

# **Virginia**

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Standards of Learning Assessments

## **Blueprint**

for the

## **Grade 3**

# **Mathematics Test**

Spring 2003

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# Grade 3 Mathematics Blueprint

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# Standards of Learning (SOL) Test Blueprint

## Introduction

### What is a test blueprint?

A test blueprint is a guide for test construction and use. The Standards of Learning (SOL) test blueprints serve a number of purposes. One, they serve as a guide to test developers as they write test questions and construct the SOL tests. Two, they serve as a guide to educators, parents and students in that they show (a) the SOL covered by the test and which, if any, have been excluded; (b) which SOL are assigned to each reporting category; (c) the number of test items in each reporting category and on the total test; (d) general information about how the test questions were constructed; and (e) the materials that students are allowed to use while taking the test.

### How is the test blueprint organized?

There is a blueprint for each test (e.g., grade 3 English, grade 5 mathematics, grade 8 science, U.S. History). Each blueprint contains the following information:

1. **Test Development Guidelines**: guidelines used by the testing contractor and the members of the Content Review Committees in developing the SOL tests. This section contains three parts:
  - A. **General Considerations** — lists general considerations that are used in developing the test as well as considerations specific to a particular content area.
  - B. **Item Format** — lists information on how items for the test are constructed.
  - C. **Ancillary Materials** — lists any materials (e.g., calculators, rulers, protractors, compasses, dictionaries) that students are allowed to use while taking each test.
2. **Blueprint Summary Table**: a summary of the blueprint which displays the following information:
  - reporting categories for each test;
  - number of test items in each reporting category;
  - Standards of Learning (SOL) included in each reporting category. SOL are identified by numbers and letters that correspond to the original SOL document (letters are assigned to the “bullets” in the original document);
  - SOL which are excluded from the SOL test;
  - number of operational items on the test;
  - number of field-test items on the test; and
  - total number of items (operational and field-test items) on the test.
3. **Expanded Blueprint**: provides the same information as the **Blueprint Summary Table** except that the full text of each SOL is included. In addition, SOL that are excluded from the test are categorized by the reason they were not included.

**What is a reporting category?**

Each test covers a number of SOL. In the test blueprint, SOL are grouped into categories that address related content or skills. These categories are labeled Reporting Categories. For example, a Reporting Category for the Grade 3 Mathematics test is “Computation and Estimation.” Each of the SOL in this reporting category addresses computation using addition, subtraction, multiplication, or division or requires the student to estimate the answer to a problem. When the results of the SOL tests are reported, the scores will be presented in terms of scores for each Reporting Category and a total test score. Each SOL is assigned to only one reporting category.

**Will all SOL listed in the blueprint be assessed each time the SOL tests are given?**

Due to the large number of SOL in a content area for a grade span, *every* SOL will not be assessed on every SOL test form. By necessity, to keep the length of a test reasonable, each test will sample from the SOL within a reporting category. However, every SOL is eligible for inclusion on each form of an SOL test.

## Grade 3 Mathematics Test Development Guidelines

### A. General Considerations

1. All items included in this test will address the knowledge and skills specified in the 2001 *Virginia Standards of Learning in Mathematics* for grades K - 3.
2. The items will be free of stereotyping or bias directed at a particular age, gender, economic status, racial, ethnic or religious group, or geographic region.
3. The test will be untimed and will be administered in one sitting. Test examiners may allow students a “stretch” break during the test as long as students are not allowed to interact and test security is maintained.
4. There is no penalty for guessing. Students’ scores will be based on the number of correct answers out of the total number of operational items on the test.
5. Items will be appropriate for third-grade students in terms of difficulty, interest, and reading level.
6. Where appropriate, “real-life” examples and situations that the student would likely encounter will be used to present data or ask questions.
7. Students will be permitted to use scratch paper (plain paper, patty paper, lined paper, or grid paper) at any time during the test.
8. Students will be permitted to use standard (e.g., inches) and metric rulers during the test.
9. Calculators are **not** permitted on this test.

