Algebra IA
(Available in English and Spanish)

SCOPE OF COURSE

This course is divided into two semesters of study (A & B) comprised of five units each. The first-semester (A) is a study of algebraic concepts including measurement and mathematical reasoning; algebraic expressions; factoring; and equations.

SEQUENCE OF SKILLS

UNIT 1 – Foundations

Real Numbers
- learn to recognize and differentiate between natural numbers, whole numbers, integers, rational numbers, irrational numbers, and real numbers
- relate the number line to the collection of real numbers

Sets
- recognize a well-defined set
- learn set notation and terminology
- study some subsets of real numbers-prime and composite numbers

Variables and Axioms
- learn why, when, or how to use a variable
- learn the definition of an axiom
- learn some specific axioms

Real Number Properties
- learn the characteristics and uses of the following properties of numbers: the commutative property, the associative property, the distributive property

Properties of Real Numbers
- to learn the meaning and some uses of identity elements, inverses, and the multiplicative property of zero
- to understand why division by zero is not allowed
- to introduce the uniqueness and existence properties

Density Property of Real Numbers
- study the density property of real numbers
- learn which subsets of real numbers are dense

Addition of Signed (+/-) Numbers (Integers): understand the concept and process of adding signed numbers
- by using additive inverses
- with the help of an algorithm (or rule) and the distance from zero (absolute value)
- by studying shortcuts to adding strings of integers
- in application problems

Subtraction of Signed (+/-) Numbers (Integers): learn to subtract signed numbers
- using an algorithm which changes the problem to an addition problem
- in applied problems

Multiplication and Division of Signed Numbers
- learn to multiply integers using pattern finding, repeated addition, and an algorithm
- learn to divide integers using the relationship between multiplication and division and an algorithm
- learn to multiply and divide integers in applications

Fractions and Number Sense
- become comfortable with fractions by understanding their make-up and comparing their sizes

Operations with Fractions: prepare for operations with algebraic fractions
- by understanding the concepts behind the algorithms
- by determining if solutions are reasonable

Decimals: become comfortable with decimals and decimal operations
- by understanding the relative size of decimals
- by understanding why the algorithms or rules dealing with decimals work
- by testing answers for reasonableness

Scientific Notation and Percent
- to review scientific notation-value and form
- to review percent and some of its applications

Properties of Real Numbers—Order and the Number Line: study the order of real numbers
- in relation to each other (the Trichotomy Property)
- as related to the number line; variables, order, and the number line

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SEQUENCE OF SKILLS

UNIT 2 – Measurement and Mathematical Reasoning
Exponents
- to recognize an exponential expression and its parts
- to use exponents to express repeated multiplication
- to evaluate arithmetic expressions with exponents (with and without a calculator)

Operations with Exponents
- to evaluate exponential expressions with a negative base
- to multiply and divide expressions involving exponents
- to evaluate expressions involving scientific notation

Radicals
- learn the meaning or concept of radicals
- learn how to perform operations involving radicals
- learn applications and problem solving involving radicals

Like Radicals
- learn to identify like radicals
- learn to simplify radical expressions with and without like radicals
- learn to solve application problems

Absolute Value
- learn absolute value notation
- perform operations involving absolute value

Order of Operations
- learn the importance of order of operations
- learn the correct order of operations
- learn to use the calculator correctly by experimenting

Measurement-Conversions: learn to make conversions
- between units in the same system using the factor/label method
- between the British and the metric system of measurement

Nonstandard Measurement and Measurement as Problem Solving
- learn to use nonstandard measuring devices
- learn to solve problems involving measurement

Measurement—Estimation and Accuracy
- learn to estimate quantities between and within the British and metric systems
- learn to estimate quantities using your senses
- learn to select appropriate instruments and techniques to measure quantities
- learn accuracy of measurement
- learn the difference between actual and relative errors

Mathematical Reasoning
- learn about statements and their negative
- learn to use Venn Diagrams for problem solving
- learn to use counter-examples to justify arguments

Mathematical Reasoning "And" and "Or"
- learn to use "and" and "or" mathematically correctly
- learn to use Venn Diagrams in problem solving with "and" and "or"

