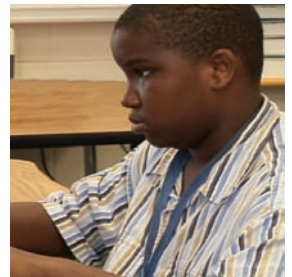
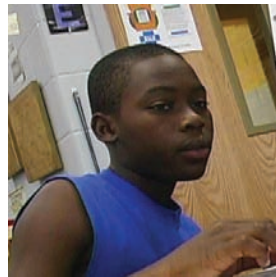
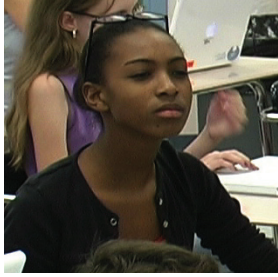


MATH



FLORIDA



Sunshine State Standards

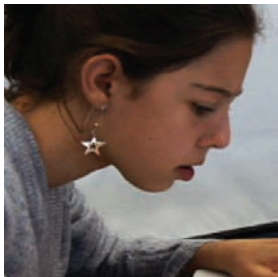


Table of Contents

Overview

History	2
A Commitment to Excellence.....	2
Revision Process.....	4
Access Points for Students for Significant Cognitive Disabilities	4
Structure of Standards Documents.....	5
Acknowledgements	7

K-8 Mathematics Standards

Introduction	13
---------------------------	-----------

Grade K.....	14
---------------------	-----------

Big Idea 1 – Represent, compare, and order whole numbers and joint and separate sets	15
Big Idea 2 – Describe shapes and space.....	15
Big Idea 3 – Order objects by measurable attributes.....	15
Supporting Idea 4 – Algebra.....	16
Supporting Idea 5 – Geometry and Measurement	16

Grade 1	17
----------------------	-----------

Big Idea 1 – Develop understandings of addition and subtraction strategies for basic addition facts and related subtraction facts	18
Big Idea 2 – Develop an understanding of whole number relationships, including grouping by tens and ones	18
Big Idea 3 – Compose and decompose two-dimensional and three-dimensional geometric shapes	18
Supporting Idea 4 – Algebra.....	19
Supporting Idea 5 – Geometry and Measurement	19
Supporting Idea 6 – Number and Operations	19

Grade 2	20
----------------------	-----------

Big Idea 1 – Develop an understanding of base-ten numerations system and place-value concepts	21
Big Idea 2 – Develop quick recall of addition facts and related subtraction facts and fluency with multi-digit addition and subtraction	21
Big Idea 3 – Develop an understanding of linear measurement and facility in measuring lengths	21
Supporting Idea 4 – Algebra.....	22
Supporting Idea 5 – Geometry and Measurement	22
Supporting Idea 6 – Number and Operations	22

Grade 3 23

Big Idea 1 – Develop understandings of multiplication and division and strategies
for basic multiplication facts and related division facts 24

Big Idea 2 – Develop an understanding of fractions and fraction equivalence 24

Big Idea 3 – Describe and analyze properties of two-dimensional shapes 24

Supporting Idea 4 – Algebra..... 25

Supporting Idea 5 – Geometry and Measurement 25

Supporting Idea 6 – Number and Operations 25

Supporting Idea 7 – Data Analysis 25

Grade 4 26

Big Idea 1 – Develop quick recall of multiplication facts and related division
facts and fluency with whole number multiplication 27

Big Idea 2 – Develop an understanding of decimals, including the connection
between fractions and decimals 27

Big Idea 3 – Develop an understanding of area and determine the area of
two-dimensional shapes 27

Supporting Idea 4 – Algebra..... 28

Supporting Idea 5 – Geometry and Measurement 28

Supporting Idea 6 – Number and Operations 28

Grade 5 29

Big Idea 1 – Develop an understanding of and fluency with division of
whole numbers..... 30

Big Idea 2 – Develop an understanding of and fluency with addition and
subtraction of fractions and decimals..... 30

Big Idea 3 – Describe three-dimensional shapes and analyze their properties,
including volume and surface area 30

Supporting Idea 4 – Algebra..... 31

Supporting Idea 5 – Geometry and Measurement 31

Supporting Idea 6 – Number and Operations 31

Supporting Idea 7 – Data Analysis 32

Grade 6 33

Big Idea 1 – Develop an understanding of and fluency with multiplication and
division of fractions and decimals 34

Big Idea 2 – Connect ratio and rates to multiplication and division 34

Big Idea 3 – Write, interpret, and use mathematical expressions and equations 34

Supporting Idea 4 – Geometry and Measurement 35

Supporting Idea 5 – Number and Operations 35

Supporting Idea 6 – Data Analysis 35

Grade 736

Big Idea 1 – Develop an understanding of an apply proportionality, including similarity 37
Big Idea 2 – Develop an understanding of and use formulas to determine
surface areas and volumes of three-dimensional shapes..... 37
Big Idea 3 – Develop an understanding of operations on all rational numbers
and solving linear equations 37
Supporting Idea 4 – Geometry and Measurement 38
Supporting Idea 5 – Number and Operations 38
Supporting Idea 6 – Data Analysis 38
Supporting Idea 7 – Probability 38

Grade 839

Big Idea 1 – Analyze and represent linear functions and solve linear equations
and systems of linear equations 40
Big Idea 2 – Analyze two- and three-dimensional figures by using distance and angle..... 40
Big Idea 3 – Analyze and summarize data sets 41
Supporting Idea 4 – Algebra..... 41
Supporting Idea 5 – Geometry and Measurement 41
Supporting Idea 6 – Number and Operations 41

9-12 Mathematics Standards: Bodies of Knowledge

Introduction42

Algebra43

Standard 1 – Real and Complex Number Systems 44
Standard 2 – Relations and Functions 44
Standard 3 – Linear Equations and Inequalities 45
Standard 4 – Polynomials 46
Standard 5 – Rational Expressions and Equations 47
Standard 6 – Radical Expressions and Equations 48
Standard 7 – Quadratic Equations 48
Standard 8 – Logarithmic and Exponential Functions 49
Standard 9 – Conic Sections 50
Standard 10 – Mathematical Reasoning and Problem Solving 50

Calculus.....51

Standard 1 – Limits and Continuity	52
Standard 2 – Differential Calculus.....	53
Standard 3 – Applications of Derivatives.....	54
Standard 4 – Integral Calculus	55
Standard 5 – Applications of Integration	56

Discrete Mathematics.....57

Standard 1 – Recursion.....	58
Standard 2 – Graph Theory.....	58
Standard 3 – Social Choice.....	59
Standard 4 – Linear Programming	59
Standard 5 – Game Theory.....	59
Standard 6 – Logic	59
Standard 7 – Set Theory	60
Standard 8 – Matrices	60
Standard 9 – Vectors	61
Standard 10 – Parametric Equations	61
Standard 11 – Sequences and Series.....	62

Financial Literacy63

Standard 1 – Simple and Compound Interest	64
Standard 2 – Net Present and Net Future Value (NPV and NFV).....	64
Standard 3 – Loans and Financing	64
Standard 4 – Individual Financial Planning	66
Standard 5 – Economic Concepts.....	67

Geometry68

Standard 1 – Points, Lines, Angles, and Planes	69
Standard 2 – Polygons.....	69
Standard 3 – Quadrilaterals	70
Standard 4 – Triangles.....	70
Standard 5 – Right Triangles.....	71
Standard 6 – Circles.....	72
Standard 7 – Polyhedra and Other Solids.....	72
Standard 8 – Mathematical Reasoning and Problem Solving	73

Probability74

Standard 1 – Counting Principals.....	75
Standard 2 – Determine Probabilities.....	75
Standard 3 – Probability Distributions	75

Statistics.....77

Standard 1 – Formulating Questions..... 78
Standard 2 – Data Collection 78
Standard 3 – Summarizing Data (Descriptive Statistics)..... 79
Standard 4 – Analyzing Data..... 80
Standard 5 – Interpreting Results..... 80

Trigonometry.....82

Standard 1 – Trigonometric Functions 83
Standard 2 – Trigonometry in Triangles 83
Standard 3 – Trigonometric Identities and Equations..... 84
Standard 4 – Polar Coordinates and Trigonometric Form of Complex Numbers 84
Standard 5 – Mathematical Reasoning and Problem Solving 85

Overview

Sunshine State Standards: Mathematics

History

The Sunshine State Standards were first approved by the State Board of Education in 1996 as a means of identifying academic expectations for student achievement in Florida. These original standards were written in several subject areas and were divided into four separate grade clusters (PreK-2, 3-5, 6-8, 9-12). This format was chosen to provide flexibility to school districts in designing curriculum based on local needs.

As Florida moved toward greater accountability for student achievement at each grade level, the Sunshine State Standards were further defined with specific “Grade Level Expectations” added over time. As time went on, two realities appeared that magnified the need to increase the level of rigor, coherence, and clarity in Florida’s academic standards. First, it was recognized that the level of rigor in the 1996 standards was inadequate to address the increased levels of achievement registered by our students. Second, ample evidence from both national and international measures of student achievement indicated the urgent need for higher levels of challenge for all our students. This could not occur without a serious effort to increase the level of rigor and expectations across the board for all Florida students.

The Department of Education recognized the need for a systematic approach to review and revise all of the academic standards, and on January 17, 2006, the State Board of Education adopted a six-year cycle that set forth a schedule of the regular review and revision of all K-12 content standards. (<http://www.flstandards.org>) This move went far beyond increasing the rigor of the standards; however, it included this alignment of the new standards with assessments, instructional materials, professional development, and teacher licensure exams. This way, the new standards and their higher levels of rigor will be fully integrated into the entire culture of K-12 instruction. This move sets the stage for higher levels of rigor and higher academic achievement for years to come.

A Commitment to Excellence

In 2006, the Florida legislature boldly stated its commitment to higher and more challenging standards for Florida’s children by passing HB 7087. Florida law now reads:

§1001.03(1) ...The state board shall establish a schedule to facilitate the periodic review of the standards to ensure adequate rigor, relevance, logical student progression, and integration of reading, writing, and mathematics across all subject areas.

This is a commitment that is shared by educators across Florida, as evidenced by the overwhelming level of public feedback to this revision process. Our goal now is to move forward with confidence and a sense of purpose as we begin implementing these higher and more rigorous standards.

Many people were involved in the review and revision of the mathematics standards. We extend our thanks to all of the teachers and members of the public for their active interest in this important area of work, and we look forward to continuing to work with them as partners in implementing these higher expectations for all of Florida's students.

Jeanine Blomberg
Commissioner of Education

Mathematics Standards Revision Process

In September 2006, the Office of Math and Science convened a committee to consider the framework for the revision of the Sunshine State Standards for mathematics. Taking into account research in mathematics education, a major goal of the revision of the Sunshine State Standards would be to strive for consensus amongst content experts, educational experts, researchers, parents, teachers, and members of the business and workforce community.

Experts in national and international mathematics curriculum articulated their analyses of the 1996 Sunshine State Standards for mathematics benchmarks and grade level expectations to the framers. These experts also presented research on the standards used by other states and the countries that lead the world in student achievement. There was agreement by all reviewers that Florida's standards fit the description of "a mile wide and an inch deep" and lacked coherence. The content of these presentations may be found online at www.flstandards.org. Combined with their own expertise in mathematics curriculum, the framers used this information to define the structure and provide recommendations that would become the guiding principles for the writers of the standards to follow.

From October 2006 to January 2007, the writers committee met to write the new standards and benchmarks according to the structure that the framers set. This was an iterative process, with the framers reviewing the work and providing comments to the writers. Responding to calls for clarity, coherence, and minimal redundancy, the numbers of K-8 grade level expectations were reduced from an average of more than 80 per grade to an average of less than 20 benchmarks per grade. High school benchmarks went from 9-12 grade bands in the 1996 standards to specific benchmarks for content including, for the first time, Calculus, Discrete Math, Trigonometry, and Financial Literacy standards.

From February 2007 to March 2007, the drafts of the standards were provided to the public via online sources and through public forums in various counties in the state of Florida. Online reviewers were able to rate the benchmarks and provide comment. Online reviewers provided 43,025 ratings of 504 draft standards and benchmarks. Of these reviewers, 1,391 interested persons completed the visitor profile. These reviewers identified themselves, in descending order of numbers of reviewers, as teachers, administrators, district staff, other interested persons, parents, and no response. Additionally, experts in mathematics and mathematics curriculum were gathered to provide an in-depth review of the drafts for comment and revision.

From April 2007 to June 2007, the benchmarks were revised based on the considerable input from the committees and other reviewers. The names of the framers, speakers, writers, and expert review panelists are included in the Acknowledgments section of this document.

