North Gibson School Corporation

High School Algebra I
SY 2022/2023

High School Algebra I

Units of Study			
Unit 1:	Expressions	7 days	1st semester
Unit 2:	Equations in One Variable	14 days	1st semester
Unit 3:	Relations and Functions	15 days	1st semester
Unit 4/5:	Linear Functions	22 days	1st semester
Unit 12:	Statistics	7 days	1st semester
Unit 6:	Linear Inequalities	15 days	1st semester
Unit 7:	Systems of Linear Equations and Inequalities	14 days	2nd semester
Unit 8/9:	Exponents and Exponential Functions	15 days	2nd semester
Unit 10:	Polynomials	22 days	2nd semester
Unit 11A:	Quadratic Functions	12 days	2nd semester
Unit 11B:	Simplify Square Roots	10 days	2nd semester

Appendices

Appendix A: Proficiency Scale Template

Appendix B: Curriculum Refinement Form

Appendix C: North Gibson Priority Standards Vertical Articulation Document

High School Algebra I Priority Standards

Priority Standards	**AI.DS.3**	Use technology to find a linear function that models a relationship between two quantitative variables to make predictions, and interpret the slope and y-intercept. Using technology, compute and interpret the correlation coefficient.
	AI.F.4	Describe, qualitatively, the functional relationship between two quantities by analyzing key features of a graph. Sketch a graph that exhibits given key features of a function that has been verbally described, including intercepts, where the function is increasing or decreasing, where the function is positive or negative, and any relative maximum or minimum values, Identify the independent and dependent variables.
	AI.L.1	Represent real-world problems using linear equations and inequalities in one variable, including those with rational number coefficients and variables on both sides of the equal sign. Solve them fluently, explaining the process used and justifying the choice of a solution method.
	AI.L.4	Represent real-world problems that can be modeled with a linear function using equations, graphs, and tables; translate fluently among these representations, and interpret the slope and intercepts.
	AI.L.6	Represent real-world problems using linear inequalities in two variables and solve such problems; interpret the solution set and determine whether it is reasonable. Graph the solutions to a linear inequality in two variables as a half-plane.
	AI.NE.5	Add, subtract, and multiply polynomials. Divide polynomials by monomials.
	AI.QE.2	Represent real-world and other mathematical problems that can be modeled with simple exponential functions using tables, graphs, and equations of the form y = ab^x (for integer values of x > 1, rational values of b > 0 and b ≠ 1) with and without technology; interpret the values of a and b.
	AI.QE.4	Solve quadratic equations in one variable by inspection (e.g., for x^2 = 49), finding square roots, using the quadratic formula, and factoring, as appropriate to the initial form of the equation.
	AI.QE.5	Represent real-world problems using quadratic equations in one or two variables and solve such problems with technology. Interpret the solution(s) and determine whether they are reasonable.
	AI.QE.6	Graph exponential and quadratic functions with and without technology. Identify and describe key features, such as zeros, lines of symmetry, and extreme values in real-world and other mathematical problems involving quadratic functions with and without technology; interpret the results in the real-world contexts.
	AI.SEI.3	Write a system of two linear equations in two variables that represents a real-world problem and solve the problem with and without technology. Interpret the solution and determine whether the solution is reasonable.
	AI.SEI.4	Represent real-world problems using a system of two linear inequalities in two variables. Graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes with and without technology. Interpret the solution set and determine whether it is reasonable.

Standards Breakdown

★: Priority Standards ●: Supporting Standards —: Additional Standards

STANDARDS		UNITS										
		1	2	3	4/5	12	6	7	8/9	10	11A	11B
Data Analysis and Statistics	1					●						
	2					●						
	3				★							
	4				●							
	5					●						
Functions	1			●								
	2			●								
	3			●								
	4			★							★	
Linear Equations, Inequalities, and Functions	1		★				★					
	2						—					
	3				●							
	4				★							
	5				●							
	6						★					
	7		●									
Number Systems and Expressions	1										—	
	2								●			
	3											●
	4									●		
	5									★		
Quadratic and Exponential Equations and Functions	1								●			
	2								★			
	3										—	
	4										★	★
	5										★	
	6								★		★	
	7										●	
Systems of Equations and Inequalities	1							●				
	2							●				
	3							★				
	4							★				

Unit 1: Expressions (7 days, 1st semester)

General Description of the Unit This unit serves as a review of expressions and other algebraic concepts from previous grade levels.		
Priority Standards • N/A	**Supporting Standards** • N/A	
Enduring Understandings • N/A	**Essential Questions** • N/A	
Key Concepts • N/A	**Related Concepts** • N/A	**Vocabulary** • N/A
Mathematical Processes • N/A		
Resources		
Proficiency Scales • N/A	**Digital** • N/A	**Manipulatives** • N/A
School Resources		
Textbook Textbook: Indiana Reveal by McGraw-Hill Module 1: Expressions 1.1 Numerical Expressions (Review) 1.2 Algebraic Expressions (Review) 1.3 Properties of Real Numbers (Review) 1.4 Distributive Property (Review) 1.5 Expressions Involving Absolute Value (Review) 1.6 Descriptive Modeling and Accuracy (Review)	**Formative Assessments**	

General Description of the Unit

This unit serves as an extension of the work around solving equations that students did in 8th grade. In 8th grade, students covered solving linear equations with rational coefficients that may involve distribution, so this aspect will be a review. Now students will extend this work to fluently solve complex equations and use them to represents real-world problems. Students will also solve literal equations for the first time.

Notes: Be sure to include real-world word problems throughout the unit. Section 2.3 may need to be supplemented to include equations involving the distributive property and combining like terms.

Priority Standards

- **AI.L.1:** Represent real-world problems using linear **equations** and inequalities in one variable, including those with rational number coefficients and variables on both sides of the equal sign. Solve them fluently, explaining the process used and justifying the choice of a solution method.

Supporting Standards

- **AI.L.7:** Solve linear and quadratic equations and formulas for a specified variable to highlight a quantity of interest, using the same reasoning as in solving equations.

Enduring Understandings

- Real-world situations can be modeled with equations and inequalities. When a relationship needs to be exactly the same, an equation is usually used. Inequalities are typically used when a minimum or maximum value is needed.
- Solving an equation or formula for a different variable can reveal new information about the context.

