

ESSENTIAL ELEMENTS FOR GRADE 10: MATHEMATICS

For all Target Grade 10 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
<p>Michigan Grade 10 Standard for Mathematics: N-Q.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</p> <p>Michigan Grade 10 Standard for Mathematics: N-Q.2: Define appropriate quantities for the purpose of descriptive modeling.</p> <p>Michigan Grade 10 Standard for Mathematics: N-Q.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.</p>			
EE. N-Q.1-3: Express quantities to the appropriate precision of measurement.	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
<p>Michigan Grade 10 Standard for Mathematics: G-CO.4: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.</p> <p>Michigan Grade 10 Standard for Mathematics: G-CO.5: Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.</p>			
<p>EE.G-CO.4-5: Given a geometric figure and a rotation, reflection, or translation of that figure, identify the components of the two figures that are congruent.</p>	Locally determined	Locally determined	Locally determined
<p>Michigan Grade 10 Standard for Mathematics: G-GMD.1: Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. <i>Use dissection arguments. Cavalieri’s principle, and informal limit arguments.</i></p> <p>Michigan Grade 10 Standard for Mathematics: G-GMD.2: Give an informal argument using Calieri’s principle for the formulas for the volume of a sphere and other solid figures.</p> <p>Michigan Grade 10 Standard for Mathematics: G-GMD.3: Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.</p>			
<p>EE.G-GMD.1-3: Make a prediction about the volume of a container, the area of a figure, and the perimeter of a figure, and then test the prediction using formulas or models.</p>	Locally determined	Locally determined	Locally determined
<p>Michigan Grade 10 Standard for Mathematics: G-GMD.4: Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.</p>			
<p>EE.G-GMD.4: Identify the shapes of two-dimensional cross-sections of three-dimensional objects.</p>	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
<p>Michigan Grade 10 Standard for Mathematics: S-ID.4: Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.</p>			
<p>EE.S-ID.4: Calculate the mean of a given data set (limit the number of data points to fewer than five).</p>	Locally determined	Locally determined	Locally determined
<p>Michigan Grade 10 Standard for Mathematics: S-CP.1: Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).</p> <p>Michigan Grade 10 Standard for Mathematics: S-CP.2: Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.</p> <p>Michigan Grade 10 Standard for Mathematics: S-CP.3: Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.</p> <p>Michigan Grade 10 Standard for Mathematics: S-CP.4: Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. <i>For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.</i></p> <p>Michigan Grade 10 Standard for Mathematics: S-CP.5: Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. <i>For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</i></p>			
<p>EE.S-CP.1-5: Identify when events are independent or dependent.</p>	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
<p>Michigan Grade 10 Standard for Mathematics: A-CED.1: Create equations and inequalities in one variable, and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i></p>			
<p>EE.A-CED.1: Create an equation involving one operation with one variable, and use it to solve a real-world problem.</p>	Locally determined	Locally determined	Locally determined
<p>Michigan Grade 10 Standard for Mathematics: A-CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p> <p>Michigan Grade 10 Standard for Mathematics: A-CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i></p> <p>Michigan Grade 10 Standard for Mathematics: A-CED.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law $V = IR$ to highlight resistance R.</i></p>			
<p>EE.A-CED.2-4: Solve one-step inequalities.</p>	Locally determined	Locally determined	Locally determined

Target Essential Element	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan Grade 10 Standard for Mathematics: A-REI.10: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).</p> <p>Michigan Grade 10 Standard for Mathematics: A-REI.11: Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.</p> <p>Michigan Grade 10 Standard for Mathematics: A-REI.12: Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.</p>			
<p>EE.A-REI.10-12: Interpret the meaning of a point on the graph of a line. <i>For example, on a graph of pizza purchases, trace the graph to a point and tell the number of pizzas purchased and the total cost of the pizzas.</i></p>	Locally determined	Locally determined	Locally determined

Functions

Target Essential Element	Michigan Range of Complexity		
	High Range	Medium Range	Low Range
<p>Michigan Grade 10 Standard for Mathematics: F-BF.1: Write a function that describes a relationship between two quantities. A. Determine an explicit expression, a recursive process, or steps for calculation from a context. B. Combine standard function types using arithmetic operations. <i>For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.</i></p>			
<p>EE.F-BF.1: Select the appropriate graphical representation (first quadrant) given a situation involving constant rate of change.</p>	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.