

**Minnesota Comprehensive  
Assessments-Modified  
(MCA-Modified)  
An Alternate Assessment Based on Modified  
Achievement Standards**

**DRAFT**  
**Test Specifications  
for Mathematics, Grade 11**

Based on the Minnesota K-12 Academic  
Standards in Mathematics, 2003



May 2011

# MINNESOTA DEPARTMENT OF EDUCATION

## MCA-Modified DRAFT Test Specifications for Mathematics, Grade 11

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Draft

# THE MATHEMATICS MINNESOTA COMPREHENSIVE ASSESSMENTS—MODIFIED (MCA-Modified), GRADE 11

## The MCA-Modified within the Minnesota Assessment System

The MCA-Modified is an alternate assessment based on modified achievement standards. It is an optional assessment that states may include in their assessment systems. It is described in the [Modified Academic Achievement Standards Non-Regulatory Guidance](#), July 20, 2007 ([www2.ed.gov/policy/speced/guid/nclb/twopercent.doc](http://www2.ed.gov/policy/speced/guid/nclb/twopercent.doc)). The MCA-Modified is an assessment designed to provide increased access to grade-level assessment tasks for students with disabilities. Minnesota has elected to provide the MCA-Modified in the subjects of mathematics and reading for students in grades 5-8 and high school.

With the addition of the MCA-Modified to the Minnesota Assessment System, students with disabilities have four options for mathematics and reading assessment which Individualized Education Program (IEP) teams may consider. These options are:

- The MCA without accommodations
- The MCA with allowable accommodations
- The MCA-Modified, an alternate assessment based on modified achievement standards
- The Minnesota Test of Academic Skills (MTAS), an alternate assessment based on alternate achievement standards

The MCA-Modified is intended to address the needs of some students for whom the MCA and the MTAS are not appropriate assessment choices. Students must meet eligibility requirements before IEP teams can consider the MCA-Modified as an option. Briefly, students are eligible to take the MCA-Modified if they:

- Have an IEP that includes goals based on grade-level standards (often referred to as a “standards-based IEP”)
- Have access to grade-level instruction

- Performed in the “Does Not Meet the Standards” achievement level on the MCAs for the two previous consecutive years, or have scored in the proficient range or above on the MTAS
- Are not expected to meet grade-level standards in the year for which the MCA-Modified is identified as the appropriate assessment

Refer to the *Alternate Assessment Eligibility Requirements* for a full discussion of the requirements, available in the Testing section of the [Minnesota Department of Education website](http://education.state.mn.us) (<http://education.state.mn.us>).

The Mathematics MCA-Modified assesses the **same** grade-level standards as the MCA. Thus, the grade-level tables that appear later in this document are identical to those found in the MCA test specifications with regard to the strands, sub-strands and benchmarks assessed. The MCA-Modified has fewer items than the MCA, and items are simplified to the extent possible while still meeting the benchmarks they assess.

## **Test Specifications**

The test specifications for the grade 11 Mathematics MCA-Modified are presented in this document. Draft test specifications for the grades 5–8 Mathematics MCA-Modified are combined with the test specifications for the grades 3–8 MCA-III and can be found in the *DRAFT Mathematics Test Specifications for MCA-III, Grades 3–8 and MCA-Modified, Grades 5–8*.

Mathematics assessments in grades 5–8 are based on the 2007 revision of the Minnesota K–12 Academic Standards in Mathematics. Pending federal or state changes in legislation, the grade 11 assessment will continue to be based on the 2003 version of the academic standards through the 2012–2013 school year. The Minnesota Academic Standards can be obtained from the [Department of Education website](http://education.state.mn.us) (<http://education.state.mn.us>).

All tests, from off-the-shelf, norm-referenced tests to customized, standards-based tests like those given in Minnesota, have test specifications. The primary purpose of a set of test specifications is to help test developers build a test that stays consistent over time. Test specifications indicate which strands, sub-strands, standards and benchmarks will be assessed on the test and in what proportions. In addition, test specifications provide the number of items, the type of items to be

included and constraints on cognitive levels. Test specifications also clarify, define and/or limit how test items will be written to any given strand, sub-strand, standard or benchmark.

The test specifications presented in this document were developed over the course of many days by Minnesota teachers, many of whom were recommended by various education organizations, school districts and other stakeholder groups. The substantive parts of this document are true to their work. The department thanks these people for their hard work and continued involvement.