### B. Item Format

1. Each item will be a multiple choice item containing four choices. Choices such as “None of the above,” “All of the above,” and “Not here” will **not** be used.
2. Answer choices will be arranged vertically beneath the item stems unless space considerations prevent such an arrangement.
3. Item stems will be in the form of questions or in the form of sentences that require completion. Incomplete sentences will be followed by a dash.
4. In most cases, numbers will be expressed as numerals.
5. Commas will be used in numerals of 4 or more digits.
6. Answer choices will be arranged in ascending or descending order, when appropriate.
7. Any decimal fraction less than 1 will include a leading zero, (e.g., 0.2).
8. Graphic displays, item stems, and answer choices will all appear on the same page.
9. Fractions will include only denominators of 10 or less.
10. Fractions will be written vertically.
11. Decimal fractions will not exceed 2 decimal places.
12. Sums and differences will not exceed 5 digits.
13. Multipliers will not exceed 5, and multiplicands will not exceed 99.
14. Quotients and divisors will be whole numbers less than 10.
15. Bar graphs will include no more than 4 categories; pictographs, no more than 5. Data points will be limited to 16 or fewer. Graphs will contain titles, a description of each axis or row and column, and a key where appropriate.

***C. Ancillary Materials***

1. Rulers with standard and metric measurement
2. Scratch paper (Plain paper will be required unless replaced by patty paper, lined paper, or grid paper which are optional.)

## Grade 3 Mathematics Blueprint Summary Table

Reporting Categories	No. of Items	Kindergarten SOL	Grade One SOL	Grade Two SOL	Grade Three SOL
<b>Number and Number Sense</b>	<b>13</b>	K.1 K.2a,b,c K.3 K.4 K.5	1.1 1.2 1.3 1.4 1.5 1.6	2.1a,b 2.2 2.3 2.4 2.5a,b,c,d	3.1 3.2 3.3 3.4 3.5a,b 3.6 3.7
<b>Computation and Estimation</b>	<b>11</b>	K.6	1.7a,b 1.8 1.9	2.6 2.7a,b 2.8a,b 2.9 2.10	3.8 3.9 3.10 3.11 3.12
<b>Measurement and Geometry</b>	<b>12</b>	K.7 K.8 K.9 K.10 K.11 K.12 K.13	1.10a,b 1.11 1.12 1.13 1.14 1.15 1.16 1.17	2.11a, b 2.12 2.13 2.14 2.15 2.16 2.17 2.18a,b,c 2.19 2.20 2.21 2.22	3.13 3.14a,b,c 3.15 3.16 3.17 3.18 3.19 3.20
<b>Probability and Statistics</b>	<b>7</b>	K.14 K.15 K.16	1.18 1.19	2.23 2.24	3.21a,b 3.22 3.23
<b>Patterns, Functions, and Algebra</b>	<b>7</b>	K.17 K.18	1.20 1.21	2.25 2.26	3.24 3.25a,b

<b>Total Number of Operational Items</b>	<b>50</b>
<b>Field Test Items*</b>	<b>10</b>
<b>Total Number of Items</b>	<b>60</b>

\*These field test items will *not* be used to compute students' scores on the test.

<b>Reporting Category: Number and Number Sense</b> <b>Number of Items: 13</b>
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**Kindergarten SOL in This Reporting Category:**

- K.1 The student, given two sets containing 10 or fewer concrete items, will identify and describe one set as having more, fewer, or the same number of members as the other set, using the concept of one-to-one correspondence.
- K.2 The student, given a set containing 10 or fewer concrete items, will
  - a) tell how many are in the set by counting the number of items orally;
  - b) select the corresponding numeral from a given set; and
  - c) write the numeral to tell how many are in the set.
- K.3 The student, given an ordered set of three objects and/or pictures, will indicate the ordinal position of each item, first through third, and the ordered position of each item from left-to-right, right-to-left, top-to-bottom, and/or bottom-to-top.
- K.4 The student will investigate and recognize patterns from counting by fives and tens to 30, using concrete objects and a calculator.
- K.5 The student will count forward to 30 and backward from 10.