Access Points for Students with Significant Cognitive Disabilities

As part of the revision to the Sunshine State Standards, access points for students with significant cognitive disabilities have been developed. These access points are expectations

written for students with significant cognitive disabilities to access the general education curriculum. Embedded in the Sunshine State Standards, access points reflect the core intent of the standards with reduced levels of complexity. The three levels of complexity include participatory, supported, and independent with the participatory level being the least complex. The new Florida Alternate Assessment will measure achievement on the Access Points.

The Access Points for the Mathematics Sunshine State Standards were developed through the cooperative efforts of writing teams composed of Florida educators and parents under the direction of staff from the Accommodations and Modifications for Students with Disabilities Project, the Accountability and Assessment for Students with Disabilities Project, and the Florida Department of Education

Structure of the Standards Documents

The new world-class Sunshine State Standards for mathematics are organized by grade level for grades K-8 and by Bodies of Knowledge for grades 9-12. This structure was determined by the Framers Committee based on review of the issues presented by experts and research in curriculum standards. The Bodies of Knowledge do not comprise courses. Standards and benchmarks will be pulled from the various Bodies of Knowledge to write specific courses in mathematics at the secondary level.

The model for writing the standards for the K-8 standards was provided by a 2006 document from the National Council of Teachers of Mathematics (NCTM) entitled Curriculum Focal Points: A Quest for Coherence.

Standards at each of the K-8 grade levels are termed Big Ideas and Supporting Ideas. The set of standards for each grade level consists of three Big Ideas and varying numbers of Supporting Ideas. Supporting Ideas are not meant to be subordinate to Big Ideas, but rather they serve to provide connections between topics at different grade levels.

At the high school level, the mathematics standards are organized into familiar Bodies of Knowledge such as Algebra, Geometry, Trigonometry, Calculus, Probability, and Statistics. There are two Bodies of Knowledge that may not be recognized as the traditional mathematics curriculum. They are Discrete Mathematics and Financial Literacy.

Discrete Mathematics consists of many of the topics in mathematics that are becoming more and more important in the modern era. For example, all computer and electronic applications of mathematics are necessarily discrete. Some of the topics in Discrete Math include set theory, graph theory, matrix algebra, recursive functions, and more.

Florida is introducing a Body of Knowledge in mathematics entitled Financial Literacy. This Body of Knowledge has been created in response to the combination of a long history of financial matters in mathematics education, the near-universal relevance of financial matters and mathematics in people's lives, and the development of financial mathematics programs at university levels. The standards and benchmarks in the Financial Literacy Body of Knowledge involve high-level, complex mathematics applications. The Financial Literacy

Body of Knowledge is intended to provide students with an opportunity to learn and use mathematics in an applied manner, thereby supporting their understanding of mathematics, their own financial well-being, and the health of the economic system in which we all operate.

With people from many aspects of the education community involved with writing, reviewing, and revising the standards, the 2007 revision of the Sunshine State Standards for mathematics are truly the stakeholder's standards. The Office of Math and Science is incredibly grateful for the intensity of the work that was performed in writing these standards.

Mary Jane Tappen
Executive Director of Florida's Office of Math and Science

Acknowledgments

The Office of Math and Science gratefully acknowledges the cooperation and assistance received from individuals and groups throughout Florida in this revision process. Without such cooperation, these revisions would not have been possible.

We would like to express special thanks to the many local educators, parents, and business people who participated in the current revision process by serving on curriculum committees and reacting to draft documents as well as those who took the time to review and rate the drafts online. These people include, but are not limited to the following:

Mathematics Standards Framers Committee

- Thomasenia Adams
Associate Professor of Mathematics, University of Florida
- Norma Agras
Chair, Department of Mathematics, Miami Dade College
- Janet Boatman
Middle School Math Supervisor, Hillsborough County
- Sue Burns
PTA Representative, Seminole County
- Maureen Carll
Family/Community Involvement Chairperson, Florida PTA
- Paula Cifuentes
Professor of Mathematics, Lake City Community College
- Michael Hynes
College of Education, University of Central Florida
- Elizabeth Jakubowski
Associate Professor, Florida State University
- Christine Johnson
Associate in Research, FSU Learning Systems Institute
- Nancy Kinard
President, Florida Council of Teachers of Mathematics
- Michael Mears
Dean of Instruction, Mathematics, Manatee Community College
- Elesea Page
Mathematics Education, St. Lucie County
- Emily Peterek
Mathematics Education Doctoral Student, University of Florida
- Walter G. Secada
Department of Teaching and Learning, University of Miami
- Hui Fang "Angie" Su
Professor of Mathematics Education, Nova Southeastern University
- Norm Thagard
Professor of College Relations at FAMU/FSU College of Engineering

- Denisse Thompson
Professor of Mathematics Education, University South Florida
- Vince Verges
FCAT Mathematics Coordinator
- Sharon Vandeventer
Math Coordinator, Lee County
- Dorett Wade
Curriculum Supervisor, Exceptional Student Education, Broward County

National Experts who Presented Research to the Framers

- Kaye Forgione
Achieve.org, Mathematics Benchmarking Initiative
- Alan Ginsburg
US Department of Education
- R. James Milgram
Professor, Stanford University
- Barbara Reys
Center for the Study of Mathematics Curriculum
- Jane Schielack
NCTM, Professor of Mathematics at Texas A&M University

Mathematics Standards Writing Committee

- Patricia Casey
Mathematics Teacher, Florida State University
- Sandra Cook
Mathematics Teacher, Vernon High School
- Robert Davis
K-12 Curriculum and Instruction Specialist, Charlotte County
- Juli Dixon
Associate Professor of Mathematics Education, UCF
- Marita Eng
Former Mathematics Supervisor
- Deirdre Englehart
UCF Instructor in Early Childhood
- Jean Giarrusso
Secondary Mathematics Administrator, Palm Beach County
- Sherry Hallman
Mathematics Instructor, Bronson High School
- Gladis Kersaint
Mathematics Education Facility, University South Florida
- Charlene Kincaid
Mathematics Specialist, FCTM Board of Directors
- Chuck Lindsey
Associate Professor of Mathematics, Florida Gulf Coast University

- Jan McKay
ESE Specialist, Florida State University
- Andy Reeves
Mathematics Educator, University South Florida
- Denise M. Snure
Mathematics Specialist, St. Lucie County
- Nancy Stokely
ESE Specialist, Florida State University
- Angie Su
Professor of Mathematics Education, Nova Southeastern University
- Vince Verges
FCAT Mathematics Coordinator for Florida Department of Education
- Kristin Weller
K-8 Mathematics Methods Instructor, University of Florida
- Dee Ann Wilson
Mathematics Program Specialist, Lake County
- Janet Wizda
Language Development K-5/ Reading
- Melissa Young
Secondary Mathematics Specialist, Orange County
- Robert Young
Assistant Professor of Mathematics, Brevard Community College
- Ana Zuniga
ELL, Mathematics Teacher Coral Gables High School

Mathematics Access Point Writing Team

- Patricia Bedford
Suntree Elementary School Mathematics Teacher, Brevard County
- Paul Bennett
Dixie County High School Mathematics Teacher, Dixie County
- Jill Brookner
District Alternate Assessment Coordinator, Miami-Dade County
- Donna Vacarro Collins
Parent, Leon County
- Conney Dahn
High School ESE Teacher (Florida Teacher of the Year), Martin County
- Susan Dunbar
Parent, Leon County
- Jane Floyd-Bullen
Principal of Gretchen Everhart School, Leon County
- Debbie Gibson,
Swift Creek Middle School Mathematics Teacher, Leon County
- Debbie Green
Curriculum Specialist, Paul B. Stevens School, Pinellas County

- Monica Griffey
Middle School ESE Teacher, Florida School for the Deaf and Blind
- Peggy Harter
Local Assistive Technology Specialist, FDLRS Miccosukee
- Michelle Hoolsema
Merritt Island High School, ESE Mathematics Teacher, Brevard County
- Gina Horton
Instructional Support Teacher, Orange County
- Mark Koorland
Professor, Exceptional Student Education, University of South Florida
- Joyce Lubbers
Project Connect, Transition Center, University of Florida
- Dave Meharg
Middle School ESE Teacher, Florida School for the Deaf and Blind
- Linda Oaksford,
Elementary Mathematics Specialist, Florida Assessment Center
- Jan Oberschlake
Human Resource Development, FDLRS Miccosukee
- Miriam Showalter
Middle School Teacher, Students with Autism, Sarasota County
- Jeris Simmons
Instructional Program Specialist, Duval County
- Jessica Sidler
High School Teacher, Gretchen Everhart School
- Becky Stack
Instructional Support Teacher, Orange County
- Frances Towk
Resource Specialist, Mathematics, Alachua County
- Jessica Webb
Lee Elementary School Teacher, Madison County
- Stacie Whinnery
Professor, Exceptional Student Education, University of West Florida

Mathematics Standards Expert Review Panelists

Florida Center for Research in Science, Technology, Engineering, and Math (FCR-STEM):

- Christine Johnson
Facilitator
- Philip Bowers
Professor of Mathematics
- Joseph Calhoun
Associate Director, Economic Education
- Kathy Clark
Assistant Professor of Mathematics Education
- James Gwartney
Professor of Economics

- Monica Hurdal
Associate Professor of Mathematics
- Elizabeth Jakubowski
Associate Professor of Mathematics Education
- Alec N. Kercheval
Associate Professor of Mathematics
- Moana Karsteter
Professor of Mathematics
- Steve Ramsier
Associate Professor of Statistics
- Robert Schoen
Doctoral Student, Mathematics Education

Individual Expert Reviewers:

- Nancy Dorff-Pennea
Mathematics Teacher, Palm Beach County
- James Milgram
Professor of Mathematics, Stanford University
- William McCallum
Professor of Mathematics, University of Arizona
- Ira Papick
Professor of Mathematics, University of Missouri
- Jae-Boon Lee
Research Fellow, Korean Educational Development Institute

Workforce/Industry Reviewers:

- Nirmala Ramlakhan
Facilitator, Workforce Central Florida
- Dawn Cavaliere
Human Resources, Conmed-Linvatec
- Lyle Conn
Systems Engineer, Adaptec, Inc.
- Mark Dawson
City President, Wachovia
- Bob Fisher
Jabil
- Glenn E. Forrest President
Glenn E. Forrest, P. E., Inc.
- Floyd Freeman Jr.
Technical Project Manager, Sprint
- Thomas J. King
Citi
- Howard Ludwig
Sr. Staff Engineer, Lockheed Martin Missiles and Fire Control
- Tim Madhanagopal
Engineer, Orange County Utilities

- Asif Rafiq
RF Engineer, Sprint
- Kim Robinson
Senior Performance Engineer, Adaptec, Inc.
- Eric Zimmer,
Franklin Templeton Investments

FLORIDA MATHEMATICS STANDARDS

K-8 GRADE-LEVEL STANDARDS

Big Ideas

Big Ideas are standards that are aligned with the *Curriculum Focal Points* released by the National Council of Teachers of Mathematics (NCTM). They include standards which should be the primary focus of mathematics instruction for each grade level, K-8. Establishing proficiency with these standards at each successive grade level will prepare a strong foundation for learning mathematics in subsequent grades.

There are three Big Ideas for each grade. The Big Ideas do not address the same topics for each grade, recognizing that at each level there are certain skills which must be honed to prepare students for more rigorous instruction as they move to the next grade. The order of the Big Idea standards does not determine the order of instruction nor does it indicate that one idea requires greater instructional emphasis. The Big Ideas are assigned numbers 1, 2, or 3 without regard to the content in each of them.

Supporting Ideas

Supporting ideas are standards which are fundamental to sound mathematics instruction. Also aligned with the *Curriculum Focal Points*, Supporting Ideas are not less important than the Big Ideas but are key components to a structurally sound mathematics education.

Supporting Ideas are standards that serve one or more of the following purposes:

- 1) Establishing connections to and between the strands of mathematics as defined by NCTM (Probability has been extracted from Data Analysis and stands alone.);
- 2) Preparing students for future mathematics teaching and learning by focusing on conceptual understanding of concepts; and
- 3) Addressing gaps in instruction that may appear insignificant but are important to the understanding, fluency, and application of mathematics ideas to problem solving.

Kindergarten

Benchmark Coding Scheme

MA.	K.	A.	1.	1
Subject	Grade Level	Body of Knowledge	Big Idea / Supporting Idea	Benchmark

Body of Knowledge Key:

A ~ Algebra

C ~ Calculus

D ~ Discrete Mathematics

F ~ Financial Literacy

G ~ Geometry

P ~ Probability

S ~ Statistics

T ~ Trigonometry

K-8 MATHEMATICS STANDARDS

GRADE K

Big Idea 1: Represent, compare, and order whole numbers and join and separate sets.

