

# Intermediate Algebra

The purpose of this course is to strengthen students' foundational conceptual and procedural skills in order to prepare students for college-and-career readiness. The course textbook, Algebra and Trigonometry Structure and Method Book 2 by Brown, Dolciani, Sorgenfrey, & Kane serves as the primary resource for students and informs sequencing of the topics of the course.

This guide is to be used in conjunction with the Intermediate Algebra Curriculum Map and the High School Flip Book in order to connect and clarify the essential understandings of the course and the Algebra I and Algebra II MCCRS State Standards that students are bridging.

## ESSENTIAL CURRICULUM

**Upon completion of Intermediate Algebra, students will be able to:**

### **A. Equations and Inequalities**

1. Define the field properties of the real number system: the commutative properties for addition and multiplication, the associative properties for addition and multiplication, the distributive property of multiplication over addition, the identities for addition and multiplication, and inverses for addition and multiplication
2. Identify the property being illustrated by a given statement
3. Use the field properties and order of operations to simplify an expression
4. Solve a literal equation for any of the variables in the equation
5. Use the addition and multiplication properties of equality to solve a linear equation in one variable
6. Evaluate a formula for specific values of the independent variables
7. Specify reasonable values for the variables in a formula
8. Rewrite a formula in terms of any of its variables
9. Indicate the operations that may be applied that leave the sense of an inequality unchanged and the operations that may be applied that change the sense of an inequality,
10. Write a compound sentence to describe an interval on a number line
11. Recognize that the connective 'and' corresponds to intersection and the connective 'or' corresponds to union
12. Solve a compound inequality and graph the solution
13. Solve a linear inequality and graph the solution
14. Write and solve an equation that answers a linear real-world problem
15. Write and solve an inequality that answers a linear real-world problem
16. Solve absolute value equations and inequalities.
17. Graph absolute value equations in two variables.

**B. Systems of Equations and Inequalities**

1. Describe what is meant by a consistent system and what is meant by an inconsistent system
2. Graph a system of linear equations in two variables and solve the system by graphing
3. Use graphing technology to solve a system of linear equations
4. Use substitution to solve a system of linear equations
5. Use addition (linear combinations) to solve a system of linear equations
6. Solve a real-world problem involving systems of equations
7. Use graphing to solve a system of linear, quadratic, or exponential inequalities
8. Use graphing technology to solve a system of inequalities, either linear or nonlinear

**C. Quadratic Equations**

1. Define the square root of a number and use the correct notation to denote square roots
2. Evaluate square roots
3. Simplify expressions involving square roots
4. Solve equations of the form  $x^2 = a$
5. Define quadratic equation
6. Evaluate quadratic expressions for specific values of the independent variable
7. Sketch a graph of a quadratic equation, both with and without using graphing technology
8. Explore the graphs of many quadratic equations and recognize that the graph of any quadratic equation is a parabola
9. Complete the square to express a quadratic equation in vertex form
10. Derive the quadratic formula
11. Solve a quadratic equation by factoring, by completing the square, or by using the quadratic formula depending upon the nature of the problem
12. Use the fact that the sum of the roots is  $-b/a$  and the product of the roots is  $c/a$  to write a quadratic equation, given its roots
13. Use the discriminant to determine whether a quadratic equation has 0, 1, or 2 real roots
14. Define imaginary number and complex number
15. Simplify square roots of negative numbers
16. Find the sum, difference, product, or quotient of two complex numbers
17. Solve a real-world problem involving a quadratic equation
18. Use the remainder/factor theorem

**D. Powers and Roots**

1. State the laws of exponents: product of powers property, power of a power property, power of a product property, quotient of powers property, power of a quotient property, and zero exponent property

2. Use the laws of exponents to simplify expressions involving positive and negative integer exponents
3. Evaluate expressions involving exponents, whether the exponents are positive or negative integers
4. Solve problems involving compound interest
5. Simplify expressions involving negative integer exponents so that the final result is written using only positive exponents
6. Define the  $n$ th root of a number
7. Find the  $n$ th root of a number with or without a calculator
8. Evaluate  $b^{1/n}$  for  $b > 0$
9. Evaluate  $b^{m/n}$  for  $b > 0$ , for positive or negative integer values of  $m$
10. Connect rational exponent notation with radical notation
11. Evaluate  $n$ th roots expressed in terms of radicals
12. Simplify expressions containing radicals
13. Solve equations involving radicals
14. Solve equations of the formula  $a(x - h)^n = b$
15. Solve a real-world problem that can be represented using powers or radicals

