

Unit 5: Introduction to Functions

Algebra Prep Honors

11 Class Meetings

Revised May 2024

Essential Questions

- How can functions describe and represent real-world situations, model predictions, and solve problems?

Enduring Understandings with Unit Goals

EU 1: Functions are a mathematical way to describe relationships between two quantities that vary.

- Describe how the dependent and independent variables relate to each other.

EU 2: Real-world situations can be represented in a variety of ways.

- Represent functions using an equation, a table, and a graph.

EU 3: Function notation is a mathematical method of representing an equation as a function.

- Decipher the meaning of questions posed in function notation.

Standards

Common Core State Standards:

- **8.F.A.1:** Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. Function notation is not required in Grade 8.
- **HS.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 $y = f(x)$.
- **HS.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.
- **HS.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.
- **HS.F.IF.B.5:** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- **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.
- **8.F.B.5:** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
- **HS.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).

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ISAAC Vision of the Graduate Competencies

Competency 1: Write effectively for a variety of purposes.

Competency 2: Speak to diverse audiences in an accountable manner.

Competency 3: Develop the behaviors needed to interact and contribute with others on a team.

Competency 4: Analyze and solve problems independently and collaboratively.

Competency 5: Be responsible, creative, and empathetic members of the community.

Unit Content Overview

1. Relations and Functions

- Identify the Domain and Range of a function
- Identify Functions – Vertical Line Test
- Vocabulary: axes, coordinate plane (cartesian plane), domain, equivalent, function, f graph, inverse of a relation, linear, non-linear, number line, ordered pair, origin, point, quadrant, range, relation, sketch, table of values, vertical line, vertical line test

2. Using Graphs to Relate Two Quantities

- Analyze a Graph (Independent and Dependent Variables)
- Compare and contrast a Table and a Graph
- Sketch a Graph
- Identify Domain and Range
- Vocabulary: axes, coefficient, constant, coordinate plane (cartesian plane), dependent variable, domain, equivalent, function, graph, inverse of a relation, independent variable, linear, ordered pair, origin, point, quadrant, range, relation, sketch, table of values, unit rate, variable, vertical line, vertical line test

3. Patterns and Linear Functions

- Compare and contrast Linear Functions
- Classify Functions as Linear or Nonlinear
- Vocabulary: axes, coefficient, constant, coordinate plane (cartesian plane), dependent variable, domain, exponent, function, graph, independent variable, input, linear, linear equation, non-linear, ordered pair, origin, output, pattern, point, quadrant, range, relation, sketch, table of values, variable, vertical line, vertical line test

4. Graphing a Function Rule

- Graph a Function Rule Using a Table
- Graph a Real-World Function Rule
- Identify and compare Continuous and Discrete Graphs
- Vocabulary: axes, coefficient, constant, constant of proportionality, coordinate plane (cartesian plane), dependent variable, domain, equivalent, function, function notation, function rule, graph, the inverse of a relation, independent variable, linear, linear equation, non-linear, number line, ordered pair, origin, point, proportional relationship, quadrant, range, rate, rate of change, relation, sketch, slope, slope formula, slope-intercept form, table of values, unit rate, variable, vertical line, vertical line test

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5. Writing a Function Rule

- Write a Function Rule
- Use Function Notation
- Vocabulary: axes, coefficient, constant, constant of proportionality, coordinate plane (cartesian plane), dependent variable, domain, equivalent, function, function notation, function rule, graph, the inverse of a relation, independent variable, linear, linear equation, non-linear, number line, ordered pair, origin, point, proportional relationship, quadrant, range, rate, rate of change, relation, sketch, slope, slope formula, slope-intercept form, table of values, unit rate, variable, vertical line, vertical line test

Interdisciplinary Connection:

- Language Arts- Accountable Talk, Word Problems

Daily Learning Objectives with *TWPS Activities*

Students will be able to...

- Describe the difference between a relation and function and identify the domain and range of a relation
 - *TWPS – Analyze a function and relation. What are the similarities and differences? Explain using mathematical reasoning.*
- Analyze graphs of real-world situations
 - *TWPS – Find the error in determining the domain and range of the function. Explain using mathematical reasoning.*
- Examine and explain patterns that describe linear functions as well as nonlinear functions
 - *TWPS – Analyze a linear and nonlinear function. What are the similarities and differences? Explain using mathematical reasoning.*
- Create a graph from equations that represent functions
 - *TWPS – Graph the given equation in slope-intercept form. What are the most important criteria needed from the equation to graph it? Explain using mathematical reasoning.*
- Write and describe equations that represent functions **
 - *TWPS – What do the slope and y-intercept represent in the given equation? Explain using mathematical reasoning.*
 - *TWPS – Given a scenario, how would you write an equation to represent it? Explain using mathematical reasoning.*
- Calculate values of a function using function notation**
 - *TWPS – Given an equation in slope-intercept form, how can we show that a given value is the solution? Explain using mathematical reasoning.*
 - *TWPS – How would you write an equation in slope-intercept form given a scenario? Explain using mathematical reasoning.*

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Instructional Strategies/Differentiated Instruction

- TWPS
- Whole-group instruction
- Creating authentic connections for students
- Rephrasing and restatement of information and concepts
- Guided notes
- Student-led instruction
- Small group instruction
- Independent problem-solving
- Collaborative problem-solving
- Cross-curricular problem solving (independent and collaborative)
- Accountable Talk
- Manipulatives
- Homework

EL DIFFERENTIATED INSTRUCTION:

- Word Walls with visuals
- TWPS (Think, Write, Pair, Share)
- Pre-reading strategies
- Culturally responsive teaching
- Explicit Modeling
- Key Vocabulary
- Graphic Organizers
- Strategic Grouping
- Non-verbal Assessments

Assessments

FORMATIVE ASSESSMENTS:

- Accountable Talk Discussions
- Do Now Activity
- Warm-ups (SBAC prep)
- Whiteboards
- Mid-class check-ins
- Exit Slips
- Student-led instruction
- Homework
- Performance Task - Hot Air Balloon
 - Problem Solving Rubric

SUMMATIVE ASSESSMENTS:

- Edulastic Quiz – EU 1 & 2
- Edulastic Test – EU 1, 2, & 3

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Unit Task

Unit Task Name: Hot Air Balloon

Description: Students will use information learned during this unit about how functions are used to describe mathematical relationships (EU 1), how real-world situations can be represented in a variety of ways (EU 2), and how function notation is a mathematical way of representing functions (EU 3) to create a graph of a hot air balloon trip. Students will be given the times and heights of the hot air balloon and must graph them on a graph. Once the hot air balloon trip is graphed on the coordinate plane, they will be instructed to use the graph to answer a series of questions about the trip. They will need to go into depth about each answer to show a true understanding of the concepts.

Evaluation: Summative Assessment and Problem Solving Rubric

Unit Resources

- Flipped Google Classroom Videos
- Worksheets
- Calculator
- Laptops
- SBAC Prep Online
- Edulastic
- Kahn Academy
- Match Fishtank
- Map.Mathshell.org
- Online resources