BENCHMARK CODE	BENCHMARK
MA.K.A.1.1	Represent quantities with numbers up to 20, verbally, in writing, and with manipulatives. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.K.A.1.2	Solve problems including those involving sets by counting, by using cardinal and ordinal numbers, by comparing, by ordering, and by creating sets up to 20. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.K.A.1.3	Solve word problems involving simple joining and separating situations. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Big Idea 2: Describe shapes and space.

BENCHMARK CODE	BENCHMARK
MA.K.G.2.1	Describe, sort and re-sort objects using a variety of attributes such as shape, size, and position. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.K.G.2.2	Identify, name, describe and sort basic two-dimensional shapes such as squares, triangles, circles, rectangles, hexagons, and trapezoids. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.K.G.2.3	Identify, name, describe, and sort three-dimensional shapes such as spheres, cubes and cylinders. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.K.G.2.4	Interpret the physical world with geometric shapes, and describe it with corresponding vocabulary. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.K.G.2.5	Use basic shapes, spatial reasoning, and manipulatives to model objects in the environment and to construct more complex shapes. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Big Idea 3: Order objects by measurable attributes.

BENCHMARK CODE	BENCHMARK
MA.K.G.3.1	Compare and order objects indirectly or directly using measurable attributes such as length, height, and weight. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Supporting Idea 4: Algebra

BENCHMARK CODE	BENCHMARK
MA.K.A.4.1	Identify and duplicate simple number and non-numeric repeating and growing patterns. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Supporting Idea 5: Geometry and Measurement

BENCHMARK CODE	BENCHMARK
MA.K.G.5.1	Demonstrate an understanding of the concept of time using identifiers such as morning, afternoon, day, week, month, year, before/after, shorter/longer. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Grade 1

Benchmark Coding Scheme

MA.	1.	A.	1.	1
Subject	Grade Level	Body of Knowledge	Big Idea / Supporting Idea	Benchmark

Body of Knowledge Key:

A ~ Algebra

C ~ Calculus

D ~ Discrete Mathematics

F ~ Financial Literacy

G ~ Geometry

P ~ Probability

S ~ Statistics

T ~ Trigonometry

K-8 MATHEMATICS STANDARDS

GRADE 1

Big Idea 1: Develop understandings of addition and subtraction strategies for basic addition facts and related subtraction facts.

BENCHMARK CODE	BENCHMARK
MA.1.A.1.1	Model addition and subtraction situations using the concepts of "part-whole," "adding to," "taking away from," "comparing," and missing addend. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.1.A.1.2	Identify, describe, and apply addition and subtraction as inverse operations. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.1.A.1.3	Create and use increasingly sophisticated strategies, and use properties such as Commutative, Associative and Additive Identity, to add whole numbers. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.1.A.1.4	Use counting strategies, number patterns, and models as a means for solving basic addition and subtraction fact problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Big Idea 2: Develop an understanding of whole number relationships, including grouping by tens and ones.

BENCHMARK CODE	BENCHMARK
MA.1.A.2.1	Compare and order whole numbers at least to 100. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.1.A.2.2	Represent two digit numbers in terms of tens and ones. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.1.A.2.3	Order counting numbers, compare their relative magnitudes, and represent numbers on a number line. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Big Idea 3: Compose and decompose two-dimensional and three-dimensional geometric shapes.

BENCHMARK CODE	BENCHMARK
MA.1.G.3.1	Use appropriate vocabulary to compare shapes according to attributes and properties such as number and lengths of sides and number of vertices. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.1.G.3.2	Compose and decompose plane and solid figures, including making predictions about them, to build an understanding of part-whole relationships and properties of shapes. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 4: Algebra

BENCHMARK CODE	BENCHMARK
MA.1.A.4.1	Extend repeating and growing patterns, fill in missing terms, and justify reasoning. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 5: Geometry and Measurement

BENCHMARK CODE	BENCHMARK
MA.1.G.5.1	Measure by using iterations of a unit, and count the unit measures by grouping units. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.1.G.5.2	Compare and order objects according to descriptors of length, weight, and capacity. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Supporting Idea 6: Number and Operations

BENCHMARK CODE	BENCHMARK
MA.1.A.6.1	Use mathematical reasoning and beginning understanding of tens and ones, including the use of invented strategies, to solve two-digit addition and subtraction problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.1.A.6.2	Solve routine and non-routine problems by acting them out, using manipulatives, and drawing diagrams. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Grade 2

Benchmark Coding Scheme

MA.	2.	A.	1.	1
Subject	Grade Level	Body of Knowledge	Big Idea / Supporting Idea	Benchmark

Body of Knowledge Key:

A ~ Algebra

C ~ Calculus

D ~ Discrete Mathematics

F ~ Financial Literacy

G ~ Geometry

P ~ Probability

S ~ Statistics

T ~ Trigonometry

K-8 MATHEMATICS STANDARDS

GRADE 2

Big Idea 1: Develop an understanding of base-ten numerations system and place-value concepts.

BENCHMARK CODE	BENCHMARK
MA.2.A.1.1	Identify relationships between the digits and their place values through the thousands, including counting by tens and hundreds. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.2.A.1.2	Identify and name numbers through thousands in terms of place value, and apply this knowledge to expanded notation. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.2.A.1.3	Compare and order multi-digit numbers through the thousands. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Big Idea 2: Develop quick recall of addition facts and related subtraction facts and fluency with multi-digit addition and subtraction.

BENCHMARK CODE	BENCHMARK
MA.2.A.2.1	Recall basic addition and related subtraction facts. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.2.A.2.2	Add and subtract multi-digit whole numbers through three digits with fluency by using a variety of strategies, including invented and standard algorithms and explanations of those procedures. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.2.A.2.3	Estimate solutions to multi-digit addition and subtraction problems through three digits. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.2.A.2.4	Solve addition and subtraction problems that involve measurement and geometry. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Big Idea 3: Develop an understanding of linear measurement and facility in measuring lengths.

BENCHMARK CODE	BENCHMARK
MA.2.G.3.1	Estimate and use standard units, including inches and centimeters, to partition and measure lengths of objects. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.2.G.3.2	Describe the inverse relationship between the size of a unit and number of units needed to measure a given object. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.2.G.3.3	Apply the Transitive Property when comparing lengths of objects. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.2.G.3.4	Estimate, select an appropriate tool, measure, and/or compute lengths to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 4: Algebra

BENCHMARK CODE	BENCHMARK
MA.2.A.4.1	Extend number patterns to build a foundation for understanding multiples and factors – for example, skip counting by 2's, 5's, 10's. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.2.A.4.2	Classify numbers as odd or even and explain why. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.2.A.4.3	Generalize numeric and non-numeric patterns using words and tables. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.2.A.4.4	Describe and apply equality to solve problems, such as in balancing situations. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.2.A.4.5	Recognize and state rules for functions that use addition and subtraction. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 5: Geometry and Measurement

BENCHMARK CODE	BENCHMARK
MA.2.G.5.1	Use geometric models to demonstrate the relationships between wholes and their parts as a foundation to fractions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.2.G.5.2	Identify time to the nearest hour and half hour. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.2.G.5.3	Identify, combine, and compare values of money in cents up to \$1 and in dollars up to \$100, working with a single unit of currency. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.2.G.5.4	Measure weight/mass and capacity/volume of objects. Include the use of the appropriate unit of measure and their abbreviations including cups, pints, quarts, gallons, ounces (oz), pounds (lbs), grams (g), kilograms (kg), milliliters (mL) and liters (L). <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>

Supporting Idea 6: Number and Operations

BENCHMARK CODE	BENCHMARK
MA.2.A.6.1	Solve problems that involve repeated addition. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Grade 3

Benchmark Coding Scheme

MA.	3.	A.	1.	1
Subject	Grade Level	Body of Knowledge	Big Idea / Supporting Idea	Benchmark

Body of Knowledge Key:

A ~ Algebra

C ~ Calculus

D ~ Discrete Mathematics

F ~ Financial Literacy

G ~ Geometry

P ~ Probability

S ~ Statistics

T ~ Trigonometry

K-8 MATHEMATICS STANDARDS

GRADE 3

Big Idea 1: Develop understandings of multiplication and division and strategies for basic multiplication facts and related division facts.

BENCHMARK CODE	BENCHMARK
MA.3.A.1.1	Model multiplication and division including problems presented in context: repeated addition, multiplicative comparison, array, how many combinations, measurement, and partitioning. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.3.A.1.2	Solve multiplication and division fact problems by using strategies that result from applying number properties. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.3.A.1.3	Identify, describe, and apply division and multiplication as inverse operations. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Big Idea 2: Develop an understanding of fractions and fraction equivalence.

BENCHMARK CODE	BENCHMARK
MA.3.A.2.1	Represent fractions, including fractions greater than one, using area, set, and linear models. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.3.A.2.2	Describe how the size of the fractional part is related to the number of equal sized pieces in the whole. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.3.A.2.3	Compare and order fractions, including fractions greater than one, using models and strategies. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.3.A.2.4	Use models to represent equivalent fractions, including fractions greater than 1, and identify representations of equivalence. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Big Idea 3: Describe and analyze properties of two-dimensional shapes.

BENCHMARK CODE	BENCHMARK
MA.3.G.3.1	Describe, analyze, compare, and classify two-dimensional shapes using sides and angles - including acute, obtuse, and right angles - and connect these ideas to the definition of shapes. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.3.G.3.2	Compose, decompose, and transform polygons to make other polygons, including concave and convex polygons with three, four, five, six, eight, or ten sides. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.3.G.3.3	Build, draw, and analyze two-dimensional shapes from several orientations in order to examine and apply congruence and symmetry. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Supporting Idea 4: Algebra

BENCHMARK CODE	BENCHMARK
MA.3.A.4.1	Create, analyze, and represent patterns and relationships using words, variables, tables, and graphs. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 5: Geometry and Measurement

BENCHMARK CODE	BENCHMARK
MA.3.G.5.1	Select appropriate units, strategies, and tools to solve problems involving perimeter. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.3.G.5.2	Measure objects using fractional parts of linear units such as $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{10}$. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.3.G.5.3	Tell time to the nearest minute and to the nearest quarter hour, and determine the amount of time elapsed. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Supporting Idea 6: Number and Operations

BENCHMARK CODE	BENCHMARK
MA.3.A.6.1	Represent, compute, estimate, and solve problems using numbers through hundred thousands. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.3.A.6.2	Solve non-routine problems by making a table, chart, or list and searching for patterns. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 7: Data Analysis

BENCHMARK CODE	BENCHMARK
MA.3.S.7.1	Construct and analyze frequency tables, bar graphs, pictographs, and line plots from data, including data collected through observations, surveys, and experiments. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Grade 4

Benchmark Coding Scheme

MA.	4.	A.	1.	1
Subject	Grade Level	Body of Knowledge	Big Idea / Supporting Idea	Benchmark

Body of Knowledge Key:

A ~ Algebra

C ~ Calculus

D ~ Discrete Mathematics

F ~ Financial Literacy

G ~ Geometry

P ~ Probability

S ~ Statistics

T ~ Trigonometry

K-8 MATHEMATICS STANDARDS

GRADE 4

Big Idea 1: Develop quick recall of multiplication facts and related division facts and fluency with whole number multiplication.

BENCHMARK CODE	BENCHMARK
MA.4.A.1.1	Use and describe various models for multiplication in problem-solving situations, and demonstrate recall of basic multiplication and related division facts with ease. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.4.A.1.2	Multiply multi-digit whole numbers through four digits fluently, demonstrating understanding of the standard algorithm, and checking for reasonableness of results, including solving real-world problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Big Idea 2: Develop an understanding of decimals, including the connection between fractions and decimals.

BENCHMARK CODE	BENCHMARK
MA.4.A.2.1	Use decimals through the thousandths place to name numbers between whole numbers. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.4.A.2.2	Describe decimals as an extension of the base-ten number system. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.4.A.2.3	Relate equivalent fractions and decimals with and without models, including locations on a number line. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.4.A.2.4	Compare and order decimals, and estimate fraction and decimal amounts in real-world problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Big Idea 3: Develop an understanding of area and determine the area of two-dimensional shapes.