**Grade One SOL in This Reporting Category:**

- 1.1 The student will count objects in a given set containing between 1 and 100 objects and write the corresponding numeral.
- 1.2 The student will group a collection of up to 100 objects into tens and ones and write the corresponding numeral to develop an understanding of place value.
- 1.3 The student will count forward by ones, fives, and tens to 100, by twos to 20, and backward by ones from 20.
- 1.4 The student will recognize and write numerals 0 through 100.
- 1.5 The student will identify the ordinal positions first through tenth, using an ordered set of objects.
- 1.6 The student will identify and represent the concepts of one-half and one-fourth, using appropriate materials or a drawing.

<b>Reporting Category: Number and Number Sense (continued)</b> <b>Number of Items: 13</b>
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**Grade Two SOL in This Reporting Category:**

- 2.1 The student will
  - a) read, write, and identify the place value of each digit in a three-digit numeral, using numeration models; and
  - b) round two-digit numbers to the nearest ten.
- 2.2 The student will compare two whole numbers between 0 and 999, using symbols ( $>$ ,  $<$ , or  $=$ ) and words (*greater than*, *less than*, or *equal to*).
- 2.3 The student will identify the ordinal positions first through twentieth, using an ordered set of objects.
- 2.4 The student will identify the part of a set and/or region that represents fractions for one-half, one-third, one-fourth, one-eighth, and one-tenth and write the corresponding fraction.
- 2.5 The student will
  - a) count forward by twos, fives, and tens to 100, starting at various multiples of 2, 5, or 10, using mental mathematics, paper and pencil, hundred chart, calculators, and/or concrete objects, as appropriate;
  - b) count backward by tens from 100;
  - c) group objects by threes and fours; and
  - d) recognize even and odd numbers, using objects.

**Grade Three SOL in This Reporting Category:**

- 3.1 The student will read and write six-digit numerals and identify the place value for each digit.
- 3.2 The student will round a whole number, 9,999 or less, to the nearest ten, hundred, and thousand.
- 3.3 The student will compare two whole numbers between 0 and 9,999, using symbols ( $>$ ,  $<$ , or  $=$ ) and words (*greater than*, *less than*, or *equal to*).
- 3.4 The student will recognize and use the inverse relationships between addition/subtraction and multiplication/division to complete basic fact sentences. Students will use these relationships to solve problems such as  $5 + 3 = 8$  and  $8 - 3 = \underline{\quad}$ .

<b>Reporting Category: Number and Number Sense (continued)</b> <b>Number of Items: 13</b>
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**Grade Three SOL in This Reporting Category (continued):**

- 3.5 The student will
  - a) divide regions and sets to represent a fraction; and
  - b) name and write the fractions represented by a given model (area/region, length/measurement, and set). Fractions (including mixed numbers) will include halves, thirds, fourths, eighths, and tenths.
- 3.6 The student will compare the numerical value of two fractions having like and unlike denominators, using concrete or pictorial models involving areas/regions, lengths/measurements, and sets.
- 3.7 The student will read and write decimals expressed as tenths and hundredths, using concrete materials and models.

<b>Reporting Category: Computation and Estimation</b> <b>Number of Items: 11</b>
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**Kindergarten SOL in This Reporting Category:**

- K.6 The student will add and subtract whole numbers, using up to 10 concrete items.

