OREGON STATEWIDE ASSESSMENT

Mathematics
TEST SPECIFICATIONS
and BLUEPRINTS
2012-2014

GRADE 4
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**Developed by the Office of Assessment and Information Services**

Oregon Department of Education  
255 Capitol Street NE  
Salem, Oregon 97310-0203  
(503) 947-5600

*Susan Castillo*  
State Superintendent of Public Instruction

*Doug Kosty*  
Assistant Superintendent

*Steve Slater*  
Manager, Scoring, Psychometrics and Validity

*Kathleen Vanderwall*  
Manager, Test Design and Administration

*Holly Carter*  
Assessment Operations and Policy Analyst

*Michelle McCoy*  
ELPA and Assessment Implementation Specialist

*Ken Hermens*  
Language Arts Assessment Specialist

*Rachel Aazzerah*  
Science and Social Sciences Assessment Specialist

*James Leigh*  
Mathematics Assessment Specialist

*Bradley J. Lenhardt*  
Monitoring and Assessment Specialist

*Sheila Somerville*  
Electronic Publishing Specialist

*Kathy Bushy*  
Project Manager

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Introduction

The primary purpose of the Test Specifications and Blueprints is to provide the consistency necessary for the development and administration of the Oregon Assessment of Knowledge and Skills (OAKS). OAKS provides critical data for Oregon’s accountability system which meets Peer Review Requirements of the Elementary and Secondary Education Act. All students in grades 3 through 8 are required to take the reading and mathematics assessments. All students in grades 5 and 8 are required to take the science assessment. In high school, at grade 11, reading, writing, mathematics, and science are required assessments.

OAKS is also one way for students to demonstrate proficiency in the Essential Skills of reading, writing, and mathematics, which will be necessary for earning a high school diploma beginning with seniors graduating in 2011-2012. The requirement in mathematics to demonstrate proficiency in Applying Mathematics in a Variety of Settings will begin with the class of 2014. In addition, English Language Proficiency Assessment (ELPA) is required for non-English speaking students until they acquire sufficient skills in English to exit the program. Social Sciences is an optional assessment.

Test specifications provide guidelines for item writers, who are typically Oregon teachers, on what content may be tested and how items must be written. These specifications lead to test blueprints that outline test design and the number of questions to be tested in each score reporting category (SRC). The Test Specifications and Blueprints document is an important resource, not only for item writers and reviewers, but for educators administering OAKS and the general public who are interested in understanding the content and format of test items.

Background

The purposes of the Oregon Statewide Assessment Program are (1) to provide information on individual student achievement on performance standards set by the State Board of Education at grade and benchmark levels; (2) to provide information for federal Elementary and Secondary Education Act requirements and for policy decisions by the legislature, the governor, the State Board of Education, and local school districts; (3) to support instructional program improvement efforts; and (4) to inform the public about student achievement in Oregon schools.

The Oregon Statewide Assessment is different from national norm-referenced tests used in many districts and states. The Oregon Statewide Assessment is a criterion-referenced assessment based on the Oregon Content Standards. As a result, the types of scores produced from the Oregon Statewide Assessment are somewhat different from those produced by national norm-referenced tests.

Oregon educators contribute to the test development and alignment process by serving on advisory committees called Content and Assessment Panels. Stakeholders in these committees are involved in each phase of the development of these specifications to assure that they accurately and clearly explain the overall design of the test and describe the specific content that might appear on the test to measure the knowledge and skills described in the content standards.

The Oregon Assessment of Knowledge and Skills test questions use multiple-choice and computer-scored constructed response formats. Each multiple-choice item has only one correct answer while computer-scored constructed response items may have many correct answers. A computer electronically collects and scores responses which are scored against the answer key to produce a raw score. The raw score is
converted to a scale score called a Rasch unit or RIT score. Students receive a scale score based on the number of questions answered correctly compared to the total number of questions on the form—taking into account the difficulty of the questions. Students are not penalized for guessing.

The content of these specifications reflects the skill expectations outlined in the State of Oregon Mathematics Content Standards for Kindergarten through Grade 8, adopted in December 2007, and the Oregon High School Mathematics Content Standards, adopted in June 2009. These standards were developed, in part, to align to the 2006 Curriculum Focal Points for Pre-kindergarten through Grade 8 Mathematics: A Quest for Coherence, published by the National Council of Teachers of Mathematics. The high school standards were developed in the same vein as those for grades K-8, to allow students to be accountable for fewer topics, but to understand the concepts more deeply.

Statewide and Local Assessments

Statewide assessments are multiple-choice and computer-scored constructed response tests of knowledge and skills that are developed and scored by the state. Local assessments include performance assessments that may be scored using statewide scoring guides that are administered and scored at the local level (see Appendix F). Local assessments are not included in state accountability reports, e.g. AYP reports.

Paper/Pencil Administration

Paper/Pencil fixed form tests are no longer administered in Oregon. All tests are computer-adaptive, as of 2011-2012.

Electronic Administration

For the mathematics OAKS online tests, two testing opportunities are offered each year for students in grades 3-8 to participate in fully-adaptive testing. Three opportunities are offered each year for high school students in grades 9-12 who have had the opportunity to learn the high school content. In this fully-adaptive format, the accuracy of the student’s responses to questions determines the next item the student will see. Having the tests fully adaptive allows for more precision in measurement and less frustration for the students.

Beginning with 2011-2012, students who need to have the test read to them may access the text-to-speech function of OAKS Online. The OAKS Online test delivery system will also be available to students with visual impairments who use Braille, providing the same number of testing opportunities as the general student test. (Beginning with 2011-2012, the paper-based Braille assessments will no longer be available.)

Online practice tests of sample items for each grade are available for students who may need practice using a scrollbar, new item types, or other features of OAKS Online. The practice tests are also adaptive in order to simulate the actual OAKS test; you must use Mozilla Firefox to access the practice tests. Downloadable fixed-form sample tests are also available, with answer keys provided. Sample tests and OAKS Online Practice tests can be found at http://www.ode.state.or.us/search/page/?id=441.

Transition to Common Core State Standards and Smarter Balanced Common Assessment

Beginning with the 2014-2015 school year, Oregon will be utilizing assessments based on the Common Core State Standards for English/Language Arts and Mathematics. The 2014-15 assessment for these subjects will comply with all criteria set forth by Smarter Balanced Common Assessment. Oregon is part of the collaborative consortium of states developing Smarter Balanced and will also use common achievement standards. This work is underway and will be in development until the transition is made in fall 2014.

See www.ode.state.or.us/go/commoncore for up-to-date information on the Common Core State Standards and http://www.smarterbalanced.org/ for information on the Smarter Balanced Common Assessment.
On the OAKS mathematics tests:

- Students are strongly encouraged to use calculators. Rulers, manipulatives, and other tools commonly available to all students are also encouraged. No problems require the use of a calculator and no more than a four-function calculator is needed for any problem, although scientific calculators are highly recommended for use at grades 8 and 10. On-screen calculators are included in the OAKS Online tests, but students are also allowed to use the calculators they regularly use for class work. (See the Test Administration Manual for guidelines.)

- For each of the grades 3-8, this statement precedes all the core standards: “It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.” Therefore, any content standard may be assessed using a context or a problem-solving situation.

- Likewise for high school, “It is essential that the high school mathematics content standards be addressed in instructional contexts that promote problem solving, reasoning and proof, communication, making connections, designing and analyzing representations, and reflecting on solutions.” Similarly, any content standard may be assessed using a context or a problem-solving situation.

- For all grades, every student should understand and be able to apply all mathematical concepts and skills from previous grade levels to the standards of their current grade.

- Each OAKS mathematics test item will measure only one Score Reporting Category (SRC). The Score Reporting Categories are the three “core standards” for each grade. Each core standard is associated with four to nine content standards. Grades 3-8 each have approximately 20 content standards. The high school standards include three disciplines of mathematics – Algebra, Geometry, and Statistics. Within each discipline “strand” there are two to three core standards. These core standards provide the major concepts and processes for teaching and learning across the grades. Beneath each of these core standards are from three to eight content standards which provide the details necessary for curriculum and assessment. The score reporting categories are shown in the diagram on the next page.

- The new mathematics standards also frequently mention “fluency” with skills and concepts. See the page following the Score Reporting Categories chart for a complete statement as to the intended meaning of “fluency” for OAKS Online.

The pages following the Fluency Statement contain a more detailed examination of the test content for mathematics.
Score Reporting Categories for Oregon Assessment of Knowledge and Skills in Mathematics

<table>
<thead>
<tr>
<th>Grade</th>
<th>First Core Standard</th>
<th>Second Core Standard</th>
<th>Third Core Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>3.1 <strong>Number and Operations:</strong> Develop an understanding of fractions and fraction equivalence.</td>
<td>3.2 <strong>Number and Operations, Algebra, and Data Analysis:</strong> Develop understandings of multiplication and division, and strategies for basic multiplication facts and related division facts.</td>
<td>3.3 <strong>Geometry and Measurement:</strong> Describe and analyze properties of two-dimensional shapes, including perimeters.</td>
</tr>
<tr>
<td>4</td>
<td>4.1 <strong>Number and Operations:</strong> Develop an understanding of decimals, including the connections between fractions and decimals.</td>
<td>4.2 <strong>Number and Operations and Algebra:</strong> Develop fluency with multiplication facts and related division facts, and with multi-digit whole number multiplication.</td>
<td>4.3 <strong>Measurement:</strong> Develop an understanding of area and determine the areas of two-dimensional shapes.</td>
</tr>
<tr>
<td>5</td>
<td>5.1 <strong>Number and Operations and Data Analysis:</strong> Develop an understanding of and fluency with addition and subtraction of fractions and decimals.</td>
<td>5.2 <strong>Number and Operations and Algebra:</strong> Develop an understanding of and fluency with division of whole numbers.</td>
<td>5.3 <strong>Geometry, Algebra, and Measurement:</strong> Analyze 3-D shapes, including volume and surface area.</td>
</tr>
<tr>
<td>6</td>
<td>6.1 <strong>Number and Operations:</strong> Develop an understanding of and fluency with multiplication and division of fractions and decimals.</td>
<td>6.2 <strong>Number and Operations and Probability:</strong> Connect ratio, rate, and percent to multiplication and division.</td>
<td>6.3 <strong>Algebra:</strong> Write, interpret, and use mathematical expressions and equations.</td>
</tr>
<tr>
<td>7</td>
<td>7.1 <strong>Number and Operations and Algebra:</strong> Develop an understanding of operations on all rational numbers and solving linear equations.</td>
<td>7.2 <strong>Number and Operations, Algebra and Geometry:</strong> Develop an understanding of and apply proportionality, including similarity.</td>
<td>7.3 <strong>Measurement and Geometry:</strong> Develop an understanding of and use formulas to determine surface area and volume.</td>
</tr>
<tr>
<td>8</td>
<td>8.1 <strong>Algebra:</strong> Analyze and represent linear functions, and solve linear equations and systems of linear equations.</td>
<td>8.2 <strong>Data Analysis and Algebra:</strong> Analyze and summarize data sets.</td>
<td>8.3 <strong>Geometry and Measurement:</strong> Analyze two- and three-dimensional spaces and figures by using distance and angle.</td>
</tr>
<tr>
<td>HS</td>
<td><strong>Algebra</strong> (H.1A, H.2A, H.3A)</td>
<td><strong>Geometry</strong> (H.1G, H.2G, H.3G)</td>
<td><strong>Statistics</strong> (H.1S, H.2S)</td>
</tr>
</tbody>
</table>
Fluency Statement to Accompany Oregon Assessment of Knowledge and Skills
Test Specifications and Blueprints

What are the Main Messages of NCTM's *Principles and Standards (2000)* Regarding Computation?

Computational fluency is an essential goal for school mathematics (p. 152):

**Embedding Fluency in Conceptual Understanding**

- The methods that a student uses to compute should be grounded in understanding (pp. 152-55).
- Students can achieve computational fluency using a variety of methods and should, in fact, be comfortable with more than one approach (p. 155).
- Students should have opportunities to invent strategies for computing using their knowledge of place value, properties of numbers, and the operations (pp. 35 and 220).
- Students should investigate conventional algorithms for computing with whole numbers (pp. 35 and 155).

**Goals of Fluency**

- Students should know the basic number combinations for addition and subtraction by the end of grade 2 and those for multiplication and division by the end of grade 4 (pp. 32, 84, and 153).
- Students should be able to compute fluently with whole numbers by end of grade 5 (pp. 35, 152, and 155).
- Students should be encouraged to use computational methods and tools that are appropriate for the context and purpose, including mental computation, estimations, calculators, and paper and pencil (pp. 36, 145, and 154).

**What is Computational Fluency?**

*NCTM Principles and Standards of School Mathematics* (2000) defines computational fluency as having efficient and accurate methods for computing that are based on well understood properties and number relationships.

The National Math Panel Report cites the NCTM definition of computational fluency in its report when it uses this phrase. For further clarity, on page 41 of chapter 3 of the Task Group Reports of the National Mathematics Advisory Panel, there is a discussion of the critical foundations for the study of algebra: (1) fluency with whole numbers, (2) fluency with fractions, and (3) particular aspects of geometry and measurement. The National Mathematics Advisory Panel Final Report (2008), page 17-20, reiterate three clusters of concepts and skills – called Critical Foundations of Algebra – reflecting their judgment about the most essential mathematics for students to learn thoroughly prior to algebra course work.
The excerpt from page 41 of chapter 3 (Report of the Task Group on Conceptual Knowledge and Skills) is below:

1. **Fluency with whole numbers**

By the end of the elementary grades, children should have a robust sense of number. This sense of number must include understanding place value, and the ability to compose and decompose whole numbers. It must clearly include a grasp of the meaning of the basic operations of addition, subtraction, multiplication, and division, including use of the commutative, associative, and distributive properties; the ability to perform these operations efficiently; and the knowledge of how to apply the operations to problem solving. Computational facility rests on the automatic recall of addition and related subtraction facts, and of multiplication and related division facts. It requires fluency with the standard algorithms for addition, subtraction, multiplication, and division. Fluent use of the algorithms not only depends on the automatic recall of number facts but also reinforces it. A strong sense of number also includes the ability to estimate the results of computations and thereby to estimate orders of magnitude, e.g., how many people fit into a stadium, or how many gallons of water are needed to fill a pool.

2. **Fluency with Fractions**

Before they begin algebra course work, middle school students should have a thorough understanding of positive as well as negative fractions. They should be able to locate both positive and negative fractions on the number line; represent and compare fractions, decimals, and related percents; and estimate their size. They need to know that sums, differences, products, and quotients (with nonzero denominators) of fractions are fractions, and they need to be able to carry out these operations confidently and efficiently. They should understand why and how (finite) decimal numbers are fractions and know the meaning of percentages. They should encounter fractions in problems in the many contexts in which they arise naturally, for example, to describe rates, proportionality, and probability. Beyond computational facility with specific numbers, the subject of fractions, when properly taught, introduces students to the use of symbolic notation and the concept of generality, both being an integral part of Algebra (Wu, 2001).