The test specifications achieve the goal of a technically sound test that respects teachers' concern for the time students spend taking tests. These test specifications have taken into account the grade and age of the students involved as well as various pedagogical concerns.

As with any test, the MCA-Modified is a sampling of student knowledge and does not test every standard or benchmark. There are standards and benchmarks that cannot be assessed with a written 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.

## **Cognitive Levels**

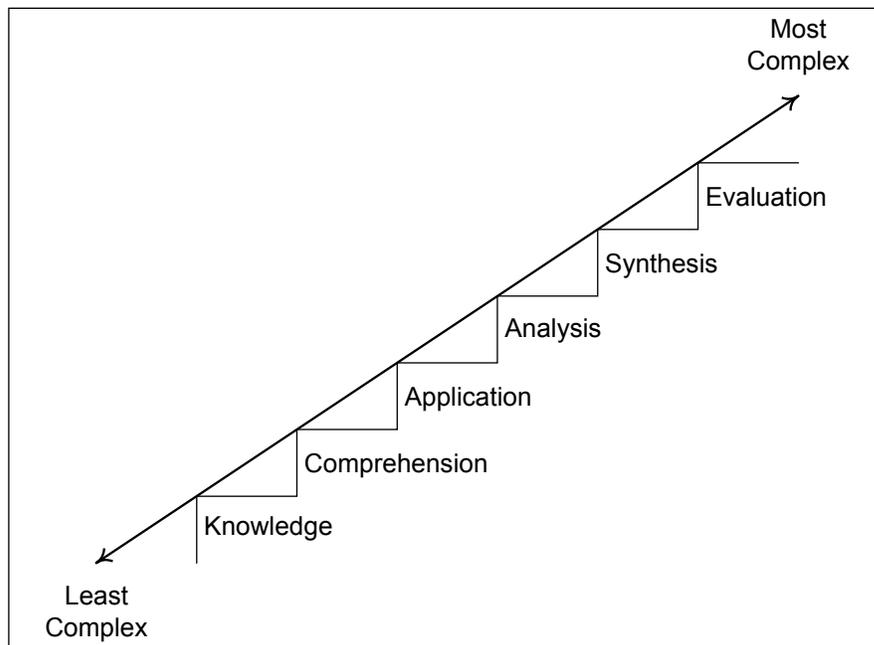
Using a taxonomy or framework to classify items and/or standards helps the test development process and helps teachers understand what students should learn, know and demonstrate at the end of instruction. One such taxonomy is that developed by Benjamin Bloom<sup>1</sup>.

Bloom developed a classification of the levels of intellectual behavior. His taxonomy contained three overlapping domains: cognitive, psychomotor and affective. Within the cognitive domain, Bloom identified six levels of complexity ranging from simple recall or recognition of facts to more complex and abstract mental levels. Bloom found that over 95 percent of the test questions he looked at require students to think only at the lowest level, recall of information.

The following figure depicts Bloom's six levels of cognitive complexity. This structure provides a basis for the cognitive levels used in the MCA-Modified.

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<sup>1</sup> Bloom, B., Englehart, M. Furst, E., Hill, W., & Krathwohl, D. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain*. New York, Toronto: Longmans, Green.



**Knowledge:** arrange, define, duplicate, label, list, memorize, name, order, recognize, relate, recall, repeat, reproduce and state.

**Comprehension (Understanding)<sup>2</sup>:** classify, describe, discuss, explain, express, identify, indicate, locate, report, restate, review, select and translate.

**Application:** apply, choose, demonstrate, dramatize, employ, illustrate, interpret, operate, practice, schedule, sketch, solve, use and write.

**Analysis:** analyze, appraise, calculate, categorize, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question and test.

**Synthesis:** arrange, assemble, collect, compose, construct, create, design, develop, formulate, manage, organize, plan, prepare, propose, set up and write.

**Evaluation:** appraise, argue, assess, attach, choose, compare, defend, estimate, judge, predict, rate, score, select, support, value and evaluate.

<sup>2</sup> These Item Specifications use *Understanding* in Level B instead of *Comprehension*. The term *comprehension* is a more global skill necessary at all cognitive levels of reading. *Understanding* is used to avoid confusion with the cognitive skill *comprehension* that is necessary for any level of reading.

The department uses this adaptation to align test items with academic standards. It also provides a familiar framework for understanding what students in Minnesota are expected to know and do in reading and mathematics upon the completion of a grade. Minnesota uses the following adaptation of Bloom's Taxonomy to classify both the academic standards and the items on the MCA-Modified.

