Unit 2 - Functions, Equations, and Solutions

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 2**
Length: **9-10 weeks**
Status: **Published**

Brief Summary of Unit

In this unit, students delve into functions and systems of linear equations, starting with the distinction between relations and functions, domain-range identification, and representation methods like tables, graphs, and equations. Linear functions' characteristics, such as slope and y-intercept, are explored alongside comparisons with nonlinear functions. Students learn to analyze graphs, focusing on key features. The unit then shifts to solving systems of linear equations through graphing, substitution, and elimination methods, understanding solutions as points of intersection. Special cases without solutions or with infinite solutions are covered. Through varied practice and real-world applications, students develop a comprehensive understanding and problem-solving skills in these mathematical concepts.

Revision Date: 5/30/24

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.KL.8.2.B	Gather vocabulary knowledge when selecting a word or phrase important to comprehension or expression.
MATH.8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
MATH.8.EE.B.6	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.
MATH.8.EE.C.8.a	Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
MATH.8.EE.C.8.b	Solve systems of two linear equations in two variables using the substitution method and estimate solutions by graphing the equations. Solve simple cases by inspection.
MATH.8.EE.C.8.c	Solve real-world and mathematical problems leading to two linear equations in two variables.

MATH.8.F.A	Define, evaluate and compare functions
MATH.8.F.A.1	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
MATH.8.F.A.2	Compare properties (e.g., rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MATH.8.F.A.3	Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
MATH.8.F.B	Use functions to model relationships between quantities
MATH.8.F.B.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
MATH.8.F.B.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
WORK.K-12.9.1	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.

Essential Questions

- How can graphing be used to find the solution to a system of linear equations?
- How can the substitution method be used to solve a system of linear equations?
- How can we convert between different representations of functions (tables, graphs, and equations)?
- How can we distinguish between linear and nonlinear functions?
- How can we identify and solve special systems of equations using graphing, substitution, and elimination methods?
- How can we sketch a graph of a function given its equation or table of values?
- How do we calculate and interpret the slope and y-intercept of a linear function?
- How do we determine the domain and range of a function?
- How does the elimination method work to solve a system of linear equations?
- In what ways can functions be represented and how do these representations help us understand the behavior of the function?
- In what ways do the graphs and equations of linear functions differ from those of nonlinear functions?
- What are the advantages and limitations of using the elimination method?
- What are the characteristics of linear functions and how can they be identified?
- What are the characteristics of systems of equations that have no solution or infinitely many solutions?
- What are the key features of a function’s graph, and how can they be used to understand the function's behavior?
- What distinguishes a function from a general relation?
- What does the point of intersection of two lines represent in the context of solving a system of equations?

- When is substitution a more advantageous method compared to graphing or elimination?

Enduring Understandings

- Functions are specific types of relations where each input is associated with exactly one output.
- Functions can be represented in multiple ways, including tables, graphs, and equations, each offering unique insights into the behavior of the function.
- Graphing systems of equations provides a visual representation of the solutions, where the point of intersection represents the common solution to both equations..
- Key features of a graph, such as intercepts and intervals of increase/decrease, provide valuable information about the function's behavior.
- Linear functions are characterized by a constant rate of change, represented by the slope, and a straight-line graph.
- Linear functions have a constant rate of change and graph as straight lines, while nonlinear functions do not.
- Systems with infinitely many solutions, known as dependent systems, occur when the lines coincide.
- Systems with no solutions, known as inconsistent systems, occur when the lines are parallel and never intersect.
- The elimination method involves adding or subtracting equations to eliminate one variable, making it possible to solve for the remaining variable.
- The substitution method involves solving one equation for one variable and substituting this value into the other equation to find the solution.

Students Will Know

- Classify functions as linear and non-linear.
- Compare properties such as the rate of change of two functions each represented in a different way
- Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions.
- How to define a function as a rule that assigns one output to each input.
- How to identify a relation and a function.
- How to use graphing to find the solution to a system of linear equations.
- Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
- Key features of a graph, such as intercepts and intervals of increase/decrease.
- Various ways to represent functions (tables, graphs, and equations). Key features of a graph, such as intercepts and intervals of increase/decrease.
- What a solution to a system of equations means.

Students Will Be Skilled At

- Explaining the differences between one solution, no solution, and infinitely many solutions.

