Seventh Grade MATHEMATICS

Grade **L**evel **C**ontent **E**xpectations
aligned with
Michigan **C**urriculum **F**ramework
Content **S**tandards and **B**enchmarks

MICHIGAN Department of Education
Office of School Improvement
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MATHEMATICS
Seventh Grade

STRAND I: PATTERNS, RELATIONSHIPS, AND FUNCTIONS

Contents Standard 1: Patterns

Students recognize similarities and generalize patterns, use patterns to create models and make predictions, describe the nature of patterns and relationships, and construct representations of mathematical relationships.

Key Ideas:
- Recognizing, describing and generalizing patterns is the starting point of mathematics.
- Patterns and relationships are represented and communicated in diverse ways.
- Patterns enable students to describe and understand the physical world and to make informed predictions.
- Recognizing and classifying families of patterns enables students to understand and use their mathematical properties.
- Pattern recognition and analysis provide an important key to solving problems and learning new mathematics.

Middle School (Seventh Grade) Benchmark 1

Describe, analyze and generalize patterns arising in a variety of contexts and express them in general terms.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 2

Represent and record patterns in a variety of ways including tables, charts and graphs, and translate between various representations.

Alignment	
GLCE Code	**GLCE Description**
A.RP.07.02	Understand and apply directly proportional relationships; relate to linear relationships: — Represent directly proportional and linear relationships using verbal descriptions, tables, graphs and formulas, and translate among these representations

Middle School (Seventh Grade) Benchmark 3

Use patterns and their generalizations to make and justify inferences and predictions.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Middle School (Seventh Grade) Benchmark 4

Use patterns and their generalizations to make and justify inferences and predictions.

Alignment	
GLCE Code	**GLCE Description**
A.PA.07.01	Understand and apply directly proportional relationships; relate to linear relationships: — Recognize when information given in a table, graph or formula suggests a proportional or linear relationship
A.RP.07.02	Understand and apply directly proportional relationships; relate to linear relationships: — Represent directly proportional and linear relationships using verbal descriptions, tables, graphs and formulas, and translate among these representations

Middle School (Seventh Grade) Benchmark 5

Use patterns and their generalizations to make and justify inferences and predictions.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Content Standard 2: Variability and Change

Students describe the relationships among variables, predict what will happen to one variable as another variable is changed, analyze natural variation and sources of variability, and compare patterns of change.

Key Ideas:
- Studying change and variability in physical and abstract contexts is an important objective of mathematics.
- Variability becomes understandable when students recognize patterns of change and natural variation.
- Changes are frequently interdependent; understanding patterns of change in one variable can help students predict changes in another.
- Variability is represented in a variety of symbolic forms.
- Functions and relationships are used to model patterns of variability arising from physical and mathematical contexts.
- Understanding variability and change is a basis for making sense of the world and of mathematical ideas.

Middle School (Seventh Grade) Benchmark 1

Identify and describe the nature of change; recognize change in more abstract and complex situations and explore different kinds of change and patterns of variation.

Alignment	
GLCE Code	**GLCE Description**
A.PA.07.03	Understand and apply directly proportional relationships; relate to linear relationships: — Given a directly proportional or linear situation, graph and interpret the slope and intercept(s) in terms of the original situation; evaluate y = kx for specific x values, given k, e.g., weight vs. volume of water, base cost plus cost per unit
N.FL.07.03	Understand and solve problems involving rates, ratios, and proportions: — Calculate rates of change, including speed
N.FL.07.05	Understand and solve problems involving rates, ratios, and proportions: — Solve simple proportion problems using such methods as unit rate, scaling, finding equivalent fractions, and solving the proportion equation a/b = c/d; know how to see patterns about proportional situations in tables

Middle School (Seventh Grade) Benchmark 2

Connect an initial state to a final state and generalize a rule that describes a pattern of change.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Middle School (Seventh Grade) Benchmark 3

Begin to investigate applications in bivariate data and linear relationships and explore questions of what will happen to one quantity if another variable is changed.

Alignment	
GLCE Code	**GLCE Description**
N.FL.07.03	Understand and solve problems involving rates, ratios, and proportions: — Calculate rates of change, including speed
N.FL.07.05	Understand and solve problems involving rates, ratios, and proportions: — Solve simple proportion problems using such methods as unit rate, scaling, finding equivalent fractions, and solving the proportion equation a/b = c/d; know how to see patterns about proportional situations in tables

Middle School (Seventh Grade) Benchmark 4

Represent variability or change by ordered pairs, tables, graphs and equations.

