Equations and Functions

Content Area: **Math**
Course(s): **Math Grade 8**
Time Period: **MP2**
Length: **45**
Status: **Published**

Unit Overview

Unit Summary	Unit Rationale
Students understand the mathematical relationship between the equation of a line and the graph of that line. The coordinates of points on the graph can be substituted into the equation of the line to make a true statement. Students will use their understanding of ratios and proportional relationships to demonstrate how the unit rate or constant of proportionality can be used to measure the steepness of a line, or slope. Students analyze equations, tables, and linear graphs to compare proportional relationships by interpreting the unit rates in context. They understand the characteristics of a graph that the slope is the same as the constant of proportionality. In this unit students build on their understanding of proportional relationships as they begin their study of functions. They internalize the definition of a relation and a function. Students explore different kinds of functions, linear and nonlinear, and are able to differentiate linear and nonlinear functions in tables and graphs. Students will also build on their knowledge of the properties of linear equations – slope and initial value – as they study the properties of linear functions. Students come to understand that the properties of linear functions relate to the properties of linear equations: constant rate of change aligns to slope and initial value aligns to y-intercept. They are able to recognize a function as nonlinear because the graph of the function does not show a constant rate of change. In this unit students will also learn that a linear function represents a relationship between two quantities. They understand that they can use different representations, such as tables, graphs, and equations, for a linear function. They come to relate the equation for a linear function to the linear equation  Students will also learn that relationships between quantities can be shown in qualitative graphs, graphs that do not always have numerical values on the x- and y-axes. They come to	Unit 2 builds upon students prior knowledge of proportional relationships as students develop procedural skills and fluency related to the topic of functions. In this unit students also develop conceptual understanding related to this topic. Using equations and functions to model real world situations is a skill that is applicable in real life and will allow students to develop a mathematical problem solving approach to real world situations. A deep understanding of proportional relationships will help students to be informed consumers. These are also foundational skills that will be further developed in upper level mathematics courses.

understand the connection between qualitative graphs and the behavior of the function in different intervals.	

NJSLS

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.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.
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.
8.EE.C.8.c	Solve real-world and mathematical problems leading to two linear equations in two variables.
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.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 for Mathematical Practice

1	Make sense of problems and persevere in solving them
2	Reason abstractly and quantitatively
3	Construct viable arguments and critique the reasoning of others
4	Model with mathematics
5	Use appropriate tools strategically
6	Attend to precision
7	Look for and make use of structure

Unit Focus

Enduring Understandings	Essential Questions
• Proportional relationships can be represented using different models, including graphs, tables, and equations. • Slope is a measure of the steepness of a line and is equal to the rate of change between quantities. • In a proportional relationship, slope is the same as the unit rate and the constant of proportionality • The slope, constant of proportionality, and unit rate are equal for proportional relationships • The y-intercept of a line is the y-coordinate of the point where the graph of the line crosses the y-axis. Its meaning depends on the context of the graph. • The slope-intercept form for a linear equation, y=mx+b, gives information to sketch a graph of the line. It indicates that the point (0, b) is on the graph of the line and shows that the slope of the line is m. • A relation is a set of ordered pairs. A function is a relation in which each input, or x value, has exactly one output, or y value. Arrow diagrams and tables can be used to determine whether a relation is a function. • Different representations such as equations, tables, and graphs, can represent a function. The graph of a linear function is a straight line; the graph of a nonlinear function is not a straight line. • Two functions presented in different representations can be compared by looking at their properties: initial value and constant rate of change. • A function that represents a linear relationship between two quantities can be represented by an equation written in the form y=mx+b. • The relationship between two quantities can be represented in a qualitative graph that shows the behavior of the function in different intervals. • A system of linear equations can have no	• How can you compare proportional relationships represented in different ways? • What is slope? • How does slope relate to the equation for a proportional relationship? • What is the y-intercept and what does it indicate? • What is the equation of a line for a nonproportional relationship? • When is a relation a function? • What are different representations of a function? • How can you compare two functions? • How can you use a function to represent a linear relationship? • How does a qualitative graph describe the relationship between quantities? • How are slopes and y-intercepts related to the number of solutions of a system of linear equations? • How does the graph of a system of linear equations represent its solution? • When is substitution a useful method for solving a system of equations?

solution, one solution, or infinitely many solutions. The number of solutions is based on the number of intersection points of the lines in the system. The number of solutions can be determined by comparing the slopes and y-intercepts of the equations. • Systems of equations can have zero solutions, one solution, or infinitely many solutions. The solution to a linear system is the point or points at which the lines intersect. • Substitution is a useful method for solving a system of linear equations. It is accomplished by rewriting an equation for one variable in terms of the other, and substituting that expression into the other equation and then solving.	