- Finding the domain and range of functions from various representations.
- Identifying a function as a one-to-one correspondence.
- Identifying a function as a set of ordered pairs on a graph.
- Identifying the slope of a linear relationship from equations, tables, and graphs.
- Solving a system of linear equations with infinitely many solutions.
- Solving a system of linear equations with no solution.
- Solving a system of linear equations with one solution using various methods.
- Writing the linear function from a graph.
- Writing the linear function from a table of values.

Evidence/Performance Tasks

Assessments

- Formative: Daily assessments using examples from class notes, iReady MyPath, Big Ideas Math online platform problems, and NJSLA test bank problems
- Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Big Ideas Math unit assessments
- Benchmark: iReady diagnostic assessments and district placement 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 adaptive learning tasks in iReady, Khan Academy, and Big Ideas Math

- Answer essential questions
- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Entrance/exit slips
- 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

8th Grade Math Curriculum Learning Plan: Functions and Systems

of Linear Equations

Based on New Jersey Student Learning Standards (NJSLS) for Mathematics

Unit 1: Functions

Relations and Functions (2 days)

- Day 1: Understanding Relations and Functions
    - Objective: Students will differentiate between relations and functions.
    - Activities:
        - Introduction to relations and functions.
        - Identifying functions from sets of ordered pairs, tables, and mappings.
        - Class discussion and practice problems.
- Day 2: Domain and Range of Functions
    - Objective: Students will identify the domain and range of functions.
    - Activities:
        - Review of function definition.
        - Guided practice identifying domain and range from graphs and tables.
        - Independent practice problems.

Representations of Functions (2 days)

- Day 1: Different Representations of Functions
    - Objective: Students will represent functions using tables, graphs, and equations.
    - Activities:
        - Introduction to different representations.
        - Guided practice converting between tables, graphs, and equations.
        - Group activity to match representations.
- Day 2: Interpreting Representations
    - Objective: Students will interpret and analyze functions in different representations.
    - Activities:

        - Review of previous day's work.
        - Independent practice with mixed representation problems.
        - Real-world application problems.

Linear Functions (3 days)

- Day 1: Understanding Linear Functions
    - Objective: Students will identify and represent linear functions.
    - Activities:
        - Introduction to linear functions and their characteristics.
        - Guided practice with linear function examples.
        - Group activity: identifying linear functions from graphs and equations.
- Day 2: Rate of Change
    - Objective: Students will understand that the rate of change in a function based on an initial vale can used to find the slope of that function.
    - Activities:
        - Use tables and graphs to identify the rate of change as slope.
        - Guided practice calculating rate of change as the slope
        - Independent practice problems.
- Day 3: Slope and Y-Intercept
    - Objective: Students will understand and calculate the slope and y-intercept of linear functions.
    - Activities:
        - Explanation of slope and y-intercept.
        - Guided practice calculating slope and y-intercept from graphs and equations.
        - Independent practice problems.

Comparing Linear and Nonlinear Functions (2 days)

- Day 1: Characteristics of Linear and Nonlinear Functions
    - Objective: Students will distinguish between linear and nonlinear functions based on their characteristics.
    - Activities:

        - Introduction to linear vs. nonlinear functions.
        - Guided practice with examples of both types.
        - Group activity: comparing characteristics from tables, graphs, and equations.
- Day 2: Analyzing Examples
    - Objective: Students will analyze and classify functions as linear or nonlinear.
    - Activities:
        - Review of linear and nonlinear characteristics.
        - Independent practice with mixed problems.
        - Real-world application problems comparing linear and nonlinear functions.

Analyzing and Sketching Graphs (2 days)

- Day 1: Analyzing Graphs of Functions
    - Objective: Students will analyze key features of graphs of functions.
    - Activities:
        - Introduction to key features: intercepts, intervals of increase/decrease, and end behavior.
        - Guided practice analyzing graphs.
        - Group activity: analyzing and interpreting given graphs.
- Day 2: Sketching Graphs
    - Objective: Students will sketch graphs of functions from equations and tables.
    - Activities:
        - Review of key features.
        - Guided practice sketching graphs.
        - Independent practice sketching graphs from various representations.

