Unit #9 Linear Modeling

Content Area: **Math**
Course(s):
Time Period:
Length: **8 weeks**
Status: **Published**

State Mandated Topics Addressed in this Unit

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N/A	N/A

Linear Modeling

Learning Objectives

- Objective 1 - Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
- Objective 10 - Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
- Objective 11 - 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. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.★
- Objective 12 - Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.★
- Objective 13 - 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.★
- Objective 14 - Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ Graph linear and quadratic functions and show intercepts, maxima, and minima.
- Objective 15 - Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.
- Objective 16 - Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- Objective 17 - Interpret the parameters in a linear or exponential function in terms of a context.
- Objective 18 - 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).

- Objective 19 - Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- Objective 2 - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- Objective 20 - Define appropriate quantities for the purpose of descriptive modeling.
- Objective 21 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- Objective 22 - Represent data with plots on the real number line (dot plots, histograms, and box plots).
- Objective 23 - Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
- Objective 24 - Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
- Objective 25 - Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
- Objective 26 - Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
- Objective 27 - Represent data on two quantitative variables on a scatter plot and describe how the variables are related. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.
- Objective 28 - Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
- Objective 29 - Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a linear function for a scatter plot that suggests a linear association.
- Objective 3 - Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.
- Objective 30 - Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- Objective 31 - Compute (using technology) and interpret the correlation coefficient of a linear fit.
- Objective 32 - Distinguish between correlation and causation.
- Objective 4 - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.
- Objective 5 - 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).
- Objective 6 - Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.
- Objective 7 - Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.
- Objective 8 - Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y4 as (x2) 2 – (y2) 2 , thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).

- Objective 9 - Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).

Essential Skills

- Essential Skill 1 - Understand polynomials are closed under addition, subtraction, and multiplication
- Essential Skill 10 - Interpret expressions in terms of context.
- Essential Skill 11 - Interpret parts of an expression in context, such as terms, factors, and coefficients.
- Essential Skill 12 - Interpret complicated expressions by viewing its parts as a single entity.
- Essential Skill 13 - Factor expressions.
- Essential Skill 14 - Identify structure to rewrite expressions.
- Essential Skill 15 - Rewrite using difference of squares.
- Essential Skill 16 - Rewrite expressions using difference of cubes.
- Essential Skill 17 - Rewrite expressions using sum of cubes.
- Essential Skill 18 - Understand that a function has one member of the domain assigned to exactly one element of the range.
- Essential Skill 19 - F(x) denotes the output of f corresponding to the input of x.
- Essential Skill 2 - Create equation that represents relationships between quantities.
- Essential Skill 20 - The graph of f is the graph of y=f(x)
- Essential Skill 21 - Use function notation to evaluation functions for inputs in their domain.
- Essential Skill 22 - Interpret statements that use function notations in terms of context.
- Essential Skill 23 - Sketch a graph using the key features of a function.
- Essential Skill 24 - Interpret key features from a graph or a table of values.
- Essential Skill 25 - Relate the domain of a function its graph.
- Essential Skill 26 - Relate the domain of a function to the quantitative relationship that it describes.
- Essential Skill 27 - Calculate the average rate of change of a function from a graph or a function on an interval.
- Essential Skill 28 - Interpret the average rate of change.
- Essential Skill 29 - Estimate the average rate of change from a graph.
- Essential Skill 3 - Graph equations on axes with labels and scales.
- Essential Skill 30 - Graph linear and quadratic functions showing key features including intercepts, maxima and minima.
- Essential Skill 31 - Compare properties of two functions represented differently (algebraically, graphically, numerically, verbally).
- Essential Skill 32 - Distinguish between situations that can be modeled with linear functions and with exponential functions.
- Essential Skill 33 - Recognize situations where one quantity changes at a constant rate relative to another.
- Essential Skill 34 - Interpret the parameters of a linear or exponential functions in context
- Essential Skill 35 - Prove the slopes for parallel and perpendicular lines.

