REL Technical Brief

REL 2008—No. 008

Aligning mathematics assessment standards: Arkansas and the 2009 National Assessment of Educational Progress (NAEP)

Prepared by

Kathy L. Shapley
Regional Educational Laboratory Southwest

Jessica Brite
Regional Educational Laboratory Southwest

October 2008

REL Technical Briefs is a new report series from Fast Response Projects that helps educators obtain evidence-based answers to their specific requests for information on pressing education issues. REL Technical Briefs offer highly targeted responses across a variety of subjects, from reviews of particular studies or groups of studies on No Child Left Behind Act implementation issues, to compilations or quick summaries of state or local education agency data, appraisals of particular instruments or tools, and very short updates of Issues & Answers reports. All REL Technical Briefs meet Institute of Education Sciences (IES) standards for scientifically valid research.

October 2008

After receiving the 2007 REL Southwest alignment study of the Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) and the National Assessment of Educational Progress (NAEP) assessment standards in science (http://ies.ed.gov/ncee/edlabs/projects/project.asp?projectID=76&productID=42), the Arkansas Department of Education and the REL Southwest Governing Board requested that REL Southwest conduct a similar alignment study to learn how the ACTAAP assessment standards align with the 2009 NAEP assessment standards in mathematics.

This REL Technical Brief was prepared for IES under Contract ED-06-CO-0017 by Regional Educational Laboratory Southwest administered by Edvance Research. The content of the publication does not necessarily reflect the views or policies of IES or the U.S. Department of Education, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.

Shapely, K., and Brite, J. (2008). *Aligning mathematics assessment standards: Arkansas and the 2009 National Assessment of Educational Progress (NAEP)* (REL Technical Brief, REL 2008–No. 008). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest. Retrieved from http://ies.ed.gov/ncee/edlabs.

This REL Technical Brief is available on the regional educational laboratory web site at http://ies.ed.gov/ncee/edlabs.

Summary

This Technical Brief examines the current alignment between the Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) mathematics assessment standards and the 2009 National Assessment of Educational Progress (NAEP) mathematics framework. It looks at the extent to which current state assessment standards cover the content on which 2009 NAEP assessments will be based. Applying the methodology used by Regional Educational Laboratory Southwest in 2007 in a similar study that examined the alignment of ACTAAP science assessment standards with the 2009 NAEP, this study presents results for areas of full alignment, partial alignment, nonalignment, and areas where the ACTAAP assessment standards go beyond the NAEP standards. The study finds that 78 percent of NAEP grade 4, 84 percent of NAEP grade 8, and 72 percent of NAEP grade 12 assessment standards are either fully or partially addressed by the ACTAAP assessment standards.

The study analyzes the alignment of the ACTAAP and 2009 NAEP mathematics assessment standards. It does not analyze individual items or the alignment of state standards with the ACTAAP assessment items. The study does not make specific recommendations about whether a state should close gaps in alignment to NAEP—a decision for state policymakers. Revising assessments requires substantial time and resources, so policymakers considering such revisions need to weigh the costs of such changes and the benefits they believe such changes will bring to students.

Technical brief

Why this brief?

In 2007 Regional Educational Laboratory Southwest conducted an alignment study of National Assessment of Educational Progress (NAEP) and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards in science (Timms et al. 2007). After receiving the science alignment report, the Arkansas Department of Education and the Regional Educational Laboratory Southwest Governing Board requested a similar alignment study to understand how the ACTAAP mathematics assessment standards[1] align with the 2009 NAEP mathematics assessment standards.[2]

One reason for this interest is the No Child Left Behind (NCLB) Act of 2001, which requires states to develop challenging academic content and achievement standards in mathematics and to test public school students in grades 3–8 and 10–12 annually to determine how well they are mastering the subject matter defined in the state standards. States must also participate in the NAEP mathematics assessments in grades 4 and 8 every two years. Because states set their own unique standards, the NAEP is increasingly being used as a benchmark for assessing and comparing student achievement countrywide (see, for example, Linn 2005; Linn, Baker, and Herman 2005).

NAEP data are being used increasingly in education research to investigate how the NCLB provisions have played out in different states. For example, the National Center for Education Statistics (NCES) mapped state test scores on the NAEP scale (NAEP equivalent score) and found differences in what is considered proficient. Proficient in some states mapped to NAEP Basic, while in others it mapped to NAEP Proficient, and in still others it mapped to NAEP Advanced. Much of the discrepancy in the percentages of students scoring proficient on state assessments and on NAEP was accounted for by how stringently states defined proficient (U.S. Department of Education, National Center for Education Statistics 2007). But it is unclear how much such discrepancies are also due to other factors, such as a lack of alignment between what is tested on NAEP and on state assessments, differences in the types of items used to test mathematics knowledge and skills (for example, multiple choice questions and short responses), and differences in cutpoints for determining proficiency levels.

The findings from this research will better inform Arkansas policymakers of specific areas in which ACTAAP and NAEP assessment standards differ so that they can, if necessary, review and revise their standards. This report describes the results of a systematic alignment study conducted for that purpose.

Traditional alignment studies and methods focus on aligning standards and tests. The objective of this study was to compare one set of assessment standards with another (see box 1 for study methodology).

Results

Results are presented for grades 4, 8, and 12 for the research question: To what extent do current state assessment standards on ACTAAP cover the content on which 2009 NAEP assessments will be based? Results are presented for areas of full alignment, partial alignment, nonalignment, and areas where the ACTAAP assessment standards go beyond the NAEP assessment standards. A NAEP assessment standard is considered to be fully addressed by an ACTAAP assessment standard or standards if all of the content of the NAEP assessment standard is contained in one or more ACTAAP assessment standards at the same or lower grade level. A NAEP assessment standard is considered to be partially addressed by the ACTAAP assessment standard or standards if the ACTAAP assessment standard or standards

BOX 1

Study methodology

This study used the WestEd methodology, which was designed to incorporate eight of the most prominent alignment methodologies (for a detailed discussion of the WestEd methodology see Timms et al. 2007).

The review team consisted of one senior reviewer and six content reviewers. The senior reviewer had 19 years of experience in mathematics education and had worked in public schools, state education agencies, and a university setting. The six content reviewers were elementary, middle, and high school mathematics educators with 4–37 years of teaching experience. Reviewers attended several training sessions.

Each reviewer conducted independent alignment ratings of the National Assessment of Educational Progress (NAEP) and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards. First, they conducted gap analyses, identifying content in the grade-specific NAEP assessment standards that was absent in the grade-specific ACTAAP assessment standards and content in the grade-specific ACTAAP assessment standards that was absent in the grade-specific NAEP assessment standards. Second, reviewers examined order to determine whether grade-specific NAEP assessment standards were included at the same grade level as the matching content in the ACTAAP assessment standards. The content reviewers then met in pairs to reach ratings consensus, a method designed to result in a single rating per NAEP assessment standard (no disagreement was permitted). The senior reviewer led each consensus meeting.

Content reviewers recorded alignment data in a crosswalk instrument that contained NAEP assessment standards at the appropriate grade level in the first column, then a column to fill in corresponding ACTAAP assessment standards, a column for ratings, a column for codes, and a column for reviewers' notes. A coding scheme was used to indicate alignment issues, including whether the assessment standard was covered at a higher or lower grade than the target grade and reason for lack of alignment. A matrix-like format was created to facilitate alignment.

address only part of the NAEP assessment standard; the NAEP assessment standard contains more content or more detailed content than the ACTAAP assessment standard or standards, or the ACTAAP assessment standard or standards imply but do not explicitly state the content found in the NAEP assessment standard; there is a matching ACTAAP assessment standard at a higher grade level than the NAEP assessment standard; or there is a matching ACTAAP assessment standard at a lower grade level than the NAEP assessment standard, but it does not address all the content addressed by the NAEP assessment standard.

Content alignment at grade 4

The content reviewers compared the NAEP grade 4 assessment standards in the *Mathematics Framework for 2009 National Assessment of Educational Progress* (National Assessment Governing Board 2007) with the assessment standards in the *Arkansas Comprehensive Testing, Assessment, and Accountability Program Released Item Booklet Grade 4 April 2007 Administration* (Arkansas Department of Education 2007b). The NAEP provides 65 assessment standards for grade 4. The number of assessment standards per content area in each alignment rating category is shown in table 1.

Fifteen of the NAEP assessment standards (23 percent) are fully addressed by the ACTAAP assessment standards, 36 (55 percent) are partially addressed, and 14 (22 percent) are not addressed (figure 1). (See appendix A for more detail on the alignment of the NAEP grade 4 assessment standards and the ACTAAP assessment standards and on the ACTAAP grade 4 assessment standards not covered by the NAEP grade 4 assessment standards, including details on assessment standards, ratings, codes, and whether a NAEP assessment standard is addressed at a higher or lower grade.)

TABLE 1

Number of National Assessment of Educational Progress (NAEP) grade 4 mathematics assessment standards and number of Arkansas Comprehensive Testing, Assessment, and Accountability Program assessment standards by alignment with NAEP, by NAEP content area, February 2008

NAEP content area	Number of NAEP assessment standards	Number of Arkansas assessment standards by alignment with NAEP[a]		
		Fully addressed	Partially addressed	Not addressed
Number properties and operations	20	8	9	3
Number sense	6	3	3	0
Estimation	3	0	2	1
Number operations	6	3	2	1
Ratios and proportional reasoning	1	0	0	1
Properties of numbers and operations	3	2	1	0
Mathematical reasoning using numbers	1	0	1	0
Measurement	10	0	9	1
Measuring physical attributes	6	0	5	1
Systems of measurement	4	0	4	0
Geometry	15	3	7	5
Dimension and shape	4	0	3	1
Transformation of shapes and preservation of properties	4	1	2	1
Relationships between geometric figures	4	1	1	2
Position, direction, and coordinate geometry	2	1	1	0
Mathematical reasoning in geometry	1	0	0	1
Data analysis, statistics, and probability	9	2	5	2
Data representations	3	1	1	1
Characteristics of data sets	2	0	1	1
Probability	4	1	3	0
Algebra	11	2	6	3
Patterns, relations, and functions	5	0	5	0
Algebraic representations	2	0	0	2
Variables, expressions, and operations	2	1	1	0
Equations and inequalities	1	1	0	0
Mathematical reasoning in algebra	1	0	0	1
All content	65	15	36	14

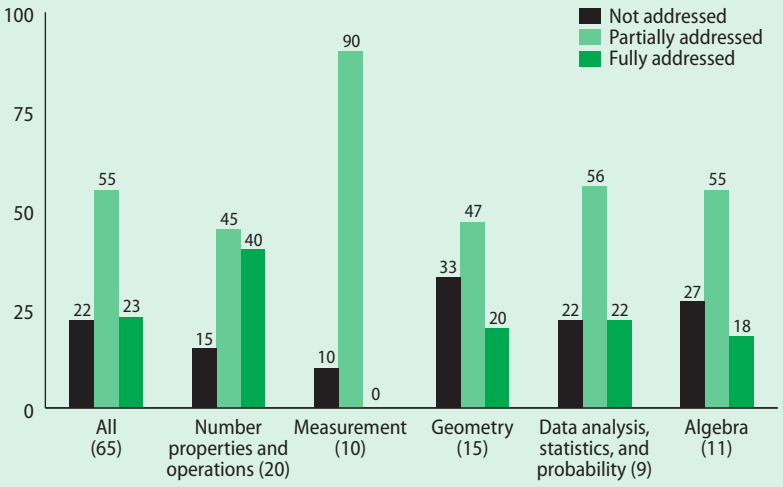
a. NAEP has 65 assessment standards at grade 4, and Arkansas has 29. Each Arkansas assessment standard may be mapped to more than one NAEP assessment standard.

Source: Expert content reviewers' summary analysis of data in appendix table A1.

Areas of full alignment. Fifteen (23 percent) of the NAEP grade 4 assessment standards are fully addressed by the ACTAAP assessment standards: 8 of 20 number properties and operations; 3 of 15 geometry; 2 of 9 data analysis, statistics, and probability; and 2 of 11 algebra assessment standards. Of these 15 fully addressed NAEP assessment standards, 4 are

FIGURE 1

Percentage of National Assessment of Educational Progress (NAEP) grade 4 mathematics assessment standards addressed by the Arkansas Comprehensive Testing, Assessment, and Accountability Program assessment standards, by NAEP content area, February 2008



Source: Expert content reviewers' summary analysis of data in appendix table A1.

addressed at a lower grade in the ACTAAP assessment standards.

Areas of partial alignment. Thirty-six (55 percent) of the NAEP grade 4 assessment standards are partially addressed by Arkansas assessment standards: 9 of 20 number properties and operations; 9 of 10 measurement; 7 of 15 geometry; 5 of 9 data analysis, statistics, and probability; and 6 of 11 algebra assessment standards. Of these 36 partially addressed NAEP grade 4 assessment standards, 4 are addressed at a lower grade and 7 at a higher grade in the ACTAAP assessment standards.

Areas of nonalignment. Fourteen (22 percent) of the NAEP grade 4 assessment standards are not addressed by the ACTAAP assessment standards: 3 of 20 number properties and operations; 1 of 10 measurement; 5 of 15 geometry; 2 of 9 data analysis, statistics, and probability; and 3 of 11 algebra assessment standards.

Areas where Arkansas assessment standards go beyond the NAEP assessment standards. Arkansas has 29 assessment standards in the *Arkansas Comprehensive Testing, Assessment, and Accountability Program Released Item Booklet Grade 4 April 2007 Administration* (Arkansas Department of Education 2007b). The NAEP assessment standards do not address 6 of these ACTAAP assessment standards: 1 of the numbers and operations, 2 of the geometry, and 3 of the measurement assessment standards.

Content alignment at grade 8

The content reviewers compared the NAEP grade 8 assessment standards in the *Mathematics Framework for 2009 National Assessment of Educational Progress* (National Assessment Governing Board 2007) with the assessment standards in the *Arkansas Comprehensive Testing, Assessment, and Accountability Program Released Item Booklet Grade 8 April 2007 Administration* (Arkansas Department of Education 2007c). NAEP provides 100 assessment standards for grade 8. The number of assessment standards per content area in each alignment rating category is shown in table 2.

Thirty-nine of these assessment standards (39 percent) are fully addressed by the ACTAAP assessment standards, 45 (45 percent) are partially addressed, and 16 (16 percent) are not addressed (figure 2). (See appendix B for more detail on the alignment of the NAEP grade 8 assessment standards and the ACTAAP assessment standards and on the ACTAAP grade 8 assessment standards not covered by NAEP grade 8 assessment standards, including details on assessment standards, ratings, codes, and whether a NAEP assessment standard is addressed at a higher or lower grade.)

