

Version 2.0 Mathematics Grade- and Course-Level Expectations

Note: This April, 2008 revisions and updates to the March 2007 version 2.0 GLEs includes:

a.) Minor language revisions

b.) Updated coding of local and state assessed GLEs and CLEs

c.) Integrated Math II and III Course Level Expectations

The *Mathematics Grade and Course Level Expectations* outline related ideas, concepts, skills and procedures that form the foundation for understanding and learning mathematics. They provide a framework to bring focus to teaching, learning, and assessing mathematics. The Grade Level Expectations (GLEs) in grades K-8 specify mathematical content that students need to understand deeply and thoroughly for future mathematics learning. The Course Level Expectations (CLEs) for Algebra I, Geometry, and Algebra II, as well as Integrated Math II and Integrated Math III, outline mathematics expectations for students enrolled in both traditional and integrated mathematics programs.

Since the Outstanding Schools Act of 1993, several documents have been developed prior to the 2004 K-12 *Grade Level Expectations* to aid Missouri school districts in creating curriculum that will enable all students to achieve their maximum potential. Those include:

- The *Show-Me Standards* which identify broad content knowledge and process skills for all students to be successful as they continue their education, enter the workforce, and assume civic responsibilities
- The *Framework for Curriculum Development* which provides districts with a “frame” for building curricula using the *Show-Me Standards* as a foundation
- The *Assessment Annotations for the Curriculum Frameworks* which identify content and processes that should be assessed at the local and state level in grades 4, 8, and 10 mathematics

Essential content, aligned to state and national documents included in the Grade and Course Level Expectations should **be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations**. Each Grade and Course Level Expectation is aligned to the Show-Me Content and Process Standards (1996). In addition, a Depth-of-Knowledge level has been assigned to each grade or course level expectation. The Depth of Knowledge identifies the highest level at which the expectation will be assessed, based upon the demand of the GLE. Depth-of-Knowledge levels include: Level 1-recall; Level 2-skill/concept; Level 3-strategic thinking; and Level 4-extended thinking.

Expectations coded with an asterisk *, indicate that it should be assessed at the local level. Those with no asterisk, indicate an expectation that will be assessed at the state level on a 3rd – 8th grade MAP Assessment or End-of-Course Exam. It is essential to include all expectations in your course or grade level curriculum, as they are important components in the understanding and learning of mathematics.

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Sources: *College Board Standards for College Success: Mathematics and Statistics* (College Board, 2006). *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics* (National Council of Teachers of Mathematics, 2007); ***Indicators of College Readiness within Missouri's Two-Year Colleges*** (Missouri Development Education Consortium); *Depth-of-Knowledge Levels* (Norman Webb); *Mathematics Engineering Technology & Science (METs) Alliance Report* (2006); *Principles and Standards for School Mathematics* (National Council of Teachers of Mathematics, 2000); *Show-Me Standards* (Missouri Department of Elementary and Secondary Education).

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Number and Operations

1. Understand numbers, ways of representing numbers, relationships among numbers and number systems					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A Read, write and compare numbers	compare and order rational and irrational numbers, including finding their approximate locations on a number line	compare and order rational and irrational numbers, including finding their approximate locations on a number line	compare and order rational and irrational numbers, including finding their approximate locations on a number line	compare and order rational and irrational numbers, including finding their approximate locations on a number line	compare and order rational and irrational numbers, including finding their approximate locations on a number line
	1	1	1	1	1
DOK	1	1	1	1	1
ST	MA 5 1.10	MA 5 1.10	MA 5 1.10	MA 5 1.10	MA 5 1.10
B Represent and use real numbers	use real numbers and various models, drawing, etc. to solve problems	use real numbers and various models, drawing, etc. to solve problems	use real numbers and various models, drawings, etc. to solve problems	use real numbers and various models, drawing, etc. to solve problems	use real numbers and various models, drawings, etc. to solve problems
	3	3	3	3	3
DOK	3	3	3	3	3
ST	MA 5 3.3	MA 5 3.3	MA 5 3.3	MA 5 3.3	MA 5 3.3
C Compose and decompose numbers	*use a variety of representations to demonstrate an understanding of very large and very small numbers			*use a variety of representations to demonstrate an understanding of very large and very small numbers	
	2			2	
DOK	2			2	
ST	MA 5 1.6			MA 5 1.6	