Essential Questions

- How does comparing quantities describe the relationship between them?
- What are the similarities and differences in solving and expressing the solutions to equations and inequalities?
- How do I know when a result is reasonable?
- Why might an architect want to solve the rectangle area formula for the base, b?

Key Concepts

- I can represent real-world problems using linear equations in one variable. (AI.L.1)
- I can represent real-world equations and inequalities with variables on both sides of the equal sign. (AI.L.1)
- I can solve a variety of linear equations in one variable fluently. (AI.L.1)
- I can explain my choice of solution method and process used to solve real world equations and inequalities. (AI.L.1)

Related Concepts

- I can solve linear equations and formulas for a specified variable. (AI.L.7)
- I can solve quadratic equations and formulas for a specified variable. (AI.L.7)
- I can extend my understanding of solving equations for a value to solving an equation for a variable. (AI.L.7)

Vocabulary

- Coefficient
- Linear equation
- Quadratic equation
- Rational number
- Variable

Mathematical Processes

- PS.1 Make sense of problems and persevere in solving them.
- PS.7 Look for and make use of structure.

Resources

Proficiency Scales

- AI.L.1

Digital

- IDOE Examples/Tasks AI.L.1
- IDOE Examples/Tasks AI.L.7

Manipulatives

- Algebra Tiles
- Scientific Calculator
- Virtual Number Line

School Resources	
Textbook Module 2: Equations in one variable 2.1 Writing and Interpreting Equations: AI.L.1 2.2 Solving One-Step Equations (Review) 2.3 Solving Multi-Step Equations (Review) 2.4 Solving Equations with the Variable on Each Side: AI.L.1 2.5 Solving Equations involving Absolute Value (SKIP) 2.6 Solving Proportions: AI.L.1 2.7 Using Formulas: AI.L.7	**Formative Assessments**

General Description of the Unit

In this unit students explore function notation, a foundational topic for the rest of the course. While the definition of a function was taught in 8th grade, the topic is covered much more deeply here. Function notation, classifying functions (as function or relation), evaluating functions, and domain/range are all covered. Students will also analyze key features of graphs and will sketch a graph from a verbal description.

Notes: Section 3.3 does not align with any Algebra 1 Indiana Academic Standards (IAS); key parts of the section will be taught when covering section 3.1.

Priority Standards

- **AI.F.4:** Describe, qualitatively, the functional relationship between two quantities by analyzing key features of a graph. Sketch a graph that exhibits given key features of a function that has been verbally described, including intercepts, where the function is increasing or decreasing, where the function is positive or negative, and any relative maximum or minimum values, Identify the independent and dependent variables.

Supporting Standards

- **AI.F.1:** Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. Understand that if f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. Understand the graph of f is the graph of the equation y = f(x) with points of the form (x, f(x)).
- **AI.F.2:** Evaluate functions for given elements of its domain, and interpret statements in function notation in terms of a context.
- **AI.F.3:** Identify the domain and range of relations represented in tables, graphs, verbal descriptions, and equations.

Enduring Understandings

- All graphs contain key features that reveal important information about the function and/or situation being modeled.
- A function is a way to model a relationship between two sets, where every input (domain, x) has one output (range, y).
- To evaluate a function for a certain value, substitute the value in for the given variable and simplify.
- Domain is the set of all inputs, and range is the set of all outputs. They can be expressed using set notation or inequalities.

Essential Questions

- What is a real-world situation that could be modeled by a function? What would the key features of the graph tell us about the situation?
- How are functions and relations similar? How are they different?
- How does examining the domain and range of a function reveal additional information about the function?

Key Concepts

- I can describe the relationship between two quantities by analyzing a graph. (AI.F.4)
- I can sketch the intercepts of a graph described verbally. (AI.F.4)
- I can sketch the intervals of increase and decrease of a graph described verbally. (AI.F.4)
- I can sketch the intervals where a function is positive or negative described verbally. (AI.F.4)
- I can sketch any relative maximum or minimum values of a graph described verbally. (AI.F.4)
- I can identify the independent and dependent variables of a function described verbally. (AI.F.4)

Related Concepts

- I can determine whether a relation is a function given a set of ordered pairs, a table, mapping diagram or a graph. (AI.F.1)
- I can represent relations and functions using concrete, verbal, numeric, graphic, and algebraic forms. (AI.F.1)
- Given one representation, I can represent a relation or function in another form. (AI.F.1)
- I can find f(x) for each x in the domain of f. (AI.F.1)
- I can relate (x, y) to (x, f(x)). (AI.F.1)
- I can evaluate functions for given elements of its domain. (AI.F.2)
- I can interpret statements in function notation in terms of a context. (AI.F.2)

Vocabulary

- Decreasing function
- Dependent variable
- Domain
- Element
- f(x)
- Function
- Function notation
- Increasing function
- Independent variable
- Input
- Intercept
- Mapping diagram
- Negative function
- Output
- Positive function
- Quantitative
- Range
- Relation
- Relative maximum

• I can sketch a graph that exhibit key qualitative features that has been verbally described. (AI.F.4)	• I can describe the domain and range of relations represented in a table. (AI.F.3) • I can describe the domain and range of relations represented in a graph. (AI.F.3) • I can describe the domain and range of relations represented in an equation. (AI.F.3) • I can describe the domain and range of relations stated verbally. (AI.F.3)	• Relative minimum

Mathematical Processes

- PS.4 Model with mathematics.
- PS.7: Look for and make use of structure.

