

# **Minnesota Comprehensive Assessments - Series III (MCA-III)**

## **Mathematics Test Specifications for MCA-III, Grades 3–8 and 11**

Based on the Minnesota K-12 Academic Standards in  
Mathematics (2007 version)



November 2015

# MINNESOTA DEPARTMENT OF EDUCATION

## Mathematics Test Specifications for MCA-III, Grades 3–8 and 11

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# MCA-III MATHEMATICS TEST SPECIFICATIONS

## Introduction

Mathematics test specifications for grades 3–8 and 11 of the Minnesota Comprehensive Assessments Series III (MCA-III) are presented in this document. The reader is encouraged to read the introductory information carefully because many important concepts are presented, including the purposes of the MCA-III in Mathematics, a description of the cognitive levels and other information about the format of the test specifications.

## Purpose of the Minnesota Comprehensive Assessments

The purpose of Minnesota assessments is to measure Minnesota students' achievement with regard to the Minnesota Academic Standards. Assessment results can be used to inform curriculum decisions at the district and school level, inform instruction at the classroom level and demonstrate student academic progress from year to year.

The passage of the No Child Left Behind Act (2000)<sup>1</sup> required that students be assessed in grades 3–8 and high school. The *Minnesota K–12 Academic Standards in Mathematics* were adopted in 2003; the Minnesota Comprehensive Assessments-Series II assessed these standards. The 2006 Minnesota Legislature approved the 2006 Omnibus Education Policy Act (see Minn. Stat. § 120B.023, subd. 2b). This legislation required the revision of the state's academic standards in mathematics in the 2006–2007 school year. The legislation also required that beginning in the 2010–2011 school year, state mathematics tests given in grades 3–8 align with the revised 2007 academic standards in mathematics. In addition, the legislation also required that beginning in the 2013–2014 school year, state mathematics tests given in grade 11 align with the revised 2007 academic standards in mathematics. The revision to the standards was significant enough that a new series of the MCA assessments was necessary. Thus, the Mathematics MCA-III are aligned with the 2007 *Minnesota K–12 Academic Standards in Mathematics*.

## Purpose and Overview of the Test Specifications

The primary purpose of test specifications is to help test developers build a test that is consistent over time. The *Mathematics Test Specifications for MCA-III, Grades 3–8 and 11* is also meant to serve as a source of information about the test design for teachers and the general public. Test specifications do not indicate what should be taught; the Minnesota academic standards do. Test specifications do not indicate how students should be taught; the classroom teacher does. Test specifications indicate which strands, standards and benchmarks will be assessed on the test and in what proportions. In addition, test specifications provide the types of items to be included, number of items and distribution of cognitive levels. Test specifications also clarify, define and/or limit how test items will be written.

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<sup>1</sup> At the time of publication, the federal government was reviewing ESEA for changes and reauthorization. Information in this document is up to date based on time of publication. If changes are made to ESEA that affect this document, then this document will be revised accordingly in a timely manner.

As with any test, the MCA-III assess a sampling of student knowledge and do not test every standard or benchmark. There are standards and benchmarks that cannot be assessed with a standardized test. That does not mean that these skills should not be taught or assessed. Teachers need to instruct and assess their students on all of the academic standards. Standards and benchmarks that are not assessed on the MCA-III are indicated in this document with the phrase “Not assessed on the MCA-III.” In addition, not all assessable benchmarks will be included on every assessment and some benchmarks are embedded within the assessment of other benchmarks.

Panels consisting of members of the Minnesota Academic Standards Committee and classroom teachers were convened to develop the Mathematics MCA-III Test Specifications. Many of the classroom teachers were recommended to the Minnesota Department of Education (MDE) by various education organizations, school districts and other stakeholder groups.

## **Item Specifications**

Item specifications are provided for each assessed benchmark. The item specifications provide restrictions of numbers, notation, scales, context and item limitations/requirements. The item specifications also list symbols and vocabulary that may be used in items. This list is cumulative in nature. For example, symbols and vocabulary listed at grade 3 are eligible for use in all of the grades that follow (i.e., grades 4 through 8 and 11).

## **Item Specification Considerations**

There are broad item-development issues addressed during the development of test items. Each of the following issues is considered for all of the items developed for the Mathematics MCA-III.