Areas of full alignment. Thirty-nine (39 percent) of the NAEP grade 8 assessment standards are fully addressed by the ACTAAP assessment standards: 10 of 27 number properties and operations; 7 of 12 measurement; 10 of 21 geometry;

TABLE 2

Number of National Assessment of Educational Progress (NAEP) grade 8 mathematics assessment standards and number of Arkansas Comprehensive Testing, Assessment, and Accountability Program assessment standards by alignment with NAEP, by NAEP content area, February 2008

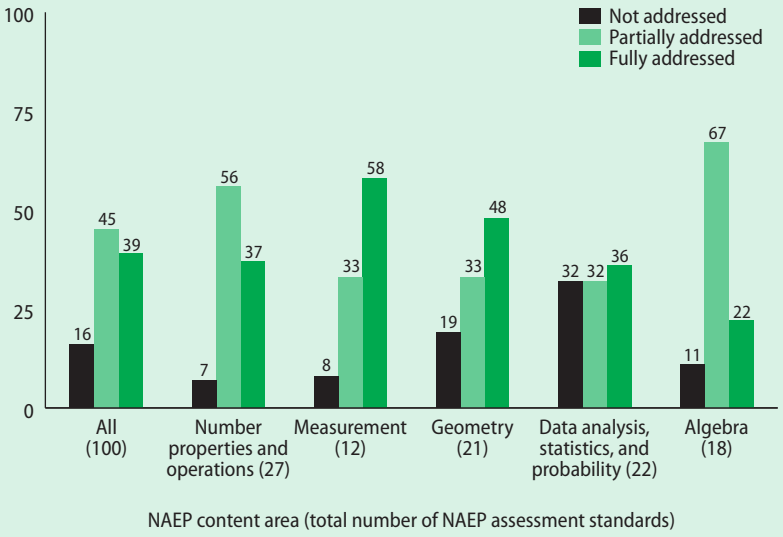
NAEP content area	Number of NAEP assessment standards	Number of Arkansas assessment standards by alignment with NAEP[a]		
		Fully addressed	Partially addressed	Not addressed
Number properties and operations	27	10	15	2
Number sense	8	4	4	0
Estimation	4	0	4	0
Number operations	4	0	3	1
Ratios and proportional reasoning	4	1	3	0
Properties of numbers and operations	5	4	1	0
Mathematical reasoning using numbers	2	1	0	1
Measurement	12	7	4	1
Measuring physical attributes	6	4	2	0
Systems of measurement	5	2	2	1
Measurement in triangles	1	1	0	0
Geometry	21	10	7	4
Dimension and shape	6	3	3	0
Transformation of shapes and preservation of properties	5	2	3	0
Relationships between geometric figures	5	3	1	1
Position, direction, and coordinate geometry	4	2	0	2
Mathematical reasoning in geometry	1	0	0	1
Data analysis, statistics, and probability	22	8	7	7
Data representations	5	2	2	1
Characteristics of data sets	5	2	1	2
Experiments and samples	3	0	1	2
Probability	9	4	3	2
Algebra	18	4	12	2
Patterns, relations, and functions	5	2	3	0
Algebraic representations	5	0	3	2
Variables, expressions, and operations	2	0	2	0
Equations and inequalities	5	2	3	0
Mathematical reasoning in algebra	1	0	1	0
All content	100	39	45	16

a. NAEP has 100 assessment standards at grade 8, and Arkansas has 33. Each Arkansas assessment standard may be mapped to more than one NAEP assessment standard.

Source: Expert content reviewers' summary analysis of data in appendix table B1.

FIGURE 2

Percentage of National Assessment of Educational Progress (NAEP) grade 8 mathematics assessment standards addressed by the Arkansas Comprehensive Testing, Assessment, and Accountability Program assessment standards, by NAEP content area, February 2008



Source: Expert content reviewers' summary analysis of data in appendix table B1.

8 of 22 data analysis, statistics, and probability; and 4 of 18 algebra assessment standards. Of these 39 fully addressed NAEP grade 8 assessment standards, 17 are addressed at a lower grade in the ACTAAP assessment standards.

Areas of partial alignment. Forty-five (45 percent) of the NAEP grade 8 assessment standards are partially addressed by the Arkansas assessment standards: 15 of 27 number properties and operations; 4 of 12 measurement; 7 of 21 geometry; 7 of 22 data analysis, statistics, and probability; and 12 of 18 algebra assessment standards. Of these 45 partially addressed NAEP grade 8 assessment standards, 12 are addressed at a lower grade and 9 at a higher grade in the ACTAAP assessment standards.

Areas of nonalignment. Sixteen (16 percent) of the NAEP grade 8 mathematics assessment standards are not addressed in the ACTAAP assessment standards: 2 of 27 number properties and operations; 1 of 12 measurement; 4 of 21 geometry; 7 of 22 data analysis, statistics, and probability; and 2 of 18 algebra assessment standards.

Areas where Arkansas assessment standards go beyond the NAEP assessment standards. Arkansas has 33 assessment standards in the *Arkansas Comprehensive Testing, Assessment, and Accountability Program Released Item Booklet Grade 8 April 2007 Administration* (Arkansas Department of Education 2007c). The NAEP assessment standards do not address 6 of these ACTAAP assessment standards: 1 of the numbers and operations, 2 of the algebra, 1 of the geometry, 1 of the measurement, and 1 of the data analysis and probability assessment standards.

Content alignment at grade 12

The content reviewers compared the NAEP grade 12 assessment standards in the *Mathematics Framework for 2009 National Assessment of Educational Progress* (National Assessment Governing Board 2007) with the assessment standards in the *Arkansas Comprehensive Testing, Assessment, and Accountability Program Algebra End-of-Course Examination April 2007 Administration* and the *Arkansas Comprehensive Testing, Assessment, and Accountability Program Geometry End-of-Course Examination April 2007 Administration* (Arkansas Department of Education 2007a,d). The NAEP provides 130 assessment standards for grade 12. The number of assessment standards per content area in each alignment rating category is shown in table 3.

Thirty-five of these assessment standards (27 percent) are fully addressed by the ACTAAP assessment standards, 58 (45 percent) are partially addressed, and 37 (28 percent) are not addressed (figure 3). (See appendix C for more details on the alignment of the NAEP grade 12 assessment standards and the ACTAAP assessment standards and on the ACTAAP assessment standards not covered by the NAEP grade 12 assessment standards, including

TABLE 3

Number of National Assessment of Educational Progress (NAEP) grade 12 mathematics assessment standards and number of Arkansas Comprehensive Testing, Assessment, and Accountability Program assessment standards by alignment with NAEP, by NAEP content area, February 2008

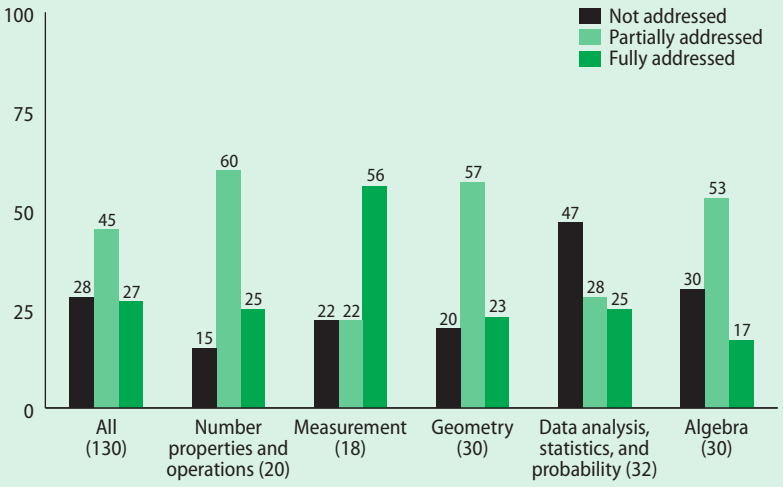
NAEP content area	Number of NAEP assessment standards	Number of Arkansas assessment standards by alignment with NAEP[a]		
		Fully addressed	Partially addressed	Not addressed
Number properties and operations	20	5	12	3
Number sense	4	2	2	
Estimation	3	0	2	1
Number operations	5	0	4	1
Ratios and proportional reasoning	2	1	1	0
Properties of numbers and operations	4	2	2	0
Mathematical reasoning using numbers	2	0	1	1
Measurement	18	10	4	4
Measuring physical attributes	6	6		0
Systems of measurement	5	2	3	0
Measurement in triangles	7	2	1	4
Geometry	30	7	17	6
Dimension and shape	4	0	4	0
Transformation of shapes and preservation of properties	6	3	3	0
Relationships between geometric figures	7	3	4	0
Position, direction, and coordinate geometry	8	1	2	5
Mathematical reasoning in geometry	5	0	4	1
Data analysis, statistics, and probability	32	8	9	15
Data representation	6	4	2	0
Characteristics of data sets	7	1	3	3
Experiments and samples	5	0	0	5
Probability	9	3	4	2
Mathematical reasoning with data	5	0	0	5
Algebra	30	5	16	9
Patterns, relations, and functions	7	2	4	1
Algebraic representations	7		6	1
Variables, expressions, and operations	7	2	3	2
Equations and inequalities	6	1	3	2
Mathematical reasoning in algebra	3	0	0	3
All content	130	35	58	37

a. NAEP has 130 assessment standards at grade 12, and Arkansas has 33. Each Arkansas assessment standard may be mapped to more than one NAEP assessment standard.

Source: Expert content reviewers' summary analysis of data in appendix table C1.

FIGURE 3

Percentage of National Assessment of Educational Progress (NAEP) grade 12 mathematics assessment standards that are addressed by Arkansas Comprehensive Testing, Assessment, and Accountability Program assessment standards, by NAEP content area, February 2008



Source: Expert content reviewers' summary analysis of data in appendix table C1.

details on assessment standards, ratings, codes, and whether a NAEP assessment standard is addressed at a higher or lower grade.)

Areas of full alignment. Thirty-five (27 percent) of the NAEP grade 12 assessment standards are fully addressed by Arkansas assessment standards: 5 of 20 number properties and operations; 10 of 18 measurement; 7 of 30 geometry; 8 of 32 data analysis, statistics, and probability; and 5 of 30 algebra assessment standards. Of these 35 fully addressed NAEP grade 12 assessment standards, 11 are addressed at a lower grade in the ACTAAP assessment standards.

Areas of partial alignment. Fifty-eight (45 percent) of the NAEP grade 12 assessment standards are partially addressed by the ACTAAP assessment standards: 12 of 20 number properties and operations; 4 of 18 measurement; 17 of 30 geometry; 9 of 32 data analysis, statistics, and probability; and 16 of 30 algebra assessment standards. Of these 58 partially addressed NAEP grade 12 assessment standards, 9 are addressed at a lower grade in the ACTAAP assessment standards.

Areas of nonalignment. Thirty-seven (28 percent) of the NAEP grade 12 assessment standards are not addressed by the Arkansas assessment standards: 3 of 20 number properties and operations; 4 of 18 measurement; 6 of 30 geometry; 15 of 32 data analysis, statistics, and probability; and 9 of 30 algebra assessment standards.

Areas where Arkansas assessment standards go beyond the NAEP assessment standards. Arkansas has 33 assessment standards in the *Arkansas Comprehensive Testing, Assessment, and Accountability Program Released Item Booklet Algebra End-of-Course Examination* (Arkansas Department of Education 2007a) and 23 assessment standards in the *Arkansas Comprehensive Testing, Assessment, and Accountability Program Released Item Booklet Geometry End-of-Course Examination* (Arkansas Department of Education 2007d). The NAEP assessment standards do not address 8 of these ACTAAP assessment standards: 3 of linear functions, 4 of data interpretation and probability, and 1 of coordinate geometry and transformations.

Limitations

The study analyzed the alignment of the ACTAAP mathematics assessment standards and the 2009 NAEP mathematics assessment standards. It did not analyze individual items or the alignment of state standards with ACTAAP assessment items. The study was not designed to make specific recommendations about whether a state should close gaps in alignment to NAEP—a decision for state policymakers. Revising assessments requires substantial time and resources, so policymakers considering such revisions must weigh the costs of such changes and the benefits they believe the changes will bring to students.

Notes

1. In discussing ACTAAP, the term *assessment standard* refers to the ACTAAP content standards and student learning expectations outlined in the *Arkansas Comprehensive Testing, Assessment, and Accountability Program Released Item Booklets April 2007 Administration* (Arkansas Department of Education 2007a–h).
2. In discussing NAEP, the term *assessment standard* refers to the content objectives outlined in the *Mathematics Framework for 2009, Pre-publication Edition* (National Assessment Governing Board 2007).

Appendix A
Details on the alignment of the National Assessment of Educational Progress grade 4 assessment standards and the Arkansas Comprehensive Testing, Assessment, and Accountability Program assessment standards

TABLE A1

Alignment of National Assessment of Educational Progress (NAEP) grade 4 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 4 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Number properties and operations				
4N.1 Number sense				
4N.1(a) Identify the place value and actual value of digits in whole numbers.	NO3.1.2 Use the place-value structure of the base 10 number system and be able to represent and compare whole numbers including thousands (using models, illustrations, symbols, expanded notation, and problem solving). E.g., 2,308 ____ 2,038	3	LG	Arkansas assessment standard includes more content than NAEP
4N.1(b) Represent numbers using models, such as base 10 representations, number lines, and two-dimensional models.	NO3.1.2 Use the place-value structure of the base ten number system and be able to represent and compare whole numbers including thousands (using models, illustrations, symbols, expanded notation, and problem solving). E.g., 2,308 ____ 2,038	3	LG	
4N.1(c) Compose or decompose whole quantities by place value (e.g., write whole numbers in expanded notation using place value: 342 = 300 + 40 + 2).	NO4.1.1 Recognize equivalent presentations for the same whole number and generate them by composing and decomposing numbers. E.g., 1,076 = 1,000 + 70 + 6; 500 + 500 + 25 + 25 + 25 + 1; 250 + 250 + 250 + 250 +75 + 1, etc.	3		
4N.1(d) Write or rename whole numbers (e.g., 10: 5 + 5, 12 – 2, 2 x 5).	NO4.1.1 Recognize equivalent presentations for the same whole number and generate them by composing and decomposing numbers. E.g., 1,076 = 1,000 + 70 + 6; 500 + 500 + 25 + 25 + 25 + 1; 250 + 250 + 250 + 250 +75 + 1, etc.	2	MC	Based on the examples, the Arkansas assessment standard does not include other ways to rename whole numbers, such as with multiplication or subtraction
4N.1(e) Connect model, number word, or number using various models and representations for whole numbers, fractions, and decimals.	NO4.1.4 Write a fraction to name part of a whole, part of a set, a location on a number line, and the division of whole numbers, using models up to 12/12	2	MC	
4N.1(i) Order or compare whole numbers, decimals, or fractions.	NO4.1.7 Write an equivalent decimal for a given fraction relating to money E.g., 1/10 = $0.10; 1/4 = $0.25	2	MC IC	

(CONTINUED)