Resources

Proficiency Scales	Digital	Manipulatives
• AI.F.4	• IDOE Examples/Tasks AI.F.4 • IDOE Examples/Tasks AI.F.1 • IDOE Examples/Tasks AI.F.2 • IDOE Examples/Tasks AI.F.3	• Function Machine • Graph Paper • Graphing Calculator • Scientific Calculator • Virtual Graph Paper

School Resources

Textbook	Formative Assessments
Module 3: Relations and Functions 3.1 Representing Relations: AI.F.1 3.3 Linearity and Continuity of Graphs (not an Algebra I IAS) 3.2 Functions: AI.F.1, AI.F.2, AI.F.3 3.4 Intercepts of Graphs: AI.F.1, AI.F.4 3.5 Shapes of Graphs: AI.F.4 3.6 Sketching Graphs and Comparing Functions: AI.F.4	

General Description of the Unit

Now students will begin graphing functions. Students will review graphing linear functions (from 8th grade) and translating between representations (equation, table, graph) and equation-types (point-slope, slope-intercept, and standard forms). All this work should extend beyond abstract math into real-world situations, including interpreting the slope and y-intercept within the context. Additionally, linear functions will be used to model data and make predictions, using technology to find the regression line and correlation coefficient.

Priority Standards

- **AI.L.4:** Represent real-world problems that can be modeled with a linear function using equations, graphs, and tables; translate fluently among these representations, and interpret the slope and intercepts.
- **AI.DS.3:** Use technology to find a linear function that models a relationship between two quantitative variables to make predictions, and interpret the slope and y-intercept. Using technology, compute and interpret the correlation coefficient.

Supporting Standards

- **AI.L.3:** Represent linear functions as graphs from equations (with and without technology), equations from graphs, and equations from tables and other given information (e.g., from a given point on a line and the slope of the line). Find the equation of a line, passing through a given point, that is parallel or perpendicular to a given line.
- **AI.L.5:** Translate among equivalent forms of equations for linear functions, including slope-intercept, point-slope, and standard. Recognize that different forms reveal more or less information about a given situation.
- **AI.DS.4:** Distinguish between correlation and causation.

Enduring Understandings

- Point-slope form and slope-intercept form of linear equations aid in the process of switching between representations (table, graph, equation) of the function.
- Parallel lines have the same slope; perpendicular lines have opposite reciprocal slopes.
- A different representation highlights different features of a function, such as the input, output, slope, solution (or solution set), and intercepts.
- Some data can be modeled by a linear function; the equation, slope, y-intercept, and correlation coefficient reveal key information about the scenario.
- Correlation does not necessarily imply causation.

Essential Questions

- When using a linear function to make predictions, what limitations might apply?
- Why is it useful to use multiple representations of linear equations?
- What is an example of two things in your life that are correlated without causation?
- In what settings would you prefer to be given an equation in point-slope form?

Key Concepts

- I can use technology to find a linear function that models a relationship between two quantitative variables in a scatter plot. (AI.DS.3)
- I can use a linear model to make predictions beyond and within the data set. (AI.DS.3)
- I can interpret the slope and y-intercept found in the context of the data graphed. (AI.DS.3)
- I can use technology to find the correlation coefficient of a linear model for a scatter plot. (AI.DS.3)
- Given the correlation coefficient, I can assess the accuracy of my predictions beyond and within the data set. (AI.DS.3)
- I can write the equation of a linear function to model a real-world situation. (AI.L.4)

Related Concepts

- I can differentiate between the definitions of correlation and causation. (AI.DS.4)
- I can identify causal fallacies such as common underlying cause or coincidence and apply this knowledge to real-world situations. (AI.DS.4)
- I can determine if the relationship between bivariate data is correlated or causal. (AI.DS.4)
- I can graph a linear equation given its equation with technology. (AI.L.3)
- I can graph a linear equation given its equation without technology. (AI.L.3)
- I can write a linear equation given its graph. (AI.L.3)

Vocabulary

- Causation
- Coincidence
- Common underlying cause
- Correlation
- Correlation coefficient
- Decreasing
- Fallacy
- Increasing
- Linear function
- Parallel
- Perpendicular
- Point-slope form
- Quantitative variable
- Slope
- Slope-intercept form
- Standard form
- Y-intercept

• I can translate among linear representations. (AI.L.4) • I can identify the slope and y-intercept of a linear function in the context of a real-world situation. (AI.L.4) • I can interpret the slope and y-intercept of a linear function that represents a real-world situation. (AI.L.4)	• I can identify the slope and y-intercept given a graph, equation, or table. (AI.L.3) • I can write a linear equation given a table of values. (AI.L.3) • I can write a linear equation given the slope and a point on the line. (AI.L.3) • I can write a linear equation given two points on the line. (AI.L.3) • I can write the equation of a line that is parallel to a given line and through a given point. (AI.L.3) • I can write the equation of a line that is perpendicular to a given line and through a given point. (AI.L.3) • I can identify a linear function as being written in either slope-intercept form, point-slope form, or standard form. (AI.L.5) • I can manipulate a linear function written in any form to another form. (AI.L.5) • I can identify the benefits of writing a linear function in various forms. (AI.L.5)	

Mathematical Processes

- PS.3 Construct convincing arguments and critique the reasoning of others.
- PS.4 Model with mathematics.

Resources

Proficiency Scales	Digital	Manipulatives
• AI.L.4 • AI.DS.3	• IDOE Examples/Tasks AI.DS.3 • IDOE Examples/Tasks AI.L.4 • IDOE Examples/Tasks AI.DS.4 • IDOE Examples/Tasks AI.L.3 • IDOE Examples/Tasks AI.L.5	• Graph Paper • Graphing Calculator • Line of Best Fit • Scientific Calculator • Virtual Graph Paper

School Resources	
Textbook Module 4: Linear and Nonlinear Functions 4.1 Graphing Linear Functions: AI.L.3 4.2 Rate of Change and Slope (not entirely an Algebra I IAS: AI.L.4) 4.3 Slope-Intercept Form: AI.L.3 Module 5: Creating Linear Equations 5.1 Writing Equations in Slope-Intercept Form: AI.L.3, AI.L.4 5.2 Writing Equations in Standard and Point-Slope Forms: AI.L.3, AI.L.4, AI.L.5 5.3 Scatter Plots and Lines of Fit: AI.DS.3 Explore 5.3 Making Predictions Using a Scatter Plot: AI.DS.3 5.4 Correlation and Causation: AI.DS.4 5.5 Linear Regression: AI.DS.3 4.4 Transformations of Linear Functions (SKIP) 4.5 Arithmetic Sequences (SKIP) 4.6 Piecewise and Step Functions (SKIP) 4.7 Absolute Value Functions (SKIP) 5.6 Inverses of Linear Functions (SKIP)	**Formative Assessments**

General Description of the Unit

In this unit, students will continue to work with bivariate data analysis. They will start by exploring different data collection methods, along with how bias can be built into both the collection method and the data representation. Additionally, they will explore with two-way frequency tables and use them to identify associations and trends.

