

Intermediate Algebra

Curriculum Outline

Intermediate Algebra is a course approved by the Oklahoma State Board of Education as a mathematics course with content and/or rigor equal to or above Algebra I. As such, it qualifies as a course for meeting Oklahoma's graduation requirement in mathematics as specified in 70 O.S. § 11-103.6. The course was originally designed by and this publication was adapted with permission from Edmond Public Schools.

I. Number and Number Theory

The student will extend the concept of numbers to include such constructs as irrational numbers and complex numbers, and will continue to develop skills in the use of real and complex numbers and their application to real-world, computational, and estimation situations.

A. Understands Forms of Numbers

The student will compare and contrast the real number system and its various subsystems with regard to their structural characteristics.

1. Identifies Rational and Irrational Numbers

The student will identify rational and irrational numbers in mathematical situations.

2. Explains Similarities/Differences of Subsystems

The student will identify and explore the similarities and differences in the subsystems of real numbers (e.g., rational, complex, prime, factors, multiples).

3. Relates Complex Numbers to Real/Imaginary

The student will identify the complex number system in relations to real numbers and imaginary numbers.

4. Uses Mathematical Symbols

The student will use appropriate symbols (e.g., radical signs, absolute value bars, inequalities, equivalency, repeating bar).

B. Performs Operations – Real Numbers

The student will perform operations on numbers written with negative or fractional exponents.

1. Estimates/Calculates Square/Cubed Roots

The student will estimate square root to the nearest tenth and use a calculator to compute decimal approximations of radicals.

2. Simplifies Negative or Fractional Exponents

The student will simplify numbers with negative or fractional exponents.

3. Simplifies Number Sentences with Absolute Value

The student will simplify number sentences involving absolute values.

4. Simplifies Using Order of Operations

The student will simplify number sentences using the correct order of operations.

C. Understands Properties and Algebraic Procedures

The student will understand number properties and algebraic procedures.

1. Identifies/Uses Properties to Simplify Expressions

The student will identify or use a property of real numbers (associative, commutative, distributive) to simplify algebraic expressions.

2. Uses Distributive Property

The student will use the distributive property to remove parentheses and collect like terms.

3. Identifies/Uses Identity and Inverse Properties

The student will identify and use identity and inverse properties to simplify expressions and solve equations.

D. Applies Discrete Math

The student will apply discrete math to finite graphs, matrices, sequences, and recurrence relations.

1. Evaluates Matrix Properties

The student will evaluate the operations of matrices.

2. Use Cramer's Rule to Solve Matrices

The student will solve matrices of equations using Cramer's rule, manually and by calculator.

3. Uses Addition/Subtraction of Matrices

The student will use addition and subtraction of matrices to solve equations.

4. Uses Multiplication of Matrices

The student will use multiplication of matrices to determine size and to solve equations.

5. Identifies/Calculates Inverse Matrices

The student will identify and calculate inverse matrices on the calculator.

6. Uses Algorithms to Solve Math Problems

The student will use a variety of algorithms to solve mathematical problems.

7. Solves System of Inequalities

The student will solve a system of inequalities to solve mathematical problems.

II. Measurement

The student will understand the essential role of measurement as a link between the abstractions of mathematics and the concreteness of the real world.

A. Works with Measurable Quantities

The student will work with fundamental, measurable, quantities of physical objects (e.g., length, area, volume, time, angle, weight) in connection with other mathematics strands and with work in other subjects.

1. Evaluates Appropriate Unit of Measure

The student will evaluate which unit of measure is appropriate for a situation (e.g., metric, U.S. standard, length, area, volume).

2. Applies Geometric Units

The student will apply geometric units of measure as necessary.

3. Solves Problems Using Combined Units

The student will solve problems using combined units (e.g., feet per second, pounds per square inch).

III. Geometry

The student will use geometry ideas and tools to understand and represent two and three-dimensional situations.

A. Represents Problems with Geometric Models

The student will represent problem situations with geometric models and apply properties of figures.

1. Plots Points/Interprets Information on Coordinate Plane

The student will plot points and interpret information on a coordinate plane.

B. Solves Geometric Problems

The student will solve geometric problems using the coordinate plane.

1. Solves Problems with Triangles/Rectangles

The student will solve equations or word problems involving triangles and rectangles and their perimeters and areas.

2. Uses Pythagorean Theorem

The student will use the Pythagorean Theorem to solve problems involving triangles.

