QualityCore®

Course Description and Syllabus
Algebra I

Description

By the time students enroll in an Algebra I course, they can answer quite a few questions about mathematical relationships. They understand arithmetic operations. They have worked with integers and rational numbers, studied the properties of numbers and number systems, and been introduced to representations of patterns. Algebra I teaches students to generalize what they know, to make predictions from their generalizations, and to broaden their generalizations to describe new, more complex relationships. Using variables, expressions, equations, inequalities, and graphs, in Algebra I students learn to recognize increasingly complex patterns, to construct mathematical models for describing and analyzing the world, and to use those models to solve problems. According to the National Research Council (2002), a rigorous Algebra I course succeeds in its goals when it

- creates a supportive environment that fosters questioning, investigation, and collaboration;
- emphasizes higher-order reasoning, relevant learning, and logical thinking; and
- asserts that process teaches content and vice versa.

Students in a rigorous Algebra I course discover mathematical relationships in much the same ways that other mathematicians have discovered them: through logical exploration and thorough investigation. The work develops students' deep understanding and increases their chances for success.

A rigorous Algebra I course is rooted in the examination of the structure of real numbers, in algebraic expressions, equations, and inequalities and in the classes of functions. It presents these algebraic concepts through patterns and events that are best described and represented by linear equations, inequalities, functions and systems, quadratic equations and functions, polynomial expressions and equations, data analysis, and probability. In the process of exploring these mathematical relationships, the course encourages students to rely upon problem-solving strategies and to use precise mathematical language to communicate their ideas and interpret their solutions. In other words, the course emphasizes the skills students need to think logically and critically. To develop those skills further, a rigorous course trains students in the use of tools such as graphing calculators, which among other things help students to study and explore the behavior of functions through their various representations. As in every Algebra I course, students in a rigorous course learn the ways that arithmetic can be generalized.

What distinguishes a rigorous Algebra I course, then, is its relevant, thorough approach to the field. The course recognizes the value of context. Some topics, for example, are explored via the natural progression from arithmetic to Algebra I to Geometry. If students learned in arithmetic that integers can be ordered on a number line, then a rigorous Algebra I course places real numbers on the line and builds upon that understanding through an introduction to the standard (x,y) coordinate plane. When students discover that the distance between two points can be generalized into the distance formula, then they can explore more complex applications of the standard (x,y) coordinate plane, such as ways of discovering the diameter of a circle on the plane—a skill not usually explored until Geometry.

In addition to connecting students to their past and future studies, a rigorous Algebra I course connects algebra to the world. Modern algebra developed across centuries as mathematicians created symbolic systems and recognized concepts such as zero and irrational and imaginary numbers. Students in a rigorous Algebra I course not only are introduced to the history of the problem of representation, but also are asked understand why symbolic notation matters and how it contributes to the development of general statements about mathematics. Building student awareness of mathematical concepts upon the history of algebra deepens students' awareness of the value of mathematics to the world around them.

A rigorous Algebra I course also connects algebra to students' lives by emphasizing real-world problems. Real-world problems help to reinforce fundamental mathematical concepts and to teach the significance and value of algebra itself. A problem that requires students to create and justify an expression to model the cost of going to the movies, for example, emphasizes logical thought processes as well as the importance of precise language when justifying mathematical ideas. A problem that asks students, first, to describe two different, appropriate strategies for finding the total cost when buying several different items of the same price, then to represent the verbal description symbolically, helps students not only to recognize the value of the distributive property of multiplication over addition in the real world, but also to connect verbal and symbolic representations of abstract concepts. At the same time as students in a rigorous Algebra I course are solving increasingly complex real-world problems, they are developing—through language and with tables, graphs, sketches, and symbols—sophisticated methods of representing real-world events. Through relevant, real-world problems students learn both the content of the course and the processes of mathematical thinking.

Because students achieve a deep understanding of algebra when they are empowered and responsible for their learning, how a teacher facilitates learning is as important as real-world relevance. Students, of course, practice routine skills on a daily basis in order to hone their ability to recall basic concepts. They also are encouraged to think deeply, to conjecture and justify their claims. When solving one-variable equations, for example, students might be asked to predict the value of the unknown in a real-world problem. Then they would set up an equation and solve it to arrive, finally, at the correct solution. In a rigorous course, significant class time is spent developing higher-order reasoning such as analyzing and interpreting information and generalizing from patterns. Teachers facilitate these skills with games, models, and other strategies. They encourage students to explore, both as a class and in groups, algebraic concepts and plausible solutions to problems. Teachers also assign projects that encourage students to plan strategically and reason through complex, multifaceted problems. Allowing students to test their ideas and to learn from their own and each other's errors helps them to consider their own understanding and to internalize the logical thinking that Algebra I requires.

