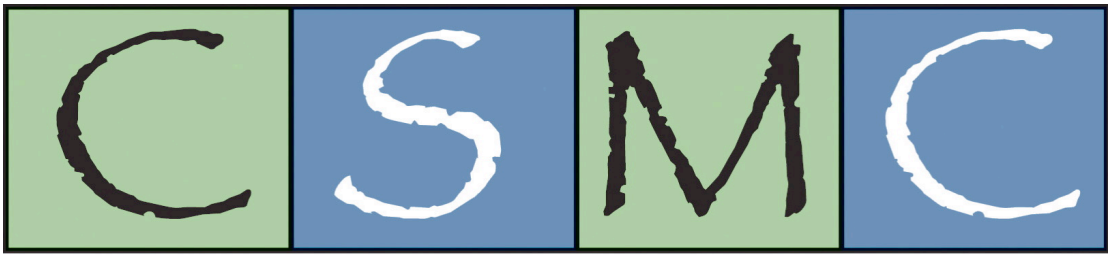

Center for the Study of Mathematics Curriculum

High School Mathematics:
State-Level Curriculum Standards and Graduation Requirements

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State-Level Curriculum Standards and Graduation Requirements

In a continuing effort to improve student-learning opportunities in mathematics, state departments of education have focused on articulating standards or learning goals at all levels, including high school mathematics. A review of K-8 mathematics curriculum standards (many of which have been published since 2002) compiled by staff from the Center for the Study of Mathematics Curriculum (CSMC) documents variation in the organization, specification, and grade placement of important learning goals across states (Reys, 2006). Mathematics curriculum standards for high school, while less common than for grades K-8, are receiving increased attention as a means to strengthen the rigor and raise expectations for what counts as a high school diploma in the U.S. In addition, many states are increasing the number of credits of mathematics required for students to receive a high school diploma, and are also specifying particular mathematics course requirements that students must complete, such as Algebra I and Geometry (The American Diploma Project, 2004).

This report provides a summary of the format and organization of state-level curriculum standards, graduation requirements for high school mathematics (see Appendix A). The information was gathered through searches of state departments of education websites as of 9/1/06. The information was current at the time of the release of this report but due to the continued work of states, some changes may have occurred since then. Therefore, we recommend that those interested in particular state requirements consult the appropriate website for the latest and most complete set of information. Links to the mathematics curriculum standards pages of state department of education websites can be found at: http://mathcurriculumcenter.org/states.php

The main elements of Appendix A include specification of:

Organization of high school mathematics curriculum standards. Curriculum standards for high school mathematics, like their K-8 counterparts, typically convey a set of mathematical learning expectations for all students. That is, they describe the mathematics that should be the focus of instruction and the goals for student learning. The organizational format of these standards varies, with some states organizing learning expectations/standards by course and others by grade or grade-band. In addition, some courses are organized by subject (Algebra, Geometry, etc.), while others are organized by integrating strands across grades (Integrated Math I, Integrated Math II, etc.).

Number of mathematics courses required for high school diploma/graduation. If a state requires a minimum number of years (generally indicated by courses) of mathematics at the high school-level this minimum is specified in the table. In some cases, these requirements are determined at the local rather that state level.

Mathematics courses required for high school diploma/graduation. If a state requires students to complete particular mathematics courses for high school graduation, those courses are specified.

A summary of some of the trends apparent in Appendix A follows.

Organization of High School Mathematics Curriculum Standards

- States generally organize high school mathematics curriculum standards in one of three ways – by course, by grade, or by grade band.

Twenty states organize high school standards by course-based learning expectations, specifying what students should know by the end of a particular course (e.g., Algebra I or Integrated Math I). Six states specify learning expectations by grade and twenty-eight states organize standards by grade-band specifying what students should study within a set of grades (e.g., grades 9-10) or by the end of a grade (e.g., by the end of grade 12). The most common grade-band organization is grades 9-12 (17 states organize standards in this way). Two states (Kentucky and Massachusetts) specify standards by course and by grade band.

- States that organize standards by courses generally utilize a traditional subject-based approach.