**Cognitive Level A:** consists of Knowledge

**Cognitive Level B:** consists of Understanding

**Cognitive Level C:** consists of Application, Analysis, Synthesis and Evaluation

### **Design Modifications in the MCA-Modified**

The MCA-Modified assesses the same grade-level standards as the MCA-II or III, but the achievement expectations are less difficult than those on the MCA-II and III. The same content is covered in the MCA-Modified, but it has been altered to increase its accessibility. To meet the goal to design a test that is accessible yet challenging for the population of students whose disability has prevented them from attaining grade-level proficiency, several design modifications have been made.

- Numbers of items: The number of operational items within a form has been reduced while maintaining the proportion of content coverage across strands, sub-strands and standards.
- Item type: All items in the MCA-Modified are three-option, multiple-choice questions. In cases where a distractor was eliminated from an MCA-II four-choice, multiple-choice item for use in this assessment, the first criterion for elimination was to remove the distractor endorsed by the fewest students. In some items, developers used their judgment to apply a different selection process when warranted.
- Focused attention: Key words are presented in boldface in some items to help students identify the main task to be completed in the item.

## Item Development 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-Modified.

1. Each item is written to measure primarily one benchmark; however, other benchmarks may also be reflected in the item content.
2. Items are appropriate for students in terms of grade-level difficulty, expected knowledge of grade-level subject-area vocabulary, life experiences and reading level.
3. At a given grade, items range in difficulty from easy to challenging for the intended population.
4. Items do 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. Each item is written to clearly and unambiguously elicit the desired response.
6. Items in the MCA–Modified are multiple-choice, closed-stem items with three answer options.
7. Items are written using principles of Universal Design, including:
  - a. Language simplification<sup>3</sup>
    - i. Use high-frequency, familiar vocabulary and short word lengths.
    - ii. Use short, syntactically non-complex sentences in subject-verb-object order.
    - iii. Use simple, common verb tenses/moods (infinitive, present indicative, past, simple future); present tense is preferred. Use past participles as adjectives.
    - iv. Use active voice rather than passive voice.
    - v. Limit use of pronouns; ensure that referents are clear.
    - vi. Avoid idioms and colloquialisms.
    - vii. Avoid unnecessary words with multiple meanings.
    - viii. Avoid long noun and prepositional phrases.
    - ix. Avoid negation.

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<sup>3</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. [Paper available online](http://www.ncele.gwu.edu/files/uploads/11/abedi_sato.pdf) ([http://www.ncele.gwu.edu/files/uploads/11/abedi\\_sato.pdf](http://www.ncele.gwu.edu/files/uploads/11/abedi_sato.pdf)).

- b. Page and item layout
  - i. Incorporate white space into pages and screens.
  - ii. Use a single column format.
  - iii. Stack sentences in stimuli.
  - iv. Increase size of graphics.
  - v. Use simple, uncluttered graphics.
  - vi. Use uncomplicated art to support item context and meaning.
  - vii. Avoid scrolling in computer-delivered items and two-page layouts in paper forms
- 8. Key terms in item stems may be presented in boldface.
- 9. Items are written to meet benchmark calculator requirements as specified in the academic standards and/or test specifications.
- 10. Appropriate formulas and conversions are provided to students with items.
- 11. Items are written according to the MDE *Guidelines for Test Construction*.
- 12. Advisory panels review items as specified in the MDE *Vendor Guide to Advisory Panels*.
- 13. Items are reviewed for content characteristics, potential bias and any issues that may be of concern. Minnesota educators with experience and expertise in special education, mathematics and English as a second language at the appropriate grade levels review the items for each passage in terms of content, bias (gender, racial/ethnic, linguistic, religious, geographic, socioeconomic and issues related to individuals with disabilities) and psychometric data collected from field-testing.

### **Cognitive Levels in Mathematics**

Items for the MCA–Modified are written to assess three distinct cognitive levels: A, B and C (see Cognitive Levels section above). Using these cognitive 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–Modified, the targeted minimum ranges of items at each cognitive level for all grades are shown in Table 1.

**Table 1. Targeted minimum ranges of items (%) at cognitive levels A, B and C**

<b>Level A</b>	15–20%
<b>Level B</b>	20–30%
<b>Level C</b>	0–5%

### **Benchmarks Not Listed in the Test Specifications**

Table 2 lists the benchmarks from the *Minnesota K-12 Academic Standards* that are not included in these specifications. Some benchmarks are designated for assessment in the classroom only, and others are assessed within the context of other benchmarks.