Note: The unit can begin with an optional supplemental review of measures of center and spread. Section 12.1 is a potential resource for this review.

Priority Standards

- N/A

Supporting Standards

- **AI.DS.1:** Understand statistics as a process for making inferences about a population based on a random sample from that population. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
- **AI.DS.2:** Understand that statistics and data are non-neutral and designed to serve a particular interest. Analyze the possibilities for whose interest might be served and how the representations might be misleading.
- **AI.DS.5:** Summarize bivariate categorical data in two-way frequency tables. Interpret relative frequencies in the contexts of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in data.

Enduring Understandings

- Two-way frequency tables organize categorical bivariate data and can reveal possible associations.
- There are multiple methods for gathering and interpreting data about a population; each method has strengths and weaknesses.
- The way that data is collected, organized and displayed influences interpretation.

Essential Questions

- What is a scenario where a two-way frequency table would be a good way to display and examine the data?
- When deciding which method to use for gathering data, what should be considered?
- How can the same data lead to different conclusions?

Key Concepts

- N/A

Related Concepts

- I can distinguish between the population and a sample of the population. (AI.DS.1)
- I can make inferences about a population based on a random sample from that population. (AI.DS.1)
- I can recognize the differences among sample surveys, experiments, and observational studies. (AI.DS.1)
- I can explain how randomization relates to sample surveys, experiments, and observational studies. (AI.DS.1)
- I can understand that numbers are neutral but data is non-neutral. (AI.DS.2)
- I can argue the idea that data is gathered to serve interests. (AI.DS.2)

Vocabulary

- Bias
- Bivariate data
- Conditional relative frequency
- Data
- Experiments
- Frequency
- Inference
- Joint relative frequency
- Marginal relative frequency
- Non-neutral
- Observational study
- Population
- Random sample
- Randomization
- Relative frequency
- Sample
- Sample survey
- Statistics
- Two-way table

	• I can identify sources of bias in data reporting or misleading representation of data. (AI.DS.2) • I can summarize bivariate categorical data in a two-way table. (AI.DS.5) • I can interpret relative frequencies in the context of data. (AI.DS.5) • I can interpret joint relative frequencies in the context of data. (AI.DS.5) • I can interpret marginal relative frequencies in the context of data. (AI.DS.5) • I can interpret conditional relative frequencies in the context of data. (AI.DS.5) • I can recognize possible associations and trends in data. (AI.DS.5)	

Mathematical Processes

- PS.3 Construct convincing arguments and critique the reasoning of others.
- PS.4 Model with mathematics.

Resources

Proficiency Scales	Digital	Manipulatives
• N/A	• IDOE Examples/Tasks AI.DS.1 • IDOE Examples/Tasks AI.DS.2 • IDOE Examples/Tasks AI.DS.5	• Graph Paper • Virtual Graph Paper

School Resources

Textbook	Formative Assessments
Module 12: Statistics Supplemental Review: Mean, Median, Mode, Range (12.1 optional resource) 12.3 Using Data: AI.DS.1, AI.DS.2 Explore 12.3 Phrasing Questions: AI.DS.2 12.7 Summarizing Categorical Data: AI.DS.5 Exploring Categorical Data: AI.DS.5 12.1 Measures of Center (Optional Resource for Supplemental Review Lesson) 12.2 Representing Data (SKIP) 12.4 Measures of Spread (SKIP) 12.5 Distributions of Data (SKIP) 12.6 Comparing Sets of Data (SKIP)	

General Description of the Unit

In this unit, students will work with one-variable and two-variable inequalities. Students solved one-variable inequalities in 8th grade; here, they will solve more complex inequalities and will use them to solve real-world problems. They will also solve compound inequalities for the first time. Finally, students will graph two-variable inequalities and will use them to solve real-world problems.

Note: Be sure to include ample practice with real-world examples.

Priority Standards

- **AI.L.6:** Represent real-world problems using linear inequalities in two variables and solve such problems; interpret the solution set and determine whether it is reasonable. Graph the solutions to a linear inequality in two variables as a half-plane.
- **AI.L.1:** Represent real-world problems using linear equations and **inequalities** in one variable, including those with rational number coefficients and variables on both sides of the equal sign. Solve them fluently, explaining the process used and justifying the choice of a solution method.

Additional Standards

- **AI.L.2:** Solve compound linear inequalities in one variable, and represent and interpret the solution on a number line. Write a compound linear inequality given its number line representation.

Enduring Understandings

- Compound inequalities use "and" or "or" to consider two inequalities at the same time. In an "and" situation, the solutions need to satisfy both inequalities. In an "or" situation, the solutions need to satisfy just one of the inequalities.
- Solutions to a two-variable linear inequality may lie on the line, above the line, and/or below the line.

Essential Questions

- How is the process for solving a single inequality similar to solving a compound inequality? How is it different?
- What is a scenario where a "less than" inequality would be a better model than a "less than or equal to" inequality? Why?

Key Concepts

- I can represent real-world problems using linear inequalities in one variable. (AI.L.1)
- I can represent real-world equations and inequalities with variables on both sides of the equal sign. (AI.L.1)
- I can solve a variety of linear inequalities in one variable fluently. (AI.L.1)
- I can justify each step I take in solving a linear equation or inequality. (AI.L.1)
- I can explain my choice of solution method and process used to solve real world equations and inequalities. (AI.L.1)
- I can write a linear inequality in two variables to represent real-world problems. (AI.L.6)
- I can graph a linear inequality in two variables that represents a real-world problem. (AI.L.6)
- Given a graph of a linear inequality that represents a real-world problem, I can identify and interpret the solution set. (AI.L.6)

Related Concepts

- I can solve compound linear inequalities in one variable. (AI.L.2)
- I can represent the solution to a compound linear inequality in one variable. (AI.L.2)
- I can interpret the solution to a compound linear inequality in one variable. (AI.L.2)
- I can write a compound linear inequality given its number line representation. (AI.L.2)

Vocabulary

- Coefficient
- Compound inequality
- Linear equation
- Linear inequality
- Rational number
- Solution set

• I can assess the reasonableness of the solution set of a linear inequality. (AI.L.6)		

Mathematical Processes

- PS.1 Make sense of problems and persevere in solving them.
- PS.7 Look for and make use of structure.

