smarthinking

Smarthinking provides help in a wide variety of Mathematics & Statistics topics

Algebra

- **Algebraic Expressions:** simplifying, combining like terms, properties, exponents and radicals, factoring
- **Binomial Theorem**
- **Complex Numbers**
- **Conic Sections:** circles, parabolas, ellipses, hyperbolas
- **Elementary Sequences and Series:** terms of sequences, arithmetic sequences, geometric sequences and series, finite series
- **Exponentials and Logarithms:** graphs, change of base formula, logarithm rules, equations, exponential growth and decay, logistic equations
- **Functions:** function notation, domain/ range, intercepts, properties, average rate of change, piecewise defined functions, graphs, transformations, algebra of functions, inverses, variation, applications
- **Graphs/Coordinate systems:** plotting, distance formula, midpoint formula, domain and range, symmetry, intercepts, one-to-one
- **Inequalities:** linear, absolute value, polynomial, rational, graphs
- **Linear Programming:** geometric approach
- **Lines:** slopes, equations, graph, applications
- **Matrices:** matrix algebra, Gaussian elimination, Inverses, Determinants, Cramer's Rule
- **Polynomials:** roots and multiplicities, graphs, long and synthetic division, fundamental theorem of algebra
- **Quadratics:** equations, vertex, properties, applications
- **Rational Expressions/Functions:** asymptotes, intercepts, graphs, partial fractions
- **Solving Equations:** linear, quadratic, quadratic in form, polynomial, rational, radical, absolute value, applications
- **Systems of Equations:** systems of linear equations, systems of nonlinear equations
- **Systems of Inequalities:** systems of linear inequalities, systems of nonlinear inequalities

Basic Math

- **Arithmetic with Decimals, Fractions, or Mixed numbers**
- **Arithmetic with Whole or Signed Numbers**
- **Bases, other than base 10**
- **Basic problem solving**
- **Dimensional Analysis, Units of Measure**
- **Exponents and Radicals**
- **Logic:** Negations, conjunction, disjunction, conditionals, biconditionals, truth tables, equivalent statements, logical arguments
- **Order of Operations**
- **Percentages and Percent Change**
- **Ratio and Proportion**
- **Reading and Interpreting Charts and Graphs**
- **Rounding and Estimating**
- **Scientific Notation**
- **Sets:** notation, operations, Venn diagrams, survey problems
- **The Real Number System**

Pearson

Calculus (Single Variable)

- **Applications of Derivatives:** rates of change, marginal cost/revenue/profit, velocity and acceleration, analysis of graphs, mean value theorem, max/min values, optimization, related rates, Newton's method
- **Applications of Integrals:** areas between curves, length of curves, work, volume, surface area, average value
- **Continuity:** definition, intermediate value theorem
- **Derivatives:** definition, product and quotient rules, chain rule, implicit differentiation, logarithmic and exponential functions
- **Hyperbolic Functions:** definitions, properties, derivatives
- **Integrals:** definition/Riemann sums, definite and indefinite integrals, fundamental theorem of calculus
- **Integration Techniques:** antiderivatives, trigonometric integrals, substitution, trigonometric substitution, by parts, partial fractions, approximate integrals, improper integrals
- **Limits:** definition, limit theorems, graphs, trigonometric limits, L'Hospital's Rule
- **Parametric equations**
- **Polar coordinates**
- **Sequences and Series:** convergence of sequences, absolute and conditional convergence of series, common series, integral test, comparison tests, alternating series, ratio test, root test, power series, Taylor series.

