

## SAT Preparation Course Essential Curriculum

### **The Mathematical Practices**

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

### **The Mathematical Content Standards**

The Mathematical Content Standards (Essential Curriculum) that follow are designed to promote a balanced combination of procedure and understanding. Expectations that begin with the word “understand”, “apply”, “evaluate”, “infer” and “interpret” are often especially good opportunities to connect the mathematical practices to the content. Students who lack understanding of a topic may rely on procedures too heavily. Without a flexible base from which to work, they may be less likely to consider analogous problems, represent problems coherently, justify conclusions, apply the mathematics to practical situations, use technology mindfully to work with the mathematics, explain the mathematics accurately to other students, step back for an overview, or deviate from a known procedure to find a shortcut. *In short, a lack of understanding effectively prevents a student from engaging in the mathematical practices.* In this respect, those content standards that set an expectation of understanding are potential “points of intersection” between the Mathematical Content Standards and the Mathematical Practices.

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### **Unit I - Heart of Algebra**

The redesigned SAT focuses strongly on algebra and the key concepts that are most essential for success in college and career. Heart of Algebra will assess students’ ability to analyze, fluently solve, and create linear equations and inequalities. Students will also be expected to analyze and fluently solve equations and systems of equations using multiple techniques.

To assess full command of the material, these problems will vary significantly in form and appearance. Problems may be straightforward fluency exercises or may pose challenges of strategy or understanding, such as interpreting the interplay between graphical and algebraic representations or solving as a process of reasoning. Students will be required to demonstrate

both procedural skill and a deeper understanding of the concepts that undergird linear equations and functions to successfully exhibit a command of the Heart of Algebra.

**SAT.HOA.01 Create, solve, or interpret a linear expression or equation in one variable** that represents a context. The expression or equation will have rational coefficients, and multiple steps may be required to simplify the expression, simplify the equation, or solve for the variable in the equation.

**SAT.HOA.02 Create, solve, or interpret linear inequalities in one variable** that represent a context. The inequality will have rational coefficients, and multiple steps may be required to simplify or solve for the variable.

**SAT.HOA.03 Algebraically solve linear equations (or inequalities) in one variable.** The equation (or inequality) will have rational coefficients and may require multiple steps to solve for the variable; the equation may yield no solution, one solution, or infinitely many solutions. The student may also be asked to determine the value of a constant or coefficient for an equation with no solution or infinitely many solutions.

**SAT.HOA.04 Interpret the variables and constants in expressions for linear functions within the context presented.** The student will make connections between a context and the linear equation that models the context and will identify or describe the real-life meaning of a constant term, a variable, or a feature of the given equation.

**SAT.HOA.05 Build a linear function that models a linear relationship between two quantities.** The student will describe a linear relationship that models a context using either an equation in two variables or function notation. The equation or function will have rational coefficients, and multiple steps may be required to build and simplify the equation or function.

**SAT.HOA.06 Understand connections between algebraic and graphical representations.** The student will select a graph described by a given linear equation, select a linear equation that describes a given graph, determine the equation of a line given a verbal description of its graph, determine key features of the graph of a linear function from its equation, or determine how a graph may be affected by a change in its equation.

**SAT.HOA.07 Algebraically solve systems of two linear equations in two variables.** The equations will have rational coefficients, and the system may yield no solution, one solution, or infinitely many solutions. The student may also be asked to determine the value of a constant or coefficient of an equation in which the system has no solution, one solution, or infinitely many solutions.

**SAT.HOA.08 Create, solve, and interpret systems of two linear equations in two variables.** The student will analyze one or more constraints that exist between two variables by creating, solving, or analyzing a system of linear equations to represent a context. The equations will have rational coefficients, and multiple steps may be required to simplify or solve the system.

**SAT.HOA.09 Create, solve, and interpret systems of linear inequalities in two variables.**

The student will analyze one or more constraints that exist between two variables by creating, solving, or interpreting an inequality in two variables or a system of inequalities in two variables to represent a context. Multiple steps may be required to create the inequality or system of inequalities or to determine whether a given point is in the solution set.