TABLE A1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 4 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 4 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Number properties and operations				
4N.2 Estimation				
4N.2(a) Use benchmarks (well-known numbers used as meaningful points for comparison) for whole numbers, decimals, or fractions in contexts (e.g., ½ and .5 may be used as benchmarks for fractions and decimals between 0 and 1.00).		1		
4N.2(b) Make estimates appropriate to a given situation with whole numbers, fractions, or decimals by: • knowing when to estimate; • selecting the appropriate type of estimate, including overestimate; underestimate, and range of estimate; or • selecting the appropriate method of estimation (e.g., rounding).	NO4.3.3 Attain, with and without appropriate technology, computational fluency in multiplication and division, using contextual problems • two-digit by two-digit multiplication (larger numbers with technology) • up to three-digit by two-digit division (larger numbers with technology) • strategies for multiplication and dividing numbers • performance of operations in more than one way • estimation of products and quotients in appropriate situations • relationships between operations NO4.3.5 Use estimation strategies to solve problems and judge the reasonableness of the answer	2	IC	
4N.2(c) Verify solutions or determine the reasonableness of results in meaningful contexts.	NO4.3.5 Use estimation strategies to solve problems and judge the reasonableness of the answer	2	IC	
4N.3 Number operations				
4N.3(a) Add and subtract: • whole numbers, • fractions with like denominators, or • decimals through hundredths.	NO4.3.4 Solve simple problems using operations involving addition, subtraction, and multiplication, using a variety of methods and tools (e.g., objects, mental computation, paper and pencil with and without appropriate technology)	2	MC	Arkansas assessment standard addresses only addition and subtraction of whole numbers
4N.3(b) Multiply whole numbers: • no larger than two-digit by two-digit with paper and pencil computation, or • larger numbers with use of calculator.	NO4.3.3 Attain, with and without appropriate technology, computational fluency in multiplication and division, using contextual problems • two-digit by two-digit multiplication (larger numbers with technology) • up to three-digit by two-digit division (larger numbers with technology) • strategies for multiplication and dividing numbers • performance of operations in more than one way • estimation of products and quotients in appropriate situations • relationships between operations	3		

(CONTINUED)

TABLE A1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 4 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 4 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Number properties and operations				
4N.3 Number operations				
4N.3(c) Divide whole numbers: • up to three-digits by one-digit with paper and pencil computation, or • up to five-digits by two-digits with use of calculator.	NO4.3.3 Attain, with and without appropriate technology, computational fluency in multiplication and division, using contextual problems. • two-digit by two-digit multiplication (larger numbers with technology) • up to three-digit by two-digit division (larger numbers with technology) • strategies for multiplication and dividing numbers • performance of operations in more than one way • estimation of products and quotients	3		
4N.3(d) Describe the effect of operations on size (whole numbers).		1		
4N.3(e) Interpret whole number operations and the relationships between them.	NO4.3.4 Solve simple problems using operations involving addition, subtraction, and multiplication, using a variety of methods and tools (e.g., objects, mental computation, paper and pencil with and without appropriate technology)	2	IC	
4N.3(f) Solve application problems involving numbers and operations.	NO4.3.4 Solve simple problems using operations involving addition, subtraction, and multiplication, using a variety of methods and tools (e.g., objects, mental computation, paper and pencil with and without appropriate technology)	3		
4N.4 Ratios and proportional reasoning				
4N.4(a) Use simple ratios to describe problem situations.		1		
4N.5 Properties of numbers and operations				
4N.5(a) Identify odd and even numbers.	NO3.2.2 Apply number theory • Determine if a three-digit number is even or odd • Use the terms multiple, factor, product, and quotient in an appropriate context. (Since $3 \times 4 = 12$, 3 and 4 are factors; 12 is the product; 3, 6, 9, 12 are multiples of 3; 4, 8, 12, 16 are multiples of 4; $12 \div 4 = 3$, the quotient)	3	LG	
4N.5(b) Identify factors of whole numbers.	NO3.2.2 Apply number theory • Determine if a three-digit number is even or odd • Use the terms multiple, factor, product, and quotient in an appropriate context (Since $3 \times 4 = 12$, 3 and 4 are factors; 12 is the product; 3, 6, 9, 12 are multiples of 3; 4, 8, 12, 16 are multiples of 4; $12 \div 4 = 3$, the quotient)	3	LG	

(CONTINUED)

TABLE A1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 4 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 4 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Number properties and operations				
4N.5 Properties of numbers and operations				
4N.5(e) Apply basic properties of operations.	NO4.3.3 Attain, with and without appropriate technology, computational fluency in multiplication and division, using contextual problems • two-digit by two-digit multiplication (larger numbers with technology) • up to three-digit by two-digit division (larger numbers with technology) • strategies for multiplication and dividing numbers • performance of operations in more than one way • estimation of products and quotients NO4.3.4 Solve simple problems using operations involving addition, subtraction, and multiplication, using a variety of methods and tools (e.g., objects, mental computation, paper and pencil with and without appropriate technology)	2	IC	
4N.6 Mathematical reasoning using numbers				
4N.6(a) Explain or justify a mathematical concept or relationship (e.g., explain why 15 is an odd number or why 7–3 is not the same as 3– 7).	NO3.2.2 Apply number theory • Determine if a three-digit number is even or odd • Use the terms multiple, factor, product, and quotient in an appropriate context. (Since $3 \times 4 = 12$, 3 and 4 are factors; 12 is the product; 3, 6, 9, 12 are multiples of 3; 4, 8, 12, 16 are multiples of 4; $12 \div 4 = 3$, the quotient)	2	LG MC	
Measurement				
4M.1 Measuring physical attributes				
4M.1(a) Identify the attribute that is appropriate to measure in a given situation.	M5.12.1 Identify and select appropriate units and tools to measure. E.g., angles with degrees, distance with feet	2	HG	
4M.1(b) Compare objects with respect to a given attribute, such as length, area, volume, time, or temperature.		1		
4M.1(c) Estimate the size of an object with respect to a given measurement attribute (e.g., length, perimeter, or area using a grid).	M3.13.11 Find the area of any region by counting squares and half-squares	2	LG MC	Arkansas assessment standard addresses only area
4M.1(e) Select or use appropriate measurement instruments such as ruler, meter stick, clock, thermometer, or other scaled instruments.	M5.12.1 Identify and select appropriate units and tools to measure. E.g., angles with degrees, distance with feet	2	HG	

(CONTINUED)

TABLE A1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 4 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 4 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Measurement				
4M.1 Measuring physical attributes				
4M.1(f) Solve problems involving perimeter of plane figures.	M5.13.4 Develop and use strategies to solve real-world problems involving perimeter and area of rectangles	2	HG	
4M.1(g) Solve problems involving area of squares and rectangles.	M4.13.10 Use strategies for finding the area of a rectangle	2	IC	
4M.2 Systems of measurement				
4M.2(a) Select or use appropriate unit for the attribute being measured, such as length, time, or temperature.	M6.13.2 Determine which unit of measure or measurement tool matches the context for a problem situation	2	HG	
4M.2(b) Solve problems involving conversions within the same measurement system, such as conversions involving inches and feet or hours and minutes.	M4.13.2 Solve problems involving conversions between minutes and hours	2	MC	Arkansas assessment standard addresses only hours and minutes
4M.2(d) Determine appropriate size of unit of measurement in problem situation involving such attributes as length, time, capacity, or weight.	M6.13.2 Determine which unit of measure or measurement tool matches the context for a problem situation	2	HG	
4M.2(e) Determine situations in which a highly accurate measurement is important.	M4.13.5 Apply money concepts in contextual situations. E.g., • Determine the better buy • Determine change back with the least amount of currency • Compare money	2	MC IC	Arkansas assessment standard addresses only money and change
Geometry				
4G.1 Dimension and shape				
4G.1(a) Explore properties of paths between points.	G4.8.3 Identify, draw, and describe a line, a line segment, a ray, an angle, and intersecting, perpendicular, and parallel lines	2	IC	
4G.1(b) Identify or describe (informally) real-world objects using simple plane figures (e.g., triangles, rectangles, squares, and circles) and simple solid figures (e.g., cubes, spheres, and cylinders).	G4.8.2 Identify regular and irregular polygons, including octagons G4.11.1 Construct a three-dimensional model composed of cubes when given an illustration	2	MC IC	
4G.1(c) Identify or draw angles and other geometric figures in the plane.	G4.8.3 Identify, draw, and describe a line, a line segment, a ray, an angle, and intersecting, perpendicular, and parallel lines	2	MC IC	
4G.1(f) Describe attributes of two- and three-dimensional shapes.		1		

(CONTINUED)

TABLE A1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 4 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 4 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Geometry				
4G.2 Transformation of shapes and preservation of properties				
4G.2(a) Identify whether a figure is symmetrical, or draw lines of symmetry.	G3.9.1 Draw one or more lines of symmetry in a polygon	2	LG MC	
4G.2(c) Identify the images resulting from flips (reflections), slides (translations), or turns (rotations).	G4.9.1 Determine the result of a transformation of a two-dimensional figure as a slide (translation), flip (reflection), or turn (rotation) and justify the answer	3		
4G.2(d) Recognize which attributes (such as shape and area) change or don't change when plane figures are cut up or rearranged.		1		
4G.2(e) Match or draw congruent figures in a given collection.	G5.8.2 Identify and draw congruent, adjacent, obtuse, acute, right, and straight angles (label parts of an angle: vertex, rays, interior, and exterior)	2	HG MC	This Arkansas assessment standard refers only to congruent angles
4G.3 Relationships between geometric figures				
4G.3(a) Analyze or describe patterns of geometric figures by increasing number of sides or changing size or orientation (e.g., polygons with more and more sides).		1		
4G.3(b) Assemble simple plane shapes to construct a given shape.	G4.11.2 Create new figures by combining and subdividing models of existing figures in multiple ways, and record results in a table	3		
4G.3(c) Recognize two-dimensional faces of three-dimensional shapes.	G4.11.1 Construct a three-dimensional model composed of cubes when given an illustration	2	IC	
4G.3(f) Describe and compare properties of simple and compound figures composed of triangles, squares, and rectangles.		1		
4G.4 Position, direction, and coordinate geometry				
4G.4(a) Describe relative positions of points and lines using the geometric ideas of parallelism or perpendicularity.	G4.8.3 Identify, draw, and describe a line, a line segment, a ray, an angle, and intersecting, perpendicular, and parallel lines	3		
4G.4(d) Construct geometric figures with vertices at points on a coordinate grid.	G3.10.1 Locate and identify points on a coordinate grid and name the ordered pair (Quadrant I only), using common language and geometric vocabulary (horizontal and vertical)	2	LG MC	

(CONTINUED)

TABLE A1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 4 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 4 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Geometry				
4G.5 Mathematical reasoning in geometry				
4G.5(a) Distinguish which objects in a collection satisfy a given geometric definition and explain choices.		1		
Data analysis, statistics, and probability				
4P.1 Data representation The following representations of data are indicated for each grade level. Objectives in which only a subset of these representations is applicable are indicated in the parentheses associated with the objective: pictographs, bar graphs, circle graphs, line graphs, line plots, tables, and tallies.				
4P.1(a) Read or interpret a single set of data.	DAP4.14.1 Create a data collection plan after being given a topic, and collect, organize, display, describe, and interpret simple data using frequency tables or line plots, pictographs, and bar graphs	2	IC	
4P.1(b) For a given set of data, complete a graph (limited time make it difficult to construct graphs completely).	DAP4.14.1 Create a data collection plan after being given a topic, and collect, organize, display, describe, and interpret simple data using frequency tables or line plots, pictographs, and bar graphs DAP4.15.1 Represent and interpret data, using pictographs, bar graphs, and line graphs in which symbols or intervals are greater than one	3		
4P.1(c) Solve problems by estimating and computing within a single set of data.		1		
4P.2 Characteristics of data sets				
4P.2(b) Given a set of data or a graph, describe the distribution of the data using median, range, or mode.	DAP5.15.2 Determine, with and without appropriate technology, the range, mean, median, and mode (whole number data sets), and explain what each indicates about the set of data	2	HG	
4P.2(d) Compare two sets of related data.		1		
4P.4 Probability				
4P.4(a) Use informal probabilistic thinking to describe chance events (i.e., likely and unlikely, certain and impossible).	DAP4.17.1 Use fractions to predict probability of an event. E.g., There are 5 blue tiles, 3 red tiles, and 2 green tiles. What is the probability of pulling out a green tile?	3		
4P.4(b) Determine a simple probability from a context that includes a picture.	DAP4.17.2 Conduct simple probability experiments, record the data, and draw conclusions about the likelihood of possible outcomes (roll number cubes, pull tiles from a bag, spin a spinner, or determine the fairness of games)	2	IC	

(CONTINUED)

TABLE A1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 4 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 4 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Data analysis, statistics, and probability				
4P.4 Probability				
4P.4(e) List all possible outcomes of a given situation or event.	DAP4.17.2 Conduct simple probability experiments, record the data, and draw conclusions about the likelihood of possible outcomes (roll number cubes, pull tiles from a bag, spin a spinner, or determine the fairness of games)	2	IC	
4P.4(g) Represent the probability of a given outcome using a picture or other graphic.	DAP4.17.2 Conduct simple probability experiments, record the data, and draw conclusions about the likelihood of possible outcomes (roll number cubes, pull tiles from a bag, spin a spinner, or determine the fairness of games)	2	IC	
Algebra				
4A.1 Patterns, relations, and functions				
4A.1(a) Recognize, describe, or extend numerical patterns.	A4.4.2 Use repeating and growing numeric and geometric patterns to make predictions and solve problems	2	IC	
4A.1(b) Given a pattern or sequence, construct or explain a rule that can generate the terms of the pattern or sequence.	A4.4.3 Determine the relationship between sets of numbers by selecting the rule (2-step rule in words)	2	MC IC	
4A.1(c) Given a description, extend or find a missing term in a pattern or sequence.	A4.4.2 Use repeating and growing numeric and geometric patterns to make predictions and solve problems	2	IC	
4A.1(d) Create a different representation of a pattern or sequence given a verbal description.	A4.4.2 Use repeating and growing numeric and geometric patterns to make predictions and solve problems	2	IC	
4A.1(e) Recognize or describe a relationship in which quantities change proportionally.	A4.6.1 Create a chart or table to organize given information and to understand relationships and explain the results. E.g., Troy must read independently for two hours a week. If Troy reads 20 minutes a day, how long will it take him to read a total of two hours?	2	IC	
4A.2 Algebraic representations				
4A.2(a) Translate between the different forms of representations (symbolic, numerical, verbal, or pictorial) of whole number relationships (such as from a written description to an equation or from a function table to a written description).		1		

(CONTINUED)

TABLE A1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 4 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 4 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Algebra				
4A.2 Algebraic representations				
4A.2(c) Graph or interpret points with whole number or letter coordinates on grids or in the first quadrant of the coordinate plane.		1		
4A.3 Variables, expressions, and operations				
4A.3(a) Use letters and symbols to represent an unknown quantity in a simple mathematical expression.	A4.5.3 Use a variable to represent an unknown quantity in a number sentence involving contextual situations and find the value. E.g., Susie bought 48 pencils. If the pencils came in packages of 12, how many packages of pencils did she buy? P = 48 ÷ 12	3		
4A.3(b) Express simple mathematical relationships using number sentences.	A4.5.2 Express mathematical relationships using simple equations and inequalities (>, <, =, ≠). E.g., 4 × 5 ____ 8 × 2 + 3	2	IC	
4A.4 Equations and inequalities				
4A.4(a) Find the value of the unknown in a whole number sentence.	A4.5.3 Use a variable to represent an unknown quantity in a number sentence involving contextual situations and find the value. E.g., Susie bought 48 pencils. If the pencils came in packages of 12, how many packages of pencils did she buy? P = 48 ÷ 12	3		
4A.5 Mathematical reasoning in algebra				
4A.5(a) Verify a conclusion using algebraic properties.		1		

a. Rating is based on a scale of 1 to 3, where 1 indicates that the ACTAAP assessment standard or standards do not address the NAEP assessment standard, 2 that the ACTAAP assessment standard or standards partially address the NAEP assessment standard, and 3 that the ACTAAP standard or standards fully address or exceed the NAEP assessment standard at the targeted grade level. A NAEP assessment standard is considered to be *fully addressed* by the ACTAAP assessment standard or standards if all of the content of the NAEP assessment standard is contained in one or more ACTAAP assessment standards at the same or lower grade level. A NAEP standard is considered to be *partially addressed* by the ACTAAP assessment standard or standards if the ACTAAP assessment standard or standards address only part of the NAEP assessment standard; the NAEP standard contains more content or more detailed content than the ACTAAP assessment standard or standards or the ACTAAP assessment standard or standards imply but do not explicitly state the content found in the NAEP assessment standard; there is a matching ACTAAP assessment standard at a higher grade level than the NAEP assessment standard; or there is a matching ACTAAP assessment standard or standards at a lower grade level than the NAEP assessment standard but it does not address all the content addressed by the NAEP assessment standard.

b. Codes: IC = implied content, LG = content covered at a lower grade level, HG = content covered at a higher grade level, MC = more content, MD = more detailed content.

