

# OREGON HIGH SCHOOL MATHEMATICS

## GRADE LEVEL GUIDANCE



OREGON  
DEPARTMENT OF  
EDUCATION



OREGON  
MATH PROJECT  
*Meaningful Math for Every Student*

## Contents

<b>Contents</b> .....	<b>2</b>
Oregon Math Project .....	2
Clarifying Documents .....	2
<b>HS Algebra Overview</b> .....	<b>3</b>
Critical Areas of Focus .....	3
Domains and Clusters .....	3
Algebraic Reasoning: Expressions and Equations (HS.AEE) .....	4
Algebraic Reasoning: Functions (HS.AFN) .....	5
Numeric Reasoning: Number and Quantity (HS.NQ) .....	6
<b>HS Geometry Overview</b> .....	<b>7</b>
Critical Areas of Focus .....	7
Domains and Clusters .....	7
Geometric Reasoning and Measurement (HS.GM) .....	8
<b>HS Data &amp; Statistics Overview</b> .....	<b>9</b>
Critical Areas of Focus .....	9
Domains and Clusters .....	9
Data Reasoning and Probability (HS.DR) .....	10

## OREGON MATH PROJECT

The Oregon Math Project (OMP) advances mathematics education in our state by cultivating a network of educators that promotes equitable math experiences for all students through guidance and the support of policies, standards, curricula, assessments, and instructional best practices. Realizing the vision of math education in Oregon includes ensuring that all students attain mathematics proficiency by having access to high-quality instruction that includes challenging and coherent content in a learning environment where each student receives the support they need to succeed in mathematics.

Please [visit the OMP website](#) to learn more about the project and opportunities to connect with this work.

## CLARIFYING DOCUMENTS

The intent of clarifying statements is to provide additional guidance for educators to communicate the intent of the [2021 Oregon math standards](#) to support the future development of aligned curricular resources and assessments.

Clarifying statements can be in the form of succinct sentences or paragraphs that attend to one of four types of clarifications: (1) Student Experiences; (2) Examples; (3) Boundaries; and (4) Connection to Math Practices.

Please [use this form to provide suggestions](#) to the Oregon Math Standards and/or Guidance document.

Questions, comment, or suggestions can also be emailed to: [ODE.MathProject@ode.oregon.gov](mailto:ODE.MathProject@ode.oregon.gov)



## HS Algebra Overview

### Critical Areas of Focus

In High School Algebra, instructional time should focus on four critical areas:

1. **Expressions:** A record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function.
2. **Equations and inequalities:** A statement of equality between two expressions, often viewed as a question asking for which values of the variables the expressions on either side are in fact equal.
3. **Connections to Functions and Modeling:** Converting a verbal description to an equation, inequality, or system of these is an essential skill in modeling.
4. **Quantities:** In real world problems, answers are usually not numbers but quantities: numbers with units, which involves measurement.

Link to summary of [HS Algebra Critical Areas](#)

*Students should spend the large majority<sup>1</sup> of their time on the major work of the grade (■). Supporting work (□) and, where appropriate, additional work (●) can engage students in the major work of the grade.*

<sup>1</sup>At least 65% and up to approximately 85% of class time

### DOMAINS AND CLUSTERS

#### *HS.AEE - Algebraic Reasoning: Expressions and Equations*

- **HS.AEE.A** Use algebraic reasoning to rewrite expressions in equivalent forms.
- **HS.AEE.B** Use algebraic reasoning to find solutions to an equation, inequality, and systems of equations or inequalities.
- **HS.AEE.C** Analyze the structure of an equation or inequality to determine an efficient strategy to find and justify a solution.
- **HS.AEE.D** Make predictions in different applications using expressions, equations, and inequalities to analyze authentic contexts.

#### *HS.AFN - Algebraic Reasoning: Functions*

- **HS.AFN.A** Describe functions by using both symbolic and graphical representations.
- **HS.AFN.B** Compare and relate functions using common attributes.
- **HS.AFN.C** Represent functions graphically and interpret key features in terms of the equivalent symbolic representation.
- **HS.AFN.D** Model a wide variety of authentic situations using functions through the process of making and changing assumptions, assigning variables, and finding solutions to contextual problems.

