

GRADE LEVEL CONTENT EXPECTATIONS

8 MATH

v. 12.05

NUMBER & OPERATIONS

ALGEBRA

MEASUREMENT

GEOMETRY

DATA & PROBABILITY

Welcome to Michigan's K-8 Grade Level Content Expectations

Purpose & Overview

In 2004, the Michigan Department of Education embraced the challenge of creating Grade Level Content Expectations in response to the federal No Child Left Behind Act of 2001. This act mandated the existence of a set of comprehensive state grade level assessments that are designed based on rigorous grade level content.

In this global economy, it is essential that Michigan students possess personal, social, occupational, civic, and quantitative literacy. Mastery of the knowledge and essential skills defined in Michigan's Grade Level Content Expectations will increase students' ability to be successful academically, contribute to the future businesses that employ them and the communities in which they choose to live.

The Grade Level Content Expectations build from the Michigan Curriculum Framework and its Teaching and Assessment Standards. Reflecting best practices and current research, they provide a set of clear and rigorous expectations for all students and provide teachers with clearly defined statements of what students should know and be able to do as they progress through school.

Why Create a 12.05 Version of the Expectations?

The Office of School Improvement is committed to creating the best possible product for educators. This commitment served as the impetus for the revision of the 6.04 edition that was previously released in June of 2004. This new version, v.12.05, refines and clarifies the original expectations, while preserving their essence and original intent. As education continues to evolve, it is important to remember that each curriculum document should be considered as a work in progress, and will continue to be refined to improve the quality.

The revision process greatly improved the continuity from one grade to the next, and better ensured coherence both in content and pedagogy. To obtain more specific details about the revisions, please refer to the addendum included in this document. The forward of the *Across the Grades v.12.05* companion document also clarifies the types of changes made. Educators can access the *Across the Grades* companion document by visiting the Michigan Department of Education Grade Level Content Expectations web page at www.michigan.gov/glce.

Assessment

The Grade Level Content Expectations document is intended to be a state assessment tool with the expectations written to convey expected performances by students. The Office of Assessment and Accountability was involved in the development of version 12.05 and has incorporated the changes in the construction of test and item specifications for the K-8 Michigan Education Assessment Program (MEAP) and MI-Access. This updated version will assist us in the creation of companion documents, content examples, and to guide program planners in focusing resources and energy.

Curriculum

Using this document as a focal point in the school improvement process, schools and districts can generate conversations among stakeholders concerning current policies and practices to consider ways to improve and enhance student achievement. Together, stakeholders can use these expectations to guide curricular and instructional decisions, identify professional development needs, and assess student achievement.

Understanding the Organizational Structure

The expectations in this document are divided into strands with multiple domains within each, as shown below. The skills and content addressed in these expectations will in practice be woven together into a coherent, Mathematics curriculum. The domains in each mathematics strand are broader, more conceptual groupings. In several of the strands, the “domains” are similar to the “standards” in Principles and Standards for School Mathematics from the National Council of Teachers of Mathematics.

To allow for ease in referencing expectations, each expectation has been coded with a strand, domain, grade-level, and expectation number. For example, **M.UN.00.01** indicates:

M - Measurement strand

UN - Units & systems of measurement domain of the Measurement strand

00 - Kindergarten Expectation

01 - First Expectation in the Grade-Level view of the Measurement strand

Strand 1 Number & Operations	Strand 2 Algebra	Strand 3 Measurement	Strand 4 Geometry	Strand 5 Data and Probability
Domains				
Meaning, notation, place value, and comparisons (ME)	Patterns, relations, functions, and change (PA)	Units and systems of measurement (UN)	Geometric shape, properties, and mathematical arguments (GS)	Data representation (RE)
Number relationships and meaning of operations (MR)	Representation (RP)	Techniques and formulas for measurement (TE)	Location and spatial relationships (LO)	Data interpretation and analysis (AN)
Fluency with operations and estimation (FL)	Formulas, expressions, equations, and inequalities (RP)	Problem solving involving measurement (PS)	Spatial reasoning and geometric modeling (SR)	Probability (PR)
			Transformation and symmetry (TR)	

Preparing Students for Academic Success

Within the hands of teachers, the Grade Level Content Expectations are converted into exciting and engaging learning for Michigan’s students. As we use these expectations to develop units of instruction and plan instructional delivery, it is critical to keep in mind that content knowledge alone is not sufficient for academic success. Students must be able to apply knowledge in new situations, to solve problems by generating new ideas, and to make connections between what they learn in class to the world around them. The art of teaching is what makes the content of learning become a reality.

