ESSENTIAL ELEMENTS FOR GRADE 7: MATHEMATICS

**Claim #1: Students demonstrate increasingly complex understanding of number sense.

Ratios and Proportional Relationships

Target Essential Element	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan Grade 7 Standard for Mathematics: 7.RP.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.* **Michigan Grade 7 Standard for Mathematics: 7.RP.2**: Recognize and represent proportional relationships between quantities. **Michigan Grade 7 Standard for Mathematics: 7.RP.2.a**: Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. **Michigan Grade 7 Standard for Mathematics: 7.RP.2.b**: Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. **Michigan Grade 7 Standard for Mathematics: 7.RP.2.c**: Represent proportional relationships by equations. *For example, if total cost t is proportional to the number* n *of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as* t = pn. **Michigan Grade 7 Standard for Mathematics: 7.RP.2.d**: Explain what a point *(x, y)* on the graph of a proportional relationship means in terms of the situation, with special attention to the points *(0, 0)* and *(1, r)* where *r* is the unit rate. **Michigan Grade 7 Standard for Mathematics: 7.RP.3**: Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*			
EE.7.RP.1-3: Use a ratio to model or describe a relationship.	**EE.7.RP.H.1-3**: The student can complete a ratio using numbers to describe a relationship.	**EE.7.RP.M.1-3**: The student can use a simple ratio to describe a relationship.	**EE.7.RP.L.1-3**: The student can recognize a 1:1 relationship of a given modeled ratio.

The Number System

Target Essential Element	Michigan Range of Complexity		
	High Range	**Medium Range**	**Low Range**
Michigan Grade 7 Standard for Mathematics: 7.NS.1: Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. **Michigan Grade 7 Standard for Mathematics: 7.NS.1.a**: Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.* **Michigan Grade 7 Standard for Mathematics: 7.NS.1.b**: Understand $p + q$ as the number located a distance $\|q\|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. **Michigan Grade 7 Standard for Mathematics: 7.NS.1.c**: Understand subtraction of rational numbers as adding the additive inverse, $p – q = p + (–q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. **Michigan Grade 7 Standard for Mathematics: 7.NS.1.d**: Apply properties of operations as strategies to add and subtract rational numbers.			
EE.7.NS.1: Add fractions with like denominators (halves, thirds, fourths, and tenths) with sums less than or equal to one.	**EE.7.NS.H.1**: The student can add fractions with common denominators with sums less than or equal to 1.	**EE.7.NS.M.1**: The student can add fractions with common denominators with sums less than or equal to 1 and limited to halves, thirds, and fourths (fractions shown as models).	**EE.7.NS.L.1**: The student can identify that the sum of two halves is equal to 1 whole.
Michigan Grade 7 Standard for Mathematics: 7.NS.2: Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. **Michigan Grade 7 Standard for Mathematics: 7.NS.2.a**: Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.			
EE.7.NS.2.a: Solve multiplication problems with products to 100.	**EE.7.NS.H.2.a**: The student can solve a simple multiplication problem (one factor times another) using concrete objects or a calculator.	**EE.7.NS.M.2.a**: The student can solve a simple multiplication problem (one factor times another) with products up to 30 using concrete objects and/or a calculator.	**EE.7.NS.L.2.a**: The student can identify double the amount of specified quantity (limited to 1, 2, 3 or 4).

Target Essential Element	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan Grade 7 Standard for Mathematics: 7.NS.2.b: Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If *p* and *q* are integers, then *–(p/q) = (–p)/q = p/(–q)*. Interpret quotients of rational numbers by describing real-world contexts.			
EE.7.NS.2.b: Solve division problems with divisors up to five and also with a divisor of 10 without remainders.	**EE.7.NS.H.2.b**: The student can solve division problems with a divisor of 2, 5, or 10 or where the dividend is less than 30 using concrete objects or a calculator.	**EE.7.NS.M.2.b**: The student can solve division problems with a divisor of 2, 5, or 10 or where the dividend is 20 or less using concrete objects and/or a calculator.	**EE.7.NS.L.2.b**: The student can identify a larger set of up to 10 that has been divided into 2 or 3 equal subsets.
Michigan Grade 7 Standard for Mathematics: 7.NS.2.c: Apply properties of operations as strategies to multiply and divide rational numbers. **Michigan Grade 7 Standard for Mathematics: 7.NS.2.d**: Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.			
EE.7.NS.2.c-d: Express a fraction with a denominator of 10 as a decimal.	**EE.7.NS.H.2.c-d**: The student can express a fraction with a denominator of 10 as a decimal. (Functional skill is expressing money as a fraction/decimal of a dollar, limited to tenths of a dollar: $0.10, $0.20, etc.)	**EE.7.NS.M.2.c-d**: The student can identify that one-half equals .50 and one-fourth equals .25 with models as support. (e.g., model of .50 is the same as one-half of a dollar.)	**EE.7.NS.L.2.c-d**: The student can use models to identify the fractions one-half and one-fourth.