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Number and Operations

1. Understand numbers, ways of representing numbers, relationships among numbers and number systems -- continued					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
D					
Classify and describe numeric relationships					
DOK					
ST					

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Number and Operations

2. Understand meanings of operations and how they relate to one another					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A					
Represent operations					
DOK					
ST					
B	*describe the effects of operations, such as multiplication, division, and computing powers and roots on the magnitude of quantities				
Describe effects of operations					
DOK	2				
ST	MA 1 1.10				
C			apply <u>properties of exponents</u> to simplify expressions or solve equations		apply <u>properties of logarithms</u> to simplify expressions or solve equations
Apply properties of operations					
DOK			2		2
ST			MA 2 1.10		MA 2 1.10

Number and Operations

2. Understand meanings of operations and how they relate to one another -- continued					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
D	*apply operations to real numbers, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases	*apply operations to real numbers, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases	*apply operations to real numbers, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases	*apply operations to matrices and complex numbers, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases	*apply operations to matrices and complex numbers, using mental computation or paper-and-pencil calculations for simple cases and technology for more complicated cases
Apply operations on real and complex numbers					
DOK	2	2	2	2	2
ST	MA 1 1.10	MA 1 1.10	MA 1 1.10	MA 1 1.10	MA 1 1.10

Number and Operations

3. Compute fluently and make reasonable estimates					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A					
Describe or represent mental strategies					
DOK					
ST					
B					
Develop and demonstrate fluency					
DOK					
ST					
C					
Compute problems					
DOK					
ST					

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Number and Operations

3. Compute fluently and make reasonable estimates -- continued					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
D	*judge the reasonableness of numerical computations and their results	*judge the reasonableness of numerical computations and their results	*judge the reasonableness of numerical computations and their results	*judge the reasonableness of numerical computations and their results, including complex numbers	*judge the reasonableness of numerical computations and their results
Estimate and justify solutions					
DOK	3	3	3	3	3
ST	MA 1 3.2	MA 1 3.2	MA 1 3.2	MA 1 3.2	MA 1 3.2
F	*solve problems involving proportions	*solve problems involving proportions	*solve problems involving proportions	*solve problems involving proportions	*solve problems involving proportions
Use proportional reasoning					
DOK	2	2	2	2	2
ST	MA 1 3.2	MA 1 3.2	MA 1 3.2	MA 1 3.2	MA 1 3.2

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Algebraic Relationships

1. Understand patterns, relations and functions					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A					
Recognize and extend patterns					
DOK					
ST					
B	generalize patterns using <u>explicitly</u> or <u>recursively</u> defined functions	generalize patterns using <u>explicitly</u> or <u>recursively</u> defined functions	generalize patterns using <u>explicitly</u> or <u>recursively</u> defined functions	generalize patterns using <u>explicitly</u> or <u>recursively</u> defined functions	generalize patterns using <u>explicitly</u> or <u>recursively</u> defined functions
Create and analyze patterns					
DOK	2	2	2	2	2
ST	MA 4 1.6	MA 4 1.6	MA 4 1.6	MA 4 1.6	MA 4 1.6
C	compare and contrast various forms of <u>representations</u> of patterns	compare and contrast various forms of <u>representations</u> of patterns	compare and contrast various forms of <u>representations</u> of patterns	compare and contrast various forms of <u>representations</u> of patterns	compare and contrast various forms of <u>representations</u> of patterns
Classify objects and representations					
DOK	3	3	3	3	3
ST	MA 4 1.6	MA 4 1.6	MA 4 1.6	MA 4 1.6	MA 4 1.6