BENCHMARK CODE	BENCHMARK
MA.4.G.3.1	Describe and determine area as the number of same-sized units that cover a region in the plane, recognizing that a unit square is the standard unit for measuring area. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.4.G.3.2	Justify the formula for the area of the rectangle "area = base x height". <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.4.G.3.3	Select and use appropriate units, both customary and metric, strategies, and measuring tools to estimate and solve real-world area problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Supporting Idea 4: Algebra

BENCHMARK CODE	BENCHMARK
MA.4.A.4.1	Generate algebraic rules and use all four operations to describe patterns, including nonnumeric growing or repeating patterns. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.4.A.4.2	Describe mathematics relationships using expressions, equations, and visual representations. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.4.A.4.3	Recognize and write algebraic expressions for functions with two operations. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 5: Geometry and Measurement

BENCHMARK CODE	BENCHMARK
MA.4.G.5.1	Classify angles of two-dimensional shapes using benchmark angles (45° , 90° , 180° , and 360°) <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.4.G.5.2	Identify and describe the results of translations, reflections, and rotations of 45, 90, 180, 270, and 360 degrees, including figures with line and rotational symmetry. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.4.G.5.3	Identify and build a three-dimensional object from a two-dimensional representation of that object and vice versa. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Supporting Idea 6: Number and Operations

BENCHMARK CODE	BENCHMARK
MA.4.A.6.1	Use and represent numbers through millions in various contexts, including estimation of relative sizes of amounts or distances. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.4.A.6.2	Use models to represent division as: <ul style="list-style-type: none">• the inverse of multiplication• as partitioning• as successive subtraction <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.4.A.6.3	Generate equivalent fractions and simplify fractions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.4.A.6.4	Determine factors and multiples for specified whole numbers. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.4.A.6.5	Relate halves, fourths, tenths, and hundredths to decimals and percents. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.4.A.6.6	Estimate and describe reasonableness of estimates; determine the appropriateness of an estimate versus an exact answer. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Grade 5

Benchmark Coding Scheme

MA.	5.	A.	1.	1
Subject	Grade Level	Body of Knowledge	Big Idea / Supporting Idea	Benchmark

Body of Knowledge Key:

A ~ Algebra

C ~ Calculus

D ~ Discrete Mathematics

F ~ Financial Literacy

G ~ Geometry

P ~ Probability

S ~ Statistics

T ~ Trigonometry

K-8 MATHEMATICS STANDARDS

GRADE 5

Big Idea 1: Develop an understanding of and fluency with division of whole numbers.

BENCHMARK CODE	BENCHMARK
MA.5.A.1.1	Describe the process of finding quotients involving multi-digit dividends using models, place value, properties, and the relationship of division to multiplication. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.5.A.1.2	Estimate quotients or calculate them mentally depending on the context and numbers involved. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.5.A.1.3	Interpret solutions to division situations including those with remainders depending on the context of the problem. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.5.A.1.4	Divide multi-digit whole numbers fluently, including solving real-world problems, demonstrating understanding of the standard algorithm and checking the reasonableness of results. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Big Idea 2: Develop an understanding of and fluency with addition and subtraction of fractions and decimals.

BENCHMARK CODE	BENCHMARK
MA.5.A.2.1	Represent addition and subtraction of decimals and fractions with like and unlike denominators using models, place value, or properties. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.5.A.2.2	Add and subtract fractions and decimals fluently, and verify the reasonableness of results, including in problem situations. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.5.A.2.3	Make reasonable estimates of fraction and decimal sums and differences, and use techniques for rounding. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.5.A.2.4	Determine the prime factorization of numbers. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Big Idea 3: Describe three-dimensional shapes and analyze their properties, including volume and surface area.

BENCHMARK CODE	BENCHMARK
MA.5.G.3.1	Analyze and compare the properties of two-dimensional figures and three-dimensional solids (polyhedra), including the number of edges, faces, vertices, and types of faces. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.5.G.3.2	Describe, define, and determine surface area and volume of prisms by using appropriate units and selecting strategies and tools. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 4: Algebra

BENCHMARK CODE	BENCHMARK
MA.5.A.4.1	Use the properties of equality to solve numerical and real world situations. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.5.A.4.2	Construct and describe a graph showing continuous data, such as a graph of a quantity that changes over time. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 5: Geometry and Measurement

BENCHMARK CODE	BENCHMARK
MA.5.G.5.1	Identify and plot ordered pairs on the first quadrant of the coordinate plane. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.5.G.5.2	Compare, contrast, and convert units of measure within the same dimension (length, mass, or time) to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.5.G.5.3	Solve problems requiring attention to approximation, selection of appropriate measuring tools, and precision of measurement. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.5.G.5.4	Derive and apply formulas for areas of parallelograms, triangles, and trapezoids from the area of a rectangle. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 6: Number and Operations

BENCHMARK CODE	BENCHMARK
MA.5.A.6.1	Identify and relate prime and composite numbers, factors, and multiples within the context of fractions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.5.A.6.2	Use the order of operations to simplify expressions which include exponents and parentheses. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.5.A.6.3	Describe real-world situations using positive and negative numbers. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.5.A.6.4	Compare, order, and graph integers, including integers shown on a number line. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.5.A.6.5	Solve non-routine problems using various strategies including “solving a simpler problem” and “guess, check, and revise”. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 7: Data Analysis

BENCHMARK CODE	BENCHMARK
MA.5.S.7.1	Construct and analyze line graphs and double bar graphs. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.5.S.7.2	Differentiate between continuous and discrete data, and determine ways to represent those using graphs and diagrams. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Grade 6

MA.	6.	A.	1.	1
Subject	Grade Level	Body of Knowledge	Big Idea / Supporting Idea	Benchmark

Body of Knowledge Key:

A ~ Algebra

C ~ Calculus

D ~ Discrete Mathematics

F ~ Financial Literacy

G ~ Geometry

P ~ Probability

S ~ Statistics

T ~ Trigonometry

K-8 MATHEMATICS STANDARDS

GRADE 6

Big Idea 1: Develop an understanding of and fluency with multiplication and division of fractions and decimals.

BENCHMARK CODE	BENCHMARK
MA.6.A.1.1	Explain and justify procedures for multiplying and dividing fractions and decimals. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.6.A.1.2	Multiply and divide fractions and decimals efficiently. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.6.A.1.3	Solve real-world problems involving multiplication and division of fractions and decimals. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Big Idea 2: Connect ratio and rates to multiplication and division.

BENCHMARK CODE	BENCHMARK
MA.6.A.2.1	Use reasoning about multiplication and division to solve ratio and rate problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.6.A.2.2	Interpret and compare ratios and rates. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Big Idea 3: Write, interpret, and use mathematical expressions and equations.

BENCHMARK CODE	BENCHMARK
MA.6.A.3.1	Write and evaluate mathematical expressions that correspond to given situations. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.6.A.3.2	Write, solve, and graph one- and two- step linear equations and inequalities. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.6.A.3.3	Work backward with two-step function rules to undo expressions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.6.A.3.4	Solve problems given a formula. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.6.A.3.5	Apply the Commutative, Associative, and Distributive Properties to show that two expressions are equivalent. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.6.A.3.6	Construct and analyze tables, graphs, and equations to describe linear functions and other simple relations using both common language and algebraic notation. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 4: Geometry and Measurement

BENCHMARK CODE	BENCHMARK
MA.6.G.4.1	Understand the concept of Pi, know common estimates of Pi (3.14; 22/7) and use these values to estimate and calculate the circumference and the area of circles. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.6.G.4.2	Find the perimeters and areas of composite two-dimensional figures, including non-rectangular figures (such as semicircles) using various strategies. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.6.G.4.3	Determine a missing dimension of a plane figure or prism given its area or volume and some of the dimensions, or determine the area or volume given the dimensions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Supporting Idea 5: Number and Operations

BENCHMARK CODE	BENCHMARK
MA.6.A.5.1	Use equivalent forms of fractions, decimals, and percents to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.6.A.5.2	Compare and order fractions, decimals, and percents, including finding their approximate location on a number line. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.6.A.5.3	Estimate the results of computations with fractions, decimals, and percents, and judge the reasonableness of the results. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Supporting Idea 6: Data Analysis

BENCHMARK CODE	BENCHMARK
MA.6.S.6.1	Determine the measures of central tendency (mean, median, mode) and variability (range) for a given set of data. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.6.S.6.2	Select and analyze the measures of central tendency or variability to represent, describe, analyze, and/or summarize a data set for the purposes of answering questions appropriately. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Grade 7

MA.	7.	A.	1.	1
Subject	Grade Level	Body of Knowledge	Big Idea / Supporting Idea	Benchmark

Body of Knowledge Key:

A ~ Algebra

C ~ Calculus

D ~ Discrete Mathematics

F ~ Financial Literacy

G ~ Geometry

P ~ Probability

S ~ Statistics

T ~ Trigonometry

K-8 MATHEMATICS STANDARDS

GRADE 7

Big Idea 1: Develop an understanding of and apply proportionality, including similarity.

BENCHMARK CODE	BENCHMARK
MA.7.A.1.1	Distinguish between situations that are proportional or not proportional, and use proportions to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.7.A.1.2	Solve percent problems, including problems involving discounts, simple interest, taxes, tips, and percents of increase or decrease. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.7.A.1.3	Solve problems involving similar figures. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.7.A.1.4	Graph proportional relationships and identify the unit rate as the slope of the related linear function. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.7.A.1.5	Distinguish direct variation from other relationships, including inverse variation. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.7.A.1.6	Apply proportionality to measurement in multiple contexts, including scale drawings and constant speed. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Big Idea 2: Develop an understanding of and use formulas to determine surface areas and volumes of three-dimensional shapes.

BENCHMARK CODE	BENCHMARK
MA.7.G.2.1	Justify and apply formulas for surface area and volume of pyramids, prisms, cylinders, and cones. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.7.G.2.2	Use formulas to find surface areas and volume of three-dimensional composite shapes. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Big Idea 3: Develop an understanding of operations on all rational numbers and solving linear equations.

BENCHMARK CODE	BENCHMARK
MA.7.A.3.1	Use and justify the rules for adding, subtracting, multiplying, dividing, and finding the absolute value of integers. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.7.A.3.2	Add, subtract, multiply, and divide integers, fractions, and terminating decimals, and perform exponential operations with rational bases and whole number exponents including solving problems in everyday contexts. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.7.A.3.3	Formulate and use different strategies to solve one-step and two-step linear equations, including equations with rational coefficients. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

MA.7.A.3.4	Use the properties of equality to represent an equation in a different way and to show that two equations are equivalent in a given context. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
------------	---

Supporting Idea 4: Geometry and Measurement

BENCHMARK CODE	BENCHMARK
MA.7.G.4.1	Determine how changes in dimensions affect the perimeter, area, and volume of common geometric figures, and apply these relationships to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.7.G.4.2	Predict the results of transformations, and draw transformed figures with and without the coordinate plane. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.7.G.4.3	Identify and plot ordered pairs in all four quadrants of the coordinate plane. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.7.G.4.4	Compare, contrast, and convert units of measure between different measurement systems (US customary or metric (SI)), dimensions, and derived units to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 5: Number and Operations

BENCHMARK CODE	BENCHMARK
MA.7.A.5.1	Express rational numbers as terminating or repeating decimals. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.7.A.5.2	Solve non-routine problems by working backwards. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 6: Data Analysis

BENCHMARK CODE	BENCHMARK
MA.7.S.6.1	Evaluate the reasonableness of a sample to determine the appropriateness of generalizations made about the population. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.7.S.6.2	Construct and analyze histograms, stem-and-leaf plots, and circle graphs. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Supporting Idea 7: Probability

BENCHMARK CODE	BENCHMARK
MA.7.P.7.1	Determine the outcome of an experiment and predict which events are likely or unlikely, and if the experiment is fair or unfair. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.7.P.7.2	Determine, compare, and make predictions based on experimental or theoretical probability of independent or dependent events, <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Grade 8

MA.	8.	A.	1.	1
Subject	Grade Level	Body of Knowledge	Big Idea / Supporting Idea	Benchmark

Body of Knowledge Key:

A ~ Algebra

C ~ Calculus

D ~ Discrete Mathematics

F ~ Financial Literacy

G ~ Geometry

P ~ Probability

S ~ Statistics

T ~ Trigonometry

K-8 MATHEMATICS STANDARDS

GRADE 8

Big Idea 1: Analyze and represent linear functions, and solve linear equations and systems of linear equations.

BENCHMARK CODE	BENCHMARK
MA.8.A.1.1	<p>Create and interpret tables, graphs, and models to represent, analyze, and solve problems related to linear equations, including analysis of domain, range, and the difference between discrete and continuous data.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>
MA.8.A.1.2	<p>Interpret the slope and the x- and y-intercepts when graphing a linear equation for a real-world problem.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
MA.8.A.1.3	<p>Use tables, graphs, and models to represent, analyze, and solve real-world problems related to systems of linear equations.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>
MA.8.A.1.4	<p>Identify the solution to a system of linear equations using graphs.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
MA.8.A.1.5	<p>Translate among verbal, tabular, graphical, and algebraic representations of linear functions.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
MA.8.A.1.6	<p>Compare the graphs of linear and non-linear functions for real-world situations.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>

Big Idea 2: Analyze two- and three-dimensional figures by using distance and angle.