3. **Particular Aspects of Geometry and Measurement**

Middle-grade experience with similar triangles is most directly relevant for the study of algebra: Sound treatments of the slope of a straight line and of linear functions depend logically on the properties of similar triangles. Furthermore, students should be able to analyze the properties of two- and three-dimensional shapes using formulas to determine perimeter, area, volume, and surface area. They should also be able to find unknown lengths, angles, and areas.
Content Standards Map

The following pages contain an examination of the test content for mathematics.

- The top row states the core standard (Score Reporting Category).
- The first column lists the content standard. Below the content standard we show “Assessable Academic Vocabulary” - vocabulary that can be used in test items without explanation. Below the vocabulary, we show symbols and notation that can be used without explanation.
- The second column lists Boundaries of Assessable Content to clarify language in the content standard. Below the Boundaries, we show standards from previous grades linked to this standard.
- Finally, the third column gives some sample items that are very similar to the type of questions asked on a test related to the content standard. Previously operational released items are in Times New Roman font, while “ideas” for test items are in Arial Gray font.

- Following all the standards pages is a comprehensive list of all the Assessable Academic Vocabulary for the grade level. Assessable Academic Vocabulary from previous grades may also be used without explanation.
<table>
<thead>
<tr>
<th>Core Standard: 4.1 Number and Operations</th>
<th>Score Reporting Category 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop an understanding of decimals, including the connections between fractions and decimals.</td>
<td>It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Content Standard:</th>
<th>Boundaries of Assessable Content:</th>
<th>Sample Items:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1.1 Extend the base-ten system to read, write, and represent decimal numbers (to the hundredths) between 0 and 1, between 1 and 2, etc.</td>
<td>Students will extend their thinking to include the idea that fractions and decimals both represent equal parts of the whole, parts of a set, or points or distances on a number line. Students will recognize that sizes of fractional parts based on 10ths and 100ths can be expressed as decimal numbers.</td>
<td>Which is the numeral for seven and five tenths?</td>
</tr>
<tr>
<td>Assessable Academic Vocabulary:</td>
<td>When working with decimals through hundredths, the emphasis for students is conceptual development. Students should have enough experiences with concrete and pictorial models to form visual images of decimals like 0.5 versus 0.05 when they see or hear the number.</td>
<td>A. 7.005</td>
</tr>
<tr>
<td>base ten</td>
<td>Read and write decimals to the hundredths. Decimals may be written to tenths or hundredths.</td>
<td>B. 7.05</td>
</tr>
<tr>
<td>between decimal</td>
<td>Represent the meaning of a decimal with a model (e.g., number line or area model).</td>
<td>C. 7.5</td>
</tr>
<tr>
<td>decimal</td>
<td>Content Connections from Previous Grades: 2.1, 3.1</td>
<td>D. 75</td>
</tr>
<tr>
<td>hundredth model</td>
<td>Source: NAEP 2011 Released Item</td>
<td></td>
</tr>
<tr>
<td>number line</td>
<td></td>
<td></td>
</tr>
<tr>
<td>place value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>represents tenth</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Symbols and Notation:

- 3,2 “Three and two tenths”
- Read decimal numbers to show value (e.g., 0.15 is read “fifteen hundredths,” NOT “zero point one five”)  
- Place a zero before the decimal point for numbers less than 1.

8

Oregon Department of Education  
Office of Assessment and Information Services
## Core Standard: 4.1 Number and Operations
Develop an understanding of decimals, including the connections between fractions and decimals.

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

### Content Standard:
4.1.2 Use models to connect and compare equivalent fractions and decimals.

### Expected/Assessable Vocabulary:
- compare
- decimal
- equivalent
- fraction
- model
- number line

### Symbols and Notation:
- `<` “is less than”
- `>` “is greater than”
- `=“is equal to”`

### Boundaries of Assessable Content:
- Items assessing this standard must include a model of some type, not just a verbal context. Items should not assume that all students have used any particular manipulative or model, so they must be very clearly explained or diagramed.
- Decimals used will be to the tenths or hundredths.
- Use models to connect and compare equivalent fractions.
- Use models to connect and compare fractions to decimals.
- Fractions include values between 0 and 1 as well as improper fractions and mixed numbers greater than 1.

### Content Connections from Previous Grades:
2.1, 3.1

### Sample Items:
- **Which picture has more than 0.75 shaded?**
  
  ![Sample Picture](image)

  These three fractions are equivalent. Give two more fractions that are equivalent to these.
  
  Source: NAEP 2007 Released Item

  (Using area models (base ten blocks)
  compare $\frac{1}{4}$ and .25 (or $\frac{1}{4}$ and $\frac{3}{12}$))

  (Using area models (show $\frac{1}{5}$, $\frac{1}{10}$, $\frac{1}{2}$, $\frac{2}{10}$),
  which one matches 0.20?)

  (Using a set model, which fraction is greater than 0.6?
  5 out of 10; 7 out of 10;
  6 out of 12; 7 out of 14)
Core Standard: 4.1 Number and Operations
Develop an understanding of decimals, including the connections between fractions and decimals.

Score Reporting Category 1

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

<table>
<thead>
<tr>
<th>Content Standard:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1.3 Determine decimal equivalents or approximations of common fractions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Boundaries of Assessable Content:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item for this standard emphasize the relationship between fractions and decimals.</td>
</tr>
<tr>
<td>Identify and represent the common fraction-decimal equivalents to include:</td>
</tr>
<tr>
<td>( \frac{1}{2} = 0.5 )</td>
</tr>
<tr>
<td>( \frac{1}{4} = 0.25 ) and ( \frac{3}{4} = 0.75 )</td>
</tr>
<tr>
<td>Fractions with denominators of 5 and 8</td>
</tr>
<tr>
<td>Multiples of ( \frac{1}{10} )</td>
</tr>
<tr>
<td>Multiples of ( \frac{1}{100} )</td>
</tr>
<tr>
<td>Identify the approximate fraction-decimal equivalents relationships to include:</td>
</tr>
<tr>
<td>( \frac{1}{3} \approx 0.33 ) and ( \frac{2}{3} \approx 0.67 )</td>
</tr>
<tr>
<td>( \frac{1}{6} \approx 0.17 ) and ( \frac{5}{6} \approx 0.83 )</td>
</tr>
<tr>
<td>Fractions include values between 0 and 1 as well as improper fractions and mixed numbers greater than 1.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample Items:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lexi is adding money on her calculator. When she presses the “equals” key, the calculator display reads 0.5. Lexi knows that 0.5 is equal to…</td>
</tr>
<tr>
<td>A. $5.50</td>
</tr>
<tr>
<td>B. $5.00</td>
</tr>
<tr>
<td>C. $0.50</td>
</tr>
<tr>
<td>D. $0.05</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessable Academic Vocabulary:</th>
</tr>
</thead>
<tbody>
<tr>
<td>approximation</td>
</tr>
<tr>
<td>decimal</td>
</tr>
<tr>
<td>equivalent</td>
</tr>
<tr>
<td>fraction</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbols and Notation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \approx ) “is approximately equal to”</td>
</tr>
</tbody>
</table>
Core Standard: 4.1 Number and Operations
Develop an understanding of decimals, including the connections between fractions and decimals.

Score Reporting Category 1

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

<table>
<thead>
<tr>
<th>Content Standard:</th>
<th>Boundaries of Assessable Content:</th>
<th>Sample Items:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1.4 Compare and order fractions and decimals.</td>
<td>● When developing the concept through pictorial and concrete models, the decimal relationship to the whole should be stressed. Therefore, when students use symbols or words to make a value comparison, the comparison is made based on an in-depth understanding of the relative size of each decimal, rather than using a comparison process or mnemonic strategy.</td>
<td>Anna is trying to decide between 4 different brands of yogurt. Order her choices from least expensive to most expensive.</td>
</tr>
<tr>
<td></td>
<td>● When comparing decimals, students should be comfortable using the comparison words is less than, is greater than, and is equal to and their respective symbols (&lt;, &gt;, = ).</td>
<td>A. $1.05, $0.95, $0.75, $0.59</td>
</tr>
<tr>
<td></td>
<td>● Items may require students to choose the least or greatest value as well as order a list of numbers.</td>
<td>B. $0.59, $0.95, $0.75, $1.05</td>
</tr>
<tr>
<td></td>
<td>● Items require students to compare and order fractions to fractions, decimals to decimals, or a combination of fractions and decimals.</td>
<td>C. $0.59, $0.75, $0.95, $1.05</td>
</tr>
<tr>
<td></td>
<td>● Fractions include values between 0 and 1 as well as improper fractions and mixed numbers greater than 1.</td>
<td>D. $1.05, $0.95, $0.59, $0.75</td>
</tr>
<tr>
<td></td>
<td>● Decimals will be to the hundredths place and include all values greater than or equal to 0.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessable Academic Vocabulary:</th>
</tr>
</thead>
<tbody>
<tr>
<td>compare decimal greatest least order</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbols and Notation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; “is less than”</td>
</tr>
<tr>
<td>&gt; “is greater than”</td>
</tr>
<tr>
<td>= “is equal to”</td>
</tr>
</tbody>
</table>

Content Connections from Previous Grades: 2.1, 3.1

<table>
<thead>
<tr>
<th>Yogurt</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>$1.05</td>
</tr>
<tr>
<td>X</td>
<td>$0.95</td>
</tr>
<tr>
<td>Y</td>
<td>$0.59</td>
</tr>
<tr>
<td>Z</td>
<td>$0.75</td>
</tr>
</tbody>
</table>

Which set of fractions are written in order from least to greatest?

A. \( \frac{8}{17}, \frac{10}{21}, \frac{9}{14} \)  
B. \( \frac{8}{17}, \frac{9}{14}, \frac{10}{21} \)  
C. \( \frac{9}{14}, \frac{8}{17}, \frac{10}{21} \)  
D. \( \frac{10}{21}, \frac{8}{17}, \frac{9}{14} \)
**Core Standard:** 4.1 Number and Operations

Develop an understanding of decimals, including the connections between fractions and decimals.

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

<table>
<thead>
<tr>
<th>Content Standard:</th>
<th>Boundaries of Assessable Content:</th>
<th>Sample Items:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1.5 Estimate decimal or fractional amounts in problem solving.</td>
<td>Estimate decimal amounts in problem solving.</td>
<td>The Rodriguez family goes to a museum. The museum costs $12.95 for one person. There are 5 people in the family. Estimate how much money they will need to pay to go to the museum.</td>
</tr>
</tbody>
</table>
|                    | Estimate fractional amounts in problem solving. | A. Less than $50  
B. Between $50 and $75  
C. Between $75 and $100  
D. More than $100 |
|                    | Use benchmarks of 0, 0.5, and 1 for fractions and decimals less than 1. For fractions and decimals greater than 1, use the context of the problem to determine whether to round to the nearest whole number or nearest half. | Amber and Charlotte each ran a mile. It took Amber 11.79 minutes. It took Charlotte 9.08 minutes. Which number sentence can Charlotte use to best estimate the difference in their times? |
|                    | Fractions include values between 0 and 1 as well as improper fractions and mixed numbers greater than 1. | A. 11 - 9 =  
B. 11 - 10 =  
C. 12 - 9 =  
D. 12 - 10 =  |
|                    | Decimals will be to the hundredths place and include all values greater than or equal to 0. | Source: NAEP 2007 Released Item |

**Symbols and Notation:**

- approximate/approximation
- decimal
- estimate
- fraction
- round

**Assessable Academic Vocabulary:**

approximate/approximation  
decimal  
estimate  
fraction  
round

**Content Connections to Previous Grades:**

2.1, 3.1

**Sample Items:**

Tickets sell for $4.95. If 2175 attended, about how much money was collected?)

(Which expression shows how to best estimate the amount of money collected? Show 4 × 2175, 5 × 2175, 4 × 2000))
## Core Standard: 4.1 Number and Operations

Develop an understanding of decimals, including the connections between fractions and decimals.

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

### Content Standard:

**4.1.6** Represent money amounts to $10.00 in dollars and cents, and apply to situations involving purchasing ability and making change.

### Assessable Academic Vocabulary:

- change
- dime
- dollar bill
- five dollar bill
- nickel
- penny
- purchase
- ten dollar bill
- total

### Symbols and Notation:

- $ “dollars”
- ¢ “cents”

### Boundaries of Assessable Content:

- Identify money amounts to $10.00 given dollars and coins.
- Determine the fewest dollars and coins needed to make money amounts to $10.00.
- Determine if a person has enough money to purchase an item or combination of items. Students may need to count bills/coins to determine an answer to these items.
- Determine the change for an item purchased that is at most $10.00. Students learn decimal subtraction in grade 5 so they will use their understanding of money amounts to “add on” from the cost of the item to the amount used to buy the item to determine change in these items.

### Content Connections from Previous Grades:

1.1.5, 2.1, 2.2.5, 4.1.1, 4.1.4

### Sample Items:

3 quarters, 1 dime, and 3 pennies equals:

- A. $0.07
- B. $0.75
- C. $0.88
- D. $3.13

Lexi is adding money on her calculator. When she presses the “equals” key, the calculator displays 0.5. Lexi knows that 0.5 is equal to __?__.

- A. $5.50
- B. $5.00
- C. $0.50
- D. $0.05

(Make change for purchase of popcorn and water for $3.75 from $5.00 bill.)

(Make change for purchase of a comic book for $2.97 from $10.00 bill.)
**Core Standard:** 4.2 Number and Operations and Algebra  
Develop fluency with multiplication facts and related division facts, and with multi-digit whole number multiplication.

**Score Reporting Category 2**

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

<table>
<thead>
<tr>
<th>Content Standard:</th>
<th>Boundaries of Assessable Content:</th>
<th>Sample Items:</th>
</tr>
</thead>
</table>
| 4.2.1 Apply with fluency multiplication facts to 10 times 10 and related division facts. | See Fluency Statement, on introduction to content pages.  
- Items assessing this standard will include application of multiplication facts to 10 times 10 and related division facts in the context of word problems as well as written expressions.  
- Items may ask students for the product of two whole numbers up to 10 times 10 or the related quotient of two whole numbers. | Noreen can’t remember the answer to this problem:  
$8 \times 7 = \square$.  
Which strategy would NOT help her to find the correct answer?  
A. Find $8 + 7$, then double it.  
B. Find $4 \times 7$ then double it.  
C. Find $2 \times 7$ then double it and double it again.  
D. Find $8 \times 5$ and then $8 \times 2$ then add them together.  

$2 \times 3, \ 3 \times 2, \ 6 \div 2$ are all related to this diagram.  
Which choice is also related to this diagram?  
-  
-  
-  
-  
A. $2 + 3$  
B. $6 \times 2$  
C. $6 \div 3$  
D. $3 \div 2$  

(Six bags with 5 cards, how many cards in total? (Or...what is the product of 6 and 5? Or...what is the value of $6 \times 5$?))  
(Package of 42 jelly beans—if divided equally among 7 kids, how many would each get?)  
(Ken has 36 fish. He wants to put an equal number in separate tanks. Which number of tanks will NOT work? (4, 9, 12, 13))

**Assessable Academic Vocabulary:**
- divide  
- multiply  
- product  
- quotient

**Symbols and Notation:**
- $\times$ “times”  
- $\div$ “divided by”

**Content Connections from Previous Grades:**
- 3.2
### Core Standard: 4.2 Number and Operations and Algebra

Develop fluency with multiplication facts and related division facts, and with multi-digit whole number multiplication.