Through the collaborative efforts of Michigan educators and creation of professional learning communities, we can enable our young people to attain the highest standards, and thereby open doors for them to have fulfilling and successful lives.

NUMBER AND OPERATIONS	Understand real number concepts
	<p>N.ME.08.01 Understand the meaning of a square root of a number and its connection to the square whose area is the number; understand the meaning of a cube root and its connection to the volume of a cube.</p> <p>N.ME.08.02 Understand meanings for zero and negative integer exponents.</p> <p>N.ME.08.03 Understand that in decimal form, rational numbers either terminate or eventually repeat, and that calculators truncate or round repeating decimals; locate rational numbers on the number line; know fraction forms of common repeating decimals, e.g., $0.\overline{1} = \frac{1}{9}$; $0.\overline{3} = \frac{1}{3}$.</p> <p>N.ME.08.04 Understand that irrational numbers are those that cannot be expressed as the quotient of two integers, and cannot be represented by terminating or repeating decimals; approximate the position of familiar irrational numbers, e.g., $\sqrt{2}$, $\sqrt{3}$, π, on the number line.</p> <p>N.FL.08.05 Estimate and solve problems with square roots and cube roots using calculators.</p> <p>N.FL.08.06 Find square roots of perfect squares and approximate the square roots of non-perfect squares by locating between consecutive integers, e.g., $\sqrt{130}$ is between 11 and 12.</p>
	<p>Solve problems</p> <p>N.MR.08.07 Understand percent increase and percent decrease in both sum and product form, e.g., 3% increase of a quantity x is $x + .03x = 1.03x$.</p> <p>N.MR.08.08 Solve problems involving percent increases and decreases.</p> <p>N.FL.08.09 Solve problems involving compounded interest or multiple discounts.</p> <p>N.MR.08.10 Calculate weighted averages such as course grades, consumer price indices, and sports ratings.</p> <p>N.FL.08.11 <i>Solve problems involving ratio units, such as miles per hour, dollars per pound, or persons per square mile.*</i></p> <p><i>* revised expectations in italics</i></p>

Understand the concept of non-linear functions using basic examples

A.RP.08.01 Identify and represent linear functions, quadratic functions, and other simple functions including inversely proportional relationships ($y = k/x$); cubics ($y = ax^3$); roots ($y = \sqrt{x}$); and exponentials ($y = a^x$, $a > 0$); using tables, graphs, and equations.*

A.PA.08.02 For basic functions, e.g., simple quadratics, direct and indirect variation, and population growth, describe how changes in one variable affect the others.

A.PA.08.03 Recognize basic functions in problem context, e.g., area of a circle is πr^2 , volume of a sphere is $\frac{4}{3}\pi r^3$, and represent them using tables, graphs, and formulas.

A.RP.08.04 Use the vertical line test to determine if a graph represents a function in one variable.

Understand and represent quadratic functions

A.RP.08.05 Relate quadratic functions in factored form and vertex form to their graphs, and vice versa; in particular, note that solutions of a quadratic equation are the x-intercepts of the corresponding quadratic function.

A.RP.08.06 Graph factorable quadratic functions, finding where the graph intersects the x-axis and the coordinates of the vertex; use words “parabola” and “roots”; include functions in vertex form and those with leading coefficient -1 , e.g., $y = x^2 - 36$, $y = (x - 2)^2 - 9$; $y = -x^2$; $y = -(x - 3)^2$.

Recognize, represent, and apply common formulas

A.FO.08.07 Recognize and apply the common formulas:

$$(a + b)^2 = a^2 + 2ab + b^2$$

$$(a - b)^2 = a^2 - 2ab + b^2$$

$(a + b)(a - b) = a^2 - b^2$; represent geometrically.

