

Algebra IIA

SCOPE OF COURSE

This course is divided into two semesters of study (A & B) comprised of five units each. Each unit teaches concepts and strategies recommended for intermediate algebra students. The first half of the course (A) addresses linear equations and functions, systems of linear equations and inequalities, quadratic functions, polynomial functions and their graphs, and power functions and inverses.

SEQUENCE OF SKILLS

UNIT 1 – Linear Equations and Functions

- Perform operations with real numbers
- Simplify and evaluate algebraic expressions.
- Use linear equations to solve problems
- Rewrite equations and formulas to solve for a given variable
- Apply formulas in problem solving
- Analyze problems and write equations to solve them
- Determine when a relation is a function
- Graph and evaluate linear functions
- Find the slope of a line given its graph or two points on the line
- Classify pairs of lines as parallel, perpendicular, or neither
- Understand slope as a rate of change
- Graph an equation using slope-intercept form
- Graph an equation that is in standard form
- Write an equation of a line given its slope and y-intercept, the slope and a point on the line, or two points on the line
- Use an algebraic model to make a prediction given a set of data
- Graph piecewise functions
- Solve absolute value equations
- Graph absolute value functions

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SEQUENCE OF SKILLS

UNIT 2 – Systems of Linear Equations and Inequalities

- Solve linear inequalities
- Solve absolute value inequalities in one variable
- Graph linear inequalities
- Write linear inequalities
- Solve a linear system graphically
- Determine whether a system has zero, one, or many solutions by observing the graph
- Use the linear combination method
- Use the substitution method
- Determine algebraically whether a system has zero, one, or many solutions
- Apply linear systems to realistic situations
- Graph a system of two inequalities in two variables
- Graph a system of three inequalities in two variables
- Describe the difference between bounded and unbounded regions
- Find minimum and maximum values of an objective function
- Use linear programming to solve problems in realistic situations
- Identify the octant in which an ordered triple is located
- Locate an ordered triple in three-dimensional space
- Write the ordered triple that corresponds to a given point in three-dimensional space
- Use the linear combination method to solve a system in three variables
- Determine whether a system has zero, one, or many solutions
- Apply systems in three variables to realistic situations
- State the dimensions of a given matrix and name its entries
- Identify row, column, square, and zero matrices
- Add and subtract matrices
- Multiply a matrix by a scalar
- Use matrices to represent realistic situations
- Recognize when it is possible to multiply two matrices
- Multiply two matrices
- Verify the properties of matrix multiplication
- Use matrix multiplication in realistic situations
- Evaluate determinants of 2×2 and 3×3 matrices
- Use the determinant of a matrix to find the area of a triangle on the coordinate plane
- Convert a system of linear equations in two variables into a matrix equation
- Solve a system of linear equations in two variables using a graphing calculator
- Apply matrices to solve systems in two variables in realistic situations using a graphing calculator
- Convert a system of linear equations in three or more variables into a matrix equation
- Solve a system of linear equations in three or more variables using a graphing calculator
- Apply matrices to solve systems in three or more variables in realistic situations using a graphing calculator

