New York State Testing Program

Educator Guide to the 2022 Grades 3–8 Mathematics Tests

THE UNIVERSITY OF THE STATE OF NEW YORK

Regents of The University

LESTER W. YOUNG, JR., *Chancellor*, B.S., M.S., Ed.D. .	Beechhurst
JOSEPHINE VICTORIA FINN, *Vice Chancellor*, B.A., J.D.	Monticello
ROGER TILLES, B.A., J.D.	Manhasset
CHRISTINE D. CEA, B.A., M.A., Ph.D. .	Staten Island
WADE S. NORWOOD, B.A.	Rochester
KATHLEEN M. CASHIN, B.S., M.S., Ed.D.	Brooklyn
JAMES E. COTTRELL, B.S., M.D.	New York
JUDITH CHIN, B.S., M.S. in Ed.	Little Neck
BEVERLY L. OUDERKIRK, B.S. in Ed., M.S. in Ed.	Morristown
CATHERINE COLLINS, R.N., N.P., B.S., M.S. in Ed., Ed.D.	
NAN EILEEN MEAD, B.A., M.A.	Manhattan
ELIZABETH S. HAKANSON, A.S., B.A., M.S., C.A.S.	Syracuse
LUIS O. REYES, B.A., M.A., Ph.D.	New York
SUSAN W. MITTLER, B.S., M.S.	Ithaca
FRANCES G. WILLS, B.A., M.A., M.Ed., C.A.S., Ph.D	Ossining
RUTH B. TURNER, BSW, LCSW, M.Ed.	Rochester
ARAMINA VEGA FERRER, B.A., M.S. in Ed., Ph.D.	Bronx

Commissioner of Education and President of the University
BETTY A. ROSA, B.A., M.S. IN ED., M.S. IN ED., M.ED., ED.D.

Senior Deputy Commissioner, O f ce of Education Policy
JAMES N. BALDWIN

Deputy Commissioner, O f ce of P12 Instructional Services
KIMBERLY YOUNG WILKINS

Assistant Commissioner, O f ce of State Assessment
STEVEN E. KATZ

Director, O f ce of State Assessment
ZACHARY WARNER

Table of Contents

2022 Mathematics Tests 1

Learning Standards for Mathematics 2

Grade 3 2

Grade 4 2

Grade 5 3

Grade 6 4

Grade 7 5

Grade 8 6

Clusters, Standards, and Sequencing in Instruction and Assessment 8

Content Emphases 8

Cluster Emphases for Instruction and the 2022 Grades 3–8 Mathematics Tests 8

Emphasized Standards 8

Sequencing 9

Emphases and Sequencing 9

Grade 3 10

Grade 4 11

Grade 5 12

Grade 6 13

Grade 7 14

Grade 8 15

The 2022 Grades 3–8 Mathematics Tests 16

Testing Sessions 16

When Students Have Completed Their Tests 16

Test Design 17

2022 Grade 3 Test Design 17

2022 Mathematics Tests

New York State Educators Involvement in Test Development

While teachers have always been included in the Grades 3–8 Test Development Process, since 2016 NYSED has expanded the number of opportunities for New York State educators to become more involved. New York State educators provide the critical input necessary to ensure that the tests are fair, valid, and appropriate for students through their participation in many test development activities.

This process includes the review and approval of passages, the development of items for those passages, the construction of feld and operational test forms, rangefnding (setting scores for feld test constructed responses), fnal approval of test forms prior to administration, and the development of scoring materials. NYSED remains committed to improving the quality of the State's assessments and the experiences that students have taking these tests. For more information on opportunities to participate in the test development process, please visit the **Test Development Participation Opportunities website** (http://www.nysed.gov/state-assessment/test-development-participation-opportunities).

Option for Schools to Administer the MathemSof items for those p71FETEMC 542 48 573.5033000520044005333

1. Students generalize their understanding of place value to 1,000,000, understanding the relative sizes of numbers in each place. They apply their understanding of models for multiplication (equal-sized groups, arrays, area models), place value, and properties of operations (in particular the distributive property) as they develop, discuss, and use e f cient, accurate, and generalizable methods to compute products of multi-digit whole numbers. Depending on the numbers and the context, they select and accurately apply appropriate methods to estimate or mentally calculate products. They develop f uency with e f cient procedures for multiplying whole numbers, understand and explain why the procedures work based on place value and properties of operations, and use them to solve problems. Students apply their understanding of models for division, place value, properties of operations, and the relationship of division to multiplication as they develop, discuss, and use e f cient, accurate, and generalizable procedures to f nd quotients involving multi-digit dividends. They select and accurately apply appropriate methods to estimate and mentally calculate quotients, and interpret remainders based upon the context.
2. Students develop an understanding of fraction equivalence and operations with fractions. They recognize that two di f erent fractions can be equal (e.g., 15/9 = 5/3), and they develop methods for generating and recognizing equivalent fractions. Students extend previous understandings about

understand and explain why the procedures for multiplying and dividing finite decimals make sense. They compute products and quotients of decimals to hundredths efficiently and accurately.