A.FO.08.08 Factor simple quadratic expressions with integer coefficients, e.g.,

$x^2 + 6x + 9$, $x^2 + 2x - 3$, and $x^2 - 4$; solve simple quadratic equations, e.g., $x^2 = 16$ or $x^2 = 5$ (by taking square roots); $x^2 - x - 6 = 0$, $x^2 - 2x = 15$ (by factoring); verify solutions by evaluation.

A.FO.08.09 Solve applied problems involving simple quadratic equations.

Understand solutions and solve equations, simultaneous equations, and linear inequalities

A.FO.08.10 Understand that to solve the equation $f(x) = g(x)$ means to find all values of x for which the equation is true, e.g., determine whether a given value, or values from a given set, is a solution of an equation (0 is a solution of $3x^2 + 2 = 4x + 2$, but 1 is not a solution).

A.FO.08.11 Solve simultaneous linear equations in two variables by graphing, by substitution, and by linear combination; estimate solutions using graphs; include examples with no solutions and infinitely many solutions.

A.FO.08.12 Solve linear inequalities in one and two variables, and graph the solution sets.

A.FO.08.13 Set up and solve applied problems involving simultaneous linear equations and linear inequalities.

* revised expectations in italics

GEOMETRY

Understand and use the Pythagorean Theorem

G.GS.08.01 Understand at least one proof of the Pythagorean Theorem; use the Pythagorean Theorem and its converse to solve applied problems including perimeter, area, and volume problems.

G.LO.08.02 Find the distance between two points on the coordinate plane using the distance formula; recognize that the distance formula is an application of the Pythagorean Theorem.

Solve problems about geometric figures

G.SR.08.03 Understand the definition of a circle; know and use the formulas for circumference and area of a circle to solve problems.

G.SR.08.04 Find area and perimeter of complex figures by sub-dividing them into basic shapes (quadrilaterals, triangles, circles).

G.SR.08.05 Solve applied problems involving areas of triangles, quadrilaterals, and circles.

Understand concepts of volume and surface area, and apply formulas

G.SR.08.06 Know the volume formulas for generalized cylinders ((area of base) × height), generalized cones and pyramids ($\frac{1}{3}$ (area of base) × height), and spheres ($\frac{4}{3}\pi$ (radius)³) and apply them to solve problems.

G.SR.08.07 Understand the concept of surface area, and find the surface area of prisms, cones, spheres, pyramids, and cylinders.

Visualize solids

G.SR.08.08 Sketch a variety of two-dimensional representations of three-dimensional solids including orthogonal views (top, front, and side), picture views (projective or isometric), and nets; use such two-dimensional representations to help solve problems.

Understand and apply concepts of transformation and symmetry

G.TR.08.09 Understand the definition of a dilation from a point in the plane, and relate it to the definition of similar polygons.

G.TR.08.10 Understand and use reflective and rotational symmetries of two-dimensional shapes and relate them to transformations to solve problems.

DATA AND

PROBABILITY

Draw, explain, and justify conclusions based on data

D.AN.08.01 Determine which measure of central tendency (mean, median, mode) best represents a data set, e.g., salaries, home prices, for answering certain questions; justify the choice made.

D.AN.08.02 Recognize practices of collecting and displaying data that may bias the presentation or analysis.

Understand probability concepts for simple and compound events

D.PR.08.03 *Compute relative frequencies from a table of experimental results for a repeated event. Interpret the results using relationship of probability to relative frequency.**

D.PR.08.04 Apply the Basic Counting Principle to find total number of outcomes possible for independent and dependent events, and calculate the probabilities using organized lists or tree diagrams.

D.PR.08.05 *Find and/or compare the theoretical probability, the experimental probability, and/or the relative frequency of a given event.**

D.PR.08.06 Understand the difference between independent and dependent events, and recognize common misconceptions involving probability, e.g., Alice rolls a 6 on a die three times in a row; she is just as likely to roll a 6 on the fourth roll as she was on any previous roll.

** revised expectations in italics*