

Unit 5: Functions

Content Area: **Math**
Course(s): **Algebra 1**
Time Period: **March**
Length: **4-5 weeks**
Status: **Published**

Title Section

Department of Curriculum and Instruction



Belleville Public Schools

Curriculum Guide

Algebra 1 A

Unit 5: Functions

Belleville Board of Education

102 Passaic Avenue

Belleville, NJ 07109

Prepared by: Annamaria Contella, Tatiana Ryjouk

Board Approved: August 27th, 2018

Unit Overview

- This unit is about representing relations in different ways, recognizing and graphing linear functions, quadratic functions, exponential functions, absolute value functions, piecewise functions, finding the inverse of a relation and a linear function.
- The students should learn how to represent relations as sets of ordered pairs, tables, mappings, and graphs; recognize and graph linear functions, quadratic functions, exponential functions, absolute value functions, piecewise functions; find the inverse of a relation and a linear function.

NJSLS

MA.9-12.S-ID.B.6c	Fit a linear function for a scatter plot that suggests a linear association.
MA.9-12.F-IF.C.8b	Use the properties of exponents to interpret expressions for exponential functions.
MA.9-12.S-ID.C.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
MA.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 $y = f(x)$.
MA.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.
MA.9-12.A-SSE.A.2	Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.
MA.9-12.F-BF.A.1	Write a function that describes a relationship between two quantities.
MA.9-12.F-IF.A.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
MA.9-12.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.9-12.F-LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions.
MA.9-12.A-SSE.B.3b	Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
MA.9-12.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.9-12.F-LE.A.1a	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
MA.9-12.F-LE.A.1b	Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
MA.9-12.A-REI.B.4a	Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
MA.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).
MA.9-12.F-LE.A.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
MA.9-12.A-REI.B.4b	Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b .
MA.9-12.N-RN.A.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.
MA.9-12.F-BF.A.2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
MA.9-12.F-IF.C.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
MA.9-12.F-IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
MA.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.
MA.9-12.F-IF.C.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
MA.9-12.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
MA.9-12.S-ID.B.6a	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.
MA.9-12.F-IF.C.8a	Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

Exit Skills

By the end of Unit 5 Students Should be able to:

- Represent relations in graphs, mappings, and tables.
- Find the domain, range, and inverse of a relation.
- Determine whether a relation is a function.
- Compare and contrast discrete and continuous functions.
- Interpret graphs of functions.
- Graph linear equations.
- Find function values and use function notation.
- Graph equations that represent functions.
- Find the intercepts and zeros of linear equations.
- Write equations that represent functions.
- Identify and represent patterns that describe linear functions.
- Identify and represent patterns that describe nonlinear functions.
- Evaluate and graph exponential functions.
- Solve problems involving exponential growth and decay using technology.
- To analyze the characteristics of graphs of quadratic functions.
- Graph quadratic functions of the form $y = ax^2 + bx + c$.
- Identify and graph special functions(absolute value, step, piecewise-linear).
- Focus on linear, quadratic, and exponential functions, including sequences, and also explore absolute value, step, and piecewise-defined functions.
- Interpret functions given graphically, numerically, symbolically, and verbally.
- Translate between representations.
- Understand the limitations of various representations. Students build on and extend their understanding of integer exponents to consider exponential functions.
- Perform transformations of functions.
- Find the inverse of a relation and linear function.
- Find inverses of real-world functions.
- Model with functions.

Enduring Understanding

- Understand the real-world meaning of the parameters of functions.
- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

Essential Questions

- How can you represent and describe functions?
- What are discrete and continuous functions?
- How can functions describe real-world situations?
- What do different representations of functions (words, tables, ordered pairs, and graphs) tell us about the relationships?
- What are the characteristics of exponential, quadratic, absolute value functions?
- How do you write, graph, and interpret an exponential decay and exponential growth function?
- What are the characteristics of real-life relationships that can be modeled with exponential functions?

