidean and non-Euclidean spaces	.44	Surfaces in multidimensional space
.47	In spaces with a connection	.5	514.752.44≅514.752.43
.743	Tensor algebra. Tensor analysis	.53	Theory of families of straight lines and planes
.2	Tensor algebra	.54	Congruences and complexes of straight lines in three-dimensional space
.22	In general affine space	.6	Families of straight lines and planes in multidimensional space
.24	In spaces with a bilinear metric (Euclidean, symplectic etc)	.7	Theory of families of curves and surfaces
.26	In linear spaces with fundamental group (biaffine etc)	.8	Differential geometry of vector fields
.28	Invariants and covariants of tensors	.753	→514.742.4 Vector analysis (vector field theory)
.4	Tensor analysis	.2	Theory of nonholonomic manifolds
.48	Differential invariants and covariants of tensors	.22	Differential geometry in non-Euclidean spaces
.744	Spinors, spinor algebra and analysis		Differential geometry in non-Euclidean spaces with nondegenerate absolute
.2	Algebra of spinors	.23	Theory of curves
.4	Spinor analysis	.24	514.753.22≅514.752.2
.745	Calculus of exterior forms		Theory of surface strips
	→514.763.8 Geometry of differential equations	.25	Theory of surfaces
	517.936 Pfaffian equations and systems	.26	514.753.24≅514.752.4
.2	Grassman algebra and its generalizations	.28	Theory of families of straight lines and planes
.4	Theory of exterior differential forms	.3	514.753.25≅514.752.5
.5	Differential algebras and their geometric applications	.32	Theory of families of curves and surfaces
.8	Theory of compatibility of systems of differential equations	.34	Theory of nonholonomic manifolds
	→514.763.8 Geometry of differential equations	.35	Differential geometry in non-Euclidean spaces with degenerate absolute
.82	Completely integrable systems	.754	Theory of curves
.84	Systems in involution	.2	Theory of surfaces
.87	Theory of extensions of systems of differential equations	.3	Theory of families of straight lines and planes
		.4	Affine differential geometry
			Affine theory of curves
			514.754.2≅514.752.2
			Affine theory of surface strips
			Affine theory of surfaces
			514.754.4≅514.752.4