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Algebraic Relationships

1. Understand patterns, relations and functions -- continued					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
D	understand and compare the properties of <u>linear</u> and <u>nonlinear functions</u>		understand and compare the properties of <u>linear</u> , <u>exponential</u> and <u>quadratic</u> functions (include domain and range)	compare properties of linear, exponential, logarithmic and rational functions	understand and compare the properties of <u>linear</u> , <u>quadratic</u> , <u>exponential</u> , <u>logarithmic</u> , rational and periodic functions (include asymptotes)
Identify and compare functions					
DOK	2		2	2	2
ST	MA 4 1.6		MA 4 1.6	MA 4 1.6	MA 4 1.6
F	describe the effects of <u>parameter changes</u> on <u>linear</u> , <u>exponential growth/decay</u> and <u>quadratic</u> functions including intercepts		describe the effects of <u>parameter changes</u> on <u>quadratic</u> and <u>exponential</u> functions	describe the effects of <u>parameter changes</u> on functions	describe the effects of <u>parameter changes</u> on <u>logarithmic</u> and <u>exponential</u> functions
Describe the effects of parameter changes					
DOK	2		2	2	2
ST	MA 4 1.6		MA 4 1.6	MA 4 1.6	MA 4 1.6

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Algebraic Relationships

2. Represent and analyze mathematical situations and structures using algebraic symbols					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A	use <u>symbolic algebra</u> to represent and solve problems that involve linear and quadratic relationships including equations and inequalities		use <u>symbolic algebra</u> to represent and solve problems that involve quadratic relationships, including <u>recursive</u> relationships	use <u>symbolic algebra</u> to represent and solve problems that involve exponential, quadratic and logarithmic relationships	use <u>symbolic algebra</u> to represent and solve problems that involve exponential and logarithmic relationships, including <u>recursive</u> and <u>parametric</u> relationships
Represent mathematical situations					
DOK	3		3	3	3
ST	MA 4 3.3		MA 4 3.3	MA 4 3.3	MA 4 3.3
B	describe and use algebraic manipulations, including factoring and rules of integer exponents and apply <u>properties of exponents</u> (including order of operations) to simplify expressions	apply appropriate <u>properties of exponents</u> to simplify expressions and solve equations	describe and use algebraic manipulations, including factoring and rules of integer exponents	describe and use algebraic manipulations, <u>inverse</u> or <u>composition</u> of functions	describe and use algebraic manipulations, including <u>inverse</u> of functions, <u>composition</u> of functions and rules of exponents
Describe and use mathematical manipulation					
DOK	2	2	2	2	2
ST	MA 4 3.2	MA 4 3.2	MA 4 3.2	MA 4 3.2	MA 4 3.2

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Algebraic Relationships

2. Represent and analyze mathematical situations and structures using algebraic symbols -- continued					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
C	use and solve equivalent forms of equations (linear, absolute value, and quadratic)		use and solve equivalent forms of equations and inequalities (piece-wise and quadratic)	use and solve equivalent forms of equations and inequalities	use and solve equivalent forms of equations and inequalities (exponential, logarithmic and rational)
Utilize equivalent forms					
DOK					
ST	MA 4 3.2		MA 4 3.2	MA 4 3.2	MA 4 3.2
D	use and solve systems of linear equations or inequalities with 2 variables		use and solve systems of linear equations or inequalities with 2 variables	use and solve systems of linear and quadratic equations or inequalities with 2 variables	use and solve systems of linear and quadratic equations or inequalities with 2 variables
Utilize systems					
DOK					
ST	MA 4 1.6		MA 4 1.6	MA 4 1.6	MA 4 1.6

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Algebraic Relationships

3. Use mathematical models to represent and understand quantitative relationships					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A	identify quantitative relationships and determine the type(s) of functions that might model the situation to solve the problem	identify quantitative relationships and determine the type(s) of functions that might model the situation to solve the problem	identify quantitative relationships and determine the type(s) of functions that might model the situation to solve the problem	identify quantitative relationships and determine the type(s) of functions that might model the situation to solve the problem	identify quantitative relationships and determine the type(s) of functions that might model the situation to solve the problem (including <u>recursive forms</u>)
Use mathematical models					
DOK	2	2	2	2	2
ST	MA 4 1.6	MA 4 1.6	MA 4 1.6	MA 4 1.6	MA 4 1.6

4. Analyze change in various contexts					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A	analyze linear and quadratic functions by investigating rates of change, intercepts and zeros	analyze linear functions by investigating rates of change and intercepts	analyze quadratic functions by investigating rates of change, intercepts and zeros	analyze exponential and logarithmic functions by investigating rates of change, intercepts and asymptotes	analyze exponential and logarithmic functions by investigating rates of change, intercepts and asymptotes
Analyze change					
DOK	3	3	3	3	3
ST	MA 4 1.6	MA 4 1.6	MA 4 1.6	MA 4 1.6	MA 4 1.6