Instructional Focus

Learning Targets

- Analyze equations, linear graphs, and tables to find unit rates and compare proportional relationships.
- Find the slope of the line using different strategies.
- Interpret a slope in context and relate it to the steepness on a graph.
- Understand how the constant of proportionality and the slope relate in a linear equation.
- Write a linear equation in the form y=mx when the slope is given.
- Graph a linear equation in the form y=mx.
- Interpret and extend the table or graph of a linear relationship to find its y-intercept.
- Analyze graphs in context to determine the meaning of the y-intercept.
- Graph a line from an equation in the form y=mx+b
- Write an equation that represents the given graph of a line
- Identify whether a relation is a function
- Interpret a function
- Identify functions in different representations: equations, tables, and graphs.
- Identify linear and nonlinear functions in different representations
- Compare properties of linear functions in different representations
- Compare properties of linear and nonlinear functions in different representations
- Construct a linear function to model a relationship using an equation in the form y=mx+b
- Describe qualitatively the behavior of a function by analyzing its graph
- Describe the graph of a function at each interval
- Examine graphs of linear systems of equations to determine the number of solutions, based on number of intersection points.
- Compare the equations in a linear system to look for a relationship between the number of solutions

and the slopes and y-intercepts of the equations
- Create and examine graphs of linear systems of equations to determine the solution
- Understand how substitution can be used to solve a linear system of equations
- Apply this understanding to solve a system of linear equations with one solution, no solutions, or infinitely many solutions

Prerequisite Skills

- Represent proportional relationships by equations
- Graphing multiple lines in the coordinate plane
- Creating Tables by evaluating equations and using input/output
- Distributive Property
- Operations with Rational Numbers
- Evaluating Expressions
- Substitution

Common Misconceptions

- Students may interchange x and y coordinates or the x and y axis.
- Students commonly think that vertical lines are linear functions.
- Students have a difficult time getting past the idea that every equation have to end as x=a.
- Students believe the variable is always on the left side of the equation.
- As students begin to build and work with expressions containing more than two operations, students tend to set aside the order of operations.
- Students commonly forget that the negative sign in front of a variable is really a coefficient of -1.
- Students confuse one-variable and two-variable equations.
- Students mistakenly believe that linear functions (with a constant rate of change) are the only type of functions.
- Students commonly do not recognize a constant rate of change when entries in a table are absent.
- Students frequently attempt to “solve” expressions.
- Students may think that all linear relationships are proportional leading them to incorrectly find the slope or equation of the relationship.
- Students reverse the coordinates when representing slope as well as when plotting ordered pairs.
- Students forget to look at the scale of a graph before solving a problem assuming it is 1.

Spiraling For Mastery

Current Unit Content/Skills	Spiral Focus	Activity
• Proportional Relationships • Slope • Relations and Functions • Properties of Functions	• Proportional Relationships (Grade 7) • Percents (Grade 7) • Proportional Relationships	• Math Diagnostic and Intervention System Activities

• Qualitative Graphs • Solve Systems of Linear Equations	(Grade 8) • Linear Equations (8th Grade) • Expressions and Equations (Grade 7) • Solve Equations (Grade 8)	

Assessment

Formative Assessment	Summative Assessment
• Homework • Lesson Checks • MathXL • Quizzes • Exit Tickets • Lesson Reflections • Performance Tasks	• Topic Tests • Unit 2 Benchmark (Link-It)

Resources

Key Resources	Supplemental Resources
• Savvas EnVision Grade 8 • Pacing Guide	• IXL • Delta Math • Desmos • Khan Academy • Manuevering the Middle

Career Readiness, Life Literacies, and Key Skills

9.4.8.CI.1	Assess data gathered on varying perspectives on causes of climate change (e.g., cross-cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).
9.4.8.CT.1	Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
9.4.8.CT.2	Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).

9.4.8.GCA.1	Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a).
9.4.8.GCA.2	Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
9.4.8.TL.3	Select appropriate tools to organize and present information digitally.

Interdisciplinary Connections

L.KL.8.2	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
L.KL.8.2.A	Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases.
L.VL.8.3	Determine or clarify the meaning of unknown and multiple-meaning words or phrases based on grade 8 reading and content, including technical meanings, choosing flexibly from a range of strategies.
SL.PE.8.1.A	Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
SL.PE.8.1.B	Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.
SL.PE.8.1.C	Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.
SL.PE.8.1.D	Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
6-8.MS-ETS1-3.4	Analyzing and Interpreting Data
6-8.MS-ETS1-3.ETS1.B.1	There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.
6-8.MS-ETS1-3.ETS1.B.2	Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.