3.

that it is a balance point. Students recognize that a measure of variability (interquartile range or mean

4. Students build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

Grade 8

In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; and (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

1. Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ($y/x = m$ or $y = mx$) as special linear equations ($y = mx + b$), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount $m \cdot A$. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and y-intercept) in terms of the situation.

   Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

2. Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

3. Students use ideas about distance and angles, how they behave under translations, rotations, reflections, dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

All the content at each grade level is connected to the Standards for Mathematical Practice. The 2022 Grades 3–8 Mathematics Tests will include questions that require students to connect mathematical content and mathematical practice.

For more information about Learning Standards and Standards for Mathematical Practice, please refer to the NYSED website (http://www.nysed.gov/curriculum-instruction)**.**

Clusters, Standards, and Sequencing in Instruction and Assessment

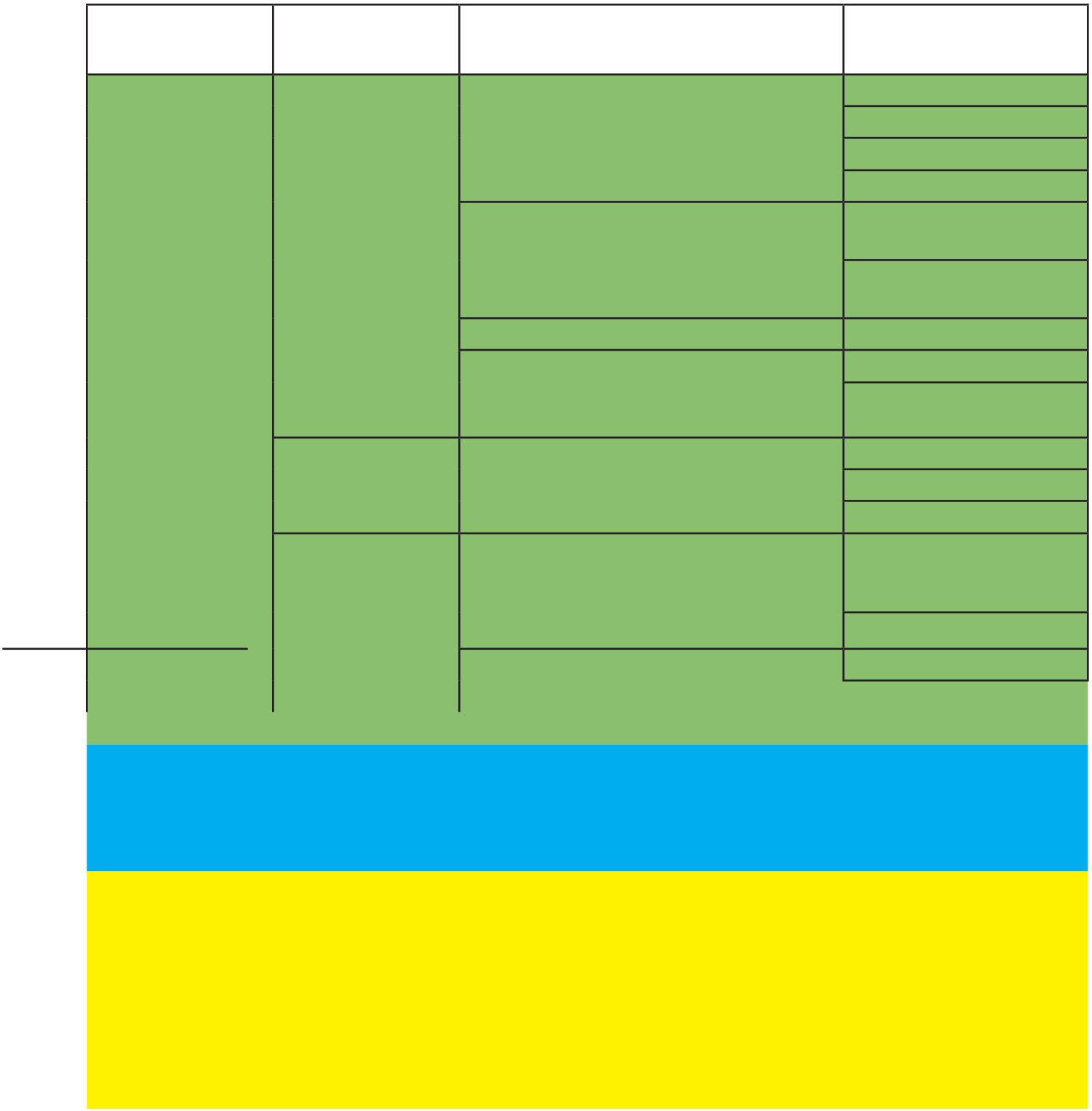
The 2022 Grades 3–8 Mathematics Tests will measure the New York State Learning Standards for Mathematics.