Alignment	
GLCE Code	**GLCE Description**
A.RP.07.02	Understand and apply directly proportional relationships; relate to linear relationships: — Represent directly proportional and linear relationships using verbal descriptions, tables, graphs and formulas, and translate among these representations

Middle School (Seventh Grade) Benchmark 5

Differentiate between functions and relationships such as linear vs. not linear or continuous vs. non-continuous.

Alignment	
GLCE Code	**GLCE Description**
A.PA.07.09	Understand and solve problems about inversely proportional relationships: — Recognize inversely proportional relationships in contextual situations; know that quantities are inversely proportional if their product is constant, e.g., the length and width of a rectangle with fixed area, and that an inversely proportional relationship is of the form y = k/x where k is some non-zero number
A.RP.07.10	Understand and solve problems about inversely proportional relationships: — Know that the graph of y = k/x is not a line; know its shape, and know that it crosses neither the x nor the y-axis

Middle School (Seventh Grade) Benchmark 6

Continue to explore relationships arising from interesting contexts and use variables and relationships to solve mathematical problems.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

STRAND II: GEOMETRY AND MEASUREMENT

Content Standard 1: Shape and Shape Relationships

Students develop spatial sense, use shape as an analytic and descriptive tool, identify characteristics and define shapes, identify properties and describe relationships among shapes.

Key Ideas:
- Spatial sense relies on the ability to recognize and describe shape.
- Recognizing attributes and characteristics of shapes is a prerequisite for understanding.
- Comparing, sorting and classifying shapes leads to useful generalizations.
- Drawing and constructing shapes in two and three dimensions are important ways to represent the world.
- Understanding shapes requires recognition of what happens when shapes are combined, dissected or transformed.
- Figures that are alike in size and/or shape and figures that have special relationships to each other lead to important generalizations.
- Shape, shape properties, and shape relationships help students to describe and make sense of the physical world and to solve problems.

Middle School (Seventh Grade) Benchmark 1

Distinguish among shapes and differentiate between examples and non-examples of shapes based on their properties; generalize about shapes of graphs and data distributions.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 2

Generalize the characteristics of shapes and apply their generalizations to classes of shapes.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 3

Derive generalizations about shapes and apply those generalizations to develop classifications of familiar shapes.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Middle School (Seventh Grade) Benchmark 4

Construct familiar shapes using coordinates, appropriate tools (including technology), sketching and drawing two- and three-dimensional shapes.

Alignment	
GLCE Code	**GLCE Description**
G.SR.07.01	Draw and construct geometric objects: — Use a ruler and other tools to draw squares, rectangles, triangles and parallelograms with specified dimensions

Middle School (Seventh Grade) Benchmark 5

Combine, dissect and transform shapes.

Alignment	
GLCE Code	**GLCE Description**
G.SR.07.02	Draw and construct geometric objects: — Use compass and straightedge to perform basic geometric constructions: the perpendicular bisector of a segment, an equilateral triangle, and the bisector of an angle; understand informal justifications

Middle School (Seventh Grade) Benchmark 6

Generalize about the common properties of similar, congruent, parallel and perpendicular shapes and verify their generalizations informally.

Alignment	
GLCE Code	**GLCE Description**
G.TR.07.03	Understand the concept of similar polygons, and solve related problems: — Understand that in similar polygons, corresponding angles are congruent and the ratios of corresponding sides are equal; understand the concepts of similar figures and scale factor
G.TR.07.05	Understand the concept of similar polygons, and solve related problems: — Show that two triangles are similar using the criteria: corresponding angles are congruent (AAA similarity); the ratios of two pairs of corresponding sides are equal and the included angles are congruent (SAS similarity); ratios of all pairs of corresponding sides are equal (SSS similarity); use these criteria to solve problems and to justify arguments
G.TR.07.06	Understand the concept of similar polygons, and solve related problems: — Understand and use the fact that when two triangles are similar with scale factor of r, their areas are related by a factor of r^2

MATHEMATICS

Middle School (Seventh Grade) Benchmark 7

Use shape, shape properties and shape relationships to describe the physical world and to solve problems.

