

# Intermediate Algebra

*Course Description and Competencies for Intermediate Algebra 4418*

## Course Description

Intermediate Algebra is designed to strengthen the students' conceptual and procedural algebraic skills by creating a bridge for skills from Algebra I and Geometry to future mathematical endeavours in a progression that will increase students' readiness for college, careers, and life. **This course has been developed to deepen student understanding by intentionally creating meaningful connections between various mathematical representations (i.e. symbolic, visual, and physical).** Intermediate Algebra will focus on strengthening and expanding the elements from Algebra 1 such as the number system, linear inequalities and linear functions and will serve as the foundation to branch into the study of polynomials, quadratic functions and statistics. This course will strengthen students' problem-solving abilities through the use of projects and collaborative learning.

## Vision and Guiding Principles

The Intermediate Algebra competencies are written with the same guiding principles as the *Oklahoma Academic Standards for Mathematics* and support students in the development of the Mathematical Actions and Processes outlined in the standards. The Intermediate Algebra competency writing team also utilized researched best-practices, NCTM's *Principles to Actions*, NCTM's *Essential Standards for High School Mathematics*, and the OAS-M for Algebra I and Algebra II to create the Intermediate Algebra competencies below.

Developing mathematical proficiency and literacy for Oklahoma students depends in large part on a clear, comprehensive, coherent, and developmentally appropriate set of competencies to guide curricular decisions. The understanding and implementation of these competencies and standards throughout PK-12 mathematics experience for students is based on the following guiding principles:

- *Guiding Principle 1:* Excellence in mathematics education requires equity—high expectations and strong support for all students.
- *Guiding Principle 2:* Mathematical ideas should be explored in ways that stimulate curiosity, create enjoyment of mathematics, and develop depth of understanding.
- *Guiding Principle 3:* An effective mathematics program focuses on problem solving.
- *Guiding Principle 4:* Technology is essential in teaching and learning mathematics.

The Intermediate Algebra competencies envision all students in Oklahoma will become mathematically proficient and literate through a strong mathematics program that emphasizes and engages them in problem solving, communicating, reasoning and proof, making connections, and using representations. Mathematically proficient and literate students can confidently and effectively use mathematics concepts, computation skills, and numbers to problem-solve, reason, and analyze information.

# Intermediate Algebra Competencies

## Oklahoma Mathematical Actions and Processes.

*The incorporation of the Oklahoma Mathematical Actions and Processes<sup>1</sup> were identified to be essential in the overall progression of PK-12 mathematics education. Throughout the implementation of the included competencies, it is essential to connect students to the holistic nature of mathematics that is represented within the Mathematical Actions and Processes. Throughout their PK-12 mathematical experience, students will:*

**Develop a Deep and Flexible Conceptual Understanding.** Demonstrate a deep and flexible conceptual understanding of mathematical concepts, operations, and relations while making mathematical and real-world connections.

**Develop Accurate and Appropriate Procedural Fluency.** Pursue efficient procedures for various computations and repeated processes based on a strong sense of numbers. They will develop a sophisticated understanding of the development and application of algorithms and procedures.

**Develop Strategies for Problem Solving.** Analyze the parts of complex mathematical tasks and identify entry points to begin the search for a solution. They will select from a variety of problem solving strategies and use corresponding multiple representations (verbal, physical, symbolic, pictorial, graphical, tabular) when appropriate. They will pursue solutions to various tasks from real-world situations and applications that are often interdisciplinary in nature. They will find methods to verify their answers in context and will always question the reasonableness of solutions.

**Develop Mathematical Reasoning.** Explore and communicate a variety of reasoning strategies to think through problems. They will apply their logic to critique the thinking and strategies of others to develop and evaluate mathematical arguments, including making arguments and counterarguments and making connections to other contexts.

**Develop a Productive Mathematical Disposition.** Hold the belief that mathematics is sensible, useful and worthwhile. They will develop the habit of looking for and making use of patterns and mathematical structures. They will persevere and become resilient, effective problem solvers.

**Develop the Ability to Make Conjectures, Model, and Generalize.** Make predictions and conjectures and draw conclusions throughout the problem solving process based on patterns and the repeated structures in mathematics. They will create, identify, and extend patterns as a strategy for solving and making sense of problems.

**Develop the Ability to Communicate Mathematically.** Discuss, write, read, interpret and translate ideas and concepts mathematically. As they progress, students' ability to communicate mathematically will include their increased use of mathematical language and terms and analysis of mathematical definitions.

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<sup>1</sup> The Mathematical Actions and Processes were included in the 2015 revisions of the Oklahoma Academic Standards for Mathematics. Each of the seven components is based on the Process Standards produced by the National Council of Teachers of Mathematics in 2000 and the interwoven strands of Mathematical Proficiency identified in the 2001 National Research Council report, Adding it Up.

## Intermediate Algebra Competencies (IA)

### Numbers and Operations (N)

*Reasoning with Numbers and Operations involves students developing number sense, understanding ways of representing numbers, analyzing relationships among numbers, and working with number systems beyond Algebra 1.*

#### **IA.N.1 Students will extend the understanding of the real number system.**

**IA.N.1.1** Explore and identify the similarities and differences in the subsets of real numbers, including counting, whole, integers, rational and irrational numbers.