The Learning Standards for Mathematics are divided into *standards, clusters,* and *domains*.

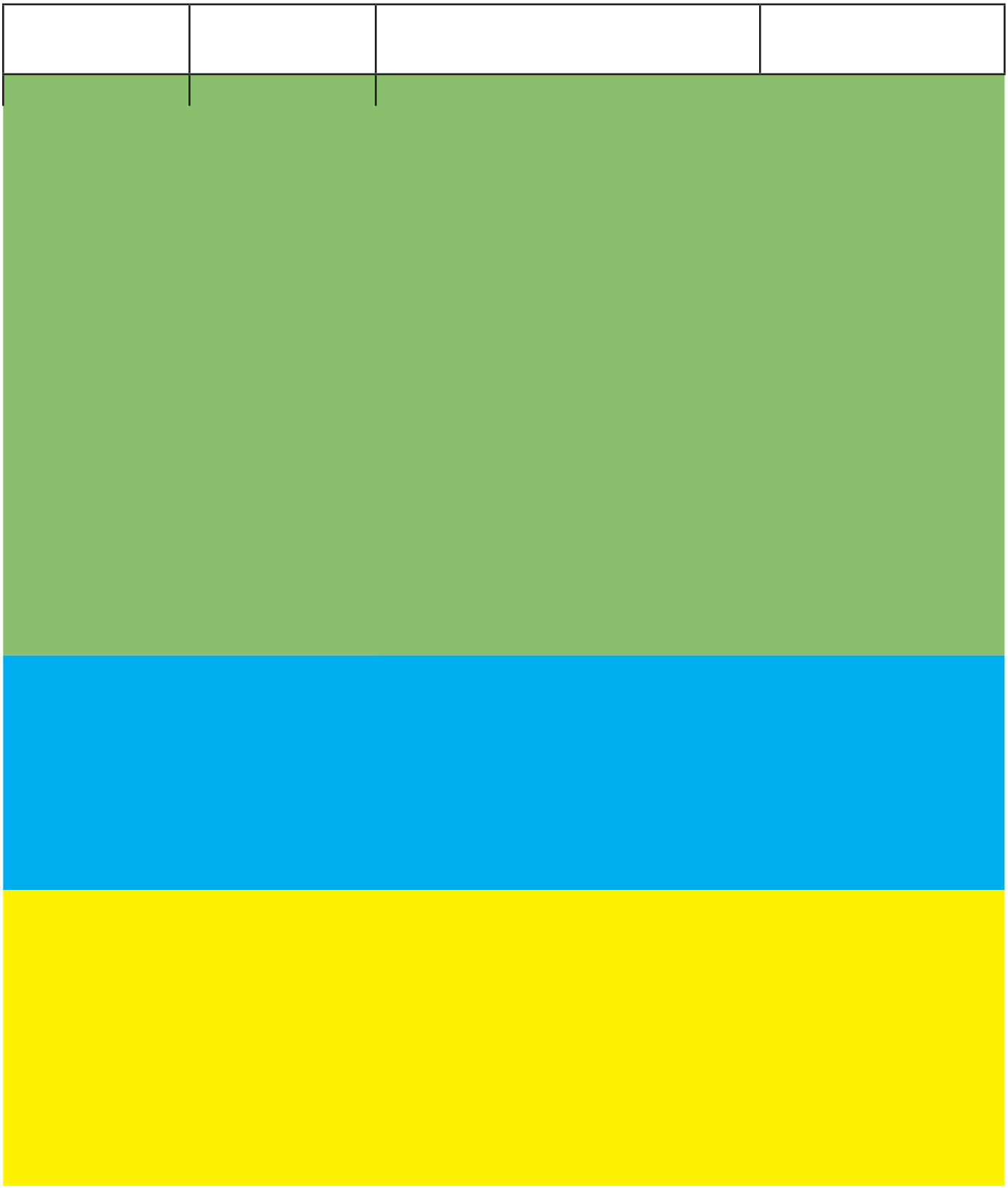
- *Standards* define what students should understand and be able to do. In some cases, *standards* are further articulated into lettered components.
- *Clusters* are groups of related *standards*. Note that *standards* from different *clusters* may sometimes be closely related, because mathematics is a connected subject.
- *Domains*

