Unit 2 - Functions and Proportional Relationships

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **Full Year**
Status: **Published**

Unit Overview

Students will understand the connection between proportional relationships, lines, and linear equations. They will graph equations and interpret slope as unit rate. Understand that functions are rules that assign inputs to exactly one output and compare functions. Interpret the equation y = mx +b as the graph of a straight line. Construct and analyze functions to model linear relationships. They will compare properties of functions represented in different ways.

Enduring Understandings

Unit rates can be explained in graphical representation, algebraic equations, and in geometry through similar triangles.
The equation y = mx + b is a straight line and that slope and y-intercept are critical to solving real problems involving linear relationships.
Changes in varying quantities are often related by patterns which can be used to predict outcomes and solve problems.
A proportional relationship will always pass through the origin (0,0) and it will always be in the form of a straight line. In a table, the rate of change/slope will always be the same.
The slope of a line is always the same regardless of what two ordered pairs are selected.
A function is a specific topic of relationship in which each input has a unique output which can be represented in a table.
A function can be represented graphically using ordered pairs that consist of the input and the output of the function in the form (input, output).
A function can be represented with an algebraic rule or verbal statement.

Essential Questions

How do we express a relationship mathematically?
How do we determine the value of an unknown quantity?
Why is one variable dependent upon the other in relationships?
What makes a solution strategy both efficient and effective?
How can linear relationships be modeled and used in real-life situations?
How is it determined if multiple solutions to an equation are valid?
How does the context of the problem affect the reasonableness of a solution?
What defines a function and how can it be represented?
What makes a function linear?

Learning Objectives

Graph and analyze the different representations of proportional relationships and interpret the unit rate as the slope of the graph which indicates the rate of change.
Derive the equation of a line (y = mx for a line through the origin and the equation y = mx +b for a line intercepting the vertical axis at b) and use similar triangles to explain why the slope (m) is the same between any two points on a non-vertical line in the coordinate plane.
Solve linear equations in one variable with rational number coefficients that might require expanding expressions using the distributive property and/or combining like terms, including examples with one solution, infinite solutions, or no solution.
Solve systems of linear equations in two variables by inspection, algebraically, and/or graphically (estimate solutions) to demonstrate solutions correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
Construct a function to model the linear relationship between two variables and determine the rate of change and initial value of the real world data it represents from either graphs or tabulated values.
Sketch a graph of a function from a qualitative description and give a qualitative description of a graph of a function.

A line uses the format y=mx when it is a proportional relationship.
Steps to solving and simplifying equations
Distributive property is useful to solve equations
A linear equation uses the form y=mx+b
Slope of a line is a ratio of the rate of change of the y-coordinates over the rate of change of the x-coordinates
Slope can also be interpreted as a unit rate of a proportional relationship
How to graph and interpret a slope
How to determine the y-intercept both algebraically and graphically
Graphs can be useful to solve an equation
Systems of linear equations include more than one equation with one solution, infinitely many solutions, or no solutions
Lines can be horizontal and vertical in the forms y=k or x=k

Standards: Content

8.EE.B	Understand the connections between proportional relationships, lines, and linear equations
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.
8.EE.B.6	Use similar triangles to explain why the slope □ is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation □ = □□ for a line through the origin and the equation □ = □□ + □ for a line intercepting the vertical axis at □.
8.F.A	Define, evaluate and compare functions
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.

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).
8.F.A.3	Interpret the equation □ = □□ + □ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.
8.F.B	Use functions to model relationships between quantities
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 (□, □) 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.
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.

Standards: Interdisciplinary

9.1.8.CDM.4	Evaluate the application process for different types of loans (e.g., credit card, mortgage, student loans).
9.1.8.CP.1	Compare prices for the same goods or services.
8.1.8.DA.1	Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.4	Transform data to remove errors and improve the accuracy of the data for analysis.
8.1.8.DA.5	Test, analyze, and refine computational models.
8.1.8.AP.1	Design and illustrate algorithms that solve complex problems using flowcharts and/or pseudocode.
8.1.8.AP.2	Create clearly named variables that represent different data types and perform operations on their values.

Assessment Evidence

Formative	Collaborative Activities, Homework, Classwork, Discussion, Independent Class Assignment, Informal Observations of Students, Games, Exit Slips, Pre-Assessments, Math Message – Warm up, Questioning, Teacher Made Pages, Learning Centers, LinkIt, Problem of the Day, Problem of the Week, Entrance Slips, Pre-Assessments
Summative	LinkIt Benchmark Assessments, Tests, Pre-Assessments, Quizzes, Written Responses
Alternative & Benchmark	Alternative – Reteaching, One on One Conferencing, Learning Centers, Levels Homework, Higher Order Thinking Problems, Additional leveled practice Benchmark - LinkIt Benchmark Assessments, Totowa TPA
Assessment Evidence Resource	

Instructional Resources

Smartboard, Computers, iPads, websites and digital interactives/models, multi-media presentations, video streaming, Brain Pop, Microsoft 365, Primary and Secondary Source Documents, Assorted Manipulatives, Khan Academy, Crosswalk Coach for the Common Core Standards, Ready Common Core Mathematics Instruction and Practice, Common Core Coach, Calculators, Reveal Math Resources.

Instructional Resource List

Curricular Mandates

Below are the curricular requirements as defined in NJ Administrative Code and Statute

	Amistad		Diversity, Equity, and Inclusion
	Holocaust		LGBT and Disabilities (Grades 6-12)
	Climate Change		Asian American & Pacific Islander

Social Emotional Learning (SEL) Competencies

NJ Social and Emotional Learning Competencies & Sub-Competencies

	Self-Awareness	X	Relationship Skills
X	Responsible Decision-Making		Social Awareness
X	Self-Management		

21st Century Skills & Themes

	Global and Cultural Awareness	X	Technology Literacy		Planning and Budgeting
X	Creativity and Innovation		Financial Institutions		Risk Management and Insurance
X	Information and Media Literacy		Digital Citizenship		Economic and Government Influences

	Critical Thinking and Problem Solving		Credit Profile		Career Awareness and Planning
	Civic Financial Responsibility		Financial Psychology		