Nineteen states specify course-based learning expectations for Algebra I, twenty states for Geometry, and 18 states for Algebra II. In all but a few cases, one or more of these subject-based courses are required for a high school diploma. See Table 1 for a list of states that offer course-based learning expectations for various high school mathematics courses.

- Six states provide standards organized for integrated high school mathematics courses. That is, these states specify standards for course sequences that include emphasis on multiple strands such as algebra, geometry, and statistics each year.

Five states (Florida, Indiana, North Carolina, New York, and Tennessee) specify high school mathematics curriculum standards for both integrated and subject-based course sequences. For example, Indiana provides standards organized into two course sequences (Algebra I, Geometry and Algebra II; Integrated Mathematics I, II, III). New York includes one course (Integrating Algebra) that specifies curriculum standards from multiple strands. The remaining New York course-based standards are organized into subject-based courses (Geometry, Algebra II, Trigonometry). Georgia organizes high school mathematics standards through three integrated course-sequences, one for each of three career or college-ready options.

Table 1. States that provide course-specific high school mathematics learning expectations or outlines.

Course	States	Total
Algebra I	AL, AR, CA, DC, FL, HI, IN, KY, MD, MA, MS, NC, OK, SC, TN, TX, UT, VA, WV	19
Geometry	AL, AR, CA, DC, FL, HI, IN, KY, MD, MA, MS, NC, NY, OK, SC, TN, TX, UT, VA, WV	20
Algebra II	AL, AR, CA, DC, FL, HI, IN, MA, MS, NC, NY, OK, SC, TN, TX, UT, VA, WV	18
Integrated Mathematics I	FL, GA, IN, NY, NC, TN	6
Integrated Mathematics II	FL, GA, IN, NC, TN	5
Integrated Mathematics III	FL, GA, IN, NC, TN	5
Precalculus	AL, DC, FL, IN, MA, MS, NC, SC, TN, TX, UT, WV	12
Trigonometry	CA, FL, HI, MS, NY, VA, WV	7
Probability & Statistics	AR, CA, DC, FL, HI, IN, MS, NC, SC, TN, UT, VA, WV	13
Calculus	CA, FL, HI, IN, MS, NC, SC, TN, UT, VA	10

Mathematics Requirements for High School Graduation

For those states that specify a minimum number of years of mathematics for high school graduation, the requirements vary from 2 to 4 years (see Table 2). Specific course requirements for graduation also vary by state (see Table 3).

- Five states allow local schools and districts to determine the number of years of mathematics to be completed in order to graduate high school.

Although many states articulate the number of years of mathematics required for graduation at the state level, five states leave these decisions to local districts and schools. Colorado, Iowa, Maine, Massachusetts, and Nebraska allow local schools to determine the number of years of mathematics and specific course requirements to earn a high school diploma. This results in variance across the state. For example, in Massachusetts 63% of local districts require students to complete 3 years of mathematics in order to graduate. In Nebraska, the number of years of mathematics required to graduate ranges from 1-4 years.

- Ten states are in the process of increasing the number of years of mathematics required for students to graduate.

There has been a recent movement in many states towards increasing the number of years of mathematics required to graduate from high school. In the next five years, ten states will phase in an increased requirement. Five states (DoDEA, MO, NH, OR, UT) are raising their requirements from 2 years of mathematics to 3 years, while five other states (AR, DE, FL, MS, TX) will require students to complete 4 years of mathematics to graduate from high school, up from their current requirement of 3 years.

- About half the states require students to complete specific mathematics classes as part of their course of study in order to earn a diploma.

Along with the number of years of mathematics required in order to graduate, 25 states also outline specific courses that must be completed. As seen in Table 4, most of these states require Algebra I, Geometry, and Algebra II, although some states offer the option of taking "equivalent" courses. Six states (DE, IN, LA, MI, NC, TN) specify that students have the option of completing integrated course sequences to meet their course requirements.

- Five states offer multiple diploma options for students, with each option requiring varying number of mathematics credits and specific courses.