**Grade One SOL in This Reporting Category:**

- 1.7 The student, given a familiar problem situation involving magnitude, will
  - a) select a reasonable magnitude from three given quantities: a one-digit numeral, a two-digit numeral, and a three-digit numeral (e.g., 5, 50, and 500); and
  - b) explain the reasonableness of his/her choice.
- 1.8 The student will recall basic addition facts – i.e., sums to 10 or less – and the corresponding subtraction facts.
- 1.9 The student will create and solve story and picture problems involving one-step solutions, using basic addition and subtraction facts.

<b>Reporting Category: Computation and Estimation (continued)</b> <b>Number of Items: 11</b>
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**Grade Two SOL in This Reporting Category:**

- 2.6 The student will recall basic addition facts – i.e., sums to 18 or less - and the corresponding subtraction facts.
- 2.7 The student, given two whole numbers whose sum is 99 or less, will
  - a) estimate the sum; and
  - b) find the sum, using various methods of calculation (mental computation, concrete materials, and paper and pencil).
- 2.8 The student, given two whole numbers, each of which is 99 or less, will
  - a) estimate the difference; and
  - b) find the difference, using various methods of calculation (mental computation, concrete materials, and paper and pencil).
- 2.9 The student will create and solve one-step addition and subtraction problems using data from simple tables, picture graphs, bar graphs, and practical situations.
- 2.10 The student, given a simple addition or subtraction fact, will recognize and describe the related facts which represent and describe the inverse relationship between addition and subtraction (e.g.,  $3 + \underline{\quad} = 7$ ,  $\underline{\quad} + 3 = 7$ ,  $7 - 3 = \underline{\quad}$ , and  $7 - \underline{\quad} = 3$ ).

**Grade Three SOL in This Reporting Category:**

- 3.8 The student will solve problems involving the sum or difference of two whole numbers, each 9,999 or less, with or without regrouping, using various computational methods, including calculators, paper and pencil, mental computation, and estimation.
- 3.9 The student will recall the multiplication and division facts through the nines table.
- 3.10 The student will represent multiplication and division, using area and set models, and create and solve problems that involve multiplication of two whole numbers, one factor 99 or less and the second factor 5 or less.
- 3.11 The student will add and subtract with proper fractions having like denominators of 10 or less, using concrete materials and pictorial models representing areas/regions, lengths/measurements, and sets.
- 3.12 The student will add and subtract with decimals expressed as tenths, using concrete materials, pictorial representations, and paper and pencil.

<b>Reporting Category: Measurement and Geometry</b> <b>Number of Items: 12</b>
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**Kindergarten SOL in This Reporting Category:**

- K.7 The student will recognize a penny, nickel, dime, and quarter and will determine the value of a collection of pennies and/or nickels whose total value is 10 cents or less.
- K.8 The student will identify the instruments used to measure length (ruler), weight (scale), time (clock: digital and analog; calendar: day, month, and season), and temperature (thermometer).
- K.9 The student will tell time to the hour, using an analog or digital clock.
- K.10 The student will compare two objects or events, using direct comparisons or nonstandard units of measure, according to one or more of the following attributes: length (shorter, longer), height (taller, shorter), weight (heavier, lighter), temperature (hotter, colder). Examples of nonstandard units include foot length, hand span, new pencil, paper clip, block.
- K.11 The student will identify, describe, and draw two-dimensional (plane) geometric figures (circle, triangle, square, and rectangle).
- K.12 The student will describe the location of one object relative to another (above, below, next to) and identify representations of plane geometric figures (circle, triangle, square, and rectangle) regardless of their position and orientation in space.
- K.13 The student will compare the size (larger, smaller) and shape of plane geometric figures (circle, triangle, square, and rectangle).

**Grade One SOL in This Reporting Category:**

- 1.10 The student will
  - a) identify the number of pennies equivalent to a nickel, a dime, and a quarter; and
  - b) determine the value of a collection of pennies, nickels, and dimes whose total value is 100 cents or less.
- 1.11 The student will tell time to the half-hour, using an analog or digital clock.
- 1.12 The student will use nonstandard units to measure length and weight.
- 1.13 The student will compare the volumes of two given containers by using concrete materials (e.g., jelly beans, sand, water, rice).