Resources

Proficiency Scales	Digital	Manipulatives
• AI.L.1 • AI.L.6	• IDOE Examples/Tasks AI.L.1 • IDOE Examples/Tasks AI.L.6 • IDOE Examples/Tasks AI.L.2	• Algebra Tiles • Graph Paper • Graphing Calculator • Scientific Calculator • Virtual Graph Paper • Virtual Number Line

School Resources

Textbook	Formative Assessments
Module 6: Linear Inequalities 6.1 Solving One-Step Inequalities (Review) 6.2 Solving Multi-Step Inequalities: AI.L.1 Explore 6.2 Modeling Multi-Step Inequalities: AI.L.1 6.3 Solving Compound Inequalities: AI.L.2 Explore 6.3 Guess the Range: AI.L.2 6.4 Solving Absolute Value Inequalities (SKIP) 6.5 Graphing Inequalities in Two Variables: AI.L.6 Explore 6.5 Graphing Linear Inequalities on the Coordinate Plane: AI.L.6	

General Description of the Unit

This unit covers systems of equations and inequalities. While systems of equations were taught in 8th grade, no algebraic methods of solving were covered. Now, students will use elimination, substitution, and technology, along with graphing, to solve a system of equations. Systems of inequalities are an entirely new concept to students; students will graph the two-variable system of inequalities and determine if a given point lies in the solution set. Finally, students will apply both systems of equations and inequalities to solve a real-world problem by writing a system, solving the system, and ensuring the solution is reasonable within the context.

Note: In section 7.3, elimination problems involving subtraction can be solved by distributing the negative to be able to use addition.

Priority Standards

- **AI.SEI.3:** Write a system of two linear equations in two variables that represents a real-world problem and solve the problem with and without technology. Interpret the solution and determine whether the solution is reasonable.
- **AI.SEI.4:** Represent real-world problems using a system of two linear inequalities in two variables. Graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes with and without technology. Interpret the solution set and determine whether it is reasonable.

Supporting Standards

- **AI.SEI.1:** Understand the relationship between a solution of a system of two linear equations in two variables and the graphs of the corresponding lines. Solve pairs of linear equations in two variables by graphing; approximate solutions when the coordinates of the solution are non-integer numbers.
- **AI.SEI.2:** Verify that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions, including cases with no solution and infinitely many solutions. Solve systems of two linear equations algebraically using elimination and substitution methods.

Enduring Understandings

- Writing and solving a system of linear equations or inequalities to represent a real-world situation can be an efficient strategy to find a solution for a real-world scenario with multiple constraints.
- The solution to a system of equations is the point or points that satisfy both equations.
- A system of equations can be solved by graphing, substitution, or elimination; examine the system to identify the most efficient method.

Essential Questions

- What key factors should we consider in a real-world scenario to distinguish between needing a single equation or a system of equations?
- How does the solution to an equation differ from the solution to a system of equations? How is it similar?
- What key factors should we consider when selecting a method for solving a system of equations?

Key Concepts

- I can write a system of linear equations to represent a real-world problem. (AI.SEI.3)
- I can solve a system of linear equations representing a real-world problem using any method (graphing, elimination, substitution). (AI.SEI.3)
- I can interpret and assess the solution to a system of linear equations representing a real-world problem. (AI.SEI.3)
- I can write a system of linear inequalities in two variables to represent a real-world problem. (AI.SEI.4)
- I can graph a system of linear inequalities in two variables and identify the solution set. (AI.SEI.4)

Related Concepts

- I can identify the solution to a system of linear equations given the graph as the point of intersection. (AI.SEI.1)
- I can substitute the point of intersection of a system of linear equations in to each equation to verify the point of intersection is the solution to the pair of linear equations. (AI.SEI.1)
- I can approximate the solution to a system linear equations graphically and assess the reasonableness of my estimation. (AI.SEI.1)
- I can use the elimination method for solving a system of two linear equations. (AI.SEI.2)
- I can determine the factor by which one equation should be multiplied to create an equivalent system of linear equations. (AI.SEI.2)

Vocabulary

- Elimination method
- Half-plane
- Infinitely many solutions
- Integer
- Non-integer
- Solution set
- Substitution method
- System of linear equations
- System of linear inequalities

• I can decide if the solution set of a system of linear inequalities is reasonable in context. (AI.SEI.4)	• I can use the substitution method for solving a system of two linear equations. (AI.SEI.2) • I can identify if a system of two linear equations has one solution, no solution, or infinitely many solutions graphically. (AI.SEI.2) • I can identify if a system of two linear equations has one solution, no solution, or infinitely many solutions algebraically. (AI.SEI.2)	

Mathematical Processes

- PS.6 Attend to precision.
- PS.8 Look for and express regularity in repeated reasoning.

Resources

Proficiency Scales	Digital	Manipulatives
• AI.SEI.3 • AI.SEI.4	• IDOE Examples/Tasks AI.SEI.3 • IDOE Examples/Tasks AI.SEI.4 • IDOE Examples/Tasks AI.SEI.1 • IDOE Examples/Tasks AI.SEI.2	• Graph Paper • Graphing Calculator • Scientific Calculator • Virtual Graph Paper

School Resources

Textbook	Formative Assessments
Module 7: Systems of Linear Equations and Inequalities 7.1 Graphing Systems of Equations: AI.SE.1, AI.SE.3 7.2 Substitution: AI.SE.2, AI.SE.3 7.3 Elimination using Addition and Subtraction: AI.SE.2, AI.SE.3 7.4 Elimination using Multiplication: AI.SE.2, AI.SE.3 7.5 Systems of Inequalities: AI.SE.4	

General Description of the Unit

In this unit, students work with algebraic manipulations involving exponents. It builds upon 8th grade standards to review exponential rules for simplifying expressions, including rational expressions with exponents. Then students explore two-variable exponential relationships. This unit is primarily an overview to exponential relationships; a deeper dive into the relationship comes in Algebra 2. Students explore the difference between linear and exponential growth, which prepares them to graph simple exponential functions with and without technology. Finally, students will use simple exponential functions to model real-world relationships; they will express these relationships as equations, tables, and graphs.