Geometric and Spatial Relationship

1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A		use inductive and deductive reasoning to establish the validity of geometric <u>conjectures</u> , prove theorems and critique arguments made by others	use trigonometric relationships with right triangles to determine lengths and angle measures	use trigonometric relationships with right triangles to determine lengths and angle measures	use inductive and deductive reasoning to determine lengths and angle measures in all types of triangles and to establish the validity of geometric <u>conjectures</u> , prove theorems and critique arguments made by others
Describe and use geometric relationships					
DOK		3	2	2	3
ST		MA 2 3.5	MA 2 3.2	MA 2 3.2	MA 2 3.2
B	*apply geometric properties such as similarity and angle relationship to solve multi-step problems in 2 dimensions		*apply relationships among surface areas and among volumes of similar objects		*determine the effect on surface area or volume of changing one measurement
Apply geometric relationships					
DOK	2		2		2
ST	MA 2 3.6		MA 2 3.6		MA 2 3.6
C					
Compose and decompose shapes					
DOK					
ST					

Geometric and Spatial Relationship

2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A		make conjectures and solve problems involving 2-dimensional objects represented with Cartesian coordinates	make conjectures and solve problems involving 2-dimensional objects represented with Cartesian coordinates		
Use coordinate systems					
DOK		3	3		
ST		MA 2 3.3	MA 2 3.3		

Geometric and Spatial Relationship

3. Apply transformations and use symmetry to analyze mathematical situations					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A		use and apply constructions and the coordinate plane to represent translations, reflections, rotations and dilations of objects	use and apply constructions and matrices to represent translations, reflections, rotations, and dilations		
Use transformations on objects					
DOK		2	2		
ST		MA 2 1.10	MA 2 1.10		
B			translate, dilate and reflect quadratic and exponential <u>functions</u>	translate, dilate and reflect <u>functions</u>	perform simple transformations and their compositions on linear, quadratic, logarithmic and exponential <u>functions</u>
Use transformations on functions					
DOK			2	2	2
ST			MA 4 3.1	MA 4 3.1	MA 4 3.1
C		identify types of symmetries of 2- and 3- dimensional figures			
Use symmetry					
DOK		2			
ST		MA 2 1.10			

Geometric and Spatial Relationship

4. Use visualization, spatial reasoning and geometric modeling to solve problems					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A		draw and use vertex-edge graphs or networks to find optimal solutions and draw representations of 3-dimensional geometric objects from different perspectives			draw representations of 3-dimensional geometric objects from different perspectives using a variety of tools
Recognize and draw three-dimensional representations					
DOK		3			3
ST		MA 2 4.1			MA 2 4.1
B	*draw or use <u>visual models</u> to represent and solve problems	*draw or use <u>visual models</u> to represent and solve problems	*draw or use <u>visual models</u> to represent and solve problems	*draw or use <u>visual models</u> to represent and solve problems	*draw or use <u>visual models</u> to represent and solve problems
Draw and use visual models					
DOK	3	3	3	3	3
ST	MA 2 3.3	MA 2 3.3	MA 2 3.3	MA 2 3.3	MA 2 3.3

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Measurement

1. Understand measurable attributes of objects and the units, systems and processes of measurement					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A					
Determine unit of measurement					
DOK					
ST					
B					*compare and contrast between angle and radian measure
Identify equivalent measures					
DOK					2
ST					MA 2 3.3
C					
Tell and use units of time					
DOK					
ST					

Measurement

1. Understand measurable attributes of objects and the units, systems and processes of measurement -- continued					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
D					
Count and compute money					
DOK					
ST					

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Measurement

2. Apply appropriate techniques, tools and formulas to determine measurements					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A					
Use standard or non-standard measurement					
DOK					
ST					
B		solve problems of angle measure, including those involving triangles or other polygons and of parallel lines cut by a transversal			solve problems of angle measure of parallel lines cut by a transversal
Use angle measurement					
DOK		2			2
ST		MA 2 3.1			MA 2 3.1
C		determine the surface area, and volume of geometric figures, including cones, spheres, and cylinders			
Apply geometric measurements					
DOK		2			
ST		MA 2 1.10			