Alignment	
GLCE Code	**GLCE Description**
A.PA.07.04	Understand and apply directly proportional relationships; relate to linear relationships: — For directly proportional or linear situations, solve applied problems using graphs and equations; e.g., the heights and volume of a container with uniform cross-section; height of water in a tank being filled at a constant rate; degrees Celsius and degrees Fahrenheit; distance and time under constant speed
A.PA.07.05	Understand and apply directly proportional relationships; relate to linear relationships: — Understand and use directly proportional relationships of the form y = mx, and distinguish from linear relationships of the form y = mx + b, b non-zero; understand that in a directly proportional relationship between two quantities one quantity is a constant multiple of the other quantity

MATHEMATICS

Content Standard 2: Position

Students identify locations of objects, identify location relative to other objects, and describe the effects of transformations (e.g., sliding, flipping, turning, enlarging, reducing) on an object.

Key Ideas:
- Locating physical objects or points in space requires understanding of position.
- Concepts of direction, orientation, relative position and symmetry enable students to describe objects relative to their surroundings.
- Certain actions can change the size, shape, position or orientation of an object.
- Locating all the points that satisfy a condition or the special points that satisfy two or more conditions is an important spatial ability.
- Concepts of position, direction and orientation enable students to describe the physical world and to solve problems.

Middle School (Seventh Grade) Benchmark 1

Locate and describe objects in terms of their position, including compass directions, Cartesian coordinates, latitude and longitude and midpoints.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 2

Locate and describe objects in terms of their orientation and relative position, including coincident, collinear, parallel, perpendicular; differentiate between fixed (e.g., N- S- E- W) and relative (e.g., right-left) orientations; recognize and describe examples of bilateral and rotational symmetry.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 3

Describe translations, reflections, rotations and dilations using the language of transformations and employ transformations to verify congruence of figures.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Middle School (Seventh Grade) Benchmark 4

Locate the position of points or objects described by two or more conditions; locate all the points (locus) that satisfy a given condition.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 5

Use concepts of position, direction and orientation to describe the physical world and to solve problems.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Content Standard 3: Measurement

Students compare attributes of two objects, or of one object with a standard (unit), and analyze situations to determine what measurement(s) should be made and to what level of precision.

Key Ideas:
- A fundamental component of measurement and learning to measure is the comparison of an object or property to a unit of comparison.
- Measurement requires that students identify the attribute to be measured and an appropriate unit.
- Students develop a better understanding of the physical world if they regularly estimate before they measure and evaluate their estimates after they measure.
- Measurement is incomplete unless students interpret the meaning and significance of their results.
- It is not always possible to measure a quantity directly; in such cases students must use other indirect means.
- Measurement reflects the usefulness and practicality of mathematics and puts students in touch with the physical world.

Middle School (Seventh Grade) Benchmark 1

Select and use appropriate tools; measure objects using standard units in both the metric and common systems and measure angles in degrees.

Alignment	
GLCE Code	**GLCE Description**
G.SR.07.01	Draw and construct geometric objects: — Use a ruler and other tools to draw squares, rectangles, triangles and parallelograms with specified dimensions
G.SR.07.02	Draw and construct geometric objects: — Use compass and straightedge to perform basic geometric constructions: the perpendicular bisector of a segment, an equilateral triangle, and the bisector of an angle; understand informal justifications

Middle School (Seventh Grade) Benchmark 2

Identify the attributes to be measured and select the appropriate unit of measurement for length, mass (weight), area, perimeter, capacity, time, temperature and money.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 3

Estimate measures with a specified degree of accuracy and decide if an estimate or a measurement is "close enough."

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Middle School (Seventh Grade) Benchmark 4

Interpret measurements and recognize that two objects may have the same measurement on one attribute (e.g., area) but not necessarily on another (e.g., perimeter).

Alignment	
GLCE Code	**GLCE Description**
G.TR.07.06	Understand the concept of similar polygons, and solve related problems: — Understand and use the fact that when two triangles are similar with scale factor of r, their areas are related by a factor of r^2

Middle School (Seventh Grade) Benchmark 5

Use proportional reasoning and indirect measurements to draw inferences.