One example of a standard needing greater emphasis is 3.NF.3, “Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.” In the Number and Operations – Fractions

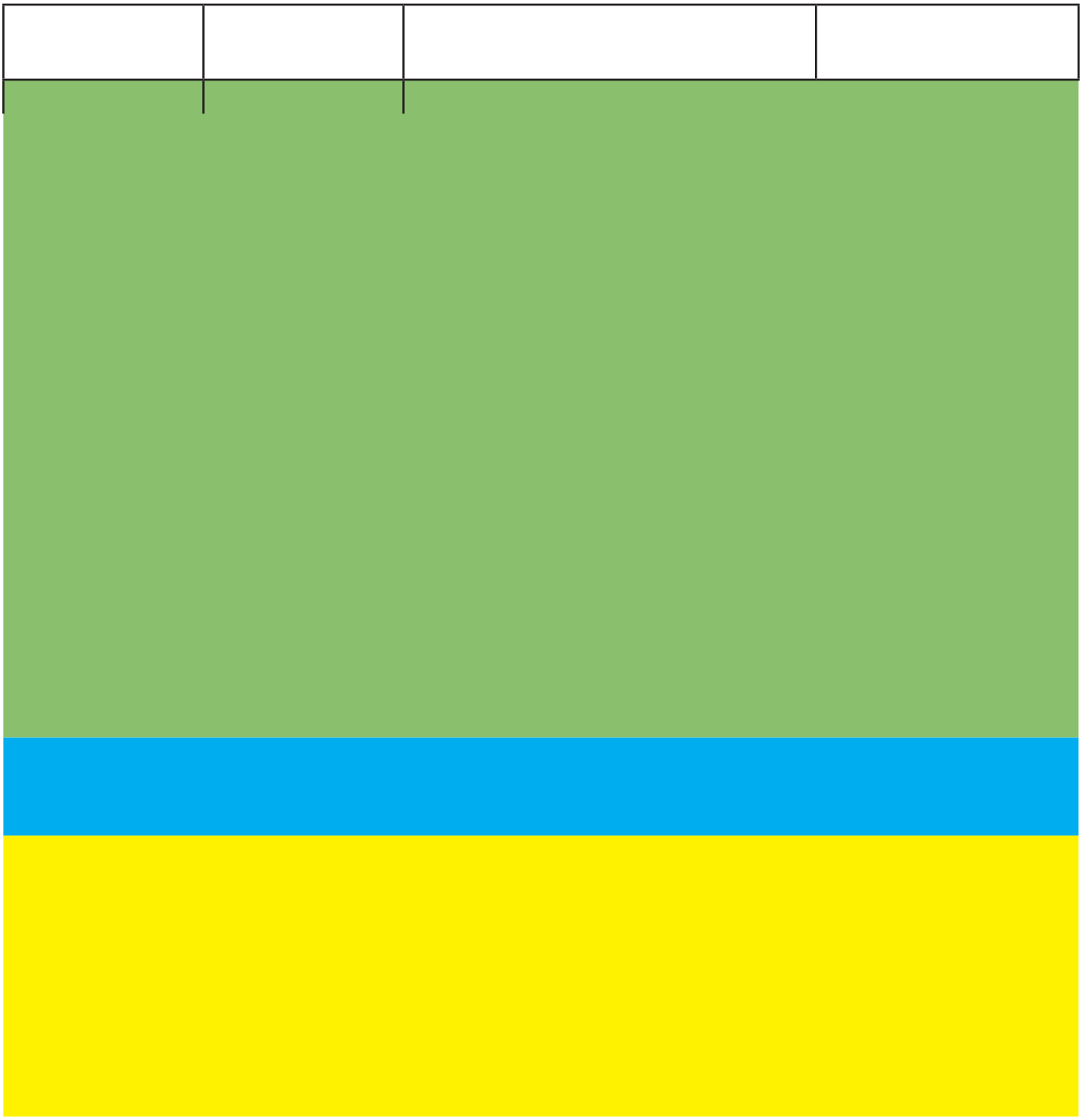
Grade 3



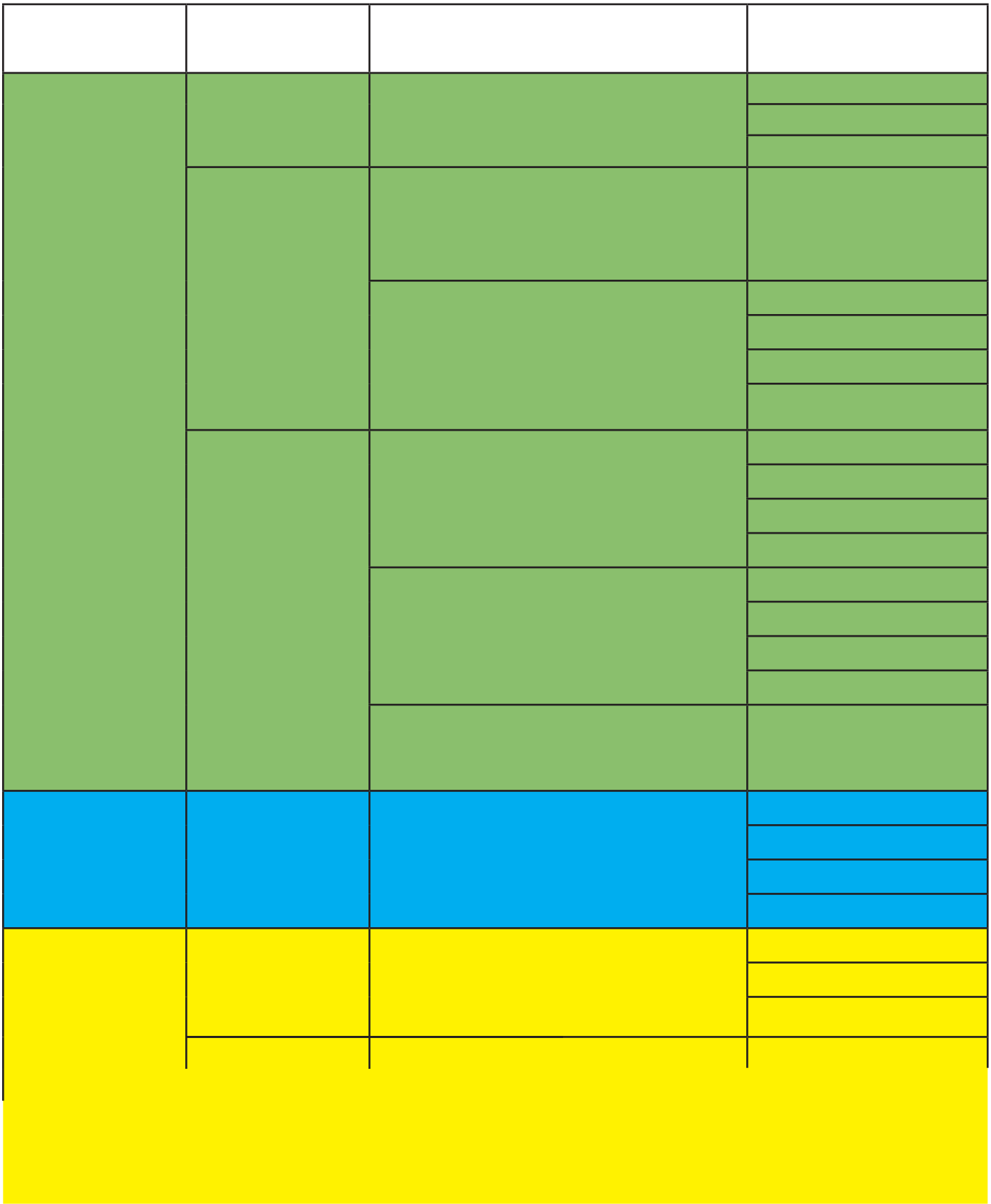
Grade 4



Grade 5



Grade 6



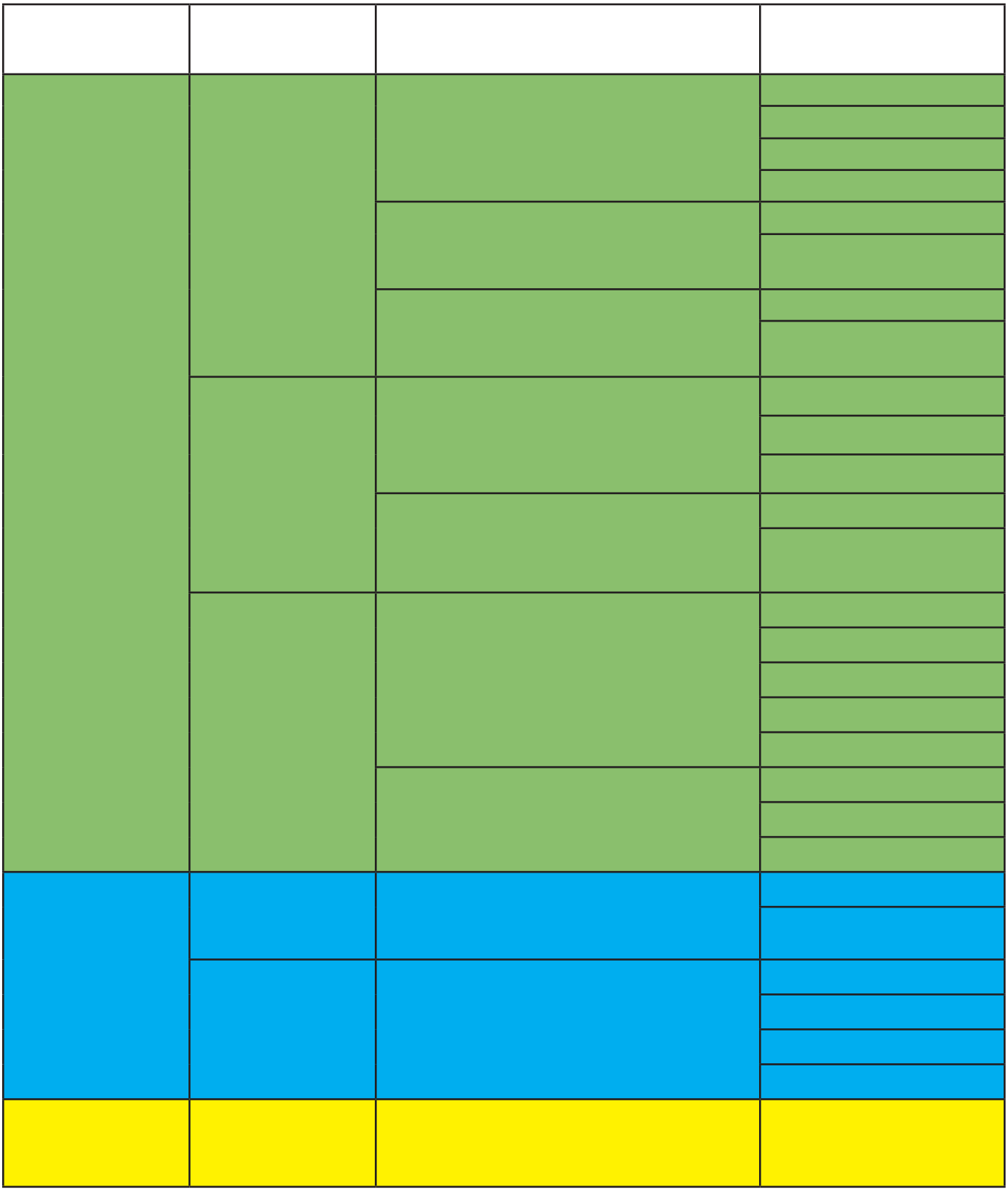
Grade 7

Cluster Emphasis	Domain	Cluster	Standard	
Major Clusters	Ratios and Proportional Relationships	*Analyze proportional relationships and use them to solve real-world and mathematical problems.*	7.RP.1	
			7.RP.2	✓
			7.RP.3	✓
	The Number System	*Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.*	7.NS.1	
			7.NS.2	
			7.NS.3	✓
	Expressions and Equations	*Use properties of operations to generate equivalent expressions.*	7.EE.1	✓
			7.EE.2	