**Table 2. Benchmarks/Standards not listed in the MCA-Modified test specifications**

<b>Benchmarks/Standards assessed within the context of other benchmarks</b>	<b>Benchmarks assessed in the classroom only</b>
I.1, I.2, I.3, I.4, I.5, I.6	
II.A	
II.B.1, II.B.3	II.B.2, II.B.4, II.B.5, II.B.6

### **Grade 11 Mathematics Test Design**

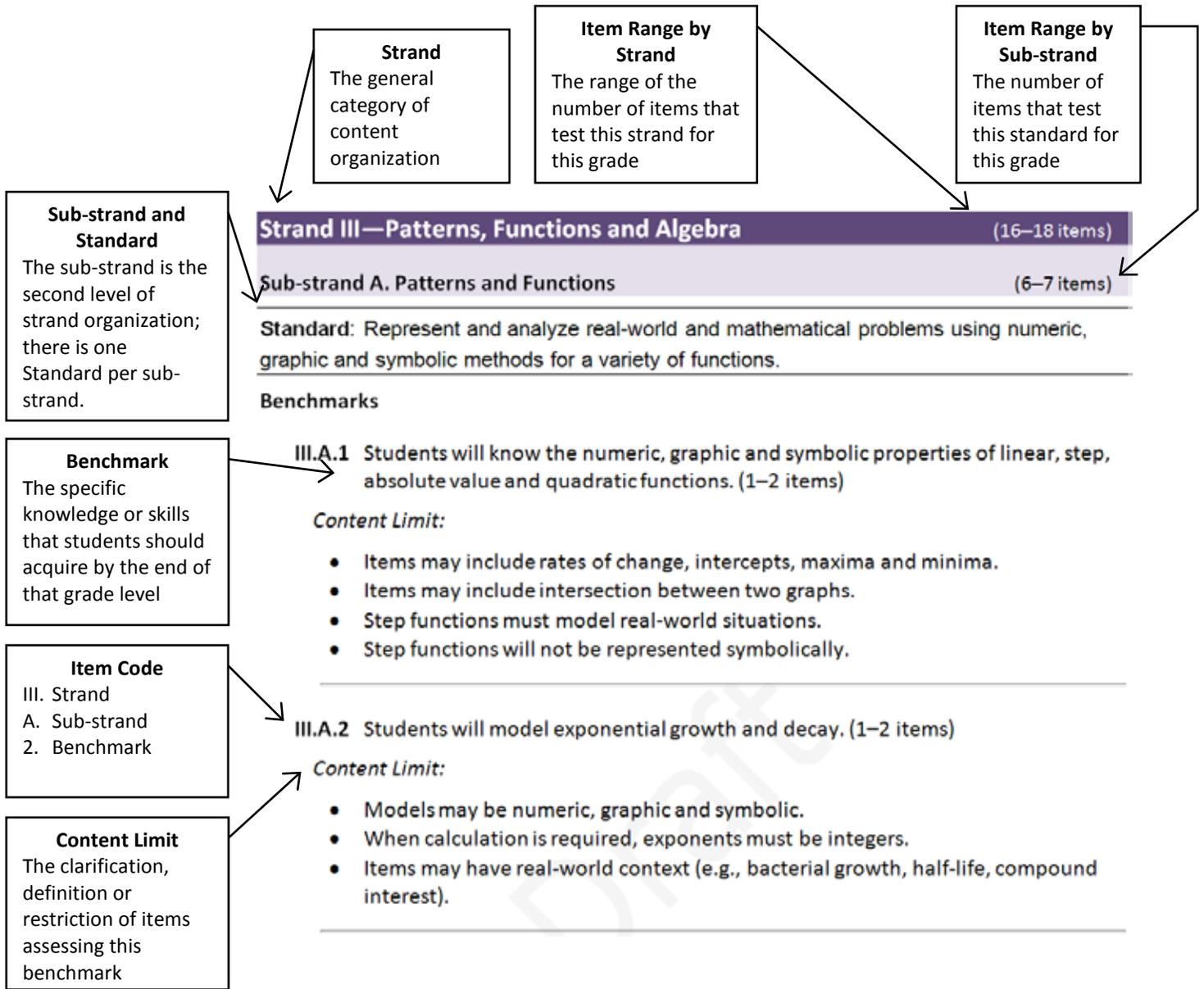
There are 40 operational items in the MCA-Modified. The range of numbers of operational items by benchmark is shown in Table 3. Items will be evenly distributed across benchmarks within a sub-strand to the extent possible. The MCA-Modified test specifications for grade 11 are aligned to the 2003 *Minnesota K–12 Academic Standards for Mathematics* and the MCA–II test specifications.