Mathematical Reasoning—Conditional and Biconditional Statements
- learn to recognize the hypothesis and conclusion of a conditional statement
- determine the truth of a conditional statement
- solve problems with conditional statements
- write and evaluate the truth of the converse of a conditional statement
- if a statement and its converse are both true, write a biconditional statement to replace them

Mathematical Reasoning—Deduction
- learn the difference between valid arguments and valid conclusions
- learn to use three types of valid arguments: direct reasoning, indirect reasoning, and the chain rule

Mathematical Reasoning—Induction

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SEQUENCE OF SKILLS

UNIT 3 – Algebraic Expressions

Writing Algebraic Expressions
- recognize constants and variables
- translate word expressions into algebraic expressions using variables and vice versa

Evaluating Algebraic Expressions with One Variable
- learn to evaluate algebraic expressions with one variable
- connect order of operations in algebraic and arithmetic expressions
- begin problem solving with algebra through applications

Evaluating Algebraic Expressions with More than One Variable
- learn to evaluate algebraic expressions with more than one variable
- use algebra to solve problems through applications

Polynomials
- recognize monomials, binomials, trinomials, polynomials, and coefficients
- find the degree of a monomial and a polynomial
- write polynomials in descending order

Combining Like Terms
- learn to recognize like terms
- add and subtract like terms

Adding and Subtracting Polynomials
- learn to add and subtract polynomials
- use the distributive property to simplify polynomial expressions

Simplifying Algebraic Expressions with Exponents
- learn to simplify algebraic expressions containing exponents of the form $a^m a^n$
- simplify algebraic expressions containing exponents of the form $\dfrac{a^m}{a^n}$

More on Algebraic Expressions with Exponents
- learn to simplify algebraic expressions of the form $\left(a^n\right)^m$
- simplify algebraic expression of the form $\left(ab\right)^n$

Multiplying Polynomials
- learn to multiply a monomial times a monomial
- learn to multiply a monomial times a polynomial

Multiplying a Binomial times a Binomial
- learn to multiply a binomial by a binomial using the distributive property
- learn to multiply a binomial by a binomial using FOIL

Special Binomial Products
- find the square of a binomial
- find the product of the sum and the difference of the same two terms

Multiplication with Polynomials
- learn to multiply a binomial times a polynomial with more than two terms
- learn to multiply two polynomials each with more than two terms

Dividing a Polynomial by a Monomial
- learn to divide a polynomial of any length by a monomial

Dividing a Polynomial by a Binomial
- learn how to divide a polynomial by a binomial

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SEQUENCE OF SKILLS

UNIT 4 – Factoring

Factoring—Common Factors
- learn to factor monomials
- learn to recognize common factors and use them to write expressions in factored form

The Difference of Two Squares
- learn to recognize the difference of two squares
- learn to factor the difference of two squares

Factoring Trinomials
- learn to factor trinomials with a leading coefficient of 1

Factoring Trinomials—Advanced
- learn to factor trinomials of the form $ax^2 + bx + c$ where $a \neq 1$ and a and c are prime
- learn to factor trinomials of the form $ax^2 + bx + c$ where $a \neq 1$ and a and c are not both prime

Factoring by Grouping
- learn to recognize when factoring by grouping is appropriate
- learn to factor by grouping

Factoring the Sum and Difference of Two Cubes
- learn to recognize the sums and differences of two cubes
- learn to factor the sum and the difference of two cubes

Factoring Completely
- learn to factor expressions completely

Reducing Algebraic Fractions Using Factoring
- learn how to use factoring to reduce algebraic fractions

Addition and Subtraction of Algebraic Fractions with Common Denominators
- learn to add algebraic fractions with a common denominator
- learn to subtract fractions with a common denominator

Addition and Subtraction of Algebraic Fractions without Common Denominators
- find the lowest common denominator of algebraic fractions
- add and subtract fractions after finding a common denominator

Multiplying and Dividing Algebraic Fractions
- learn to multiply algebraic fractions
- learn to divide algebraic fractions

Complex Algebraic Fractions
- learn to recognize complex fractions
- learn to simplify complex fractions by changing to the equivalent multiplication problem
- learn to simplify complex fractions using the least common multiple
- learn to use complex fractions in applications

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SEQUENCE OF SKILLS

UNIT 5 – Equations

Equations
- learn to recognize equations
- learn to recognize solutions or roots of equations
- learn to identify conditional equations, identities, and impossible equations and find solution sets for each type