1. Each item will be written to measure primarily one benchmark; however, other benchmarks may also be reflected in the item content.
2. Items will be appropriate for students in terms of grade-level difficulty, expected knowledge of grade-level mathematical vocabulary, life experiences and reading level.
3. At a given grade, items will range in difficulty from easy to challenging for the intended population.
4. Items will not disadvantage or disrespect any segment of the population with regard to age, gender, race, ethnicity, language, religion, socioeconomic status, disability or geographic region.
5. Items will be written to meet benchmark calculator requirements as specified in the academic standards and/or test specifications.
6. Each item will be written to clearly and unambiguously elicit the desired response.
7. For the Mathematics MCA-III, a reference sheet of appropriate formulas and conversions is provided to students in grades 5–11 for use during testing.
8. Items will be written according to the MDE *Guidelines for Test Construction*.
9. Advisory Panels will review items as specified in the MDE *Vendor Guide to Advisory Panels*.

10. Items will be written using principles of Universal Design (see the linguistic modification report from the US Department of Education LEP Partnership<sup>2</sup>). These principles include the following:
  - a. Use active voice rather than passive voice.
  - b. Avoid negation.
  - c. Avoid proper nouns.
  - d. Avoid using general language terms that have a special meaning in math contexts.
  - e. Reduce written context and be as universal as possible.
  - f. To the extent possible, write sentences that are simple and in standard word order.
11. A read-aloud of items is provided via built-in audio in the online assessment.

## Cognitive Complexity

Cognitive complexity refers to the cognitive demand associated with an item. The level of cognitive demand focuses on the type and level of thinking and reasoning required of the student on a particular item. Levels of cognitive complexity for MCA-III are based on Norman L. Webb's Depth of Knowledge<sup>3</sup> levels.

A Level 1 (recall) item requires the recall of information such as a fact, definition, term or simple procedure, as well as performing a simple algorithm or applying a formula. A well-defined and straight algorithmic procedure is considered to be at this level. A Level 1 item specifies the operation or method of solution and the student is required to carry it out.

A Level 2 (skill/concept) item calls for the engagement of some mental processing beyond a habitual response, with students required to make some decisions as to how to approach a problem or activity. Interpreting information from a simple graph and requiring reading information from the graph is a Level 2. An item that requires students to choose the operation or method of solution and then solve the problem is a Level 2. Level 2 items are often similar to examples used in textbooks.

Level 3 (strategic thinking) items require students to reason, plan or use evidence to solve the problem. In most instances, requiring students to explain their thinking is a Level 3. A Level 3 item may be solved using routine skills but the student is not cued or prompted as to which skills to use.

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<sup>2</sup> Abedi, J. & Sato, E. (2008). *Linguistic modification. Part I: Language factors in the assessment of English language learners: The theory and principles underlying the linguistic modification approach; Part II: A guide to linguistic modification: Increasing English language learner access to academic content*. Washington, DC: U.S. Department of Education: LEP Partnership. [View report online](http://www.ncela.us/files/rcd/BE024210/Linguistic_Modification.pdf) ([http://www.ncela.us/files/rcd/BE024210/Linguistic\\_Modification.pdf](http://www.ncela.us/files/rcd/BE024210/Linguistic_Modification.pdf)).

<sup>3</sup> Webb, N. L. *Alignment of science and mathematics standards and assessments in four states* (Research Monograph No. 18). Madison: University of Wisconsin – Madison, National Institute for Science Education, 1999.

Level 4 (extended thinking) items require complex reasoning, planning, developing and thinking, most likely over an extended period of time. Level 4 items are best assessed in the classroom, where the constraints of standardized testing are not a factor.

Using these cognitive complexity levels to categorize items ensures that the complexity of the test items matches the complexity of the content domain assessed. Based on the benchmarks included in the Mathematics MCA-III, Table 1 indicates the target proportion of test items at each cognitive level included in each test.

**Table 1.** Cognitive Level Target Minimum Distribution of Items

<b>Grades</b>	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>
3–8, 11	20%	30%	5%

### **Calculator Designation**

The Academic Standards committee identified several benchmarks across grades 3–8 that students should master without using a calculator. These benchmarks are identified in this document with the wording “using common algorithms.” Since the MCA-III are aligned with the Minnesota academic standards, the items assessing benchmarks identified as non-calculator will be assessed within a non-calculator segment.