**Table 3. Grade 11 range of item counts by benchmark**

**Number of operational items in grade 11: 40**

<b>Sub-strand</b>	<b>Range of items per Sub-strand</b>	<b>Benchmarks</b>	<b>Range of Items per Benchmark</b>
III.A. Patterns & Functions	6–7	III.A.1	0–2
		III.A.2	0–2
		III.A.3	0–2
		III.A.4	0–2
		III.A.5	0–2
III.B. Algebra	10–11	III.B.1	0–2
		III.B.2	0–2
		III.B.3	0–2
		III.B.4	0–2
		III.B.5	0–2
		III.B.6	0–2
		III.B.7	0–2
		III.B.8	0–2
		III.B.9	0–1
		III.B.10	0–1
		III.B.11	0–2
		III.B.12	0–2
IV.A. Data & Statistics	7–8	IV.A.1	0–2
		IV.A.2	0–2
		IV.A.3	0–2
		IV.A.4	0–2
		IV.A.5	0–2
		IV.A.6	0–2
		IV.A.7	0–2
IV.B. Probability	6–7	IV.B.1	0–2
		IV.B.2	0–2
		IV.B.3	0–2
		IV.B.4	0–2
		IV.B.5	0–2
		IV.B.6	0–2
V.A. Spatial Sense	1–2	V.A.1	1–2
V.B. Geometry	7–8	V.B.1	0–2
		V.B.2	0–2
		V.B.3	1–3
		V.B.4	0–2
		V.B.5	0–2
		V.B.6	0–2
		V.B.7	0–1
		V.B.8	0–1
V.C. Measurement	1–2	V.C	1–2

# A Guide to Reading the Test Specifications



## An Explanation of Terms on the Mathematics Grade-Level Tables

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

**Sub-strand:** This is a subcategory of a strand in the *Minnesota K–12 Academic Standards (2003)*.

**Standard:** This statement explains the general goal of student learning within each sub-strand. One standard exists in each sub-strand.

**Benchmark:** Each standard is divided into several benchmarks. The benchmark identifies the specific knowledge or skills that students should acquire by the end of that grade level.

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

**Content Limit:** These statements provide more specific clarifications, definitions or restrictions for the benchmark as it is assessed on the MCA-Modified.

### Item Range

**By Strand:** This number is the range of the number of items measuring the strand that could be on the test. For example, in Grade 11 mathematics, there will be a minimum of 40 items on the operational test assessing Strands III, IV and V. Of those 40 items, 16 to 18 items will be from Strand III.

**By Sub-strand:** This number is the range of the number of items measuring the sub-strand that could be on the test. For example, in Grade 11 mathematics, Strand III has two sub-strands: A) Patterns and Functions and B) Algebra.

**By Benchmark:** The range of the number of items per benchmark on the operational MCA-Modified is listed next to each benchmark.

Grade-Level Tables: Grade 11

**Strand III—Patterns, Functions and Algebra (16–18 items)**

**Standard:** Represent and analyze real-world and mathematical problems using numeric, graphic and symbolic methods for a variety of functions.

**Benchmarks**

**III.A.1** Students will know the numeric, graphic and symbolic properties of linear, step, absolute value and quadratic functions. (0–2 items)

*Content Limit:*

- Items may include rates of change, intercepts, maxima and minima.
- Items may include intersection between two graphs.
- Step functions must model real-world situations.
- Step functions will not be represented symbolically.

**III.A.2** Students will model exponential growth and decay. (0–2 items)

*Content Limit:*

- Models may be numeric, graphic and symbolic.
- When calculation is required, exponents must be integers.
- Items may have real-world context (e.g., bacterial growth, half-life, compound interest).

**III.A.3** Students will analyze the effects of coefficient changes on linear and quadratic functions and their graphs. (0–2 items)

*Content Limit:*

- Changes to coefficients in  $ax^2 + bx + c$  are limited to  $a$  and  $c$ .