In some states, requirements for courses and the number of years of mathematics depends upon the type of diploma a student seeks. In fact, five states offer multiple diplomas, each with different requirements for graduation. Georgia offers two degree programs: a Technology/Career-Preparatory and Technology Career Preparatory with Distinction program that requires 3 years of mathematics and a College Preparatory and College Preparatory with Distinction programs that require 4 years. Virginia also offers two different degree programs for those seeking a standard diploma and an advanced studies diploma. The states of Indiana and South Dakota offer 3 different diploma programs with varying requirements, while North Carolina outlines 4 diplomas that students can attain, varying between 3-4 years of required mathematics.

Table 2. Number of years of high school mathematics courses/credits required for graduation*

Specified at Local Level	1 year	2 years	3 years	4 years	Varies by Diploma
CO, IA, ME, MA, NE		AK, AZ, CA, ID, MT, ND, WI	CT, DC, DoDEA, HI, IL, KS, KY, LA, MD, MN, MO, NH, NM, NJ, NV, NY, OH, OK, OR, PA, TN, UT, VT, WY	AL, AR, DE, FL, MI, MS, RI, SC, TX, WA, WV	IN (2-4 yrs) GA (3-4 yrs) NC (3-4 yrs) SD (3-4 yrs) VA (3-4 yrs)
5	0	7	24	11	5

* This information includes requirements that have been approved and are being phased in with a particular freshman class.

Table 3. Courses required for high school graduation/diploma

Course	States Requiring Course	Total
Algebra I	AL, AR, CA, DoDEA, DC*, FL*, GA*, IL, KY, MD, MI, MS, ND, NH, NM**, OK**, SD, TX, UT*	19
Algebra I or Integrated Mathematics I	IN, LA*, NC, TN*	4
Geometry	AL, AR, DoDEA, IL, KY, MD, MI, TX, UT*	9
Geometry or Integrated Mathematics II		0
Algebra II	AR, MI	2
Algebra II or Integrated Mathematics III	DE*	1
Algebra I, Geometry, Algebra II or Integrated Mathematics I-III	LA, TN*, VA	3

* Or an equivalent course
** Minimum Requirement

Summary

The federal No Child Left Behind (NCLB) Act has prompted increased activity at the state level in the specification of mathematics curriculum learning goals in the United States. As a direct result of NCLB, 39 states have replaced or revised their mathematics curriculum standards since 2002 (Reys, 2006).

Along with the NCLB requirements focusing on curriculum, states have also increased graduation requirements in order to engage their students in more mathematics throughout their secondary education. The information in this report illustrates that states vary with respect to required mathematics credit hours and courses for graduation.

References

The American Diploma Project. (2004). *Ready or not: Creating a high school diploma that counts*. Washington, DC: Achieve, Inc.

Reys, B.J. (Ed.) (2006). *The Intended Mathematics Curriculum as Represented in State-Level Curriculum Standards: Consensus or Confusion?* Greenwich, CT: Information Age Publishing, Inc.

Appendix A. State-Level Standards, Required Years and Courses for High School Mathematics

State	Organization of High School Mathematics Curriculum Standards					Required Years of Mathematics for High School Graduation	Required Mathematics Courses for High School Graduation[1]
	Course-based Learning Expectations[2]		Courses	Grade-level Learning Expectations (by strand)	Grade-band Learning Expectations (by strand)		
	Subj	Int					
AL	X		A1, G, AC, A2, A2wT, A3wS, PC			4 years	A1 and G
AK				9, 10		2 years	
AZ					9-12	2 years	
AR	X		A1, A1A, A1B, G, GA, GB, IG, AC, A2, A3, TCM, PCwT, ST, CM			4 years	A1, G, A2
CA	X		A1, G, A2, PS, TR, LA, MA, CA			2 years	A1
CO					9-12	Determined by local school district.[3]	
CT					9-12	3 years	
DE				9,10,11		4 years	Content equivalent to A2 (subject based or integrated), math course required in senior year.
DOD					9-12	3 years	A1, G, and one course beyond
DC	X		A1, G, A2, PS, PC			3 years	A1 or equivalent
FL					9-12	4 years	A1 or equivalent[4]
GA		X	CRM1, CRM2, CRM3, CRM4 (post-sec. options) M1, M2, M3, M4 (enter calculus in college) ACM1, ACM2, ACM3 (AP calculus in high school)			3-4 years[5]	Minimum of A1 or equivalent, other requirements vary by diploma type.
HI	X		PA, A1, A2, G, TR, AG, PR, ST, CA			3 years	
ID				9, 10		2 years	
IL					Early hs, late hs	3 years	A1 and G
IA					High school	Determined by local school district.	
IN	X	X	A1, A2, G, IM1, IM2, IM3, PC, CA, PS, DM			2-4 years[5]	Minimum of A1 or equivalent, other requirements vary by diploma type.
KS					9-10	3 years	Algebraic and geometric concepts
KY	X		A1, G		High school	3 years	A1, G, math elective