		Solve real-life and mathematical problems using numerical and algebraic expressions and equations.	7.EE.3	✓
			7.EE.4a	✓
			7.EE.4b	
Supporting Clusters	Statistics and Probability	*Use random sampling to draw inferences about a population.*	7.SP.1	
			7.SP.2	
		Investigate chance processes and develop, use, and evaluate probability models.	7.SP.5	
			7.SP.6	
			7.SP.7	
			7.SP.8	
Additional Clusters	Geometry	*Draw, construct, and describe geometrical fgures and describe the relationships between them.*	7.G.1	
			7.G.2	*Post*
			7.G.3	*Post*
		Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.	7.G.4	
			7.G.5	*Post*
			7.G.6	*Post*
	Statistics and Probability	*Draw informal comparative inferences about two populations.*	7.SP.3	
			7.SP.4	

✓ = Standards recommended for greater emphasis

Post = Standards recommended for instruction in May-to-June

Grade 8



Test Design

In Grades 3–8, students are required to apply mathematical understandings and mathematical practices gained in the classroom in order to answer three types of questions: multiple-choice, short-response, and extended-response. Session 1 consists of multiple-choice questions. Session 2 consists of multiple-choice, short-response, and extended-response questions. Students will **NOT** be permitted to use calculators in Grades 3–5. In Session 2 of Grade 6 students **must have the exclusive use of a four-function calculator with a square root key or a scientific calculator**. In Grades 7–8, students **must have the exclusive use of a scientific calculator for both Session 1 and Session 2**. For more information about calculator use, please refer to page 26.

