



Ohio Grade 10 Math Learning Map

The Ohio Mathematics Academic Content Standards and Grade-Level Indicators are correlated in the map on the following page to LearningExpress's 10th Grade Math Diagnostic Skills. In the map, the official content standards are listed in an abbreviated format in the left-most column. To understand these abbreviations, please refer to following diagram:

The letter refers to the associated Ohio Mathematics Content Standard. In this example, "G" refers to "Geometry and Spatial Sense." The complete list of these abbreviations can be found below.

This number refers to the corresponding Ohio Mathematics Grade-Level Indicator. These official indicators correspond with the individual standards, and are listed on page 12 of this document.

G10.7

This number refers to the corresponding grade level.

| Ohio Mathematics Content Standards Abbreviations Key | |
|--|-------------------------------------|
| N = | Number, Number Sense and Operations |
| M = | Measurement |
| G = | Geometry and Spatial Sense |
| A = | Patterns, Functions and Algebra |
| D = | Data Analysis and Probability |

| Ohio Mathematics Academic Content Standards and Grade-Level Indicators | High School Math Diagnostic Skills | Supporting Courses | Supporting Practice Exercises |
|--|------------------------------------|--|---|
| N10.1; N10.2 | Application of Real Numbers | High School Math Course 1: Number Sense 1 High School Math Course 2: Number Sense 2 | High School Math Practice: Fundamentals 1 High School Math Practice: Fundamentals 2 |
| G10.3 | Applying the Pythagorean Theorem | High School Math Course 4: Measurement | High School Math Practice: Measurement 1 High School Math Practice: Measurement |
| N/A | Changes in Area and Volume | High School Math Course 4: Measurement | High School Math Practice: Measurement 1 High School Math Practice: Measurement 2 |
| G10.3 | Classification of Angle Pairs | High School Math Course 3: Geometry | High School Math Practice: Geometry 1 High School Math Practice: Geometry 2 High School Math Practice: Geometry 3 |
| G10.3 | Congruency and Similarity Concepts | High School Math Course 3: Geometry | High School Math Practice: Geometry 1 High School Math Practice: Geometry 2 High School Math Practice: Geometry 3 |

| Ohio Mathematics Academic Content Standards and Grade-Level Indicators | High School Math Diagnostic Skills | Supporting Courses | Supporting Practice Exercises |
|--|---------------------------------------|--|---|
| N10.2; N10.4 | Exponential and Logarithmic Functions | High School Math Course 1: Number Sense 1 High School Math Course 2: Number Sense 2 | High School Math Practice: Fundamentals 1 High School Math Practice: Fundamentals 2 |
| G10.3 | Formal and Informal Geometric Proofs | High School Math Course 3: Geometry | High School Math Practice: Geometry 1 High School Math Practice: Geometry 2 High School Math Practice: Geometry 3 |
| N/A | Operations with Real Numbers | High School Math Course 1: Number Sense 1 High School Math Course 2: Number Sense 2 | High School Math Practice: Fundamentals 1 High School Math Practice: Fundamentals 2 |
| M10.5; G10.1; G10.10 | Properties and Equation of a Circle | High School Math Course 3: Geometry High School Math Course 4: Measurement | High School Math Practice: Geometry 1 High School Math Practice: Geometry 2 High School Math Practice: Geometry 3 High School Math Practice: Measurement 1 High School Math Practice: Measurement 2 |

| Ohio Mathematics Academic Content Standards and Grade-Level Indicators | High School Math Diagnostic Skills | Supporting Courses | Supporting Practice Exercises |
|--|------------------------------------|---|---|
| G10.3; A10.9 | Properties of Parallel Lines | High School Math Course 3: Geometry | High School Math Practice: Geometry 1 High School Math Practice: Geometry 2 High School Math Practice: Geometry 3 |
| G10.3 | Properties of Quadrilaterals | High School Math Course 3: Geometry High School Math Course 4: Measurement | High School Math Practice: Geometry 1 High School Math Practice: Geometry 2 High School Math Practice: Geometry 3 High School Math Practice: Measurement 1 High School Math Practice: Measurement 2 |
| G10.1; G10.3 | Properties of Triangles | High School Math Course 3: Geometry High School Math Course 4: Measurement | High School Math Practice: Geometry 1 High School Math Practice: Geometry 2 High School Math Practice: Geometry 3 High School Math Practice: Measurement 1 High School Math Practice: Measurement 2 |