For Grade 11, there are no non-calculator benchmarks. A calculator will be available for student use on all items of the Grade 11 MCA-III.

### **Test Design by Grade Level**

A variety of item types will be used on the Mathematics MCA-III, including multiple-choice (MC) items and technology-enhanced (TE) items. Technology-enhanced items may consist of the following types of responses: type-in (student will type numerical answers in a box), graphing (student will plot data to complete various mathematical displays), drag-and-drop (students will formulate, rather than select, a response using drag-and-drop response options) and hot-spot (students will select multiple correct responses or will mark locations on mathematical graphics and displays).

Table 2A indicates the number of operational items appearing on an online adaptive form of the Mathematics MCA-III for each grade level, as well as the range of items within a test form aligned to each strand for grades 3–8. Table 2B gives the same information for the paper accommodated Mathematics MCA-III.

**Table 2A.** Range of Items per Strand for Online Adaptive Mathematics MCA-III  
Grades 3–8 and 11

Grade	Number of Operational Items	Number & Operation	Algebra	Geometry & Measurement	Data Analysis & Probability
3	42	18–20	6–8	10–13	6–7
4	42	16–20	7–8	10–14	6–7
5	42	15–21	9–13	8–10	6–7
6	42	11–19	10–13	8–11	6–8
7	42	12–16	13–18	7–9	7–9
8	42	6–8	18–29	6–8	6–7
11	47	NA	21–24	13–15	8–13

**Table 2B.** Range of Items per Strand for Paper Accommodated Mathematics MCA-III  
Grades 3–8 and 11

Grade	Number of Operational Items	Number & Operation	Algebra	Geometry & Measurement	Data Analysis & Probability
3	50	20–24	8–10	10–13	6–8
4	50	18–22	8–10	12–15	6–8
5	50	18–22	10–14	8–10	6–8
6	50	14–19	12–16	10–12	6–8
7	50	12–16	16–20	8–10	8–10
8	50	6–8	24–30	8–10	6–8
11	56	NA	25–29	16–18	10–15

Table 3 indicates the type and number of items for the online adaptive Mathematics MCA. Table 4 indicates the type and number of items for the paper accommodated Mathematics MCA.