BENCHMARK CODE	BENCHMARK
MA.8.G.2.1	<p>Use similar triangles to solve problems that include height and distances.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>
MA.8.G.2.2	<p>Classify and determine the measure of angles, including angles created when parallel lines are cut by transversals.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i></p>
MA.8.G.2.3	<p>Demonstrate that the sum of the angles in a triangle is 180-degrees and apply this fact to find unknown measure of angles and the sum of angles in polygons.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
MA.8.G.2.4	<p>Validate and apply Pythagorean Theorem to find distances in real world situations or between points in the coordinate plane.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>

Big Idea 3: Analyze and summarize data sets.

BENCHMARK CODE	BENCHMARK
MA.8.S.3.1	Select, organize and construct appropriate data displays, including box and whisker plots, scatter plots, and lines of best fit to convey information and make conjectures about possible relationships. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.8.S.3.2	Determine and describe how changes in data values impact measures of central tendency. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Supporting Idea 4: Algebra

BENCHMARK CODE	BENCHMARK
MA.8.A.4.1	Solve literal equations for a specified variable. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.8.A.4.2	Solve and graph one- and two-step inequalities in one variable. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Supporting Idea 5: Geometry and Measurement

BENCHMARK CODE	BENCHMARK
MA.8.G.5.1	Compare, contrast, and convert units of measure between different measurement systems (US customary or metric (SI)) and dimensions including temperature, area, volume, and derived units to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Supporting Idea 6: Number and Operations

BENCHMARK CODE	BENCHMARK
MA.8.A.6.1	Use exponents and scientific notation to write large and small numbers and vice versa and to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.8.A.6.2	Make reasonable approximations of square roots and mathematical expressions that include square roots, and use them to estimate solutions to problems and to compare mathematical expressions involving real numbers and radical expressions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.8.A.6.3	Simplify real number expressions using the laws of exponents. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.8.A.6.4	Perform operations on real numbers (including integer exponents, radicals, percents, scientific notation, absolute value, rational numbers, and irrational numbers) using multi-step and real world problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

FLORIDA MATHEMATICS STANDARDS

SECONDARY BODIES OF KNOWLEDGE

- These Bodies of Knowledge (BOK) do NOT represent courses. Courses (such as Algebra I or Pre-Calculus) will be developed from these standards and individual courses may have standards from more than one BOK.
- ★ The sunbursts denote benchmarks that include content that all students should know and be able to do. These benchmarks are considered to be appropriate for statewide assessment. Some benchmarks are divided into partial sunburst and partial non-sunburst. This is indicated by color or shading of words to denote the aspect of the benchmark that is applicable to the sunburst categorization.
- There will be some Florida mathematics courses with curriculum defined by other organizations (such as College Board for Advanced Placement Calculus or International Baccalaureate mathematics courses).

Bodies of Knowledge Coding Scheme

MA.	912.	A.	1.	1
Subject	Grade Level	Body of Knowledge	Standard	Benchmark

Body of Knowledge Key:

A ~ Algebra

C ~ Calculus

D ~ Discrete Mathematics

F ~ Financial Literacy

G ~ Geometry

P ~ Probability

S ~ Statistics

T ~ Trigonometry

Algebra

Body of Knowledge

MA.	912.	A.	1.	1
Subject	Grade Level	Body of Knowledge	Standard	Benchmark

ALGEBRA BODY OF KNOWLEDGE

Standard 1: Real and Complex Number Systems

Students expand and deepen their understanding of real and complex numbers by comparing expressions and performing arithmetic computations, especially those involving square roots and exponents. They use the properties of real numbers to simplify algebraic expressions and equations, and they convert between different measurement units using dimensional analysis.

	Benchmark Code	Benchmark
*	MA.912.A.1.1	Know equivalent forms of real numbers (including integer exponents and radicals, percents, scientific notation, absolute value, rational numbers, irrational numbers). <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
*	MA.912.A.1.2	Compare real number expressions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.1.3	Simplify real number expressions using the laws of exponents. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
*	MA.912.A.1.4	Perform operations on real numbers (including integer exponents, radicals, percents, scientific notation, absolute value, rational numbers, irrational numbers) using multi-step and real-world problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.1.5	Use dimensional (unit) analysis to perform conversions between units of measure, including rates. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.1.6	Identify the real and imaginary parts of complex numbers and perform basic operations. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.1.7	Represent complex numbers geometrically. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.1.8	Use the zero product property of real numbers in a variety of contexts to identify solutions to equations. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 2: Relations and Functions

Students draw and interpret graphs of relations. They understand the notation and concept of a function, find domains and ranges, and link equations to functions.

	Benchmark Code	Benchmark
*	MA.912.A.2.1	Create a graph to represent a real-world situation. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.2.2	Interpret a graph representing a real-world situation. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

*	MA.912.A.2.3	Describe the concept of a function, use function notation, determine whether a given relation is a function, and link equations to functions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.2.4	Determine the domain and range of a relation. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.2.5	Graph absolute value equations and inequalities in two variables. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.2.6	Identify and graph common functions (including but not limited to linear, rational, quadratic, cubic, radical, absolute value). <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.2.7	Perform operations (addition, subtraction, division, and multiplication) of functions algebraically, numerically, and graphically. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.2.8	Determine the composition of functions. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.A.2.9	Recognize, interpret, and graph functions defined piece-wise with and without technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.2.10	Describe and graph transformations of functions <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.2.11	Solve problems involving functions and their inverses. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
*	MA.912.A.2.12	Solve problems using direct , inverse, and joint variations. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.A.2.13	Solve real-world problems involving relations and functions. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 3: Linear Equations and Inequalities

Students solve linear equations and inequalities.

	Benchmark Code	Benchmark
*	MA.912.A.3.1	Solve linear equations in one variable that include simplifying algebraic expressions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.3.2	Identify and apply the distributive, associative, and commutative properties of real numbers and the properties of equality. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.3.3	Solve literal equations for a specified variable. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.3.4	Solve and graph simple and compound inequalities in one variable and be able to justify each step in a solution. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

*	MA.912.A.3.5	Symbolically represent and solve multi-step and real-world applications that involve linear equations and inequalities. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.3.6	Solve and graph the solutions of absolute value equations and inequalities with one variable. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.3.7	Rewrite equations of a line into slope-intercept form and standard form. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
*	MA.912.A.3.8	Graph a line given any of the following information: a table of values, the x- and y-intercepts, two points, the slope and a point, the equation of the line in slope-intercept form, standard form, or point-slope form . <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.3.9	Determine the slope, x-intercept, and y-intercept of a line given its graph, its equation, or two points on the line. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.3.10	Write an equation of a line given any of the following information: two points on the line, its slope and one point on the line, or its graph. Also, find an equation of a new line parallel to a given line, or perpendicular to a given line, through a given point on the new line. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.3.11	Write an equation of a line that models a data set, and use the equation or the graph to make predictions. Describe the slope of the line in terms of the data, recognizing that the slope is the rate of change. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
*	MA.912.A.3.12	Graph a linear equation or inequality in two variables with and without graphing technology. Write an equation or inequality represented by a given graph. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.3.13	Use a graph to approximate the solution of a system of linear equations or inequalities in two variables with and without technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.3.14	Solve systems of linear equations and inequalities in two and three variables using graphical, substitution, and elimination methods. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.3.15	Solve real-world problems involving systems of linear equations and inequalities in two and three variables . <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 4: Polynomials

Students perform operations on polynomials. They find factors of polynomials, learning special techniques for factoring quadratics. They understand the relationships among the solutions of polynomial equations, the zeros of a polynomial function, the x-intercepts of a graph, and the factors of a polynomial.

	Benchmark Code	Benchmark
*	MA.912.A.4.1	Simplify monomials and monomial expressions using the laws of integral exponents. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>

*	MA.912.A.4.2	Add, subtract, and multiply polynomials. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
*	MA.912.A.4.3	Factor polynomial expressions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.4.4	Divide polynomials by monomials and polynomials with various techniques, including synthetic division. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.4.5	Graph polynomial functions with and without technology and describe end behavior. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.4.6	Use theorems of polynomial behavior (including but not limited to the Fundamental Theorem of Algebra, Remainder Theorem, the Rational Root Theorem, Descartes' Rule of Signs, and the Conjugate Root Theorem) to find the zeros of a polynomial function. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.4.7	Write a polynomial equation for a given set of real and/or complex roots. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.4.8	Describe the relationships among the solutions of an equation, the zeros of a function, the x-intercepts of a graph, and the factors of a polynomial expression with and without technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.4.9	Use graphing technology to find approximate solutions for polynomial equations. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.A.4.10	Use polynomial equations to solve real-world problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.4.11	Solve a polynomial inequality by examining the graph with and without the use of technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.4.12	Apply the Binomial Theorem. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 5: Rational Expressions and Equations

Students simplify rational expressions and solve rational equations using what they have learned about factoring polynomials.

	Benchmark Code	Benchmark
*	MA.912.A.5.1	Simplify algebraic ratios. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.5.2	Add, subtract, multiply, and divide rational expressions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.5.3	Simplify complex fractions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.5.4	Solve algebraic proportions. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.A.5.5	Solve rational equations. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

MA.912.A.5.6	Identify removable and non-removable discontinuities, and vertical, horizontal, and oblique asymptotes of a graph of a rational function, find the zeros, and graph the function. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.A.5.7	Solve real-world problems involving rational equations (mixture, distance, work, interest, and ratio). <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 6: Radical Expressions and Equations

Students simplify and perform operations on radical expressions and equations. They also rationalize square root expressions and understand and use the concepts of negative and rational exponents. They add, subtract, multiply, divide, and simplify radical expressions and expressions with rational exponents. Students will solve radical equations and equations with terms that have rational exponents.

	Benchmark Code	Benchmark
*	MA.912.A.6.1	Simplify radical expressions <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.6.2	Add, subtract, multiply, and divide radical expressions (square roots and higher). <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.6.3	Simplify expressions using properties of rational exponents. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.A.6.4	Convert between rational exponent and radical forms of expressions. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.A.6.5	Solve equations that contain radical expressions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 7: Quadratic Equations

Students draw graphs of quadratic functions. They solve quadratic equations and solve these equations by factoring, completing the square and by using the quadratic formula. They also use graphing calculators to find approximate solutions of quadratic equations.

	Benchmark Code	Benchmark
*	MA.912.A.7.1	Graph quadratic equations with and without graphing technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.7.2	Solve quadratic equations over the real numbers by factoring and by using the quadratic formula. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.7.3	Solve quadratic equations over the real numbers by completing the square. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.7.4	Use the discriminant to determine the nature of the roots of a quadratic equation. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>

	MA.912.A.7.5	Solve quadratic equations over the complex number system. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.7.6	Identify the axis of symmetry, vertex, domain, range and intercept(s) for a given parabola. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.A.7.7	Solve non-linear systems of equations with and without using technology. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
*	MA.912.A.7.8	Use quadratic equations to solve real-world problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.7.9	Solve optimization problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.A.7.10	Use graphing technology to find approximate solutions of quadratic equations. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>

Standard 8: Logarithmic and Exponential Functions

Students understand the concepts of logarithmic and exponential functions. They graph exponential functions and solve problems of growth and decay. They understand the inverse relationship between exponents and logarithms and use it to prove laws of logarithms and to solve equations. They convert logarithms between bases and simplify logarithmic expressions.

	Benchmark Code	Benchmark
	MA.912.A.8.1	Define exponential and logarithmic functions and determine their relationship <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.8.2	Define and use the properties of logarithms to simplify logarithmic expressions and to find their approximate values. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.A.8.3	Graph exponential and logarithmic functions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.8.4	Prove laws of logarithms. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.A.8.5	Solve logarithmic and exponential equations. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.8.6	Use the change of base formula. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.A.8.7	Solve applications of exponential growth and decay. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 9: Conic Sections

Students write equations and draw graphs of conic sections (circle, ellipse, parabola, and hyperbola), thus relating an algebraic representation to a geometric one.

	Benchmark Code	Benchmark
	MA.912.A.9.1	Write the equations of conic sections in standard form and general form, in order to identify the conic section and to find its geometric properties (foci, asymptotes, eccentricity, etc.). <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.9.2	Graph conic sections with and without using graphing technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.A.9.3	Solve real-world problems involving conic sections <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 10: Mathematical Reasoning and Problem Solving

In a general sense, all of mathematics is problem solving. In all of their mathematics, students use problem-solving skills: they choose how to approach a problem, they explain their reasoning, and they check their results.

