BOB JONES UNIVERSITY
Department of Mathematics
https://math.bju.edu/

The following has been prepared in conjunction with a talk given at a Spring 2019 Teach Them Diligently conference for homeschoolers. It is intended as a resource for those who wish to improve their potential performance on the Math portion of the ACT. General information/guidelines/tips are presented. Then a connection between the usual high school curriculum and the Math ACT content is presented.

General SAT Information

Knowing what to expect and how to prepare effectively will help improve SAT performance.

- Make sure you're comfortable using an allowable calculator, and remember there's a no calculator section. The TI 30 is an inexpensive allowable option that works very well. Most common graphing calculators are allowed, but check the list to be sure. See the official SAT calculator policy.
- Sites that provide tips for doing well on the ACT:
  o How to Get 800 on SAT Math, by a Perfect Scorer - This article was written by the co-founder and head of product design for this website, Allen Chang. He earned two perfect scores on the SAT, one perfect score on the ACT, and graduated from Harvard University summa cum laude. The ten strategies include general math test-taking strategies.
- Practice Questions and Study Manuals
  o Tips and Practice Questions from SAT in partnership with Khan Academy
  o The Official SAT Subject Test in Mathematics Level 1 Study Guide (Amazon link)
  o The 150 HARDEST SAT Math Problems REINCARNATED for the NEW SAT (Amazon link)
- Know what's going to be on the test. See below for more details on the test content.

Remember that it's worth preparing for the SAT. Your scores can affect not only admission into college but also your ability to be ready for required collegiate courses without remediating.

Mapping the High School Curriculum to the SAT

The following relates the standard 7th-12th grade high school math curriculum to the content of the SAT. We've use the scope and sequence of the Bob Jones University Press (BJUP) math textbooks since the content is similar to many high school math curricula and we are personally familiar with the materials (BJUP secondary math scope and sequence). We trust you will be able to match much of the content listed below to the curriculum that you have chosen to use.

SAT content is broken into three main categories: algebra based questions (called the Heart of Algebra and Passport to Advanced Math, which represents 19 and 16 questions and 33% and 28% of the test respectively), geometric problems (called Additional Topics in Math, which represents 6 questions and 10% of the test), and application and statistics questions (called Problem Solving and Data Analysis, which represents 17 questions and 29% of the test). ACT also indicates that 25% of the questions will incorporate some sort of mathematical modeling of the problem.

The following descriptions are taken directly from the SAT website, and their headings will be used to connect the usual high school curriculum to the SAT content.

- **Heart of Algebra** (33%): focuses on linear equations, systems of linear equations, and functions that are found in many fields of study. These questions ask you to create equations that represent a situation and solve equations and systems of equations as well as to make connections between different representations of linear relationships.
    - Analyzing and fluently solving linear equations and systems of linear equations.
    - Creating linear equations and inequalities to represent relationships between quantities and to solve problems.
    - Understanding and using the relationship between linear equations and inequalities and their graphs to solve problems.
- **Problem Solving and Data Analysis** (29%): includes using ratios, percentages, and proportional reasoning to solve problems in real-world situations, including science, social science, and other contexts. It also includes describing relationships shown graphically and analyzing statistical data. This group of skills is really about being quantitatively literate and demonstrating a command of the math that resonates throughout college courses, career training programs, and everyday life.
    - Creating and analyzing relationships using ratios, proportional relationships, percentages, and units.
    - Representing and analyzing quantitative data.
    - Finding and applying probabilities in context.
- **Passport to Advanced Math** (28%): problems in this area focus on the math you will need to pursue further study in a discipline such as science or economics and for career opportunities in the STEM fields of science, technology, engineering, and math. The Passport to Advanced Math area requires familiarity with more-complex equations or functions, which will prepare you for calculus and advanced courses in statistics.
    - Identifying and creating equivalent algebraic expressions.
    - Creating, analyzing, and fluently solving quadratic and other nonlinear equations.
    - Creating, using, and graphing exponential, quadratic, and other nonlinear functions.
- **Additional Topics in Math** (10%): key concepts from geometry, including applications of volume, area, surface area, and coordinate geometry; similarity, which is another instance of proportional reasoning; and properties of lines, angles, triangles and other polygons, and circles. There are also problems that focus on the fundamental ideas of trigonometry and radian measure, which are essential for study in STEM fields. Finally, there are problems involving the arithmetic of complex numbers, another concept needed for more-advanced study in math and the STEM fields.
    - Solving problems related to area and volume.
    - Applying definitions and theorems related to lines, angles, triangles, and circles.
    - Working with right triangles, the unit circle, and trigonometric functions.
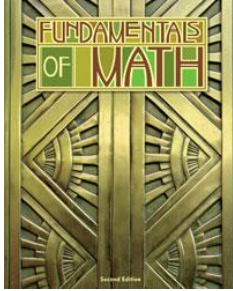
Fundamentals of Math
traditionally 7th grade content