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SEQUENCE OF SKILLS

UNIT 3 – Quadratic Functions

- Recognize that the graph of a quadratic function is a parabola
- Identify the vertex and the axis of symmetry for a parabola by observing its graph
- Determine whether a quadratic function is written in standard form, vertex form, or intercept form
- Graph a quadratic function in standard form, vertex form, or intercept form
- Explore some realistic applications of quadratic functions
- Identify monomials, binomials, and trinomials, and recognize that these are all polynomials
- Factor a trinomial of the form $x^2 + bx + c$ or $ax^2 + bx + c$
- Recognize and factor a difference of two squares or a perfect square trinomial
- Check to see if the terms of a given polynomial have a common monomial factor
- Solve quadratic equations by factoring
- Solve realistic problems using quadratic equations
- Recognize that solutions, zeros, x -intercepts, and roots are all related
- Discover that the maximum or minimum value of a quadratic function is the average of its zeros
- Find the zeros of a quadratic function by factoring and writing the function in intercept form
- Find the zeros of a quadratic function using a graphing calculator
- Understand and use the properties of square roots
- Apply the properties of square roots to solving quadratic equations
- Verify the solutions of a quadratic equation both algebraically and by using a graphing calculator
- Use quadratic functions to model falling objects
- Discover that some parabolas do not cross the x -axis and therefore have no real solutions
- Understand the definitions of an imaginary number, complex number, and pure imaginary number
- Solve quadratic equations with imaginary solutions
- Add and subtract complex numbers
- Multiply complex numbers
- Recognize complex conjugates and discover that the product of complex numbers is always a real number
- Divide complex numbers
- Explore the powers of i and discover a pattern
- Simulate the process of completing the square using algebra tiles or sketches
- Complete a perfect square trinomial and write it as the square of a binomial
- Solve quadratic equations by completing the square
- Write the vertex form of a quadratic function by completing the square, given the standard form
- Find the maximum value of a quadratic function by completing the square
- Given a graph of a quadratic function, select an equation in vertex form that represents the graph
- Determine whether a quadratic function has two real solutions, one real solution, or two imaginary solutions by examining its graph
- Apply the quadratic formula to solve quadratic equations with two real solutions, one real solution, or two imaginary solutions
- Identify the discriminant of a quadratic equation and use it to determine the number and nature of the functions' solutions
- Choose the most appropriate method for solving a quadratic equation: factoring, square roots, quadratic formula, or graphing calculator
- Apply quadratic equations to realistic solutions
- Review graphs of linear inequalities
- Given a quadratic inequality and its graph, choose several points inside and outside the parabola to determine which ones satisfy the inequality
- Match a quadratic inequality with its graph
- Graph a quadratic inequality
- Explore realistic applications of quadratic inequalities
- Graph a system of quadratic inequalities
- Solve a quadratic inequality by graphing
- Solve a quadratic inequality algebraically
- Explore some more realistic applications of quadratic inequalities
- Write a quadratic function in vertex form, intercept form, and standard form given information about its graph
- Produce a quadratic function that models a given set of data
- Find the best-fitting quadratic model for a set of data using a graphing calculator

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SEQUENCE OF SKILLS

UNIT 4 – Polynomial Functions and Their Graphs

- Evaluate and simplify expressions with exponents
- Apply scientific notation to solve realistic problems
- Identify and evaluate polynomial functions
- Use synthetic substitution
- Graph a polynomial function
- Determine the end behavior of a graph
- Add and subtract polynomials vertically and horizontally
- Multiply polynomials
- Apply special product patterns
- Factor polynomial expressions using the sum or difference of cubes
- Factor polynomials by grouping
- Apply factoring to solve polynomial equations
- Solve polynomial equations in realistic situations
- Divide polynomials using long division
- Divide polynomials using synthetic division
- Find rational zeros of polynomial functions
- Find rational zeros of polynomial functions with the assistance of a graphing calculator
- State the number of solutions or zeros of a polynomial function
- Write polynomial functions using zeros
- Solve realistic problems using polynomial models
- Graph a polynomial function using x -intercepts
- Analyze the graph of a polynomial function

Algebra IIA

SEQUENCE OF SKILLS

UNIT 5 – Power Functions and Inverses

- Identify the index of a given radical
- Evaluate the n^{th} root of real numbers using radical notation
- Identify the number of real roots of a given real number
- Rewrite the n^{th} roots using rational exponential notation
- Evaluate expressions with rational exponents
- Solve an equation using an n^{th} root
- Use n^{th} roots and rational exponents to solve realistic problems
- Simplify expressions using the properties of rational exponents
- Simplify expressions using the properties of radicals
- Write radicals in simplest form
- Add and subtract roots and radicals
- Identify a power function
- Graph a power function using both paper/pencil and the graphing calculator
- Add and subtract two functions
- Multiply and divide two functions
- Use function operations in a realistic situation
- Find the composition of two functions
- Find the inverse of a linear function numerically and algebraically
- Graph a linear function and its inverse
- Find the inverse of a nonlinear function
- Graph a nonlinear function and its inverse
- Graph the inverse of a function using the graphing calculator
- Determine if two functions are inverses using the graphing calculator
- Graph a square root function
- Investigate the effect of changing a in a function of the form $y = a\sqrt{x}$ using a graphing calculator
- Graph a cube root function
- Investigate the effect of changing a in a function $y = a\sqrt[3]{x}$ using a graphing calculator
- Use a radical function in a realistic situation
- Solve a simple radical equation
- Solve an equation with rational exponents
- Solve an equation with one radical
- Solve an equation with two radicals
- Solve an equation with extraneous solution(s)