#### *HS.NQ - Numeric Reasoning: Number and Quantity*

- **HS.NQ.A** Understand and apply the real number system.
- **HS.NQ.B** Attend to units of measurement needed to solve problems through quantitative reasoning and mathematical modeling.





## ALGEBRAIC REASONING: EXPRESSIONS AND EQUATIONS (HS.AEE)

**HS.AEE.A** *Use algebraic reasoning to rewrite expressions in equivalent forms.*

**HS.AEE.A.1** Interpret an expression which models a quantity by viewing one or more of its parts as a single entity. Reason about how changes in parts of the expression impact the whole, and vice versa.

**HS.AEE.A.2** Create and recognize an equivalent form of an expression to understand the quantity represented in an authentic context.

**HS.AEE.A.3** Rearrange formulas and equations to highlight a specific quantity.

**HS.AEE.B** *Use algebraic reasoning to find solutions to an equation, inequality, and systems of equations or inequalities.*

**HS.AEE.B.4** Define variables and create equations with two or more variables to represent relationships between quantities in order to solve problems in authentic contexts.

**HS.AEE.B.5** Define variables and create inequalities with one or more variables and use them to solve problems in authentic contexts.

**HS.AEE.B.6** Solve systems of linear equations and systems of linear inequalities in authentic contexts through reasoning, algebraic means, or strategically using technology.

**HS.AEE.C** *Analyze the structure of an equation or inequality to determine an efficient strategy to find and justify a solution.*

**HS.AEE.C.7** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities; interpret solutions as viable or nonviable options in authentic contexts.

**HS.AEE.C.8** Construct a viable argument to justify a method for solving equations or inequalities.

**HS.AEE.D** *Make predictions in different applications using expressions, equations, and inequalities to analyze authentic contexts.*

**HS.AEE.D.9** Understand that the solution to an equation in two variables is a set of points in the coordinate plane that form a curve, which could be a line.

**HS.AEE.D.10** Recognize and explain why the point(s) of intersection of the graphs of  $f(x)$  and  $g(x)$  are solutions to the equation  $f(x)=g(x)$ . Interpret the meaning of the coordinates of these points in authentic contexts.

**HS.AEE.D.11** Graph and explain why the points in a half plane are solutions to a linear inequality and the solutions to a system of inequalities are the points in the intersection of corresponding half planes. Interpret the meaning of the coordinates of these points in authentic contexts.





## ALGEBRAIC REASONING: FUNCTIONS (HS.AFN)

**HS.AFN.A** *Describe functions by using both symbolic and graphical representations.*

**HS.AFN.A.1** Understand a function as a rule that assigns a unique output for every input and that functions model situations where one quantity determines another.

**HS.AFN.A.2** Use function notation and interpret statements that use function notation in terms of the context and the relationship it describes.

**HS.AFN.A.3** Calculate and interpret the average rate of change of a function over a specified interval.

**HS.AFN.B** *Compare and relate functions using common attributes.*

**HS.AFN.B.4** Compare properties of two functions using multiple representations. Distinguish functions as members of the same family using common attributes.

**HS.AFN.B.5** Relate the domain of a function to its graph and to its context.

**HS.AFN.C** *Represent functions graphically and interpret key features in terms of the equivalent symbolic representation.*

**HS.AFN.C.6** Interpret key features of functions, from multiple representations, and conversely predict features of functions from knowledge of context.

**HS.AFN.C.7** Graph functions using technology to show key features.

**HS.AFN.D** *Model a wide variety of authentic situations using functions through the process of making and changing assumptions, assigning variables, and finding solutions to contextual problems.*

**HS.AFN.D.8** Model situations involving arithmetic patterns. Use a variety of representations such as pictures, graphs, or an explicit formula to describe the pattern.

**HS.AFN.D.9** Identify and interpret the effect on the graph of a function when the equation has been transformed.

**HS.AFN.D.10** Explain why a situation can be modeled with a linear function, an exponential function, or neither. In a given model, explain the meaning of coefficients and features of functions used, such as slope for a linear model.