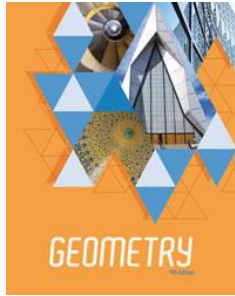| Curriculum Chapter/Topic	SAT Testing Content
Whole Numbers – Comparing and ordering; Estimating; Operations; Exponents; Roots of perfect squares	Heart of Algebra
Decimals – Comparing and ordering; Rounding; Approximating square roots; Operations; Estimating square roots; Scientific notation	Heart of Algebra
Number Theory – Divisibility; Factors; Prime and composite numbers GCD and LCM; Converting to and adding in other number bases	Heart of Algebra
Fractions – Equivalent fractions; Mixed numbers; Comparing and ordering; Operations; Order of operations	Heart of Algebra
Rational numbers – Ratio and proportion; Solving proportions; Scale drawings; Decimals as rational numbers; Finding a percent (part) of a number; Finding the percent; Finding the whole amount	Heart of Algebra
Using percents – Enlargement and reduction; Sales tax; Discounts; Sale price; Simple interest; Commission; Percent change	Problem Solving and Data Analysis
Measurements – Customary units of length; Capacity, and weight; SI (metric) units of length, capacity, and mass; Renaming metric units; Time zones; Temperature conversions; Precision	
Geometry – Measuring angles; Pairs of angles; Perpendicular and parallel lines; Transversal of parallel lines; Polygons; Circle; Perimeter and circumference; Pythagorean theorem; Congruent and similar figures	Additional Topics in Math
Area and Volume – Area of quadrilaterals, triangles, and circles; Areas of similar figures; Surface area of prisms, cylinders, and pyramids; Volume of prisms and cylinders	Additional Topics in Math
Probability and statistics – Fundamental principle of counting; Permutations; Probability; Mean, median, mode; Circle, bar, and line graphs; Histograms; Box–and–whisker plots; Stem–and–leaf diagrams	Problem Solving and Data Analysis
Integers – Ordering; Operations; Applying order of operations; Expansion to and properties of the real numbers	Heart of Algebra
Algebra – Evaluating expressions; Solving one–and two–step equations; Solving one–and two–step inequalities	Heart of Algebra
Relations and functions – Coordinate plane; Functions and function rules; Graphing linear functions; Slope; Translation of figures on a plane	Heart of Algebra
Logic and set theory – Statements and negations; Compound and conditional statements and negations; Truth tables; Sets and subsets; Union and intersection of sets; Finite and infinite sets	
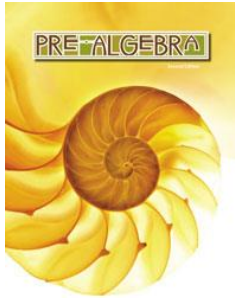
Pre–Algebra
traditionally 8th grade content