Source: Expert content reviewers' analysis based on data from National Assessment Governing Board (2007) and Arkansas Department of Education (2007b,e,f,g).

TABLE A2

Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 4 assessment standards not covered by the National Assessment of Educational Progress (NAEP) grade 4 assessment standards, February 2008

ACTAAP strand	ACTAAP grade 4 assessment standard not covered by NAEP
Numbers and operations	NO4.2.4 Represent and explain division as measurement and partitive division, including equal groups, related rates, price, rectangular arrays (area model), combinations, and multiplicative comparison. For example: • Translate contextual situations involving division into conventional mathematical symbols • Explain how a remainder may impact an answer in a real-world situation
Geometry	G4.8.4 Identify and describe intersecting, perpendicular, and parallel lines in problem solving context
	G4.8.5 Classify angles relative to 90° as more than, less than, or equal to
Measurement	M4.13.1 Use a calendar to determine elapsed time from month to month
	M4.13.4 Determine elapsed time in contextual situations to five-minute intervals with beginning time unknown. E.g., Mary watched a movie for 1 hour and 15 minutes. The movie ended at 8:15. When did the movie begin?
	M4.13.11 Use strategies to find the volume (cubic units) of rectangular prisms and cubes

Source: Arkansas Department of Education (2007b).

Appendix B
Details on the alignment of the National Assessment of Educational Progress grade 8 assessment standards and the Arkansas Comprehensive Testing, Assessment, and Accountability Program assessment standards

TABLE B1

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Number properties and operations				
8N.1 Number sense				
8N.1(a) Use place value to model and describe integers and decimals.	NO8.1.3 Compare and order real numbers, including irrational numbers, and find their approximate location on a number line (use technology when appropriate)	2	IC	Place value is not explicitly mentioned in the Arkansas assessment standard
8N.1(b) Model or describe rational numbers or numerical relationships using number lines and diagrams.	NO8.1.3 Compare and order real numbers, including irrational numbers, and find their approximate location on a number line (use technology when appropriate)	2	IC	Diagrams are explicitly mentioned in NAEP but not in the Arkansas assessment standard
8N.1(d) Write or rename rational numbers.	NO6.1.2 Find decimal and percent equivalents for proper fractions, and explain why they represent the same value	2	LG	Writing rational numbers is not mentioned in this grade 6 Arkansas assessment standard
8N.1(e) Recognize, translate between, or apply multiple representations of rational numbers (fractions, decimals, and percents) in meaningful contexts.	NO6.1.2 Find decimal and percent equivalents for proper fractions, and explain why they represent the same value NO7.3.1 Compute, with and without appropriate technology, with integers and positive rational numbers, using real-world situations to solve problems	3	LG	
8N.1(f) Express or interpret numbers using scientific notation from real-life contexts.	NO8.1.1 Read, write, compare, and solve problems, with and without appropriate technology, including numbers less than one in scientific notation	2	IC	"Real-life contexts" is not explicit in the Arkansas assessment standard
8N.1(g) Find or model absolute value or apply to problem situations.	NO7.3.5 Represent and solve problem situations that can be modeled by and solved using concepts of absolute value, exponents, and square roots (for perfect squares), with and without appropriate technology	3	LG	
8N.1(h) Order or compare rational numbers (fractions, decimals, percents, or integers) using various models and representations (e.g., number line).	NO8.1.3 Compare and order real numbers, including irrational numbers, and find their approximate location on a number line (use technology when appropriate)	3		Arkansas assessment standard also includes irrational numbers

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Number properties and operations				
8N.1 Number sense				
8N.1(i) Order or compare rational numbers including very large and small integers, and decimals and fractions close to zero.	NO8.1.3 Compare and order real numbers, including irrational numbers, and find their approximate location on a number line (use technology when appropriate) NO8.1.1 Read, write, compare, and solve problems, with and without appropriate technology, including numbers less than 1 in scientific notation	3		Arkansas assessment standard also includes irrational numbers
8N.2 Estimation				
8N.2(a) Establish or apply benchmarks for rational numbers and common irrational numbers (e.g., π) in contexts.	NO8.1.3 Compare and order real numbers, including irrational numbers, and find their approximate location on a number line (use technology when appropriate)	2	IC	Arkansas assessment standard does not address "benchmarks" and "in contexts"
8N.2(b) Make estimates appropriate to a given situation by: • identifying when estimation is appropriate, • determining the level of accuracy needed, • selecting the appropriate method of estimation, or • analyzing the effect of an estimation method on the accuracy of results.	NO5.3.4 Develop and use strategies to estimate the results of whole number computations and to judge the reasonableness of such results	2	LG IC	
8N.2(c) Verify solutions or determine the reasonableness of results in a variety of situations, including calculator and computer results.	NO5.3.4 Develop and use strategies to estimate the results of whole number computations and to judge the reasonableness of such results	2	LG MC	Does not specify calculator and computer results
8N.2(d) Estimate square or cube roots of numbers less than 1,000 between two whole numbers.	NO7.3.5 Represent and solve problem situations that can be modeled by and solved using concepts of absolute value, exponents, and square roots (for perfect squares), with and without appropriate technology	2	LG MC	Does not specify cube roots or estimating
8N.3 Number operations				
8N.3(a) Perform computations with rational numbers.	NO8.2.5 Model and develop addition, subtraction, multiplication, and division of rational numbers. E.g., (–8½ + 2¾)	2	IC	In Arkansas assessment standard "model and develop" implies a different skill than the NAEP "perform computation"

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Number properties and operations				
8N.3 Number operations				
8N.3(d) Describe the effect of multiplying and dividing by numbers, including the effect of multiplying or dividing a rational number by: • zero, or • a number less than zero, or • a number between zero and one, • one, or • a number greater than one.		1		
8N.3(e) Interpret rational number operations and the relationships between them.	NO8.2.4 Apply rules (conventions) for order of operations to rational numbers	2	IC	
8N.3(f) Solve application problems involving rational numbers and operations using exact answers or estimates as appropriate.	NO7.3.1 Compute, with and without appropriate technology, with integers and positive rational numbers, using real-world situations to solve problems	2	LG MC	Does not include negative rational numbers or estimates
8N.4 Ratios and proportional reasoning				
8N.4(a) Use ratios to describe problem situations.	NO7.1.1 Relate, with and without models and pictures, concepts of ratio, proportion, and percent, including percents less than 1 and greater than 100 G7.8.5 Model and develop the concept that pi (π) is the ratio of the circumference to the diameter of any circle	2	LG MC	Does not specify problem situations
8N.4(b) Use fractions to represent and express ratios and proportions.	NO7.1.1 Relate, with and without models and pictures, concepts of ratio, proportion, and percent, including percents less than 1 and greater than 100	2	LG IC	
8N.4(c) Use proportional reasoning to model and solve problems (including rates and scaling).	A(SEI)2.5 Solve real-world problems that involve a combination of rates, proportions, and percents	2	HG	
8N.4(d) Solve problems involving percentages (including percent increase and decrease, interest rates, tax, discount, tips, or part/whole relationships).	NO8.3.6 Solve, with and without technology, real-world percent problems, including percent of increase or decrease	3		
8N.5 Properties of numbers and operations				
8N.5(a) Describe odd and even integers and how they behave under different operations.	NO7.2.4 Model and develop addition, subtraction, multiplication, and division of integers	2	LG IC	

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Number properties and operations				
8N.5 Properties of numbers and operations				
8N.5(b) Recognize, find, or use factors, multiples, or prime factorization.	NO6.3.5 Find and use factorization (tree diagram), including prime factorization of composite numbers (expanded and exponential notation), to determine the greatest common factor (GCF) and least common multiple (LCM) NO7.3.4 Apply factorization, LCM, and GCF to solve problems using more than two numbers, and explain the solution	3	LG	
8N.5(c) Recognize or use prime and composite numbers to solve problems.	NO6.3.5 Find and use factorization (tree diagram), including prime factorization of composite numbers (expanded and exponential notation), to determine the greatest common factor (GCF) and least common multiple (LCM) NO7.3.4 Apply factorization, LCM, and GCF to solve problems using more than two numbers, and explain the solution	3	LG	
8N.5(d) Use divisibility or remainders in problem settings.	NO5.2.1 Use divisibility rules to determine if a number is a factor of another number (2, 3, 5, 10) NO5.3.1 Develop and use a variety of algorithms, with computational fluency, to perform whole number operations using addition and subtraction (up to five-digit numbers), multiplication (up to three-digit by two-digit), and division (up to two-digit divisor), interpreting remainders, including real-world problems	3	LG	
8N.5(e) Apply basic properties of operations.	NO8.2.1 Apply the addition, subtraction, multiplication, and division properties of equality to two-step equations NO8.2.4 Apply rules (conventions) for order of operations to rational numbers	3		
8N.6 Mathematical reasoning using numbers				
8N.6(a) Explain or justify a mathematical concept or relationship (e.g., explain why 17 is prime).		1		
8N.6(b) Provide a mathematical argument to explain operations with two or more fractions.	NO6.3.2 Develop and analyze algorithms for computing with fractions (including mixed numbers) and decimals, and demonstrate, with and without technology, computational fluency in their use, and justify the solution	3	LG	

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Measurement				
8M.1 Measuring physical attributes				
8M.1(b) Compare objects with respect to length, area, volume, angle measurement, weight, or mass.	M8.12.1 Understand, select, and use, with and without appropriate technology, the appropriate units and tools to measure angles, perimeter, area, surface area, and volume to solve real-world problems	2	IC	
8M.1(c) Estimate the size of an object with respect to a given measurement attribute (e.g., area).	M6.13.6 Use estimation to check the reasonableness of measurements obtained from the use of various instruments (including angle measures)	3	LG	
8M.1(e) Select or use appropriate measurement instrument to determine or create a given length, area, volume, angle, weight, or mass.	M8.12.1 Understand, select, and use, with and without appropriate technology, the appropriate units and tools to measure angles, perimeter, area, surface area, and volume to solve real-world problems	2	IC	Arkansas assessment standard does not include weight or mass
8M.1(f) Solve mathematical or real-world problems involving perimeter or area of plane figures, such as triangles, rectangles, circles or composite figures.	M8.12.1 Understand, select, and use, with and without appropriate technology, the appropriate units and tools to measure angles, perimeter, area, surface area, and volume to solve real-world problems M8 13.5 Estimate and compute the area of irregular two-dimensional shapes	3		
8M.1(h) Solve problems involving volume or surface area of rectangular solids, cylinders, prisms, or composite shapes.	M8.13.2 Solve problems involving volume and surface area of pyramids, cones, and composite figures, with and without appropriate technology	3		
8M.1(i) Solve problems involving rates, such as speed or population density.	M8.13.3 Apply proportional reasoning to solve problems involving indirect measurements, scale drawings, or rates	3		
8M.2 Systems of measurement				
8M.2(a) Select or use appropriate type of unit for the attribute being measured, such as length, area, angle, time, or volume.	M8.12.1 Understand, select, and use, with and without appropriate technology, the appropriate units and tools to measure angles, perimeter, area, surface area, and volume to solve real-world problems	3		
8M.2(b) Solve problems involving conversions within the same measurement system, such as conversions involving square inches and square feet.	M8.12.2 Describe and apply equivalent measures using a variety of units within the same system of measurement	3		

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Measurement				
8M.2 Systems of measurement				
8M.2(c) Estimate the measure of an object in one system given the measure of that object in another system and the approximate conversion factor. E.g., • Distance conversion: 1 kilometer is approximately 5/8 of a mile. • Money conversion: US dollar is approximately 1.5 Canadian dollars. • Temperature conversion: Fahrenheit to Celsius		1		Arkansas assessment standards do not address conversions between systems
8M.2(d) Determine appropriate size of unit of measurement in problem situation involving such attributes as length, area, or volume.	M8.12.1 Understand, select, and use, with and without appropriate technology, the appropriate units and tools to measure angles, perimeter, area, surface area, and volume to solve real-world problems	2	IC	
8M.2(e) Determine appropriate accuracy of measurement in problem situations (e.g., the accuracy of each of several lengths needed to obtain a specified accuracy of a total length) and find the measure to that degree of accuracy.	M8.13.1 Draw and apply measurement skills with fluency to appropriate levels of precision	2	IC	
8M.3 Measurement in triangles				
8M.3(a) Solve problems involving indirect measurement, such as finding the height of a building by comparing its shadow with the height and shadow of a known object.	M8.13.3 Apply proportional reasoning to solve problems involving indirect measurements, scale drawings, or rates	3		
Geometry				
8G.1 Dimension and shape				
8G.1(a) Draw or describe a path of shortest length between points to solve problems in context.	G8.8.3 Determine appropriate application of geometric ideas and relationships, such as congruence, similarity, and the Pythagorean theorem, with and without appropriate technology M8.13.4 Find the distance between two points on a coordinate plane using the Pythagorean theorem	2	IC	
8G.1(b) Identify a geometric object with a written description of its properties.	G7.8.1 Identify, draw, classify, and compare geometric figures, using models and real-world examples	2	LG IC	
8G.1(c) Identify, define, or describe geometric shapes in the plane and in three-dimensional space given a visual representation.	G7.8.1 Identify, draw, classify, and compare geometric figures, using models and real-world examples	2	LG IC	