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

### Content Standard:

4.2.2. Apply understanding of models for multiplication (e.g., equal-sized groups, arrays, area models, equal intervals on the number line), place value, and properties of operations (commutative, associative, and distributive).

### Assessable Academic Vocabulary:

- array
- associative property
- column
- commutative property
- dimensions
- distributive property
- equal intervals
- factors
- multiplication
- multiply
- number line
- product
- row

### Symbols and Notation:

- $\times$ “times”
- $4 \times (8+2)$ “4 times the quantity 8 plus 2”

### Boundaries of Assessable Content:

See Fluency Statement, on introduction to content pages.

- Items may require students to identify an appropriate model, create a model, or analyze a given model to show understanding of multiplication. Models will include:
  - equal-sized groups
  - arrays
  - area models
  - equal intervals on the number line
- Any other model used will be clearly defined and explained.

- Apply understanding of place value.
- Apply understanding of properties of operations to include:
  - commutative property
    \[ 2 \times 3 = 3 \times 2 \]
  - associative property
    \[ (2 \times 4) \times 5 = 2 \times (4 \times 5) \]
  - distributive property
    \[ 3(5 + 6) = (3 \times 5) + (3 \times 6) \]

### Sample Items:

What digit is in the thousands place in 48,130?

A. 1  B. 3  C. 4  D. 8

Display a rectangular array of objects and ask students to determine which multiplication expression matches the array.

### Content Connections from Previous Grades:

1.2.4, 3.2
### Core Standard: 4.2 Number and Operations and Algebra

Develop fluency with multiplication facts and related division facts, and with multi-digit whole number multiplication.

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

### Content Standard:

4.2.3. Select and use appropriate estimation strategies for multiplication (e.g., use benchmarks, overestimate, underestimate, round) to calculate mentally based on the problem situation when computing with whole numbers.

### Assessable Academic Vocabulary:

- approximate/approximation
- benchmark
- estimate/estimation
- factors
- multiplication
- multiply
- overestimate
- product
- round
- strategy
- underestimate

### Symbols and Notation:

- $\times$ “times”
- $\approx$ “is approximately equal to”

### Boundaries of Assessable Content:

See Fluency Statement, on introduction to content pages.

- Students select and use strategies to estimate products in problem situations involving whole numbers.
- Estimation strategies will include:
  - use of benchmarks
  - overestimate
  - underestimate
  - round
- Estimate and determine the reasonableness of the product of whole numbers. Refine estimates using terms such as closer to, between, and a little more than.

### Sample Items:

Mrs. Gomez bought 4 items at the grocery store. The items ranged in price from $2 to $9. What is a reasonable estimate of how much she spent for all the items?

A. Over $35  
B. About $23  
C. Less than $14  
D. About $10

A student had to multiply $328 \times 41$. The student’s answer was 4,598. Use estimation to explain why this answer is not reasonable.

Source: NAEP 2011 Released Item

(There are 24 students in our class. If each person gets 3 pieces of candy, about how many pieces of candy will we need?)

(Give an example of a situation when overestimating would be the best estimation strategy.)
### Core Standard: 4.2 Number and Operations and Algebra

Develop fluency with multiplication facts and related division facts, and with multi-digit whole number multiplication.

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

### Score Reporting Category 2

### Content Standard:

4.2.4. Develop and use accurate, efficient, and generalizable methods to multiply multi-digit whole numbers.

### Assessable Academic Vocabulary:

- factors
- multiply
- product

### Symbols and Notation:

× “times”

### Boundaries of Assessable Content:

- See Fluency Statement, on introduction to content pages.
- Use accurate, efficient, and generalizable methods to multiply multi-digit whole numbers. This includes, but is not limited to, the standard algorithm for multiplication of multi-digit whole numbers.
- Items assessing the development of accurate, efficient, and generalizable methods may give a method and have students explain why it works or may include the use of models, place value, or properties of operations to explain why a method for multiplying multi-digit whole numbers is valid.

### Content Connections from Previous Grades:

3.2, 4.2.1, 4.2.2

### Sample Items:

#### Patty expects that each tomato plant in her garden will bear 24 tomatoes. If there are 6 tomato plants in her garden, how many tomatoes does she expect?

A. 4  
B. 18  
C. 30  
D. 144

Source: NAEP 2011 Released Item

#### Bags of Healthy Snack Mix are packed into small and large cartons. The small cartons contain 12 bags each. The large cartons contain 18 bags each. Meg claimed that she packed a total of 150 bags of Healthy Snack Mix into 2 small cartons and 7 large cartons. Could Meg have packed the cartons the way she claimed?

- Yes  
- No

Show the computations you used to arrive at your answer.

Source: NAEP 2011 Released Item
**Core Standard:** 4.2 Number and Operations and Algebra  
Develop fluency with multiplication facts and related division facts, and with multi-digit whole number multiplication.

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

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<th>Sample Items:</th>
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</thead>
</table>
| 4.2.5 Develop fluency with efficient procedures for multiplying multi-digit whole numbers and justify why the procedures work on the basis of place value and number properties. | See Fluency Statement, on introduction to content pages.  
- Find products of multi-digit whole numbers using efficient procedures.  
- Items assessing this standard may require using and explaining how a variety of multiplication strategies work. Use place value and the commutative, associative, and distributive properties to justify why the strategies work. | Pam has 21 fish tanks.  
There are 65 guppies in each tank.  
How many guppies does Pam have?  
A. 86 guppies  
B. 195 guppies  
C. 1,365 guppies  
D. 13,065 guppies  
Which digit belongs in the box?  
\[23 \times 4 \quad 944\]  
A. 8  
B. 6  
C. 4  
D. 1  
Which of the following is equivalent to \(12 \times 36\)?  
A. \((2 \times 6) + (2 \times 3) + (1 \times 36)\)  
B. \((2 \times 36) + (10 \times 36)\)  
C. \((12 \times 6) + (12 \times 3)\)  
D. \((12 \times 30) + 6\)  
Which expression is NOT equal to \(29 \times 20\)?  
A. \(29 \times 10 \times 2\)  
B. \((20 \times 20) + (20 \times 9)\)  
C. \((30 \times 20) - 20\)  
D. \(20 \times 20 \times 9\) |

**Assessable Academic Vocabulary:**
- associative property
- commutative property
- distributive property
- factors
- justify
- multiply
- place value
- product

**Symbols and Notation:**
- \(\times\) “times”  

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**Content Connections from Previous Grades:**  
2.2.3, 3.2, 4.2.2, 4.2.4
<table>
<thead>
<tr>
<th>Core Standard: 4.3 Measurement</th>
<th>Score Reporting Category 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop an understanding of area and determine the areas of two-dimensional shapes.</td>
<td></td>
</tr>
</tbody>
</table>

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

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<th>Sample Items:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.1 Recognize area as an attribute of two-dimensional regions.</td>
<td>● Items assessing this standard involve the recognition of area as an attribute of two-dimensional regions. Students may be given shapes and asked which ones have area or may be asked to sort shapes by those which have area.</td>
<td>Which highlighted region represents the area of the figure?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessable Academic Vocabulary:</th>
<th>Content Connections from Previous Grades:</th>
</tr>
</thead>
<tbody>
<tr>
<td>area</td>
<td>3.3.6</td>
</tr>
<tr>
<td>two-dimensional</td>
<td></td>
</tr>
</tbody>
</table>

Symbols and Notation:

Sample Items:

Which highlighted region represents the area of the figure?

A.  
B.  
C.  
D.  

In which figure is it possible to measure area?

A.  
B.  
C.  
D.  

(Give a pentagon. Ask which measurements you can NOT find on the pentagon. List perimeter, area, volume, and number of vertices.)

(Show two different polygons (convex hexagon and concave pentagon). Ask how you might sort these into the same group. One answer is “both have area”.)
### Core Standard: 4.3 Measurement
Develop an understanding of area and determine the areas of two-dimensional shapes.

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

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<tr>
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<th>Sample Items:</th>
</tr>
</thead>
</table>
| 4.3.2 Determine area by finding the total number of same-sized units of area that cover a shape without gaps or overlaps. | ● Students are expected to generate strategies to determine area of two dimensional shapes. Each strategy involves finding the total number of same-sized units of area that cover a shape without gaps or overlaps. Squares, rectangles, triangles, and pattern blocks are examples of area units that can fill regions.  
● Students may be asked to find area using something other than squares as the unit of measure. | Which 2 shapes have the same area? |

#### Assessable Academic Vocabulary:
- area
- gaps
- overlaps

#### Symbols and Notation:

#### Content Connections from Previous Grades:
3.3

#### Sample Items:
Which 2 shapes have the same area?

- A. 1 and 2
- B. 2 and 3
- C. 1 and 4
- D. 2 and 4

Lisa got a new desk. She measured the desk top and then drew it on graph paper. What is the area of the top of Lisa’s desk?

A. 2 square units  
B. 5 square units  
C. 7 square units  
D. 10 square units
### Core Standard: 4.3 Measurement
Develop an understanding of area and determine the areas of two-dimensional shapes.

Score Reporting Category 3

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

### Content Standard:
- **4.3.3** Recognize a square that is one unit on a side as the standard unit for measuring area.

### Assessable Academic Vocabulary:
- centimeter, square centimeter
- foot, square foot
- inch, square inch
- kilometer, square kilometer
- meter, square meter
- mile, square mile
- millimeter, square millimeter
- standard unit of measure
- unit, square unit
- yard, square yard

### Symbols and Notation:
- mm "millimeter"
- cm "centimeter"
- m "meter"
- km "kilometer"

- Customary units will be spelled (inch, foot, yard, mile).
- Metric units may be abbreviated
- Square units will NOT be written using exponents (cm²), but rather "square cm" or "square centimeters."

### Boundaries of Assessable Content:
- Students should see that each length has a corresponding area unit (e.g., inch to square inch, foot to square foot, yard to square yard, centimeter to square centimeter, and meter to square meter)
- Recognize that one unit length along the perimeter of a shape corresponds to one square unit of area within the shape.
- When measuring area, the answer should be reflected as a square unit.

### Content Connections to Previous Grades:
- **3.3.6**, **3.3.7**

### Sample Items:
Students found the area of this shape. Each is correct, but only one uses the standard unit for area. Which one is it?

**A.** 48 of these

**B.** 24 of these

**C.** 8 of these

**D.** 4 of these

The area of a picture is 15 square inches. Which statement can be true?

**A.** The picture is 15 inches × 15 inches.
**B.** 15 one inch squares cover this picture.
**C.** The picture is 10 inches × 5 inches.
**D.** The diagonal of the picture is 15 inches.
**Core Standard: 4.3 Measurement**
Develop an understanding of area and determine the areas of two-dimensional shapes.

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

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<tbody>
<tr>
<td>4.3.4 Determine the appropriate units, strategies, and tools for solving problems that involve estimating or measuring area.</td>
<td>● Determine the appropriate unit needed to estimate or measure area. This may include recognizing that area requires square units or identifying an appropriate unit (e.g., inch or mile).</td>
<td>The area of a triangular face of a square pyramid is calculated to be 12.78 units. Which of the following could be an appropriate label for this measurement?</td>
</tr>
</tbody>
</table>
| **Assessable Academic Vocabulary:** | ● Determine the appropriate tool to solve problems that involve estimating or measuring area. Students may need to measure sides of a figure with a ruler or use a nonstandard measure such as side of an index card, hexagon, or paperclip. | A. Square meters  
B. Square inches  
C. Centimeters  
D. Millimeters |
| estimate  
square unit  
square inch  
square foot  
square yard  
square mile  
square millimeter  
square centimeter  
square meter  
square kilometer | ● Students select strategies (for example covering index cards with color tiles, or using grid paper) to solve problems that involve estimating or measuring area. | What is the area of the shaded region, assuming each block is one square foot? |
| **Symbols and Notation:** | ● Students may estimate area by estimating the number of square units that fill a shape or by drawing a rectangle around a shape and finding the area of the rectangle. | A. 22 feet  
B. 22 square feet  
C. 24 feet  
D. 24 square feet |
| mm “millimeter”  
cm “centimeter”  
m “meter”  
km “kilometer” | **Content Connections from Previous Grades:**  
3.3.6, 4.1.5, 4.3.2, 4.3.4 | |
### Core Standard: 4.3 Measurement
Develop an understanding of area and determine the areas of two-dimensional shapes.

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

### Content Standard:
4.3.5 Connect area measure to the area model used to represent multiplication and use this to justify the formula for area of a rectangle.

### Assessable Academic Vocabulary:
- area
- area model
- dimensions
- length
- product
- rectangle
- square units
- width

### Symbols and Notation:
- \( A = lw \) “Area equals length times width.”
- Customary units will be spelled (inch, foot, yard, mile).
- Metric units may be abbreviated.
- Square units will NOT be written using exponents (cm\(^2\)), but, rather, “square cm” or “square centimeters”.

### Boundaries of Assessable Content:
- Items assessing this standard may include students explaining how the area of a rectangle connects to the area model for multiplication.
- Use the area formula for rectangles to find the area of rectangles.

### Sample Items:
Each tile on the floor is a square. Each tile measures 1 foot by 1 foot. Counting the number of tiles on the floor gives you which measurement?

*Show an area model for 3 × 5 and ask how many square units are inside the rectangular model.*

(The area of a rectangle is 12 square units. Ask which area model shows this rectangle. (Options could include rectangles that are 6 by 2, 4 by 4, 8 by 4, and 3 by 5))

(Ask students to explain how the area model matches the formula for the area of a rectangle.)
**Core Standard:** 4.3 Measurement  
Develop an understanding of area and determine the areas of two-dimensional shapes.

**Score Reporting Category 3**  

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

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</table>
| 4.3.6 Find the areas of complex shapes that can be subdivided into rectangles. | - Items assessing this standard involve complex shapes that can be separated into one or more rectangles. Students will have to find the area of each rectangle to find the area of the shape.  
- Subdivided rectangles may have missing dimensions which students will have to solve for in order to find the area of the rectangle.  
- Area may be found by counting unit squares from a grid or applying the formula for area of a rectangle.  
- Students may need to identify two different complex shapes that have the same area.  
- Answers will be written with labels of “square units”. |

<table>
<thead>
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<th>Assessable Academic Vocabulary:</th>
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<tbody>
<tr>
<td>area</td>
<td></td>
</tr>
<tr>
<td>complex shape</td>
<td></td>
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<tr>
<td>rectangle</td>
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<table>
<thead>
<tr>
<th>Symbols and Notation:</th>
<th></th>
</tr>
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</table>

<table>
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<tr>
<th>Sample Items:</th>
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<tbody>
<tr>
<td>Ken had a weekly lawn-mowing job working for Mr. Gentry. Each Saturday, Ken mowed the lawn. How much area did he mow each week?</td>
</tr>
</tbody>
</table>

A. 38 square feet  
B. 51 square feet  
C. 78 square feet  
D. 117 square feet

Source: NAEP 2011 Released Item

**Content Connections from Previous Grades:**  
3.3.5, 3.3.6, 4.3.5

**Mathematics, Grade 4**

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**Mathematics Test Specifications and Test Blueprints**

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**Oregon Department of Education**  
Office of Assessment and Information Services
**Core Standard: 4.3 Measurement**
Develop an understanding of area and determine the areas of two-dimensional shapes.