Target Essential Element	Michigan Range of Complexity		
	High Range	**Medium Range**	**Low Range**
Michigan Grade 7 Standard for Mathematics: 7.NS.3: Solve real-world and mathematical problems involving the four operations with rational numbers.			
EE.7.NS.3: Compare quantities represented as decimals in real-world examples to tenths.	**EE.7.NS.H.3**: The student can compare quantities represented as decimals in real-world examples to tenths (e.g., a combination of bills and coins, a discount of 10 percent = .10).	**EE.7.NS.M.3**: The student can identify a combination of coins and bills up to $5 using decimal notation. (e.g., $2.50 is equal to two one-dollar bills and two quarters).	**EE.7.NS.L.3**: The student can differentiate coins and bills from each other and from other similar objects.

****Claim #2: Students demonstrate increasingly complex spatial reasoning and understanding of geometric principles.**

Geometry

Target Essential Element	Michigan Range of Complexity		
	High Range	**Medium Range**	**Low Range**
Michigan Grade 7 Standard for Mathematics: 7.G.1: Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.			
EE.7.G.1: Match two similar geometric shapes that are proportional in size and in the same orientation.	**EE.7.G.H.1**: The student can identify two similar two- and three-dimensional shapes that are proportional in size and in the same orientation.	**EE.7.G.M.1**: The student can identify two similar two-dimensional shapes or objects that are proportional in size and in the same orientation; limited to square, circle, and triangle. (e.g., a postage stamp and a picture frame).	**EE.7.G.L.1**: The student can match a similar two-dimensional shape with an object that is proportional in size and in the same orientation; limited to round and square (e.g., an analog clock and a coin).
Michigan Grade 7 Standard for Mathematics: 7.G.2: Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.			
EE.7.G.2: Recognize geometric shapes with given conditions.	**EE.7.G.H.2**: The student can recognize geometric shapes with specified attributes.	**EE.7.G.M.2**: The student can identify common two-dimensional shapes (e.g., square, circle, triangle, and star).	**EE.7.G.L.2**: The student can differentiate between round/circle and square or sphere and cube.
Michigan Grade 7 Standard for Mathematics: 7.G.3: Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.			
EE.7.G.3: Match a two-dimensional shape with a three-dimensional shape that shares an attribute.	**Michigan Range of Complexity:** Not measured at state level, range of complexity determined at classroom level.		

Target Essential Element	Michigan Range of Complexity		
	High Range	**Medium Range**	**Low Range**
Michigan Grade 7 Standard for Mathematics: 7.G.4: Know the formulas for the area and circumference of a circle, and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.			
EE.7.G.4: Determine the perimeter of a rectangle by adding the measures of the sides.	**EE.7.G.H.4**: The student can determine the perimeter of a rectangle by adding the measures of the sides.	**EE.7.G.M.4**: The student can use a model to determine the perimeter of a rectangle by adding the side lengths; lengths limited to 1, 2, or 3.	**EE.7.G.L.4**: The student can match objects to their outlines.
Michigan Grade 7 Standard for Mathematics: 7.G.5: Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.			
EE.7.G.5: Recognize angles that are acute, obtuse, and right.	**EE.7.G.H.5**: The student can recognize an angle as being greater than or less than a right angle when given a model of a right angle.	**EE.7.G.M.5**: The student can match an angle to a shape that has the same angle.	**EE.7.G.L.5**: The student can differentiate between a shape that has corners and one that does not.
Michigan Grade 7 Standard for Mathematics: 7.G.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.			
EE.7.G.6: Determine the area of a rectangle using the formula for length × width, and confirm the result using tiling or partitioning into unit squares.	**EE.7.G.H.6**: The student can find the area of a rectangle when given the formula of length x width, a model, and the dimensions of the rectangle up to 40 square units.	**EE.7.G.M.6**: The student can use unit squares to determine the area of a model of a rectangle up to 20 square units.	**EE.7.G.L.6**: The student can count unit squares to find the area of a model of a rectangle up to 6 square units.