[1] Current or new requirements proposed for future graduates, if approved by governing body.
[2] "Subj" refers to subject-based course learning expectations (algebra, geometry, statistics, etc.). "Int" refers to course learning expectations organized to integrate multiple subjects.
[3] Colorado Commission on Higher Education established minimum admission requirements to enter all public four-year institutions within the state.
[4] Florida provides 58 high school course descriptions organized in 14 categories (one category is Integrated Mathematics)
[5] Varies by diploma type.

Appendix A (cont.)

State	Organization of High School Mathematics Curriculum Standards					Required Years of Mathematics for High School Graduation	Required Mathematics Courses for High School Graduation
	Course-based Learning Expectations		Courses	Grade-level Learning Expectations (by strand)	Grade-band Learning Expectations (by strand)		
	Subj	Int					
LA				9,10	11-12	3 years	One unit from: A1 or A1A and A1B or IM1. Remaining years from: IM2, IM3, G, A2, FM, AM1, AM2, PC, CA, PS, DM
ME					9-diploma	Determined by local school district.	
MD	X		A/DA, G			3 years	A/DA, G
MA	X		A1, G, A2, PC		9-10, 11-12	Determined by local school district.[6]	Required courses are set by the local district.
MI					High school	4 years	A1, G, A2, and one credit in senior year. Integrated course sequence is an acceptable alternative.
MN					9-11, 11-12	3 years	A1, A2
MS	X		PA, TA, A1, G, A2, AA, TR, PC, DM, CA, ST, SU, IE			4 years	A1 and at least one higher than A1
MO				9, 10, 11, 12		3 years	
MT					9-12	2 years	
NE					9-12	Determined at local level[7]	
NV					9-12	3 years	
NC	x	x	Introductory Mathematics, A1, G, A2, TXM1, TXM2, AF, DM, PC, IM1, IM2, IM3, IM4, PS, CA			3-4 years[5]	Minimum of A1 or equivalent, other requirements vary by diploma type.
ND					9-10, 11-12	2 years	A1 and another math course
NH					High school (9-10) and Adv. Math (11-12)	3 years	A1
NJ					9-12	3 years	
NM					9-12	3 years	at least one of which is equivalent to the a A1 level or higher
NY	x	x	IA, G, A2, TR			3 years	At a more advanced level than grade eight
OH				9, 10, 11, 12		3 years	

[6] In most recent year, 63% of districts require 3 years of mathematics.
[7] Range of 1-4 years across school districts.

Appendix A (cont.)