Alignment	
GLCE Code	**GLCE Description**
G.TR.07.03	Understand the concept of similar polygons, and solve related problems: — Understand that in similar polygons, corresponding angles are congruent and the ratios of corresponding sides are equal; understand the concepts of similar figures and scale factor
G.TR.07.04	Understand the concept of similar polygons, and solve related problems: — Solve problems about similar figures and scale drawings
G.TR.07.05	Understand the concept of similar polygons, and solve related problems: — Show that two triangles are similar using the criteria: corresponding angles are congruent (AAA similarity); the ratios of two pairs of corresponding sides are equal and the included angles are congruent (SAS similarity); ratios of all pairs of corresponding sides are equal (SSS similarity); use these criteria to solve problems and to justify arguments
G.TR.07.06	Understand the concept of similar polygons, and solve related problems: — Understand and use the fact that when two triangles are similar with scale factor of r, their areas are related by a factor of r^2
N.FL.07.05	Understand and solve problems involving rates, ratios, and proportions: — Solve simple proportion problems using such methods as unit rate, scaling, finding equivalent fractions, and solving the proportion equation a/b = c/d; know how to see patterns about proportional situations in tables

Middle School (Seventh Grade) Benchmark 6

Apply measurement to describe the real world and to solve problems.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

STRAND III: DATA ANALYSIS AND STATISTICS

Content Standard 1: Collection, Organization and Presentation of Data
Students collect and explore data, organize data into a useful form, and develop skill in representing and reading data displayed in different formats.

Key Ideas:
- Data drive many facets of modern society; knowing what data to collect and when and how to obtain them is the starting point of quantitative literacy.
- Data are of little use until they are organized and presented in a meaningful format.
- Since different representations highlight different patterns in the data, students must make critical judgments.
- To solve problems, students frequently must decide what data are needed and plan how to obtain, organize and present them.

Middle School (Seventh Grade) Benchmark 1
Collect and explore data through observation, measurement, surveys, sampling techniques and simulations.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 2
Organize data using tables, charts, graphs, spreadsheets and databases.

Alignment	
GLCE Code	**GLCE Description**
D.RE.07.01	Represent data and interpret: — Represent and interpret data using circle graphs, stem and leaf plots, histograms, and box-and-whisker plots, and select appropriate representation to address specific questions
D.AN.07.02	Create and interpret scatter plots and use an estimated line of best fit to answer questions about the data

Middle School (Seventh Grade) Benchmark 3
Present data using a variety of appropriate representations and explain why one representation is preferred over another or how a particular representation may bias the presentation.

Alignment	
GLCE Code	**GLCE Description**
D.RE.07.01	Represent data and interpret: — Represent and interpret data using circle graphs, stem and leaf plots, histograms, and box-and-whisker plots, and select appropriate representation to address specific questions
D.AN.07.02	Represent data and interpret: — Create and interpret scatter plots and use an estimated line of best fit to answer questions about the data

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Middle School (Seventh Grade) Benchmark 4

Identify what data are needed to answer a particular question or solve a given problem, and design and implement strategies to obtain organize and present those data.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Content Standard 2: Description and Interpretation

Students examine data and describe characteristics of a distribution, relate data to the situation from which they arose, and use data to answer questions convincingly and persuasively.

Key Ideas:
- The ability to read and interpret data has become a basic-literacy skill in today's world.
- Patterns in data distributions help students to interpret the findings.
- Students learn to draw conclusions and to convince and persuade using data to justify their positions.
- Students should think critically about the data they encounter and exercise judgment in describing and interpreting data.
- Gathering and interpreting data are important strategies for analyzing and solving problems.

Middle School (Seventh Grade) Benchmark 1

Critically read data from tables, charts or graphs and explain the source of the data and what the data represent.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 2

Describe the shape of a data distribution and identify the center, the spread, correlations and any outliers.

Alignment	
GLCE Code	**GLCE Description**
D.AN.07.04	Compute statistics about datasets: — Find and interpret the median, quartiles, and interquartile range of a given set of data

Middle School (Seventh Grade) Benchmark 3

Draw, explain and justify conclusions, such as trends based on data.

Alignment	
GLCE Code	**GLCE Description**
D.RE.07.01	Represent data and interpret: — Represent and interpret data using circle graphs, stem and leaf plots, histograms, and box-and-whisker plots, and select appropriate representation to address specific questions
D.AN.07.02	Represent data and interpret: — Create and interpret scatter plots and use an estimated line of best fit to answer questions about the data

MATHEMATICS

Middle School (Seventh Grade) Benchmark 4

Critically question the sources of data; the techniques used to collect, organize and present data; the inferences drawn from the data; and the possible sources of bias in the data or their presentation.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 5

Formulate questions and problems and gather and interpret data to answer those questions.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Content Standard 3: Inference and Prediction

Students draw defensible inferences about unknown outcomes, make predictions, and identify the degree of confidence they have in their predictions.