3. Uses Distance Formula to Verify Distance

The student will use the distance formula to find the distance between two points.

IV. Functions

The student will investigate functional relationships.

A. Models Phenomena With Variety of Functions

The student will model real-world phenomena with a variety of functions.

1. Models Situation with Appropriate Function

The student will model real-world situations with appropriate linear or quadratic functions.

B. Represents/Analyzes Relationships

The student will represent and analyze functional relationships using tables, verbal rules, equations, and graphs.

1. Identifies if Graph Represents a Function

The student will identify whether a graph does or does not represent a function.

2. Creates Tables/Graphs/Ordered Pairs

The student will create tables, graphs, and ordered pairs from a function.

3. Relates Graph to Real-World Situations

The student will relate a graph to a real-world situation.

4. Interprets Tables/Graphs/Ordered Pairs for Function

The student will interpret tables, graphs, and ordered pairs to identify a function.

5. Determines Domain and Range

The student will determine the domain and range of a function.

6. Describes Intervals

The student will describe intervals using graphs on a number line.

7. Identifies Inequality Represented on a Number Line

The student will identify an inequality represented on a number line (e.g., $x < 5$; $x \geq -3$).

C. Analyzes Effects of Parameter Changes

The student will analyze the effects of parameter changes on the graphs of functions.

1. Recognizes Effect of Changing Slope/y-Intercept

The student will recognize the effect of changing the slope or y-intercept of a linear equation.

2. Recognizes Changes – Horizontal/Vertical Shifts/Reflections

The student will recognize changes in a function resulting in horizontal or vertical shifts or reflections about an axis.

D. Understands Classes of Functions

The student will understand operations on functions, and the general properties and classes of functions.

1. Performs Operations on Functions

The student will perform operations on functions (e.g., sum, product, and composition of functions).

2. Classifies Functions

The student will classify functions (e.g., linear and quadratic).

3. Describes Characteristics/Properties of Functions

The student will describe the characteristics and properties of classes of functions.

V. Algebra

The student will use algebraic concepts as a means of representation and algebraic methods as a problem-solving tool.

A. Algebraic Symbols

The student will identify, describe, and utilize algebraic symbolism.

1. Recognizes and Uses Symbols

The student will recognize and use the following symbols: greater than, greater than or equal to, approximately equal to, less than, and less than or equal to.

2. Uses Set Notation

The student will use set notation.

3. Describes Empty/Null Set

The student will describe and identify the empty or null set.

4. Describes Intersection/Union Sets

The student will describe and identify the intersection and union of sets.

B. Represents Situations Using Expressions

The student will represent situations that involve quantities with expressions.

1. Evaluates Variable Expressions

The student will evaluate and simplify a variable expression.

2. Writes Variable Expressions From Verbal Expressions

The student will write a variable expression from a verbal expression.

3. Performs Basic Operations on Rational Algebraic Expressions

The student will perform basic operations on rational algebraic expressions.

4. Performs Basic Operations on Radical Expressions

The student will perform basic operations on radical expressions.

C. Uses Polynomials

The student will use polynomials.

1. Multiplies/Divides Monomials

The student will use the properties of exponents including negatives to multiply and divide monomials.

2. Simplifies Polynomials

The student will simplify, add, subtract, multiply, and divide polynomial expressions.

3. Factors Polynomials

The student will factor polynomial expressions completely.

4. Factors Greatest Common Monomial

The student will factor out the greatest common monomial.

5. Factors/Identifies Two Squares, Perfect Square Trinomials

The student will factor and identify the difference of two squares and perfect square trinomials.

6. Factors Quadratic Trinomials

The student will factor quadratic trinomials of form $ax^2 + bx + c$.

7. Multiplies Monomials/Binomials/Polynomials

The student will multiply monomials, binomials, and polynomials.

D. Represents Situations Using Equations

The student will represent situations that involve quantities with an equation.

1. Uses Ratio, Proportion, and Percent

The student will use ratio, proportion, and percent to solve problems.

2. Evaluates Formulas

The student will evaluate a formula for a problem situation.

3. Writes Equations From Verbal Expressions

The student will write an equation from a verbal sentence.

4. Solves Linear Equations

The student will solve linear equations in one variable.

5. Solves Systems of Linear Equations

The student will solve systems of linear equations in two variables using appropriate methods (e.g., substitution, linear combinations – addition and multiplication, graphing).

6. Determines Number of Solutions

The student will determine how many solutions there are in a specific system of equations.