**Unit 2 - Problem Solving and Data Analysis**

The redesigned SAT's Math Test has responded to the research that has identified what is essential for college readiness and success by focusing significantly on problem solving and data analysis: the ability to create a representation of a problem, consider the units involved, attend to the meaning of quantities, and know and use different properties of operations and objects. Problems in this category will require significant quantitative reasoning about ratios, rates, and proportional relationships and will place a premium on understanding and applying unit rate.

Students will be expected to identify quantitative measures of center, overall patterns, and any striking deviations from the overall pattern and spread in one or two different data sets. This includes recognizing the effects of outliers on the measures of center of a data set.

All Problem Solving and Data Analysis questions test the ability of students to use their math understanding and skills to solve problems they could encounter in the real world. Many of these problems are set in academic and career contexts and are likely to draw from science and social science.

**SAT.PSDA.01 Use ratios, rates, proportional relationships, and scale drawings to solve single- and multistep problems.** The student will use a proportional relationship between two variables to solve a multistep problem to determine a ratio or rate; calculate a ratio or rate and then solve a multistep problem; or take a given ratio or rate and solve a multistep problem.

**SAT.PSDA.02 Solve single- and multistep problems involving measurement quantities, units, and unit conversion.** The student will solve a multistep problem to determine a unit rate; calculate a unit rate and then solve a multistep problem; solve a multistep problem to complete a unit conversion; solve a multistep problem to calculate density; or use the concept of density to solve a multistep problem.

**SAT.PSDA.03 Solve single- and multistep problems involving percentages.** The student will solve a multistep problem to determine a percentage; calculate a percentage and then solve a multistep problem; or take a given percentage and solve a multistep problem.

**SAT.PSDA.04 Compare linear growth with exponential growth.** The student will infer the connection between two variables given a context in order to determine what type of model fits best.

**SAT.PSDA.05 Given a scatterplot, use linear, quadratic, or exponential models to describe how the variables are related.** The student will, given a scatterplot, select the equation of a line

or curve of best fit; interpret the line in the context of the situation; or use the line or curve of best fit to make a prediction.

**SAT.PSDA.06 Use the relationship between two variables to investigate key features of the graph.** The student will make connections between the graphical representation of a relationship and properties of the graph by selecting the graph that represents the properties described, or using the graph to identify a value or set of values.

**SAT.PSDA.07 Use two-way tables to summarize categorical data and relative frequencies, and calculate conditional probability.** The student will summarize categorical data or use categorical data to calculate conditional frequencies, conditional probabilities, association of variables, or independence of events.

**SAT.PSDA.08 Make inferences about population parameters based on sample data.** The student will estimate a population parameter given the results from a random sample of the population. The sample statistics may mention confidence intervals and measurement error that the student should understand and make use of, but need not calculate.

**SAT.PSDA.09 Use statistics to investigate measures of center of data and analyze shape, center, and spread.** The student will calculate measures of center and/or spread for a given set of data or use given statistics to compare two separate sets of data. The measures of center that may be calculated include mean, median, and mode, and the measures of spread that may be calculated include range. When comparing two data sets, the student may investigate mean, median, mode, range, and/or standard deviation.

**SAT.PSDA.10 Evaluate reports to make inferences, justify conclusions, and determine appropriateness of data collection methods.** The reports may consist of tables, graphs, or text summaries.

### **Unit 3 - Passport to Advanced Math**

Passport to Advanced Math questions include topics that are especially important for students to master **before** studying advanced math. Chief among these topics is the understanding of the structure of expressions and the ability to analyze, manipulate, and rewrite these expressions. This domain also includes reasoning with more complex equations, and interpreting and building functions.

**SAT.PAM.01 Create a quadratic or exponential function** or equation that models a context. The equation will have rational coefficients and may require multiple steps to simplify or solve the equation.

**SAT.PAM.02 Solve a quadratic equation** having rational coefficients. The equation can be presented in a wide range of forms to reward attending to algebraic structure and can require manipulation in order to solve.

**SAT.PAM.03 Solve a system of one linear equation and one quadratic equation.** The equations will have rational coefficients.