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Geometry				
8G.1 Dimension and shape				
8G.1(d) Draw or sketch from a written description polygons, circles, or semicircles.	G7.8.1 Identify, draw, classify, and compare geometric figures, using models and real-world examples	3	LG	
8G.1(e) Represent or describe a three-dimensional situation in a two-dimensional drawing from different views.	G7.11.2 Construct a building out of cubes from a set of views (front, top, side) G8.11.1 Using isometric dot paper, interpret and draw different views of buildings	3	LG	
8G.1(f) Demonstrate an understanding about the two- and three-dimensional shapes in our world through identifying, drawing, modeling, building, or taking apart.	G7.11.2 Construct a building out of cubes from a set of views (front, top, side)	3	LG	
8G.2 Transformation of shapes and preservation of properties				
8G.2(a) Identify lines of symmetry in plane figures, or recognize and classify types of symmetries of plane figures.	G8.9.1 Determine a transformation's line of symmetry and compare the properties of the figure and its transformation	3		
8G.2(c) Recognize or informally describe the effect of a transformation on two-dimensional geometric shapes (reflections across lines of symmetry, rotations, translations, magnifications, and contractions).	G(CGT)5.5 Draw and interpret the results of transformations and successive transformations on figures in the coordinate plane: • translations • reflections • rotations (90°, 180°, clockwise and counterclockwise about the origin) • dilations (scale factor)	2	HG	
8G.2(d) Predict results of combining, subdividing, and changing shapes of plane figures and solids (e.g., paper folding, tiling, and cutting up and rearranging pieces).	G7.9.2 Perform translations and reflections of two-dimensional figures using a variety of methods (paper folding, tracing, graph paper)	3	LG	
8G.2(e) Justify relationships of congruence and similarity, and apply these relationships using scaling and proportional reasoning.	G8.8.3 Determine appropriate application of geometric ideas and relationships such as congruence, similarity, and the Pythagorean theorem, with and without appropriate technology	2	IC	
8G.2(f) For similar figures, identify and use the relationships of conservation of angle and of proportionality of side length and perimeter.	G8.8.3 Determine appropriate application of geometric ideas and relationships such as congruence, similarity, and the Pythagorean theorem, with and without appropriate technology	2	IC	
8G.3 Relationships between geometric figures				
8G.3(b) Apply geometric properties and relationships in solving simple problems in two and three dimensions.		1		

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Geometry				
8G.3 Relationships between geometric figures				
8G.3(c) Represent problem situations with simple geometric models to solve mathematical or real-world problems.	G7.8.1 Identify, draw, classify, and compare geometric figures, using models and real-world examples	3	LG	
8G.3(d) Use the Pythagorean theorem to solve problems.	G8.8.3 Determine appropriate application of geometric ideas and relationships such as congruence, similarity, and the Pythagorean theorem, with and without appropriate M8.13.4 Find the distance between two points on a coordinate plane using the Pythagorean theorem	3		
8G.3(f) Describe or analyze simple properties of, or relationships between, triangles, quadrilaterals, and other polygonal plane figures.	G7.8.1 Identify, draw, classify, and compare geometric figures, using models and real-world examples	3	LG	
8G.3(g) Describe or analyze properties and relationships of parallel or intersecting lines.	G7.8.3 Recognize the pairs of angles formed and the relationship between the angles including two intersecting lines and parallel lines cut by a transversal (vertical, supplementary, complementary, corresponding, alternate interior, alternate exterior angles, and linear pair)	2	LG IC	
8G.4 Position, direction, and coordinate geometry				
8G.4(a) Describe relative positions of points and lines using the geometric ideas of midpoint, points on common line through a common point, parallelism, or perpendicularity.	G(CGT)5.1 Use coordinate geometry to find the distance between two points, the midpoint of a segment, and the slopes of parallel, perpendicular, horizontal, and vertical lines	2	HG	
8G.4(b) Describe the intersection of two or more geometric figures in the plane (e.g., intersection of a circle and a line).		1		
8G.4(c) Visualize or describe the cross section of a solid.		1		
8G.4(d) Represent geometric figures using rectangular coordinates on a plane.	G7.10.2 Plot points that form the vertices of a geometric figure and draw, identify, and classify the figure	3	LG	
8G.5 Mathematical reasoning in geometry				
8G.5(a) Make and test a geometric conjecture about regular polygons.		1		

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Data analysis, statistics, and probability				
8P.1 Data representation The following representations of data are indicated for each grade level. Objectives in which only a subset of these representations is applicable are indicated in the parentheses associated with the objective: histograms, line graphs, scatter plots, box plots, circle graphs, stem and leaf plots, frequency distributions, tables, and bar graphs.				
8P.1(a) Read or interpret data, including interpolating or extrapolating from data.	DAP8.14.3 Interpret or solve real-world problems using data from charts, line plots, stem-and-leaf plots, double-bar graphs, line graphs, box and whisker plots, scatter plots, frequency tables, or double line graphs	3		
8P.1(b) For a given set of data, complete a graph, and then solve a problem using the data in the graph (histograms, line graphs, scatter plots, circle graphs, and bar graphs).	DAP8.14.3 Interpret or solve real-world problems using data from charts, line plots, stem-and-leaf plots, double-bar graphs, line graphs, box and whisker plots, scatter plots, frequency tables, or double line graphs	2	IC	
8P.1(c) Solve problems by estimating and computing with data from a single set or across sets of data.		1		
8P.1(d) Given a graph or a set of data, determine whether information is represented effectively and appropriately (histograms, line graphs, scatter plots, circle graphs, and bar graphs).	DAP8.14.2 Explain which types of display are appropriate for various data sets (scatter plot for relationship between two variants and line of best fit) DAP8.14.3 Interpret or solve real-world problems using data from charts, line plots, stem-and-leaf plots, double-bar graphs, line graphs, box and whisker plots, scatter plots, frequency tables, or double line graphs	3		
8P.1(e) Compare and contrast the effectiveness of different representations of the same data.	DAP8.14.2 Explain which types of display are appropriate for various data sets (scatter plot for relationship between two variants and line of best fit)	2	IC	
8P.2 Characteristics of data sets				
8P.2(a) Calculate, use, or interpret mean, median, mode, or range.	DAP7.15.2 Analyze, with and without appropriate technology, a set of data by using and comparing measures of central tendencies (mean, median, mode) and measures of spread (range, quartile, interquartile range)	3	LG	
8P.2(b) Describe how mean, median, mode, range, or interquartile ranges relate to the shape of the distribution.		1		

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Data analysis, statistics, and probability				
8P.2 Characteristics of data sets				
8P.2(c) Identify outliers and determine their effect on mean, median, mode, or range.	DAP8.15.4 Describe how the inclusion of outliers affects those measures	3		
8P.2(d) Using appropriate statistical measures, compare two or more data sets describing the same characteristic for two different populations or subsets of the same population.		1		
8P.2(e) Visually choose the line that best fits given a scatter plot and informally explain the meaning of the line. Use the line to make predictions.	A(DIP)5.1 Construct and use scatter plots and line of best fit to make inferences in real-life situations	2	HG	
8P.3 Experiments and samples				
8P.3(a) Given a sample, identify possible sources of bias in sampling.		1		
8P.3(b) Distinguish between a random and nonrandom sample.		1		
8P.3(d) Evaluate the design of an experiment.	DAP8.17.2 Make predictions based on theoretical probabilities, design and conduct an experiment to test the predictions, compare actual results with predicted results, and explain differences. (E.g., suggested materials for simulations are: polyhedra die, random number table, and technology.)	2	IC	
8P.4 Probability				
8P.4(a) Analyze a situation that involves probability of an independent event.		1		
8P.4(b) Determine the theoretical probability of simple and compound events in familiar contexts.	DAP8.17.1 Compute, with and without appropriate technology, probabilities of compound events, using organized lists, tree diagrams, and logic grids DAP8.17.2 Make predictions based on theoretical probabilities, design and conduct an experiment to test the predictions, compare actual results with predicted results, and explain differences (E.g., suggested materials for simulations are: polyhedra die, random number table, and technology.)	3		

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Data analysis, statistics, and probability				
8P.4 Probability				
8P.4(c) Estimate the probability of simple and compound events through experimentation or simulation.	DAP8.17.1 Compute, with and without appropriate technology, probabilities of compound events, using organized lists, tree diagrams, and logic grids DAP8.17.2 Make predictions based on theoretical probabilities, design and conduct an experiment to test the predictions, compare actual results with predicted results, and explain differences (E.g., suggested materials for simulations are: polyhedra die, random number table, and technology.)	3		
8P.4(d) Use theoretical probability to evaluate or predict experimental outcomes.	DAP8.17.2 Make predictions based on theoretical probabilities, design and conduct an experiment to test the predictions, compare actual results with predicted results, and explain differences (E.g., suggested materials for simulations are: polyhedra die, random number table, and technology.)	2	IC	
8P.4(e) Determine the sample space for a given situation.	DAP5.17.2 List and explain all possible outcomes in a given situation	3	LG	
8P.4(f) Use a sample space to determine the probability of the possible outcomes of an event.	DAP8.17.1 Compute, with and without appropriate technology, probabilities of compound events, using organized lists, tree diagrams, and logic grids	3		
8P.4(g) Represent probability of a given outcome using fractions, decimals, and percents.	DAP7.17.1 Understand that probability can take any value between 0 and 1 (events that are not going to occur have probability 0; events certain to occur have probability 1)	2	LG IC	
8P.4(h) Determine the probability of independent and dependent events. (Dependent events should be limited to linear functions with a small sample size.)		1		
8P.4(j) Interpret probabilities within a given context.	DAP8.17.2 Make predictions based on theoretical probabilities, design and conduct an experiment to test the predictions, compare actual results with predicted results, and explain differences (E.g., Suggested materials for simulations are polyhedra die, random number table, and technology.)	2	IC	

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Algebra				
8A.1 Patterns, relations, and functions				
8A.1(a) Recognize, describe, or extend numerical and geometric patterns using tables, graphs, words, or symbols.	A8.4.1 Find the nth term in a pattern or a function table A8.4.2 Using real-world situations, describe patterns in words, tables, pictures, and symbolic representations	2	IC	
8A.1(b) Generalize a pattern appearing in a numerical sequence or table or graph using words or symbols.	A8.4.2 Using real-world situations, describe patterns in words, tables, pictures, and symbolic representations	2	IC	
8A.1(c) Analyze or create patterns, sequences, or linear functions given a rule.	A7.4.1 Create and complete a function table (input/output) using a given rule with two operations	3	LG	
8A.1(e) Identify functions as linear or nonlinear or contrast distinguishing properties of functions from tables, graphs, or equations.	A(DIP)5.7 Recognize linear functions and non-linear functions by using a table or a graph	2	HG	
8A.1(f) Interpret the meaning of slope or intercepts in linear functions.	A8.6.1 Describe, with and without appropriate technology, the relationship between the graph of a line and its equation, including being able to explain the meaning of slope as a constant rate of change (rise/run) and y-intercept in real-world problems	3		
8A.2 Algebraic representations				
8A.2(a) Translate between different representations of linear expressions using symbols, graphs, tables, diagrams, or written descriptions.		1		
8A.2(b) Analyze or interpret linear relationships expressed in symbols, graphs, tables, diagrams, or written descriptions.	A8.4.2 Using real-world situations, describe patterns in words, tables, pictures, and symbolic representations A8.4.4 Use tables, graphs, and equations to identify independent and dependent variables (input/output) A8.6.1 Describe, with and without appropriate technology, the relationship between the graph of a line and its equation, including being able to explain the meaning of slope as a constant rate of change (rise/run) and y-intercept in real-world problems	2	IC	
8A.2(c) Graph or interpret points that are represented by ordered pairs of numbers on a rectangular coordinate system.	A(LF)3.1 Distinguish between functions and non-functions/relations by inspecting graphs, ordered pairs, mapping diagrams, and/or tables of data	2	HG IC	

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Algebra				
8A.2 Algebraic representations				
8A.2(d) Solve problems involving coordinate pairs on the rectangular coordinate system.		1		
8A.2(f) Identify or represent functional relationships in meaningful contexts including proportional, linear, and common nonlinear (e.g., compound interest, bacterial growth) in tables, graphs, words, or symbols.	A8.6.1 Describe, with and without appropriate technology, the relationship between the graph of a line and its equation, including being able to explain the meaning of slope as a constant rate of change (rise/run) and y-intercept in real-world problems A8.6.4 Represent, with and without appropriate technology, simple exponential and/or quadratic functions, using verbal descriptions, tables, graphs, and formulas, and translate among these representations	2	IC	
8A.3 Variables, expressions, and operations				
8A.3(b) Write algebraic expressions, equations, or inequalities to represent a situation.	A(LA)1.2 Translate word phrases and sentences into expressions, equations, and inequalities, and vice versa	2	HG	
8A.3(c) Perform basic operations, using appropriate tools, on linear algebraic expressions (including grouping and order of multiple operations involving basic operations, exponents, roots, simplifying, and expanding).	A8.5.4 Write and evaluate algebraic expressions using rational numbers	2	MC	
8A.4 Equations and inequalities				
8A.4(a) Solve linear equations or inequalities (e.g., $ax + b = c$ or $ax + b = cx + d$ or $ax + b > c$).	A8.5.1 Solve and graph two-step equations and inequalities with one variable, and verify the reasonableness of the result with real-world application, with and without appropriate technology	3		
8A.4(b) Interpret "=" as an equivalence between two expressions and use this interpretation to solve problems.	NO8.2.1 Apply the addition, subtraction, multiplication, and division properties of equality to two-step equations	2	IC	
8A.4(c) Analyze situations or solve problems using linear equations and inequalities with rational coefficients symbolically or graphically (e.g., $ax + b = c$ or $ax + b = cx + d$).	A(SEI)2.1 Solve multistep equations and inequalities with rational coefficients: • numerically (from a table, or guess and check) • algebraically (including the use of manipulatives) • graphically • technologically	2	HG	

(CONTINUED)

TABLE B1 (CONTINUED)

Alignment of National Assessment of Educational Progress grade 8 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Algebra				
8A.4 Equations and inequalities				
8A.4(d) Interpret relationships between symbolic linear expressions and graphs of lines by identifying and computing slope and intercepts (e.g., know in y = ax + b, that a is the rate of change and b is the vertical intercept of the graph).	A8.6.1 Describe, with and without appropriate technology, the relationship between the graph of a line and its equation, including being able to explain the meaning of slope as a constant rate of change (rise/run) and y-intercept in real-world problems	3		
8A.4(e) Use and evaluate common formulas [e.g., relationship between a circle's circumference and diameter (C = pi d), distance and time under constant speed].	G(M)3.2 Apply, using appropriate units, appropriate formulas (area, perimeter, surface area, volume) to solve application problems involving polygons, prisms, pyramids, cones, cylinders, and spheres, as well as composite figures, expressing solutions in both exact and approximate forms	2	HG	The NAEP examples imply a higher level of understanding
8A.5 Mathematical reasoning in algebra				
8A.5(a) Make, validate, and justify conclusions and generalizations about linear relationships.	A8.6.1 Describe, with and without appropriate technology, the relationship between the graph of a line and its equation, including being able to explain the meaning of slope as a constant rate of change (rise/run) and y-intercept in real-world problems	2	IC	The NAEP assessment standard is very broad and unclear

a. Rating is based on a scale of 1 to 3, where 1 indicates that the ACTAAP assessment standard or standards do not address the NAEP assessment standard, 2 that the ACTAAP assessment standard or standards partially address the NAEP assessment standard, and 3 that the ACTAAP standard or standards fully address or exceed the NAEP assessment standard at the targeted grade level. A NAEP assessment standard is considered to be *fully addressed* by the ACTAAP assessment standard or standards if all of the content of the NAEP assessment standard is contained in one or more ACTAAP assessment standards at the same or lower grade level. A NAEP standard is considered to be *partially addressed* by the ACTAAP assessment standard or standards if the ACTAAP assessment standard or standards address only part of the NAEP assessment standard; the NAEP standard contains more content or more detailed content than the ACTAAP assessment standard or standards or the ACTAAP assessment standard or standards imply but do not explicitly state the content found in the NAEP assessment standard; there is a matching ACTAAP assessment standard at a higher grade level than the NAEP assessment standard; or there is a matching ACTAAP assessment standard or standards at a lower grade level than the NAEP assessment standard but it does not address all the content addressed by the NAEP assessment standard.

b. Codes: IC = implied content, LG = content covered at a lower grade level, HG = content covered at a higher grade level, MC = more content, MD = more detailed content.