A rigorous Algebra I course further engages students through reading and writing. An assignment in which students are to compare and contrast, using the language of the discipline, different mathematical representations of the same pattern or event not only emphasizes the value of critical exploration but also encourages students to communicate their findings to others. When students keep class notebooks, they not only learn to take clear, precise notes that allow them to understand mathematical terminology or the processes used to solve various types of problems, but they also learn to revisit the notes they've taken and to revise them to better reflect later learning. Regularly kept journals encourage students to think reflectively and develop their understanding of mathematical reasoning. In such ways teachers empower students by engaging them in a variety of learning strategies that solidify their conceptual understanding and develop their reasoning.

As students learn, a rigorous Algebra I course takes advantage of a variety of ways to check for understanding. With preassessments, question-and-answer sessions, in-class activities, homework assignments, quizzes, tests, and culminating projects, teachers discover students' misconceptions as well as what they know and are learning. As teachers assess students' work, they discover areas in which instruction may need to be modified in order to better meet students' needs; moreover, they identify students who may need extra help. In other words, teachers in a rigorous Algebra I course adjust dynamically to the demands of both the material and the students. Meanwhile, students not only receive ample feedback from the teacher, but also they respond to each other's work and check each other's understanding. In the process, students take responsibility for their own learning.

A rigorous Algebra I course emphasizes a variety of instructional and assessment strategies because its goal is to help students become independent learners, critical thinkers, and problem solvers. Through in-class assignments and homework, they are given numerous opportunities to apply the concepts or principles they are learning. At the beginning of a unit about algebraic expressions, for instance, students might participate in a gallery walk that explores patterns and graphs. For the remainder of the unit, they would return to the problems they encountered in the walk in order to analyze and revise their solutions in new and multiple ways. Students thus explore algebraic concepts thoroughly, solidifying both the processes and the reasons behind those processes into a deep understanding of algebra.

From relevant instruction that sets high standards and enables students to achieve those standards, to interactive and progressive instruction and assessment, a rigorous Algebra I course is a vibrant learning environment. By emphasizing the fundamentals of algebra and encouraging investigation, collaborative learning, problem-solving, and reasoning, the course places students in the best position to succeed.

Model Course Syllabus—Algebra I

On Course for Success (2004) revealed that rigorous Algebra I syllabi share several important characteristics. Not only do they describe the course and identify the content it will cover, but also they outline policies to which teachers and students are held accountable. This model syllabus is a composite drawn from the syllabi studied in *On Course for Success.* As a model, it is addressed to students and should be used as a general guideline, adapted according to a particular district's, school's, or teacher's policies.

Course Overview

Welcome to Algebra I! In this course, the mathematics topics you have previously learned will be extended to mathematical models in order to solve complex real-world problems. From learning to recognize patterns, relationships between variable quantities, to understanding how to interpret those patterns, you will discover how to find the solutions to problems. In the process, you will learn to rely on symbols to represent and explain mathematical relationships. You will also use technology, such as graphing calculators, that will help you to analyze data and recognize patterns more easily.

Throughout Algebra I, we will build a mathematical foundation that will make connections among mathematical concepts, across disciplines, and into everyday experiences. Moreover, this course will help prepare you for other mathematics courses you will take in high school. If you bring to class your curiosity and your willingness to work hard, then I promise this mathematical journey will reward all you put into it!

Prerequisites

- The correct order of operations
- Greatest common factors, least common multiples of whole numbers
- Additive and multiplicative inverses
- Simplify ratios
- Scientific notation
- Addition, subtraction, multiplication, and division of rational numbers

Course Content

- Exploring the Skills and Strategies Underlying Mathematics: Mathematical Processes
- Establishing Number Sense and Operation Skills: Foundations
- First-Degree Expressions, Equations, and Inequalities
- First-Degree Graphs, Relations, and Functions
- Quadratic Equations and Inequalities
- Quadratic Graphs, Relations, and Functions
- Rational and Radical Expressions, Equations, and Functions
- Data Relations, Probability, and Statistics

Course Materials

You will need to bring the following materials with you each day to class:

- Textbook
- Pencils, erasers, and marking pen
- Loose-leaf paper and binder (Class Notebook)
- Ruler that has both inches and metric measurements
- Graphing calculator
- Graph paper
- Colored pencils

Course Policies

Absences/Makeup Work: When you return from an absence, you are responsible for the following:

- Turning in any homework that was due the day(s) of your absence.
- Reading the textbook section or other material that was used as a resource during your absence.
- Getting the homework assignment(s) you missed and updating your class notebook.
- Turning in your make-up work.

According to school policy, you have as many days as you were absent to turn in missed assignments. However, you should turn in at least one make-up assignment as well as the current assignment each day until you are caught up. If you are absent only on a test day, a note from your parents will be required, and you will be expected to make up the test on the day you return to class. If you are absent any more days, you will have as many days as you were absent to make up the test. Make-up tests must be taken outside of regular class time.