## NUMERIC REASONING: NUMBER AND QUANTITY (HS.NQ)

**HS.NQ.A** *Understand and apply the real number system.*

**HS.NQ.A.1** Use reasoning to establish properties of positive integer exponents. Extend the definition of exponentiation to include negative and rational exponents so as to be consistent with these properties. Utilize exponentiation to model authentic contexts.

**HS.NQ.A.2** Compare real numbers presented through different representations, including both rational and irrational numbers. Apply comparisons in authentic contexts.

**HS.NQ.B** *Attend to units of measurement needed to solve problems through quantitative reasoning and mathematical modeling.*

**HS.NQ.B.3** Use reasoning to choose and interpret measurement units consistently in formulas, graphs, and data displays, as a way to understand problems and to guide the solution of multi-step problems.

**HS.NQ.B.4** Define, manipulate, and interpret appropriate quantities using rational and irrational numbers to authentically model situations and use reasoning to justify these choices.

**HS.NQ.B.5** Use reasoning to choose a level of accuracy appropriate to limitations on measurement when reporting quantities in modeling situations.





## HS Geometry Overview

### Critical Areas of Focus

In High School Geometry, instructional time should focus on three critical areas:

1. **Geometric Reasoning:** An understanding of the attributes and relationships of geometric objects can be applied in diverse contexts
2. **Congruence, similarity, and symmetry:** The concepts of congruence, similarity, and symmetry can be understood from the perspective of geometric transformation.
3. **Connections to Equations:** Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof.

[Link to summary of HS Geometry Critical Areas](#)

Students should spend the large majority<sup>1</sup> of their time on the major work of the grade (■). Supporting work (□) and, where appropriate, additional work (●) can engage students in the major work of the grade.

<sup>1</sup>At least 65% and up to approximately 85% of class time

### DOMAINS AND CLUSTERS

#### *Geometric Reasoning and Measurement (HS.GM)*

- **HS.GM.A** Apply geometric transformations to figures through analysis of graphs and understanding of functions.
- **HS.GM.B** Construct and communicate geometric arguments through use of proofs, logical reasoning, and geometric technology.
- **HS.GM.C** Solve problems and interpret solutions of area and volume of shapes by applying concepts of congruence, similarity, symmetry in authentic contexts.
- **HS.GM.D** Apply concepts of right triangle trigonometry in authentic contexts to solve problems and interpret solutions.





## GEOMETRIC REASONING AND MEASUREMENT (HS.GM)

**HS.GM.A** *Apply geometric transformations to figures through analysis of graphs and understanding of functions.*

**HS.GM.A.1** Apply definitions of rotations, reflections, and translations to transform a figure and map between two congruent figures in authentic contexts.

**HS.GM.A.2** Verify experimentally the properties of a dilation given a center and a scale factor. Solve problems in authentic contexts involving similar triangles or dilations.

**HS.GM.A.3** Use the slopes of segments and the coordinates of the vertices of triangles, parallelograms, and trapezoids to solve problems in authentic contexts.

**HS.GM.A.4** Use definitions of transformations and symmetry relationships to justify the solutions of problems in authentic contexts.

**HS.GM.B** *Construct and communicate geometric arguments through use of proofs, logical reasoning, and geometric technology.*

**HS.GM.B.5** Apply and justify triangle congruence and similarity theorems in authentic contexts.

**HS.GM.B.6** Justify theorems of line relationships, angles, triangles, and parallelograms; and use them to solve problems in authentic contexts.

**HS.GM.B.7** Perform geometric constructions with a variety of tools and methods.

**HS.GM.C** *Solve problems and interpret solutions of area and volume of shapes by applying concepts of congruence, similarity, symmetry in authentic contexts.*

**HS.GM.C.8** Solve authentic modeling problems using area formulas for triangles, parallelograms, trapezoids, regular polygons, and circles.

**HS.GM.C.9** Use volume and surface area formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems and apply to authentic contexts.

**HS.GM.C.10** Use geometric shapes, their measures, and their properties to describe real world objects, and solve related authentic modeling and design problems.