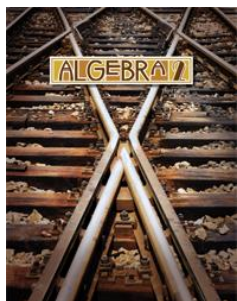| Curriculum Chapter/Topic	SAT Testing Content
Integers – Absolute value; Operation; Exponents; Order of operation; Scientific notation	Heart of Algebra
Expressions – Real–number properties; Evaluating and simplifying expressions; Translating word phrases; Rounding and estimating results of operations	Heart of Algebra
Equations – Solving two–step equations; Removal of parentheses; Subsets of the real numbers; Irrational numbers; Solving linear inequalities; Applying equations and inequalities	Heart of Algebra
Number Theory – Prime factorization; GCD and LCM; Arithmetic and geometric sequences; Number bases other than 10, including hexadecimal; Operations in other bases	Heart of Algebra
Rational Numbers – Forms of ordering fractions and decimals; Decimal equivalents of fractions; Conversion of repeating decimals to fractions; Ratios and proportions; Subsets and properties of real numbers	Heart of Algebra
Operations on rational numbers – Operations; Evaluating and simplifying expressions; Solving equations involving rationals; Operations in scientific notation	Heart of Algebra
Percents – Solving percent equations; Applying percents; Scales; Discount, markup, commissions, tips, and interest (including compound); Percent change	Problem Solving and Data Analysis
Applications – Equations with variables on both side; Writing and solving equations and inequalities	Heart of Algebra
Relations and functions – Coordinate plane; Functions; Graphing linear functions and linear inequalities; Slope; Direct variation	Heart of Algebra
Statistics and probability – Population and sample; Mean, median, and mode; Scatterplot; Quartiles; Box–and–whisker; Stem–and–leaf; Histograms; Choosing the correct type of graph; Permutations; Combinations; Probability	Problem Solving and Data Analysis
Radicals – Square roots; Radical equations; Equations with radicals; Equations of the form $ax^2+b=c$; Pythagorean theorem; Operations with radicals; Cube roots	Heart of Algebra
Geometry – Pairs of angles; Polygons; Perimeter and circumference; Congruence and similarity; 30—60 and 45—45 right triangle ratios; Distance and midpoint formulas; Symmetry and transformation	Additional Topics in Math
Areas and volume – Areas of quadrilaterals, triangles, and circles; Relation of lengths and areas of similar regions; Surface areas of prisms, cylinders, pyramids, cones, and spheres	Additional Topics in Math
Polynomials – Definition of a polynomial; Operations with polynomials, including multiplying binomials and dividing a polynomial by a monomial	Heart of Algebra

Algebra 1
traditionally 9th grade content

Curriculum Chapter/Topic	SAT Testing Content
Operations – Review of the real number system, number lines, absolute value, arithmetic operations of integers and rational numbers, exponents, and order of operations	Heart of Algebra
Variables and equations – Using variables, algebraic expressions, and formulas; Writing and solving linear equations	Heart of Algebra
Using algebra – Solving literal equations and proportions; Applying equations to applications involving similar figures, percentages, money, motion, and mixtures	Heart of Algebra
Solving inequalities – Linear inequalities, including conjunctions, disjunctions; Absolute-value equations and inequalities	Heart of Algebra
Relations and functions – Representing relationships between data, using graphs, equations, and tables; Direct and inverse variations; Graphing absolute value functions	Problem Solving and Data Analysis
Linear functions – Graphs, slopes, and intercepts of linear equations; Determining the equation of a line; Parallel and perpendicular lines; Correlation and lines of fit; Graphing linear inequalities	Heart of Algebra
Systems of equations and inequalities – Solving systems graphically, by substitution, and by elimination; Applications of systems	Heart of Algebra
Exponents – Products, quotients, and powers of exponential expressions; Scientific notation; Graphing exponential functions; Exponential growth and decay	Passport to Advanced Math
Polynomials – Classification, evaluation, operations, special patterns	Passport to Advanced Math
Factoring – Common monomials, trinomials, special patterns	Passport to Advanced Math
Radicals – Simplification and operations with radicals; Pythagorean theorem; Distance and midpoint formulas; Solving radical equations and graphing radical functions; Applications	Passport to Advanced Math
Quadratic Equations – Solving by factoring, taking roots, completing the square, and the quadratic formula; Graphing parabolas and finding zeros; Applications	Passport to Advanced Math
Rational expressions and equations – Simplification and operations with rational expressions; Solving rational equations; Applications	Passport to Advanced Math

Geometry
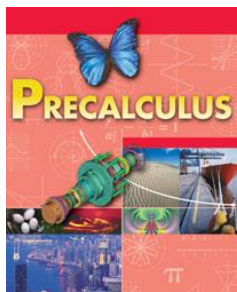traditionally 10th grade content

Curriculum Chapter/Topic	SAT Testing Content
Foundations of Geometry – Sets; definitions; incidence postulates and theorems; segment and angle measure; circles; polygons; polyhedra	Additional Topics in Math
Reasoning and Proof – Inductive and deductive reasoning; truth tables; proofs using angles and segments; bisectors; constructions	
Parallel and Perpendicular Lines – Characteristics; proofs; constructions; and coordinate geometry	Additional Topics in Math
Congruent Triangles – Angles in triangles; congruence postulates and theorems; flow-chart proofs; right triangles; midsegments	Additional Topics in Math
Relationships in Triangles – Circumcenter; incenter; orthocenter; centroid; indirect proof; triangle inequalities; constructions	
Quadrilaterals – Classification; characteristics; proofs; analytic geometry related to trapezoids; kites; parallelograms; squares; rectangles; and rhombii	
Area – Postulates; polygons; Pythagorean Theorem; special triangles; regular polygons; and circles	Additional Topics in Math
Circles – Chords; tangents; arc length; sectors; inscribed angles; secants; constructions; graphs	Additional Topics in Math
Surface Area and Volume – Nets; prisms; cylinders; pyramids; spheres; non-Euclidean geometry; perspective	Additional Topics in Math
Transformations and Symmetry – Reflections; translations; rotations; dilations; invariants; symmetry; applications	
Similarity – Triangles; right triangles; proportions; chords and tangents of circles; golden ratio	Additional Topics in Math
Trigonometry – Basic ratios; solving right triangles; applications; vectors; areas; identities	Additional Topics in Math