Priority Standards

- **AI.QE.2:** Represent real-world and other mathematical problems that can be modeled with simple exponential functions using tables, graphs, and equations of the form y = ab^x (for integer values of x > 1, rational values of b > 0 and b ≠ 1) with and without technology; interpret the values of a and b.
- **AI.QE.6:** Graph **exponential** and quadratic functions with and without technology. Identify and describe key features, such as zeros, lines of symmetry, and extreme values in real-world and other mathematical problems involving quadratic functions with and without technology; interpret the results in the real-world contexts.

Supporting Standards

- **AI.NE.2:** Simplify algebraic rational expressions, with numerators and denominators containing monomial bases with integer exponents, to equivalent forms.
- **AI.QE.1:** Distinguish between situations that can be modeled with linear functions and with exponential functions. Understand that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. Compare linear functions and exponential functions that model real-world situations using tables, graphs, and equations.

Enduring Understandings

- When simplifying expressions with exponents, exponent rules can only be applied to terms with the same base.
- Exponential growth occurs in situations or tables where a quantity is growing by a multiple. In the equation $y=ab^x$, the a is the initial value and b is the growth rate.
- The graph of an exponential function has a single asymptote and is either always increasing or always decreasing.
- If the difference between successive terms is constant, the function is linear and if the ratio of successive terms is constant, the function is exponential.

Essential Questions

- Why is it helpful to be able to represent numbers and expressions in multiple forms?
- How is the graph of an exponential function similar to that of a linear function? How is it different?
- What types of situations are often modeled by an exponential function?

Key Concepts

- I can model simple exponential functions graphically, numerically, and algebraically with technology. (AI.QE.2)
- I can model simple exponential functions graphically, numerically, and algebraically without technology. (AI.QE.2)
- I can extend my understanding of exponential functions to real-world situations. (AI.QE.2)
- I can describe the important values of an exponential function and how they present in an equation, table, or graph. (AI.QE.2)
- I can interpret the values of a and b in y = ab^x in context. (AI.QE.2)
- I can graph an exponential function with and without technology. (AI.QE.6)

Related Concepts

- I can simplify rational expressions containing monomial bases with integer exponents in the numerator and/or denominator using the properties of exponents. (AI.NE.2)
- I can divide monomials. (AI.NE.2)
- I can give examples of situations that would be modeled with a linear function and those that would be modeled with an exponential function. (AI.QE.1)
- I can identify an exponential function graphically, numerically, and algebraically. (AI.QE.1)
- I can identify a linear function graphically, numerically, and algebraically. (AI.QE.1)
- I can find the constant rate of change or the constant ratio of

Vocabulary

- Denominator
- Equivalent
- Exponential function
- Extreme value
- Factor
- Factoring
- Integer
- Interval
- Line of symmetry
- Linear function
- Monomial
- Monomial algebraic expression
- Numerator
- Parabola
- Parent function
- Properties of exponents
- Rational
- Rational expression
- Transformations

• I can graph various transformations of the parent exponential function. (AI.QE.6)	change given a table, graph, or equation. (AI.QE.1) • I can model real-world situations both exponentially and linearly using tables, graphs, or equations. (AI.QE.1)	• Zeros of a function

Mathematical Processes

- PS.2 Reason abstractly and quantitatively.
- PS.5 Use tools appropriately.

Resources

Proficiency Scales	Digital	Manipulatives
• AI.QE.2 • AI.QE.6	• IDOE Examples/Tasks AI.QE.2 • IDOE Examples/Tasks AI.QE.6 • IDOE Examples/Tasks AI.NE.2 IDOE Examples/Tasks AI.QE.1	• Algebra Tiles • Graph Paper • Graphing Calculator • Scientific Calculator • Virtual Graph Paper

School Resources

Textbook	Formative Assessments
Module 8: Exponents and Roots 8.3 Negative Exponents (includes zero exponents): AI.NE.2 8.1 Multiplication Properties of Exponents: AI.NE.2 8.2 Division Properties of Exponents: AI.NE.2 Module 9: Exponential Functions 9.1 Exponential Functions: AI.QE.1, AI.QE.2, AI.QE.6 9.3 Writing Exponential Functions: AI.QE.2 8.4 Rational Exponents (not an Algebra I IAS) – UNIT 11B 8.5 Simplifying Radical Expressions: AI.NE.3 – UNIT 11B 8.6 Operations with Radical Expressions (not an Algebra I IAS) – UNIT 11B 8.7 Exponential Equations (SKIP) 9.2 Transformations of Exponential Functions (SKIP) 9.4 Transforming Exponential Expressions (SKIP) 9.5 Geometric Sequences (SKIP) 9.6 Recursive Formulas (SKIP)	

General Description of the Unit

Before diving deeper into quadratic functions in the next two units, students first pause to explore polynomial operations. They will build upon some of the exponential rules covered in the previous unit as they add, subtract, and multiply polynomials; they will also divide polynomials by a monomial. Finally, students will factor quadratic expressions.

Note: The vertical method can be skipped in section 10.3.

Priority Standards

- **AI.NE.5:** Add, subtract, and multiply polynomials. Divide polynomials by monomials.

Supporting Standards

- **AI.NE.4:** Factor quadratic expressions (including the difference of two squares, perfect square trinomials and other quadratic expressions).

Enduring Understandings

- When adding polynomials, we combine the like terms to find the sum without using properties of exponents. When multiplying polynomials, we utilize properties of exponents to write the product.
- Factoring is the process of determining the product of binomials that result in the given quadratic expression.

Essential Questions

- How do adding and multiplying polynomials differ?
- How does the process of factoring a polynomial relate to multiplying polynomials?

