

# New Jersey Student Learning Standards Mathematics: Climate Change Companion Guide

Office of Standards, Division of Teaching and Learning Services
New Jersey Department of Education

## Introduction

This document contains select 2023 New Jersey Student Learning Standards–Mathematics (NJSLS–M) and a corresponding climate change example. The standards and examples are organized by grade for kindergarten through grade 8, and by conceptual category for high school. Please note that the examples are featured in green text.

This document serves as a resource for school districts seeking to integrate climate change education into their curricula. While not exhaustive, it offers a foundation for understanding and action; districts are encouraged to explore additional measures and initiatives that align with local contexts, ensuring a dynamic and adaptable response to the multifaceted challenges posed by climate change.

## A Note on the Inclusion of Climate Change Opportunities Icon of hand holding plant: opportunity to integrate climate change education,

With the adoption of the 2020 New Jersey Student Learning Standards (NJSLS), New Jersey became the first state in the nation to include climate change across content areas. The goal of inclusion of climate change education implementation is to foster generations of New Jersey students that can analyze, question, interpret, to think independently, and bring critical deduction to fulfill, and to lead in jobs created by burgeoning industries of the future green economy.

Revisions to the NJSLS-Mathematics reflect the means in which humans analyze and critically develop data-supported questions through the study of counting, measuring, and describing the given subject. Students will use informed and reasoned discussions to analyze patterns, form new conjectures and develop deductive reasoning skills. Mathematics will further ensure a generation of New Jersey students that can think analytically to solve problems, look for solutions, and lead in the future green workforce.

The symbol for climate change through the standards ( ) notes opportunities to integrate specific examples of climate change education provided by additional age-appropriate resources. These additional materials are designed to support educators in creating interdisciplinary units focused on authentic learning experiences integrating a range of perspectives.

## **Kindergarten**

* K.OA.A.2 Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem. 
Climate Change Example: Students may use counters when adding to find the total number of trees that they and a partner observed (e.g., from their front door, in a back yard, from a classroom window). With prompting and support, they may ask and answer questions about how trees may reduce the warming effect of sunlight.
* K.DL.A.1 Classify objects into given categories; count the numbers of objects in each category and sort the categories by count. (Clarification: Limit category counts to be less than or equal to 10) 
Climate Change Example: With prompting and support, students may ask and answer questions about objects that may be reused, objects that may be recycled, and objects that must be placed in the trash. Students may classify used objects into those categories with no more than 10 objects in each category. Students may count the number of objects in each category and sort the categories by count.
* K.G.B.5 Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes. 
Climate Change Example: Students may use sticks and clay to model trees and umbrellas and may then draw shapes (e.g., triangle, rectangle) to model those objects. With prompting and support, they may ask and answer questions about how trees and umbrellas may be used to reduce the warming effect of sunlight.

## **Grade 1**

* 1.OA.A.1 Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. 
Climate Change Example: Given a number of light bulb stickers, students may determine how many total stickers they and a partner have. With support, students may ask and answer questions about how turning off lights and unplugging electronics saves electricity. Students may then determine, with their partner, who saves more electricity based on the number of light bulb stickers each has.
* 1.OA.A.2 Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. 
Climate Change Example: Given a number of light bulb stickers, students may determine how many total stickers they and two partners have. With support, students may ask and answer questions about how turning off lights and unplugging electronics saves electricity. Students may then, with their partners, determine who saves the most electricity based on the number of light bulb stickers each has.
* 1.DL.A.1 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another. 
Climate Change Example: Students mayask and answer questions about objects that may be reused, objects that may be recycled, and objects that must be placed in the trash. Students may organize used objects into those categories, and ask and answer questions about the total number of objects, how many are in each category, and how many more or fewer are in one category than in another.

## **Grade 2**

* 2.OA.A.1 Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions*,* e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. 
Climate Change Example: Students may solve two-step word problems involving a climate change related issue in their school, such as food waste, recycling, reusing and/or reducing the consumption of goods. They may add and subtract within 100 while using drawing or equations to represent the climate change related issue.
* 2.M.B.5 Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem. 
Climate Change Example: Students may add and subtract within 100 to solve word problems about a climate change issue that involves length. To solve these problems, they may use drawings or equations to represent a climate change related issue in their school, such as food waste, recycling, reusing and/or reducing the consumption of goods.
* 2.DL.B.4 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put together, take-apart, and compare problems using information presented in a bar graph. 
Climate Change Example: Students may draw a bar graph having single-unit scale to represent a data set about a climate change related issue in their school, such as food waste, recycling, reusing and/or reducing the consumption of goods.