<b>Reporting Category: Measurement and Geometry (continued)</b> <b>Number of Items: 12</b>
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**Grade One SOL in This Reporting Category (continued):**

- 1.14 The student will compare the weight of two objects, using a balance scale.
- 1.15 The student will describe the proximity of objects in space (*near, far, close by, below, above, up, down, beside, and next to*).
- 1.16 The student will draw, describe, and sort plane geometric figures (triangle, square, rectangle, and circle) according to number of sides, corners, and square corners.
- 1.17 The student will identify and describe objects in his/her environment that depict plane geometric figures (triangle, rectangle, square, and circle).

**Grade Two SOL in This Reporting Category:**

- 2.11 The student will
  - a) count and compare a collection of pennies, nickels, dimes, and quarters whose total value is \$2.00 or less; and
  - b) identify the correct usage of the cent symbol (*¢*), dollar symbol (*\$*), and decimal point (*.*).
- 2.12 The student will estimate and then use a ruler to make linear measurements to the nearest centimeter and inch, including measuring the distance around a polygon in order to determine perimeter.
- 2.13 The student, given grid paper, will estimate and then count the number of square units needed to cover a given surface in order to determine area.
- 2.14 The student will estimate and then count the number of cubes in a rectangular box in order to determine volume.
- 2.15 The student will estimate and then determine weight/mass of familiar objects in pounds and/or kilograms, using a scale.
- 2.16 The student will tell and write time to the quarter hour, using analog and digital clocks.
- 2.17 The student will use actual measuring devices to compare metric and U.S. Customary units (cups, pints, quarts, gallons, and liters) for measuring liquid volume, using the concepts of *more, less, and equivalent*.

<b>Reporting Category: Measurement and Geometry (continued)</b> <b>Number of Items: 12</b>
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**Grade Two SOL in This Reporting Category (continued):**

- 2.18 The student will
  - a) use calendar language appropriately (e.g., months, today, yesterday, next week, last week);
  - b) determine past and future days of the week; and
  - c) identify specific dates on a given calendar.
- 2.19 The student will read the temperature on a Celsius and/or Fahrenheit thermometer to the nearest 10 degrees.
- 2.20 The student will identify, describe, and sort three-dimensional (solid) concrete figures, including a cube, rectangular solid (prism), square pyramid, sphere, cylinder, and cone, according to the number and shape of the solid's faces, edges, and corners.
- 2.21 The student will identify and create figures, symmetric along a line, using various concrete materials.
- 2.22 The student will compare and contrast plane and solid geometric shapes (circle/sphere, square/cube, and rectangle/rectangular solid).

**Grade Three SOL in This Reporting Category:**

- 3.13 The student will determine by counting the value of a collection of bills and coins whose total value is \$5.00 or less, compare the value of the coins or bills, and make change.
- 3.14 The student will estimate and then use actual measuring devices with metric and U.S. Customary units to measure
  - a) length—\_inches, feet, yards, centimeters, and meters;
  - b) liquid volume—cups, pints, quarts, gallons, and liters; and
  - c) weight/mass—ounces, pounds, grams, and kilograms.
- 3.15 The student will tell time to the nearest five-minute interval and to the nearest minute, using analog and digital clocks.
- 3.16 The student will identify equivalent periods of time, including relationships among days, months, and years, as well as minutes and hours.

**Reporting Category: Measurement and Geometry (continued)**  
**Number of Items: 12**

**Grade Three SOL in This Reporting Category (continued):**

- 3.17 The student will read temperature to the nearest degree from a Celsius thermometer and a Fahrenheit thermometer. Real thermometers and physical models of thermometers will be used.
- 3.18 The student will analyze two-dimensional (plane) and three-dimensional (solid) geometric figures (circle, square, rectangle, triangle, cube, rectangular solid [prism], square pyramid, sphere, cone, and cylinder) and identify relevant properties, including the number of corners, square corners, edges, and the number and shape of faces, using concrete models.
- 3.19 The student will identify and draw representations of line segments and angles, using a ruler or straightedge.
- 3.20 The student, given appropriate drawings or models, will identify and describe congruent and symmetrical two-dimensional (plane) figures, using tracing procedures.