**III.A.4** Students will apply basic concepts of linear, quadratic and exponential expressions or equations in real-world problems. (0–2 items)

*Content Limit:*

- Exponents must be integers.

## Grade 11

**III.A.5** Students will distinguish functions from other relations using graphic and symbolic methods. (0–2 items)

*Content Limit:*

- Not more than 10 increments on either side of axes.

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**Standard:** Solve simple equations and inequalities numerically, graphically and symbolically. Use recursion to model and solve real-world and mathematical problems.

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### Benchmarks

**III.B.1** Students will translate among equivalent forms of expressions. (0–2 items)

*Content Limit:*

- Items may include simplifying algebraic expressions involving nested pairs of parentheses and brackets; simplifying rational expressions; factoring a common monomial term from an expression; applying associative, commutative and distributive laws.
- A simplified expression should contain at most four terms with at most two variables per term.

---

**III.B.2** Students will understand the relationship between absolute value and distance on the number line.

Students will graph simple expressions involving absolute value. (0–2 items)

*Content Limit:*

- At most one absolute value on each side of the equation or inequality.
- Absolute values will be in the form of  $|x-b| = c$ ;  $|x-b| < c$ ;  $|x-b| > c$ ;  $|x-b| \leq c$ ;  $|x-b| \geq c$  (e.g.,  $|x-3| = 6$  or  $|x+2| < 5$ ).

---

**III.B.3** Students will find equations of a line. (0–2 items)

*Content Limit:*

- Items will provide two points on the line, a point and the slope of the line or the slope and  $y$ -intercept of the line.
  - All answer options will be given in the same form within a MC item, either slope-intercept ( $y = mx + b$ ) or standard form ( $ax + by = c$ ).
-

## Grade 11

**III.B.4** Students will translate among equivalent forms of linear equations and inequalities. (0–2 items)

*Content Limit:*

- Translating may require simplification (e.g.,  $(2x + 2) + 2(x - 4) = y$  translates to  $y = 4x - 6$ ).
  - Equivalent forms may be slope-intercept, standard or two-point.
  - All answer options will be given in the same form within a MC item, either slope-intercept ( $y = mx + b$ ) or standard form ( $ax + by = c$ ).
- 

**III.B.5** Students will use a variety of models to represent functions and patterns in real-world and mathematical problems. (0–2 items)

*Content Limit:*

- Models may include equations, inequalities, algebraic formulas, written statements, tables, graphs or spreadsheets of linear, quadratic, exponential, absolute value and step functions.
  - Step functions must model real-world situations.
  - Step functions will not be represented symbolically.
- 

**III.B.6** Students will apply the laws of exponents to perform operations on expressions with integer exponents. (0–2 items)

*Content Limit:*

- A simplified expression should contain at most two variables.
  - Multiplication and division operations should only be performed on monomials.
  - Items may include scientific notation with appropriate treatment of significant digits.
- 

**III.B.7** Students will solve linear equations and inequalities in one variable with numeric, graphic and symbolic methods. (0–2 items)

*Content Limit:*

- Forms of the linear equations or inequalities are not limited (e.g.,  $4(x + 5) - 3x = 6(x + 10)$  is acceptable).
  - Items may include context.
-

## Grade 11

**III.B.8** Students will determine solutions to quadratic equations in one variable with numeric, graphic and symbolic methods. (0–2 items)

*Content Limit:*

- All solutions are real.
  - Solutions determined from a graph will be integer solutions.
  - Items may include context.
- 

**III.B.9** Students will use appropriate terminology and mathematical notation to define and represent recursion. (0–1 items)

*Content Limit:*

- $x_1$  is the initial term in the sequence  $x_{n+1}$  is the next term.
  - The term  $a_n$  is also included in appropriate terminology.
  - Items require only addition and multiplication to find the  $n^{\text{th}}$  term (arithmetic and geometric only).
  - III.B.9 and III.B.10 will not both have 0 items in the same administration.
- 

**III.B.10** Students will create and use recursive formulas to model and solve real-world and mathematical problems. (0–1 items)

*Content Limit:*

- Progressions are limited to arithmetic and geometric.
  - Items will not require identification past tenth term.
  - III.B.10 and III.B.9 will not both have 0 items in the same administration.
- 

**III.B.11** Students will solve systems of two linear equations and inequalities with 2 variables using numeric, graphic and symbolic methods. (0–2 items)

*Content Limit:*

- Inequalities will only be solved graphically.
  - Items may include context.
-

## Grade 11

**III.B.12** Students will understand how slopes can be used to determine whether lines are parallel or perpendicular and determine equations for parallel lines and perpendicular lines. (0–2 items)

*Content Limit:*

- Items may provide a line and a point not on that line.
- Items may require students to determine the equation of the line passing through a given point and parallel to a given line.
- Items may require students to determine the equation of the line passing through a given point and perpendicular to a given line.
- Items may include context.

