Mathematics: Grade 8

Overview

The *Algebra and Functions* standards for grade eight represent the culmination of all the learning about expressions, equations, and variables in the middle grades. In grade six, students write and evaluate equivalent linear expressions,[6.NS.7] understand what it means to solve an algebraic equation,[6.AF.2] and solve one-step linear equations and inequalities in one variable.[6.AF.3-4] In grade seven, they solve two-step linear equations and inequalities in one variable,[7.AF.3-4] and in grade eight they solve linear equations and inequalities with rational number coefficients in one variable fluently.[8.AF.1] Grade seven students also define slope as vertical change divided by horizontal change, use slope to graph lines, and understand constant rate of change as an attribute of linear functions.[7.AF.5-6] Algebra I students use one-variable linear equations with variables on both sides of the equal sign to model real-world situations and solve them fluently.[A1.L.1]

The progression of learning around functions is supported by grade six standards that ask students to use equations with two variables to model proportional relationships and understand the role of dependent and independent variables in a function relationship.[6.RP.5] Students in grade seven use two variable equations, as well as graphs and tables, to model real-world proportional relationships,[7.RP.3] and they represent real-world problems using linear equations.[7.AF.3] In grade eight, they understand the formal definition of a function, analyze linear functions in multiple representations, and differentiate between linear and nonlinear functions.[8.AF.3-5]

Grade eight students also understand what it means to solve a system of linear equations in two unknowns[8.AF.8] and this concept is developed further in the *Systems of Equations and Inequalities* domain in Algebra I. An understanding of functions is essential to success with high school algebra, which focuses heavily on using linear and nonlinear functions to model real-world relationships between varying quantities using multiple representations.

Algebra and Functions	
Learning Outcome	Students understand the formal definition of a function, analyze linear functions in multiple representations, and differentiate between linear and nonlinear functions. Students also solve a system of linear equations in two unknowns.
Standard	**8.AF.4:** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described. (E)

Evidence Statements	Academic Vocabulary
● Distinguish between graphs of linear and	● Qualitative

- nonlinear functions.
- Identify or describe intervals of a given graph as increasing, decreasing or staying at a constant rate.
- Interpret intervals of a given graph based on the context in which it is presented.
- Identify or describe maximum or minimum values on a graphed function.
- Describe a given graph's characteristics using terms such as linear, nonlinear, increasing, decreasing, constant, minimum, and maximum.
- Identify or sketch a graph based on given maximum and minimum values.
- Sketch a graph of a function that has been verbally described.
- Communicate understanding of the qualitative features of a function using precise mathematical language and provide evidence from the graph to support statements.

- Linear
- Nonlinear
- Increasing functions
- Decreasing functions
- Maximum value
- Minimum value
- Constant rate
- Slope
- Varying rate
- *Y*-intercept
- Qualitative description
- Interval

Clarification Statements	Common Misconceptions
- Students should be able to create graphs and examine graphs based on a variety of the qualitative features at the same time. - Students should be exposed to examples of graphs that have multiple local maxima/minima, and learn how to contrast that to cases where there is a global maximum/minimum.	- Students may find it difficult to tell the difference between linear and nonlinear relationships, misclassifying nonlinear relationships as linear based just on how the graph looks. - When the graph shows fluctuations or uneven patterns, students may confuse increasing and decreasing trends. - It may be difficult for students to locate and explain a graph's maximum or minimum values. - Students may struggle with changing labels of axes (e.g., time vs. speed compared with time vs. acceleration).

Looking Back	Looking Ahead
7.AF.6: Graph a line given its slope and a point on the line. Find the slope of a line given its graph. (E)	**AI.L.2:** Represent linear functions as graphs from equations (with emphasis on technology), equations from graphs, and equations from tables and other given information (e.g., from a given point on a line and the slope of the line). Find the equations of a line in a slope-intercept, point-slope, and standard forms. Reveal more or less information about a given situation based on the form used.

	AI.L.3: Represent real-world problems that can be modeled with a linear function using equations, graphs, and tables, including with technology; translate fluently among these representations, and interpret the slope and intercepts. (E)
	AI.QE.5: Graph exponential and quadratic functions with and without technology. Identify and describe key features, such as zeros, lines of symmetry, and extreme values in real-world and other mathematical problems involving quadratic functions with and without technology; interpret the results in the real-world contexts.

Instructional Resources

- Mathematics Grades 6-8 Vertical Articulation Guide
- Learning Progressions & Content Supports: Grade 6 through Grade 8
- Implementing the Mathematics Process Standards: Grades Six to Eight
- Mathematics Assessment Resource Service Shell Center - Baseball Jerseys
- Mathematics Assessment Resource Service Shell Center - Meal Out

Universal Supports for All Learners

- 2024 Content Connectors
- Universal Design for Learning Playbook
- UDL Guideline Infographic, from Learning Designed
- UDL Tips from CAST
- Mathematics Learning Recovery Series: Part 2-Addressing the Gaps in Student Learning
- Mathematics Learning Recovery Series: Part 3-Instructional Strategies for All Learners

Instructional Strategies
- What Works Clearinghouse-Concrete-Semi-Concrete-Abstract Video (Print Recommendations)
- What Works Clearinghouse-Clear & Concise Mathematical Language Video (Print Recommendations)
- NYSED-Frayer Vocabulary Model Scaffolding Example & Template
- Magma Math: Math Teaching Practices
- Problem Solving Instructional Support
- WIDA-Doing and Talking Mathematics: A Teachers Guide to Meaning-Making with English Learners
- Virginia Department of Education Students with Disabilities in Mathematics Frequently Asked Questions

Assessment Considerations

- ILEARN Test Blueprint: Mathematics 2025-2026 (Spreadsheet)
- ILEARN Test Blueprint: Mathematics 2025-2026 (PDF)
- IDOE Released Items Repository

Updated June 18, 2025

- [I AM - Indiana's Alternate Measure](#)
- [Quality Mathematic Items for Classroom Assessments (Featuring New ILEARN Item Specifications)](#)
- [Grade 7 & 8 ILEARN Math Desmos Scientific Calculator](#)
- [UDL Assessment StrategiesEARN Test Blueprint: Mathematics 2025-2026 (PDF)](#)

Interdisciplinary Connections
Coming Soon
Disciplinary Literacy
Coming Soon

Contact IDOE's [Office of Teaching and Learning](#) with any questions.