**Reporting Category: Probability and Statistics**  
**Number of Items: 7**

**Kindergarten SOL in This Reporting Category:**

- K.14 The student will gather data relating to familiar experiences by counting and tallying.
- K.15 The student will display objects and information, using object graphs, pictorial graphs, and tables.
- K.16 The student will investigate and describe the results of dropping a two-colored counter or using a multicolored spinner.

**Grade One SOL in This Reporting Category:**

- 1.18 The student will investigate, identify, and describe various forms of data collection in his/her world (e.g., recording daily temperature, lunch count, attendance, and favorite ice cream), using tables, picture graphs, and object graphs.
- 1.19 The student will interpret information displayed in a picture or object graph, using the vocabulary *more, less, fewer, greater than, less than, and equal to*.

<b>Reporting Category: Probability and Statistics (continued)</b> <b>Number of Items: 7</b>
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**Grade Two SOL in This Reporting Category:**

- 2.23 The student will read, construct, and interpret a simple picture and bar graph.
- 2.24 The student will record data from experiments, using spinners and colored tiles/cubes, and use the data to predict which of two events is more likely to occur if the experiment is repeated.

**Grade Three SOL in This Reporting Category:**

- 3.21 The student, given grid paper, will
  - a) collect and organize data on a given topic of his/her choice, using observations, measurements, surveys, or experiments; and
  - b) construct a line plot, a picture graph, or a bar graph to represent the results. Each graph will include an appropriate title and key.
- 3.22 The student will read and interpret data represented in line plots, bar graphs, and picture graphs and write a sentence analyzing the data.
- 3.23 The student will investigate and describe the concept of probability as chance and list possible results of a given situation.

<b>Reporting Category: Patterns, Functions, and Algebra</b> <b>Number of Items: 7</b>
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**Kindergarten SOL in This Reporting Category:**

- K.17 The student will sort and classify objects according to similar attributes (size, shape, and color).
- K.18 The student will identify, describe, and extend a repeating relationship (pattern) found in common objects, sounds, and movements.

**Reporting Category: Patterns, Functions, and Algebra (continued)**

**Number of Items: 7**

**Grade One SOL in This Reporting Category:**

- 1.20 The student will sort and classify concrete objects according to one or more attributes, including color, size, shape, and thickness.
- 1.21 The student will recognize, describe, extend, and create a wide variety of patterns, including rhythmic, color, shape, and numerical. Patterns will include both growing and repeating patterns. Concrete materials and calculators will be used by students.

**Grade Two SOL in This Reporting Category:**

- 2.25 The student will identify, create, and extend a wide variety of patterns, using numbers, concrete objects, and pictures.
- 2.26 The student will solve problems by completing a numerical sentence involving the basic facts for addition and subtraction. Examples include:  $3 + \underline{\quad} = 7$ , or  $9 - \underline{\quad} = 2$ . Students will create story problems, using the numerical sentences.

**Grade Three SOL in This Reporting Category:**

- 3.24 The student will recognize and describe a variety of patterns formed using concrete objects, numbers, tables, and pictures, and extend the pattern, using the same or different forms (concrete objects, numbers, tables, and pictures).
- 3.25 The student will
- investigate and create patterns involving numbers, operations (addition and multiplication), and relations that model the identity and commutative properties for addition and multiplication; and
  - demonstrate an understanding of equality by recognizing that the equal sign (=) links equivalent quantities, such as  $4 \cdot 3 = 2 \cdot 6$ .