Class Participation: At times we will all be algebra teachers; therefore, be willing to share your ideas with others and to support your reasoning to help each other understand new ways to solve problems. In other words, participate fully in all class activities. Be “on the court” playing the game, not “in the stands” watching what is going on.

Special Projects: We will be using projects to explore extended problems that are relevant to us and have real-world connections. For every project I assign, I will provide a scoring rubric that identifies and explains the important components of each project.

Classroom Rules/Expectations:

- Be responsible for your work. Bring supplies and homework every day.
- Be in your assigned seat ready to work when the tardy bell rings.
- Seek additional help immediately if a topic seems difficult or requires alternative approaches to assist in your understanding.

Homework Policy: Homework will be assigned almost every school day (including over weekends) in order to allow you to explore and practice what you are learning.

Most homework has one or more of the following purposes:

- *Practice* reinforces the learning of material already presented in class and helps you master specific skills.
- *Preparation* provides supporting information—history, skills, definitions—for what’s forthcoming; it will help when new material is covered in class.
- *Extension* or elaboration involves the transfer of previously learned skills to new situations.
- *Integration* asks you to apply skills and concepts to produce a single product.

I will make every effort to communicate the purpose of homework assignments to you.

Unless otherwise specified, homework will be due the following school day at the beginning of the period. For all homework:

- Show all calculations and work, even if you do it in your head or on a calculator.
- Explain your reasoning at the conclusion of each solved problem.
- When you get stuck on a problem, solve it as far as you can, then write a short explanation of your difficulty.
- Review the textbook discussion of new topics prior to beginning any homework assignment.
- Use your class notebook as a resource.
- Late assignments will be accepted, but a penalty will be incurred.
- No homework or make-up work will be accepted after a test day.

In addition, be proactive about creating study groups, using outside resources such as dictionaries and websites, and discussing problems with each other and with me: any and all of these can help you understand the concepts we will be studying more thoroughly.

Grading Policy

Grade Distribution: Quarter grades will be calculated as follows: 40% will be determined by tests and projects, 20% by quizzes, 20% by assignments, 10% by investigations/projects, and 10% by notebooks. Eighty percent of semester grades will be determined by an average of two quarters' grades; the remaining 20% will be determined by the semester exam.

Types of Assessments: Tests will be given every 2–3 weeks. Quizzes will be given every 3–4 days. Projects will be assigned throughout the course. For all assignments, I will provide a rubric or explain the expectations. Several projects will be assigned throughout the course of the year.

Progress Reports: You will be told of your progress and will be given a partial grade every 2–3 weeks.

Course Procedures

Work Requirements: A heading should be in the upper right-hand corner of the page and should consist of the following:

- First and last name
- Date
- Course name and period number
- Textbook page number and assignment numbers OR the name of the assignment
- Problem number(s) when using the textbook

Class Notebook: You will be required to keep a notebook (or binder) containing definitions, explanations, and examples given in class; paperwork; investigations and other long-term projects; quizzes (which are valuable in studying for tests) and tests; and a journal. Your notebook will be turned in for a grade. It should be clearly organized, and each section labeled clearly. For example:

- Notes (includes vocabulary)
- Homework (in chronological order)
- Investigations and Projects
- Quizzes and Tests (in chronological order)
- Journal

Signature(s): Discuss this course syllabus with your parent(s) or guardian(s). You were given two copies—the blue one is for you and your parent/guardian to sign, and the yellow one is for you to keep. Please sign and return the blue copy to me by (insert date). I am looking forward to working with you this year.

I, _____ (Student Name), have read, understand, and accept the Algebra I course syllabus and the course expectations.

I, _____ (Parent/Guardian Name), have read, understand, and accept the Algebra I course syllabus and the course expectations.

Student Signature:_____ Date:_____

Parent/Guardian Signature: _____ Date:_____

Personal Statement

If you are having difficulties with any of the topics covered in this course, see me as soon as possible. Times when I am available for extra help are included below. In addition, keep the following thoughts in mind:

- When you worry, "I can't do it," tell yourself, "I can do it, and I just need to figure it out."
- You can always ask for help.
- Set goals every week and recognize your accomplishments.
- Bring a positive attitude and a smile to class.

Additional Information

Extra Help: Get extra help when you need it. I am usually available after school from 2:40 to 3:30 P.M. on Mondays and Wednesdays. I will be happy to arrange extra help sessions for anyone who requests it.

Contact information:

School telephone number:
Best time to call:
E-mail:

References

ACT, Inc., and The Education Trust. (2004). *On course for success: A close look at selected high school courses that prepare all students for college.* Iowa City, IA: Author.

National Research Council. (2002). *Learning and understanding: Improving advanced study of mathematics and science in U.S. high schools.* Washington, D.C.: National Academy.