The charts below illustrate the test designs for the 2022 Grades 3–8 Mathematics Tests. Embedded field test questions are included in the number of multiple-choice questions in Session 1 listed below. It will not be apparent to students whether a question is an embedded field test question that does not count toward their score or an operational test question that does count toward their score.

2022 Grade 3 Test Design

Session	Number of Multiple-Choice Questions	Number of Short-Response Questions	Number of Extended-Response Questions	Total Number of Questions
1	25	0	0	25
2	8	6	1	15
Total	33	6	1	40

2022 Grade 4 Test Design

Session	Number of Multiple-Choice Questions	Number of Short-Response Questions	Number of Extended-Response Questions	Total Number of Questions
1	30	0	0	30
2	8	6	1	15
Total	38	6	1	45

2022 Grade 6 Test Design

Session	Number of Multiple-Choice Questions	Number of Short-Response Questions	Number of	

Test Blueprint

All questions on the 2022 Grades 3–8 Mathematics Tests measure the Learning Standards for Mathematics. The tests were designed around the Content Emphases (page 9). As such, questions that assess the Major Clusters make up the majority of the test. Additionally, standards recommended for more emphasis within clusters (pages 10–15) are assessed with greater frequency.

While all questions are linked to a primary standard, some questions measure more than one standard and

Domain-Level Test Blueprint—Percent of Test Points on Grade 5 Test				
Number and Operations in Base Tens	Number and Operations—Fractions	Operations and Algebraic Thinking	Measurement and Data	Geometry
20–30%	30–40%	5–15%	20–30%	5–15%

Cluster-Emphasis Test Blueprint—Percent of Test Points on Grade 5 Test		
Major Clusters	Supporting Clusters	Additional Clusters
70–80%	10–20%	5–10%

Domain-Level Test Blueprint—Percent of Test Points on Grade 6 Test				
The Number Systems	Expressions and Equations	Ratios and Proportional Relationships	Geometry	Statistics and Probability
15–25%	35–45%	20–30%	10–20%	0%

Cluster-Emphasis Test Blueprint—Percent of Test Points on Grade 6 Test		
Major Clusters	Supporting Clusters	Additional Clusters

Question Formats

The 2022 Grades 3–8 Mathematics Tests contain multiple-choice (1-point), short-response (2-point), and extended-response (3-point) questions. For multiple-choice questions, students select the correct response from four answer choices. For short- and extended-response questions, students write an answer to an open-ended question and may be required to show their work. In some cases, they may be required to explain, in words, how they arrived at their answers. Some test questions target more than one standard or assess an entire cluster. As such, many individual test questions assess September-to-April standards in conjunction with May-to-June standards from past grades.

Multiple-Choice Questions

Multiple-choice questions are designed to assess Learning Standards for Mathematics. Mathematics multiple-choice questions will mainly be used to assess standard algorithms and conceptual standards. Multiple-choice questions incorporate both Standards and Standards for Mathematical Practice, some in real-world applications. Many multiple-choice questions require students to complete multiple steps. Likewise, some of these questions are linked to more than one standard, drawing on the simultaneous application of multiple skills and concepts. Within answer choices, distractors[2] will all be based on plausible missteps.

Short-Response Questions

Short-response questions require students to complete a task and show their work. Like multiple-choice questions, short-response questions will often require multiple steps, the application of multiple mathematics skills, and real-world applications. Many of the short-response questions will cover conceptual and application standards.

Extended-Response Questions

Extended-response questions ask students to show their work in completing two or more tasks or a more

Mathematics Rubrics and Scoring Policies

The 2022 Grades 3–8 Mathematics Tests will use the rubrics and scoring policies as shown in this guide.

2-Point Holistic Rubric

	A 2-point response includes the correct solution to the question and demonstrates a thorough understanding of the mathematical concepts and/or procedures in the task. This response • indicates that the student has completed the task correctly, using mathematically sound procedures •

3-Point Holistic Rubric

	A 3-point response includes the correct solution(s) to the question and demonstrates a thorough understanding of the mathematical concepts and/or procedures in the task. This response • indicates that the student has completed the task correctly, using mathematically sound procedures • contains su f cient work to demonstrate a thorough understanding of the mathematical concepts and/or procedures • may contain inconsequential errors that do not detract from the correct solution(s) and the demonstration of a thorough understanding
	A 2-point response demonstrates a partial understanding of the mathematical concepts and/or procedures in the task. This response • appropriately addresses most but not all aspects of the task using mathematically sound procedures • may contain an incorrect solution but provides sound procedures, reasoning, and/or explanations •

2022 2- and 3-Point Mathematics Scoring Policies

Below are the policies to be followed while scoring the mathematics tests for all grades:

1. If a student shows the work in other than a designated "Show your work" or "Explain" area, that work should still be scored.
2. If the question requires students to show their work, and the student shows appropriate work and clearly identifies a correct answer but fails to write that answer in the answer space, the student should still receive full credit.
3. If students are directed to show work or provide an explanation, a correct answer with **no** work shown or **no** explanation provided, receives **no** credit.
4. If students are **not** directed to show work, any work shown will **not** be scored. This applies to items that do **not** ask for any work and items that ask for work for one part and do **not** ask for work in another part.
5. If the student provides one legible response (and one response only), the rater should score the response, even if it has been crossed out.
6. If the student has written more than one response but has crossed some out, the rater should score only the response that has **not** been crossed out.
7. If the student provides more than one response, but does not indicate which response is to be considered the correct response and none have been crossed out, the student shall not receive full credit.
8. If the student makes a conceptual error (that is an error in understanding rather than an arithmetic or computational error), that student shall not receive more than 50% credit.
9. Trial-and-error responses are **not** subject to Scoring Policy #6 above, since crossing out is part of the trial-and-error process.
10. If a response shows repeated occurrences of the same conceptual error within a question, the conceptual error should **not** be considered more than once in gauging the demonstrated level of understanding.
11. In questions requiring number sentences, the number sentences must be written horizontally.
12. When measuring angles with a protractor, there is a +/- 5 degrees deviation allowed of the true measure.
13. Condition Code A is applied whenever a student who is present for a test session leaves an entire constructed-response question in that session completely blank (no response attempted). This is not to be confused with a score of zero wherein the student does respond to part or all of the question but that work results in a score of zero.

Mathematics Tools

Why Mathematics Tools?

These provisions are necessary for students to meet Standard for Mathematical Practice Five found throughout the New York State P–12 Learning Standards for Mathematics:

> **Use appropriate tools strategically**
>
> *Mathematically proficient students consider the available tools when solving a mathematical problem. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.*

It is up to the student to decide when it will be helpful to use the mathematics tools to answer a question.

Rulers and Protractors

Students in Grade 3 must have a ruler for their exclusive use for both sessions of the test. Students in Grades 4–8 must have a ruler and a protractor for their exclusive use for all sessions of the test. Students with disabilities may use adapted rulers and protractors if this is indicated as a testing accommodation on the student's Individualized Education Program or Section 504 Accommodation Plan.

Note: Schools are responsible for supplying the appropriate tools for use with the Grades 3–8 Mathematics Tests when testing with printed test booklets. A ruler tool and a protractor tool are provided to the student as part of the computer testing delivery system, Nextera.

Calculators

Students in Grades 3–5 are **NOT** permitted to use a calculator on the 2022 Mathematics Tests.

Students in Grade 6 are **NOT** permitted to use a calculator with Session 1. For Session 2, students should have exclusive **use of a four-function calculator with a square root key or a scientific calculator**. Graphing calculators are **NOT** permitted.

Students in Grades 7–8 should have exclusive **use of a scientific calculator** for both Session 1 and Session 2. Graphing calculators are **NOT** permitted.

For students testing on computers in Grades 6–8, a calculator is provided as part of the computer testing delivery system, but schools should continue to supply students with exclusive use of the type of hand-held calculator the students use for everyday mathematics instruction.

Value of Pi

Students should learn that π is an irrational number. For the short-response and extended-response questions in Grades 7–8 (Session 2), the π key and the full display of the calculator should be used in computations. The approximate values of π, such as 3.1416, 3.14, or $\frac{22}{7}$, are unacceptable.

Reference Sheets

Each student testing in Grades 5–8 will be provided with a mathematics reference sheet for their exclusive use during both Session 1 and Session 2.

Grade 5 Mathematics Reference Sheet

CONVERSIONS

1 mile = 5,280 feet
1 mile = 1,760 yards

1 pound = 16 ounces
1 ton = 2,000 pounds

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
1 liter = 1,000 cubic centimeters

FORMULAS

Right Rectangular Prism	$V = Bh$ or $V = lwh$

Grade 6 Mathematics Reference Sheet

Grade 8 Mathematics Reference Sheet

CONVERSIONS

1 inch = 2.54 centimeters
1 meter = 39.37 inches
1 mile = 5,280 feet
1 mile = 1,760 yards
1 mile = 1.609 kilometers

1 kilometer = 0.62 mile
1 pound = 16 ounces
1 pound = 0.454 kilogram
1 kilogram = 2.2 pounds
1 ton = 2,000 pounds

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
1 gallon = 3.785 liters
1 liter = 0.264 gallon
1 liter = 1,000 cubic centimeters

FORMULAS

Triangle	$A = \frac{1}{2}bh$
Parallelogram	$A = bh$