	Benchmark Code	Benchmark
*	MA.912.A.10.1	Use a variety of problem-solving strategies, such as drawing a diagram, making a chart, guessing- and-checking, solving a simpler problem, writing an equation, working backwards, and creating a table. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
*	MA.912.A.10.2	Decide whether a solution is reasonable in the context of the original situation. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.A.10.3	Decide whether a given statement is always, sometimes, or never true (statements involving linear or quadratic expressions, equations, or inequalities , rational or radical expressions, or logarithmic or exponential functions). <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.A.10.4	Use counterexamples to show that statements are false. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Calculus

Body of Knowledge

MA.	912.	C.	1.	1
Subject	Grade Level	Body of Knowledge	Standard	Benchmark

CALCULUS BODY OF KNOWLEDGE

Standard 1: Limits and Continuity

Students develop an understanding of the concept of limit by estimating limits graphically and numerically, and evaluating limits analytically. They extend the idea of a limit to one-sided limits and limits at infinity. They use limits to define and understand the concept of continuity, decide whether a function is continuous at a point, and find types of discontinuities. They understand and apply continuity theorems.

	Benchmark Code	Benchmark
	MA.912.C.1.1	Understand the concept of limit and estimate limits from graphs and tables of values. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.1.2	Find limits by substitution. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.C.1.3	Find limits of sums, differences, products, and quotients. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.C.1.4	Find limits of rational functions that are undefined at a point. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.C.1.5	Find one-sided limits. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.C.1.6	Find limits at infinity. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.1.7	Decide when a limit is infinite and use limits involving infinity to describe asymptotic behavior. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.1.8	Find special limits such as $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.1.9	Understand continuity in terms of limits. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.C.1.10	Decide if a function is continuous at a point. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.C.1.11	Find the types of discontinuities of a function. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.1.12	Understand and use the Intermediate Value Theorem on a function over a closed interval. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.1.13	Understand and apply the Extreme Value Theorem: If $f(x)$ is continuous over a closed interval, then f has a maximum and a minimum on the interval. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 2: Differential Calculus

Students develop an understanding of the derivative as an instantaneous rate of change, using geometrical, numerical, and analytical methods. They use this definition to find derivatives of algebraic and transcendental functions and combinations of these functions (using, for example, sums, composites, and inverses). Students find second and higher order derivatives. They understand and use the relationship between differentiability and continuity. They understand and apply the Mean Value Theorem.

Students find derivatives of algebraic, trigonometric, logarithmic, and exponential functions. They find derivatives of sums, products, and quotients, and composite and inverse functions. They find derivatives of higher order and use logarithmic differentiation and the Mean Value Theorem.

	Benchmark Code	Benchmark
	MA.912.C.2.1	Understand the concept of derivative geometrically, numerically, and analytically, and interpret the derivative as an instantaneous rate of change or as the slope of the tangent line. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.C.2.2	State, understand, and apply the definition of derivative. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.2.3	Find the derivatives of functions, including algebraic, trigonometric, logarithmic, and exponential functions. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.C.2.4	Find the derivatives of sums, products, and quotients. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.C.2.5	Find the derivatives of composite functions using the Chain Rule. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.2.6	Find the derivatives of implicitly-defined functions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.2.7	Find derivatives of inverse functions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.2.8	Find second derivatives and derivatives of higher order. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.C.2.9	Find derivatives using logarithmic differentiation. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.2.10	Understand and use the relationship between differentiability and continuity. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.2.11	Understand and apply the Mean Value Theorem. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 3: Applications of Derivatives

Students apply what they learn about derivatives to find slopes of curves and the related tangent lines. They analyze and graph functions, finding where they are increasing or decreasing, their maximum and minimum points, their points of inflection, and their concavity. They solve optimization problems, find average and instantaneous rates of change (including velocities and accelerations), and model rates of change.

Students find slopes and equations of tangent lines, maximum and minimum points, and points of inflection. They solve optimization problems and find rates of change.

Benchmark Code	Benchmark
MA.912.C.3.1	Find the slope of a curve at a point, including points at which there are vertical tangent lines and no tangent lines. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.C.3.2	Find an equation for the tangent line to a curve at a point and a local linear approximation. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.C.3.3	Decide where functions are decreasing and increasing. Understand the relationship between the increasing and decreasing behavior of f and the sign of f' . <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.C.3.4	Find local and absolute maximum and minimum points. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.C.3.5	Find points of inflection of functions. Understand the relationship between the concavity of f and the sign of f'' . Understand points of inflection as places where concavity changes. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.C.3.6	Use first and second derivatives to help sketch graphs. Compare the corresponding characteristics of the graphs of f , f' , and f'' . <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.C.3.7	Use implicit differentiation to find the derivative of an inverse function. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.C.3.8	Solve optimization problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.C.3.9	Find average and instantaneous rates of change. Understand the instantaneous rate of change as the limit of the average rate of change. Interpret a derivative as a rate of change in applications, including velocity, speed, and acceleration. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.C.3.10	Find the velocity and acceleration of a particle moving in a straight line. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.C.3.11	Model rates of change, including related rates problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.C.3.12	Solve problems using the Newton-Raphson method. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 4: Integral Calculus

Students understand that integration is used to find areas and they evaluate integrals using rectangular approximations. From this, they develop the idea that integration is the inverse operation to differentiation — the Fundamental Theorem of Calculus. They use this result to find definite and indefinite integrals, including using the method of integration by substitution. They also apply approximate methods, such as the Trapezoidal Rule, to find definite integrals.

Students define integrals using Riemann sums, use the Fundamental Theorem of Calculus to find integrals using antiderivatives, and use basic properties of integrals. They integrate by substitution and find approximate integrals.

Benchmark Code	Benchmark
MA.912.C.4.1	Use rectangle approximations to find approximate values of integrals. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.912.C.4.2	Calculate the values of Riemann Sums over equal subdivisions using left, right, and midpoint evaluation points. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.912.C.4.3	Interpret a definite integral as a limit of Riemann sums. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.C.4.4	Interpret a definite integral of the rate of change of a quantity over an interval as the change of the quantity over the interval. That is, $\int_a^b f'(x)dx = f(b) - f(a)$ (Fundamental Theorem of Calculus) <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.C.4.5	Use the Fundamental Theorem of Calculus to evaluate definite and indefinite integrals and to represent particular antiderivatives. Perform analytical and graphical analysis of functions so defined. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.C.4.6	Use these properties of definite integrals: <ul style="list-style-type: none">• $\int_a^b [f(x) + g(x)]dx = \int_a^b f(x)dx + \int_a^b g(x)dx$• $\int_a^b k \cdot f(x)dx = k \int_a^b f(x)dx$• $\int_a^a f(x)dx = 0$• $\int_a^b f(x)dx = -\int_b^a f(x)dx$• $\int_a^b f(x)dx + \int_b^c f(x)dx = \int_a^c f(x)dx$• If $f(x) \leq g(x)$ on $[a, b]$, then $\int_a^b f(x)dx \leq \int_a^b g(x)dx$ <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.912.C.4.7	Use integration by substitution (or change of variable) to find values of integrals. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

	MA.912.C.4.8	Use Riemann Sums, the Trapezoidal Rule, and technology to approximate definite integrals of functions represented algebraically, geometrically, and by tables of values. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
--	--------------	---

Standard 5: Applications of Integration

Students apply what they learn about integrals to finding velocities from accelerations, solving separable differential equations, and finding areas and volumes. They also apply integration to model and solve problems in physics, biology, economics, etc.

Students find velocity functions and position functions from their derivatives, solve separable differential equations, and use definite integrals to find areas and volumes.

	Benchmark Code	Benchmark
	MA.912.C.5.1	Find specific antiderivatives using initial conditions, including finding velocity functions from acceleration functions, finding position functions from velocity functions, and solving applications related to motion along a line. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.5.2	Solve separable differential equations, and use them in modeling. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.5.3	Solve differential equations of the form $\frac{dy}{dt} = ky$ as applied to growth and decay problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.5.4	Use slope fields to display a graphic representation of the solution to a differential equation, and locate particular solutions to the equation. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.5.5	Use definite integrals to find the area between a curve and the x-axis or between two curves. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.C.5.6	Use definite integrals to find the average value of a function over a closed interval. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.C.5.7	Use definite integrals to find the volume of a solid with known cross-sectional area, including solids of revolution. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.C.5.8	Apply integration to model, and solve problems in physical, biological, and social sciences. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Discrete Mathematics Body of Knowledge

MA.	912.	D.	1.	1
Subject	Grade Level	Body of Knowledge	Standard	Benchmark

DISCRETE MATHEMATICS BODY OF KNOWLEDGE

Standard 1: Recursion

Students understand and apply recursive methods to solve problems, including the use of finite differences.

	Benchmark Code	Benchmark
	MA.912.D.1.1	Use recursive and iterative thinking to solve problems, including identification of patterns, population growth and decline, and compound interest. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.D.1.2	Use finite differences to solve problems and to find explicit formulas for recurrence relations. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.D.1.3	Use mathematical induction to prove various concepts in number theory (such as sums of infinite integer series, divisibility statements, and parity statements), recurrence relations, and other applications. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 2: Graph Theory

Students understand how graphs of vertices joined by edges can model relationships and be used to solve various problems with relation to directed graphs, weighted graphs, networks, tournaments, transportation flows, matching, and coverage.

	Benchmark Code	Benchmark
	MA.912.D.2.1	Use Euler and Hamilton cycles and paths in graphs to solve routing problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.D.2.2	Use critical path analysis to solve scheduling problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.D.2.3	Use graph coloring techniques to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.D.2.4	Use spanning trees, rooted trees, binary trees, and decision trees to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.D.2.5	Use bin-packing techniques to solve problems concerning optimizing resource usage. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 3: Social Choice

Students analyze election data to evaluate different election methods and use weighted voting techniques to decide voting power within a group. They understand and use fair division techniques to solve apportionment problems.

	Benchmark Code	Benchmark
	MA.912.D.3.1	Use election theory techniques to analyze election data. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.D.3.2	Use weighted voting techniques to decide voting power within a group. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.D.3.3	Use fair division techniques to divide continuous objects. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.D.3.4	Use fair division techniques to solve apportionment problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 4: Linear Programming

Students understand how to use linear programming and coordinate geometry to solve simple linear optimization problems.

	Benchmark Code	Benchmark
	MA.912.D.4.1	Solve maximal profit/minimal cost problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 5: Game Theory

Students understand and use game theory methods to solve strictly determined games and non-strictly determined games.

	Benchmark Code	Benchmark
	MA.912.D.5.1	Use game theory to solve strictly determined games. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.D.5.2	Use game theory to solve non-strictly determined games. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 6: Logic

Students develop an understanding of the fundamentals of propositional logic, arguments, and methods of proof.

	Benchmark Code	Benchmark
	MA.912.D.6.1	Use truth tables to determine truth values of propositional statements. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

*	MA.912.D.6.2	Find the converse, inverse, and contrapositive of a statement <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.D.6.3	Determine whether two propositions are logically equivalent. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.D.6.4	Use methods of direct and indirect proof and determine whether a short proof is logically valid. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.D.6.5	Identify and give examples of: <ul style="list-style-type: none"> ◦ undefined terms; ◦ axioms; ◦ theorems; ◦ inductive and deductive proofs; and, ◦ inductive and deductive reasoning. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.D.6.6	Construct logical arguments using laws of detachment (modus ponens), syllogism, tautology, and contradiction; judge the validity of arguments, and give counterexamples to disprove statements. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.D.6.7	Use applications of the universal and existential quantifiers to propositional statements. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>

Standard 7: Set Theory

Students operate with sets and use set theory to solve problems.

	Benchmark Code	Benchmark
*	MA.912.D.7.1	Perform set operations such as union and intersection, complement, and cross product. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
*	MA.912.D.7.2	Use Venn diagrams to explore relationships and patterns and to make arguments about relationships between sets. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 8: Matrices

Students understand how matrices can be used to store and organize data and to solve systems of equations. They also use matrices to solve Markov chain problems that link present events to future events using probabilities.

	Benchmark Code	Benchmark
	MA.912.D.8.1	Use matrices to organize and store data. Perform matrix operations (addition, subtraction, scalar multiplication, multiplication) <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.D.8.2	Use matrix operations to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

MA.912.D.8.3	Use row-reduction techniques to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.D.8.4	Find the inverse of a matrix, and use the inverse to solve problems with and without the use of technology. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.D.8.5	Use determinants of 2 x 2 and 3 x 3 matrices as well as higher order matrices with and without the use of technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.912.D.8.6	Use matrices to solve Markov chain problems that link present events to future events using probabilities. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 9: Vectors

Students recognize vectors in both two- and three-dimensions and that they are represented geometrically and algebraically. Students perform basic operations on vectors, including addition, scalar multiplication, dot product, and cross product. Students solve problems using vectors.

Benchmark Code	Benchmark
MA.912.D.9.1	Demonstrate an understanding of the geometric interpretation of vectors and vector operations including addition, scalar multiplication, dot product, and cross product in the plane and in three-dimensional space. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.D.9.2	Demonstrate an understanding of the algebraic interpretation of vectors and vector operations including addition, scalar multiplication, dot product, and cross product in the plane and in three-dimensional space. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.D.9.3	Use vectors to model and solve application problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 10: Parametric Equations

Students use parametric equations in two dimensions to model time dependant situations and convert parametric equations to rectangular coordinates and vice-versa.

