Unit 02 Linear Functions

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 1**
Length: **11 days**
Status: **Published**

Brief Summary of Unit

Students will briefly review how to graph a line, find the slope of a line, decide if two lines are parallel, perpendicular, or neither. Students will be able to find the missing value of two coordinate points knowing their slope. For example (4, 5) and (5, y) has a slope of 2, solve for y. Students will be able to do the same concept for finding a missing value for two parallel lines and perpendicular lines. For example, if line k uses the points (6, 7) and line k uses the points (x, -1), then find the value of x that makes line k and j parallel. Find the value of x that makes lines j and k perpendicular. Students will write the equation of a line given various pieces of information (the slope, the x-intercept, a line it is perpendicular to). They will be able to use slope-intercept form and point-slope form.

Students will also apply the distance formula and midpoint formula. Students will be able to find the distance between two points, simplify a radical, and be able to properly compare values. Students will be given the distance between two points and be asked to find the missing x or y value of one of the coordinate points. Students will do the same for the midpoint formula. Students will be able to plot points on a coordinate plane and show on a graph that they have the correct value of the midpoint. They will also be able to find a missing endpoint when given the midpoint and one endpoint. They will use graph paper and slope to find the missing endpoint. They will also be able to find the missing endpoint algebraically.

The rest of this chapter is comprised of transformations of functions, building new functions from existing functions, a topic that students explored in Algebra 1 using a variety of functions. The goal is to identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(k(x), and f(x + k) for specific values of k. Students will be able to graph:

a) y = x

b) y = x^2

c) y = x^3

d) y = square root of x

e) y = 1/x

f) y = absolute value of x.

Students will explore what happens to the function when a negative is placed in front of the x, ie y = -x^2. Students will further explore what happens to y = (x + 2)^2 vs. y = x^2 + 2. We will explore vertical and horizontal shifts, stretching, shrinking, and reflections. We will describe a rule for y = a (x + b)^n + c and how each variable alters the graph. Students will identify the "1, 3, 5" pattern of the parabola and how that

pattern changes in shrinking/stretching.

Students will begin to explore the domain and range of their graphs. They will be able to write the domain and range in interval notation and inequality notation. Students will be introduced to the "union" concept later in the course. For now, it is just basic. Students will see how continuity on a graph and the arrows can tell us if the graph has an infinite value or not.

A review of 2x2 systems will be reviewed independently by the students over their long weekends as this topic was applied constantly in Honors Geometry.

Students will begin to use the graphing calculator along with Demos to help with data interpretation at a faster pace and to see how to find and evaluate specific values of a graph. We will also use the graphing calculator to show the stretching and shifting of various graphs.

Students will be introduced to the real number system. They will be able to classify real numbers into the categories of:

a) Rational

b) Irrational

c) Whole

d) Integer

e) Natural

We will discuss fractions, radicals, decimals, and how they are all placed in their categories of real numbers.

Revised Date: July 2025

Standards

Diversity and Inclusion: Students will focus on equity, inclusion, and tolerance when analyzing the comparison of various quantities regarding characteristics of people. Equality will also be highlighted which can be associated with both numerical representations and the connection between people. This can be associated with treating people fairly and equally.

MATH.9-12.F.BF.A	Build a function that models a relationship between two quantities
MATH.9-12.F.BF.A.1	Write a function that describes a relationship between two quantities.
MATH.9-12.S.ID.B.6.a	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.
MATH.9-12.F.BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\ f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k(both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
MATH.9-12.A.CED	Creating Equations
MATH.9-12.S.ID.C.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.
MATH.9-12.A.CED.A	Create equations that describe numbers or relationships
MATH.9-12.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.
MATH.9-12.A.CED.A.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.
MATH.9-12.F.IF.A.1	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 $y = f(x)$.
MATH.9-12.F.IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MATH.9-12.A.REI.A	Understand solving equations as a process of reasoning and explain the reasoning
MATH.9-12.F.IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MATH.9-12.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.
MATH.9-12.F.IF.C.7.a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
MATH.9-12.A.REI.C.6	Solve systems of linear equations algebraically (include using the elimination method) and graphically, focusing on pairs of linear equations in two variables.
MATH.9-12.F.IF.C.7.b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
MATH.9-12.A.REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
MATH.9-12.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).
MATH.9-12.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.
MATH.9-12.F.IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MATH.9-12.F.LE.A	Construct and compare linear and exponential models and solve problems
WRK.9.2.12.CAP.12	Explain how compulsory government programs (e.g., Social Security, Medicare) provide insurance against some loss of income and benefits to eligible recipients.
WRK.9.2.12.CAP.22	Compare risk and reward potential and use the comparison to decide whether starting a

business is feasible.

Essential Questions

- How can intercepts of linear functions be distinguished from each other?
- How can two lines be determined parallel using geometric and algebraic methods?
- How can two lines be determined perpendicular using geometric and algebraic methods?
- What characteristics of a linear function determine its visual representation and behavior?
- Why are linear functions useful in the real world?

Enduring Understandings

- Linear functions represent situations involving a constant rate of change.
- The characteristics of linear functions and their representations are useful in solving real world problems.

Students Will Know

- Students will know how to describe transformations of parent functions.
- Students will know how to find the domain and range of a graph.
- Students will know how to find the equation of a line, graph it, find the slope, y-intercept, and any critical values.
- Students will know how to identify parent functions and transformations.
- Students will know how to model with linear functions.
- Students will know how to solve linear systems.