Key Ideas:
- Making and testing hypotheses is an essential technique for gaining new knowledge.
- In order to test hypotheses, students must carefully design their experimental techniques.
- Critical judgment develops as students learn to formulate, communicate and evaluate arguments and conclusions based on data.
- Patterns in known data give students confidence in making inferences about unknown situations.
- Students learn that inferences and predictions are powerful tools for answering questions and solving problems.

Middle School (Seventh Grade) Benchmark 1

Make and test hypotheses.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 2

Design experiments to model and solve problems using sampling, simulations and controlled investigations.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 3

Formulate and communicate arguments and conclusions based on data and evaluate their arguments and those of others.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 4

Make predictions and decisions based on data, including interpolations and extrapolations.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Middle School (Seventh Grade) Benchmark 5

Employ investigations, mathematical models and simulations to make inferences and predictions to answer questions and solve problems.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

STRAND IV: NUMBER SENSE AND NUMERATION

Content Standard 1: Concepts and Properties of Numbers
Students experience counting and measuring activities to develop intuitive sense about numbers, develop understanding about properties of numbers, understand the need for the existence of different sets of numbers, and investigate properties of special numbers.

Key Ideas
- An intuitive quantitative sense develops from students' investigations of numbers and their properties.
- A solid understanding of the numeration system is essential for later success with calculations.
- Important properties provide students with deeper insight into numbers and their uses.
- Numeration systems become most useful as students use them to model and describe problems.

Middle School (Seventh Grade) Benchmark 1
Develop an understanding of integers and rational numbers and represent rational numbers in both fraction and decimal form.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 2
Extend their understanding of numeration systems to include decimal numeration, scientific numeration and non-decimal numeration systems.

Alignment	
GLCE Code	**GLCE Description**
N.MR.07.06	Recognize irrational numbers: — Understand the concept of square root and cube root, and estimate using calculators

Middle School (Seventh Grade) Benchmark 3
Develop an understanding of the properties of the integer and rational number systems (e.g., order, density) and of the properties of special numbers including 0, 1 and π, and the additive and multiplicative inverses.

Alignment	
GLCE Code	**GLCE Description**
A.PA.07.11	Apply basic properties of real numbers in algebraic contexts: — Understand and use basic properties of real numbers: additive and multiplicative identities, additive and multiplicative inverses, commutativity, associativity, and the distributive property of multiplication over addition
A.FO.07.12	Combine algebraic expressions and solve equations: — Add, subtract and multiply simple algebraic expressions of the first degree; e.g., (92x + 8y) – 5x + y, or – 2x (5x – 4), and justify using properties of real numbers

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Middle School (Seventh Grade) Benchmark 4

Apply their understanding of number systems to model and solve mathematical and applied problems.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Content Standard 2: Representation and Uses of Numbers

Students recognize that numbers are used in different ways such as counting, measuring, ordering and estimating, understand and produce multiple representations of a number, and translate among equivalent representations.

Key Ideas:
- Students recognize and understand numbers that they encounter in varied formats.
- Numeracy requires that students recognize when numbers are equivalent even though they may be represented in different formats.
- Numbers are used for varied purposes, and it is important to differentiate among their uses.
- Estimation is one of the most important skills for students to develop and use on a regular basis.
- Knowing what numbers to use and how to represent them is key to students' abilities to solve problems.

Middle School (Seventh Grade) Benchmark 1

Give geometric representations of fractions, prime and composite numbers, triangular and square numbers, and other number concepts; represent rational numbers and integers on the number line.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 2

Recognize equivalent representations of a number, especially fractions, decimals and percents, and translate freely among representations.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 3

Distinguish between numbers that are used for counting, numbers that are used for ordering, numbers that are used for measuring and numbers that are used for naming.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 4

Develop strategies for estimating quantity and evaluate the reasonableness of their estimates.

Alignment	
GLCE Code	**GLCE Description**
N.MR.07.06	Recognize irrational numbers: — Understand the concept of square root and cube root, and estimate using calculators
N.FL.07.09	Compute with rational numbers: — Estimate results of computations with rational numbers

MATHEMATICS

Middle School (Seventh Grade) Benchmark 5

Select appropriate numbers and representations in order to solve problems.

