# Unit 7- Linear Equations and Inequalities

Content Area: **Mathematics**
Course(s): **Algebra, Math 8**
Time Period: **January**
Length: **35 Days**
Status: **Published**

## Unit Summary

This unit leads students through the exploration of the linear function family. The topics include translating among verbal, tabular, graphical, and algebraic representations of linear functions with the goal of modeling real-world situations by graphing data and finding line of best fit. The building blocks of this function family address the skills and concepts of slope as a constant rate of change, y-intercept as a "starting point", that equations communicate transformations on the parent equation, and that infinitely many solutions form a line. Students will analyze various linear functions and develop the vocabulary to compare and contrast linear functions within the linear function family, as well as, with quadratic and exponential functions. These concepts will be extended to linear inequalities as appropriate.

## Standards

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| MA.K-12.1 | Make sense of problems and persevere in solving them. |
| MA.K-12.2 | Reason abstractly and quantitatively. |
| MA.F-IF.B | Interpret functions that arise in applications in terms of the context |
| MA.K-12.4 | Model with mathematics. |
| MA.F-IF.B.4 | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. |
| MA.K-12.5 | Use appropriate tools strategically. |
| MA.F-IF.B.5 | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. |
| MA.K-12.6 | Attend to precision. |
| MA.F-IF.B.6 | Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. |
| MA.F-IF.C | Analyze functions using different representations |
| MA.K-12.7 | Look for and make use of structure. |
| MA.F-IF.C.7 | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. |
| MA.8.EE.B | Understand the connections between proportional relationships, lines, and linear equations. |
| MA.F-IF.C.7a | Graph linear and quadratic functions and show intercepts, maxima, and minima. |
| 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. |
| 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.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. |

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| MA.F-IF.C.9 | Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). |
| MA.F-BF.A | Build a function that models a relationship between two quantities |
| MA.F-BF.A.1 | Write a function that describes a relationship between two quantities. |
| MA.8.F.A | Define, evaluate, and compare functions. |
| MA.A-CED.A | Create equations that describe numbers or relationships |
| 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.A-CED.A.1 | Create equations and inequalities in one variable and use them to solve problems. |
| MA.A-CED.A.2 | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. |
| 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.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.F-LE.A | Construct and compare linear and exponential models and solve problems |
| MA.F-LE.A.1b | Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. |
| MA.A-REI.D | Represent and solve equations and inequalities graphically |
| MA.G-GPE.B | Use coordinates to prove simple geometric theorems algebraically |
| MA.A-REI.D.10 | Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). |
| MA.A-REI.D.11 | Explain why the $x$-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. |
| MA.8.SP.A | Investigate patterns of association in bivariate data. |
| MA.8.SP.A.2 | Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line. |
| MA.G-GPE.B.5 | Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). |
| MA.8.SP.A.3 | Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. |
| CAEP.9.2.8.B.3 | Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career. |
| TECH.8.1.8.A.CS1 | Understand and use technology systems. |
| TECH.8.1.8.A.CS2 | Select and use applications effectively and productively. |
| TECH.8.1.8.D.CS2 | Demonstrate personal responsibility for lifelong learning. |

## Student Learning Objectives

- Students will learn to graph linear equations using a table and slope-intercept form.
- Students will learn to find the slope of a line from a graph or using 2 points.
- Students will learn to graph direct variation and find the constant of variation.
- Students will learn to find rates of change or slope from a table.
- Students will learn to use similarity to connect the concept of slope to geometry.
- Students will learn to compare and analyze characteristics of linear functions.
- Students will learn to write linear equations in slope-intercept form.
- Students will learn to content addition to write linear equations in point-slope form, and standard form.
- Students will learn to write linear equations given a slope and the y-intercept.
- Students will learn to content addition to write linear equations given a slope and a point or two points.
- Students will learn to model real-world scenarios with linear functions.
- Students will learn to content addition to write equations for parallel and perpendicular lines.
- Students will learn to graph one linear inequality on a coordinate plane.

## Essential Questions

- Is life a straight line?
- How are linear inequalities related to linear equations?
- What types of relationships can be modeled by a straight line?
- What is the language of linear models?
- How can real life situations be represented by linear functions?

## Enduring Understandings

- Students wil understand that linear models allow us to understand the present and predict the future.

## Application

- Students will be able to independently use their learning to identify the characteristics of linear functions and relate to the parent function.
- Students will be able to independently use their learning to identify that linear functions graph as straight lines.
- Students will be able to independently use their learning to explain slope as a ratio that quantifies the steepness of a line.
- Students will be able to independently use their learning to apply the numerical value of slope to problem situations as a constant rate of change.
- Students will be able to independently use their learning to explain when linear functions and proportions are related and explain when and how they are different.
- Students will be able to independently use their learning to identify relationships between two lines (parallel, perpendicular, and intersecting) from graphs, tables and equations.
- Students will be able to independently use their learning to model real world situations with linear equations and inequalities to find the best solution.
- Students will be able to independently use their learning to recognize linear patterns and their associated characteristics when presented with bivariate data.

## Skills

Students will be skilled at:

- Calculating slope from a table, graph, or set of points.
- Graphing a linear function from a table or equation.
- Graphing linear inequalities from an inequality.
- Writing linear equations from a graph, table, or set of information.
- Modeling real worls situations by writing linear equations and inequalities.
- Identifying direct variation scenarios and write direct variation equations.
- Identifying the strengths and weaknesses of various ways to write a linear equation (slope-intercept vs standard form) and use them accordingly.
- Graphing data as a scatterplot and draw a line of best fit.