| Ohio Mathematics Academic Content Standards and Grade-Level Indicators | High School Math Diagnostic Skills | Supporting Courses | Supporting Practice Exercises |
|--|-------------------------------------|--|--|
| G10.3 | Ratio and Proportion in Geometry | High School Math Course 2: Number Sense 2 High School Math Course 4: Measurement | High School Math Practice: Fundamentals 1 High School Math Practice: Fundamentals 2 High School Math Practice: Measurement 1 High School Math Practice: Measurement 2 |
| N/A | Real Number Systems | High School Math Course 1: Number Sense 1 High School Math Course 2: Number Sense 2 | High School Math Practice: Fundamentals 1 High School Math Practice: Fundamentals 2 |
| G10.6; G10.8; G10.9 | Recognize and Apply Transformations | High School Math Course 3: Geometry | High School Math Practice: Geometry 1 High School Math Practice: Geometry 2 High School Math Practice: Geometry 3 |
| N/A | Simplifying Rational Expressions | High School Math Course 1: Number Sense 1 High School Math Course 2: Number Sense 2 | High School Math Practice: Fundamentals 1 High School Math Practice: Fundamentals 2 |
| N/A | Use of Ratio, Proportion, and Rates | High School Math Course 1: Number Sense 1 High School Math Course 2: Number Sense 2 | High School Math Practice: Fundamentals 1 High School Math Practice: Fundamentals 2 |

| Ohio Mathematics Academic Content Standards and Grade-Level Indicators | High School Math Diagnostic Skills | Supporting Courses | Supporting Practice Exercises |
|--|------------------------------------|--|---|
| G10.2 | Using Concepts of Locus Points | High School Math Course 3: Geometry | High School Math Practice: Geometry 1 High School Math Practice: Geometry 2 High School Math Practice: Geometry 3 |
| G10.2; G10.8 | Using Coordinate Geometry | High School Math Course 3: Geometry | High School Math Practice: Geometry 1 High School Math Practice: Geometry 2 High School Math Practice: Geometry 3 |
| N/A | Converting Units of Measure | High School Math Course 4: Measurement | High School Math Practice: Measurement 1 High School Math Practice: Measurement 2 |
| M10.1; M10.2; M10.3; M10.4 | Estimation and Error | High School Math Course 4: Measurement | High School Math Practice: Measurement 1 High School Math Practice: Measurement 2 |
| N/A | Perimeter, Circumference, and Area | High School Math Course 4: Measurement | High School Math Practice: Measurement 1 High School Math Practice: Measurement 2 |
| G10.1 | Right Triangle Trigonometry | High School Math Course 4: Measurement | High School Math Practice: Measurement 1 High School Math Practice: Measurement 2 |

| Ohio Mathematics Academic Content Standards and Grade-Level Indicators | High School Math Diagnostic Skills | Supporting Courses | Supporting Practice Exercises |
|--|-------------------------------------|---|--|
| M10.4 | Use of Scale Drawings and Models | High School Math Course 4: Measurement | High School Math Practice: Measurement 1 High School Math Practice: Measurement 2 |
| M10.5 | Using Formulas to Find Quantities | High School Math Course 4: Measurement | High School Math Practice: Measurement 1 High School Math Practice: Measurement 2 |
| A10.1; A10.2; A10.10 | Developing Algebraic Functions | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |
| A10.3; A10.6 | Fractional and Decimal Coefficients | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |

| Ohio Mathematics Academic Content Standards and Grade-Level Indicators | High School Math Diagnostic Skills | Supporting Courses | Supporting Practice Exercises |
|--|------------------------------------|--|---|
| A10.5; A10.6; A10.7; A10.11 | Graphing Linear Inequalities | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |
| A10.2; A10.10 | Linear and Nonlinear Functions | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |
| N10.1; N10.2; N10.4; A10.12 | Mathematical Reasoning | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |

| Ohio Mathematics Academic Content Standards and Grade-Level Indicators | High School Math Diagnostic Skills | Supporting Courses | Supporting Practice Exercises |
|--|------------------------------------|--|---|
| N10.1; N10.2; N10.4 | Logical Reasoning | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |
| A10.3 | Monomial and Polynomial Operations | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |
| N/A | Patterns and Sequences | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |

| Ohio Mathematics Academic Content Standards and Grade-Level Indicators | High School Math Diagnostic Skills | Supporting Courses | Supporting Practice Exercises |
|--|--------------------------------------|--|---|
| N/A | Problems of Distance, Rate, and Time | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |
| A10.10; A10.11 | Real-World Applications | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |
| A10.8 | Solve and Graph Quadratics | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |

| Ohio Mathematics Academic Content Standards and Grade-Level Indicators | High School Math Diagnostic Skills | Supporting Courses | Supporting Practice Exercises |
|--|-------------------------------------|--|---|
| A10.7 | Systems of Equations | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |
| A10.5; A10.6; A10.7 | Understanding Linear Equations | Algebra Course 1: Algebra & Patterns Algebra Course 2: Methods with Algebraic Equations & Expressions Algebra Course 3: Patterns, Functions, & Systems of Equations | High School Math Practice: Algebra 1 High School Math Practice: Algebra 2 High School Math Practice: Algebra 3 |
| D10.1 | Central Tendency and Variability | High School Math Course 5: Data Analysis & Probability | High School Math Practice: Data Analysis & Probability 1 High School Math Practice: Data Analysis & Probability 2 |
| D10.2; D10.3 | Collect, Organize, and Display Data | High School Math Course 5: Data Analysis & Probability | High School Math Practice: Data Analysis & Probability 1 High School Math Practice: Data Analysis & Probability 2 |
| D10.7 | Determining Probability of Events | High School Math Course 5: Data Analysis & Probability | High School Math Practice: Data Analysis & Probability 1 High School Math Practice: Data Analysis & Probability 2 |

| Ohio Mathematics Academic Content Standards and Grade-Level Indicators | High School Math Diagnostic Skills | Supporting Courses | Supporting Practice Exercises |
|--|------------------------------------|--|--|
| N10.3 | Factorial Notation | High School Math Course 5: Data Analysis & Probability | High School Math Practice: Data Analysis & Probability 1 High School Math Practice: Data Analysis & Probability 2 |
| D10.8 | Independent and Dependent Events | High School Math Course 5: Data Analysis & Probability | High School Math Practice: Data Analysis & Probability 1 High School Math Practice: Data Analysis & Probability 2 |
| D10.6 | Reading and Interpreting Data | High School Math Course 5: Data Analysis & Probability | High School Math Practice: Data Analysis & Probability 1 High School Math Practice: Data Analysis & Probability 2 |
| D10.5 | Recognizing Trends in Data | High School Math Course 5: Data Analysis & Probability | High School Math Practice: Data Analysis & Probability 1 High School Math Practice: Data Analysis & Probability 2 |
| D10.8 | Simple and Compound Events | High School Math Course 5: Data Analysis & Probability | High School Math Practice: Data Analysis & Probability 1 High School Math Practice: Data Analysis & Probability 2 |

Ohio Grade 10 Mathematics Grade-Level Indicators

Standard: Number, Number Sense and Operations Standard (N)

Grade-Level Indicators:

1. Connect physical, verbal and symbolic representations of irrational numbers; e.g., construct $\sqrt{2}$ as a hypotenuse or on a number line.
2. Explain the meaning of the n th root.
3. Use factorial notation and computations to represent and solve problem situations involving arrangements.
4. Approximate the n th root of a given number greater than zero between consecutive integers when n is an integer; e.g., the 4th root of 50 is between 2 and 3.