7. Recognizes Point of Intersection

The student will recognize that the point of intersection between two lines is the solution to a system of equations.

8. Solves Absolute Value Equations

The student will solve absolute value equations.

9. Solves Radical Equations

The student will solve radical equations.

10. Solves Fractional Equations

The student will solve fractional equations.

11. Uses Expressions in Word Problems

The student will use algebraic expressions in word problems that involve variable quantities.

12. Uses Equations in Word Problems

The student will use linear and quadratic equations to solve word problems.

E. Understands Inequalities

The student will understand how to solve and represent inequalities.

1. Solves Inequalities

The student will solve inequalities with one variable.

2. Solves Compound/Absolute Value Inequalities

The student will solve compound and absolute value inequalities.

F. Uses Graphs as Tools to Interpret

The student will use tables and graphs as tools to interpret expressions, equations, and inequalities.

1. Describes Slope as Rate of Change

The student will describe and understand slope as a rate of change.

2. Finds Slope of Line

The student will find the slope of a line by using the slope formula, the equation of the line and the graph.

3. Determines Equation of a Line

The student will utilize the concepts of graphing to determine the linear equation of the line using slope and y-intercept.

4. Determines Equation of a Line

The student will determine the equation of a line given two points.

5. Interprets Types of Equations from Graph

The student will identify linear equations from a graph.

6. Interprets Types of Inequalities from Graph

The student will identify inequalities from a graph.

7. Creates Chart/Table to Interpret Algebraic Expression

The student will create a chart or table to interpret an algebraic expression.

8. Creates Tables/Graphs to Interpret Functions

The student will create tables and graphs to interpret linear and quadratic functions.

9. Graphs Equations/Inequalities

The student will graph linear and absolute value equations and inequalities and determine the equations of lines in planes.

10. Identifies Graph of Inequality

The students will identify the graph of a given inequality.

11. Identifies Graph of Linear/Absolute Value

The student will identify the graph of a linear or absolute value equation.

12. Determines Graph from Equation

The student will determine the graph from an equation that is not a straight line (parabola, circle, ellipse).

13. Identifies/Describes Conical Equations/Graphs

The student will identify and describe the graphs and equations of the conic sections (parabola, circle, ellipse).

14. Determines Characteristics of Conic Sections

The student will determine characteristics of the conic sections (parabola, circle, ellipse).

G. Simplifies Expressions

The student will simplify expressions.

1. Simplifies Imaginary/Complex Numbers

The student will simplify expressions involving imaginary or complex numbers.

2. Simplifies Basic Operations

The student will simplify expressions written in scientific notation, polynomials, and rational expressions.

3. Simplifies Negative/Fractional Exponents

The student will simplify algebraic expressions containing negative or fractional exponents.

4. Uses Logarithms to Convert

The student will use logarithms to convert an expression to an equivalent expression.

H. Understands Equations

The student will understand how to simplify and solve equations.

1. Determines Equivalent Equations

The student will determine equivalent equations using fractions, decimals, and integers.

2. Translates Equations

The student will translate a written statement into an equation and vice versa.

- 3. Solve Equations with One or Two Variables**
The student will solve linear equations of one or two variables.
- 4. Manipulates Algebraic Equations**
The student will manipulate algebraic equations into simplified forms.
- 5. Completes the Square**
The student will solve quadratic equations by completing the square.
- 6. Solves Polynomial Equations**
The student will solve polynomial equations of degree greater than two.
- 7. Converts Logarithmic to Exponential Form**
The student will convert an equation in logarithmic form to exponential form and vice versa.
- 8. Solves Logarithmic/Exponential Equations**
The student will solve logarithmic and exponential equations.
- 9. Simplifies/Solves Complex Number Equations**
The student will simplify and solve equations containing complex numbers.
- 10. Solves Inequalities**
The student will solve inequalities in one variable.

VI. Statistics and Probability

The student will understand methods of exploratory data analysis and statistical tools and apply these techniques to solving problems involving probability.

A. Constructs/Draws Inferences From Experiments

The student will construct and draw inferences from charts, tables, and graphs that summarize data from experiments.

- 1. Distinguishes Among Types of Graphs**

The student will distinguish among the types of graphs and their uses.

- 2. Chooses Appropriate Graphs**

The student will choose the appropriate graph (histogram, broken line graph, pie chart, bar graph, straight line graph) to display statistical data.

- 3. Interprets Charts/Graphs/Diagrams**

The student will interpret data represented in pie charts, bar graphs, broken line graphs, histograms, and straight line graphs.