One Step Equations—Addition and Subtraction
- learn to solve equations that require one step: addition and subtraction
- learn to solve equations by writing equivalent equations

One Step Equations—Multiplication and Division
- learn to solve equations that require one step: multiplication and division
- learn to use a reciprocal to solve one step problems involving multiplication or division

Two Step Equations: learn to solve two step equations of the form
- $ax + bx = c$
- $ax + b = c$
- $ax + b = cx + d$

Multiple Step Equations
- learn to solve multiple-step problems involving the distributive property and clearing fractions

Writing Equations
- learn to write, solve, and check equations

Word Problems with One Variable (Number Relations, Consecutive Integer, and Average Problems)
- learn to write, solve, and check word problems that fall into the following three categories: number relations, consecutive integers, and average

Word Problems with One Variable (Coin Problems and Interest Problems)
- learn to solve coin or money problems and interest problems
- learn to use tables to organize data

Word Problems with One Variable (Perimeter and Area)
- learn to solve perimeter problems, area problems, and use drawings to help organize data

Rational Algebraic Expressions
- learn to solve rational algebraic equations using the lowest common denominator
- learn to use the cross product rule correctly
- learn to check solutions to rational algebraic equations for extraneous roots

Distance-Rate-Time Problems
- learn to combine sketches and tables to help solve problems
- learn to solve word problems involving distance, rate, and time
- learn to solve distance-rate-time problems with wind or current involved

Work Problems and Percent Problems
- learn to solve problems involving percent
- learn to solve work problems

Mixture Problems
- learn to solve mixture problems by mixing ingredients of different strengths or values to get a desired result
- learn to solve mixture problems by replacing part of the substance with a substance of another strength to obtain a desired result
- learn to use proportions to adjust for different amounts of a substance

Literal Equations
- learn to solve a literal equation for any of the variables it contains

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SCOPE OF COURSE

This course is divided into two semesters of study (A & B) comprised of five units each. The second semester (B) is a study of linear functions; inequalities, absolute value, and radicals; quadratic functions, circles, modeling exponential growth and decay; systems of equations and inequalities; and probability and statistics.

SEQUENCE OF SKILLS

UNIT 1 – Linear Functions
Functions and Relations
- learn about relations and functions
- learn about ordered pairs
- learn about domain and range

Functional Notation
- learn functional notation
- learn the difference between a dependent and an independent variable
- learn to evaluate functions

Graphing
- introduce the Cartesian coordinate system
- name points
- plot points
- use a table

Linear Functions
- learn what a linear function is
- verify whether or not a given point lies on a line
- graph equations of the form $y = mx + b$ and $ax + by = c$ by plotting points
- use the vertical line test

Slope of a Line
- define slope
- find slopes using a graph or data
- find slopes using equations in the form $y = mx + b$ and $ax + by = c$

Intercepts
- define intercepts
- find intercepts using a graph or data
- find intercepts using equations in the form $y = mx + b$ and $ax + by = c$

Applications of Slopes and Intercepts
- look at slope as a rate
- interpret slope and intercepts in applied situations
- look at graphs in terms of direct variation

Effects of Change of Slope and Intercepts: look at equations in the form $y = mx + b$ and determine
- what happens to the graph if m changes
- what happens to the graph if b changes

Parallel and Perpendicular Lines
- learn the characteristics of lines that are parallel and lines that are perpendicular

Writing Linear Equations: write the equation of a line
- given the slope and the y-intercept
- given the graph of the line
- given a slope and a point on a line
- given the y-intercept and a point on the line

More on Writing Linear Equations: write the equation of a line
- given any two points on the line
- given a point on the line and the line is parallel to another given line
- given a point on the line and the line is perpendicular to another given line
- in real-world applications

Horizontal and Vertical Lines: learn to recognize the graphs of equations in the form
- $y = c$ and $x = c$

Other Special Linear Equations: learn to recognize and use equations of the form
- $y = x$ and $y = -x$

Applications: study some applications of linear functions such as
- scatter plots and lines of best fit
- matching graphs with data

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SEQUENCE OF SKILLS

UNIT 2 – Inequalities, Absolute Value, and Radicals

Graphing and Writing Inequalities
- learn to graph inequalities on a number line
- learn to write inequalities to represent real-world solutions
- learn to write inequalities given a number line graph
- learn to graph and recognize inequalities of the form $x \leq a$ or $x \leq b$
- write and graph the corresponding real-world examples
- recognize valid and invalid inequality strings