**IA.N.1.2** Use applicable symbols to categorize real numbers and interpret mathematical situations.

#### **IA.N.2 Students will perform operations with real numbers.**

**IA.N.2.1** Use real numbers with various arithmetic operations involving radicals and simplify to both exact and approximate solutions.

**IA.N.2.2** Use all the properties of exponents to simplify monomials including zero and negative exponents.

**IA.N.2.3** Use the Pythagorean theorem and distance formula.

**IA.N.2.4** Find and illustrate the midpoint of a line segment given the two endpoints. Find and illustrate the endpoint of a line segment given one endpoint and the midpoint.

### Algebraic Reasoning & Algebra (A)

*Reasoning with Algebra involves students extending their mathematical understanding beyond the skills learned in Algebra 1. Students will have the opportunity to extend their knowledge of linear inequalities, absolute value functions and polynomials beyond the basic knowledge gathered in previous math classes. Students will become fluent with inequalities and absolute value equations as seen in real world situations.*

#### **IA.A.1 Students will have opportunities to represent, solve and interpret inequalities.**

**IA.A.1.1** Solve inequalities in one variable and graph the solutions on the number line.

**IA.A.1.2** Solve compound inequalities and graph their solutions on the number line.

**IA.A.1.3** Represent the solutions of systems of inequalities on the coordinate plane

**IA.A.1.4** Use algebraic, interval, and set notations to specify the solution sets of one and two variable inequalities.

**IA.A.1.5** Represent and solve real world situations with inequalities and interpret the solutions in their original context.

#### **IA.A.2 Students will solve absolute value equations and interpret the results.**

**IA.A.2.1** Solve absolute value equations in one variable and graph the solution sets on the number line.

**IA.A.2.2** Use set builder and interval notation to describe solutions to absolute value equations.

**IA.A.2.3** Model real world situations involving absolute value equations.

## Algebraic Reasoning & Algebra (A): *continued*

### IA.A.3 Students will simplify and perform operations with polynomials.

IA.A.3.1 Add and subtract various polynomials.

IA.A.3.2 Multiply various polynomials.

IA.A.3.3 Divide polynomials by binomials.

IA.A.3.4 Factor out the greatest common factor (constant or single variable only) of any polynomial.

IA.A.3.5 Identify zeros, roots, x-intercept, solutions of trinomials with a leading coefficient of 1 by factoring.

IA.A.3.6 Use the quadratic formula to find solutions of polynomials with a leading coefficient of 1.

IA.A.3.7 Use the discriminant ( $b^2-4ac$ ) to identify the number of real solutions of a polynomial.

IA.A.3.8 Factor difference of squares and perfect square trinomials with any leading coefficient.

IA.A.3.9 Identify zeros, roots, x-intercepts, solutions of trinomials with a leading coefficient **greater than 1** by factoring, using the quadratic formula, completing the square or other methods.

## Functions (F)

*Reasoning with functions provides students with opportunities to investigate multiple representations using the same data. Students will deepen their understanding of functions beyond understandings from Algebra 1.*

### IA.F.1 Students will analyze properties of functions through the use of data.

IA.F.1.1 Create and interpret graphs to solve mathematical and real-world problems.

IA.F.1.2 Identify the restrictions on the domain and range in real-world contexts.

IA.F.1.3 Write functions using function notation to model real-world situations.

IA.F.1.4 Identify the type of function used within a real-world situation while representing the function using tables, graphs or equations.

IA.F.1.5 Interpret function notation as an ordered pair and vice versa.

IA.F.1.6 Describe the contextual meaning of the coordinate point or interval within a function.

### IA.F.2 Students will create, analyze, and model transformations of absolute value and quadratic (in vertex form) functions.

IA.F.2.1 Identify and graph absolute value and vertex-form quadratic functions with vertical and horizontal translations.

IA.F.2.2 Understand the role of the leading coefficient of absolute value and vertex-form quadratic functions.

IA.F.2.3 Explore the effects of using different patterns to build absolute value and quadratic functions.

### IA.F.3 Students will create and interpret piecewise functions.

IA.F.3.1 Given a graph modeling a real-world situation, read and interpret piecewise-functions.

IA.F.3.2 Given a real-world situation, model the situation using a piecewise functions.

## Statistics (S)

*Statistics involves extending students' observational skills and ability to differentiate between types of data. Students will become fluent with data interpretation and choosing the best data display for any occasion.*

### **IA.S.1 Students will interpret and infer future trends using multiple representations of data.**

**IA.S.1.1** Recognize and interpret the different representations of data.

**IA.S.1.2** Use real-world scenarios to recognize patterns in problems.

**IA.S.1.3** Describe data patterns (clusters, outliers, associations) and distinguish between random/non-random sampling.

**IA.S.1.4** Identify the difference between correlation vs. causation of data.

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## Questions about this document?

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