## **E. Polynomials**

1. Define a polynomial in the variable  $x$ . Students should be able to determine the degree of the polynomial
2. Describe some models that give rise to polynomials, such as compound interest situations and geometric area situations
3. Find the sum, difference, product, or quotient of two factorable polynomials
4. Expand  $(a + b)^2$  or  $(a - b)^2$
5. Students should be able to simplify  $(a + b)(a - b)$
6. Write a difference of squares binomial in factored form
7. Write a perfect square trinomial in factored form
8. Write a sum or difference of cubes binomial in factored form
9. Express a trinomial in factored form
10. Use graphing technology to determine the possible roots of a polynomial and use that information to write the polynomial in factored form
11. Find the roots of a polynomial by factoring and applying the zero product property
12. Use graphing technology to find the roots of a polynomial
13. Solve a real world situation that can be modeled by means of a polynomial
14. Use the method of finite differences to write a polynomial that describes a set of data points that can be modeled by means of a polynomial
15. Find the quotient of two polynomials using long or synthetic division
16. \*\*Solve problems involving direct and inverse variation

**F. Quadratic Relations**

1. Give the locus definition of a parabola
2. Write an equation in standard form for a parabola whose axis of symmetry is vertical and whose vertex is the origin
3. Use the locus definition to sketch a parabola
4. Solve a real-world problem involving a parabola
5. Find the distance between two points in a plane
6. Approximate the solutions of a quadratic-linear system by graphing, both with and without using graphing technology
7. Use substitution to find the exact solutions of a quadratic, parabolas only, -linear system
8. Approximate the solutions of a quadratic-quadratic system, parabolas only, by graphing, both with and without using graphing technology
9. Use substitution to find the exact solutions of a quadratic-quadratic, parabolas only, system
10. Solve a real-world problem involving a quadratic-linear or quadratic-quadratic system, parabolas and/or lines.

**G. Rational Equations and Expressions**

1. Define rational expression and indicate any restrictions on the variables
2. Simplify a rational expression and express the result in simplest terms
3. Find the sum or difference of two rational expressions and express the result in simplest terms
4. Find the product or quotient of two rational expressions and express the result in simplest terms
5. Define a complex fraction
6. Simplify a complex fraction and express the result in simplest terms
7. Solve a rational equation
8. Solve a real-world problem involving a rational equation

**H. Linear Relations**

1. Recognize that real situations involving a constant increase or decrease can be modeled by a linear equation in the form  $y = mx + b$
2. Recognize that real situations involving a linear combination can be modeled by a linear equation of the form  $ax + by = c$
3. Sketch the graph of a linear equation in slope-intercept form
4. Sketch the graph of a linear equation in the form  $ax + by = c$
5. Find the slope of a line through any two points
6. Write an equation for a line given its slope and y-intercept
7. Write an equation for a line given its slope and a point on the line

8. Write an equation for a line given two points on the line
9. Write equations for a real-world problem defined differently on different domains and use them to solve the problem
10. Graph a linear inequality in two variables

## **I. Functions**

1. Define function
2. Define the domain and range of a function
3. Specify the domain of a function
4. Specify the domain and range of a function
5. Use function notation
6. Evaluate functions for specific values of the independent variable
7. Use the vertical line test to determine whether or not a graph represents a function
8. Use graphing technology to sketch the graphs of a wide range of functions and then transfer the results to paper-and-pencil
9. Evaluate the greatest integer function for specific values of the independent variable
10. Sketch the graph of a step function, both with and without using graphing technology
11. Write an equation that describes a real-world situation modeled by a step function and then use the equation to answer questions about the situation
12. Sketch the graph of any linear function
13. Sketch the graph of any powering function of the form  $y = x^n$  where  $n$  is a positive integer
14. Sketch the graph of any quadratic function
15. Discuss symmetry of graphs of functions
16. Find the maximum and/or minimum values of a function
17. Use transformations (dilations, reflections, and/or translations) to graph functions.

## **J. Exponents and Logarithms**

1. Interpret logarithmic scales
2. Define logarithm to the base  $b$
3. Evaluate logarithms, both with and without using a calculator depending on the problem
4. Evaluate common logarithms, both with and without using a calculator
5. State properties of logarithms:  $\log_b 1 = 0$ ,  $\log_b b^n = n$ , the log of a product of two numbers, the log of a quotient of two numbers, and the log of a power of a number
6. Use properties of logarithms to rewrite logarithmic expressions and equations
7. Solve logarithmic equations

## **K. Trigonometry**

1. Find six trigonometric ratios when given two side lengths of a right triangle.

2. Solve a triangle when given two side lengths or a side length and an acute angle.