Standard: Measurement Standard (M)

Grade-Level Indicators:

1. Explain how a small error in measurement may lead to a large error in calculated results.
2. Calculate relative error.
3. Explain the difference between absolute error and relative error in measurement.
4. Give examples of how the same absolute error can be problematic in one situation but not in another; e.g., compare "accurate to the nearest foot" when measuring the height of a person versus when measuring the height of a mountain.
5. Determine the measures of central and inscribed angles and their associated major and minor arcs.

Standard: Geometry and Spatial Sense Standard (G)

Grade-Level Indicators:

1. Formally define and explain key aspects of geometric figures, including:
 - a. interior and exterior angles of polygons;
 - b. segments related to triangles (median, altitude, midsegment);
 - c. points of concurrency related to triangles (centroid, incenter, orthocenter, circumcenter);
 - d. circles (radius, diameter, chord, circumference, major arc, minor arc, sector, segment, inscribed angle).
2. Recognize and explain the necessity for certain terms to remain undefined, such as point, line and plane.
3. Make, test and establish the validity of conjectures about geometric properties and relationships using counterexample, inductive and deductive reasoning, and paragraph or two-column proof, including:
 - a. prove the Pythagorean theorem;
 - b. prove theorems involving triangle similarity and congruence;
 - c. prove theorems involving properties of lines, angles, triangles and quadrilaterals;
 - d. test a conjecture using basic constructions made with a compass and straightedge or technology.

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4. Construct right triangles, equilateral triangles, parallelograms, trapezoids, rectangles, rhombuses, squares and kites, using compass and straightedge or dynamic geometry software.
5. Construct congruent figures and similar figures using tools, such as compass, straightedge, and protractor or dynamic geometry software.
6. Identify the reflection and rotation symmetries of two- and three-dimensional figures.
7. Perform reflections and rotations using compass and straightedge constructions and dynamic geometry software.
8. Derive coordinate rules for translations, reflections and rotations of geometric figures in the coordinate plane.
9. Show and describe the results of combinations of translations, reflections and rotations (compositions); e.g., perform compositions and specify the result of a composition as the outcome of a single motion, when applicable.
10. Solve problems involving chords, radii and arcs within the same circle.

Standard: Patterns, Functions and Algebra Standard (A)

Grade-Level Indicators:

1. Define function formally and with $f(x)$ notation.
2. Describe and compare characteristics of the following families of functions: square root, cubic, absolute value and basic trigonometric functions; e.g., general shape, possible number of roots, domain and range.
3. Solve equations and formulas for a specified variable; e.g., express the base of a triangle in terms of the area and height.
4. Use algebraic representations and functions to describe and generalize geometric properties and relationships.
5. Solve simple linear and nonlinear equations and inequalities having square roots as coefficients and solutions.
6. Solve equations and inequalities having rational expressions as coefficients and solutions.
7. Solve systems of linear inequalities.
8. Graph the quadratic relationship that defines circles.
9. Recognize and explain that the slopes of parallel lines are equal and the slopes of perpendicular lines are negative reciprocals.
10. Solve real-world problems that can be modelled using linear, quadratic, exponential or square root functions.
11. Solve real-world problems that can be modelled, using systems of linear equations and inequalities.
12. Describe the relationship between slope of a line through the origin and the tangent function of the angle created by the line and the positive x -axis.

Standard: Data Analysis and Probability Standard (D)

Grade-Level Indicators:

1. Describe measures of center and the range verbally, graphically and algebraically.
2. Represent and analyze bivariate data using appropriate graphical displays (scatterplots, parallel box-and-whisker plots, histograms with more than one set of data, tables, charts, spreadsheets) with and without technology.
3. Display bivariate data where at least one variable is categorical.
4. Identify outliers on a data display; e.g., use interquartile range to identify outliers on a box-and-whisker plot.
5. Provide examples and explain how a statistic may or may not be an attribute of the entire population; e.g., intentional or unintentional bias may be present.
6. Interpret the relationship between two variables using multiple graphical displays and statistical measures; e.g., scatterplots, parallel box-and-whisker plots, and measures of center and spread.
7. Model problems dealing with uncertainty with area models (geometric probability).
8. Differentiate and explain the relationship between the probability of an event and the odds of an event, and compute one given the other.