Unit 04 Inequalities and Absolute Value

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

Brief Summary of Unit

This will be a short unit that does some review work on how to solve a basic inequality and build up to solving nonlinear inequalities, absolute value equations, absolute value inequalities, along with interval notation.

Students will have to solve a linear inequality, graph the linear inequality, state the domain of the inequality in interval notation, and properly show on a graph the open circle vs closed circle value. Students will recall from Algebra 1 that if you multiply or divide both sides of the inequality by a negative value, that it flips the inequality symbol around. Students will need to master which symbol means greater than vs less than. Students will then solve a compound inequality, properly graph it, and state the interval notation. Students will be able to complete word problems on this topic and again graph their solution set. We will discuss the concept of "and" problems vs. "or" problems and how the graph needs to appear (overlap or outwards). Students will be given graphs and will be able to come up with an inequality that represents the graph. As we move into the nonlinear inequalities, we will review the definition of linear vs nonlinear. Students will be able to solve and graph nonlinear inequalities properly using a chart. We will complete this unit with absolute value equations. Students will be able to write and solve for the two equations that are generated. Furthermore, students will be able to solve for absolute value inequalities. They will once again be able to create two inequalities properly, solve, and graph. Students will be able to give the solution in interval notation.

Revised Date: July 2025

Standards

	Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol.
MATH.9-12.A.CED.A.1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
MATH.9-12.A.CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.
MATH.9-12.N.CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.

MATH.9-12.A.REI	Reasoning with Equations and Inequalities
MATH.9-12.A.REI.A	Understand solving equations as a process of reasoning and explain the reasoning
MATH.9-12.A.REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
MATH.9-12.A.REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
MATH.9-12.A.REI.B	Solve equations and inequalities in one variable
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.F.IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
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.F.IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
MATH.9-12.A.SSE.A.1.a	Interpret parts of an expression, such as terms, factors, and coefficients.

Essential Questions

- How are linear inequalities different from nonlinear inequalities?
- How can inequalities be used to compare values in real world situations?
- Why is it impossible to claim that the absolute value of an expression is equal to a negative value?
- Why or why not is it possible for an inequality or absolute value to have infinite solutions?
- Why or why not is it possible for an inequality or absolute value to have no solution?

Enduring Understandings

- Operations and properties of the real number system can be extended to situations involving complex numbers, which have many useful applications when working with quadratic functions.
- There are multiple methods used to solve quadratic equations; each equation should be analyzed and the solver should make a strategic decision to choose the most efficient method to solve the equation. Often, quadratic equations have solutions that are complex numbers.

Students Will Know

- Nonlinear systems can be solved using multiple methods.
- Quadratic inequalities can be solved algebraically and graphically.
- Quadratics may be used to model real-world situations.
- Students will know how to properly graph inequalities, solve for them, and give their solution in interval notation.

- Students will know that absolute value equations and inequalities must have two solution sets before graphing.
- The difference between linear and nonlinear.
- The Quadratic Formula can be used to solve quadratic equations.

Students Will Be Skilled At

- Describe the graph of the Quadratic inequality.
- Describe what a nonlinear systems of equations is.
- Graph quadratic inequalities.
- Knowing how to plug in values from their shaded number line to properly check their solutions.
- Knowing when there are infinitely many solutions of an inequality or absolute value equation.
- Knowing when there is no solution to an inequality or absolute value equation.
- Properly writing the solution in interval notation.
- Solve quadratic inequalities algebraically and graphically.
- Solving all types of inequalities properly.

Evidence/Performance Tasks

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, Albert/AP Classroom
- Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments
- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath
- SAT questions related to these topics

- Answer essential questions
- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Provide alternative means of assessments for certain students
- Teacher Observation
- Tests and quizzes that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations

Learning Plan

Begin with Section 1.7

Day 1

- Review the symbols for less than, greater than, less than or equal to, greater than or equal to
- Practice basic graphing such as $x > 7$ on a number line
    - Show the use of an open circle and what it means
    - Show the use of a closed circle and what it means
    - Discuss how you know when to shade left or right
    - Begin interval notation
- Students will recall from Algebra 1 that when you need to divide or multiply BOTH sides on an inequality that you flip the inequality symbol
- Students will solve a compound inequality and graph.
    - Discuss when to graph as an overlap using the "and" condition and that there must be a common solution -- which inequality symbol uses this?
    - Discuss when there is no overlap on the graph and shading outwards (use the word "or") -- which inequality symbol does this use?
        - Practice the interval notation for "or" graphs and introduce the concept of a "union" on the interval notation
- Students will be given a graph or just the interval notation and then write an inequality that will match this condition
    - Students will complete a matching puzzle on graphing and solving inequalities (equation on the left, answer on the right, graph in the center and connect it all together)

Day 2

- Quick quiz (10 minutes)
- Begin nonlinear inequalities
    - Define a nonlinear inequality in the quadratic form
        - Set inequality to zero
        - Factor and solve for x
        - Graph the values of x on a number line -- use open or closed circles
        - Perform a sign chart test to determine where to shade
        - State the solution in interval notation
    - Solve an inequality involving a quotient
    - Solve an inequality with repeated factors
    - Perform all sign tests properly

Day 3

- Practice day on nonlinear inequalities
- Complete word problems on nonlinear inequalities
- Review for quiz

Day 4 - Quiz on linear and nonlinear inequalities

Day 5

- Students will be able to solve absolute value equations
    - Discuss absolute value and what it means
    - Explain how the absolute value of -7 and 7 are the same
    - Students will realize that absolute value can have two solutions
        - Students will create and solve with two equations for example: [abs value of 4x -1] = 7
            - Students will say that the absolute value could total 7 or -7 so they will write out two equations and two solutions
        - Can [abs 4x - 1] = -7? Why or why not? Prove it with work
        - Students will check their solutions to show and confirm why we have more than one solution
            - Is it possible for absolute value equations to have only 1 solution? No solutions?
            - How can you solve when it is an absolute value equation set equal to another absolute value equation?
    - Students will complete an absolute value worksheet
- For the remainder of the period, begin absolute value inequalities
    - Once again there will be two solution sets and students will have to decipher when the problem is an "and" problem vs. an "or" problem. Do you shade as an overlap or outwards?
        - Students will isolate the absolute value and recall to flip the absolute value inequality if they divide or multiply by a negative value
        - Students will state their solution in interval notation
            - Students will pick a value from the shaded section of their solutions set on their graph and plug it in to confirm they have shaded the correct region

Day 6

- Practice absolute value equations and inequalities
    - Puzzle worksheet with matching
    - More challenging problems that involve more algebra

Day 7

- Quick quiz
- Review for regular quiz
- Begin notes on functions for next unit if there is time

Day 8 - Quiz on absolute value

Materials

Core instructional materials:Core Book List including Algebra & Trigonometry 4E by Stewart

Supplemental materials: Khan Academy, Edia, and DeltaMath

- District approved textbook and ancillary materials
- Online resources: Delta Math, Ed Puzzle, Edia, Khan Academy
- Teacher created activiites
- Teacher created notes

Integrated Accommodation & Modifications

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