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**Strand IV—Data Analysis, Statistics and Probability (13–15 items)**

**Sub-strand A. Data and Statistics (7-8items)**

**Standard:** Represent data and use various measures associated with data to draw conclusions and identify trends. Understand the effects of display distortion and measurement error on the interpretation of data.

**Benchmarks**

**IV.A.1** Students will analyze graphs and demonstrate understanding of the strengths and weaknesses of each format by choosing appropriately among them for a given situation. (0–2 items)

*Content Limit:*

- Items may contain circle graphs, bar graphs, histograms, box-and-whisker plots, scatter plots, tables and stem and leaf plots.
- Circle graphs may have at most eight sectors.
- Scales are in increments appropriate to the application.

**IV.A.2** Students will use measures of central tendency and variability to describe, compare and draw conclusions about sets of data. (0–2 items)

*Content Limit:*

- Measures may be mean, median, maximum, minimum, range, standard deviation, quartile, percentile, mode or interquartile range (IQR).

**IV.A.3** Students will determine approximate line of best-fit and use the line to draw conclusions. (0–2 items)

*Content Limit:*

- Items will provide a scatter plot (coordinates of points on scatter plot are integers) or data set.

## Grade 11

**IV.A.4** Students will know the influence of outliers on various measures and representations of data about real-world and mathematical problems. (0–2 items)

*Content Limit:*

- Items may require students to understand that the median is resistant to outliers.
  - Items may require students to understand that outliers affect the mean.
  - Given a mathematical definition, items may require students to verify that a data point is an outlier.
- 

**IV.A.5** Students will distinguish between correlation and causation. (0–2 items)

*Content Limit:*

- Items may provide several statements about correlation and causation of a situation and require the student to select the correct statement (e.g., high correlation does not guarantee causation).
  - Items will not require calculation of correlation coefficients.
- 

**IV.A.6** Students will interpret data credibility in the context of measurement error and display distortion. (0–2 items)

*Content Limit:*

- Items will assess either measurement error or display distortion, but not both in the same item.
  - Items may address the effect of sample size on measurement error.
- 

**IV.A.7** Students will compare outcomes of voting methods. (0–2 items)

*Content Limit:*

- Voting methods may include majority, plurality, ranked by preference, run-off and pair-wise comparison.

### **Strand IV, Sub-strand B. Probability (6–7 items)**

**Standard:** Use appropriate counting procedures, calculate probabilities in various ways and apply theoretical probability concepts to solve real-world and mathematical problems.

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## Grade 11

### Benchmarks

**IV.B.1** Students will select and apply appropriate counting procedures to solve real-world and mathematical problems. (0–2 items)

*Content Limit:*

- Items may involve computing probabilities.
  - Items may include combinations and permutations.
- 

**IV.B.2** Students will calculate probabilities and relate the results in real-world and mathematical problems. (0–2 items)

*Content Limit:*

- Items may use area, trees, unions and intersections to calculate probabilities.
  - Items may involve both the concept of mutually exclusive events or not mutually exclusive events.
  - Items may involve independent or dependent events.
  - Items may involve conditional probability.
- 

**IV.B.3** Students will use probability models in real-world and mathematical problems. (0–2 items)

*Content Limit:*

- Models may include area and binomial models.
  - Binomial probabilities will involve at most 4 events.
- 

**IV.B.4** Students will determine the expected values of random variables for simple probability models. (0–2 items)

*Content Limit:*

- Sample spaces will include at most four possible outcomes.
  - Probabilities for each outcome may be given or may have to be computed.
-

## Grade 11

**IV.B.5** Students will know the effect of sample size on experimental and simulation probabilities. (0–2 items)

*Content Limit:*

- Items may require the application of the Law of Large Numbers.
  - Items will not require the application of the Central Limit Theorem.
  - Items may require the interpretation of confidence intervals, but will not require the calculation of confidence intervals.
- 

**IV.B.6** Students will calculate probabilities. (0–2 items)

*Content Limit:*

- Items use a variety of experimental, simulation and theoretical methods.
- 

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**Strand V—Spatial Sense, Geometry and Measurement (9–12 items)****Strand V, Sub-strand A. Spatial Sense (1–2 items)**

**Standard:** Use models to represent and understand two- and three-dimensional shapes and how various motions affect them. Recognize the relationship between different representations of the same shape.