The Algebra of Inequalities
- learn how to find solutions to algebraic inequalities

Linear Inequalities in Two Variables
- learn why it is necessary to use the Cartesian plane instead of using a number line to graph the solution to some inequalities
- learn to determine whether or not an ordered pair is a solution to an inequality in two variables
- learn to graph the solution of linear inequalities in two variables

Writing Linear Equations in Two Variables
- learn to write inequalities associated with graphs
- learn to write inequalities corresponding to word problems

Absolute Value Equations: learn to solve and graph absolute value equations
- involving one variable-graph results on a number line
- involving two variables-graph results on the Cartesian plane

Absolute Value Inequalities with One Variable
- learn to simplify and graph absolute value inequalities with one variable
- learn to write absolute value inequalities represented by graphs
- learn to write absolute value inequalities corresponding to word problems

Absolute Value Inequalities in Two Variables
- learn to graph absolute value inequalities in two variables
- learn to write absolute value inequalities in two variables given their graph

Simplifying Radicals with Variables
- learn to simplify radicals that contain variables

Multiplying and Dividing Radical Expressions with Variables
- learn to multiply and divide radical expressions with variables

Addition and Subtraction of Radicals with Variables
- learn to recognize like radical terms
- learn to add and subtract radical expressions with variables

Rational Expressions with Radical Monomial Denominators: learn to rationalize fractions with a
- square root for a denominator
- cube root for a denominator

Rational Expressions with Radical Binomial Denominators
- learn to find the conjugate of a binomial containing a square root
- learn to rationalize the denominators of fractions that are binomials with square roots

Gears, Pulleys, and the Wheel and Axle
- learn how gears and pulleys use the number of teeth or radius of circles to gain speed or to gain mechanical advantage

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SEQUENCE OF SKILLS

UNIT 3 – Quadratic Functions, Circles, and Modeling Exponential Growth and Decay

Conic Sections
- recognize which second-degree equations, in general form, are equations of parabolas, circles, or neither
- recognize solutions to quadratic equations
- graph circles and parabolas by plotting points

The Basics About Quadratic Functions
- recognize when a parabola is a quadratic function
- find the vertex of a quadratic function by observation
- write the equation of the line of symmetry
- determine whether a vertex is a maximum or a minimum
- find the points of reflection of points on a parabola

Solving Quadratic Equations-Using Square Roots
- learn the relationship between the graph of a quadratic function and the solutions to a quadratic equation
- learn when quadratic equations may be solved algebraically using square roots and how to do it

Solving Quadratic Equations-By Factoring
- learn the zero-product property
- learn to solve equations by factoring

Completing the Square
- learn to solve quadratic equations by completing the square

The Quadratic Formula
- learn how to solve quadratic equations by using the quadratic formula

The Discriminant and the Nature of Roots: learn how to use the discriminant to determine
- the number of roots a given quadratic equation will have
- the kind of roots to expect from a given quadratic equation

The Vertex of a Parabola
- learn to find the vertex of a quadratic function written in the general form $y = ax^2 - bx + c$
- learn to find the vertex of a quadratic function written in the standard form $y - k = a(x - h)^2$
- learn to change from standard form to general form by expanding
- learn to change from general form to standard form by completing the square

Graphing Quadratic Functions
- study the effects of changing the a in $y = ax^2$
- study the effects of changing the c in $y = x^2 + c$
- graph a quadratic function written in standard form and written in general form

Writing the Equations of Quadratic Functions: learn to write the equation of a quadratic function given
- a graph
- practical problems

Maximum and Minimum Problems
- learn to find the maximum and minimum value of a quadratic function on an interval $[a,b]$
- use the information learned about quadratic functions to solve practical problems

The Distance Formula and a Circle
- learn how to find the distance between two points in a plane
- learn how to write the equation of a circle in standard form
- learn how to find the center and radius of a circle when it is written in standard form
- learn how to change the equation of a circle in standard form to one in general form

The Midpoint Formula and the Circle
- learn how to find the midpoint of a line segment
- learn more on writing equations of circles
- learn how to find the center and radius of a circle when it is written in general form