Alignment	
GLCE Code	**GLCE Description**
N.FL.07.02	Understand derived quantities: — Solve problems involving derived quantities
N.FL.07.05	Understand and solve problems involving rates, ratios, and proportions: — Solve simple proportion problems using such methods as unit rate, scaling, finding equivalent fractions, and solving the proportion equation a/b = c/d; know how to see patterns about proportional situations in tables

MATHEMATICS

Content Standard 3: Number Relationships

Students investigate relationships such as equality, inequality, inverses, factors and multiples, and represent and compare very large and very small numbers.

Key Ideas:
- Relationships of equality and inequality are among the most fundamental in mathematics.
- Students learn the importance of making comparisons between numbers, especially as ratios and rates.
- By classifying numbers according to their properties and identifying important numerical relationships, students develop a deeper understanding of numbers.
- Numbers that are related exponentially exhibit important relationships that students will encounter in a variety of applications.
- Students can invoke important number relationships to help them understand and solve problems.

Middle School (Seventh Grade) Benchmark 1

Compare and order integers and rational numbers using relations of equality and inequality.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 2

Express numerical comparisons as ratios and rates.

Alignment	
GLCE Code	**GLCE Description**
N.ME.07.01	Understand derived quantities: — Understand derived quantities such as density, velocity, and weighted averages
N.MR.07.04	Understand and solve problems involving rates, ratios, and proportions: — Convert ratio quantities between different systems of units, such as feet per second to miles per hour
A.PA.07.01	Understand and apply directly proportional relationships; relate to linear relationships: — Recognize when information given in a table, graph or formula suggests a proportional or linear relationship
A.RP.07.02	Understand and apply directly proportional relationships; relate to linear relationships: — Represent directly proportional and linear relationships using verbal descriptions, tables, graphs and formulas, and translate among these representations
A.PA.07.03	Understand and apply directly proportional relationships; relate to linear relationships: — Given a directly proportional or linear situation, graph and interpret the slope and intercept(s) in terms of the original situation; evaluate y = kx for specific x values, given k, e.g., weight vs. volume of water, base cost plus cost per unit
A.PA.07.05	Understand and apply directly proportional relationships; relate to linear relationships: — Understand and use directly proportional relationships of the form y = mx, and distinguish from linear relationships of the form y = mx + b, b non-zero; understand that in a directly proportional relationship between two quantities one quantity is a constant multiple of the other quantity
A.PA.07.06	Understand and represent linear functions: — Calculate the slope from the graph of a linear function as the ratio of "rise/run" for a pair of points on the graph, and express the answer as a fraction and a decimal; understand that linear functions have slope that is a constant rate of change
A.PA.07.07	Represent linear functions in the form y = x + b, y = mx, and y = mx + b, and graph, interpreting slope and y-intercept

MATHEMATICS

Middle School (Seventh Grade) Benchmark 3

Distinguish between prime and composite numbers; identify factors, multiples, common factors and multiples, and relatively prime numbers; and apply divisibility tests to numbers.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 4

Explain the meaning of powers and roots of numbers and use calculators to compute powers and square roots.

Alignment	
GLCE Code	**GLCE Description**
N.MR.07.06	Recognize irrational numbers: — Understand the concept of square root and cube root, and estimate using calculators

Middle School (Seventh Grade) Benchmark 5

Apply their understanding of number relationships in solving problems.

Alignment	
GLCE Code	**GLCE Description**
N.FL.07.02	Understand derived quantities: — Solve problems involving derived quantities
N.FL.07.03	Understand and solve problems involving rates, ratios, and proportions: — Calculate rates of change, including speed
N.FL.07.05	Understand and solve problems involving rates, ratios, and proportions: — Solve simple proportion problems using such methods as unit rate, scaling, finding equivalent fractions, and solving the proportion equation a/b = c/d; know how to see patterns about proportional situations in tables
A.PA.07.04	Understand and apply directly proportional relationships; relate to linear relationships: — For directly proportional or linear situations, solve applied problems using graphs and equations; e.g., the heights and volume of a container with uniform cross-section; height of water in a tank being filled at a constant rate; degrees Celsius and degrees Fahrenheit; distance and time under constant speed

MATHEMATICS

STRAND V: NUMERICAL AND ALGEBRAIC OPERATIONS AND ANALYTICAL THINKING

Content Standard 1: Operations and their Properties
Students understand and use various types of operations (e.g., addition, subtraction, multiplication, division) to solve problems.