**Benchmarks**

- V.A.1** Students will use models and visualization to understand and represent various three-dimensional objects and their cross sections from different perspectives. (1–2 items)

*Content Limit:*

- Items are limited to top view, side view, front view or net.
- Shapes are limited to polyhedra, combinations of polyhedra, cylinders and cones.
- No figures will be oblique.
- All visible sides of views are clearly labeled.
- Prisms will have a base with at most six sides.
- Pyramids will have a base with at most six sides.
- Cross sections are limited to rectangular prisms, cones, cylinders, rectangular pyramids and triangular pyramids.

**Strand V, Sub-strand B. Geometry (7–8 items)**

**Standard:** Apply basic theorems of plane geometry, right triangle trigonometry, coordinate geometry and a variety of visualization tools to solve real-world and mathematical problems.

**Benchmarks**

- V.B.1** Students will know and use theorems about triangles and parallel lines in elementary geometry to justify facts about various geometrical figures and solve real-world and mathematical problems. (0–2 items)

*Content Limit:*

- Theorems may include criteria for two triangles to be congruent or similar.
- Theorems may include facts about angles formed by parallel lines cut by a transversal.
- Items may involve the application of these theorems to solve real-world and mathematical problems involving other plane figures.

## Grade 11

**V.B.2** Students will know and use theorems about circles to justify geometrical facts and solve real-world and mathematical problems. (0–2 items)

*Content Limit:*

- Theorems may include the relationship involving tangent lines and radii.
  - Theorems may include the relationship between inscribed and central angles.
  - Theorems may include the relationship between the measure of the central angle and the length of the related arc.
  - Items may involve the application of these theorems to solve real-world and mathematical problems.
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**V.B.3** Students will use properties of two- and three-dimensional figures to solve real-world and mathematical problems. (1–3 items)

*Content Limit:*

- Use 3.14 as an approximation for  $\pi$ .
  - Situations may include finding area, perimeter, volume and surface area.
  - Situations may include applying direct or indirect methods of measurement.
  - Situations may include applying the Pythagorean Theorem and its converse.
  - Situations may include properties of 45-45-90 and 30-60-90 triangles.
- 

**V.B.4** Students will apply the basic concepts of right triangle trigonometry to determine unknown sides or unknown angles when solving real-world and mathematical problems. (0–2 items)

*Content Limit:*

- Concepts may include sine, cosine and tangent.
  - Items will not require the use of the reciprocals or inverses of sine, cosine and tangent.
  - Items will provide a table of decimal approximations of three trigonometry values for each angle given in the item or students may use trigonometry values from a calculator.
- 

**V.B.5** Students will use coordinate geometry. (0–2 items)

*Content Limit:*

- Concepts may include distance between two points or midpoint of a line segment.
  - Concepts may include slope of a line, slopes of parallel lines or slopes of perpendicular lines.
-

## Grade 11

**V.B.6** Students will use numeric, graphic and symbolic representations of transformations to solve real-world and mathematical problems. (0–2 items)

*Content Limit:*

- Transformations may include rotations, reflections, translations and change of scale.
- 

**V.B.7** Students will perform basic constructions with a straightedge and compass. (0–1 items)

*Content Limit:*

- Items may require analysis or justification of the steps in a construction.
  - Items may provide construction diagrams for midpoint of a line segment, perpendicular bisector of a line segment, the perpendicular to a line through a point not on the line, the perpendicular to a line through a point on the line and angle bisector.
  - Constructions are best assessed in the classroom.
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**V.B.8** Students will draw accurate representations of planar figures using a variety of tools. (0–1 items)

*Content Limit:*

- This benchmark is best assessed in the classroom.
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**Standard:** Use the interconnectedness of geometry, algebra and measurement to explore real-world and mathematical problems.

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### Benchmarks

**V.C.** Students will demonstrate an understanding of the interconnectedness of geometry, algebra and measurement. (1–2 items)

*Content Limit:*

- Measurements will be provided with the item.
- Items may include context.