Source: Expert content reviewers' analysis based on data from National Assessment Governing Board (2007) and Arkansas Department of Education (2007a,c,d,g,h).

TABLE B2

Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) grade 8 assessment standards not covered by the National Assessment Educational Progress (NAEP) grade 8 assessment standards, February 2008

ACTAAP strand	ACTAAP grade 8 assessment standards not covered by NAEP
Numbers and operations	NO8.3.4 Apply factorization to find least common multiple (LCM) and greatest common factor (GCF) of algebraic expressions. (E.g., $4x^2y^3$, $6xy^2$, GCF = $2xy^2$, LCM = $12x^2y^3$).
Algebra	A8.6.3 Differentiate between independent and dependent variables, given a linear relationship in context. A8.6.4 Represent, with and without appropriate technology, simple exponential and/or quadratic functions, using verbal descriptions, tables, graphs, and formulas, and translate among these representations.
Geometry	G8.10.1 Use coordinate geometry to explore the links between geometric and algebraic representations of problems (lengths of segments/distance between points, slope/perpendicular-parallel lines).
Measurement	M8.13.5 Estimate and compute the area of irregular two-dimensional shapes.
Data analysis and probability	DAP8.15.3 Given at least one of the measures of central tendency, create a data set.

Source: Arkansas Department of Education (2007c).

Appendix C
Details on the alignment of the National Assessment of Educational Progress grade 12 assessment standards and the Arkansas Comprehensive Testing, Assessment, and Accountability Program assessment standards

TABLE C1

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Number properties and operations				
12N.1 Number sense				
12N.1(d) Represent, interpret, or compare expressions for real numbers, including expressions utilizing exponents and logarithms.	A(LA)1.2 Translate word phrases and sentences into expressions, equations, and inequalities, and vice versa	2	IC	This Arkansas assessment standard does not specify logarithms
12N.1(f) Represent or interpret expressions involving very large or very small numbers in scientific notation.	A(LA)1.4 Solve problems involving scientific notation	3		
12N.1(g) Represent, interpret or compare expressions or problem situations involving absolute values.	A(SEI)2.4 Solve and graph simple absolute value equations and inequalities. (E.g., $\|x\| = 5$,$\|x\| \leq 5$,$\|x\| > 5$)	2	IC	
12N.1(i) Order or compare real numbers, including very large and very small real numbers.	NO8.1.1 Read, write, compare, and solve problems, with and without appropriate technology, including numbers less than one in scientific notation NO8.1.3 Compare and order real numbers, including irrational numbers, and find their approximate location on a number line (use technology when appropriate)	3	LG	
12N.2 Estimation				
12N.2(b) Identify situations where estimation is appropriate, determine the needed degree of accuracy, and analyze* the effect of the estimation method on the accuracy of results.		1		
12N.2(c) Verify solutions or determine the reasonableness of results in a variety of situations.	NO5.3.4 Develop and use strategies to estimate the results of whole number computations and to judge the reasonableness of such results	2	LG	
12N.2(d) Estimate square or cube roots of numbers less than 1,000 between two whole numbers.	NO8.1.3 Compare and order real numbers, including irrational numbers, and find their approximate location on a number line (use technology when appropriate)	2	LG IC	
12N.3 Number operations				
12N.3(a) Find integral or simple fractional powers of real numbers.	A(LA)1.3 Apply the laws of (integral) exponents	2	MC	This Arkansas assessment standard does not include fractional powers

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Number properties and operations				
12N.3 Number operations				
12N.3(b) Perform arithmetic operations with real numbers, including common irrational numbers.	A(LA)1.8 Simplify radical expressions such as $3/\sqrt{7}$	2	MC	
12N.3(c) Perform arithmetic operations with expressions involving absolute value.	A(SEI)2.4 Solve and graph simple absolute value equations and inequalities. (E.g., $\|x\| = 5$,$\|x\| \leq 5$,$\|x\| > 5$)	2	IC	
12N.3(d) Describe the effect of multiplying and dividing by numbers, including the effect of multiplying or dividing a real number by: • Zero, or • A number less than zero, or • A number between zero and one, or • One, or • A number greater than one.		1		
12N.3(f) Solve application problems involving numbers, including rational and common irrationals.	NO7.3.1 Compute, with and without appropriate technology, with integers and positive rational numbers, using real-world situations to solve problems NO7.3.5 Represent and solve problem situations that can be modeled by and solved using concepts of absolute value, exponents, and square roots (for perfect squares), with and without appropriate technology	2	LG MC	Arkansas assessment standard does not address irrationals (except for perfect squares)
12N.4 Ratios and proportional reasoning				
12N.4(c) Use proportions to solve problems (including rates of change).	A(SEI)2.5 Solve real-world problems that involve a combination of rates, proportions, and percents A(SEI)2.6 Solve problems involving direct variation and indirect (inverse) variation to model rates of change	3		
12N.4(d) Solve multi-step problems involving percentages, including compound percentages.	A(SEI)2.5 Solve real-world problems that involve a combination of rates, proportions, and percents	2	MD	This Arkansas assessment standard does not specify compound percentages
12N.5 Properties of numbers and operations				
12N.5(c) Solve problems using factors, multiples, or prime factorization.	NO7.3.4 Apply factorization, least common multiple (LCM), and greatest common factor (GCF) to solve problems using more than two numbers, and explain the solution	3	LG	

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Number properties and operations				
12N.5 Properties of numbers and operations				
12N.5(d) Use divisibility or remainders in problem settings.	NO5.2.1 Use divisibility rules to determine if a number is a factor of another number (2, 3, 5, 10) NO5.3.1 Develop and use a variety of algorithms, with computational fluency, to perform whole number operations using addition and subtraction (up to five-digit numbers), multiplication (up to three-digit by two-digit), and division (up to two-digit divisor), interpreting remainders, including real-world problems	2	LG	NAEP assessment standard does not seem to be a grade 12 skill
12N.5(e) Apply basic properties of operations, including conventions about the order of operations.	NO8.2.1 Apply the addition, subtraction, multiplication, and division properties of equality to two-step equations NO8.2.4 Apply rules (conventions) for order of operations to rational numbers	3	LG	
12N.5(f) Recognize properties of the number system—whole numbers, integers, rational numbers, real numbers, and complex numbers—recognize how they are related to each other, and identify examples of each type of number.	NO8.1.3 Compare and order real numbers, including irrational numbers, and find their approximate location on a number line (use technology when appropriate)	2	LG MC	Does not include complex numbers
12N.6 Mathematical reasoning using numbers				
12N.6(a) Give a mathematical argument to establish the validity of a simple numerical property or relationship.		1		
12N.6(b) * Analyze or interpret a proof by mathematical induction of a simple numerical relationship.	G(LG)1.1 Define, compare, and contrast inductive reasoning and deductive reasoning for making predictions based on real world situations: • Venn diagrams • matrix logic • conditional statements (statement, inverse, converse, and contrapositive)	2	IC	This Arkansas assessment standard does not specify numerical relationships
Measurement				
12M.1 Measuring physical attributes				
12M.1(b) Determine the effect of proportions and scaling on length, areas, and volume.	G(M)3.3 Relate changes in the measurement of one attribute of an object to changes in other attributes. (E.g., How does changing the radius or height of a cylinder affect its surface area or volume?) G(M)3.4 Use (given similar geometric objects) proportional reasoning to solve practical problems (including scale drawings)	3		

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Measurement				
12M.1 Measuring physical attributes				
12M.1(c) Estimate, or compare perimeters or areas of two-dimensional geometric figures.	G(M)3.2 Apply, using appropriate units, appropriate formulas (area, perimeter, surface area, volume) to solve application problems involving polygons, prisms, pyramids, cones, cylinders, and spheres, as well as composite figures, expressing solutions in both exact and approximate forms G(M)3.3 Relate changes in the measurement of one attribute of an object to changes in other attributes. (E.g., How does changing the radius or height of a cylinder affect its surface area or volume?)	3		
12M.1(d) Solve problems of angle measure, including those involving triangles or other polygons or parallel lines cut by a transversal.	G(R)4.2 Solve problems using properties of polygons: • sum of the measures of the interior angles of a polygon • interior and exterior angle measure of a regular polygon or irregular polygon • number of sides or angles of a polygon G(T)2.1 Apply congruence (SSS ...) and similarity (AA ...) correspondences and properties of figures to find missing parts of geometric figures and provide logical justification G(LG)1.4 Apply, with and without appropriate technology, definitions, theorems, properties, and postulates related to such topics as complementary, supplementary, vertical angles, linear pairs, and angles formed by perpendicular lines	3		
12M.1(f) Solve problems involving perimeter or area of plane figures, such as polygons, circles, or composite figures.	G(M)3.2 Apply, using appropriate units, appropriate formulas (area, perimeter, surface area, volume) to solve application problems involving polygons, prisms, pyramids, cones, cylinders, and spheres, as well as composite figures, expressing solutions in both exact and approximate forms	3		

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Measurement				
12M.1 Measuring physical attributes				
12M.1(h) Solve problems by determining, estimating, or comparing volumes or surface areas of three-dimensional figures.	G(M)3.2 Apply, using appropriate units, appropriate formulas (area, perimeter, surface area, volume) to solve application problems involving polygons, prisms, pyramids, cones, cylinders, and spheres, as well as composite figures, expressing solutions in both exact and approximate forms G(M)3.3 Relate changes in the measurement of one attribute of an object to changes in other attributes (E.g., How does changing the radius or height of a cylinder affect its surface area or volume?)	3		
12M.1(i) Solve problems involving rates, such as speed, density, population density, or flow rates.	A(LF)3.5 Interpret the rate of change/ slope and intercepts within the context of everyday life. E.g., telephone charges based on base rate (y-intercept) plus rate per minute (slope) A(SEI)2.6 Solve problems involving direct variation and indirect (inverse) variation to model rates of change	3		
12M.2 Systems of measurement				
12M.2(a) Recognize that geometric measurements (length, area, perimeter, and volume) depend on the choice of a unit, and apply such units in expressions, equations, and problem solutions.	G(M)3.2 Apply, using appropriate units, appropriate formulas (area, perimeter, surface area, volume) to solve application problems involving polygons, prisms, pyramids, cones, cylinders, and spheres, as well as composite figures, expressing solutions in both exact and approximate forms	3		
12M.2(b) Solve problems involving conversions within or between measurement systems, given the relationship between the units.	M8.12.2 Describe and apply equivalent measures using a variety of units within the same system of measurement	2	LG MC	This Arkansas assessment standard includes only measurements in the same measurement system
12M.2(d) Understand that numerical values associated with measurements of physical quantities are approximate, are subject to variation, and must be assigned units of measurement.	G(M)3.2 Apply, using appropriate units, appropriate formulas (area, perimeter, surface area, volume) to solve application problems involving polygons, prisms, pyramids, cones, cylinders, and spheres, as well as composite figures, expressing solutions in both exact and approximate forms	2	IC	

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Measurement				
12M.2 Systems of measurement				
12M.2(e) Determine appropriate accuracy of measurement in problem situations (e.g., the accuracy of measurement of the dimensions to obtain a specified accuracy of area) and find the measure to that degree of accuracy.	M8.13.1 Draw and apply measurement skills with fluency to appropriate levels of precision	2	LG MD	
12M.2(f) Construct or solve problems involving scale drawings.	G(M)3.4 Use (given similar geometric objects) proportional reasoning to solve practical problems (including scale drawings)	3		
12M.3 Measurement in triangles				
12M.3(a) Solve problems involving indirect measurement.	G(T)2.6 Use trigonometric ratios (sine, cosine, tangent) to determine lengths of sides and measures of angles in right triangles, including angles of elevation and angles of depression G(T)2.5 Use the special right triangle relationships (30°-60°-90° and 45°-45°-90°) to solve problems	2	IC	
12M.3(b) Solve problems using the fact that trigonometric ratios (sine, cosine, and tangent) stay constant in similar triangles.	G(T)2.6 Use trigonometric ratios (sine, cosine, tangent) to determine lengths of sides and measures of angles in right triangles, including angles of elevation and angles of depression	3		
12M.3(c) Use the definitions of sine, cosine, and tangent as ratios of sides in a right triangle to solve problems about length of sides and measure of angles.	G(T)2.6 Use trigonometric ratios (sine, cosine, tangent) to determine lengths of sides and measures of angles in right triangles, including angles of elevation and angles of depression	3		
12M.3(d) Interpret and use the identity $\sin^2 q + \cos^2 q = 1$ for angles q between 0° and 90°; recognize this identity as a special representation of the Pythagorean theorem.		1		
12M.3(e) * Determine the radian measure of an angle and explain how radian measurement is related to a circle of radius 1.		1		
12M.3(f) * Use trigonometric formulas such as addition and double angle formulas.		1		
12M.3(g) * Use the law of cosines and the law of sines to find unknown sides and angles of a triangle.		1		

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Geometry				
12G.1 Dimension and shape				
12G.1(c) Give precise mathematical descriptions or definitions of geometric shapes in the plane and in three-dimensional space.	G(LG)1.3 Describe relationships derived from geometric figures or figural patterns	2	MD	
12G.1(d) Draw or sketch from a written description plane figures and planar images of three-dimensional figures.	G(CGT)5.3 Determine, given a set of points, the type of figure based on its properties (parallelogram, isosceles triangle, trapezoid) G(R)4.7 Use orthographic drawings (top, front, side) and isometric drawings (corner) to represent three-dimensional objects	2	IC	
12G.1(e) Use two-dimensional representations of three-dimensional objects to visualize and solve problems.	G(R)4.7 Use orthographic drawings (top, front, side) and isometric drawings (corner) to represent three-dimensional objects	2	MC	This Arkansas assessment standard does not include solving problems from the representations
12G.1(f) Analyze properties of three-dimensional figures including spheres and hemispheres.	G(M)3.2 Apply, using appropriate units, appropriate formulas (area, perimeter, surface area, volume) to solve application problems involving polygons, prisms, pyramids, cones, cylinders, and spheres, as well as composite figures, expressing solutions in both exact and approximate forms	2	IC MC	
12G.2 Transformation of shapes and preservation of properties				
12G.2(a) Recognize or identify types of symmetries (e.g., point, line, rotational, self-congruence) of two- and three-dimensional figures.	G8.9.1 Determine a transformation's line of symmetry and compare the properties of the figure and its transformation G8.9.2 Draw the results of translations and reflections about the x- and y-axis and rotations of objects about the origin	2	LG MC	
12G.2(b) Give or recognize the precise mathematical relationship (e.g., congruence, similarity, orientation) between a figure and its image under a transformation.	G(CGT)5.5 Draw and interpret the results of transformations and successive transformations on figures in the coordinate plane: • translations • reflections • rotations (90°, 180°, clockwise and counterclockwise about the origin) • dilations (scale factor)	3		

