Topics Supported by SMARTHINKING

Mathematics and Statistics

Basic Math Skills, Algebra, Geometry, Trigonometry, Calculus I & II (Single Variable Calculus), Statistics

Basic Math: Operations on Whole Numbers, Addition and Subtraction Using Fractional Notation, Addition and Subtraction Using Decimal Notation, Multiplication and Division Using Fractional Notation, Multiplication and Division Using Decimal Notation, Ratio and Proportion, Percent Notation, The Real Number System, Dimensional analysis, Number systems other than base 10, Order of Operations, Exponents, Set Operations, Venn diagrams, Logic; Truth tables, Conditionals and Bi-conditionals.

Algebra: Linear equations; Applications, Absolute value - Inequalities; Linear, Absolute value, Non linear - Functions / Graphs; Function notation, Linear, Polynomials, Translations / Shifting / reflecting graphs, Composition, Inverse functions - Roots of polynomials; Quadratic, Factoring, Complete square, Quadratic formula, Complex Numbers, Higher Degree, Factoring special cases, Synthetic division - Exponentials and Logs; Graphs, Properties, Solving equations - Systems of linear equations; 2 equations 2 unknowns, Matrix algebra, Gaussian elimination, Inverses, Determinates - Conics - Mathematics of finance; Simple/compound interest, Annuities, Amortization - Linear programming; Geometric approach, simplex method.

Geometry: Basic Definitions; Points, Lines, Rays, Angles, Triangles - Angles, Types, Measurements - Congruent Triangles - Planes and Parallel Lines - Circles, Polygons, Quadrilaterals - Coordinate Geometry, Midpoint, Slope, Distance Formula - Theorems, Postulates, and Proofs.


Calculus: Limits; definition, limit theorems, L'Hopital's Rule - Continuity; intermediate value theorem - Derivatives; chain rule, implicit differentiation - Applications of Derivatives; Analysis of Graphs, mean value theorem, max/min, related rates - Integrals; definition, definite integrals, fundamental theorem of calculus - Integration techniques; polynomials, exponential and logs, trigonometric, substitution, trig substitution, parts, partial fractions - Applications of Integrals; length of curves, work, volume, surface area - Parametric equations - Polar coordinates - Sequences and Series; Convergence test, Power series, Taylor series.

Statistics: Descriptive Statistics, Data Analysis (Graphic Representations, Measures of Central Tendency, Dispersion, Position, Regression and Correlation); Probability (Combinatorics, Random Variables, Probability Distributions for Discrete and Continuous Random Variables; Inferential Statistics (Sampling and Sampling Distributions, Central Limit Theorem, Confidence Intervals, Hypothesis Testing, Inference Concerning Correlation and Regression); Analysis of Variance (Categorical Data Analysis; Chi-square; Contingency Tables; Homogeneity tests; Decision Theory); Process and Quality Control (Control Charts)

Bi-lingual Math: Bi-lingual Math tutoring is available in all of the content areas described under Mathematics and Statistics.

Writing

The SMARTHINKING Online Writing Lab is designed to assist students with writing across the curriculum. SMARTHINKING writing tutors have advanced degrees in composition and rhetoric, literature, creative writing, and other relevant fields within the humanities. They are trained to respond to essays in a range of academic subjects (e.g. lab reports, business plans, and literary analyses) and at a range of academic levels (from "developmental" writers to graduate students). Specifically, SMARTHINKING E-structor® Certified Tutors review students' writing in the following general academic areas at the secondary through graduate levels, unless otherwise indicated:
Composition; Literature; English for Speakers of Other Languages (ESOL); Creative Writing; AP English (high school); English Language Arts (high school); Writing-Intensive Courses Across the Curriculum (to include writing projects for classes in the humanities, sciences, and business, and to include thesis and dissertation projects in the humanities and business).

Science

Biology, Introductory Human Anatomy & Physiology, General Chemistry, and Physics

Biology: Chemistry of Life; Evolution; Cells; Molecules; Energy; DNA; Genetics; Biodiversity; Plant Form and Function; Physiology; Ecology. SMARTHINKING tutorial support aligns with the AP™ Biology course*.

Introductory Human Anatomy & Physiology: cells, tissues, organs, and skeletal, muscular, circulatory, lymphatic, respiratory, nervous, endocrine, digestive, urinary and reproductive systems.

General Chemistry: Measurement; Atomic Structure; Chemical Formula & Equations; Chemical Reactions; Thermo Chemistry; Electron Configurations; Bonding; States of Matter; Solubility; Reaction Rates; Acids & Bases; Equilibria; brief introduction to Nuclear chemistry; simple organic nomenclature & introduction to functional groups. SMARTHINKING tutorial support aligns with the AP™ Chemistry course*.

Physics: Kinematics; Forces and Newton’s Laws of Motion; Work and Energy; Circular Motion; Momentum; Simple and Harmonic Motion; Fluids; Heat and Temperature; The Ideal Gas Law; Thermodynamics; Electric Forces and Electric Fields; Electric Circuits; Magnetic Forces and Fields; Optics; Special Relativity; Particles and Waves; Nuclear Physics and Radioactivity; Waves and Sound; Electromagnetic Waves. SMARTHINKING’s tutorial support aligns with the AP™ Physics B, AP™ Physics C (Mechanics), AP™ Physics C (Electricity & Magnetism)* courses.

Business Studies

Accounting and Economics

Accounting: Topics covered in Principles Accounting I and Principles Accounting 2 classes including topics such as Financial Reporting and Accounting Cycle, Operating Activities, Investing and Financing Activities, Foundations of Management Accounting, Capital Investment Decisions, and Planning, Control, and Performance Evaluation. SMARTHINKING E-structor® Certified Tutors are also qualified to provide support to students taking intermediate Managerial and Financial Accounting, Cost Accounting, and Tax Accounting on a pre-arranged basis.

