Unit 05: Inequalities and Systems

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 2**
Length: **4 weeks**
Status: **Published**

Brief Summary of Unit

Students will extend the topic of linear inequalities to polynomial, rational and radical expressions. Utilizing number lines and test points in addition to two-dimensional graphs, students will solve advanced inequalities and state their answers in both inequality form as well as interval notation. Students will then review and apply the concepts of substitution and elimination to solve linear and nonlinear systems.

Revised Date: July 2025

Standards

Diversity and Inclusion: Students will focus on equity, inclusion, and tolerance when analyzing the comparison of various quantities regarding characteristics of people. Equality will also be highlighted which can be associated with both numerical representations and the connection between people. This can be associated with treating people fairly and equally.

ELA.L.SS.11–12.1	Demonstrate command of the system and structure of the English language when writing or speaking.
ELA.L.VL.11–12.3	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, including technical meanings, choosing flexibly from a range of strategies.
MATH.9-12.A.REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
MATH.9-12.A.REI.B.4	Solve quadratic equations in one variable.
MATH.9-12.A.REI.B.4.a	Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
MATH.9-12.A.REI.B.4.b	Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.
MATH.9-12.A.REI.C.5	Prove 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.
MATH.9-12.A.REI.C.6	Solve systems of linear equations algebraically (include using the elimination method) and graphically, focusing on pairs of linear equations in two variables.

MATH.9-12.A.REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
MATH.9-12.A.REI.D.11	Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.
MATH.9-12.A.REI.D.12	Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
WRK.9.2.12.CAP.5	Assess and modify a personal plan to support current interests and post-secondary plans.
WRK.9.2.12.CAP.13	Analyze how the economic, social, and political conditions of a time period can affect the labor market.
TECH.9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
TECH.9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).

Essential Questions

- How can one tell what would be the most effective method to use for linear and non-linear systems?
- What is the difference between a linear and non-linear inequality? What are the steps necessary to solve them?
- What processes can be used to solve systems of equations?

Enduring Understandings

- A graphing calculator can graph a polynomial inequality and the sign chart will be made by determining where this graph is above or below the x-axis.
- Some systems have multiple solutions. The graphs of these functions can help determine the number of points of intersection.
- There are two types of situations that occur when solving an equation/inequality involving absolute value: a conjunction (AND) which deals with < inequalities, a disjunction (OR) which deals with equations and > inequalities.
- A polynomial inequality with degree 2 or more involves finding the 'roots' and making a sketch on a number line and testing each region.
- Solving a linear inequality is similar to solving a linear equation except that one must reverse the inequality symbol when multiplying or dividing both sides of the inequality by a negative.

Students Will Know

- How to solve absolute value inequalities and equations.
- How to use a graphing calculator to solve an inequality.
- How to use and apply the processes of elimination and substitution.
- How to write solutions in interval notation as well as inequality form.
- If there are no roots of even multiplicity, then the signs on the sign chart will alternate for any

polynomial inequality.

- Non-linear (radical, rational, polynomial) inequalities require a sign chart and/or graph.
- The effect of imaginary solutions on polynomial inequalities.
- The relationship between a two-dimensional graph and its inequality.
- To reverse the inequality symbol if one multiplies or divides by a negative.
- When solving a system of inequalities, you must graph each inequality and find the shaded region that is shared by these inequalities.

Students Will Be Skilled At

- Identifying how imaginary solutions effect the graph of a polynomial inequality.
- Recalling basic skills to solve an inequality with one variable.
- Solving a system of inequalities of linear or non-linear function.
- Solving equations and inequalities involving absolute values.
- Solving non-linear inequalities on the graphing calculator.
- Translating an answer in inequality form to interval notation.

Assessment

Assessments

- Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments
- Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Albert/AP Classroom and/or Big Ideas Math unit assessments
- Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments from Big Ideas Math
- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL

- Classwork and homework that assess the essential questions
- Provide alternative means of assessments for certain students
- Take tests and quizzes that will assess the essential questions, including pre-assessments.
- Teacher Observation
- Written assignments that assess the essential questions that involves providing explanations

Learning Plan

The following list is meant to create a day-to-day plan. Teachers are encouraged to slow down or condense days as appropriate to the student population in the class. Assessment(s) should be given when appropriate.

- Recall interval notation, based on inequality notation.
- Solve linear inequalities. Extend to solving systems of linear inequalities on a coordinate plane.
- Define solving non-linear inequalities using sign charts.
- Recall the algebraic definition of absolute value. Solve equations and inequalities involving absolute value.
- Introduce how to graph systems of linear and quadratic equations. Solve these graphs for the solution(s) to the system. Also, solve these systems algebraically.
- Incorporate other non-linear equations (ie: absolute value, x=y^2, circles, etc) when solving for solutions on a coordinate plane as well as algebraically.

Graphing calculators are encouraged to be used as an extension of these topics.

Materials

Core instructional materials: Core Book List including PreCalculus Enhanced with Graphing Utilities, Sullivan, Savvas

Supplemental materials: Khan Academy, Edia, and DeltaMath

- District approved textbook
- Khan Academy
- Teacher created activiites
- Teacher created notes
- Whiteboard tables

Integrated Accommodation & Modifications

Possible accommodations/modification for CP PreCalc & Trig