## **Grade 3**

* 3.OA.A.3 Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. 
Climate Change Example: Students may solve multiplication and division word problems involving measurement quantities related to glacier retreat.
* 3.OA.D.8 Solve two-step word problems, including problems involving money, using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. (Clarification: This standard is limited to problems posed with whole numbers and having whole number answers; students should know how to perform operations in the conventional order when there are no parentheses to specify a particular order) (Order of Operations) 
Climate Change Example: Students may use the four operations to solve two-step word problems related to glacier retreat.
* 3.M.C.6Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters. 
Climate Change Example:Students maysolve real world problems about glacier retreat that involve perimeters of polygons.

## **Grade 4**

* 4.OA.A.3 Solve multi-step word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. 
Climate Change Example: Students may, knowing that energy and fuels are derived from natural resources and that their uses affect the climate, use the four operations to solve multi-step word problems posed with whole numbers, having whole-number answers and that are based on energy, fuels, and natural resources.
* 4.M.A.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale. 
Climate Change Example: Students may, knowing that energy and fuels are derived from natural resources and that their uses affect the climate, use the four operations to solve word problems related to the use of natural resources and involving distance, time, liquid volume, and/or the mass of objects.
* 4.DL.B.5 Make a line plot to display a data set of measurements in fractions of a unit (½, ¼, ⅛). Solve problems involving addition and subtraction of fractions by using information presented in line plots. For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection. 
Climate Change Example: Students may, knowing that energy and fuels are derived from natural resources and that their uses affect the climate, make a line plot to display a data set of measurements in fractions of a unit.

## **Grade 5**

* 5.NF.B.3 Interpret a fraction as division of the numerator by the denominator (i.e., ). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. For example, interpret  as the result of dividing 3 by 4, noting that  multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size  . If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie? 
Climate Change Example: To examine the impact climate change has on agriculture, students may solve word problems about the reduced yields of staple crops and their distribution that involve division of whole numbers and lead to answers in the form of fractions.
* **5.NF.B.7c Solve** real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. For example, how much chocolate will each person get if 3 people share  lb. of chocolate equally? How many -cup servings are in 2 cups of raisins? 
Climate Change Example: To examine the impact climate change has on agriculture, students may solve real-world problems about the reduced yields of staple crops and their distribution that involve division of unit fractions by non-zero whole numbers and/or division of whole numbers by unit fractions.
* **5.G.A.2** Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane and interpret coordinate values of points in the context of the situation. 
Climate Change Example: Students may represent real world problems about the reduced yields of staple crops by graphing points in the first quadrant of the coordinate plane; Students may interpret coordinate values of points in the agricultural context.

## **Grade 6**

* **6.EE.B.7** Solve real-world and mathematical problems by writing and solving equations of the form $x+ p=q$and $px=q$for cases in which *p*, *q* and *x* are all nonnegative rational numbers. 
Climate Change Example: Students may solve real-world problems by writing and solving one-variable equations related to deforestation and/or increasing livestock farming as contributors to climate change.
* **6.EE.C.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation to represent the relationship between distance and time. 
Climate Change Example: Students may analyze and use variables to represent the relationship between greenhouse emissions and livestock farming when representing relationships among contributors to climate change.
* 6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots. 
Climate Change Example: Students may display numerical data related to deforestation and increasing livestock farming as contributors to climate change in plots on a number line, including dot plots, histograms, and box plots.

## **Grade 7**

* **7.NS.B.3** Solve real-world and mathematical problems involving the four operations with rational numbers. (Clarification: Computations with rational numbers extend the rules for manipulating fractions to complex fractions.) Climate Change Example: Students may solve real-world problems involving the four operations with rational numbers related to the relationship between altitude and the temperature above sea level.
* 7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional  of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar  inches long in the center of a door that is  inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation. 
Climate Change Example:Students may solve multi-step real-lifeproblemsposed with positive and negative rational numbers in any formrelated to the relationship between altitude and the temperature above sea level**.**
* **7.G.B.6** Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. 
Climate Change Example:Students may solvereal-worldproblems involvingarea, surface area, and volumerelated to deforestation and increasing livestock farming as key contributors to climate change.