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

<table>
<thead>
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<th>Content Standard:</th>
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<tbody>
<tr>
<td>4.3.7 Solve problems involving perimeters and areas of rectangles and squares.</td>
</tr>
</tbody>
</table>

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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>perimeter</td>
</tr>
<tr>
<td>rectangle</td>
</tr>
<tr>
<td>square</td>
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</table>

<table>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Boundaries of Assessable Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solve problems requiring the calculation of perimeters of rectangles and squares.</td>
</tr>
<tr>
<td>Solve problems requiring the calculation of the areas of rectangles and squares.</td>
</tr>
<tr>
<td>Determine whether area or perimeter is needed to find the answer to a word problem.</td>
</tr>
<tr>
<td>Answers for area will have labels of &quot;square units&quot;.</td>
</tr>
<tr>
<td>Answers for perimeter will have labels of &quot;unit&quot;.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample Items:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jack is measuring around a rectangular table. The perimeter of the rectangle is 28 cm. How long is the side of the rectangle?</td>
</tr>
</tbody>
</table>

| A. 4 cm |
| B. 7 cm |
| C. 10 cm |
| D. 11 cm |

| Tyron’s garden is 2 feet by 3 feet. If he triples the length and the width, which statement is true? |

| A. The perimeter and the area are twice as big. |
| B. The perimeter triples and the area is nine times as big. |
| C. The perimeter triples and the area doubles. |
| D. The perimeter triples and the area triples. |

<table>
<thead>
<tr>
<th>Content Connections from Previous Grades:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.7, 3.3.8, 4.3.5</td>
</tr>
<tr>
<td>Core Standard: 4.3 Measurement</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>Develop an understanding of area and determine the areas of two-dimensional shapes.</td>
</tr>
</tbody>
</table>

It is essential that these standards be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

### Content Standard:
4.3.8 Recognize that rectangles with the same area can have different perimeters and that rectangles with the same perimeter can have different areas.

### Assessable Academic Vocabulary:
- area
- perimeter

### Symbols and Notation:

### Boundaries of Assessable Content:
- Students recognize that rectangles with the same area can have different perimeters.
- Students recognize that rectangles with the same perimeter can have different areas.
- Calculate perimeter and area of rectangles.
- When measuring area, the answer should be reflected as a square unit.
- When measuring perimeter, the answer should be reflected as a linear unit.

### Content Connections from Previous Grades:
3.3.7, 3.3.8, 4.3.5, 4.3.7

### Sample Items:
The perimeter of each rectangle is 30 cm. Which rectangle has the greatest area?

- **A.**
  - 6 cm x 6 cm
  - 9 cm x 1 cm
- **B.**
  - 14 cm x 1 cm
  - 8 cm x 7 cm
- **C.**
  - 8 cm x 5 cm
- **D.**
  - 10 cm x 10 cm

(Recognize that if you are given a perimeter of a rectangle (ex: 16 cm), the square is the shape that will always maximize the area.)
Assessable Academic Vocabulary Summary List for Grade 4
(Note: Assessable Academic Vocabulary from previous grades may also be used without explanation.)

approximate
approximation
area
area model
array
associative property
base ten
benchmark
between
centimeter
change
column
commutative property
compare
complex shape
decimal
dime
dimensions
distributive property
divide
dollar bill
equal intervals
equivalent
estimate
estimation
factors
five dollar bill
foot
fraction
gaps
change
greatest
hundredth
inch
justify
kilometer
least
length
meter
mile
model
multiplication
multiply
nickel
number line
order
overestimate
overlaps
penny
perimeter
place value
product
purchase
quotient
rectangle
represents
round
row
square centimeter
square foot
square inch
square kilometer
square meter
square mile
square millimeter
square unit
square yard
standard unit of measure
strategy
ten dollar bill
tenth
total
two-dimensional
underestimate
unit
width
yard
Item Specifications

Oregon Assessment of Knowledge and Skills (OAKS) is a statewide assessment scored by the state. It is a required assessment that provides the base for the accountability system. The OAKS also measures proficiency in the Essential Skills and is one way to determine student’s eligibility for a high school diploma or modified diploma beginning with the graduating class of 2014.

Criteria for All OAKS Test Questions

Test items must:

- be appropriate for students in terms of grade-level difficulty, cognitive complexity, reading level, interests and experience.
- be free of age, gender, ethnic, religious, socioeconomic, or disability stereotypes or bias.
- provide clear and complete instructions to students.

Graphics Criteria

Graphics are used in OAKS to provide both necessary and supplemental information. Some graphics contain information that is necessary for answering the question, while other graphics illustrate or support the context of the question.

- Graphic displays, their corresponding items and answer choices will appear on the same screen for online items.
- Shading and color will be minimized. It will be used to make a figure’s size, shape or dimensions clear, and not solely for artistic effect.
- When objects or regions of particular colors must be identified from a graphic, the objects or regions will be labeled as to their color.
- Graphics used for computer scored constructed response items are displayed within a grid space and allow students to manipulate answer graphics and answer choices.

Item Style and Format Criteria for Multiple-Choice Items

- Test items will be in the form of questions - or sentences that require completion.
- Each item will have three, four, or five answer choices. Students will be told in the test directions to choose the best answer from among the choices.
- Answer choices will be arranged one of three ways beneath the question: vertically, horizontally, or in two columns (i.e., A and B in the left column, C and D in the right column).
- Neither “None of the above” nor “All of the above” will be used as one of the answer choices. “There is not enough information to tell” is an allowed answer choice.
- Test items may be worded in the negative (“Which of these is NOT . . .”), but this structure will be used only when it offers substantial advantages for the item construction.
- Items should be free of absolute wording, such as “always” and “never,” and may have qualifying words (e.g., least, most, except) printed in CAPS for emphasis.
- Masculine pronouns should NOT be used to refer to both sexes. Plural forms should be used whenever possible to avoid gender-specific pronouns (e.g., instead of “The student will make changes so that he . . .”, use “The students will make changes so that they . . .”).
- An equal balance of male and female names should be used, including names representing different ethnic groups.
• Test items aligned to standards may contain extraneous information.
• Stacked English-Spanish test items are used on electronic tests for the English-Spanish OAKS.
• Each Score Reporting Category will have items with a range of difficulty and complexity levels.
• Each test item will measure only one Score Reporting Category

Item Style and Format Criteria for Computer-Scored Constructed Response Items

• Test items will be in the form of questions that ask for at least one object to be created or matched to an existing picture,
• Each item may have many discrete and correct answer choices.
• Test items may be worded so that not all answer choices are used to construct the correct response.
• An equal balance of male and female names should be used including names representing different ethnic groups.
• Test items aligned to standards may contain extraneous information but only to enhance the students’ understanding of the question.
• Side-by-side English-Spanish test items of this type are under development.

Additional Criteria for Mathematics Test Questions

• Except in translation items (name to numeral, numeral to name), numbers will be expressed as numerals.
• In general, numbers zero through nine should be presented as words, and numbers 10 and above should be presented as numerals. In the item stem, any numbers needed to compute answers should be presented as numerals.
• Commas will be used in numbers with four or more digits.
• Decimal numbers less than one will be written with leading zeros.
• All fractions will be written with a horizontal bar separating the numerator and denominator.
• If the answer choices for an item are strictly decimal numerals or integers, they should be arranged in ascending or descending order, with the place values of digits aligned. An exception would be when this ordering of options might give a clue as to the correct option. When the item requires the identification of relative size or magnitude, choices should be arranged as they are presented in the item stem.
• If the answer choices for an item are neither strictly numerical nor denominate numbers, the choices should be arranged by the logic presented in the question or by length.
• Answer choices will include units, as appropriate.
• Computations required in test items will not be so complicated that they take an inordinate amount of time to complete, even with calculators. Instead, reasoning within the context of the items is emphasized.
• Test items will be appropriate for students in the assigned grade in terms of reading level, interests, and experience. For mathematics test items, the reading level should be approximately one grade level below the grade level of the test, except for specifically assessed mathematical terms or concepts.
• Standard units of measure should be spelled out, except in graphics where an abbreviation may be
used (e.g., ft or yd). Abbreviations that also spell a word must be punctuated to avoid confusion. For example, to avoid confusion with the preposition “in,” the abbreviation “in.” should be used for the unit of measure “inches.” If an abbreviation is used in a graphic, an explanation of the meaning of the abbreviation should be included in the stem. Metric units may be abbreviated.

In addition (See: Test Administration Manual at http://www.ode.state.or.us/go/tam)

- Students are strongly encouraged to use calculators – either the on-screen calculator, their own, or one provided by the school.
- Rulers, manipulative and other tools commonly available to all students are also encouraged. No problems require the use of a calculator and no more than a four-function calculator is needed for any problem, although scientific calculators are highly recommended for use at grades 8 and 10.
- A reference sheet containing appropriate formulas and conversions is provided to students. If formulas not on the sheet are needed, they should be included with the item.
Mathematics Test Blueprint

Introduction

The blueprints used to construct Knowledge and Skills Tests for Mathematics prescribe the:

- Score Reporting Categories (SRC) included on each test,
- The cognitive demand and difficulty level of items as distributed on a test form,
- the number and percentages of test items from each SRC included on each test, and
- the total number and percentages of operational and field test items included for each test.

Teachers and other educators have historically played a vital role in the development of these specifications and blueprints by serving on Content and Assessment Panels and other review groups. These groups have advised the Department as content standards have been developed, and have helped establish priorities on which standards to assess and the weighting of the strands within each content area assessment.

Alignment of Test Items to Content Standards

Test items are carefully aligned to content standards at the appropriate grade level through a rigorous process at two points in the test item development process:

- At item development workshops, item writers are provided with adopted content standards and content standard elements to which they must write test items; during a peer review process, this alignment is verified by another grade level item developer and the grade-level facilitator.

- Alignment of items to the standards is further verified during a review by members of a Content and Assessment Panel, who ensure items not only match the standards, but also verify overall quality and appropriateness. Reviewers either accept items as a strong match to the targeted standards, edit items to achieve a strong match, or reject items which do not strongly match the standards.

The Appendix to this document includes additional evidence describing procedures ensuring alignment during item development, including descriptions of Item Development and the Life of an Item.

Content Coverage

Prior to item writing activities, item databases are reviewed to determine the extent that the available items represent the emphasis and content in the standards. If any content standards are underrepresented in the item pool, they are identified and targeted specifically for additional item development. This assures that the item pools will have sufficient numbers of items aligned to the each of the content standards to allow the test algorithm to deliver tests which follow the blueprint for content, difficulty, and cognitive complexity.

For electronic administration, all tests and the item pools from which they are constructed follow the weighting of each score reporting category as reflected in the chart titled “Weighting of Mathematics Score Reporting Categories.” Items aligned to the same SRC are selected to provide a range of difficulty so that the progressive nature of the test is maintained as students of varied
ability levels are presented with items most appropriate to their ability from that pool. Although a student may not see an item addressing every one of the standards in a single test event, the item pool contains multiple items for each content standard at a variety of difficulty levels and cognitive complexity.

In addition, the adaptive algorithm specifically considers alignment criteria when drawing test items. As a result, we accomplish the dual purpose of creating a test form that is appropriately developed for each student and it meets the criteria set forth for alignment (e.g., balance of representation, depth of knowledge).

In order to report subscores, or scores for SRCs, no fewer than six items will be used for each SRC. Online tests report total test scores and scores for SRCs. (Subscores)

Additional Test Design Criteria

Each item assesses only one SRC at one grade.

Each item assesses only one content standard at one grade.

Online-adaptive test opportunities provide a range and breadth of items within each SRC and content standard. Test pools attempt to provide a minimum of one item at each difficulty level for each content standard. Test pools range in size from 800 to 1500 items.

Key placement cannot be controlled for online-adaptive assessments, so to ensure more random correct keys, item writers are instructed to rotate the correct key for their items during item authoring.

English test blueprints provide the criteria for all English-Spanish tests. Test pools and are designed to match the English test opportunities.
Weighting of Mathematics Score Reporting Categories

The chart below shows the score reporting categories for each of the grades and the percentage of questions on a test that assess each score reporting category. For example, at grade 5, 35% of the items on a test assess Number and Operations and Data Analysis, which equals about 14 items on a 40-item test. The second chart, on the next page, is an expanded view of the criteria for test weighting.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Score Reporting Category 1</th>
<th>Weight</th>
<th>Score Reporting Category 2</th>
<th>Weight</th>
<th>Score Reporting Category 3</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Number and Operations</td>
<td>35%</td>
<td>Number and Operations, Algebra, and Data Analysis</td>
<td>35%</td>
<td>Geometry and Measurement</td>
<td>30%</td>
</tr>
<tr>
<td>4</td>
<td>Number and Operations</td>
<td>35%</td>
<td>Number and Operations and Algebra</td>
<td>35%</td>
<td>Measurement</td>
<td>30%</td>
</tr>
<tr>
<td>5</td>
<td>Number and Operations and Data Analysis</td>
<td>35%</td>
<td>Number and Operations and Algebra</td>
<td>35%</td>
<td>Geometry, Algebra, and Measurement</td>
<td>30%</td>
</tr>
<tr>
<td>6</td>
<td>Number and Operations</td>
<td>35%</td>
<td>Number and Operations and Probability</td>
<td>35%</td>
<td>Algebra</td>
<td>30%</td>
</tr>
<tr>
<td>7</td>
<td>Number and Operations and Algebra</td>
<td>35%</td>
<td>Number and Operations, Algebra and Geometry</td>
<td>35%</td>
<td>Measurement and Geometry</td>
<td>30%</td>
</tr>
<tr>
<td>8</td>
<td>Algebra</td>
<td>40%</td>
<td>Data Analysis and Algebra</td>
<td>30%</td>
<td>Geometry and Measurement</td>
<td>30%</td>
</tr>
<tr>
<td>HS</td>
<td>Algebra</td>
<td>50%</td>
<td>Geometry</td>
<td>30%</td>
<td>Statistics</td>
<td>20%</td>
</tr>
</tbody>
</table>
Mathematics Test Blueprint- Grade 4

Content Coverage and Weighting

<table>
<thead>
<tr>
<th>Score Reporting Categories</th>
<th>Number of OAKS Online Items</th>
<th>Target % of Questions Assessed per Test*</th>
<th>Online Test Pool Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number and Operations:</td>
<td>12-16</td>
<td>35%</td>
<td>250</td>
</tr>
<tr>
<td>Develop an understanding of decimals, including the connections between fractions and decimals.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number and Operations and Algebra:</td>
<td>12-16</td>
<td>35%</td>
<td>210</td>
</tr>
<tr>
<td>Develop fluency with multiplication facts and related division facts, and with multi-digit whole number multiplication.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement:</td>
<td>10-14</td>
<td>30%</td>
<td>330</td>
</tr>
<tr>
<td>Develop an understanding of area and determine the areas of two-dimensional shapes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational Item Total</td>
<td>40</td>
<td></td>
<td>790</td>
</tr>
<tr>
<td>Field Test Item Total</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Items on Test</td>
<td>45</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

*During an individual student testing session, the test algorithm selects items from each SRC, targeting the percentages indicated. Furthermore, items are selected to match the target item difficulty level, determined by the student’s performance on previous items, and also to match the Cognitive Demand Distribution Goals for the test. The numbers of items available in the item pool for each SRC are sufficient to allow three tests per student each year, without the student seeing any item more than once.
Target Cognitive Demand and Item Difficulty Distribution

The mathematics test pools are designed so that items having a range of Cognitive Demand and a range of difficulty are included for each student test opportunity. The target item pool difficulty distribution for the Grade 4 test is outlined in the chart. A target range of cognitive demand item delivery is also included. (See Appendix B, Cognitive Demand and RIT by Difficulty for all grades). The three Cognitive Demand levels used to qualify Oregon’s test items are:

- Recall: Item requires a student to recall a fact, information or procedure.
- Skill/Concept: Item requires a student to use skill or concept, including thinking that requires two or more steps.
- Strategic Thinking: Item requires a student to use reason, develop a plan or use a sequence of steps.