Learning Objectives

Students will be able to:

- Represent relations by graphs, mappings, ordered pairs, and tables.
- Find the domain, range, and inverse of a relation by interactions with the domain and range of a function .
- Determine whether a relation is a function by analyzing the domain and range of a function.
- Compare and contrast discrete and continuous functions by using their properties.
- Interpret graphs of functions by evaluating the parameters.
- Graph linear and quadratic equations using a graphing calculator.
- Find function values and use function notation.
- Find the intercepts and zeros of linear equations by reading a graph or solving an equation.
- Write equations that represent functions by identifying patterns that describe linear and nonlinear functions..
- Evaluate and graph exponential functions by creating a table.
- Explore and solve problems involving exponential growth and exponential decay functions.
- Analyze the characteristics of graphs of quadratic functions.
- Identify and graph special functions (absolute value, step, piecewise-linear).
- Perform transformations of functions by using special rules .
- Find the inverse of a relation and linear function by solving $y=f(x)$ for x and switching the x and y .
- Find inverses of real-world functions.
- Model with functions by exploring and illustrating functions' behavior in projects.

Interdisciplinary Connections

Economics, business, financing, geometry, literacy, science.

CRP.K-12.CRP2

Apply appropriate academic and technical skills.

CRP.K-12.CRP4

Communicate clearly and effectively and with reason.

CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
TECH.8.1.12.A.3	Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
TECH.8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

Alignment to 21st Century Skills & Technology

Key SUBJECTS AND 21st CENTURY THEMES

Mastery of key subjects and 21st century themes is essential for all students in the 21st century.

Key subjects include:

- English, reading or language arts
- World languages
- Arts
- Mathematics
- Economics
- Science
- Geography
- History
- Government and Civics

21st Century/Interdisciplinary Themes

- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness

21st Century Skills

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

Suggested Activities & Best Practices

Real World applications of Functions:

<https://www.illustrativemathematics.org/content-standards/HSA/CED/A/1/tasks/581>

<http://threeacts.mrmeyer.com/fallingglowsticks/>

<https://robertkaplinsky.com/work/in-n-out-100-x-100/>

Functions:

<https://betterlesson.com/lesson/449120/what-s-your-function>

Sample of Differentiating Instruction in Algebra(Functions)

http://www.prufrock.com/Assets/ClientPages/pdfs/Differentiating_Instruction_Algebra.pdf

Textbook, eAssessment, supplemental materials:

<https://my.mheducation.com/login>

AI Assessment and Learning System:

<https://www.aleks.com/>

Mindset:

<https://www.youtube.com/watch?v=3icoSeGqQtY>

<http://www.youcubed.org/wp-content/uploads/Positive-Classroom-Norms2.pdf>

Teaching Strategies for Improving Algebra Knowledge in Middle and High School Students:

<https://ies.ed.gov/ncee/wwc/PracticeGuide/20>

Coaching Corner:

<https://sites.google.com/belleville.k12.nj.us/thecoachingcorner/home>

Algebra Tools - Functions:

<https://www.state.nj.us/education/aps/cccs/math/NJISTFunctions.pdf>

Algebra Tools - Algebra:

<https://www.state.nj.us/education/aps/cccs/math/NJISTAAlgebra.pdf>

Misc Mathematics materials:

<http://www.mathnstuff.com/>

Algebra Kahoots:

<https://kahoot.com/explore/collections/math-kahoot-algebra/>

Technology Infusion

- Youtube
- Khan academy
- MS Excel
- Office 365
- MS Word
- PodCasts
- MS Powerpoint
- Wikipedia
- Skype
- Twitter
- Ted Talks
- QR Barcode Generator
- Calculator/Graphic calculator
- desmos.com
- geogebra.org

Differentiation

- Cooperative groups
- Board work
- Team work
- Classroom discussions
- Questions and Answers
- Study guide
- Tests/quizzes reviews
- Notes taking/transparencies
- Organizer
- Calculator/graphic calculator
- Posters display
- Extra time

Special Education

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multiple test sessions
- multi-sensory presentation
- preferential seating
- preview of content, concepts, and vocabulary
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

ELL

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required

- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

Intervention Strategies

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Evidence of Student Learning-CFU's

Please list ways educators may effectively check for understanding in this section.

- Admit Tickets
- Anticipation Guide
- Common benchmarks
- Compare & Contrast
- Define

- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Illustration
- KWL Chart
- Outline
- Quizzes
- Self- assessments
- Study Guide
- Teacher Observation Checklist
- Unit tests

Primary Resources

Glencoe McGraw-Hill Algebra1 2014

Glencoe McGraw-Hill Algebra1 2010

Practice Glencoe Algebra1

Study Guide Glencoe Algebra1

Ancillary Resources

Houghton Mifflin Harcourt On core Mathematics Algebra1

Glencoe McGraw-Hill Science and Mathematics Lab Manual