**Table 3.** Type and Number of Items for Online Adaptive Mathematics MCA-III Grades 3–8 and 11

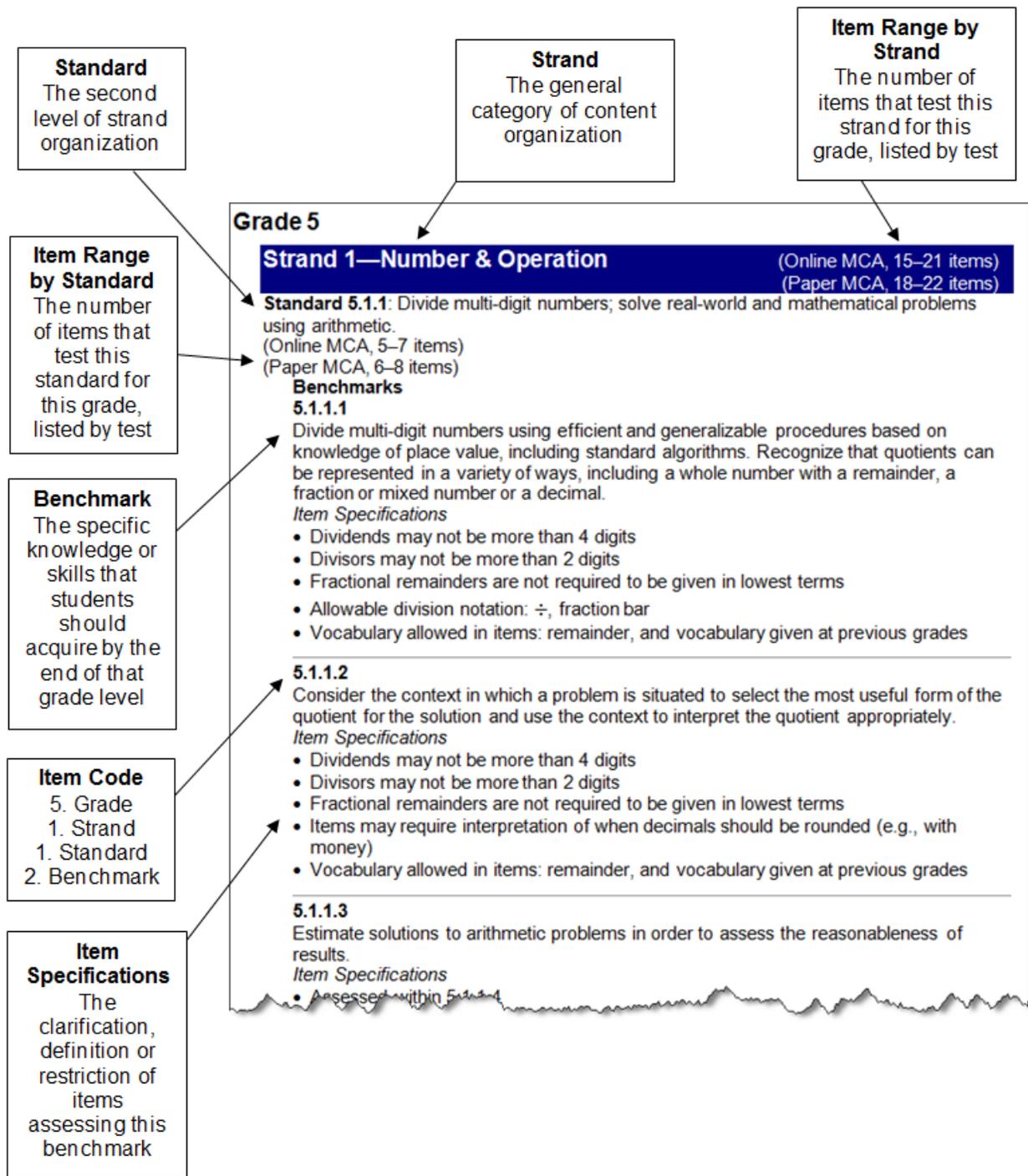
<b>Grade</b>	<b>MC Items (1 point)</b>	<b>Technology- Enhanced Items (1 point)</b>	<b>Total Items/Points</b>
3	32–40	2–10	42
4	32–40	2–10	42
5	32–40	2–10	42
6	32–40	2–10	42
7	32–40	2–10	42
8	32–40	2–10	42
11	40–45	2–7	47

**Table 4.** Type and Number of Items for Paper Accommodated Mathematics MCA-III Grades 3–8 and 11

<b>Grade</b>	<b>MC Items (1 point)</b>	<b>Fill-In Items (1 point)</b>	<b>Total Items/Points</b>
3	50	NA	50
4	50	NA	50
5	46–48	2–4	50
6	46–48	2–4	50
7	46–48	2–4	50
8	46–48	2–4	50
11	50–54	2–6	56

The minimum and maximum numbers of operational items by standard for the online adaptive and paper accommodated Mathematics MCA-III grades 3–8 and 11 are shown in Tables 5–11, located in Appendix A of this document.

# A Guide to Reading the Test Specifications



## **An Explanation of Terms Related to the Grade-Level Tables**

**Strand:** This is the most general categorization of content in the Minnesota Academic Standards.

**Standard:** Standards describe the expectations in mathematics that all students must satisfy to meet state requirements for credit.

**Benchmark:** The purpose of benchmarks is to provide details about "the academic knowledge and skills that schools must offer and students must achieve to satisfactorily complete" the standards (Minn. Stat. § 120B.023 (2006)). Benchmarks are intended to "inform and guide parents, teachers, school districts and other interested persons and for use in developing tests consistent with the benchmarks" (Minn. Stat. § 120B.023 (2006)). Each standard is divided into several benchmarks.

**Item Code:** Test developers use this code to identify the strand, standard and benchmark to which a test item is aligned.

**Item Specifications:** These statements provide more specific clarifications, definitions or restrictions for the benchmark as it is assessed on the MCA.

**Item Range by Strand:** This range is the possible number of items that will be on the operational form from a specific strand.

**Item Range by Standard:** This range is the total number of items measuring the standard that could be on the test for the indicated strand. For example, for the paper Grade 3 Mathematics, 20–24 items are from Strand 1. Of those 20–24 Strand 1 items, 5–7 items are from Standard 1 (3.1.1).