Online adaptive tests provide students with questions at the beginning of the test at or about the mean RIT level and as the student responds, the test item delivery system makes adjustments by selecting appropriate items for each student based upon their correct and incorrect responses.

Student scores on each test will vary due to performance and the set of unique test items issued to the student. Generally, students will earn scores between the maximum high and minimum low range. The following are the possible high and low RIT student scores for grade 4 tests, within one or two points, based on a given year’s item pool.

<table>
<thead>
<tr>
<th>RIT Range</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>193-212</td>
<td>33%</td>
</tr>
<tr>
<td>213-220</td>
<td>33%</td>
</tr>
<tr>
<td>221-241</td>
<td>33%</td>
</tr>
</tbody>
</table>

| Mean RIT  | 217        |

<table>
<thead>
<tr>
<th>Target Cognitive Demand Distribution Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recall</td>
</tr>
<tr>
<td>Skill/Concept</td>
</tr>
<tr>
<td>Strategic Thinking</td>
</tr>
</tbody>
</table>

| High RIT | 275 |
| Low RIT  | 149 |
Achievement Level Descriptors

Achievement level descriptors describe what students know and can do based on their performance on statewide knowledge and skills tests in the various content areas. These may be used by educators to target instruction and inform parents and students of the expectations for students to be considered proficient at a particular grade level.

The Achievement Level Descriptors are based on a sampling of a larger set of content outlined in the State of Oregon Content Standards for Kindergarten through Grade 8 (2007) and the State of Oregon High School Mathematics Standards (2009). Results for individual students are only one indicator of student ability as measured at the time of testing. These statements give a general description of what most students know and can do within a particular band of achievement and are presented in the order of the way they are reported rather than by importance or test emphasis.

Students who score at or within a particular level of achievement possess the bulk of the abilities described at that level and generally have mastered the skills described in the preceding achievement levels.

Achievement Level Descriptors for each subject area were developed by groups of parents, educators, and business people who worked with state officials to establish the minimum scores required for Exceeds, Meets, Nearly Meets and Does Not Yet Meet.
# Oregon Mathematics Achievement Level Descriptors – Grade 4

The achievement level descriptors are cumulative.

<table>
<thead>
<tr>
<th>General Policy Definitions (Apply to all grades and all subjects)</th>
<th>Does Not Yet Meet</th>
<th>Nearly Meets</th>
<th>Meets</th>
<th>Exceeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students do not demonstrate mastery of grade-level knowledge and skills required for proficiency.</td>
<td>Students demonstrate partial mastery of grade-level knowledge and skills required for proficiency.</td>
<td>Students demonstrate mastery of grade-level knowledge and skills required for proficiency.</td>
<td>Students demonstrate mastery of grade-level knowledge and skills exceeding the requirement for proficiency.</td>
<td></td>
</tr>
</tbody>
</table>

| Mathematics Policy Definitions (Apply to all grades) | Students demonstrate limited mathematical knowledge and skills through the direct application of a concept or procedure in simplified and familiar situations with occasional success. | Students demonstrate mathematical knowledge and skills through the direct application of concepts and procedures in familiar situations with regular success. They are able to explain their steps. | Students demonstrate mathematical knowledge and skills through selecting from an assortment of strategies and integrating concepts and procedures in a variety of situations with consistent success. They are able to explain steps and procedures. | Students demonstrate mathematical knowledge and skills through the use of multiple reasoning strategies and apply them in new and complex situations with consistent success. They are able to analyze their strategies and solutions. |

| Mathematics Achievement Level Descriptors | 4.1 Number and Operations: Develop an understanding of decimals, including the connections between fractions and decimals. | • Inconsistently read, write, or represent decimal numbers (to the hundredths). • Use models to represent fractions and decimals and inconsistently connect equivalent fractions and decimals. • Inconsistently determine decimal equivalents for common fractions. • Inconsistently compare fractions or decimals. • Inconsistently estimate decimal or fractional amounts in routine situations. • Inconsistently represent money amounts to $10.00 in dollars and cents. | • Read, write, or represent decimal numbers (to the hundredths). • Use models to connect equivalent fractions and decimals. • Determine decimal equivalents or approximation for some common fractions. • Compare and order fractions or compare and order decimals. • Estimate decimal or fractional amounts in routine situations. • Represent money amounts to $10.00 in dollars and cents. | • Read, write, and represent decimal numbers (to the hundredths). • Use models to connect and compare equivalent fractions and decimals. • Determine decimal equivalent and/or approximation for common fractions. • Compare and order fractions and decimals. • Estimate decimal or fractional amounts in routine and non-routine situations. • Represent money amounts to $10.00 in dollars and cents and apply to situations involving purchasing ability and making change. | • Read, write, and represent decimal numbers (to the hundredths) in a context. • Use models to connect and compare equivalent fractions and decimals including mixed numbers or improper fractions. • Determine decimal equivalents or approximation for common fractions and can explain the relationship between them. • Compare and order fractions and decimals, including improper fractions and mixed numbers. • Estimate decimal or fractional amounts and justify solutions. • Represent money amounts to $10.00 in dollars and cents and apply to situations involving purchasing ability and making change with the fewest bills and coins. |

Adopted 10/28/2010

Oregon Department of Education
Office of Assessment and Information Services
# Oregon Mathematics Achievement Level Descriptors – Grade 4

The achievement level descriptors are cumulative.

<table>
<thead>
<tr>
<th>General Policy Definitions (Apply to all grades and all subjects)</th>
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<th>Nearly Meets</th>
<th>Meets</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Students do not demonstrate mastery of grade-level knowledge and skills required for proficiency.</td>
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<td>Students demonstrate mastery of grade-level knowledge and skills required for proficiency.</td>
<td>Students demonstrate mastery of grade-level knowledge and skills exceeding the requirement for proficiency.</td>
<td></td>
</tr>
</tbody>
</table>

**Mathematics Policy Definitions (Apply to all grades)**

<table>
<thead>
<tr>
<th>Mathematics Achievement Level Descriptors</th>
<th>Does Not Yet Meet</th>
<th>Nearly Meets</th>
<th>Meets</th>
<th>Exceeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2 Number and Operations and Algebra: Develop fluency with multiplication facts and related division facts, and with multi-digit whole number multiplication.</td>
<td>• Inconsistently compute multiplication facts to 10 times 10.</td>
<td>• Apply with fluency multiplication facts to 10 times 10.</td>
<td>• Apply with fluency multiplication facts to 10 times 10 and related division facts.</td>
<td>• Apply with fluency multiplication facts to 10 times 10 and related division facts in complex situations.</td>
</tr>
<tr>
<td></td>
<td>• Demonstrate inconsistent understanding of application of models for multiplication (e.g., equal-sized groups, arrays, area models, equal intervals on the number line).</td>
<td>• Demonstrate partial understanding of application of models for multiplication (e.g., equal-sized groups, arrays, area models, equal intervals on the number line), place value, or properties of operations (commutative, associative, and distributive).</td>
<td>• Demonstrate understanding of application of models for multiplication (e.g., equal-sized groups, arrays, area models, equal intervals on the number line), place value, and properties of operations (commutative, associative, and distributive).</td>
<td>• Demonstrate understanding of application of models for multiplication (e.g., equal-sized groups, arrays, area models, equal intervals on the number line), place value, and properties of operations (commutative, associative, and distributive) in complex situations.</td>
</tr>
<tr>
<td></td>
<td>• Inconsistently use a given estimation strategy for multiplication (e.g., use benchmarks, overestimate, underestimate, round) when computing with whole numbers.</td>
<td>• Use a given or familiar estimation strategy for multiplication (e.g., use benchmarks, overestimate, underestimate, round) when computing with whole numbers.</td>
<td>• Select and use appropriate estimation strategies for multiplication (e.g., use benchmarks, overestimate, underestimate, round) to calculate mentally based on the problem situation when computing with whole numbers.</td>
<td>• Select and use appropriate estimation strategies for multiplication (e.g., use benchmarks, overestimate, underestimate, round) to calculate mentally based on the problem situation when computing with whole numbers and explain why a strategy was chosen.</td>
</tr>
<tr>
<td></td>
<td>• Inconsistently use accurate methods to multiply multi-digit whole numbers.</td>
<td>• Use accurate or generalizable methods to multiply multi-digit whole numbers.</td>
<td>• Develop and use accurate, efficient, and generalizable methods to multiply multi-digit whole numbers.</td>
<td>• Develop and use accurate, efficient, and generalizable methods to multiply multi-digit whole numbers or larger.</td>
</tr>
<tr>
<td></td>
<td>• Inconsistently multiply multi-digit whole numbers.</td>
<td>• Use given or familiar procedures for multiplying multi-digit whole numbers.</td>
<td>• Develop fluency with efficient procedures for multiplying multi-digit whole numbers.</td>
<td>• Develop fluency with efficient procedures for multiplying multi-digit whole numbers and justify why the procedures work on the basis of place value and number properties.</td>
</tr>
</tbody>
</table>

Adopted 10/28/2010
## Oregon Mathematics Achievement Level Descriptors – Grade 4

The achievement level descriptors are cumulative.

<table>
<thead>
<tr>
<th>General Policy Definitions</th>
<th>Does Not Yet Meet</th>
<th>Nearly Meets</th>
<th>Meets</th>
<th>Exceeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Apply to all grades and all subjects)</td>
<td>Students do not demonstrate mastery of grade-level knowledge and skills required for proficiency.</td>
<td>Students demonstrate partial mastery of grade-level knowledge and skills required for proficiency.</td>
<td>Students demonstrate mastery of grade-level knowledge and skills required for proficiency.</td>
<td>Students demonstrate mastery of grade-level knowledge and skills exceeding the requirement for proficiency.</td>
</tr>
</tbody>
</table>

### Mathematics Policy Definitions

(Apply to all grades)

<table>
<thead>
<tr>
<th>Mathematics Achievement Level Descriptors</th>
<th>Does Not Yet Meet</th>
<th>Nearly Meets</th>
<th>Meets</th>
<th>Exceeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3 Measurement: Develop an understanding of area and determine the areas of two-dimensional shapes.</td>
<td>• Inconsistently recognize area as an attribute of two-dimensional regions or inconsistently recognize a square that is one unit on a side as the standard unit for measuring area.</td>
<td>• Recognize area as an attribute of two-dimensional regions or recognize a square that is one unit on a side as the standard unit for measuring area.</td>
<td>• Recognize area as an attribute of two-dimensional regions and recognize a square that is one unit on a side as the standard unit for measuring area.</td>
<td>• Recognize area as an attribute of two-dimensional regions and recognize a square that is one unit on a side as the standard unit for measuring area.</td>
</tr>
<tr>
<td></td>
<td>• Inconsistently identify a standard unit for measuring area.</td>
<td>• Partially determine area by finding the total number of same-sized units of area that cover a shape without gaps or overlaps.</td>
<td>• Determine area by finding the total number of same-sized units of area that cover a shape without gaps or overlaps.</td>
<td>• Determine area by finding the total number of same-sized units of area that cover a shape without gaps or overlaps.</td>
</tr>
<tr>
<td></td>
<td>• Use different-sized units of area to cover a shape with gaps and/or overlaps.</td>
<td>• Sometimes determine the appropriate units, strategies, or tools to solve problems that involve estimating or measuring area.</td>
<td>• Determine the appropriate units, strategies, and tools to solve problems that involve estimating and/or measuring area.</td>
<td>• Determine and justify appropriate units, strategies, and tools to solve problems that involve estimating and/or measuring area.</td>
</tr>
<tr>
<td></td>
<td>• Begin to see the area model of multiplication or begin to observe area measure as multiplication.</td>
<td>• Connect area measure to the area model used to represent multiplication.</td>
<td>• Connect area measure to the area model used to represent multiplication and use this to express the formula for area of a rectangle.</td>
<td>• Connect area measure to the area model used to represent multiplication and explains how this justifies the formula for area of a rectangle.</td>
</tr>
<tr>
<td></td>
<td>• Inconsistently find the area of common shapes that can be subdivided into rectangles.</td>
<td>• Find the areas of common shapes that can be subdivided into rectangles.</td>
<td>• Find the area of complex shapes that can be subdivided into rectangles.</td>
<td>• Determine the areas of complex shapes that can be subdivided into rectangles and can explain their thinking.</td>
</tr>
<tr>
<td></td>
<td>• Inconsistently find perimeters or areas of rectangles or squares.</td>
<td>• Solve problems involving perimeters or areas of rectangles and squares.</td>
<td>• Solve problems involving perimeters and areas of rectangles and squares.</td>
<td>• Solve problems involving perimeters and areas of rectangles and squares and justify their thinking.</td>
</tr>
<tr>
<td></td>
<td>• Inconsistently calculate perimeters and areas of given rectangles.</td>
<td>• Calculate perimeter and area of given rectangles and identifies rectangles with equal perimeters or equal areas.</td>
<td>• Recognize that rectangles with the same area can have different perimeters and that rectangles with the same perimeter can have different areas.</td>
<td>• Recognize, generalize, and justify that rectangles with the same area can have different perimeters and that rectangles with the same perimeter can have different areas.</td>
</tr>
</tbody>
</table>

Adopted 10/28/2010

Mathematics Test Specifications and Test Blueprints

Oregon Department of Education
Office of Assessment and Information Services
LOCAL ASSESSMENTS REQUIRED BY OAR 581-22-0615
ASSESSMENT OF ESSENTIAL SKILLS

Local Performance Assessments
School districts and public charter schools that offer instruction at grades 3 through 8 or high school must administer annual local performance assessments for students in grades 3 through 8 and at least once in high school for the skill areas of writing, speaking, mathematics problem solving, and scientific inquiry. The purpose of the local performance assessment requirement is to ensure that students in grades 3 through high school are afforded opportunities to learn and to receive feedback regarding their progress toward meeting specific state standards throughout their years in public schools.

A local performance assessment is a standardized measure (e.g., activity, exercise, problem, or work sample scored using an official state scoring guide), embedded in the school district’s or public charter school’s curriculum that evaluates the application of students’ knowledge and skills. Local performance assessments must be designed to closely align with state standards and to promote independent, individual student work.