B. Uses and Understands Probability

The student will use and understand experimental or theoretical probability, as appropriate, to represent and solve problems involving uncertainty.

1. Finds Finite Probabilities

The student will find finite probabilities.

C. Calculates Statistical Measures

The student will calculate statistical measures.

1. Calculates Mean/Median/Mode/Range

The student will calculate mean, median, mode, and range for a set of data.

D. Uses Experimental/Theoretical Probability in Problem Solving

The student will use experimental or theoretical probability, as appropriate, to represent and solve problems involving uncertainty.

1. Explores Independent/Dependent Probabilities

The student will explore independent and dependent probabilities.

2. Solves Problems Involving Compound Events

The student will solve problems involving compound events and conditional probability (e.g., dice, cards).

3. Uses Counting Techniques

The student will use the counting principle, permutations, and combinations to determine probability.

VII. Reasoning and Problem Solving

The student will use logical reasoning to clarify ideas in mathematics and to solve problems.

A. Demonstrates Reasoning Skills

The student will demonstrate reasoning skills of estimation and counterexample.

1. Uses Estimation to Check Solution

The student will use estimation to check the reasonableness of a solution.

2. Provides Counterexamples

The student will provide a counterexample as a means of verifying desired results.

B. Uses Problem-Solving Approaches

The student will use problem-solving approaches to investigate and understand mathematical content.

1. Identifies Problem Situations

The student will identify problem situations that could be represented by given mathematical models (e.g., number sentences, equations, graphs, tables, diagrams).

2. Recognizes/Uses an Inequality

The student will recognize and use an inequality in a problem situation.

C. Applies Problem Solving to Real-World Problems

The student will apply integrated, mathematical problem-solving strategies to solve real-world problems.

1. Identifies Appropriate Equation

The student will identify the appropriate equation to solve a given problem.

2. Identifies Missing/Extraneous Information

The student will identify missing and/or extraneous information in a given problem.

3. Applies Algebra/Geometry/Other to Real World Problems

The student will apply algebra, geometry, and other mathematical areas together in order to solve real-world problems.

4. Uses Tools – Calculators/Computers

The student will use calculators, computers, spreadsheets, or graphing utilities to assist in problem solving.

D. Recognizes Problems Within/Outside Math

The student will recognize and formulate problems from situations within and outside mathematics.

1. Recognizes Mathematical Word Problems

The student will recognize situations from within and outside mathematics that can be formulated into mathematical word problems.

2. Analyzes Graphs and Charts

The student will analyze real-world graphs and charts to determine the solution to a problem.

VIII. Communications and Connections

The student will use language and symbolism in order to communicate mathematical ideas and make connections.

A. Communicates Interrelationships of Concepts

The student will use mathematical language and symbolism to communicate perceived interrelationships between concepts, express generalizations and analogies, and formulate mathematical definitions.

1. Applies Terminology of Algebra

The student will apply the terminology of algebra (e.g., polynomials, functions, conics, sets).

B. Communicates Ideas Visually/Orally/in Writing

The student will use mathematical language and symbolism in order to communicate mathematical ideas visually, orally, and in writing.

1. Presents Graphs/Charts/Other Data

The student will present graphs, charts, and other forms of organized data appropriately.

2. Communicates Ideas Orally

The student will express himself or herself orally in order to communicate mathematical ideas.

3. Expresses Ideas in Writing

The student will express his or her mathematical ideas in writing.

4. Asks Questions on Material Presented

The student will read written presentations, view visual presentations, listen to oral presentations of mathematics and ask clarifying and expounding questions related to the mathematics he or she reads, views, or hears.

C. Uses/Values Connections Between Math/Other Disciplines

The student will use and value the connection between mathematics and other disciplines.

1. Applies Math to Other Disciplines

The student will apply mathematical concepts to solving problems in other disciplines (e.g., physics, chemistry, biology).

2. Compiles/Organizes/Graphs Data

The student will compile, organize, and graph data for scientific experiments.

3. Complies Data/Forms Hypothesis/Makes Predictions

The student will compile data, form a hypothesis, and make predictions.

D. Displays Achievement in Understanding Connections

The student will display his or her achievement in understanding mathematical connections through investigations, performance tasks, writing, open-ended questions, portfolios, and other active assessments.

1. Creates Tables/Graphs/Equations

In the context of a math investigation, the student will create tables, graphs, and equations and connect results to other areas.