Mathematical Modeling-Exponential Growth and Decay
- learn to model an exponential growth and decay
- learn to solve problems involving exponential growth and decay

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SEQUENCE OF SKILLS

UNIT 4 – Systems of Equations and Inequalities

Systems of Two Linear Equations-Graphing
- determine the possible number of solutions to a system of two linear equations
- find the solution to the system by graphing

Systems of Two Linear Equations-Substitution
- learn to solve a system of linear equations by substitution
- learn how to recognize systems with no solutions or an infinite number of solutions when solving the system by substitution

Systems of Two Linear Equations-Addition or Elimination Method
- learn how to find the solution to a system of equations by the addition or elimination method

Writing Systems of Equations
- learn what is necessary for a problem involving two variables, to have a unique solution
- learn how to write systems of equations in order to solve practical situations

Systems of Equations with More than Two Variables
- examine systems with more than two variables visually
- determine the number of possible solutions to these systems
- solve a system with more than two variables by substitution

Solving Systems of Equations in Three Variables by Elimination
- learn to use elimination to solve systems of equations in three variables

Applications of Systems of Equations with Three Variables
- learn to recognize systems of equations that do not have unique solutions
- learn to write and solve practical problems involving three variables

Simultaneous Solutions-A Linear Equation and a Quadratic Function
- determine the number of possible solutions to a system of equations
- find the solution to systems of equations (with a linear equation and a quadratic function) algebraically and by graphing

Simultaneous Solutions-A Linear Equation and a Absolute Value Function or a Circle
- compare quadratic functions and absolute value functions
- find simultaneous solutions to systems with a linear function and an absolute value function
- find simultaneous solutions to systems with a linear function and a circle

Matrices-Introduction
- learn what a matrix is and how it is named
- learn what the elements and dimensions of a matrix are
- learn some arithmetic operations with matrices

Solving Systems of Equations with Matrices
- learn to write systems of equations in matrix form
- learn the row operations for matrices
- learn to solve systems of equations with matrices

Determinants and Cramer's Rule
- learn what a determinant of a square matrix is and how to find its value
- learn how to use determinants to solve systems of linear equations in two variables
- learn to use determinants to determine if a system of linear equations in two variables is dependent, independent, or inconsistent

System of Linear Inequalities
- learn to find the solution to a system of linear inequalities by graphing
- learn to recognize whether or not specific points are part of the solution by observation
- learn to solve application problems involving linear inequalities

Linear Programming
- learn how to solve systems of inequalities using linear programming

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UNIT 5 – Probability and Statistics

Theoretical Probability
- develop an understanding of the number associated with a probability
- find sample spaces and events
- determine theoretical probabilities

Mutually Exclusive and Complementary Events
- learn how to recognize mutually exclusive events and complementary events
- learn to use Venn Diagrams with probability
- learn properties of probability for complementary and mutually exclusive events

Tree Diagrams and Multistage Experiments
- find probabilities of a multistage experiment with the help of tree diagrams
- understand the difference between dependent and independent events
- learn to use the counting principle to check that the number of outcomes is correct

Geometric Probability and Expected Value
- learn to use an area model and geometric shapes to find probabilities
- learn to use expected value to make wise decisions

Experimental Probability and Simulations
- learn how to model experiments using random numbers
- learn how to find probabilities using simulations

Permutations
- learn how to use permutations for counting
- learn about factorials and how to evaluate them
- solve problems using permutations

Combinations
- understand the difference between permutations and combinations
- evaluate combinations
- solve problems with combinations

Organizing Data
- show how to organize statistical data using line plots and stem and leaf plots
- use data to draw conclusions

Bar Graphs
- learn to create bar graphs
- learn to create histograms
- learn to create double bar graphs
- learn to analyze data

Line Graphs and Pictographs
- learn to analyze data
- learn to create line graphs
- learn to create pictographs

Circle Graphs
- learn to analyze data
- learn to create circle graphs

Mean and Median
- learn to calculate mean and median measures of central tendency
- learn to analyze data using central tendency

Frequency Distributions
- learn to calculate the mean and median of a frequency distribution
- learn to find the mode of a set of data
- learn to analyze data using central tendency

Box and Whisker Plots
- study range and outliners
- learn about quartiles and interquartile range (IQR)
- learn to make and interpret box and whisker plots