School districts and public charter schools may either use a work sample scored using an official state scoring guide or a comparable measure adopted by the school district or public charter school to satisfy the local performance assessment requirement. Appendix E – Work Samples and State Scoring Guides of the 2009-10 Test Administration Manual provides guidance for those school districts and public charter schools choosing to use a work sample to satisfy this requirement.

Assessment of Proficiency in the Essential Skills
As part of the new graduation requirements, high school students must demonstrate proficiency in a set of Essential Skills, which are defined as process skills that cross academic disciplines and are embedded in the content standards. Starting with the graduating class of 2012, high school students must demonstrate proficiency in the Essential Skills of Reading, Writing, Speaking, and Mathematics.

Students may demonstrate proficiency in these Essential Skills using any of the assessment options approved by the State Board of Education.

As of May 2009, the Oregon Assessment of Knowledge and Skills (OAKS) is one of the approved assessment options for the Essential Skills of Reading, Writing, and Mathematics. Another approved option for the Essential Skills of Writing, Speaking, and Mathematics is the completion of work samples scored locally using an official state scoring guide. Appendix D – Requirements for Assessment of Essential Skills of the 2009-10 Test Administration Manual provides guidance for those school districts and public charter schools choosing to use a work sample to satisfy this requirement.

The Assessment of Essential Skills Review Panel (AESRP), which consists of experts from school districts and post-secondary education institutions, reviews and recommends additions or changes to the list of approved assessment options. The AESRP bases its recommendations on evidence provided by the school districts, research organizations, and other experts that the proposed assessment option accurately measures the Essential Skill. The State Board of Education then makes the determination whether to adopt the AESRP’s recommendations. ODE anticipates that the State Board of Education will approve additional assessment options based on recommendations from the AESRP in the coming months. In addition, the AESRP is developing a set of criteria for approval by the State Board of Education that school districts and public charter schools may use in developing local assessment options.
Appendices

The Appendices of this document include ancillary materials provided to students to complete mathematics testing; and additional assessment documents that deal with test construction and design.

Included in this section are:

Appendix A: Oregon Achievement Standards Summary for All Subjects
Appendix B: Cognitive Demand and Item Difficulty Distribution Goals
Appendix C: Item Development Process
Appendix D: Life of an Item
Appendix E: Mathematical Problem Solving Official Scoring Guide Background and Resources
Appendix F: Official Formula Sheet and Conversion Tables
# 2012-13 Achievement Standards Summary

The charts below show the achievement standards (requirements to meet and exceed) for Oregon’s Assessments of Knowledge and Skills (OAKS) by content area and grade or benchmark level. All students are required to take reading/literature and mathematics assessments in grades 3-8 and 11; in writing in grades 4, 7, and 11; and science in grades 5, 8, and 11. Assessments in social sciences are optional; however, they may be required by some districts or schools. For detailed assessment information, refer to the 2011-12 Test Administration Manual (www.ode.state.or.us/go/TAM). It provides timelines, options, and procedures that ensure both test reliability and validity from classroom to classroom, teacher to teacher, school to school, and district to district.

<table>
<thead>
<tr>
<th>Grade 3</th>
<th>MEET</th>
<th>EXCEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading/Literature</td>
<td>211</td>
<td>224</td>
</tr>
<tr>
<td>Mathematics</td>
<td>212</td>
<td>219</td>
</tr>
<tr>
<td>Writing, Speaking, Science, Social Sciences</td>
<td>No state test</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade 4</th>
<th>MEET</th>
<th>EXCEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading/Literature</td>
<td>216</td>
<td>226</td>
</tr>
<tr>
<td>Writing **</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Composite Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Minimum score in each trait</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Conventions score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 32 to 39* (out of 48)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 40 to 48 (out of 48)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voice and Word Choice are not included in the achievement standard.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*A composite score of 28 to 31 points nearly meets the standard. Scores in this range indicate that the writing is close to meeting the standard and that local performance assessments could be used to provide a more comprehensive view of student proficiency in writing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>219</td>
<td>227</td>
</tr>
<tr>
<td>Speaking, Science, and Social Sciences</td>
<td>No state test</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade 5</th>
<th>MEET</th>
<th>EXCEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading/Literature</td>
<td>221</td>
<td>230</td>
</tr>
<tr>
<td>Mathematics</td>
<td>225</td>
<td>234</td>
</tr>
<tr>
<td>Science</td>
<td>226</td>
<td>239</td>
</tr>
<tr>
<td>Social Sciences #</td>
<td>215</td>
<td>225</td>
</tr>
<tr>
<td># Optional state test; may be required by districts or schools.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Writing, Speaking</td>
<td>No state test</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade 6</th>
<th>MEET</th>
<th>EXCEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading/Literature</td>
<td>226</td>
<td>237</td>
</tr>
<tr>
<td>Mathematics</td>
<td>227</td>
<td>237</td>
</tr>
<tr>
<td>Writing, Speaking, Science, Social Sciences</td>
<td>No state test</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade 7</th>
<th>MEET</th>
<th>EXCEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading/Literature</td>
<td>229</td>
<td>241</td>
</tr>
<tr>
<td>Writing **</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Composite Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Minimum score in each trait</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Conventions score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 40 to 49* (out of 60)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 50 to 60 (out of 60)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voice and Word Choice are not included in the achievement standard.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*A composite score of 35 to 39 points nearly meets the standard. Scores in this range indicate that the writing is close to meeting the standard and that local performance assessments could be used to provide a more comprehensive view of student proficiency in writing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>232</td>
<td>242</td>
</tr>
<tr>
<td>Speaking, Science, and Social Sciences</td>
<td>No state test</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade 8</th>
<th>MEET</th>
<th>EXCEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading/Literature</td>
<td>232</td>
<td>242</td>
</tr>
<tr>
<td>Mathematics</td>
<td>234</td>
<td>245</td>
</tr>
<tr>
<td>Science</td>
<td>235</td>
<td>247</td>
</tr>
<tr>
<td>Social Sciences #</td>
<td>231</td>
<td>241</td>
</tr>
<tr>
<td># Optional state test; may be required by districts or schools.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Writing, Speaking</td>
<td>No state test</td>
<td></td>
</tr>
</tbody>
</table>

** Due to legislative action during the 2011 session the state writing assessment at grades 4 & 7 were suspended for the 2011-2012 and 2012-2013 school years.
# Achievement Standards for High School

**High School Achievement Standards for Oregon Statewide Assessments**

Oregon Assessment of Knowledge and Skills (OAKS) is one option to provide evidence of proficiency in Essential Skills.

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>Meets</th>
<th>Exceeds</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading/Literature</td>
<td>236</td>
<td>247</td>
<td>Content of the 2011-2012 OAKS Reading/Literature Assessment is based on the Grade Level Content Standards adopted in 2002-2003. Read and comprehend a variety of text.</td>
</tr>
<tr>
<td>Writing</td>
<td>• 40 to 49 (out of 60)</td>
<td>• 50 to 60</td>
<td>A composite score of 35 to 39 points nearly meets the standard. Scores in this range indicate that the writing is close to meeting the standard and that local performance assessments could be used to provide a more comprehensive view of student proficiency in writing. Score on Voice and Word Choice traits are not included in the achievement standard. Write clearly and accurately.</td>
</tr>
<tr>
<td>Mathematics</td>
<td>236</td>
<td>251</td>
<td>Content of the 2011-12 OAKS Mathematics test is based on the Content Standards adopted in 2009 for high school and 2007 for grades K-8. Apply mathematics in a variety of settings.</td>
</tr>
<tr>
<td>Science</td>
<td>240</td>
<td>252</td>
<td>Content of the 2011-12 OAKS Science test is based on the Content Standards adopted in 2009.</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>239</td>
<td>249</td>
<td>Optional State Assessment; content of the 2011-12 OAKS Social Sciences Assessment is based on the Content Standards adopted in 2001.</td>
</tr>
</tbody>
</table>

## Achievement Standards for Demonstrating Proficiency in Essential Skills for High School Diploma

<table>
<thead>
<tr>
<th>Essential Skill</th>
<th>OAKS Assessment</th>
<th>Required Scores</th>
<th>Other Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading (Class of 2012 &amp; beyond)</td>
<td>Reading/Literature</td>
<td>236 Meets 247 Exceeds</td>
<td>Other approved standardized test; Work samples</td>
</tr>
<tr>
<td>Writing (Class of 2013 &amp; beyond)</td>
<td>Writing Performance Assessment</td>
<td>40 Meets 50 Exceeds</td>
<td>Work samples</td>
</tr>
<tr>
<td>Apply Mathematics (Class of 2014 &amp; beyond)</td>
<td>Mathematics</td>
<td>236 Meets 251 Exceeds</td>
<td>Other approved standardized test; Work samples</td>
</tr>
</tbody>
</table>

1. In future years, Achievement Standards may change for the purposes of accountability and earning a high school diploma.

2. For purposes of demonstrating mastery of Essential Skills, students must meet the achievement standards in effect during their 8th grade year. However, students may use achievement standards adopted in their 9th through 12th grade years that are equal to or lower than the achievement standards approved as of March 1 of the students' 8th grade year. In addition, students may demonstrate proficiency in the Essential Skills using additional assessment options adopted in their 9th through 12th grade years.
Local Performance assessments evaluate the application of students’ knowledge and skills. OAR 581-022-0615 Assessment of Essential Skills requires students to complete one or more local performance assessments for each assessed skill area per year in grades 3-8 and at least once in high school. The table below outlines the achievement standards for work samples scored with an official state scoring guide and used as a local performance assessment. For detailed assessment information refer to the 2011-12 Test Administration Manual at www.ode.state.or.us/go/TAM. It provides work sample guidelines, options, and procedures that help ensure both work sample reliability and validity from classroom to classroom, teacher to teacher, school to school, and district to district.

| Skill Area (Official State Scoring Guide) | Grade      | Achievement Standard for Purpose of Local Performance Assessment | Notes about Work Samples                                      |
|----------------------------------------|------------|================================================================|---------------------------------------------------------------|
|                                        | Grade 3    | Meets (out of 6) 3  Exceeds (out of 6) 4                        | Grade 3 students are not held to a standard in Sentence Fluency. |
| Writing                                | Grades 4-8 and High School | 4  5                    | Voice and Word Choice may be scored but are not required traits. Exemplars reflect expectations at each grade level. |
| Speaking                               | Grade 3    | 3  4                    | Grade 3 students are not held to a standard in Language.       |
|                                        | Grades 4-8 and High School | 4  5                    | Exemplars reflect expectations at each grade level.            |
| Mathematics Problem Solving¹           | Grades 3-8 and High School | 4  5                    | Exemplars reflect expectations at each grade level.            |
| Scientific Inquiry²                    | Grades 3-8 and High School | 4  5                    | Separate Official scoring guides exist for each grade/band (Grade 3, Benchmark 2 (Grades 4-5), Benchmark 3 (Grades 6-8), and High School). |

Related Web Links:
Official State Scoring Guides: www.ode.state.or.us/search/page/?id=32
Exemplars of scored work samples are currently found on subject-specific assessment pages linked from: www.ode.state.or.us/search/page/?id=1307

¹ Revised mathematics problem scoring guide was adopted by the State Board of Education (May 19, 2011) for use beginning with the 2011-2012 school year.

² Revised scientific inquiry scoring guides and newly-developed engineering design scoring guides were adopted by the State Board of Education (May 19, 2011) for use beginning with the 2011-2012 school year.
Using Work Samples to Assess Essential Skills for the Oregon Diploma

Essential Skills graduation requirements are determined based on when a student is first enrolled in grade 9, which is referred to as the cohort year. These requirements are applied to students earning either the regular or modified diploma. Students who entered grade 9 in the 2008-2009 school year (most of whom will graduate in 2012) are required to demonstrate proficiency in the Essential Skill of Reading. The remaining implementation timeline is described in the table below.

Work samples are one assessment option that high school students may use to demonstrate they are proficient in the Essential Skills. Regarding demonstration of proficiency in the Essential Skills, districts must:

- provide students with instruction in and multiple assessment opportunities to demonstrate proficiency in the Essential Skills for the purpose of earning a high school or modified diploma.
- allow students to use assessment options adopted in a student’s 9th through 12th grade years.
- allow students to use achievement standards adopted in their 9th through 12th grade years that are equal to or lower than the achievement standards approved as of March 1 of the students’ 8th grade year.

At the high school level, students may use work samples to fulfill both the local performance assessment and the Essential Skills requirements.

The table below describes the achievement standard for work samples scored for the purpose of demonstrating proficiency in the Essential Skills with regard to conferring a high school diploma.

<table>
<thead>
<tr>
<th>Essential Skill</th>
<th>Number and Types of Work Samples</th>
<th>Scoring Guide</th>
<th>First Implementation</th>
<th>Achievement Standard for Purpose of Conferring High School Diploma (Cut Scores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read and comprehend a variety of text</td>
<td>2 total work samples: at least one must be informative or literary</td>
<td>Official Reading Scoring Guide</td>
<td>Students who entered grade 9 in 2008-2009</td>
<td>Total score of 12 (6-point scale) across 3 traits with no trait lower than a 3; score of 5 or 6 on all traits to exceed.</td>
</tr>
<tr>
<td>Write clearly and accurately</td>
<td>2 total work samples: One must be in either expository or persuasive mode, the other may be in any of the four approved modes: expository persuasive narrative (personal) narrative (fictional)</td>
<td>Official Writing Scoring Guide</td>
<td>Students who entered grade 9 in 2009-2010</td>
<td>Score of 4 (6-point scale) to meet in each of the 4 required traits; score of 5 or 6 to exceed.</td>
</tr>
<tr>
<td>Apply mathematics in a variety of settings</td>
<td>2 total work samples: One each from two of these: algebra geometry statistics</td>
<td>Official Mathematics Problem Solving Scoring Guide</td>
<td>Students who entered grade 9 in 2010-2011</td>
<td>Score of 4 (6-point scale) to meet in each required trait; score of 5 or 6 to exceed.</td>
</tr>
</tbody>
</table>
Appendix B: Cognitive Demand and Item Difficulty Distribution Goals

Oregon recognizes the importance of Cognitive Demand (Depth of Knowledge) as part of test specification. To that end, we are implementing a strategy to overtly incorporate a test design process that includes the three dimensions of content, difficulty, and depth of knowledge.

- The first step in the process is convening our content panels to ask for their determination as to the appropriate allocation of Cognitive Demand (Depth of Knowledge), given the content standards.
- The second is analyzing the gap between the Cognitive Demand (Depth of Knowledge) available in our current item pools against the recommendations of the content panels.
- The third step involves engaging item writers to write items to fill in the critical gaps. These items would then be reviewed through our standard processes.

We anticipate being able to include Cognitive Demand (Depth of Knowledge) as an explicit part of the test specifications in the near future. The three Cognitive Demand (Depth of Knowledge) levels to be addressed in Mathematics are:

- **Recall**: includes the recall of information such as a fact, definition, term, or implementing a simple procedure. In mathematics, a one-step, well defined and straight-forward algorithmic procedure should be included at this lowest level.