Algebra 2
traditionally 11th grade content

Curriculum Chapter/Topic	SAT Testing Content
Operations – Real and complex numbers; Polynomial; Matrix; Function	Heart of Algebra
Linear equations – Solving equations and inequalities; Absolute value equations and inequalities; Distance on number lines; Word problems; Compound inequalities	Heart of Algebra
Linear relations – Graphs of linear functions; Slopes; Special functions; Linear inequalities; Distances and midpoints; Modeling with linear regressions	Heart of Algebra
Systems – Solved graphically and algebraically; Systems of inequalities; Systems of three variables; Problem solving; Linear programming	Heart of Algebra
Matrices – Organizing data; Operations; Determinants; Solving systems using Cramer's Rule and inverse matrices; Transformations	Heart of Algebra
Quadratic equations – Solving factoring, taking roots, completing the square, and the quadratic formula; Using the discriminant; Complex roots; Quadratic inequalities	Passport to Advanced Math
Polynomial functions – Roots, graphing, and modeling with quadratic and polynomial functions; Problem solving; Rational root, remainder, and factor theorems; Fundamental theorem of algebra	Passport to Advanced Math
Radicals, Exponents, and Logarithms – Rational exponents; Inverse functions; Simplifying expressions; Solving equations, graphing and modeling with radical, exponential, and logarithmic functions; Natural and common logarithms	Passport to Advanced Math
Rational Expressions – Simplifying; Solving equations; Graphing; Variations	Passport to Advanced Math
Trigonometry – Right triangle and coordinate plane trigonometry; Special triangles and the unit circle; Radians; Graphs of trigonometric functions; Inverse functions	Additional Topics in Math
Trigonometric Identities – Law of Sines; Law of Cosines; Problem solving; Proving identities; Trigonometric equations	
Sequences and Series – Explicit and recursive formulas; Arithmetic and geometric sequences and series; Summation notation	
Probability and Statistics – Counting principles; Theoretical and experimental probabilities; Independent, dependent, and mutually exclusive events; Binomial distribution, descriptive statistics, representing data; Normal distributions; Making inferences	Problem Solving and Data Analysis
Analytic Geometry – Circles; Parabolas; Ellipses; Hyperbolas; Systems of quadratic relations	Passport to Advanced Math

Precalculus
traditionally 12th grade content

Curriculum Chapter/Topic	SAT Testing Content
Trigonometry – Reference angles; Law of Sines; Law of Cosines	Additional Topics in Math
Polynomials – Linear; Quadratic and polynomial functions; Factoring higher–degree polynomials; Zeros; Graphing	Passport to Advanced Math
Functions – Power; Exponential; Piece; Periodic; Trigonometric; Reciprocal; Rational	Passport to Advanced Math
Inverse Functions – Increasing and decreasing functions; Checking and finding inverses; Radical functions; Inverse trigonometric functions; Logarithms	
Equations – Polynomial; Rational; Radical; Logarithmic; Exponential functions; Identities; Trigonometric equations	Passport to Advanced Math
Conic sections and polar graphs – Circles; Ellipses; Parabolas; Hyperbolas; Variation; Polar coordinates; Polar equations	Passport to Advanced Math
Complex numbers – Graphs; Polar form; Powers and roots; Vectors; Dot products; Applications	Passport to Advanced Math
Matrix Algebra – Gaussian elimination; Determinants; Cramer's Rule; Inverses	Heart of Algebra
Statistics – Central tendency; Variability; Bell curve; Linear correlation; Hypothesis testing	Problem Solving and Data Analysis
Sequences – Recursive and explicit formula; Arithmetic and geometric sequences; Mathematical induction; Summation	
Limits and Calculus – Limits of sequences; Series; Limits of functions; Continuous functions; Asymptotes; Limit theorems	
Differential calculus – Definition; Graphs, properties; Chain rule; Quotient rule; Motion applications	