**HS.GM.C.11** Apply concepts of density based on area and volume in authentic modeling situations.

**HS.GM.D** *Apply concepts of right triangle trigonometry in authentic contexts to solve problems and interpret solutions.*

**HS.GM.D.12** Apply sine, cosine, and tangent ratios, and the Pythagorean Theorem, to solve problems in authentic contexts.

**HS.GM.D.13** Apply the Pythagorean Theorem in authentic contexts, and develop the standard form for the equation of a circle.

**HS.GM.D.14** Use the coordinate plane to determine parallel and perpendicular relationships, and the distance between points.







## HS Data & Statistics Overview

### Critical Areas of Focus

In High School Data & Statistics, instructional time should focus on four critical areas:

1. **Questioning in Statistics:** The statistical problem-solving process typically starts with a statistical investigative question, followed by a study designed to collect data that aligns with answering the question.
2. **Analyze, summarize, and describe data:** Data are gathered, displayed, summarized, examined, and interpreted to discover patterns and deviations from patterns.
3. **Technology in Statistics:** Modern statistical practice is intertwined with technology; thus, it is recommended that technology be embraced to the greatest extent possible within a given circumstance.
4. **Connections to Functions and Modeling:** Functions may be used to describe data

Link to summary of [HS Data & Stats Critical Areas](#)

Students should spend the large majority<sup>a</sup> of their time on the major work of the grade (■). Supporting work (□) and, where appropriate, additional work (●) can engage students in the major work of the grade.

<sup>a</sup>At least 65% and up to approximately 85% of class time

### DOMAINS AND CLUSTERS

#### Data Reasoning and Probability (HS.DR)

- **HS.DR.A** Formulate Statistical Investigative Questions.
- **HS.DR.B** Collect and Consider Data.
- **HS.DR.C** Analyze, summarize, and describe data.
- **HS.DR.D** Interpret data and answer investigative questions.
- **HS.DR.E** Understand independence and conditional probability and use them to interpret data.





## DATA REASONING AND PROBABILITY (HS.DR)

*HS.DR.A Formulate Statistical Investigative Questions.*

HS.DR.A.1 Formulate multivariable statistical investigative questions and determine how data from samples can be collected and analyzed to provide an answer.

HS.DR.A.2 Formulate summative, comparative, and associative statistical investigative questions for surveys, observational studies, and experiments using primary or secondary data.

HS.DR.A.3 Formulate inferential statistical investigative questions regarding causality and prediction from correlation.

HS.DR.A.4 Use mathematical and statistical reasoning to formulate questions about data to evaluate conclusions and assess risks.

*HS.DR.B Collect and Consider Data.*

HS.DR.B.5 Articulate what constitutes good practice in designing a sample survey, an experiment, and an observational study. Understand issues of bias and confounding variables in a study and their implications for interpretation.

HS.DR.B.6 Distinguish and choose between surveys, observational studies, and experiments to design an appropriate data collection that answers an investigative question of interest.

HS.DR.B.7 Apply an appropriate data collection plan when collecting primary data or selecting secondary data for the statistical investigative question of interest.

*HS.DR.C Analyze, summarize, and describe data.*

HS.DR.C.8 Identify appropriate ways to summarize and then represent the distribution of univariate and bivariate data multiple ways with graphs and/or tables. Use technology to present data that supports interpretation of tabular and graphical representations.

HS.DR.C.9 Use statistics appropriate to the shape of the data distribution to compare the center and spread of two or more different data sets.

HS.DR.C.10 Use data to compare two groups, describe sample variability, and decide if differences between parameters are significant based on the statistics.

*HS.DR.D Interpret data and answer investigative questions.*

HS.DR.D.11 Use statistical evidence from analyses to answer statistical investigative questions, and communicate the findings in a variety of formats (verbal, written, visual) to support informed data-based decisions.

HS.DR.D.12 Articulate what it means for an outcome or an estimate of a population characteristic to be plausible or not plausible compared to chance variation.

HS.DR.D.13 Use multivariate thinking to articulate how variables impact one another, and measure the strength of association using correlation coefficients for regression curves.

*HS.DR.E Understand independence and conditional probability and use them to interpret data.*

HS.DR.E.14 Describe the possible outcomes for a situation as subsets of a sample space.

HS.DR.E.15 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