Key Ideas:
- Understanding the basic computational operations is essential for competence in mathematics, but there is no one way to perform a calculation.
- Methods of computation include proficiency with mental calculation, paper and pencil, and calculators; students must know which method is most appropriate for a given task.
- Understanding the operations requires that students also understand the properties of those operations and how to apply them.

The ultimate reason for mastering the computational operations and their algorithms is to solve problems.

Middle School (Seventh Grade) Benchmark 1
Use manipulatives and diagrams to model operations and their inverses with integers and rational numbers and relate the models to their symbolic expressions.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 2
Compute with integers, rational numbers and simple algebraic expressions using mental computation, estimation, calculators and paper-and-pencil; explain what they are doing and how they know which operations to perform in a given situation.

Alignment	
GLCE Code	**GLCE Description**
N.FL.07.08	Compute with rational numbers: — Add, subtract, multiply and divide negative rational numbers
N.FL.07.09	Compute with rational numbers: — Estimate results of computations with rational numbers

Middle School (Seventh Grade) Benchmark 3
Describe the properties of operations with rationales and integers (e.g., closure; associative, commutative and distributive properties) and give examples of how they use those properties.

Alignment	
GLCE Code	**GLCE Description**
A.PA.07.11	Apply basic properties of real numbers in algebraic contexts: — Understand and use basic properties of real numbers: additive and multiplicative identities, additive and multiplicative inverses, commutativity, associativity, and the distributive property of multiplication over addition

MATHEMATICS

Middle School (Seventh Grade) Benchmark 4

Efficiently and accurately apply operations with integers, rational numbers and simple algebraic expressions in solving problems.

Alignment	
GLCE Code	**GLCE Description**
N.FL.07.02	Understand derived quantities: — Solve problems involving derived quantities
N.FL.07.05	Understand and solve problems involving rates, ratios, and proportions: — Solve simple proportion problems using such methods as unit rate, scaling, finding equivalent fractions, and solving the proportion equation a/b = c/d; know how to see patterns about
N.FL.07.07	Compute with rational numbers: — Solve problems involving operations with integers
N.FL.07.09	Compute with rational numbers: — Estimate results of computations with rational numbers

MATHEMATICS

Content Standard 2: Algebraic and Analytic Thinking

Students analyze problems to determine an appropriate process for solution, and use algebraic notations to model or represent problems.

Key Ideas:

- Students develop both symbol sense and number sense as they learn to read, write and speak the language of mathematics.
- Mathematical representations, which may be numerical, literal, symbolic, graphical, pictorial or physical, enable students to visualize and understand problems.
- Solving mathematical problems involves a process as well as a product; the context of the problem determines the nature of the solution.
- Students learn analytic thinking most effectively when it is studied in the context of problems and applications.
- Students employ algebraic and analytic thinking and the power of technology to explore problems that reveal the many ways that mathematics is used in a wide variety of contemporary applications.

Middle School (Seventh Grade) Benchmark 1

Read and write algebraic expressions; develop original examples expressed verbally and algebraically; simplify expressions and translate between verbal and algebraic expressions; and solve linear equations and inequalities.

Alignment	
GLCE Code	**GLCE Description**
A.FO.07.12	Combine algebraic expressions and solve equations: — Add, subtract and multiply simple algebraic expressions of the first degree; e.g., (92x + 8y) – 5x + y, or – 2x (5x – 4), and justify using properties of real numbers

Middle School (Seventh Grade) Benchmark 2

Represent algebraic concepts with geometric models (e.g., algebra tiles), physical models (e.g., balance beam), tables and graphs; and write algebraic expressions to correspond to the multiple representations.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 3

Solve linear equalities and inequalities using algebraic and geometric methods, and use the context of the problem to interpret and explain their solutions.

Alignment	
GLCE Code	**GLCE Description**
A.FO.07.08	Understand and represent linear functions: — Know that the solution to a linear equation corresponds to the point at which its graph crosses the x-axis
A.FO.07.13	Combine algebraic expressions and solve equations: — From applied situations, generate and solve linear equations of the form ax + b = c and ax + b = cx + d, and interpret solutions

MATHEMATICS

Middle School (Seventh Grade) Benchmark 4

Analyze problems modeled by linear functions, determine strategies for solving the problems, and evaluate the adequacy of the solutions in the context of the problems.