Geometry

- **Basic Definitions:** points, lines, rays, angles
- **Congruent Triangles**
- **Circles, Polygons, Quadrilaterals**
- **Coordinate Geometry:** midpoint, slope, distance formula
- **Perimeters, Areas, Volumes and Applications**
- **Planes and Parallel Lines**
- **Similar Figures**
- **Theorems, Postulates, and Proofs**
- **Triangles:** angles, types, measurements

Liberal Arts Math

- **Apportionment:** quota rule and paradoxes, Hamilton's method, Jefferson's method, Adam's method, Huntington-Hill method
- **Averages:** mean, median, mode, frequency distributions, percentile rank
- **Basic Probability:** basic theoretical probability, experimental probability, odds
- **Brief Survey of Graph Theory:** introductory Euler and Hamilton circuits and paths, Fleury's algorithm, nearest-neighbor and repetitive nearest neighbor algorithms, cheapest link algorithm, minimal spanning trees, Kruskal's algorithm
- **Consumer Mathematics:** simple interest, compound interest, ordinary annuities, mortgages, amortization, average daily balance
- **Fair Division:** divider-chooser, lone-divider, lone-chooser, last-diminisher, sealed bids, markers
- **Introductory Counting:** fundamental counting principle, permutations, combinations
- **Introductory Scheduling:** digraphs, priority lists
- **Voting:** voting methods, fairness criteria, weighted voting

Statistics

- **Descriptive Statistics:** measures of central tendency, measures of dispersion, graphical data display, summary statistics
- **Inferential Statistics:** confidence intervals (means, proportions, variance, standard deviation), hypothesis testing (z tests, t tests, F tests, chisquared tests, oneway ANOVA), sample size estimation
- **Process and Quality Control:** control charts
- **Probability:** counting, fundamental principles of probability, discrete and continuous probability distributions, normal probabilities, central limit theorem
- **Relationships Between Variables:** linear correlation, simple linear regression
- **Understanding Data:** variable types, populations and samples, sampling techniques

Trigonometry

- **Angles and their measure:** degrees minutes seconds, radians, linear and angular speed, arc length, area of a sector
- **Area of a Triangle**
- **Basics of Simple Harmonic Motion**
- **Complex numbers:** polar form, DeMoivre's theorem
- **Conic sections:** circles, parabolas, ellipses, hyperbolas
- **Formulas:** sum and difference formula, double angle formula, half angle formulas, sum-to-product formulas, product-to-sum formulas
- **Graphs of Trigonometric Functions:** domain, range, amplitude, period, phase shift, curve fitting
- **Inverse Trig Functions**
- **Law of Sines, Law of Cosines**
- **Polar Coordinates:** coordinates, polar equations.
- **Trigonometric Equations**
- **Trigonometric Functions:** basic properties, Right triangle trigonometry, coterminal angles, reference angles, unit circle trigonometry
- **Trigonometric Identities:** common identities, verifying identities
- **Vectors:** rectangular and polar form, arithmetic, unit vectors, angle between vectors

Advanced Statistics

- **Analysis of Variance:** variance components, factorial designs, complete, incomplete, and randomized block designs, response surfaces, split-plot and repeated measures designs, mixed models, ANCOVA, experimental design, effect sizes, preplanned comparisons, post-hoc tests, power analysis
- **Common Families of Distributions:** discrete and continuous distributions, transformations and expectations, expected values, moments and moment-generating functions, location and scale families, inequalities and identities, joint and marginal distributions, bivariate transformations, hierarchical models, multivariate distributions
- **Hypothesis Testing:** types of error, most powerful tests, likelihood ratio tests, composite hypotheses, power analysis, basis of T-tests and F-tests, chi-squared tests for goodness of fit or independence, f-test for equality of variance
- **Multivariate Statistics:** multivariate regression, MANOVA, dimension reduction techniques (PCA, MDS, factor analysis, canonical correlation, discriminant functions, clustering techniques)
- **Nonparametric Statistics:** Kruskal Wallis, Mann-Whitney, sign test, Wilcoxon signed-rank, Wilcoxon rank sum test, spearman rank correlation, Kendall's tau, bootstrapping, bayes decision rules
- **Probability Theory:** set theory, conditional probability and independence theorems, random variables, density and mass functions, point estimation, interval estimation, sufficient statistics, likelihood and likelihood ratio tests, evaluating estimators
- **Regression:** least-squares and maximum likelihood methods, statistical inference in regression, confidence and prediction intervals, classification problems, boosting algorithm, multiple linear regression, model selection techniques, model checking, logistic regression, nonlinear methods, dummy variables, modern regression techniques, time series