Key Concepts

- I can add and subtract polynomials. (AI.NE.5)
- I can multiply polynomials. (AI.NE.5)
- I can divide polynomials by monomials. (AI.NE.5)

Related Concepts

- I can factor the difference of two squares. (AI.NE.4)
- I can factor perfect square trinomials. (AI.NE.4)
- I can factor quadratic expressions. (AI.NE.4)

Vocabulary

- Difference of two squares
- Factor
- Monomial
- Perfect square trinomial
- Polynomial
- Quadratic expression
- Rational expression

Mathematical Processes

- PS.2 Reason abstractly and quantitatively.
- PS.7 Look for and make use of structure.

Resources

Proficiency Scales

- AI.NE.5

Digital

- IDOE Examples/Tasks AI.NE.5
- IDOE Examples/Tasks AI.NE.4

Manipulatives

- Algebra Tiles
- Scientific Calculator

School Resources

Textbook

Module 10: Polynomials
10.1 Adding and Subtracting Polynomials: AI.NE.5
10.2 Multiplying Polynomials by Monomials: AI.NE.5
10.3 Multiplying Polynomials: AI.NE.5
10.4 Special Products: AI.NE.5
10.5 Using the Distributive Property: AI.NE.5
10.6 Factoring Quadratic Trinomials: AI.NE.4
10.7 Factoring Special Products: AI.NE.4

Formative Assessments

General Description of the Unit

In this unit, students will build upon the algebra skills developed in the previous unit to solve and graph quadratic equations. Students solve quadratic equations by taking the square root, the quadratic formula (which is developed by area models and completing the square), and factoring. These different methods should be compared, and students should have opportunities to select the best method for the problem. Students graph quadratic functions with and without technology and will identify key features of the graph (vertex, intercepts, axis of symmetry). Additionally, students will explore the relationship between the solution, *x*-intercept, and zero of a quadratic function. Finally, and most importantly, students will apply all these skills to represent and solve real-world problems with one-variable and two-variable quadratic equations.

Notes: This unit is supplemented to include an introduction to complex numbers. Students don't need to perform any calculations or operations with imaginary numbers until Algebra 2 and beyond. Section 11.6 should be lightly supplemented to cover AI.QE.3.

Priority Standards

- **AI.QE.4:** Solve quadratic equations in one variable by inspection (e.g., for x^2 = 49), finding square roots, using the quadratic formula, and factoring, as appropriate to the initial form of the equation.
- **AI.QE.5:** Represent real-world problems using quadratic equations in one or two variables and solve such problems with technology. Interpret the solution(s) and determine whether they are reasonable.
- **AI.QE.6:** Graph exponential and **quadratic** functions with and without technology. Identify and describe key features, such as zeros, lines of symmetry, and extreme values in real-world and other mathematical problems involving quadratic functions with and without technology; interpret the results in the real-world contexts.
- **AI.F.4:** Describe, qualitatively, the functional relationship between two quantities by analyzing key features of a graph. Sketch a graph that exhibits given key features of a function that has been verbally described, including intercepts, where the function is increasing or decreasing, where the function is positive or negative, and any relative maximum or minimum values, Identify the independent and dependent variables.

Supporting Standards

- **AI.QE.7:** Describe the relationships among a solution of a quadratic equation, a zero of the function, an x-intercept of the graph, and the factors of the expression. Explain that every quadratic has two complex solutions, which may or may not be real solutions.

Additional Standards

- **AI.NE.1:** Explain the hierarchy and relationships of numbers and sets of numbers within the complex number system. Know that there is an imaginary number, i, such that sqrt -1 = i. Understand that the imaginary numbers along with the real numbers form the complex number system.
- **AI.QE.3:** Use area models to develop the concept of completing the square to solve quadratic equations. Explore the relationship between completing the square and the quadratic formula.

Enduring Understandings

- Certain methods of solving a quadratic equation can be more efficient depending on the solutions of the equation and the format of the original equation.
- The graph of a quadratic function has a maximum/minimum at the vertex and an axis of symmetry through the vertex.
- The vertex of a parabola is the maximum or minimum value of a quadratic function, depending on how the parabola opens. The vertex provides the maximum or minimum value of the scenario it is modeling.
- The solutions, the zeroes, the x-intercepts, and the factors of a quadratic equation are all related.

Essential Questions

- Why is it advantageous to know a variety of ways to solve a quadratic equation?
- How is the graph of a quadratic function similar to that of a linear function? How is it different?
- How are quadratic equations used to solve real-world situations?
- Why are the zeroes of a quadratic function important?

Key Concepts	Related Concepts	Vocabulary
• I can solve quadratic equations by using square roots. (AI.QE.4) • I can write a quadratic equation in standard form in order to identify the correct values to be used in the quadratic formula. (AI.QE.4) • I can solve a quadratic equation by using the quadratic formula. (AI.QE.4) • I can solve a quadratic equation by using a variety of factoring techniques. (AI.QE.4) • I can explain the zero-product property and how it relates to solving a quadratic equation by factoring. (AI.QE.4) • I can determine which strategy for solving quadratic equations is most appropriate given an initial equation. (AI.QE.4) • I can represent real-world problems using quadratic equations in one variable. (AI.QE.5) • I can represent real-world problems using quadratic equations in two variables. (AI.QE.5) • I can solve a real-world problem modeled with a quadratic equation using technology. (AI.QE.5) • I can interpret the solution(s) to a quadratic equation in the context of a real-world problem and determine their reasonableness. (AI.QE.5) • I can graph a quadratic function with and without technology. (AI.QE.6) • I can graph various transformations of the parent quadratic function. (AI.QE.6) • I can use a variety of factoring techniques to find the zeros of a quadratic function. (AI.QE.6) • I can locate the line of symmetry of a parabola as the vertical line that goes through the point directly in the middle of the zeros. (AI.QE.6) • I can determine the maximum/minimum value of a quadratic function using the line of symmetry and the equation. (AI.QE.6) • I can analyze key features of a parabola and discuss their relevance in real-world context. (AI.QE.6) • I can describe the relationship between two quantities by analyzing a graph. (AI.F.4)	• I can discuss the connection between the solutions of a quadratic equation, the zeros of the function, and the x-intercepts of the graph, and the factors of the expression. (AI.QE.7) • I can compare the factors of a quadratic expression to the solutions of a quadratic function. (AI.QE.7) • I can explain that all quadratic equations have two complex solutions, which may or may not be real algebraically. (AI.QE.7) • I can explain that all quadratic equations have two complex solutions, which may or may not be real graphically. (AI.QE.7) • I can classify numbers and sets of numbers within the complex number system. (AI.NE.1) • I can identify numbers as rational or irrational. (AI.NE.1) • I can classify rational numbers as integers, whole numbers, and natural numbers. (AI.NE.1) • I can define and identify imaginary numbers. (AI.NE.1) • I can classify numbers and sets of numbers within the complex number system. (AI.NE.1) • I can represent a quadratic expression using an area model. (AI.QE.3) • I can use area models to develop the concept of completing the square as a method for solving quadratic equations. (AI.QE.3) • I can describe the relationship between completing the square and the quadratic formula. (AI.QE.3)	• Area model • Completing the square • Complex number • Complex number system • Complex solution • Decreasing function • Dependent variable • Domain • Extreme value • Factor • Factoring • Function notation • Imaginary numbers • Increasing function • Independent variable • Integers • Intercept • Irrational numbers • Line of symmetry • Natural numbers • Negative function • Parabola • Parent function • Positive function • Quadratic Equation • Quadratic Formula • Quadratic function • Quantitative • Rational numbers • Real numbers • Real solution • Relative maximum • Relative minimum • Solution • Square root • Transformations • Whole numbers • X-intercept • Zero • Zero-Product Property • Zeros of a function