Benchmark Code	Benchmark
MA.912.D.10.1	Sketch the graph of a curve in the plane represented parametrically, indicating the direction of motion. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.D.10.2	Convert from a parametric representation of a plane curve to a rectangular equation and vice-versa. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.912.D.10.3	Use parametric equations to model applications of motion in the plane. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 11: Sequences and Series

Students define and use arithmetic and geometric sequences and series.

	Benchmark Code	Benchmark
	MA.912.D.11.1	Define arithmetic and geometric sequences and series. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.D.11.2	Use sigma notation to describe series. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.D.11.3	Find specified terms of arithmetic and geometric sequences. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.D.11.4	Find partial sums of arithmetic and geometric series, and find sums of infinite convergent geometric series. Use Sigma notation where applicable. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.D.11.5	Explore and use other sequences found in nature such as the Fibonacci sequence and the golden ratio. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Financial Literacy Body of Knowledge

MA.	912.	F.	1.	1
Subject	Grade Level	Body of Knowledge	Standard	Benchmark

FINANCIAL LITERACY BODY OF KNOWLEDGE

Standard 1: Simple and Compound Interest

Benchmark Code	Benchmark
MA.912.F.1.1	Explain the difference between simple and compound interest. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.1.2	Solve problems involving compound interest. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.F.1.3	Demonstrate the relationship between simple interest and linear growth. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.1.4	Demonstrate the relationship between compound interest and exponential growth. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 2: Net Present and Net Future Value (NPV and NFV)

Benchmark Code	Benchmark
MA.912.F.2.1	Calculate the future value of a given amount of money with and without technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.2.2	Calculate the present value of a certain amount of money for a given length of time in the future with and without technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.2.3	Use a consumer price index to express dollars in constant terms with and without technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.2.4	Calculate the present value of an income stream with and without technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 3: Loans and Financing

Students are familiar with and can describe the advantages and disadvantages of short-term purchases, long-term purchases, and mortgages.

Benchmark Code	Benchmark
MA.912.F.3.1	Compare the advantages and disadvantages of using cash versus a credit card. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.F.3.2	Analyze credit scores and reports. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.3.3	Calculate the finance charges and total amount due on a credit card bill. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>

MA.912.F.3.4	Compare the advantages and disadvantages of deferred payments. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.F.3.5	Calculate deferred payments. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.3.6	Calculate total cost of purchasing consumer durables over time given different down payments, financing options, and fees. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.3.7	Calculate the following fees associated with a mortgage: <ul style="list-style-type: none"> • discount points • origination fee • maximum brokerage fee on a net or gross loan • documentary stamps • prorated expenses (interest, county and/or city property taxes, and mortgage on an assumed mortgage) <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.912.F.3.8	Substitute to solve a variety of mortgage formulas, including but not limited to Front End Ratio, Total Debt-to-Income Ratio, Loan-to-Value Ratio (LTV), Combined Loan-to-Value Ratio (CLTV), and Amount of Interest Paid Over the Life of a Loan. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.912.F.3.9	Calculate the total amount to be paid over the life of a fixed rate loan. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.3.10	Calculate the effects on the monthly payment in the change of interest rate based on an adjustable rate mortgage. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.3.11	Calculate the final pay out amount for a balloon mortgage. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.3.12	Compare the cost of paying a higher interest rate and lower points versus a lower interest rate and more points. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.3.13	Calculate the total amount paid for the life of a loan for a house including the down payment, points, fees, and interest. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.3.14	Compare the total cost for a set purchase price using a fixed rate, adjustable rate, and a balloon mortgage. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.3.15	Interpret the legal description using the metes and bounds; lot and block (plat); government survey; and monument methods. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.3.16	Estimate real property value using the sales comparison approach, cost-depreciation approach, or the income capitalization approach. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.3.17	Compare interest rate calculations and annual percentage rate calculations to distinguish between the two rates. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 4: Individual Financial and Investment Planning

Benchmark Code	Benchmark
MA.912.F.4.1	Develop personal budgets that fit within various income brackets. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.4.2	Explain cash management strategies including debit accounts, checking accounts, and savings accounts. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.4.3	Calculate net worth. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.912.F.4.4	Establish a plan to pay off debt. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.F.4.5	Develop and apply a variety of strategies to use tax tables, and to determine, calculate, and complete yearly federal income tax. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.4.6	Compare different insurance options and fees. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.F.4.7	Compare and contrast the role of insurance as a device to mitigate risk and calculate expenses of various options. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.4.8	Collect, organize, and interpret data to determine an effective retirement savings plan to meet personal financial goals. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.4.9	Calculate, compare, and contrast different types of retirement plans, including IRAs, ROTH accounts, and annuities. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.F.4.10	Analyze diversification in investments. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.F.4.11	Purchase stock with a set amount of money, and follow the process through gains, losses, and selling. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.4.12	Compare and contrast income from purchase of common stock, preferred stock, and bonds. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.F.4.13	Given current exchange rates be able to convert from one form of currency to another. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
MA.912.F.4.14	Use data to compare historical rates of return on investments with investment claims to make informed decisions and identify potential fraud. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 5: Economic Concepts

	Benchmark Code	Benchmark
	MA.912.F.5.1	Demonstrate how price and quantity demanded relate, how price and quantity supplied relate, and how price changes or price controls affect distribution and allocation in the economy. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.F.5.2	Use basic terms and indicators associated with levels of economic performance and the state of the economy. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Geometry

Body of Knowledge

MA.	912.	G.	1.	1
Subject	Grade Level	Body of Knowledge	Standard	Benchmark

GEOMETRY BODY OF KNOWLEDGE

Standard 1: Points, Lines, Angles, and Planes

Students understand geometric concepts, applications, and their representations with coordinate systems. They find lengths and midpoints of line segments, slopes, parallel and perpendicular lines, and equations of lines. Using a compass and straightedge, patty paper, a drawing program or other techniques, students also construct lines and angles, explaining and justifying the processes they use.

	Benchmark Code	Benchmark
*	MA.912.G.1.1	Find the lengths and midpoints of line segments in two-dimensional coordinate systems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.G.1.2	Construct congruent segments and angles, angle bisectors, and parallel and perpendicular lines using a straight edge and compass or a drawing program, explaining and justifying the process used. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.1.3	Identify and use the relationships between special pairs of angles formed by parallel lines and transversals. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.1.4	Use coordinate geometry to find slopes, parallel lines, perpendicular lines, and equations of lines. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 2: Polygons

Students identify and describe polygons (triangles, quadrilaterals, pentagons, hexagons, etc.), using terms such as regular, convex, and concave. They find measures of angles, sides, perimeters, and areas of polygons, justifying their methods. They apply transformations to polygons. They relate geometry to algebra by using coordinate geometry to determine transformations. Students use algebraic reasoning to determine congruence, similarity, and symmetry. Students create and verify tessellations of the plane using polygons.

	Benchmark Code	Benchmark
*	MA.912.G.2.1	Identify and describe convex, concave, regular, and irregular polygons. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
*	MA.912.G.2.2	Determine the measures of interior and exterior angles of polygons, justifying the method used. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.2.3	Use properties of congruent and similar polygons to solve mathematical or real-world problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

*	MA.912.G.2.4	Apply transformations (translations, reflections, rotations, dilations, and scale factors) to polygons. to determine congruence, similarity, and symmetry. Know that images formed by translations, reflections, and rotations are congruent to the original shape. Create and verify tessellations of the plane using polygons. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
*	MA.912.G.2.5	Explain the derivation and apply formulas for perimeter and area of polygons (triangles, quadrilaterals, pentagons, etc.). <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.2.6	Use coordinate geometry to prove properties of congruent, regular and similar polygons, and to perform transformations in the plane. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
*	MA.912.G.2.7	Determine how changes in dimensions affect the perimeter and area of common geometric figures. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 3: Quadrilaterals

Students classify and understand relationships among quadrilaterals (rectangle, parallelogram, kite, etc.). They relate geometry to algebra by using coordinate geometry to determine regularity, congruence, and similarity. They use properties of congruent and similar quadrilaterals to solve problems involving lengths and areas, and prove theorems involving quadrilaterals.

	Benchmark Code	Benchmark
*	MA.912.G.3.1	Describe, classify, and compare relationships among quadrilaterals including the square, rectangle, rhombus, parallelogram, trapezoid, and kite. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.3.2	Compare and contrast special quadrilaterals on the basis of their properties. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.3.3	Use coordinate geometry to prove properties of congruent, regular, and similar quadrilaterals. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.G.3.4	Prove theorems involving quadrilaterals. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 4: Triangles

Students identify and describe various kinds of triangles (right, acute, scalene, isosceles, etc.). They define and construct altitudes, medians, and bisectors, and triangles congruent to given triangles. They prove that triangles are congruent or similar and use properties of these triangles to solve problems involving lengths and areas. They relate geometry to algebra by using coordinate geometry to determine regularity, congruence, and similarity. They understand and apply the inequality theorems of triangles.

	Benchmark Code	Benchmark
*	MA.912.G.4.1	Classify, construct, and describe triangles that are right, acute, obtuse, scalene, isosceles, equilateral, and equiangular. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

*	MA.912.G.4.2	Define, identify, and construct altitudes, medians, angle bisectors, perpendicular bisectors, orthocenter, centroid, incenter, and circumcenter. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.G.4.3	Construct triangles congruent to given triangles. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
*	MA.912.G.4.4	Use properties of congruent and similar triangles to solve problems involving lengths and areas. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.4.5	Apply theorems involving segments divided proportionally. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.4.6	Prove that triangles are congruent or similar and use the concept of corresponding parts of congruent triangles. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
*	MA.912.G.4.7	Apply the inequality theorems: triangle inequality, inequality in one triangle, and the Hinge Theorem. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.G.4.8	Use coordinate geometry to prove properties of congruent, regular, and similar triangles. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 5: Right Triangles

Students apply the Pythagorean Theorem to solving problems, including those involving the altitudes of right triangles and triangles with special angle relationships. Students use special right triangles to solve problems using the properties of triangles.

	Benchmark Code	Benchmark
*	MA.912.G.5.1	Prove and apply the Pythagorean Theorem and its converse. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.G.5.2	State and apply the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.5.3	Use special right triangles ($30^\circ - 60^\circ - 90^\circ$ and $45^\circ - 45^\circ - 90^\circ$) to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.G.5.4	Solve real-world problems involving right triangles. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 6: Circles

Students define and understand ideas related to circles (radius, tangent, chord, etc.). They perform constructions and prove theorems related to circles. They find measures of arcs and angles related to them, as well as measures of circumference and area. They relate geometry to algebra by finding the equation of a circle in the coordinate plane.

	Benchmark Code	Benchmark
	MA.912.G.6.1	Determine the center of a given circle. Given three points not on a line, construct the circle that passes through them. Construct tangents to circles. Circumscribe and inscribe circles about and within triangles and regular polygons. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
*	MA.912.G.6.2	Define and identify: circumference, radius, diameter, arc, arc length, chord, secant, tangent and concentric circles. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.G.6.3	Prove theorems related to circles, including related angles, chords, tangents, and secants. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
*	MA.912.G.6.4	Determine and use measures of arcs and related angles (central, inscribed, and intersections of secants and tangents). <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.6.5	Solve real-world problems using measures of circumference, arc length, and areas of circles and sectors. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
*	MA.912.G.6.6	Given the center and the radius, find the equation of a circle in the coordinate plane or given the equation of a circle in center-radius form, state the center and the radius of the circle. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.G.6.7	Given the equation of a circle in center-radius form or given the center and the radius of a circle, sketch the graph of the circle. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 7: Polyhedra and Other Solids

Students describe and make regular and nonregular polyhedra (cube, pyramid, tetrahedron, octahedron, etc.). They explore relationships among the faces, edges, and vertices of polyhedra. They describe sets of points on spheres, using terms such as great circle. They describe symmetries of solids and understand the properties of congruent and similar solids.

	Benchmark Code	Benchmark
*	MA.912.G.7.1	Describe and make regular, non-regular, and oblique polyhedra, and sketch the net for a given polyhedron and vice versa. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.G.7.2	Describe the relationships between the faces, edges, and vertices of polyhedra. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.G.7.3	Identify, sketch, find areas and/or perimeters of cross sections of solid objects. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

*	MA.912.G.7.4	Identify chords, tangents, radii, and great circles of spheres <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
*	MA.912.G.7.5	Explain and use formulas for lateral area, surface area, and volume of solids. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.7.6	Identify and use properties of congruent and similar solids. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.7.7	Determine how changes in dimensions affect the surface area and volume of common geometric solids. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 8: Mathematical Reasoning and Problem Solving

In a general sense, mathematics is problem solving. In all mathematics, students use problem-solving skills: they choose how to approach a problem, they explain their reasoning, and they check their results. At this level, students apply these skills to making conjectures, using axioms and theorems, constructing logical arguments, and writing geometric proofs. They also learn about inductive and deductive reasoning and how to use counterexamples to show that a general statement is false.