## **Grade 8**

* **8.G.C.9** Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems. 
Climate Change Example: Students may use the formula for the volume of a sphere to approximate the volume of hailstones to consider how climate change may affect the size of hailstones over time.
* 8.SP.A.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. 
Climate Change Example: Students may construct and interpret scatterplots of measurement data to investigate patterns of association in bivariate data involving the amount of a greenhouse gas in the atmosphere and its effect on temperature.
* 8.SP.A.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.
Climate Change Example: Students may use the equation of a linear model to interpret the slope when comparing local and global precipitation rates for rainfall in different regions.

## **High School: Number and Quantity**

* **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. 
Climate Change Example: Students may use units to guide the solution of multi-step problems about how variations in the flow of energy into and out of the Earth’s systems result in climate change. Note: Changes in climate are limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.
* **N.Q.A.2 Define** appropriate quantities for the purpose of descriptive modeling. 
Climate Change Example: Students may define appropriate quantities for a descriptive model of how variations in the flow of energy into and out of Earth’s systems result in climate change. Note: changes in climate are limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.
* N.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. 
Climate Change Example:Students may**,** when reporting quantities related tohow variations in the flow of energy into and out of the Earth’s systems result in climate change, choose a level of accuracy appropriate to limitations on how quantities were measured.

## **High School: Algebra**

* **A.CED.A.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. 
Climate Change Example: Students may create equations and/or inequalities to represent the economic impact of climate change.
* **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. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. 
Climate Change Example: Students may represent constraints describing the economic impact of climate change by equations, inequalities, and/or by systems of inequalities, and interpret solutions as viable or nonviable options.
* A.CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm’s law  to highlight resistance *R*. 
Climate Change Example:Students may rearrange formulas related tothe economic impact of climate changeto highlight a quantity of interest, using the same reasoning as in solving equations.

## **High School: Function**

* **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. 
Climate Change Example: Students may use function notation to determine the amount of carbon dioxide produced by burning a given number of molecules of ethane (gasoline),m, where c(m) is the number of molecules of carbon dioxide.
* F.IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function. 
Climate Change Example:Students mayrelate the domain of a function c(m) representingthe amount of carbon dioxide produced by burningm molecules of ethane (gasoline),to its graph in order to determine the appropriate domain for c(m).
* 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.  
Climate Change Example:Students maycalculate the average rate of change of a function c(m) presented symbolically or as a table, where c(m) representsthe amount of carbon dioxide produced by burninga given number of molecules of ethane (gasoline).

## **High School: Geometry**

* **G.MG.A.1** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). 
Climate Change Example:Students may use circles, their measures, and their properties to describe the cross section of a tree and compare changes in radial diameter or circumference variations of tree trunks when considering changes in seasonal weather patterns over time.
* **G.MG.A.2** Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). 
Climate Change Example: Students may apply the concept of population density of different urban areas, including calculations of population density, and discuss different environmental factors (e.g., air and water quality, waste disposal, energy consumption) that might be exacerbated by increased population density.
* **G.MG.A.3** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). 
Climate Change Example:Students may apply geometric methods to solve design problems such as increasing access to green spaces in cities given physical and cost constraints.

## **High School: Statistics and Probability**

* **S.ID.A.1** Represent data with plots on the real number line (dot plots, histograms, and box plots). 
Climate Change Example: Students may represent geoscience data, with plots on the real number line, as they analyze results from global climate models.
* S.ID.B.6 Represent data on two quantitative variables on a scatter plot and describe how the variables are related. 
Climate Change Example: Students may represent geoscience data on two quantitative variables on a scatter plot and describe how the variables are related in order to analyze the data and the results from global climate models.
* 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. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models. 
Climate Change Example: Students may use linear or exponential functions fitted to geoscience data to solve problems and analyze the results from global climate models to make an evidence-based forecast of the current rate of global climate change.