Unit 2: Systems of Linear Equations

Solving Systems of Linear Equations by Graphing (4-5 days)

- Day 1: Introduction to Systems of Linear Equations
    - Objective: Students will understand the concept of a system of linear equations.

    - Activities:
        - Introduction to systems of equations.
        - Graphing systems to find points of intersection.
        - Class discussion on solutions (one, none, infinitely many).
- Day 2: Graphing Systems of Equations
    - Objective: Students will graph systems of equations and identify solutions.
    - Activities:
        - Guided practice with graphing systems.
        - Partner work on graphing and solving systems.
        - Independent practice problems.
- Day 3: Practice and Application
    - Objective: Students will apply graphing techniques to solve systems.
    - Activities:
        - Review and additional practice with graphing systems.
        - Group activity with real-world problems.
        - Peer review and feedback session.
- Day 4: Review and Assessment
    - Objective: Students will demonstrate their understanding of solving systems by graphing.
    - Activities:
        - Review of key concepts.
        - Formative assessment (quiz or project).
        - Reflection on graphing methods.

Solving Systems of Linear Equations by Substitution (4-5 days)

- Day 1: Introduction to Substitution Method
    - Objective: Students will understand and apply the substitution method to solve systems.
    - Activities:
        - Explanation of substitution method.

        - Guided practice with substitution examples.
        - Class discussion on the advantages of substitution.
- Day 2: Practice with Substitution
    - Objective: Students will solve systems using substitution.
    - Activities:
        - Review of substitution steps.
        - Partner work on substitution problems.
        - Independent practice problems.
- Day 3: Application of Substitution Method
    - Objective: Students will apply substitution to solve real-world problems.
    - Activities:
        - Review and additional practice.
        - Group activity with application problems.
        - Peer review and feedback session.
- Day 4: Review and Assessment
    - Objective: Students will demonstrate their understanding of solving systems by substitution.
    - Activities:
        - Review of key concepts.
        - Formative assessment (quiz or project).
        - Reflection on substitution methods.

Solving Systems of Linear Equations by Elimination (4-5 days)

- Day 1: Introduction to Elimination Method
    - Objective: Students will understand and apply the elimination method to solve systems.
    - Activities:
        - Explanation of elimination method.
        - Guided practice with elimination examples.
        - Class discussion on the advantages of elimination.

- Day 2: Practice with Elimination
    - Objective: Students will solve systems using elimination.
    - Activities:
        - Review of elimination steps.
        - Partner work on elimination problems.
        - Independent practice problems.
- Day 3: Application of Elimination Method
    - Objective: Students will apply elimination to solve real-world problems.
    - Activities:
        - Review and additional practice.
        - Group activity with application problems.
        - Peer review and feedback session.
- Day 4: Review and Assessment
    - Objective: Students will demonstrate their understanding of solving systems by elimination.
    - Activities:
        - Review of key concepts.
        - Formative assessment (quiz or project).
        - Reflection on elimination methods.

Solving Special Systems of Linear Equations (4-5 days)

- Day 1: Identifying Special Systems
    - Objective: Students will recognize and solve special systems of equations.
    - Activities:
        - Introduction to special systems (no solution, infinite solutions).
        - Guided practice with examples of special systems.
        - Class discussion on identifying characteristics.
- Day 2: Practice with Special Systems
    - Objective: Students will solve special systems using various methods.

    - Activities:
        - Review of special systems.
        - Partner work on identifying and solving special systems.
        - Independent practice problems.
- Day 3: Application of Methods to Special Systems
    - Objective: Students will apply methods to solve real-world problems involving special systems.
    - Activities:
        - Review and additional practice.
        - Group activity with application problems.
        - Peer review and feedback session.
- Day 4: Review and Assessment
    - Objective: Students will demonstrate their understanding of solving special systems.
    - Activities:
        - Review of key concepts.
        - Formative assessment (quiz or project).
        - Reflection on solving special systems.

Materials

Core instructional materials: Core Book List including Big Ideas Math textbook and online platform for all levels of grade 6, 7, 8, and Algebra 1

Supplemental materials: Khan Academy, Edia, and DeltaMath

- Calculators/Math Tools
- District approved textbook
- Manipulatives
- Teacher created activiites
- Teacher created notes

- Websites, such as Khan Academy

Suggested Strategies for Modifications

Possible accommodations/modification for Grade 8