01-Functions

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **2 weeks (8-10 blocks)**
Status: **Published**

General Overview, Course Description or Course Philosophy

In this unit, students will be introduced to the key components of functions and how they relate to their graphs. Students will learn function notation and use it to analyze and describe various functions, both contextually and algebraically. Students will apply concepts like domain/range and function tables/graphs to describe contextual situations. Students will also be introduced to arithmetic sequences and use recursive and explicit formulas to describe these relationships.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Students will understand that:

- Functions can be used to represent and analyze real-world situations
- Function notation can be used to represent the relationship algebraically
- The graph of a function represents all possible solutions
- Functions can be represented in multiple ways (equation, table, graph, or in words)

Essential Questions:

- How can you represent and describe functions?
- How can functions represent real-world situations?
- How are the equations, graphs, and tables of functions related?

CONTENT AREA STANDARDS

HS Functions

F.BF

A. Build a function that models a relationship between two quantities

B. Build new functions from existing functions

F.IF

A. Understand the concept of a function and use function notation

B. Interpret functions that arise in applications in terms of the context

C. Analyze functions using different representations

A.APR

A. Perform arithmetic operations on polynomials

B. Understand the relationship between zeros and factors of polynomials

C. Use polynomial identities to solve problems

D. Rewrite rational expressions

MA.K-12.2	Reason abstractly and quantitatively.
MA.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.A-SSE.A.1a	Interpret parts of an expression, such as terms, factors, and coefficients.
MA.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.A-SSE.A.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.
MA.F-IF.A.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
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.N-Q.A.1	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.
MA.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.F-BF.A.1a	Determine an explicit expression, a recursive process, or steps for calculation from a context.
MA.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.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.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.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).

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

9.1.8.PB.1: Predict future expenses or opportunities that should be included in the budget planning process. • 9.1.8.PB.2: Explain how different circumstances can affect one's personal budget.

LA.K-12.NJSLSA.R7	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
CS.K-12.3.a	Identify complex, interdisciplinary, real-world problems that can be solved computationally.
CS.K-12.3.b	Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.
CS.K-12.3.c	Evaluate whether it is appropriate and feasible to solve a problem computationally.
TECH.9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).
TECH.9.4.12.IML.4	Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
TECH.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
TECH.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will understand that:

- Functions are defined as relations that pair each domain value with exactly one range value
- Functions can be represented by tables, graphs, equations, and real-world situations
- Function notation can be used to represent function rules
- The set of all solutions of a function form its graph
- The vertical line test can be used to identify a function on a graph
- Arithmetic sequences have a constant difference
- Recursive formulas depend on the previous term to get the next term
- Explicit formulas relate the term to the term number

Procedural Knowledge

Students will be able to:

- Create function tables by evaluating functions in their domains
- Define a function using tables, equations, and graphs
- Analyze real-world situations and write equations to represent them
- Apply the vertical line test and a mapping diagram to determine whether or not a relation is a function
- Identify and extend patterns in sequences
- Create equations in function notation to represent arithmetic sequences
- Identify recursive and explicit formulas for arithmetic sequences and use these formulas to extend the sequence

EVIDENCE OF LEARNING

Benchmark Assessments

Benchmark Assessments conducted three times per year, using Pear Assessment (Standards Based Assessments)

Alternate Assessments

- Portfolios
- Verbal Assessment (instead of written)
- Multiple choice
- Modified Rubrics
- Performance Based Assessments

Formative Assessments

- Class Discussion/Exit Cards (example questions below):
    - How can you represent and describe functions?
    - How can functions represent real-world situations?
    - How can you identify an arithmetic sequence?
    - What is the difference between an explicit formula and a recursive formula?
- Homework/practice problems (assigned from textbook or various web resources, such as Khan Academy, Albert, Quizizz, or Desmos)

Summative Assessments

- Lesson quizzes
- Teacher-generated unit test
- Performance tasks

RESOURCES (Instructional, Supplemental, Intervention Materials)

Core Instructional Resources

- *Pearson Algebra 1: Common Core*, Chapter 4, Sections 4-4 through 4-7

Supplemental Instructional Resources

- Illustrative Math Tasks
- Arlington Algebra Project (Functions)
- Desmos Guess My Rule

INTERDISCIPLINARY CONNECTIONS

Functions of varying complexity are essential in modeling many real-world situations. Students will utlilize their knowledge of functions in science, especially chemistry and physics, and computer science courses. Functions are used to study economics, biology, physics, communications, politics, art, music, and countless more disciplines.

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.