State	Organization of High School Mathematics Curriculum Standards					Required Years of Mathematics for High School Graduation	Required Mathematics Courses for High School Graduation
	Course-based Learning Expectations		Courses	Grade-level Learning Expectations (by strand)	Grade-band Learning Expectations (by strand)		
	Subj	Int					
OK	X		A1, G, A2			3 years	A1, G, A2, TR, MA, CA, PS, or any math course with content and/ or rigor above A1 and approved for college admission.
OR						3 years	
PA					9-11	3 years	
RI					9-10	4 years[8]	
SC	X		A1, G, A2, A3, CA, DM, MT1, MT2, MT3, MT4, PC, PS.			4 years	
SD					9-12	3-4 years[5]	Minimum of A1. Other course requirements vary by diploma type.
TN	X	X	FM1, FM2, A1, A2, TXA, G, IM1, IM2, IM3, A3, DM, PC, ST, CA, TXM, TXG			3 units	Must complete one of the following: A1, IM1, or TXA. Must also complete one of the following: A2, G, IM2, or TXG.
TX	X		A1, A2, G, PC, MMAP,			4 years	A1, G, A2
UT	X		A1, G, A2, AP1, AP2, PC, CA, ST			3 units	(a) A1 or AP1 or (b) G or AP2 or any Advanced Mathematics courses in sequence beyond (a) and (b);
VT					9-12	3 years	
VA	X		A1, G, A2, TR, A2wT, CPM, PS, DM, MA, CA			3-4 years[5]	Minimum of A1, G, A2.
WA					9-10	4 years	
WV	X		A/G, A1, AP1, AP2, G, A2, CCM, TR, PS, PC			4 years	
WI					9-12	2 years	
WY					9-11	3 years	

[8] Fourth course can be math-related (computer science, physics, accounting)

Course titles and codes used in Appendix A.

PA – Pre-Algebra
TA – Transition to Algebra
A/G – Algebra/Geometry Preparation
A1- Algebra I
A1A – Algebra I-A
A1B – Algebra I-B
AC – Algebra Connections
A/DA – Algebra/Data Analysis
A2 – Algebra II
A2wT – Algebra II with Trigonometry
AA – Advanced Algebra
A3 – Algebra III
A3wS – Algebra III with Statistics
AF – Advanced Functions and Modeling
AG – Analytic Geometry
G – Geometry
GA – Geometry A
GB – Geometry B
IG – Investigating Geometry
FM – Financial Math 1 or 2
CCM – Conceptual Math
IA – Integrated Algebra
IM – Integrated Mathematics I, 2, 3, or 4
M – Mathematics 1, 2, 3, or 4
CRM – Core Mathematics 1, 2, 3, or 4
ACM – Accelerated Mathematics 1, 2, or 3
MT – Mathematics for Technologies 1, 2, 3, or 4
TXM – Technical Math 1 or 2
TXA – Technical Algebra
TXG – Technical Geometry
AP – Applied Math 1 or 2
TCM – Transition to College Mathematics
MMAP – Mathematical Models with Applications
PC – Precalculus
PCwT – Precalculus with Trigonometry
TR - Trigonometry
ST – Statistics
PR - Probability
PS – Probability and Statistics (Reg. or Adv. Placement)
DM – Discrete Mathematics
SU – Survey of Mathematical Topics
CPM – Computer Mathematics
LA – Linear Algebra
MA – Mathematical Analysis
CA – Calculus (Reg. or Adv. Placement)
IE – Introduction to Engineering

ABOUT THE CENTER FOR THE STUDY OF MATHEMATICS CURRICULUM (CSMC)

The Center for the Study of Mathematics Curriculum, funded by the National Science Foundation in 2004, is engaged in a coordinated plan of scholarly inquiry and professional development around mathematics curriculum, examining and characterizing the role of curriculum materials and their influence on both teaching and student learning. The goal is to engage in systemic research to illuminate the essential features and characteristics of curriculum materials and related teacher support that contribute to increased student learning.

Major areas of CSMC work include understanding the influence and potential of mathematics curriculum materials, enabling teacher learning through curriculum material investigation and implementation, and building capacity for developing, implementing, and studying the impact of mathematics curriculum materials.

PRINCIPLES THAT GUIDE THE WORK OF CSMC:

A well-articulated, coherent, and comprehensive set of K-12 mathematics learning goals/standards is necessary to large-scale improvement of school mathematics.

Mathematics curriculum materials play a central role in any effort to improve school mathematics and that their development is a scholarly process involving a continual cycle of research-based design, field-testing, evidence gathering, and revision.

Teaching and curriculum materials are highly interdependent and increasing opportunities for student learning rests on better understanding the relationship between curriculum and instruction.

Research addressing mathematics curriculum can inform policy and practice and in so doing narrow the gap between the ideal and the achieved curriculum.

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