Students Will Be Skilled At

- Students will be skilled at comparing linear equations to solve real life problems.
- Students will be skilled at determining a line of fit and line of best fit.
- Students will be skilled at graphing transformations of functions.
- Students will be skilled at identifying the function family to which a function belongs.
- Students will be skilled at solving real life problems using systems of equations in three variables.
- Students will be skilled at understanding how translations, reflections, stretches, and shrinks affect the graphs of functions.
- Students will be skilled at writing equations of linear functions.
- Students will be skilled at writing functions that represent transformations of absolute value functions.
- Students will be skilled at writing functions that represent transformations of linear functions.

Evidence/Performance Tasks

Assessments

- Formative: Daily assessments using examples from class notes and NJGPA test bank problems
- Summative: Teacher-created assessments, NJGPA test bank problems
- Benchmark: Teacher created diagnostic assessments
- Alternative Assessments: as needed
- Weekly SAT sheets that are relevant to the topic the students are currently studying

- Answer essential questions
- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Open-notes quick quizzes on each topic
- Provide alternative means of assessments for certain students
- Review sheets for completion
- Teacher Observation
- Tests and quizzes that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations

Learning Plan

Unit 1 Linear Functions (3 weeks)

1.1 Day 1

- Introduction or real numbers: students will classify their numbers are rational or irrational, integer, whole, natural. Students will be given a list of numbers that they must classify.
- Students will have a table with numbers and put check marks in each box for the category that suites them.
- Students will answer always/sometimes/never questions about their real numbers.
- Students will answer true/false statements and provide counterexamples as needed.

1.2 Day 2

- Students will be able to graph a line using the slope and y-intercept.
- Students will define slope and find the slope between two points.
- Students will define the y-intercept and write the equation of a line given the slope and y-intercept or write the equation given the graph.
- Students will be able to define parallel and perpendicular lines with regards to their slopes and provide examples of each type.

- Students will use slope-intercept and point-slope formula to write the equation of a line given the slope and one point.
- They will write the equation of a line given two points (they will need to find the slope).
- They will write the equation of a line given the slope and the x-intercept.
- They will write the equation of a line given the x-intercept and y-intercept (find the slope).
- They will write the equation of a line that is parallel to a given line and passing through a specific point. They will be able to isolate the y-variable if needed.
- They will write the equation of a line that is perpendicular to a given line through a specific point.
- Students will use the graphing calculator to graph as well and show various table values.

1.2 Day 3

- Review Day 1 and Day 2, students will have a quick quiz before the next material is given.
- Students will be able to find the value of x when given two points (5, 6) and (x, -11) and being told that the slope is -1/7.
- Students will perform higher application problems on attached worksheets and challenge sheets.

1.2 Day 4 - Quiz

1.3 Day 5

- Students will be able to find the distance between two points. They will graph the two points on graph paper, label them, and show the correct length. A discussion on right triangles will follow this as to how the distance formula was created. Students can also do the Pythagorean Theorem if preferred.
- Students will simplify all radicals correctly.
- Students will be given two pairs of points, one of which has a missing x or y coordinate value and have to find the value of that variable so that the two pairs of points each have the same distance. Students will use higher level Algebra 1 skills to this task. Students will check their work by plugging in their answer.
- Students will use the midpoint formula to find the midpoint of a line segment.
- Students will find a missing value of x or y in a coordinate point when they are given the midpoint value.
- Students will find a missing endpoint when given one other endpoint and the midpoint by algebra or graphing (slopes).
- Students will complete higher level challenge skills supplied by a worksheet.

1.3 Day 6 and 7- Quick quiz

- Students will begin to graph parent functions on the guided notes by making a table and plotting points
  - $y = x$
  - $y = x^2$
  - $y = x^3$
  - y = square root of x
  - y = absolute value of x
  - $y = 1/x$
- Students will perform horizontal and vertical shifts.
- Students will perform reflections.

- Students will use colored pencils and stretch/shrink their graph.
- Students will fill in the derived rules for each type of transformation.
- Students will describe the variables and how they alter the graph in $y = a (x + h)^2 - k$
- Students will apply the 1, 3, 5 pattern to parabolas and the reciprocal to the square root function.
- Students will be able to find the equation of a function when given the graph.

- Apply multiple transformations to linear and absolute value functions. Identify the equation of a given graph. Graph a given function.

- Apply transformations on a non-parent function and find a new equation.

- Students will use the graphing calculator as a tool for graphing.

1.3 Day 8

- Practice day on parents functions
- Students will apply the notation f(x) for y. Students will describe how f(x +4) vs. f(x) + 4 is shifted. They will be given a basic graph (no equation) and perform various transformations
- Review

1.3 Day 9 - Quiz

1.4 Day 10-11 Compositions. Students will be given an equation for f(x) and g(x). They will be able to find:

- f(x) + g(x)
- f(x) - g(x)
- f(x) x g(x)
- f(x) divided by g(x)
- f(g(7) ; g(f(3)) and so on
- Using a graph that is provided and drawn for them, evaluate f(7) on the graph. Evaluate f(-3). Evaluate f(f(-2)). They will find if x = 2, then f(x) = ?

Day 12: Unit review

Day 13: Unit test

Materials

Core instructional materials:Core Book List including Algebra & Trigonometry 4E by Stewart

Supplemental materials: Khan Academy, Edia, and DeltaMath

- District approved textbook and ancillary materials
- Online resources: Khan Academy, Delta Math, Edia, Ed Puzzle
- Teacher created activites
- Teacher created notes

Integrated Accommodation & Modifications

Integrated Accommodation & Modifications for Algebra 2/Intro to Trig Honors