- **Sampling Theory and Practice:** sampling distributions, types of random samples, sample design, sample analysis, variance estimation, sampling from the normal distribution, generating a random sample, imputation and multiple imputation

Differential Equations (i.e. Introductory Differential Equations)

- **Higher-Order Differential Equations:** initial-value problems, boundary-value problems, homogeneous equations with constant coefficients, non-homogeneous equations, reduction of order, undetermined coefficients, variation of parameters, Cauchy-Euler equation, solving systems of linear equations by elimination, nonlinear differential equations, modeling

- **The Laplace Transform:** definition of the Laplace transform, inverse transforms, transforms of derivatives, translations on the saxis, translations on the taxis, derivatives of a transform, transforms of integrals, transform of a periodic function, Dirac delta function, systems of linear equations

- **Numerical Solutions of Ordinary Differential Equations:** Euler methods and error analysis, Runge-Kutta methods, multistep methods, higher-order equations and systems, second-order boundary value problems

- **Series Solutions of Linear Equations:** solutions about ordinary points, solutions about singular points

- **Solution of First-order Differential Equations:** direction fields, separable equations, linear equations, exact equations, solutions by substitutions, Riccati equation, numerical methods, modeling

- **Systems of Linear First-Order Differential Equations:** homogeneous linear systems (distinct, repeated or complex eigenvalues); nonhomogeneous linear systems (solved via undetermined coefficients or variation of parameters), matrix exponential

Discrete Mathematics

- **Boolean Algebra:** functions, logic gates, minimization of circuits

- **Counting:** pigeonhole principle, permutations, combinations

- **Discrete Probability:** Bayes' theorem, expected value

- **Functions:** injections, surjections, inverses, composition

- **Graphs:** representation, isomorphism, connectivity, Euler & Hamiltonian paths, trees

- **Integers and Numbers:** division algorithm, primes, Euclidean algorithm/gcd, integers mod n, bases other than 10

- **Logic:** propositional logic, rules of inference, equivalences, quantifiers

- **Order Relations:** partially ordered sets, lattices, Boolean algebras, extreme elements and bounds

- **Proofs:** methods and strategies

- **Relations:** representations, properties, linear recurrence relations, equivalence relations

- **Sets:** set operations, Venn diagrams, families of sets

- **Sequences and Series:** explicitly defined, recursion

Linear Algebra (Sophomore Level)

- **Determinants:** properties, Cramer's rule

- **Eigenvalues and Eigenvectors:** characteristic equation, diagonalization, complex eigenvalues, positive definite matrices, quadratic forms, discrete dynamical systems

- **Linear Transformations:** image, kernel

- Matrices and Systems of Linear Equations: solving systems, row operations, echelon form, homogeneous systems, types of matrices, rank of a matrix

- **Matrix Algebra:** matrix operations, inverses, matrix equations

- **Optimization:** graphical method of linear programming, simplex method of linear programming

- **Orthogonality:** dot product and inner product spaces, Orthogonality, Gram-Schmidt process, least squares, inner product spaces

- **Vectors and Vector Spaces:** vector equations, subspaces, null space, row and column spaces, bases, dimension

Multivariable Calculus (i.e. Calculus III)

- **Functions of Several Variables:** planes, surfaces, graphs and level curves, limits, continuity, partial derivatives, chain rules, directional derivatives, gradient, tangent planes, linear approximation, extrema, Lagrange multipliers

- **Multiple Integration:** iterated integrals, area in the plane, volume, change of variables, mass, inertia, surface area, Jacobians

- **Vector Calculus:** vector fields, line integrals, conservative vector fields, Green's theorem, divergence, curl, surface integrals, Stokes' Theorem

- **Vectors and Vector-Valued Functions:** dot product, cross product, lines, curves in space, differentiation, integration, motion in space, lengths of curves, curvature, normal vectors

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