****Claim #3: Students demonstrate increasingly complex understanding of measurement, data and analytic procedures.**

Statistics and Probability

Target Essential Element	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan Grade 7 Standard for Mathematics: 7.SP.1: Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences. **Michigan Grade 7 Standard for Mathematics: 7.SP.2**: Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.*			
EE.7.SP.1-2: Answer a question related to the collected data from an experiment, given a model of data, or from data collected by the student.	**Michigan Range of Complexity:** Not measured at state level, range of complexity determined at classroom level.		
Michigan Grade 7 Standard for Mathematics: 7.SP.3: Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.*			
EE.7.SP.3: Compare two sets of data within a single data display such as a picture graph, line plot, or bar graph.	**EE.7.SP.H.3**: The student can solve problems using data presented within a single data display: tables, bar graphs, circle graphs, tallies, and pictographs, including graphs and charts that have more than one set of data.	**EE.7.SP.M.3**: The student can compare sets of data within two similar data displays (2 bar graphs or 2 picture graphs) to determine whether two quantities are the same, more than, or less than.	**EE.7.SP.L.3**: The student can identify the quantity of data, limited to 1, 2, or 3 on a pictograph.

Target Essential Element	Michigan Range of Complexity		
	High Range	**Medium Range**	**Low Range**
Michigan Grade 7 Standard for Mathematics: 7.SP.5: Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. **Michigan Grade 7 Standard for Mathematics: 7.SP.6**: Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.* **Michigan Grade 7 Standard for Mathematics: 7.SP.7**: Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. **Michigan Grade 7 Standard for Mathematics: 7.SP.7.a**: Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.* **Michigan Grade 7 Standard for Mathematics**: **7.SP.7.b**: Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*			
EE.7.SP.5-7: Describe the probability of events occurring as possible or impossible.	**EE.7.SP.H.5-7**: The student can describe the probability of events occurring as possible or impossible.	**EE.7.SP.M.5-7**: The student can identify possible events that occur in the natural environment (e.g., possible: sun produces warmth; rain results in wet).	**EE.7.SP.L.5-7**: The student can identify when activities are likely to happen (e.g., go to school in the morning, eat lunch at noon).

****Claim #4: Students solve increasingly complex mathematical problems, making productive use of algebra and functions.**

Solving Expressions and Equations

Target Essential Element	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan Grade 7 Standard for Mathematics: 7.EE.1: Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.			
EE.7.EE.1: Use the properties of operations as strategies to demonstrate that expressions are equivalent.	**Michigan Range of Complexity:** Not measured at state level, range of complexity determined at classroom level.		
Michigan Grade 7 Standard for Mathematics: 7.EE.2: Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."			
EE.7.EE.2: Identify an arithmetic sequence of whole numbers with a whole-number common difference.	**EE.7.EE.H.2**: The student can recognize an arithmetic sequence of numbers with and without decimals (e.g., 2, 4, 6; 2.5, 4.5, 6.5) with a whole-number common difference.	**EE.7.EE.M.2**: The student can recognize an arithmetic sequence of whole numbers with and without a model and limited to 2s, 5s, and 10s.	**EE.7.EE.L.2**: The student can recognize the number that comes next in a sequence of numbers to 10 in sequential order with a difference of 1.

Target Essential Element	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan Grade 7 Standard for Mathematics: 7.EE.4: Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. **Michigan Grade 7 Standard for Mathematics: 7.EE.4a**: Solve word problems leading to equations of the form *px + q = r and p(x + q) = r*, where *p, q,* and *r* are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?* **Michigan Grade 7 Standard for Mathematics: 7.EE.4b**: Solve word problems leading to inequalities of the form *px + q > r or px + q < r*, where *p, q,* and *r* are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.*			
EE.7.EE.4: Use the concept of equality with models to solve one-step addition and subtraction equations.	**EE.7.EE.H.4**: The student can solve one-step addition and subtraction equations with an unknown represented with a box. (e.g., box + 5 = 10; box – 2 = 3).	**EE.7.EE.M.4**: The student can solve one-step addition and subtraction equations, where the unknown is the sum or difference, paired with pictures or objects. (e.g., 5 + 5 = box; 5 – 2 = box)	**EE.7.EE.L.4**: The student can identify how much is “one more” or when one is “taken away” from a quantity up to 5 with a model.

Target Essential Elements as developed by: Dynamic Learning Maps Consortium (2013). Dynamic Learning Maps Essential Elements for Mathematics. Lawrence, KS: University of Kansas.