• I can sketch the intercepts of a graph described verbally. (AI.F.4) • I can sketch the intervals of increase and decrease of a graph described verbally. (AI.F.4) • I can sketch the intervals where a function is positive or negative described verbally. (AI.F.4) • I can sketch any relative maximum or minimum values of a graph described verbally. (AI.F.4) • I can identify the independent and dependent variables of a function described verbally. (AI.F.4) • I can sketch a graph that exhibit key qualitative features that has been verbally described. (AI.F.4)		

Mathematical Processes

- PS.2 Reason abstractly and quantitatively.
- PS.4 Model with mathematics.

Resources

Proficiency Scales	Digital	Manipulatives
• AI.QE.4 • AI.QE.5 • AI.QE.6 • AI.F.4	• IDOE Examples/Tasks AI.F.4 • IDOE Examples/Tasks AI.QE.4 • IDOE Examples/Tasks AI.QE.5 • IDOE Examples/Tasks AI.QE.6 • IDOE Examples/Tasks AI.QE.7 • IDOE Examples/Tasks AI.NE.1 • IDOE Examples/Tasks AI.QE.3	• Algebra Tiles • Function Machine • Graph Paper • Graphing Calculator • Scientific Calculator • Virtual Graph Paper

School Resources

Textbook	Formative Assessments
Module 11: Quadratic Functions 11.1 Graphing Quadratic Functions: AI.F.4, AI.QE.6 11.3 Solving Quadratic Equations by Graphing: AI.QE.6, AI.QE.7 11.4 Solving Quadratic Equations by Factoring: AI.QE.4, AI.QE.5, AI.QE.7 11.6 Solving Quadratic Equations by Using the Quadratic Formula: AI.QE.4, AI.QE.5 11.8 Modeling and Curve Fitting (Optional) Expand 11.8 Exponential Growth Patterns: (Optional) 11.2 Transformations of Quadratic Functions (SKIP) 11.5 Solving Quadratic Equations by Completing the Square (SKIP) 11.7 Solving Systems of Linear and Quadratic Equations (SKIP) 11.9 Combining Functions (SKIP)	

General Description of the Unit

In this unit, students simplify square roots of algebraic expressions; this does not need to extend to radicals beyond square roots, even though the textbook includes cube roots and beyond. Students will apply this skill to simplify square roots when solving a quadratic equation.

Priority Standards

- **AI.QE.4:** Solve quadratic equations in one variable by inspection (e.g., for x^2 = 49), finding square roots, using the quadratic formula, and factoring, as appropriate to the initial form of the equation.

Supporting Standards

- **AI.NE.3:** Simplify square roots of monomial algebraic expressions, including non-perfect squares.

Enduring Understandings

- Square roots of monomial algebraic expressions can be simplified by extending the process of evaluating the square root of a number.
- The final solution to a quadratic equation can be put in decimal or radical form.

Essential Questions

- Why is it helpful to be able to represent numbers and expressions in multiple forms?
- How does the process of simplifying square roots relate to solving a quadratic equation?

Key Concepts

- I can solve quadratic equations by using square roots. (AI.QE.4)
- I can write a quadratic equation in standard form in order to identify the correct values to be used in the quadratic formula. (AI.QE.4)
- I can solve a quadratic equation by using the quadratic formula. (AI.QE.4)
- I can solve a quadratic equation by using a variety of factoring techniques. (AI.QE.4)
- I can explain the zero-product property and how it relates to solving a quadratic equation by factoring. (AI.QE.4)
- I can determine which strategy for solving quadratic equations is most appropriate given an initial equation. (AI.QE.4)

Related Concepts

- I can simplify square roots of non-perfect squares. (AI.NE.3)
- I can simplify square roots of monomial algebraic expressions. (AI.NE.3)

Vocabulary

- Factoring
- Monomial algebraic expression
- Non-perfect square
- Quadratic Equation
- Quadratic Formula
- Square root
- Zero-Product Property

Mathematical Processes

- PS.5 Use tools appropriately.
- PS.7 Look for and make use of structure.

Resources

Proficiency Scales

- AI.QE.4

Digital

- IDOE Examples/Tasks AI.QE.4
- IDOE Examples/Tasks AI.NE.3

Manipulatives

- Algebra Tiles
- Graph Paper
- Graphing Calculator
- Scientific Calculator
- Virtual Graph Paper

School Resources	
Textbook Module 8: Exponents and Roots 8.4 Rational Exponents (not an Algebra I IAS) 8.5 Simplifying Radical Expressions: AI.NE.3 8.6 Operations with Radical Expressions (not an Algebra I IAS) Supplement: Quadratic Formula and Finding Square Roots: Simplifying the Radicals	**Formative Assessments**