- Essential Skill 36 - Use the slopes of parallel and perpendicular lines to solve geometric problems.
- Essential Skill 37 - Apply scales to graphs, origin of graph and data displays.
- Essential Skill 38 - Use units to make sense of solutions.
- Essential Skill 39 - Apply scales to multi-step problems and formulas.
- Essential Skill 4 - Represent solutions of equations, inequalities, and systems to real-world applications.
- Essential Skill 40 - Interpret units in formulas.
- Essential Skill 41 - Choose units in formulas.
- Essential Skill 42 - Define quantities for descriptive modeling problems. (Incorporate appropriate units).
- Essential Skill 43 - Choose limits on measurements when reporting quantities.
- Essential Skill 44 - Choose the level of accuracy.
- Essential Skill 45 - Represent data with plots on the real number line.
- Essential Skill 46 - Use statistics appropriate to the shape of a data distribution.
- Essential Skill 47 - Compare the center(mean/median) and spread (interquartile range, standard deviation) of two (or more) different data sets.
- Essential Skill 48 - Interpret differences in shape, center, and spread in data sets, accounting for the effects of outliers
- Essential Skill 49 - Use mean and standard deviation of data set to fit a normal distribution and estimate population percentages.
- Essential Skill 5 - Interpret solutions as viable based on the constraints of the application.
- Essential Skill 50 - Recognize when appropriate to use mean and Standard deviation for data sets.
- Essential Skill 51 - Use Calculators, spreadsheets and tables to estimate area under the normal curve.
- Essential Skill 52 - Summarize data in a two-way frequency table.
- Essential Skill 53 - Interpret the relative frequencies including joint, marginal and conditional relative frequencies.
- Essential Skill 54 - Recognize possible trends and associations in the data.
- Essential Skill 55 - Represent data on two quantitative variables on a scatter plot.
- Essential Skill 56 - Describe how variables are related.
- Essential Skill 57 - Fit a function to the data.
- Essential Skill 58 - Use functions fitted to the data to solve problems.
- Essential Skill 59 - Use given functions or choose a function based on the context with an emphasis on linear and exponential models.
- Essential Skill 6 - Rearrange formulas to highlight a quantity of interest.
- Essential Skill 60 - Represent data on two quantitative variables on a scatter plot.
- Essential Skill 61 - Describe how variables are related.
- Essential Skill 62 - Informally assess the fit of a function through plotting and analyzing residuals.
- Essential Skill 63 - Represent two quantitative variables on a scatter plot. Describe how the variables are related.
- Essential Skill 64 - Fit a linear function for a scatterplot with a linear association.
- Essential Skill 65 - Interpret the slope (rate of change) of a linear model.
- Essential Skill 66 - Compute the correlation coefficient of a linear fit.

- Essential Skill 67 - Interpret the correlation coefficient of a linear fit.
- Essential Skill 68 - Distinguish between correlation and causation.
- Essential Skill 7 - Understand that the graph of an equation in two variables is the set of all of its solutions plotted in the coordinate plane
- Essential Skill 8 - Understand that the solution set to an equation in two variables often forms a curve (which could be a line).
- Essential Skill 9 - Interpret parts of expressions including terms, factors, and coefficients.

Standards

Instructional Tasks/Activities

- Baseball Activity
- Bingo
- Jeopardy
- Ladder Activity
- Manipulative Activities as needed
- Zombie Grudge Match

Assessment Procedure

- Classroom Total Participation Technique
- Classwork
- DBQ
- Essay
- Exit Ticket/Entrance Ticket/Do Now
- Identify the Error Problems
- Journal / Student Reflection
- Kahoot
- Other named in lesson
- Peer Review
- Performance
- Problem Correction
- Project
- Quiz
- Rubric
- Teacher Collected Data
- Test

- Worksheet

Recommended Technology Activities

- Appropriate Content Specific Online Resource
- Appropriate Content Specific Online Resource
- Gimkit
- GoGuardian
- Google Classroom
- Google Docs
- Google Slides
- Google Slides
- Kahoot
- MagicSchool AI
- Other- Specified in Lesson
- Quiziz
- Screencastify

Accommodations & Modifications & Differentiation

Accommodations and Modifications should be used to meet individual needs. Their IEP and 504 plans should be used in addition to the following suggestions.

Gifted and Talented

- Compare & Contrast
- Conferencing
- Debates
- Jigsaw
- Peer Partner Learning
- Problem Solving
- Structured Controversy
- Think, Pair, Share
- Tutorial Groups

Instruction/Materials

- alter format of materials (type/highlight, etc.)

- color code materials
- eliminate answers
- extended time
- extended time
- large print
- modified quiz
- modified test
- Modify Assignments as Needed
- Modify/Repeat/Model directions
- necessary assignments only
- Other (specify in plans)
- other- named in lesson
- provide assistance and cues for transitions
- provide daily assignment list
- read class materials orally
- reduce work load
- shorten assignments
- study guide/outline
- utilize multi-sensory modes to reinforce instruction

Environment

- alter physical room environment
- assign peer tutors/work buddies/note takers
- assign preferential seating
- individualized instruction/small group
- modify student schedule (Describe)
- other- please specify in plans
- provide desktop list/formula

Honors Modifications

Resources

- https://deltamath.com/
- https://education.ti.com/en/timathnspired/us/algebra-1
- www.Khanacademy.com

- www.mathforum.com

Special Education Pull out Essential Skills

- 1) The artist will be able to understand the concept of slope as a rate of change.
- 2) The artist will be able to discover the connection between slope and parallel/perpendicular lines.
- 3) The artist will be able to understand, apply, and manipulate the various formulas for linear equations.
- 4) The artist will be able to graph linear equations.