Alignment	
GLCE Code	**GLCE Description**
A.PA.07.04	Understand and apply directly proportional relationships; relate to linear relationships: — For directly proportional or linear situations, solve applied problems using graphs and equations; e.g., the heights and volume of a container with uniform cross-section; height of water in a tank being filled at a constant rate; degrees Celsius and degrees Fahrenheit; distance and time under constant speed
A.PA.07.07	Understand and represent linear functions: — Represent linear functions in the form y = x + b, y = mx, and y = mx + b, and graph, interpreting slope and y-intercept

Middle School (Seventh Grade) Benchmark 5

Explore problems that reflect the contemporary uses of mathematics in significant contexts and use the power of technology and algebraic and analytic reasoning to experience the ways mathematics is used in society.

Alignment	
GLCE Code	**GLCE Description**
A.PA.07.04	Understand and apply directly proportional relationships; relate to linear relationships: — For directly proportional or linear situations, solve applied problems using graphs and equations; e.g., the heights and volume of a container with uniform cross-section; height of water in a tank being filled at a constant rate; degrees Celsius and degrees Fahrenheit; distance and time under constant speed

MATHEMATICS

STRAND VI: PROBABILITY AND DISCRETE MATHEMATICS

Content Standard 1: Probability

Students develop an understanding of the notion of certainty and of probability as a measure of the degree of likelihood that can be assigned to a given event based on the knowledge available, and make critical judgments about claims that are made in probabilistic situations.

Key Ideas:
- Students develop an understanding of the concepts of chance and uncertainty.
- Students express the likelihood of chance events in terms of probabilities.
- Through experiments students learn that some outcomes are affected by prior events, while others are independent.
- Students also learn to examine outcomes and search for explanations, and they realize the difference between probabilities determined from observations and probabilities derived mathematically.
- Making predictions and decisions in the face of uncertainty are essential skills for coping with the modern world.

Middle School (Seventh Grade) Benchmark 1

Describe events as likely or unlikely and give qualitative and quantitative descriptions of the degree of likelihood.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 2

Describe probability as a measure of certainty ranging from 0 to 1 and conduct activities that allow them to express probabilities of simple events in mathematical terms.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 3

Conduct experiments and give examples to illustrate the difference between dependent and independent events.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Middle School (Seventh Grade) Benchmark 4

Explain the difference between probabilities determined from experiments or chance events (empirical) and probabilities derived mathematically (theoretical), and explain how the empirical probability changes for a large number of trials.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 5

Conduct probability experiments and simulations to model and solve problems.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Content Standard 2: Discrete Mathematics

Students investigate practical situations such as scheduling, routing, sequencing, networking, organizing and classifying, and analyze ideas like recurrence relations, induction, iteration, and algorithm design.

Key Ideas:
- Problems involving counting and arranging finite collections of objects occur in many applications.
- Concepts of sets and set relationships give students useful tools for representing problems.
- Many important practical applications involve networks.
- Many important practical applications are modeled by recurrence relations.
- Mathematical applications frequently require students to develop their own procedures for solving problems.
- Applications of discrete mathematics drawn from many important practical situations introduce students to contemporary uses of mathematics.

Middle School (Seventh Grade) Benchmark 1

Use manipulatives, diagrams and the fundamental theorem of counting to count permutations and combinations.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 2

Use sets and set relationships to explore and solve simple algebraic and geometric problems.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 3

Solve problems involving networks, for example planning delivery routes or counting paths between points.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 4

Explore recurrence relations and iterations.

Alignment	
GLCE Code	**GLCE Description**
None	

MATHEMATICS

Middle School (Seventh Grade) Benchmark 5

Continue to use manipulatives and drawings to model the concepts and procedures for the standard arithmetic algorithms, and develop and analyze their own and other students' algorithms to accomplish a task or solve a mathematical problem.

Alignment	
GLCE Code	**GLCE Description**
None	

Middle School (Seventh Grade) Benchmark 6

Use discrete mathematics concepts as described above to model situations and solve problems; and look for whether or not there is a solution (existence problems), determine how many solutions there are (counting problems) and decide upon a best solution (optimization problems).

Alignment	
GLCE Code	**GLCE Description**
None	

Contact:

Michigan Department of Education
Office of School Improvement
Dr. Yvonne Caamal Canul, Director
(517) 241-3147
www.michigan.gov/mde

MICHIGAN Department of Education