Benchmark Code	Benchmark	
MA.912.G.8.1	Analyze the structure of Euclidean geometry as an axiomatic system. Distinguish between undefined terms, definitions, postulates, and theorems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>	
MA.912.G.8.2	Use a variety of problem-solving strategies, such as drawing a diagram, making a chart, guess-and-check, solving a simpler problem, writing an equation, and working backwards. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>	
*	MA.912.G.8.3	Determine whether a solution is reasonable in the context of the original situation. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.G.8.4	Make conjectures with justifications about geometric ideas. Distinguish between information that supports a conjecture and the proof of a conjecture. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.G.8.5	Write geometric proofs, including proofs by contradiction and proofs involving coordinate geometry. Use and compare a variety of ways to present deductive proofs, such as flow charts, paragraphs, two-column, and indirect proofs. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>	
MA.912.G.8.6	Perform basic constructions using straightedge and compass, and/or drawing programs describing and justifying the procedures used. Distinguish between sketching, constructing, and drawing geometric figures. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>	

Probability

Body of Knowledge

MA.	912.	P.	1.	1
Subject	Grade Level	Body of Knowledge	Standard	Benchmark

PROBABILITY BODY OF KNOWLEDGE

Standard 1: Counting Principals

Students understand the counting principle, permutations, and combinations and use them to solve problems.

	Benchmark Code	Benchmark
*	MA.912.P.1.1	Use counting principles, including the addition and the multiplication principles, to determine size of finite sample spaces and probabilities of events in those spaces. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.P.1.2	Use formulas for permutations and combinations to count outcomes and determine probabilities of events. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 2: Determine Probabilities

Students develop rules for finding probabilities of combined and complementary events. They understand and use conditional probability and the related Bayes' Theorem.

	Benchmark Code	Benchmark
*	MA.912.P.2.1	Determine probabilities of complementary events, and calculate odds for and against the occurrence of events. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.P.2.2	Determine probabilities of independent events. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.P.2.3	Understand and use the concept of conditional probability, including: understanding how conditioning affects the probability of events and finding conditional probabilities from a two-way frequency table. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 3: Probability Distributions

Students investigate probability distributions and calculate and interpret their means and variances. They use and apply the normal distribution, including using the central limit theorem.

	Benchmark Code	Benchmark
	MA.912.P.3.1	Determine probabilities of events from distributions, including: <ul style="list-style-type: none"> • discrete uniform (all outcomes in a finite set equally likely) • binomial • normal • exponential <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

MA.912.P.3.2		<p>Determine the mean and variance of distributions, including:</p> <ul style="list-style-type: none"> • discrete uniform (all outcomes in a finite set equally likely) • binomial • normal • exponential <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
MA.912.P.3.3		<p>Apply the properties of the normal distribution.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
MA.912.P.3.4		<p>Apply the Central Limit Theorem to determine the probability that a sample mean will be in a certain interval.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>

Statistics

Body of Knowledge

MA.	912.	S.	1.	1
Subject	Grade Level	Body of Knowledge	Standard	Benchmark

STATISTICS BODY OF KNOWLEDGE

Standard 1: Formulating Questions

Students learn to define appropriate questions for research, and to pose questions in a form that can be answered by collecting and analyzing data.

	Benchmark Code	Benchmark
	MA.912.S.1.1	Formulate an appropriate research question to be answered by collecting data or performing an experiment. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.S.1.2	Determine appropriate and consistent standards of measurement for the data to be collected in a survey or experiment. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 2: Data Collection

Students learn key methods for collecting data and basic sampling principles.

	Benchmark Code	Benchmark
	MA.912.S.2.1	Compare the difference between surveys, experiments, and observational studies and what types of questions can and cannot be answered by a particular design. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.S.2.2	Apply the definition of random sample and basic types of sampling, including representative samples, stratified samples, censuses. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
*	MA.912.S.2.3	Identify sources of bias, including sampling and nonsampling errors. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 3: Summarizing Data (Descriptive Statistics)

Students learn to work with summary measures of sets of data, including measures of the center, spread, and strength of relationship between variables. Students learn to distinguish between different types of data and to select the appropriate visual form to present different types of data.

	Benchmark Code	Benchmark
*	MA.912.S.3.1	<p>Read and interpret data presented in various formats. Determine whether data is presented in appropriate format, and identify possible corrections. Formats to include:</p> <ul style="list-style-type: none"> • bar graphs • line graphs • stem and leaf plots • circle graphs • histograms • box and whiskers plots • scatter plots • cumulative frequency (ogive) graphs <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
*	MA.912.S.3.2	<p>Collect, organize, and analyze data sets, determine the best format for the data and present visual summaries from the following:</p> <ul style="list-style-type: none"> • bar graphs • line graphs • stem and leaf plots • circle graphs • histograms • box and whisker plots • scatter plots • cumulative frequency (ogive) graphs <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>
*	MA.912.S.3.3	<p>Calculate and interpret measures of the center of a set of data, including mean, median, and weighted mean, and use these measures to make comparisons among sets of data.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
	MA.912.S.3.4	<p>Calculate and interpret measures of variance and standard deviation. Use these measures to make comparisons among sets of data.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
*	MA.912.S.3.5	<p>Calculate and interpret the range and quartiles of a set of data.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
	MA.912.S.3.6	<p>Use empirical rules such as the 68-95-99.7 rule to estimate spread of distributions and to make comparisons among sets of data.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
	MA.912.S.3.7	<p>Calculate the correlation coefficient of a set of paired data, and interpret the coefficient as a measure of the strength and direction of the relationship between the variables.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
	MA.912.S.3.8	<p>Determine whether a data distribution is symmetric or skewed based on an appropriate graphical presentation of the data.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Low</i></p>
	MA.912.S.3.9	<p>Identify outliers in a set of data based on an appropriate graphical presentation of the data, and describe the effect of outliers on the mean, median, and range of the data.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>

Standard 4: Analyzing Data

Students learn to use simulations of standard sampling distributions to determine confidence levels and margins of error. They develop measures of association between two numerical or categorical variables. They can use technological tools to find equations of regression lines and correlation coefficients.

Benchmark Code	Benchmark
MA.912.S.4.1	Explain and interpret the concepts of confidence level and "margin of error." <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.S.4.2	Use a simulation to approximate sampling distributions for the mean, using repeated sampling simulations from a given population. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.S.4.3	Apply the Central Limit Theorem to solve problems. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.S.4.4	Approximate confidence intervals for means using simulations of the distribution of the sample mean. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.S.4.5	Find the equation of the least squares regression line for a set of data. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>

Standard 5: Interpreting Results

Students gather data and determine confidence intervals to make inferences about means and use hypothesis tests to make decisions. They learn to use data to approximate p-values and to determine whether correlations between variables are significant.

Benchmark Code	Benchmark
MA.912.S.5.1	Analyze the relationship between confidence level, margin of error, and sample size. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.S.5.2	Apply the general principles of hypothesis testing. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.S.5.3	Explain and identify the following: null hypothesis, alternative hypotheses, Type I error, and Type II error. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.S.5.4	Explain the meaning of p-value and its role in hypothesis testing. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.S.5.5	Perform hypothesis tests of means and proportions for large samples, using simulations to determine whether a sample mean (proportion) has a low likelihood of occurring. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
MA.912.S.5.6	Interpret the results of hypothesis tests of means and proportions, and make decisions based on p-values of test. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

	MA.912.S.5.7	<p>Use simulations to approximate the p-value of a correlation coefficient, and use the results to determine whether the correlation between two variables is significant.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: High</i></p>
	MA.912.S.5.8	<p>Use a regression line equation to make predictions.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>
	MA.912.S.5.9	<p>Interpret the coefficient of determination, r^2, for a least-squares regression.</p> <p><i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i></p>

Trigonometry

Body of Knowledge

MA.	912.	T.	1.	1
Subject	Grade Level	Body of Knowledge	Standard	Benchmark

TRIGONOMETRY BODY OF KNOWLEDGE

Standard 1: Trigonometric Functions

Students extend the definitions of the trigonometric functions beyond right triangles using the unit circle and they measure angles in radians as well as degrees. They draw and analyze graphs of trigonometric functions (including finding period, amplitude, and phase shift) and use them to solve word problems. They define and graph inverse trigonometric functions and determine values of both trigonometric and inverse trigonometric functions.

	Benchmark Code	Benchmark
	MA.912.T.1.1	Convert between degree and radian measures. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.T.1.2	Define and determine sine and cosine using the unit circle. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.T.1.3	State and use exact values of trigonometric functions for special angles, i.e. multiples of $\frac{\pi}{6}$ and $\frac{\pi}{4}$ (degree and radian measures) <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.T.1.4	Find approximate values of trigonometric and inverse trigonometric functions using appropriate technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Low</i>
	MA.912.T.1.5	Make connections between right triangle ratios, trigonometric functions, and circular functions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.T.1.6	Define and graph trigonometric functions using domain, range, intercepts, period, amplitude, phase shift, vertical shift, and asymptotes with and without the use of graphing technology. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.T.1.7	Define and graph inverse trigonometric relations and functions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.T.1.8	Solve real-world problems involving applications of trigonometric functions using graphing technology when appropriate. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 2: Trigonometry in Triangles

Students understand how the trigonometric functions relate to right triangles and solve word problems involving right and oblique triangles. They understand and apply the laws of sines and cosines. They use trigonometry to find the area of triangles.

	Benchmark Code	Benchmark
*	MA.912.T.2.1	Define and use the trigonometric ratios (sine, cosine, tangent , cotangent, secant, cosecant) in terms of angles of right triangles. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

*	MA.912.T.2.2	Solve real-world problems involving right triangles using technology when appropriate. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.T.2.3	Apply the laws of sines and cosines to solve real-world problems using technology. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.T.2.4	Use the area of triangles given two sides and an angle or three sides to solve real-world problems. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

Standard 3: Trigonometric Identities and Equations

Students know basic trigonometric identities derived from definitions and use them to prove other identities. They use the sum, difference, double-angle, and half-angle formulas. They solve trigonometric equations and word problems using trigonometry.

Benchmark Code	Benchmark
MA.912.T.3.1	Verify the basic Pythagorean identities, e.g., $\sin^2 x + \cos^2 x = 1$, and show they are equivalent to the Pythagorean Theorem. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.T.3.2	Use basic trigonometric identities to verify other identities and simplify expressions. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.T.3.3	Use the sum and difference, half-angle and double-angle formulas for sine, cosine, and tangent, when formulas are provided. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.T.3.4	Solve trigonometric equations and real-world problems involving applications of trigonometric equations using technology when appropriate. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>

Standard 4: Polar Coordinates and Trigonometric Form of Complex Numbers

Students define, use polar coordinates, and relate them to Cartesian coordinates. They translate equations in terms of Cartesian coordinates into polar coordinates and graph the resulting equations in the polar coordinate plane. They convert complex numbers from standard to trigonometric form, and vice-versa. They multiply complex numbers in trigonometric form and use De Moivre's Theorem.

Benchmark Code	Benchmark
MA.912.T.4.1	Define polar coordinates and relate polar coordinates to Cartesian coordinates with and without the use of technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.T.4.2	Represent equations given in rectangular coordinates in terms of polar coordinates. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.T.4.3	Graph equations in the polar coordinate plane with and without the use of graphing technology. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
MA.912.T.4.4	Define the trigonometric form of complex numbers, convert complex numbers to trigonometric form, and multiply complex numbers in trigonometric form. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>

	MA.912.T.4.5	Apply DeMoivre's Theorem to perform operations with complex numbers. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
--	--------------	---

Standard 5: Mathematical Reasoning and Problem Solving
Students use a variety of strategies to solve problems. They develop and evaluate mathematical arguments and proofs.

	Benchmark Code	Benchmark
	MA.912.T.5.1	Use a variety of problem-solving strategies, such as drawing a diagram, guess-and-check, solving a simpler problem, examining simpler problems, and working backwards, using technology when appropriate. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>
	MA.912.T.5.2	Decide whether a solution is reasonable in the context of the original situation. <i>Cognitive Complexity/Depth of Knowledge Rating: Moderate</i>
	MA.912.T.5.3	Determine whether a given trigonometric statement is always, sometimes, or never true. Use the properties of the real numbers, order of operations, and trigonometric identities to justify the steps involved in verifying identities and solving equations. <i>Cognitive Complexity/Depth of Knowledge Rating: High</i>