Algebra IIB

SCOPE OF COURSE

This course is divided into two semesters of study (A & B) comprised of five units each. Each unit teaches concepts and strategies recommended for intermediate algebra students. The second half of the course (B) addresses exponential and logarithmic functions, rational functions and their graphs, quadratic relations and conic sections, fundamentals of trigonometry, and probability and statistics.

SEQUENCE OF SKILLS

UNIT 1 – Exponential and Logarithmic Functions

- Investigate and compare the graphs of exponential functions
- Learn the definitions of “exponential function” and “asymptote”
- Graph exponential functions
- State the domain and range of an exponential function
- Differentiate between a “percent increase” and a “growth factor”
- Write an equation that models an exponential function
- Graph a model of an exponential function
- Make predictions involving exponential functions
- Understand compound interest and find the balance of an account at a given time
- Differentiate between an exponential growth function and an exponential decay function
- Graph exponential decay functions
- Understand the meaning of “decay factor”
- Use exponential decay functions in realistic situations
- Discover the value of e
- Simplify expressions involving e
- Use a calculator to evaluate expressions involving e
- Graph functions involving the number e .
- State the domain and range of a function involving e .
- Use the equations $A = Pe^{rt}$ and $A = P\left(1 + \frac{r}{n}\right)^{nt}$ in realistic situations
- Examine the difference between common logarithms and natural logarithms
- Evaluate common and natural logarithms
- Write an exponential equation in logarithmic form
- Write a logarithmic equation in exponential form
- Graph a logarithmic function
- Investigate the effect of changing the b , h , or k in a function of the form $y = \log_b(x - h) + k$
- Use logarithms in a realistic situation
- Discover the properties of logarithms through investigations
- Use the product, quotient, and power properties of logarithms
- Expand or condense a logarithmic expression
- Evaluate a logarithmic expression using the change-of-base formula
- Solve an exponential equation by equating exponents
- Solve an exponential equation by taking the logarithm of each side
- Solve a logarithmic equation by rewriting it as an exponential equation
- Solve a logarithmic equation involving logarithms with the same base
- Solve a logarithmic equation with extraneous solutions
- Write the equation of an exponential function whose graph passes through two given points
- Decide whether an exponential function is a good model for a given set of data
- Use exponential regression on a graphing calculator
- Use power regression on a graphing calculator
- Write the equation of a power function whose graph passes through two given points
- Decide whether a power function is a good model for a given set of data
- Recognize situations for which a logistic growth function is a good model
- Use a graphing calculator to graph logistic growth functions and describe their shape
- Evaluate a logistic growth function for a given value
- Sketch the graph of a logistic growth function by using the asymptotes, the y -intercept, and the point of maximum growth
- Solve a logistic growth equation

- Examine the graph of a logistic growth function and describe what it reveals about the situation modeled by the graph
- Use logistic regression on a graphing calculator to formulate a logistic growth model