- **Skill/Concept**: includes the engagement of some mental processing beyond a habitual response. A Level 2 assessment item requires students to make some decisions as to how to approach the problem or activity, whereas Level 1 requires students to demonstrate a rote response, follow a set procedure, or perform a clearly defined series of steps.

- **Strategic Thinking**: includes tasks which require reasoning, planning, using evidence, explaining their thinking or to making conjectures, and a higher level of thinking than the previous two levels. The cognitive demands are complex and abstract. The complexity does not result from the fact that there are multiple answers but because the task requires more demanding reasoning.
### 2012-2014 Target Difficulty Distribution Goals and Cognitive Demand Distribution Goals for Mathematics

<table>
<thead>
<tr>
<th>Grade 3</th>
<th>Grade 4</th>
<th>Grade 5</th>
<th>Grade 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Item Pool Difficulty Distribution Goals</strong></td>
<td><strong>Target Item Pool Difficulty Distribution Goals</strong></td>
<td><strong>Target Item Pool Difficulty Distribution Goals</strong></td>
<td><strong>Target Item Pool Difficulty Distribution Goals</strong></td>
</tr>
<tr>
<td>187-204</td>
<td>193-212</td>
<td>201-217</td>
<td>202-219</td>
</tr>
<tr>
<td>205-212</td>
<td>213-220</td>
<td>218-225</td>
<td>220-228</td>
</tr>
<tr>
<td>213-231</td>
<td>221-241</td>
<td>226-246</td>
<td>229-247</td>
</tr>
<tr>
<td><strong>RIT Range</strong></td>
<td>187-231</td>
<td><strong>RIT Range</strong></td>
<td>201-246</td>
</tr>
<tr>
<td><strong>Mean RIT</strong></td>
<td>208</td>
<td><strong>Mean RIT</strong></td>
<td>222</td>
</tr>
<tr>
<td><strong>Target Cognitive Demand Distribution Goals</strong></td>
<td><strong>Target Cognitive Demand Distribution Goals</strong></td>
<td><strong>Target Cognitive Demand Distribution Goals</strong></td>
<td><strong>Target Cognitive Demand Distribution Goals</strong></td>
</tr>
<tr>
<td>Recall</td>
<td>35%</td>
<td>Recall</td>
<td>35%</td>
</tr>
<tr>
<td>Skill/Concept</td>
<td>50%</td>
<td>Skill/Concept</td>
<td>50%</td>
</tr>
<tr>
<td>Strategic Thinking</td>
<td>15%</td>
<td>Strategic Thinking</td>
<td>15%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade 7</th>
<th>Grade 8</th>
<th>High School</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Item Pool Difficulty Distribution Goals</strong></td>
<td><strong>Target Item Pool Difficulty Distribution Goals</strong></td>
<td><strong>Target Item Pool Difficulty Distribution Goals</strong></td>
</tr>
<tr>
<td>212-226</td>
<td>212-228</td>
<td>213-229</td>
</tr>
<tr>
<td>227-233</td>
<td>229-236</td>
<td>230-235</td>
</tr>
<tr>
<td>234-252</td>
<td>237-257</td>
<td>236-253</td>
</tr>
<tr>
<td><strong>RIT Range</strong></td>
<td><strong>RIT Range</strong></td>
<td><strong>RIT Range</strong></td>
</tr>
<tr>
<td>212-252</td>
<td>212-257</td>
<td>213-253</td>
</tr>
<tr>
<td><strong>Mean RIT</strong></td>
<td><strong>Mean RIT</strong></td>
<td><strong>Mean RIT</strong></td>
</tr>
<tr>
<td>231</td>
<td>233</td>
<td>232</td>
</tr>
<tr>
<td><strong>Target Cognitive Demand Distribution Goals</strong></td>
<td><strong>Target Cognitive Demand Distribution Goals</strong></td>
<td><strong>Target Cognitive Demand Distribution Goals</strong></td>
</tr>
<tr>
<td>Recall</td>
<td>30%</td>
<td>Recall</td>
</tr>
<tr>
<td>Skill/Concept</td>
<td>50%</td>
<td>Skill/Concept</td>
</tr>
<tr>
<td>Strategic Thinking</td>
<td>20%</td>
<td>Strategic Thinking</td>
</tr>
<tr>
<td><strong>Appendix B</strong></td>
<td><strong>Mathematics Test Specifications and Test Blueprints</strong></td>
<td><strong>Oregon Department of Education</strong></td>
</tr>
<tr>
<td><strong>Mathematics, Grade 4</strong></td>
<td><strong>B-2</strong></td>
<td><strong>Office of Assessment and Information Services</strong></td>
</tr>
</tbody>
</table>
RECALL includes the recall of information such as a fact, definition, term, or implementing a simple procedure. In mathematics, a one-step, well-defined and straightforward algorithmic procedure should be included at this lowest level. Other key works that signify Recall include “identify,” “recall,” and “measure.” Verbs such as “describe” and “explain” could be classified at different levels, depending on what is to be described and explained. Some examples that represent, but do not constitute all of, Recall performance, are:

- Perform a simple algorithm.
- Recall a fact, term, formula, or property.
- Identify an example of a concept.
- Calculate a sum, difference, product, or quotient.
- Identify an equivalent representation.

Evaluate an expression in an equation or formula for a given variable. (Here, evaluate is used in the context of substitution and calculation with open expressions.)

- Answer (Solve) a routine one-step word problem
- Draw or measure simple geometric figures.
- Read or select information from a graph, table, or figure.

SKILL/CONCEPT includes the engagement of some mental processing beyond a habitual response. A Skill/Concept assessment item requires students to make some decisions as to how to approach the problem or activity, whereas Recall requires students to demonstrate a rote response, follow a set procedure, or perform a clearly defined series of steps. Key words that generally distinguish a Skill/Concept item include “classify,” “organize,” “estimate,” and “observe.” These actions imply more than one step. For example, to compare data requires first identifying characteristics of objects or phenomena and then grouping or ordering the objects. Some action verbs, such as “explain,” “describe,” or “interpret,” could be classified at different levels depending on the object of the action. For example, interpreting information from a simple graph or reading information from the graph would be at Skill/Concept. Interpreting information from a complex graph that requires some decisions on what features of the graph need to be considered and how information from the graph can be aggregated is at Strategic Thinking. Skill/Concept activities are not limited only to number skills, but may involve visualization skills and probability skills. Some examples that represent, but do not constitute all of, Skill/Concept performance, are:

- Describe non-trivial patterns.
- Apply experimental procedures.
- Observe and collect data.
- Classify, organize and compare data.
- Organize and display data in tables, graphs, and charts.
- Represent a situation mathematically in more than one way.
- Solve a word problem requiring multiple steps.
- Compare figures or statements.

- Interpret a visual representation.
- Extend a pattern.
- Use information from a graph, table, or figure to solve a problem requiring multiple steps.
- Formulate a routine problem, given data and conditions.
- Interpret a simple argument.
STRATEGIC THINKING requires reasoning, planning, using evidence, and a higher level of thinking than the previous two levels. In most instances, requiring students to explain their thinking is at Strategic Thinking. Activities that require students to make conjectures are also at this level. The cognitive demands at Strategic Thinking are complex and abstract. The complexity does not result from the fact that there are multiple answers but because the task requires more demanding reasoning. An activity that has more than one possible answer and requires students to justify the response they give would most likely be at Strategic Thinking. Some examples that represent, but do not constitute all of, Strategic Thinking performance, are:

- Draw conclusions from observations.
- Cite evidence and develop a logical argument for concepts.
- Explain phenomena in terms of concepts.
- Decide which concepts to apply in order to solve a complex problem.
- Describe how different representations can be used for different purposes.
- Perform or adapt a complex procedure having multiple steps and multiple decision points.
- Identify similarities and differences between procedures and concepts.
- Formulate an original problem, given a situation.
- Solve a non-routine or novel problem.
- Solve a problem in more than one way.
- Explain and justify a solution to a problem.
- Describe, compare, and contrast solution methods.
- Formulate a mathematical model for a complex situation.
- Appraise the assumptions made in a mathematical model.
- Critique or develop a deductive argument.
- Develop a mathematical justification.

EXTENDED THINKING involves high cognitive demands and complex reasoning, planning, developing and thinking, most likely over an extended period of time. Extended thinking is not considered to be assessable through the OAKS multiple choice items, but could be assessed through appropriate Work Sample or Local Performance Assessment tasks. The extended time period is not a distinguishing factor if the required work is only repetitive and does not require apply significant conceptual understanding and higher-order thinking. For example, if a student has to take the water temperature from a river each day for a month and then construct a graph, this would be classified as a Skill/Concept. However, if the student is to conduct a river study that requires taking into consideration a number of variables, this would be at Extended Thinking. At Extended Thinking, the cognitive demands of the task should be high and the work should be very complex. Students should be required to make several connections – relate ideas within the content area or among content areas – and have to select one approach among many alternative on how the situation should be solved, in order to be at his highest level. Some examples that represent, but do not constitute all of, Extended Thinking performance, are:

- Design and conduct experiments and project
- Develop and prove conjectures
- Connect a finding to related concepts and phenomena
- Synthesize ideas into a new concept.
- Critique experimental designs
APPENDIX C: ITEM DEVELOPMENT PROCESS

Oregon’s item development process is consistent with industry practice and takes approximately two years, including writing, reviewing, and field-testing new items. Just as the development of Oregon’s content and performance standards is an open, consensus-driven process, the development of test items and prompts to measure those constructs is grounded in a similar philosophy.

**Item Writing**

For the Knowledge and Skills (multiple-choice) tests and the Writing Performance Assessment, most item writing takes place during either onsite, remote and/or online item writing workshops, in which Oregon teachers across the five main content areas write and review items. The process remains the same regardless of workshop format.

Item writers are typically Oregon teachers who have received training in item construction, are familiar with test specifications, and have demonstrated skill in writing items that pass content and sensitivity panel review. Item writers receive professional development compensation for their time and travel expenses. Among other security precautions, ODE requires item writers to sign confidentiality forms assuring that they will work with the items in a secure manner.

All items are written to measure specific subdomains of the content standards at a variety of specified levels of cognitive complexity. Cognitive complexity is represented by the following classification, developed from Bloom’s (1956) educational taxonomy:

- **Recall:** Recall, label, or locate information; define or describe facts or processes.
- **Skill/Concept (Basic Application):** Use information or conceptual knowledge, often requiring two or more steps; summarize, classify, or explain information or processes; make predictions or generalizations; solve problems.
- **Strategic thinking:** Analyze, critique, compare or contrast; create new information; or organize presented information.
- **Extended thinking:** Make connections and extensions (exclusively assessed in the Writing Performance Assessment and local performance assessments).

During the item writing workshop, writers draft items, document rationale of distracters, and conduct peer reviews of each other’s items. Examples of items are provided, and facilitators provide process guidance and additional review. Writers and reviewers evaluate the strength and clarity of the match between the drafted item and the standard it measures. All issues are worked out or solved multiple times by multiple reviewers who verify that distracters are plausible, that answers are correct, and that each item has only a single correct answer.

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Following item writing workshops, items are entered into the Item Tracking System (ITS). Oregon’s original graphics are initially entered into the ODE’s Comprehensive Item Management System (CIMS) and then transferred to ITS.

Within ITS and CIMS, each item is given a unique item identification number to facilitate the monitoring and tracking of changes to and usage of the item throughout the review process and each item’s history. ITS provides authorized users with access to each item’s alignment and attributes, field-test results and use, response rationales, and previous versions.

Although item writing workshops may still occur annually, ODE has recently moved toward distributed item writing in which consistently strong item writers author additional items throughout the year. Items still go through the review process previously described. Item writers are trained on the use of secure item entry using ITS, and graphic drafts are scanned by the item writers and securely transmitted to ODE.

Committee/Panel Review

ODE convenes a series of advisory groups to advise ODE both on assessment-related policy and on item development. ODE seeks to ensure that membership on these advisory groups reflects the demographics of Oregon’s student population. Each advisory group has approximately 15–35 members who serve three-year terms with one-third of the members rotating out each year and being replaced by new representatives. The following table describes the structure of these groups.
### Structure of ODE Assessment-Related Advisory Groups

<table>
<thead>
<tr>
<th>Committee/Panel</th>
<th>Number of Members</th>
<th>Meeting Frequency</th>
<th>Who Nominates Members?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Policy Advisory Committee</td>
<td>15–20</td>
<td>2-3 times a year</td>
<td>School districts, COSA, OSBA, OEA, ESDs, and OPTA</td>
</tr>
<tr>
<td>Sensitivity Panel</td>
<td>15–20</td>
<td>4–6 times a year</td>
<td>School districts, OEA, ESDs (application process)</td>
</tr>
<tr>
<td>English/Language Arts Content and Assessment Panel</td>
<td>35</td>
<td>4-6 times a year</td>
<td>School districts, OEA, ESDs, and self-nominate (application process)</td>
</tr>
<tr>
<td>Mathematics Content and Assessment Panel</td>
<td>35</td>
<td>4 - 6 times a year</td>
<td>School districts, OEA, ESDs, and self-nominate (application process)</td>
</tr>
<tr>
<td>Science Content and Assessment Panel</td>
<td>35</td>
<td>4 - 6 times a year</td>
<td>School districts, OEA, ESDs, and self-nominate (application process)</td>
</tr>
<tr>
<td>Social Sciences Content and Assessment Panel</td>
<td>25</td>
<td>1 - 2 times a year</td>
<td>School districts, OEA, ESDs, and self-nominate (application process)</td>
</tr>
<tr>
<td>English Language Proficiency Content and Assessment Panel</td>
<td>35</td>
<td>1 – 2 times a year</td>
<td>School districts, OEA, ESDs, and self-nominate (application process)</td>
</tr>
</tbody>
</table>

*Note: Oregon’s Accommodations and Modifications Review Panel is not described here.*

Source: [http://www.ode.state.or.us/teachlearn/testing/dev/panels/structurecapanels.doc](http://www.ode.state.or.us/teachlearn/testing/dev/panels/structurecapanels.doc)

Panel members commit up to 6 school days of service with an additional 3 or 4 days during the summer. However, panels will be convened remotely rather than in person as secure technology improvements allow distributed work. Although committee members on district contracts are not compensated for their service, they do receive travel reimbursement for committee travel of more than 70 miles, and substitute teachers are provided for service during the school year. When classroom teacher members work for ODE during non-contract time, they are compensated at an hourly wage as temporary employees.

ESDs who are knowledgeable about assessment-related issues. The purpose of the Committee is to advise ODE on both the procedural and policy implications of Oregon’s assessment system, as well as the feasibility of proposed improvements to Oregon’s assessment system. Committee members provide input regarding the various elements of the state assessment system such as educational technology, electronic reporting, operational assessment issues, and test administration.

In addition to seeking advice on assessment-related policy, ODE requires that all items generated for use on Oregon statewide assessments must pass a series of rigorous reviews before they can be used in field and operational tests. All items go through both a content and a sensitivity review as part of the...
item development process; only those items that measure the grade-level expectations and meet both overall quality and sensitivity criteria are carried forward to the field-test stage.

ODE Content and Assessment Panels exist for each of the content areas for which statewide tests are given: English/Language Arts (this panel reviews Writing and Reading/Literature assessment items), Mathematics, Science, Social Sciences, and English Language Proficiency.