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Geometry				
12G.2 Transformation of shapes and preservation of properties				
12G.2(c) Perform or describe the effect of a single transformation on two- and three-dimensional geometric shapes (reflections across lines of symmetry, rotations, translations, and dilations).	G(CGT)5.5 Draw and interpret the results of transformations and successive transformations on figures in the coordinate plane: • translations • reflections • rotations (90°, 180°, clockwise and counterclockwise about the origin) • dilations (scale factor)	2	MC	This Arkansas assessment standard does not include three dimensional shapes
12G.2(d) Identify transformations, combinations or subdivisions of shapes that preserve the area of two-dimensional figures or the volume of three-dimensional figures.	G(CGT)5.5 Draw and interpret the results of transformations and successive transformations on figures in the coordinate plane: • translations • reflections • rotations (90°, 180°, clockwise and counterclockwise about the origin) • dilations (scale factor)	2	MD	
12G.2(e) Justify relationships of congruence and similarity, and apply these relationships using scaling and proportional reasoning.	G(T)2.1 Apply congruence (SSS ...) and similarity (AA ...) correspondences and properties of figures to find missing parts of geometric figures and provide logical justification	3		
12G.2(g) Perform or describe the effects of successive transformations.	G(CGT)5.5 Draw and interpret the results of transformations and successive transformations on figures in the coordinate plane: • translations • reflections • rotations (90°, 180°, clockwise and counterclockwise about the origin) • dilations (scale factor)	3		
12G.3 Relationships between geometric figures				
12G.3(b) Apply geometric properties and relationships to solve problems in two and three dimensions.	G(M)3.2 Apply, using appropriate units, appropriate formulas (area, perimeter, surface area, volume) to solve application problems involving polygons, prisms, pyramids, cones, cylinders, and spheres, as well as composite figures, expressing solutions in both exact and approximate forms G(M)3.4 Use (given similar geometric objects) proportional reasoning to solve practical problems (including scale drawings)	2	IC	
12G.3(c) Represent problem situations with geometric models to solve mathematical or real world problems.	G(M)3.4 Use (given similar geometric objects) proportional reasoning to solve practical problems (including scale drawings)	2	MC	

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Geometry				
12G.3 Relationships between geometric figures				
12G.3(d) Use the Pythagorean theorem to solve problems in two- or three-dimensional situations.	G(T)2.4 Apply the Pythagorean Theorem and its converse in solving practical problems	2	MD	Arkansas assessment standards do not specify two or three dimensions
12G.3(e) Recall and interpret definitions and basic properties of congruent and similar triangles, circles, quadrilaterals, polygons, parallel, perpendicular, and intersecting lines, and associated angle relationships.	G(T)2.1 Apply congruence (SSS ...) and similarity (AA ...) correspondences and properties of figures to find missing parts of geometric figures and provide logical justification G(R)4.1 Explore and verify the properties of quadrilaterals G(R)4.2 Solve problems using properties of polygons: • sum of the measures of the interior angles of a polygon • interior and exterior angle measure of a regular polygon or irregular polygon • number of sides or angles of a polygon G(LG)1.4 Apply, with and without appropriate technology, definitions, theorems, properties, and postulates related to such topics as complementary, supplementary, vertical angles, linear pairs, and angles formed by perpendicular lines G(LG)1.5 Explore, with and without appropriate technology, the relationship between angles formed by two lines cut by a transversal to justify when lines are parallel	3		

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Geometry				
12G.3 Relationships between geometric figures				
12G.3(f) Analyze properties or relationships of triangles, quadrilaterals, and other polygonal plane figures.	G(LG)1.3 Describe relationships derived from geometric figures or figural patterns G(T)2.2 Investigate the measures of segments to determine the existence of triangles (triangle inequality theorem) G(T)2.1 Apply congruence (SSS ...) and similarity (AA ...) correspondences and properties of figures to find missing parts of geometric figures and provide logical justification G(T)2.3 Identify and use the special segments of triangles (altitude, median, angle bisector, perpendicular bisector, and midsegment) to solve problems G(R)4.1 Explore and verify the properties of quadrilaterals G(R)4.2 Solve problems using properties of polygons: • sum of the measures of the interior angles of a polygon • interior and exterior angle measure of a regular polygon or irregular polygon • number of sides or angles of a polygon	3		
12G.3(g) Analyze properties and relationships of parallel, perpendicular, or intersecting lines, including the angle relationships that arise in these cases.	G(LG)1.5 Explore, with and without appropriate technology, the relationship between angles formed by two lines cut by a transversal to justify when lines are parallel G(LG)1.4 Apply, with and without appropriate technology, definitions, theorems, properties, and postulates related to such topics as complementary, supplementary, vertical angles, linear pairs, and angles formed by perpendicular lines	3		
12G.3(h) Analyze properties of circles and the intersections of lines and circles (inscribed angles, central angles, tangents, secants, chords).	G(R)4.6 Solve problems using inscribed and circumscribed figures	2	MC	
12G.4 Position, direction, and coordinate geometry				
12G.4(a) Solve problems involving the coordinate plane, such as the distance between two points, the midpoint of a segment, or slopes of perpendicular or parallel lines.	G(CGT)5.1 Use coordinate geometry to find the distance between two points, the midpoint of a segment, and the slopes of parallel, perpendicular, horizontal, and vertical lines	3		

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Geometry				
12G.4 Position, direction, and coordinate geometry				
12G.4(b) Describe the intersections of lines in the plane and in space, intersections of a line and a plane, or of two planes in space.		1		
12G.4(c) Describe or identify conic sections and other cross sections of solids.		1		
12G.4(d) Represent two-dimensional figures algebraically using coordinates and/or equations.	G(CGT)5.3 Determine, given a set of points, the type of figure based on its properties (parallelogram, isosceles triangle, trapezoid) G(CGT)5.4 Write, in standard form, the equation of a circle, given a graph on a coordinate plane or the center and radius of a circle	2	IC	
12G.4(e) * Use vectors to represent velocity and direction; multiply a vector by a scalar and add vectors both algebraically and graphically.		1		
12G.4(f) Find an equation of a circle given its center and radius and, given an equation of a circle, find its center and radius.	G(CGT)5.4 Write, in standard form, the equation of a circle, given a graph on a coordinate plane or the center and radius of a circle	2	MC	This Arkansas assessment standard does not include "given an equation of a circle, find its center and radius"
12G.4(g) *Graph ellipses and hyperbolas whose axes are parallel to the coordinate axes and demonstrate understanding of the relationship between their standard algebraic form and their graphical characteristics.		1		
12G.4(h) * Represent situations and solve problems involving polar coordinates.		1		
12G.5 Mathematical reasoning in geometry				
12G.5(a) Make, test, and validate geometric conjectures using a variety of methods including deductive reasoning and counterexamples.	G(LG)1.1 Define, compare, and contrast inductive reasoning and deductive reasoning for making predictions based on real world situations: • Venn diagrams • matrix logic • conditional statements (statement, inverse, converse, and contrapositive)	2	IC	

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Geometry				
12G.5 Mathematical reasoning in geometry				
12G.5(b) Determine the role of hypotheses, logical implications, and conclusion, in proofs of geometric theorems.	G(LG)1.1 Define, compare, and contrast inductive reasoning and deductive reasoning for making predictions based on real world situations: • Venn diagrams • matrix logic • conditional statements (statement, inverse, converse, and contrapositive)	2	IC MD	
12G.5(c) Analyze or explain a geometric argument by contradiction	G(LG)1.1 Define, compare, and contrast inductive reasoning and deductive reasoning for making predictions based on real world situations: • Venn diagrams • matrix logic • conditional statements (statement, inverse, converse, and contrapositive)	2	IC MD	
12G.5(d) Analyze or explain a geometric proof of the Pythagorean theorem.		1		
12G.5(e) Prove basic theorems about congruent and similar triangles and circles.	G(T)2.1 Apply congruence (SSS ...) and similarity (AA ...) correspondences and properties of figures to find missing parts of geometric figures and provide logical justification	2	MC	This Arkansas assessment standard does not include circles
Data analysis, statistics, and probability				
12P.1 Data representation				
The following representations of data are indicated for each grade level. Objectives in which only a subset of these representations is applicable are indicated in the parentheses associated with the objective: histograms, line graphs, scatterplots, box plots, bar graphs, circle graphs, stem and leaf plots, frequency distributions, and tables, including two-way tables.				
12P.1(a) Read or interpret graphical or tabular representations of data.	DAP8.14.3 Interpret or solve real-world problems using data from charts, line plots, stem-and-leaf plots, double-bar graphs, line graphs, box and whisker plots, scatter plots, frequency tables, or double line graphs	3	LG	
12P.1(b) For a given set of data, complete a graph and solve a problem using the data in the graph (histograms, scatterplots, line graphs).	DAP7.14.3 Construct and interpret circle graphs, box-and-whisker plots, histograms, scatterplots, and double-line graphs, with and without appropriate technology DAP8.14.3 Interpret or solve real-world problems using data from charts, line plots, stem-and-leaf plots, double-bar graphs, line graphs, box and whisker plots, scatter plots, frequency tables, or double line graphs	3	LG	

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Data analysis, statistics, and probability				
12P.1 Data representation				
12P.1(c) Solve problems involving univariate or bivariate data.	DAP8.14.2 Explain which types of display are appropriate for various data sets (scatter plot for relationship between two variants and line of best fit) DAP8.14.3 Interpret or solve real-world problems using data from charts, line plots, stem-and-leaf plots, double-bar graphs, line graphs, box and whisker plots, scatter plots, frequency tables, or double line graphs	3	LG	
12P.1(d) Given a graphical or tabular representation of a set of data, determine whether information is represented effectively and appropriately.	DAP8.14.2 Explain which types of display are appropriate for various data sets (scatter plot for relationship between two variants and line of best fit)	3	LG	
12P.1(e) Compare and contrast different graphical representations of univariate and bivariate data.	DAP8.14.2 Explain which types of display are appropriate for various data sets (scatter plot for relationship between two variants and line of best fit)	2	LG IC	
12P.1(f) Organize and display data in a spreadsheet in order to recognize patterns and solve problems.	A(DIP)5.1 Construct and use scatter plots and line of best fit to make inferences in real-life situations	2	IC	
12P.2 Characteristics of data sets				
12P.2(a) Calculate, interpret, or use summary statistics for distributions of data including measures of typical value (mean, median), position (quartiles, percentiles), and spread (range, interquartile range, variance, standard deviation).	DAP7.15.2 Analyze, with and without appropriate technology, a set of data by using and comparing measures of central tendencies (mean, median, mode) and measures of spread (range, quartile, interquartile range)	3	LG	
12P.2(b) Recognize how linear transformations of one-variable data affect mean, median, mode, range, interquartile range, and standard deviation.	A(DIP)5.4 Determine the effects of changes in the data set on the measures of central tendency	2	MC	
12P.2(c) Determine the effect of outliers on mean, median, mode, range, interquartile range, or standard deviation.	A(DIP)5.4 Determine the effects of changes in the data set on the measures of central tendency	2	IC MC	This Arkansas assessment standard does not include range, interquartile range, and standard deviation

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Data analysis, statistics, and probability				
12P.2 Characteristics of data sets				
12P.2(d) Compare data sets using summary statistics (mean, median, mode, range, interquartile range, or standard deviation), describing the same characteristic for two different populations or subsets of the same population.		1		
12P.2(e) Approximate a trend line if a linear pattern is apparent in a scatterplot or use a graphing calculator to determine a least-squares regression line, and use the line or equation to make predictions.	A(DIP)5.1 Construct and use scatter plots and line of best fit to make inferences in real-life situations	2	MC	
12P.2(f) Recognize that the correlation coefficient is a number from –1 to +1 that measures the strength of the linear relationship between two variables; visually estimate the correlation coefficient (e.g., positive or negative, closer to 0, .5, or 1.0) of a scatterplot.		1		
12P.2(g) Know and interpret the key characteristics of a normal distribution such as shape, center (mean), and spread (standard deviation).		1		
12P.3 Experiments and samples				
12P.3(a) Identify possible sources of bias in sample surveys, and describe how such bias can be controlled and reduced.		1		
12P.3(b) Recognize and describe a method to select a simple random sample.		1		
12P.3(c) * Draw inferences from samples, such as estimates of proportions in a population, estimates of population means, or decisions about differences in means for two "treatments."		1		
12P.3(d) Identify or evaluate the characteristics of a good survey or of a well designed experiment.		1		
12P.3(e) * Recognize the differences in design and in conclusions between randomized experiments and observational studies.		1		

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Data analysis, statistics, and probability				
12P.4 Probability				
12P.4(a) Recognize whether two events are independent or dependent.	A(DIP)5.8 Compute simple probability with and without replacement	2	IC	
12P.4(b) Determine the theoretical probability of simple and compound events in familiar or unfamiliar contexts.	A(DIP)5.8 Compute simple probability with and without replacement	2	MC	
12P.4(c) Given the results of an experiment or simulation, estimate the probability of simple or compound events in familiar or unfamiliar contexts.	DAP8.17.2 Make predictions based on theoretical probabilities, design and conduct an experiment to test the predictions, compare actual results with predicted results, and explain differences. (E.g., suggested materials for simulations are: polyhedra die, random number table, and technology.)	3	LG	
12P.4(d) Use theoretical probability to evaluate or predict experimental outcomes.	DAP8.17.2 Make predictions based on theoretical probabilities, design and conduct an experiment to test the predictions, compare actual results with predicted results, and explain differences. (E.g., suggested materials for simulations are: polyhedra die, random number table, and technology.)	3	LG	
12P.4(e) Determine the number of ways an event can occur using tree diagrams, formulas for combinations and permutations, or other counting techniques.	DAP8.17.1 Compute, with and without appropriate technology, probabilities of compound events, using organized lists, tree diagrams, and logic grids DAP5.17.2 List and explain all possible outcomes in a given situation	3	LG	
12P.4(h) Determine the probability of independent and dependent events.	A(DIP)5.8 Compute simple probability with and without replacement	2	IC	
12P.4(i) Determine conditional probability using two-way tables.		1		
12P.4(j) Interpret and apply probability concepts to practical situations.	G(M)3.1 Calculate probabilities arising in geometric contexts. (E.g., find the probability of hitting a particular ring on a dartboard.)	2	MC	This Arkansas assessment standard addresses only geometric contexts
12P.4(k) *Use the binomial theorem to solve problems.		1		
12P.5 Mathematical reasoning with data				
12P.5(a) Identify misleading uses of data in real-world settings and critique different ways of presenting and using information.		1		