UNIT 2 – Rational Functions and Their Graphs

- Classify an equation as having direct variation, inverse variation, or neither
- Write an inverse variation equation
- Write an algebraic model of inverse variation to solve problems in realistic situations
- Write a joint variation equation
- Write a combined variation equation
- Write an algebraic model of joint variation to solve problems in realistic situations
- State the domain and range of a rational function
- Graph a rational function
- Investigate the effect of changing the numerator or denominator of a rational function
- Write an algebraic model of a rational function to solve problems in realistic situations
- State the domain and range of a given function
- Graph a given function
- Find a local minimum to solve problems in realistic situations
- Simplify a rational expression
- Multiply a rational expression containing monomials
- Multiply a rational expression containing polynomials
- Multiply a rational expression and a polynomial
- Write a rational expression to solve problems in realistic situations
- Divide rational expressions
- Divide a rational expression by a polynomial
- Combine multiplication and division to simplify rational expressions
- Write a rational expression to solve problems in realistic situations
- Verify numerically the results of rational expressions using a table (graphing calculator)
- Verify graphically the results of rational expressions (graphing calculator)
- Add rational expressions with like denominators
- Add rational expressions with unlike denominators
- Use addition of rational expressions to solve problems in realistic situations
- Subtract rational expressions with like denominators
- Subtract rational expressions with unlike denominators
- Use subtraction of rational expressions to solve problems in realistic situations
- Simplify a complex fraction
- Write an equation involving complex fractions to solve problems in realistic situations
- Determine whether a given value is a solution of a rational equation
- Simplify and solve rational equations
- Simplify and solve rational equations with two solutions.
- Verify a solution of a rational equation.
- Identify an extraneous solution.
- Use the graph of a rational expression to determine if a solution is extraneous.
- Solve a rational equation by cross multiplying
- Solve a rational equation by using the least common denominator or by cross multiplying
- Prove the results are solutions to a given rational equation
- Identify extraneous solutions
- Write an algebraic model of a rational expression
- Use an algebraic model of a rational expression to solve problems in realistic situations

**Portable Assisted Study Sequence
Algebra IIB**

SEQUENCE OF SKILLS

UNIT 3 – Quadratic Relations and Conic Sections

- Use the distance formula to find the distance between two points
- Use the distance formula to classify a triangle as scalene, isosceles, or equilateral
- Find the midpoint of a line segment
- Apply the midpoint formula to write an equation for the line that is a perpendicular bisector of a given line segment
- Use the distance formula in a realistic situation
- Graph a parabola
- Identify the focus and directrix of a parabola
- Write an equation for a parabola that opens up or down
- Use parabolas in realistic situations
- Write an equation of a circle in standard form given the center and radius
- Identify the center and radius of a circle
- Graph an equation of a circle
- Write an equation of a circle in standard form given a point on the circle and the center
- Write an equation of the line that is tangent to a circle at a given point
- Use circles in realistic situations
- Identify the vertices, co-vertices, and foci of an ellipse
- Graph an equation of an ellipse
- Write an equation of an ellipse in standard form given the center, vertex, and co-vertex
- Write an equation of an ellipse in standard form given the center, vertex, and focus
- Use ellipses in realistic situations
- Graph an equation of a hyperbola
- Write an equation of a hyperbola
- Use a hyperbola in a realistic situation
- Write an equation of a translated parabola, circle, ellipse, or hyperbola
- Classify a conic section as a circle, parabola, ellipse, or hyperbola, given its equation
- Graph a conic section
- Solve a quadratic system by substitution
- Solve a quadratic system by linear combination
- Solve a system of quadratic models