**SAT.PAM.04 Add, subtract, and multiply polynomial expressions** and simplify the result. The expressions will have rational coefficients.

**SAT.PAM.05 Understand the relationship between zeros and factors of polynomials,** and use that knowledge to sketch graphs. Students will use properties of factorable polynomials to solve conceptual problems relating to zeros, such as determining whether an expression is a factor of a polynomial based on other information provided.

**SAT.PAM.06 Create equivalent expressions involving rational exponents** and radicals, including simplifying or rewriting in other forms.

**SAT.PAM.07 Rewrite simple rational expressions.** Students will add, subtract, multiply, or divide two rational expressions or divide two polynomial expressions and simplify the result. The expressions will have rational coefficients.

**SAT.PAM.08 Solve an equation in one variable that contains radicals or contains the variable in the denominator of a fraction.** The equation will have rational coefficients, and the student may be required to identify when a resulting solution is extraneous.

**SAT.PAM.09 Determine the most suitable form of an expression** or equation to reveal a particular trait, given a context.

**SAT.PAM.10 Create an equivalent form of an algebraic expression** by using structure and fluency with operations.

**SAT.PAM.11 Use structure to isolate or identify a quantity of interest** in an expression or isolate a quantity of interest in an equation. The student will rearrange an equation or formula to isolate a single variable or a quantity of interest.

**SAT.PAM.12 Interpret parts of nonlinear expressions in terms of their context.** Students will make connections between a context and the nonlinear equation that models the context to identify or describe the real-life meaning of a constant term, a variable, or a feature of the given equation.

**SAT.PAM.13 Understand a nonlinear relationship between two variables** by making connections between their algebraic and graphical representations. The student will select a graph corresponding to a given nonlinear equation; interpret graphs in the context of solving systems of equations; select a nonlinear equation corresponding to a given graph; determine the equation of a curve given a verbal description of a graph; determine key features of the graph of a linear function from its equation; or determine the impact on a graph of a change in the defining equation.

**SAT.PAM.14 Use function notation, and interpret statements using function notation.** The student will use function notation to solve conceptual problems related to transformations and compositions of functions.

#### **Unit 4 - Additional Topics in Math**

Additional topics will include geometric and trigonometric concepts.

**SAT.ATM.01 Add, subtract, multiply, divide, and simplify complex numbers.**

**SAT.ATM.02 Use trigonometric ratios and the Pythagorean theorem** to solve applied problems involving right triangles. The student will use information about triangle side lengths or angles presented in a context to calculate missing information using the Pythagorean theorem and/or trigonometric ratios.

**SAT.ATM.03 Use concepts and theorems about congruence and similarity to solve problems about lines, angles, and triangles.** The student will use theorems about triangles and intersecting lines to determine missing lengths and angle measures of triangles. The student may also be asked to provide a missing length or angle to satisfy a given theorem.

**SAT.ATM.04 Use the relationship between similarity, right triangles, and trigonometric ratios; use the relationship between sine and cosine of complementary angles.** The student will use trigonometry and theorems about triangles and intersecting lines to determine missing lengths and angle measures of right triangles. The student may also be asked to provide a missing length or angle that would satisfy a given theorem.

**SAT.ATM.05 Convert between degrees and radians and use radians to determine arc lengths; use trigonometric functions of radian measure.** The student will convert between angle measures in degrees and radians in order to calculate arc lengths by recognizing the relationship between an angle measured in radians and an arc length, evaluating trigonometric functions of angles in radians.

**SAT.ATM.06 Apply theorems about circles to find arc lengths, angle measures, chord lengths, and areas of sectors.** The student will use given information about circles and lines to calculate missing values for radius, diameter, chord length, angle, arc, and sector area.

**SAT.ATM.07 Create or use an equation in two variables to solve a problem about a circle in the coordinate plane.** The student will create an equation or use properties of an equation of a circle to demonstrate or determine a property of the circle's graph.

**SAT.ATM.08 Solve problems using volume formulas.** The student will use given information about figures, such as length of a side, area of a face, or volume of a solid, to calculate missing information. Any required volume formulas will be provided to students either on the formula sheet or within the question.