Most members of these panels are classroom teachers, with some representation from higher education, district curriculum and assessment personnel, and related businesses. Criteria for panel selection include the following:

- Knowledge of Oregon’s content standards and expertise in the subject area and its eligible content
- Teaching experience at the grade level or benchmark to which the individual will be assigned
- Geographical location to ensure that all regions of Oregon are represented
- Gender and ethnic diversity to ensure that the panel represents the diversity of Oregon’s student population

Current item writers are not allowed to serve on item review committees. However, in some cases, content and assessment panel experts may be utilized as item writing facilitators.

Items are accepted, rejected, or modified by the Content and Assessment Panel to make sure they represent the constructs embodied in grade-specific content standards and test specifications. In addition to judgments of content relevance, the panels appraise the technical quality of items, looking for items that are free from such flaws as (a) inappropriate readability level, (b) ambiguity, (c) incorrectly keyed answers and distractors, (d) unclear instructions, and (e) factual inaccuracy. The panels for each content area use the following review process:

1. Three content panel members review each item independently and complete an Item Review Form (IRF) (figure 1) using a pre-assigned reviewer ID.

2. Then, the three content panel members review the item collectively, and item reviewers make a recommendation for each item on the IRF to either (a) accept the item as written, (b) accept the item with revisions, or (c) reject the item (sometimes an alternate question is offered that entails a simple revision).

3. When all three reviewers agree that an item should be accepted or rejected, no further discussion is needed. If one or more of the reviewers feel that an item should be revised, then they attempt to reach a consensus and produce a “master copy” of their recommendation. The same is true if one or two of the reviewers reject an item that another reviewer finds acceptable with or without revisions.

4. In most cases, recommendations are followed and revisions are made, or items are eliminated. The ODE assessment specialist can override the recommendation, but this occurs rarely and only for compelling reasons.
The content panels perform specific checks on items to confirm that:

- the SRC and subcategory match.
- the key is correct.
- alternate valid interpretations making the distracters correct do not exist.
- the item is grade-level appropriate in content and reading levels.
- the item is of overall high quality (wording and grammar, graphic quality, curricular importance, etc).
- the identified level of difficulty (i.e., easy, medium, hard) is correct.
- Reading/Literature passages are appropriate in content and reading levels. Science and Social Sciences stimuli align to appropriate content and reading skills.
- the level of cognitive complexity (i.e., recall, skill/concept or strategic thinking) is appropriate to the item and correctly identified.

Following review by the content panel, and according to panel feedback, ODE assessment specialists edit and revise items in ITS in preparation for review by the Sensitivity Panel.

All items that pass review by the content specialist are next presented to the sensitivity panel. The sensitivity panel reviews convenes day-long meetings, four to six times a year. The panel reviews items from all grade levels and content areas for bias, controversial content, and overly emotional issues.
In general, the sensitivity panel ensures that items:

- present racial, ethnic, and cultural groups in a positive light.
- do not contain controversial, offensive, or potentially upsetting content.
- avoid content familiar only to specific groups of students because of race or ethnicity, class, or geographic location.
- aid in the elimination of stereotypes.
- avoid words or phrases that have multiple meanings.

Following the sensitivity panels and according to panel feedback, ODE assessment specialists edit and revise items in the ITS system.

**EXPERT REVIEW**

Next, ODE assessment specialists submit the new items for review by experts that have experience in the roles of item writer and content and assessment panel member. Expert reviewers add an additional quality control check for the online assessments. Experts have received extensive professional development in ITS to review items in a web-preview format providing the exact rendering provided in the online assessments. Experts review each item and confirm that:

- the key is correct.
- alternate valid interpretations making the distracters correct do not exist.
- the item is grade-level appropriate in content and reading levels.
- the item is of overall high quality (wording and grammar, graphic quality, curricular importance, etc).

Following the expert review in most cases, recommendations are followed and revisions are made, or items are eliminated. The ODE assessment specialist can override the recommendation, but this occurs rarely and only for compelling reasons.

**FIELD TESTING**

Once the items have been reviewed by the content and assessment panel, the sensitivity panel, and an expert reviewer, all Mathematics, Reading/Literature, Science, and Social Sciences test items are field tested. Field test items identified by the ODE assessment specialists are embedded in the operational tests by content area. As students take the operational tests, they also respond to approximately 5-8 field test items embedded in the test.

ODE then receives data files of the student responses, which ODE analyzes to determine whether the field test items are behaving as expected. The ODE assessment specialists eliminate those items which the data analysis indicate performed weakly. ODE assessment staff calibrate the difficulty level for those items that performed successfully in preparation for using the item operationally.
TRANSLATION OF ITEMS TO SPANISH

Concurrent with the field testing of items in English, all Mathematics, Science, and Social Sciences test items are translated into Spanish. All required grade-level and benchmark-level statewide tests for Mathematics and Science are offered in English-Spanish tests. English-Spanish tests are also available for Social Sciences. Stacked English-Spanish items are used on electronic tests. Side-by-side English-Spanish and English-Russian Paper/Pencil assessments are available in Mathematics and Science.

Following translation by ODE’s translation vendor, the translated items are reviewed by ODE’s Spanish- and Russian-speaking experts to ensure that each item accurately conveys the intent of the English text. While the procedure described below specifically addresses Spanish translation, ODE follows a similar procedure for translation of Paper/Pencil items into Russian.

The following linguistic guidelines are used by ODE’s translation vendor and Spanish-speaking experts:

- Students are expected to have subject knowledge and use proper terminology/vocabulary for that subject. In other words, what is expected from English-speaking students is also expected from Spanish-speaking students.
- ODE uses formal Spanish (usted, not tú) for test items and includes proper verb conjugation.
- ODE strives to use Global Spanish language that will be interpreted and understood by all Spanish speakers from anywhere in the world. Global Spanish language includes words used worldwide by most Spanish speakers.

After the ODE Spanish reviewers complete a review of the newly translated items, extensive research is conducted by a small group of reviewers on any word that has not met group consensus. Every attempt is made to choose the most correct translation based upon grade level and cultural relevance. A variety of resources are used for selecting the proper translated words including: dictionaries from Mexico, South America and Spain (e.g. Diccionario Hispanoamericano de Dudas, Diccionario de Matemáticas), and ODE’s list of translated terms for Science at http://www.ode.state.or.us/search/page/?id=517 and for Mathematics at http://www.ode.state.or.us/search/page/?id=500.

ADDITIONAL EXPERT REVIEW OF ITEMS

On an annual basis, ODE assessment specialists review items from the field test pool for inclusion within the operational test. This level of review acts as an additional quality control for the online assessments. In addition, whenever ODE transitions to a different test delivery system, ODE submits all of its Reading/Literature, Mathematics, Science, and Social Sciences items for an additional level of expert review to ensure that all items appear consistently from year to year when presented to students.

ITEM USE AND RELEASE

Approximately every three years, ODE releases one sample test for each content area and grade-level and benchmark-level comprised of items used on previous test forms. These items are no longer secure and are taken out of the pool of eligible test items. Released items are provided in the form of practice tests. Practice tests for Reading/Literature, Mathematics, Social Sciences, and Science are available on ODE’s Website at http://www.ode.state.or.us/search/page/?id=1222.

Sample Writing prompts are also available at http://www.ode.state.or.us/teachlearn/subjects/elarts/writing/assessment/usingsampleprompts.pdf

Oregon Department of Education
Office of Assessment and Information Services
The complete two-year Lifecycle of a Knowledge and Skills Item
Mathematics, Reading/Literature, Science, Social Sciences

Page 1

1 Phase 1: Item Writing

**SITES**
- A. Assessment staff schedules and coordinates item writing activities, and recruits Oregon teachers to construct items to be entered into an item database.

**WRITING**
- B. Item Writing: Teachers receive professional development training on item development, including a focus on standards alignment and item content and format. Items are written explicitly to measure Oregon academic content standards.
- C. Teachers review items written by their peers.
- D. After items are written, assessment staff enter items into a database.

Bank of **POTENTIAL** items

**ENTRY**

Bank of **REVIEWED** items

Bank of **FIELD** items

2 Phase 2: Item Review

**SORT**
- A. Assessment Specialist sorts and organizes items for review.

**REVIEW**
- B. Subject Specific Content and Assessment Panels, consisting of Oregon teachers, review test items with respect to content validity and grade appropriateness.
- C. Assessment Specialist edits and revises items according to content panel feedback.
- D. Sensitivity Panel reviews items in two-day meetings, generally held four times a year.

3 Phase 3: Field Testing

**FIELD TEST**
- A. Assessment Specialist identifies items to be field tested.

**EMBED**
- B. Field test items are embedded in an operational test.

**TEST**
- C. Students complete operational tests with embedded field test items.

**PROCESS**
- D. Data files of student responses are submitted to ODE for analysis.
The complete two-year Lifecycle of a Knowledge and Skills Item Mathematics, Reading/Literature, Science, Social Sciences

Phase 4: Data Analysis of Field Test Items

**ANALYZE**
A. Assessment staff generates psychometric data to determine if the item “behaves” as expected.

**REVIEW**
B. Assessment Specialist reviews data to determine which items should be “dropped” because of weak performance.

**CALIBRATE**
C. Assessment staff calibrate the difficulty of field test items that meet the successful criteria.

Bank of CALIBRATED items

Phase 5: Test Construction

**SELECT**
A. Assessment Specialist selects items for operational testing.

**RANGE**
B. Assessment Specialist balances items across Score Reporting Categories (SRCs) (such as Geometry in Mathematics or Vocabulary in Reading/Literature) and range of difficulty according to test specifications.

**CONSTRUCT**
C. Assessment staff construct tests, online test pools, and finalize Administration Manual.

**REVIEW**
D. Assessment staff and expert reviewers proofread test items and stimuli for errors.

**FINAL**
E. Final Operational Tests and pools are prepared.

Phase 6: Data Analysis of Operational Test Items

**PRESENTED**
A. Tests are sent to contractor for print distribution or delivery online.

**SCORES**
B. Students complete the operational test and receive instant scores when using online delivery.

**TEST**
C. Assessment staff analyze item statistics to verify the item performs as expected.

**PROCESS**
D. Assessment staff analyze item statistics to make sure items are not biased against a particular subgroup (e.g., students with disabilities, ethnic groups, or gender).

**TARGET**
E. Item performance tables which describe how well each item performs are used to review items and pools of items to identify any additional items to be dropped.
The *Mathematics Problem Solving Official Scoring Guide* was adopted by the State Board of Education in May 2011 for scoring work samples beginning with the 2011-2012 school year. This scoring guide reflects significant efforts of Oregon educators working to capture the essentials of problem solving, based on the following:

- Over-arching statement in the *Mathematics Content Standards for Kindergarten through Grade 8 and High School* that it is essential that these standards be addressed in instructional contexts that promote problem solving, reasoning, communication, making connections, designing and analyzing representations, and reflecting on solutions.  
  ([http://www.ode.state.or.us/teachlearn/real/standards/sbd.aspx](http://www.ode.state.or.us/teachlearn/real/standards/sbd.aspx))

- Essential Skill Apply Mathematics in a Variety of Settings
  
  *This skill includes all of the following:*
  
  - Interpret a situation and apply workable mathematical concepts and strategies, using appropriate technologies where applicable.
  - Produce evidence, such as graphs, data, or mathematical models, to obtain and verify a solution.
  - Communicate and defend the verified process and solution, using pictures, symbols, models, narrative or other methods.  
    ([http://www.ode.state.or.us/teachlearn/certificates/diploma/essential-skills-definitions.pdf](http://www.ode.state.or.us/teachlearn/certificates/diploma/essential-skills-definitions.pdf))


This scoring guide reflects input by the Oregon Council of Teachers of Mathematics (OCTM), Oregon Mathematics Specialists, and ODE’s mathematics content panel during 2009-10, and at the 2010 Oregon Math Leaders Conference.

The most recent version of the *Mathematics Problem Solving Official Scoring Guide* and other support documents may be accessed at [http://www.ode.state.or.us/search/page/?=32](http://www.ode.state.or.us/search/page/?=32). The Plain Language Student Versions may be accessed at [http://www.ode.state.or.us/search/page/?=2667](http://www.ode.state.or.us/search/page/?=2667).

Sample anchor papers, student versions, and other support materials are under development. Professional development on the new scoring guide is was piloted in training sessions during the 2010-11 school year by the OCTM Professional Development Cadre and extensive training opportunities are planned for the 2011-2012 school year. Refer to the Work Sample Resources web page for mathematics for updated support documents and training opportunities. ([http://www.ode.state.or.us/search/page/?id=2707](http://www.ode.state.or.us/search/page/?id=2707))
Use of Formula and Conversion Sheets

The Formula and Conversion Sheets have been revised to reflect the content in the 2007 Grades 3-8 and 2009 High School Standards. They are reorganized to be used in Grade 3-5, Grades 6-8, and in High School. While all students may have access to any of the sheets, these show the information appropriate to the grade levels. Note that grade 3 standards do not necessitate any formulas or conversion factors, based on the standards. Also, variables are not introduced until grade 6, so the formulas for grades 4-6 are stated in words. Grade 6 standards do not necessitate any formulas other than those needed for grades 4 and 5, since grade 6 has no new geometry content, however, in grade 6, students may be using variables, so students in grade 6 may prefer either the formula sheet for grades 3-5 or the one for grades 6-8.

All Formula and Conversion Sheets in English and Spanish are available at http://www.ode.state.or.us/search/page/?=2346

The Formula and Conversion Sheets may be used during classroom instruction at any time.
### Mathematics Test Specifications

#### and Test Blueprints

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**Appendix F**

**Official Formula Sheet and Conversion Table**

**Grades 3 - 5**

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**Measurements**

<table>
<thead>
<tr>
<th>1 meter = 100 centimeters</th>
<th>1 gram = 1000 milligrams</th>
<th>1 liter = 1000 cubic centimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kilometer = 1000 meters</td>
<td>1 kilogram = 1000 grams</td>
<td></td>
</tr>
<tr>
<td>1 yard = 3 feet</td>
<td>1 pound = 16 ounces</td>
<td>1 cup - 8 fluid ounces</td>
</tr>
<tr>
<td>1 mile = 5280 feet</td>
<td>1 ton - 2000 pounds</td>
<td>1 pint = 2 cups</td>
</tr>
<tr>
<td>1 hour = 60 minutes</td>
<td></td>
<td>1 quart = 2 pints</td>
</tr>
<tr>
<td>1 minute = 60 seconds</td>
<td></td>
<td>1 gallon = 4 quarts</td>
</tr>
</tbody>
</table>

---

**Area**

- **Rectangular Shape:**
  - **Area =** \( \text{length} \times \text{width} \)

- **Triangular Shape:**
  - **Area =** \( \text{base} \times \text{height} + 2 \)

---

**Surface Area and Volume**

- **Rectangular Shape:**
  - **Surface Area =** sum of area of all faces
  - **Volume =** \( \text{length} \times \text{width} \times \text{height} \)

- **Triangular Shape:**
  - **Surface Area =** Sum of Areas of all faces
  - **Volume =** Area of Base \( \times \text{height} \)