Algebra IIB

SEQUENCE OF SKILLS

UNIT 4 – Fundamentals of Trigonometry

- Write the ratios of trigonometric functions
- Evaluate trigonometric functions
- Use trigonometry to find the length of a side of a right triangle
- Use trigonometric functions to solve problems in realistic situations
- Draw angles in standard position
- Identify the quadrant in which the terminal side of an angle lies
- Find coterminal angles
- Convert between radian and degree measure
- Find the arc length and area of a given sector
- Evaluate a trigonometric function, given a point on the terminal side of an angle
- Find a reference angle for a given angle
- Evaluate trigonometric functions using reference angles
- Evaluate the inverse of a trigonometric function
- Use a trigonometric inverse to find the measure of an angle in a right triangle
- Write and solve a trigonometric equation
- Use inverse trigonometric functions to solve problems in realistic situations
- Write and solve an equation using the law of sines to find the measure of a side or an angle in a triangle
- Use the sine function to find the area of a triangle
- Apply the sine function to solve problems in realistic situations
- Write and solve an equation using the law of cosines to find the measure of a side or an angle in a triangle
- Use Heron's formula to find the area of a triangle
- Apply the law of cosines to solve problems in realistic situations
- Graph parametric equations
- State the domain for parametric equations
- Write parametric equations to solve projectile problems in realistic situations
- Identify the period and amplitude of sine and cosine functions
- Identify the intercepts, maximum, and minimum of sine and cosine functions
- Graph sine functions
- Graph cosine functions
- Identify the intercepts, asymptotes, and halfway points of tangent functions
- Graph tangent functions
- Graph translations of sine, cosine, and tangent functions
- Graph reflections of sine, cosine, and tangent functions
- Use a combination of a translation and a reflection to graph a sine, cosine, or tangent function
- Find values of trigonometric functions using trigonometric identities
- Simplify trigonometric expressions using trigonometric identities
- Verify trigonometric identities
- Solve a trigonometric equation in a given interval
- Apply factoring to solve a trigonometric equation
- Use the quadratic formula to solve trigonometric equations
- Identify an extraneous solution of a trigonometric equation
- Write a trigonometric function for a sinusoid
- Use given data to graph a sinusoid
- Apply sinusoidal regression to graph a model of data on a graphing calculator
- Use the sum or difference of angles to simplify trigonometric expressions
- Use the sum or difference of angles to evaluate trigonometric expressions
- Use the double- and half-angle formulas to evaluate trigonometric expressions
- Use the double- and half-angle formulas to simplify trigonometric expressions
- Use the double- and half-angle formulas to verify a trigonometric identity
- Use the double- and half-angle formulas to solve a trigonometric equation

Algebra IIB

SEQUENCE OF SKILLS

UNIT 5 – Probability and Statistics

- Use measures of central tendency and measures of variance to describe data sets
- Use box-and-whisker plots and histograms to represent data graphically
- Use the graphing calculator to find measures of central tendency
- Use the graphing calculator to draw a histogram or box and whisker plot
- Use the fundamental counting principle to count the number of ways an event can occur
- Use permutations to count the number of ways an event can occur
- Use combinations to count the number of ways an event can occur
- Solve realistic problems using combinations
- Find the theoretical probability that an event will occur
- Use permutations or combinations to find the probability that an event will occur
- Find the experimental probability of an event occurring
- Use geometric probabilities to find the probability that a length, area, or volume could occur in a given situation
- Find the probability of mutually exclusive events
- Find the probability of compound events
- Use the intersection of two sets to find the probability of an event
- Use complements to find the probability of an event
- Use complements in realistic situations
- Find the probability of two or three independent events
- Compare dependent and independent events
- Find the probability of dependent events
- Use a tree diagram to find conditional probabilities
- Identify probability experiments that are binomial experiments
- Find the binomial probability of an event
- Construct a histogram, given a binomial distribution
- Given a normal distribution, calculate the probability that an event will occur
- Use a normal distribution to solve a realistic situation
- Interpret the histogram of a binomial distribution

Algebra/Geometry Tutor Guide

SCOPE

The Algebra/Geometry Tutor Guide provides tutors or mentors who do not have a mathematical background with additional resources to assist them in supporting their students. The guide includes algebraic and geometric definitions plus an annotated listing of necessary axioms, postulates, and propositions. Along with the written definitions, the mathematical concepts are reinforced with visual representations. Some mathematical concepts are further highlighted with hands-on, supplementary activities. These activities may be presented by the instructor/mentor, or performed by the student in a semi-independent work environment. While developed to assist the tutor and/or student with successful completion of a PASS course, the *Algebra/Geometry Tutor Guide* offers general strategies for helping any student studying algebra or geometry.

SEQUENCE

- Glossary of Terms
- Axioms
- Postulates
- Propositions
- Algebra Classroom Extensions
- Geometry Classroom Extensions