# Unit 9 - Linear Functions

Content Area: **Mathematics**
Course(s): **Pre-Algebra 6**
Time Period: **May**
Length: **4 weeks**
Status: **Published**

## Transfer

**Big Idea:** **Linear Functions**

## Enduring Understandings

Functions and patterns of change can be represented by using tables, graphs, words, and symbolic expressions.

Relationships among quantities can often be expressed symbolically in more than one way.

Algebraic properties govern the fluent manipulation of symbols in expressions, and equations.

## Essential Questions

What is the most appropriate way of communicating a mathematical idea in a particular situation?

How do tables, graphs, words, and symbolic expressions represent the same thing?

Is there a time when one form of representation is stronger than another?

How can we use representations to determine and explain the underlying patterns?

## Critical Knowledge and Skills

## Vocabulary

**Vocabulary**

Relation

Domain

Range

Input

Output

Function

Vertical line test

x-intercept

y-intercept

slope

rise

run

linear function

linear equation

function form

## Learning Objectives

Use graphs to represent relations and functions

Find solutions of equations in two variables

Understand that functions can be linear or nonlinear

Use x and y intercepts to graph linear equations

Find and interpret slopes of lines.

Interpret and create graphs representing real-world situations

Graph and write linear equations in slope-intercept form

Construct a function to model a linear relationship between two quantities.

Compare two different proportional relationships and compare two different functional relationships.

Graph and solve systems of linear equations

## Resources

**Prior Knowledge**

*Located points in a coordinate plane

*Wrote and solved equations

## Standards

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| MA.6.RP.A | Understand ratio concepts and use ratio reasoning to solve problems. |
| MA.7.RP.A | Analyze proportional relationships and use them to solve real-world and mathematical problems. |
| MA.6.RP.A.1 | Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. |
| MA.7.RP.A.2 | Recognize and represent proportional relationships between quantities. |
| MA.8.EE.A | Work with radicals and integer exponents. |
| MA.6.RP.A.3a | Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. |

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| MA.7.RP.A.3 | Use proportional relationships to solve multistep ratio and percent problems. |
| MA.K-12.7 | Look for and make use of structure. |
| MA.8.EE.A.4 | Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology. |
| | Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers $x$ and $y$. |
| MA.8.EE.B | Understand the connections between proportional relationships, lines, and linear equations. |
| MA.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. |
| MA.K-12.8 | Look for and express regularity in repeated reasoning. |
| | Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results. |
| MA.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 $b$. |
| MA.8.EE.C | Analyze and solve linear equations and pairs of simultaneous linear equations. |
| MA.8.EE.C.8 | Analyze and solve pairs of simultaneous linear equations. |
| MA.6.NS.C | Apply and extend previous understandings of numbers to the system of rational numbers. |
| MA.8.F.A | Define, evaluate, and compare functions. |
| MA.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. |
| MA.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). |
| MA.7.EE.B | Solve real-life and mathematical problems using numerical and algebraic expressions and equations. |

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| MA.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. |
| MA.8.F.B | Use functions to model relationships between quantities. |
| MA.7.EE.B.4 | Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. |
| MA.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. |
| MA.6.NS.C.8 | Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate. |
| MA.6.EE.A | Apply and extend previous understandings of arithmetic to algebraic expressions. |
| MA.6.EE.A.4 | Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). |
| MA.6.EE.B | Reason about and solve one-variable equations and inequalities. |
| MA.6.EE.B.6 | Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. |
| MA.6.EE.C | Represent and analyze quantitative relationships between dependent and independent variables. |
| MA.6.EE.C.9 | Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. |