ESSENTIAL ELEMENTS FOR GRADE 9: MATHEMATICS

For all Target Grade 9 Essential Elements, the Michigan Range of Complexity is not measured at the state level; range of complexity is determined at the classroom level.

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

Number and Quantity

Target Essential Element	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
Michigan Grade 9 Standard for Mathematics: N-CN.2: Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.			
EE.N-CN.2.a: Use the commutative, associative, and distributive properties to add, subtract, and multiply whole numbers.	Locally determined	Locally determined	Locally determined
EE.N-CN.2.b: Solve real-world problems involving addition and subtraction of decimals, using models when needed.	Locally determined	Locally determined	Locally determined
EE.N-CN.2.c: Solve real-world problems involving multiplication of decimals and whole numbers, using models when needed.	Locally determined	Locally determined	Locally determined

****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 9 Standard for Mathematics: G-CO.1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.			
EE.G-CO.1: Know the attributes of perpendicular lines, parallel lines, and line segments; angles; and circles.	Locally determined	Locally determined	Locally determined
Michigan Grade 9 Standard for Mathematics: G-GPE.7: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.			
EE.G-GPE.7: Find perimeters and areas of squares and rectangles to solve real-world problems.	Locally determined	Locally determined	Locally determined
Michigan Grade 9 Standard for Mathematics: G-MG.1: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). **Michigan Grade 9 Standard for Mathematics: G-MG.2**: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). **Michigan Grade 9 Standard for Mathematics: G-MG.3**: Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).			
EE.G-MG.1-3: Use properties of geometric shapes to describe real-life objects.	Locally determined	Locally determined	Locally determined

****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 9 Standard for Mathematics: S-ID.1: Represent data with plots on the real number line (dot plots, histograms, and box plots). **Michigan Grade 9 Standard for Mathematics: S-ID.2**: Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.			
EE.S-ID.1-2: Given data, construct a simple graph (line, pie, bar, or picture) or table, and interpret the data.	Locally determined	Locally determined	Locally determined

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

Algebra

Target Essential Element	Michigan Range of Complexity		
	High Range	**Medium Range**	**Low Range**
Michigan Grade 9 Standard for Mathematics: **A-SSE.1**: Interpret expressions that represent a quantity in terms of its context. A. Interpret parts of an expression, such as terms, factors, and coefficients. B. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.*			
EE.A-SSE.1: Identify an algebraic expression involving one arithmetic operation to represent a real-world problem.	Locally determined	Locally determined	Locally determined
Michigan Grade 9 Standard for Mathematics: **A-SSE.3**: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. A. Factor a quadratic expression to reveal the zeros of the function it defines. B. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. C. Use the properties of exponents to transform expressions for exponential functions. *For example, the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*			
EE.A-SSE.3: Solve simple algebraic equations with one variable using multiplication and division.	Locally determined	Locally determined	Locally determined

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