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Data analysis, statistics, and probability				
12P.5 Mathematical reasoning with data				
12P.5(b) Distinguish relevant from irrelevant information, identify missing information, and either find what is needed or make appropriate approximations.		1		
12P.5(c)* Recognize, use, and distinguish between the processes of mathematical (deterministic) and statistical modeling.		1		
12P.5(d) Recognize when arguments based on data confuse correlation with causation.		1		
12P.5(e) * Recognize and explain the potential errors caused by extrapolating from data.		1		
Algebra				
12A.1 Patterns, relations, and functions				
12A.1(a) Recognize, describe, or extend numerical patterns, including arithmetic and geometric progressions.	A(DIP)5.9 Recognize patterns using explicitly defined and recursively defined linear functions.	2	MC	
12A.1(b) Express linear and exponential functions in recursive and explicit form given a table, verbal description, or some terms of a sequence.	A(DIP)5.9 Recognize patterns using explicitly defined and recursively defined linear functions A(LF)3.3 Know and/or use function notation, including evaluating functions for given values in their domain	2	MC	
12A.1(e) Identify or analyze distinguishing properties of linear, quadratic, rational, exponential, or *trigonometric functions from tables, graphs, or equations.	A(NLF)4.2 Determine minimum, maximum, vertex, and zeros, given the graph A(NLF)4.4 Recognize function families and their connections including vertical shift and reflection over the x-axis: • quadratics • absolute value • exponential functions A(LF)3.9 Describe the effects of parameter changes, slope, and/or y-intercept on graphs of linear functions and vice versa	2	MC	These Arkansas assessment standards do not specify rational or trigonometric functions
12A.1(g) Determine whether a relation, given in verbal, symbolic, tabular, or graphical form, is a function.	A(LF)3.1 Distinguish between functions and nonfunctions/relations by inspecting graphs, ordered pairs, mapping diagrams, and/or tables of data	3		

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Algebra				
12A.1 Patterns, relations, and functions				
12A.1(h) Recognize and analyze the general forms of linear, quadratic, rational, exponential, or *trigonometric functions.	A(LF)3.9 Describe the effects of parameter changes, slope, and/or y-intercept on graphs of linear functions and vice versa A(NLF)4.4 Recognize function families and their connections including vertical shift and reflection over the x-axis: • quadratics • absolute value • exponential functions	2	MC	These Arkansas assessment standards do not specify rational or trigonometric functions
12A.1(i) Determine the domain and range of functions given in various forms and contexts.	A(LF)3.2 Determine domain and range of a relation from an algebraic expression, graphs, set of ordered pairs, or table of data	3		
12A.1(j) * Given a function, determine its inverse if it exists, and explain the contextual meaning of the inverse for a given situation.		1		
12A.2 Algebraic representations				
12A.2(a) Create and translate between different representations of algebraic expressions, equations, and inequalities (e.g., linear, quadratic, exponential, or *trigonometric) using symbols, graphs, tables, diagrams, or written descriptions.	A(LA)1.2 Translate word phrases and sentences into expressions, equations, and inequalities, and vice versa	2	MD	
12A.2(b) Analyze or interpret relationships expressed in symbols, graphs, tables, diagrams (including Venn diagrams), or written descriptions and evaluate the relative advantages or disadvantages of different representations to answer specific questions.	A(NLF)4.5 Communicate real-world problems graphically, algebraically, numerically, and verbally	2	IC MC	This Arkansas assessment standard does not include evaluating the advantages or disadvantages of different representations
12A.2(d) Perform or interpret transformations on the graphs of linear, quadratic, exponential, and *trigonometric functions.	A(LF)3.9 Describe the effects of parameter changes, slope, and/or y-intercept on graphs of linear functions and vice versa. A(NLF)4.4 Recognize function families and their connections including vertical shift and reflection over the x-axis: • quadratics • absolute value • exponential functions	2	MC	These Arkansas assessment standards include absolute value functions but not trigonometric functions

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Algebra				
12A.2 Algebraic representations				
12A.2(e) Make inferences or predictions using an algebraic model of a situation.	A(LF)3.5 Interpret the rate of change/ slope and intercepts within the context of everyday life. E.g., telephone charges based on base rate (y-intercept) plus rate per minute (slope)	2	IC	
12A.2(f) Given a real-world situation, determine if a linear, quadratic, rational, exponential, logarithmic, or *trigonometric function fits the situation.	A(LF)3.5 Interpret the rate of change/ slope and intercepts within the context of everyday life. E.g., telephone charges based on base rate (y-intercept) plus rate per minute (slope) A(NLF)4.5 Communicate real-world problems graphically, algebraically, numerically, and verbally	2	MD	
12A.2(g) Solve problems involving exponential growth and decay.		1		
12A.2(h) * Analyze properties of exponential, logarithmic, and rational functions.	A(NLF)4.4 Recognize function families and their connections including vertical shift and reflection over the x-axis: • quadratics • absolute value • exponential functions	2	MC	
12A.3 Variables, expressions, and operations				
12A.3(b) Write algebraic expressions, equations, or inequalities to represent a situation.	A(LA)1.2 Translate word phrases and sentences into expressions, equations, and inequalities, and vice versa. A(SEI)2.8 Communicate real-world problems graphically, algebraically, numerically, and verbally.	3		
12A.3(c) Perform basic operations, using appropriate tools, on algebraic expressions including polynomial and rational expressions.	A(LA)1.3 Apply the laws of (integral) exponents A(LA)1.5 Perform polynomial operations (addition, subtraction, multiplication) with and without manipulatives A(LA)1.8 Simplify radical expressions such as $3/\sqrt{7}$ A(NLF)4.1 Factoring polynomials: • greatest common factor • binomials (difference of squares) • trinomials	2	MC	These Arkansas assessment standards do not specify rational expressions

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Algebra				
12A.3 Variables, expressions, and operations				
12A.3(d) Write equivalent forms of algebraic expressions, equations, or inequalities to represent and explain mathematical relationships.	A(NLF)4.5 Communicate real-world problems graphically, algebraically, numerically, and verbally A(SEI)2.8 Communicate real-world problems graphically, algebraically, numerically, and verbally	3		Same Arkansas assessment standards statement was found under Solving Linear Functions strand [A(NLF)4.5], and Non Linear Function strand [A(SEI)2.8]
12A.3(e) Evaluate algebraic expressions, including polynomials and rational expressions.		1		
12A.3(f) Use function notation to evaluate a function at a specified point in its domain and combine functions by addition, subtraction, multiplication, division, and composition.	A(LF)3.3 Know and/or use function notation, including evaluating functions for given values in their domain	2	MC	This Arkansas assessment standard does not specify combining functions
12A.3(g) * Determine the sum of finite and infinite arithmetic and geometric series.		1		
12A.3(h) Use basic properties of exponents and *logarithms to solve problems.	A(LA)1.3 Apply the laws of (integral) exponents	2	MC	
12A.4 Equations and inequalities				
12A.4(a) Solve linear, rational or quadratic equations or inequalities, including those involving absolute value.	A(NLF)4.3 Solve quadratic equations using the appropriate methods with and without technology: • factoring • quadratic formula with real-number solutions A(SEI)2.1 Solve multistep equations and inequalities with rational coefficients: • numerically (from a table, or guess and check) • algebraically (including the use of manipulatives) • graphically • technologically A(SEI)2.4 Solve and graph simple absolute value equations and inequalities (E.g., $\|x\| = 5$,$\|x\| \leq 5$,$\|x\| > 5$)	2	MC	These Arkansas assessment standards do not address quadratic inequalities

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

NAEP assessment standards	Arkansas assessment standards	Overall rating[a]	Code[b]	Notes
Algebra				
12A.4 Equations and inequalities				
12A.4(c) Analyze situations, develop mathematical models, or solve problems using linear, quadratic, exponential, or logarithmic equations or inequalities symbolically or graphically.	A(SEI)2.1 Solve multistep equations and inequalities with rational coefficients: • numerically (from a table, or guess and check) • algebraically (including the use of manipulatives) • graphically • technologically A(NLF)4.3 Solve quadratic equations using the appropriate methods with and without technology: • factoring • quadratic formula with real-number solutions	2	MC	
12A.4(d) Solve (symbolically or graphically) a system of equations or inequalities and recognize the relationship between the analytical solution and graphical solution.	A(SEI)2.2 Solve systems of two linear equations: • numerically (from a table or guess and check) • algebraically (including the use of manipulatives) • graphically • technologically	2	MC	This Arkansas assessment standard does not include systems of inequalities
12A.4(e) Solve problems involving special formulas such as: $A = P(I + r)t$, $A = Pert$].		1		
12A.4(f) Solve an equation or formula involving several variables for one variable in terms of the others.	A(SEI)2.3 Solve linear formulas and literal equations for a specified variable (E.g., Solve for p in I = prt)	3		
12A.4(g) Solve quadratic equations with complex roots.		1		
12A.5 Mathematical reasoning in algebra				
12A.5(a) Use algebraic properties to develop a valid mathematical argument.		1		
12A.5(b) Determine the role of hypotheses, logical implications, and conclusions in algebraic argument.		1		
12A.5(c) Explain the use of relational conjunctions (and, or) in algebraic arguments.		1		

Note: NAEP grade 12 content statements marked with an asterisk (*) include content that is beyond what is usually taught in a standard three-year course of study and are selected less often for inclusion in NAEP than are other content statements (National Assessment Governing Board 2007).

a. Rating is based on a scale of 1 to 3, where 1 indicates that the ACTAAP assessment standard or standards do not address the NAEP assessment standard, 2 that the ACTAAP assessment standard or standards partially address the NAEP assessment standard, and 3 that the ACTAAP standard or standards fully

(CONTINUED)

TABLE C1 (CONTINUED)

Alignment of National Assessment of Educational Progress (NAEP) grade 12 mathematics and Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) assessment standards, February 2008

address or exceed the NAEP assessment standard at the targeted grade level. A NAEP assessment standard is considered to be *fully addressed* by the ACTAAP assessment standard or standards if all of the content of the NAEP assessment standard is contained in one or more ACTAAP assessment standards at the same or lower grade level. A NAEP standard is considered to be *partially addressed* by the ACTAAP assessment standard or standards if the ACTAAP assessment standard or standards address only part of the NAEP assessment standard; the NAEP standard contains more content or more detailed content than the ACTAAP assessment standard or standards, or the ACTAAP assessment standard or standards imply but do not explicitly state the content found in the NAEP assessment standard; or there is a matching ACTAAP assessment standard or standards at a lower grade level than the NAEP assessment standard but it does not address all the content addressed by the NAEP assessment standard.

b. Codes: IC = implied content, LG = content covered at a lower grade level, HG = content covered at a higher grade level, M C = more content, MD = more detailed content.

Source: Expert content reviewers' analysis based on data from National Assessment Governing Board (2007) and Arkansas Department of Education (2007a,c,d,f,h).

TABLE C2

Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP) algebra and geometry assessment standards not covered by the National Assessment of Educational Progress (NAEP) grade 12 assessment standards, February 2008

ACTAAP strand	ACTAAP algebra and geometry assessment standard not covered by NAEP
Linear functions	A(LF)3.6 Calculate the slope given: • two points • the graph of a line • the equation of a line
	A(LF)3.7 Determine, by using slope, whether a pair of lines are parallel, perpendicular, or neither
	A(LF)3.8 Write an equation in slope-intercept given: • two points • a point and *y*-intercept • *x*-intercept and *y*-intercept • a point and slope • a table of data • the graph of a line
Data interpretation and probability	A(DIP)5.2 Use simple matrices in addition, subtraction, and scalar multiplication
	A(DIP)5.3 Construct simple matrices for real-life situations
	A(DIP)5.5 Use two or more box-and-whisker plots to compare data sets
	A(DIP)5.7 Recognize linear functions and nonlinear functions by using a table or a graph
Coordinate geometry and transformations	G(CGT)5.2 Write equations of lines in slope-intercept form, and use slope to determine parallel and perpendicular lines

Source: Expert content reviewers' analysis based on data from Arkansas Department of Education (2007a,d).

References

Arkansas Department of Education. (2007a). *Arkansas Comprehensive Testing, Assessment, and Accountability Program released item booklet algebra end-of-course examination April 2007 administration.* Retrieved March 25, 2008, from http://www.arkansased.org/testing/benchmark_iowa.html.

Arkansas Department of Education. (2007b). *Arkansas Comprehensive Testing, Assessment, and Accountability Program released item booklet benchmark examination grade 4 April 2007 administration.* Retrieved March 25, 2008, from http://www.arkansased.org/testing/benchmark_iowa.html.

Arkansas Department of Education. (2007c). *Arkansas Comprehensive Testing, Assessment, and Accountability Program released item booklet benchmark examination grade 8 April 2007 administration.* Retrieved March 25, 2008, from http://www.arkansased.org/testing/benchmark_iowa.html.

Arkansas Department of Education. (2007d). *Arkansas Comprehensive Testing, Assessment, and Accountability Program released item booklet geometry end-of-course examination April 2007 administration.* Retrieved March 25, 2008, from http://www.arkansased.org/testing/benchmark_iowa.html.

Arkansas Department of Education. (2007e). *Arkansas Comprehensive Testing, Assessment, and Accountability Program released item booklet grade 3 April 2007 administration.* Retrieved March 25, 2008, from http://www.arkansased.org/testing/benchmark_iowa.html.

Arkansas Department of Education. (2007f). *Arkansas Comprehensive Testing, Assessment, and Accountability Program released item booklet grade 5 April 2007 administration.* Retrieved March 25, 2008, from http://www.arkansased.org/testing/benchmark_iowa.html.

Arkansas Department of Education. (2007g). *Arkansas Comprehensive Testing, Assessment, and Accountability Program released item booklet grade 6 April 2007 administration.* Retrieved March 25, 2008, from http://www.arkansased.org/testing/benchmark_iowa.html.

Arkansas Department of Education. (2007h). *Arkansas Comprehensive Testing, Assessment, and Accountability Program released item booklet grade 7 April 2007 administration.* Retrieved March 25, 2008, from http://www.arkansased.org/testing/benchmark_iowa.html.

Linn, R.L. (2005). *Fixing the NCLB accountability system* (CRESST Policy Brief 8). Los Angeles: University of California, Los Angeles, National Center for Research on Evaluation, Standards, and Student Testing.

Linn, R.L., Baker, E.L., and Herman, J.L. (2005, fall). Chickens come home to roost. *Newsletter of the National Center for Research on Evaluation, Standards, and Student Testing.* Los Angeles: University of California, Los Angeles.

National Assessment Governing Board. (2007). *Mathematics framework for 2009 National Assessment of Educational Progress, pre-publication edition*. Retrieved March 1, 2008, from http://www.nagb.org/frameworks/fw.html.

No Child Left Behind Act of 2001. (2002). Pub. L. 107–110. 115 Stat. 1425.

Timms, M., Schneider, S., Lee, C., and Rolfhus, E. (2007). *Aligning science assessment standards: Arkansas and the 2009 National Assessment of Educational Progress (NAEP)* (REL 2007–No. 19). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest. Retrieved December 15, 2007, from http://ies.ed.gov/ncee/edlabs/regions/southwest/pdf/REL_2007019_rev.pdf.

U.S. Department of Education, National Center for Education Statistics. (2007). *Mapping 2005 State Proficiency Standards onto the NAEP Scales* (NCES 2007-482). Washington, DC: U.S. Department of Education, National Center for Education Statistics.