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Measurement

2. Apply appropriate techniques, tools and formulas to determine measurements -- continued					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
D	*describe the effects of operations, such as multiplication, division and computing powers and roots on magnitudes of quantities and effects of computation on <u>precision</u> which include the judging of reasonableness of numerical computations <u>and their results</u>		*analyze effects of computation on accuracy and <u>precision</u> in measurement	apply concepts of successive approximation	*analyze concepts of successive approximation
Analyze precision					
DOK	2		2	2	2
ST	MA 2 1.7		MA 2 1.6	MA 2 1.6	MA 2 1.6
F	*use <u>unit analysis</u> to solve problems	*use <u>unit analysis</u> to solve problems		*use <u>unit analysis</u> to solve problems involving rates, such as speed, density or population density	*use <u>unit analysis</u> to solve problems involving rates, such as speed, density or population density
Use relationships within a measurement system					
DOK	2	2		2	2
ST	MA 4 1.6	MA 4 1.6		MA 4 1.6	MA 4 1.6

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Data and Probability

1. Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A	formulate questions and collect data about a characteristic which include <u>sample spaces</u> and distributions	formulate and collect data about a characteristic			describe the characteristics of well designed studies, including the role of randomization in survey and experimental research
Formulate questions					
DOK	3	3			3
ST	MA 3 1.2	MA 3 1.2			MA 3 1.2
B					
Classify and organize data					
DOK					
ST					
C	select and use appropriate graphical representation of data and given <u>one-variable quantitative data</u> , display the distribution and describe its shape	select and use appropriate graphical representation of data and given <u>one-variable quantitative data</u> , display the distribution and describe its shape		select and use appropriate graphical representation of data and given <u>one-variable quantitative data</u> , describe its shape and calculate <u>summary statistics</u>	display and analyze <u>bivariate data</u> where one variable is <u>categorical</u> and the other is numerical
Represent and interpret data					
DOK	3	3		3	3
ST	MA 6 1.8	MA 6 1.8		MA 3 1.8	MA 6 1.8

Data and Probability

2. Select and use appropriate statistical methods to analyze data					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A	apply statistical measures of center to solve problems		apply statistical concepts to solve problems and distinguish between a statistic and a parameter	apply statistical measures of center to solve problems	
Describe and analyze data					
DOK	2		3	3	
ST	MA 3 1.10		MA 3 1.10	MA 3 1.10	
B					recognize how linear transformations of single-variable data affect shape, center, and spread
Compare data representations					
DOK					3
ST					MA 3 1.10
C	given a scatterplot, determine an equation for <u>a line of best fit</u>		given a scatterplot, determine the type of function which models the data	given a scatterplot, determine a type of function which models the data	create a scatter plot, describe its shape, determine and analyze regression equations
Represent data algebraically					
DOK	2		2	2	3
ST	MA 3 1.6		MA 3 1.6	MA 3 1.6	MA 3 1.6

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Data and Probability

3. Develop and evaluate inferences and predictions that are based on data					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A	make <u>conjectures</u> about possible relationships between 2 characteristics of a sample on the basis of scatter plots of the data				describe how sample statistics reflect the <u>values of population parameters</u> and use <u>sampling distributions</u> as the basis for <u>informal reference</u>
Develop and evaluate inferences					
DOK	3				3
ST	MA 3 3.5				MA 3 3.5
B					
Analyze basic statistical techniques					
DOK					
ST					

Data and Probability

4. Understand and apply basic concepts of probability					
	Algebra I	Geometry	Integrated Math II	Algebra II	Integrated Math III
A			describe the concepts of <u>sample space</u> and <u>probability distribution</u>	describe the concepts of <u>sample space</u> and <u>probability distribution</u>	
Apply basic concepts of probability					
DOK			2	2	
ST			MA 3 3.1	MA 3 3.1	
B			use and describe the concepts of <u>conditional probability</u> and <u>independent events</u>	use and describe the concepts of <u>conditional probability</u> and <u>independent events</u> and how to compute the probability of a <u>compound event</u>	use and describe how to compute the probability of a <u>compound event</u>
Use and describe compound events					
DOK			2	2	2
ST			MA 3 3.1	MA 3 3.1	MA 3 3.1