Economics: Topics covered in Principles Microeconomics and Principles Macroeconomics classes including topics such as Basic Price Theory, the Theory of the Firm, Public Economics, Analysis of the Market Structure, Resource Allocation and Welfare Analysis, National Income Analysis, Monetary System and the Federal Reserve, Business Cycles and Growth and International Trade. SMARTHINKING E-structor® Certified Tutors are also qualified to provide support to students taking Intermediate Microeconomics and Macroeconomics, Money and Banking, International Trade and Finance, Mathematical Economics and Industrial Organization on a pre-arranged basis.

Advanced Subject Suite

Organic Chemistry, Introductory Finance, Mathematics Beyond Calculus II, and Advanced Statistics

students preparing for MCAT™ Organic Chemistry.

**Introductory Finance:** Role and objective of financial management; review of the four basic financial statements; analysis of financial statements and financial performance; the financial environment: markets, institutions, interest rates, and taxes; risk and rates of return; time value of money; bonds and their valuation; stocks and their valuation; cost of capital; capital budgeting, including cash flow estimation, decision criteria, and risk analysis; capital structure and leverage; distributions to shareholders: dividends and share repurchases/treasury stock; managing current assets/working capital; financing current assets/managing current liabilities; financial planning, budgeting, and forecasting.

**Mathematics Beyond Calculus II:** Multivariable Calculus (i.e. Calculus III) - Vectors: dot product, cross product, lines, planes; Vector-Valued Functions: limits, derivatives, curves, tangents, curvature; Partial Derivatives: chain rule, directional derivatives, gradient, Lagrange multipliers; Multiple Integrals: surface area, polar & cylindrical coordinates, moments and center of gravity; Vector Calculus: vector fields, line integrals, Green's theorem, surface integrals, Integrals, Divergence Theorem.

Differential Equations (i.e. Introductory Differential Equations) - Solution of First-order ODE's: analytical, graphical and numerical methods; Linear ODE's; Undetermined Coefficients and Variation of Parameters; Sinusoidal and Exponential Signals: Oscillations, Damping, Resonance; Complex Numbers and Exponentials; Fourier Series, Periodic Solutions; Delta Functions, Convolution, and Laplace Transform Methods; Matrix and First-order Linear Systems: Eigenvalues and Eigenvectors; and Non-linear Autonomous Systems: Critical Point Analysis and Phase Plane Diagrams.

Linear Algebra (Sophomore Level) - Linear Equations: row reduction, vector and matrix equations, linear independence, linear transformations; Matrix Algebra: matrix operations, inverse, subspaces, dimension, rank; Determinants: properties of determinants, Cramer's rule; Vector Spaces: subspaces, null, column & kernel spaces, bases; Eigenvectors: eigenvalues & eigenvectors, characteristic equation, diagonalization, linear transformations, complex eigenvalues, discrete dynamical systems; Orthogonality: inner product, Gram-Schmidt process, least-squares, inner product spaces, Symmetric Matrices: quadratic forms; Optimization: Simplex method.

Discrete Mathematics - Logic and proofs: propositional logic & equivalences, proof methods, and strategies; Discrete structures: sets, set operations, functions, sequences, and series; Algorithms: integers, primes, gcd, matrices, induction, recursion; Counting: pigeonhole principal, permutations, combinations, linear recurrence relations, generating functions; Discrete probability: Baye's theorem, expected value, variance; Graphs: representation, isomorphism, connectivity, Euler & Hamiltonian paths, trees; Boolean Algebra: functions, logic gates, minimization of circuits.

**Advanced Statistics:** Basic Review: Box plots, histograms, bar charts, pie charts, counting principles; descriptive statistics, mean, median, mode, five-number summary, standard deviation, range, IQR, Probability distributions.

Estimation Theory: Estimates by method of moments, their properties; Maximum likelihood estimates & their properties, Fisher information, Rao-Cramer inequality, efficient estimates; Bayes estimates, prior and posterior distributions, conjugate priors; Sufficient and jointly sufficient statistics, Neyman-Fisher factorization criterion, Rao-Blackwell theorem; Estimates for parameters of normal distribution, their properties; Chi-square, Fisher and Student distributions; Sampling distributions; Confidence intervals (For sampling distribution and for parameters of normal distribution).

Hypotheses Testing: Testing simple hypotheses, Bayes decision rules, types of error, most powerful tests, likelihood ratio tests, randomized tests; Composite hypotheses, power function, monotone likelihood ratio and uniformly most powerful tests; t-tests and F-tests; Goodness-of-fit tests, chi-square tests, tests of independence and homogeneity, Kolmogorov-Smirnov test, Effect Sizes; Two independent samples, paired sample t-tests; Test for equality of variance.

Regression and Classification: Simple linear regression, least-squares fit, statistical inference in simple linear regression, confidence intervals, prediction intervals; Classification problem, boosting algorithm; Multiple linear regression; Correlation; Normal probability plots and other assumption checking techniques; Effect Sizes; Logistic
regression; Correlation and regression techniques for quantitative and qualitative data analysis; nominal scales, interactions; other related multivariate methods.

ANOVA: Basic One-Way, repeated measures, mixed model, factorial, randomized block ANOVA, ANCOVA; Effect Sizes; Preplanned comparisons; Post-hoc analysis/comparisons: Bonferroni, Tukey, LSD, Dunnett’s.

Non-parametric Statistics: Kruskal Wallis; Sign Test; Wilcoxin Signed-Rank; Wilcoxin Rank Sum Test; Other tests.

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