Mathematics

The grade 4 LEAP 21 Mathematics test is composed of sixty multiple-choice and three constructed-response items. A student earns one point for each correct answer to a multiple-choice item and from 0 to 4 points for the answer and work shown for each constructed-response item.

The general scoring rubric for constructed-response items is:

Score	Description
4	• The student's response demonstrates in-depth understanding of the relevant content and/or procedures. • The student completes all important components of the task accurately and communicates ideas effectively. • Where appropriate, the student offers insightful interpretations and/or extensions. • Where appropriate, the student uses more sophisticated reasoning and/or efficient procedures.
3	• The student completes most important aspects of the task accurately and communicates clearly. • The student's response demonstrates an understanding of major concepts and/or processes, although less important ideas or details may be overlooked or misunderstood. • The student's logic and reasoning may contain minor flaws.
2	• The student completes some parts of the task successfully. • The student's response demonstrates gaps in conceptual understanding.
1	• The student completes only a small portion of the task and/or shows minimal understanding of the concepts and/or processes.
0	• The student's response is incorrect, irrelevant, too brief to evaluate, or blank.

Note: It is important to recognize that score points for constructed-response items and LEAP 21 achievement levels do not share a one-to-one correspondence. For example, it should *not* be assumed that a student who scores at the *Advanced* level in the assessment has earned a score of 4 on each of the constructed-response items.

It is possible for a 4th-grade student to earn a total of 72 points on the LEAP 21 Mathematics test. The number of raw score points that a student would have to achieve to reach each achievement level may change slightly from year to year, given the difficulty of that particular form of the test. The spring 2005 raw score range for each achievement level is listed on the next page.

Spring 2005 Mathematics Test, Grade 4

Achievement Level	Raw Score Range
Advanced	65.5 – 72 points
Mastery	58 – 65 points
Basic	43.5 – 57.5 points
Approaching Basic	35 – 43 points
Unsatisfactory	0 – 34.5 points

The following section of this document presents four multiple-choice items selected to illustrate results from four of the five achievement levels used to report LEAP 21 results—*Advanced, Mastery*, *Basic,* and *Approaching Basic*. Examples of *Unsatisfactory* work are not included; by definition, work classified as *Unsatisfactory* exhibits a narrower range of knowledge and skills than work classified as *Approaching Basic*. Information shown for each item includes

- the correct answer,
- the achievement level,
- the strand and benchmark each item measures, and
- commentary on the skills/knowledge measured by the item.

In addition, one constructed-response item with its scoring rubric and sample student responses at scores of 0 to 4 is included. Each student response is annotated to explain how its score was derived and the strengths and weaknesses of the response.

Note: Items may have been reduced in size for this document. Font size on the LEAP 21 assessments is typically 12 points.

Grade 4—Mathematics
Multiple-Choice Items

Strand: Number and Number Relations

Benchmark N.1: Constructing number meaning and demonstrating that a number can be expressed in many different forms (e.g., standard notation, number words, number lines, geometrical representation, fractions, and decimals)

Achievement Level: ***Advanced***

Richard saved 1,812 pennies. Which expression shows another way to represent 1,812?

A. 1 thousand + 7 hundreds + 1 ten + 12 ones

B. 10 thousands + 8 hundreds + 1 ten + 2 ones

C. 1 hundred + 8 tens + 12 ones

* D. 1 thousand + 7 hundreds + 10 tens + 12 ones

* correct answer

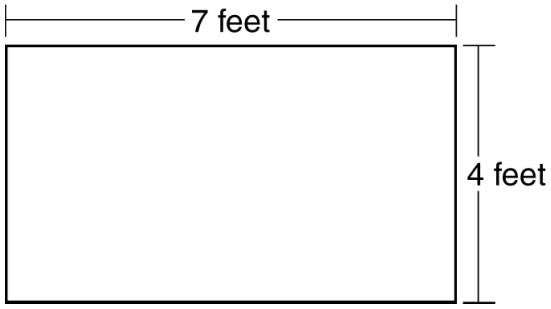
This item would most likely be answered correctly by students who score at the *Advanced* level. The item requires students to represent the number 1,812, written in standard form, as a number written in a different form. The ability to recognize and form representations demonstrates a level of understanding that is often helpful in solving more complex problems. To respond correctly to this item, students must recognize that the leftmost digit (1) in the number 1,812 actually represents the value *1 thousand.* Likewise, since the digit 8 is in the hundreds place, it actually represents the value *8 hundreds*, which can be found by adding *7 hundreds + 10 tens.* The next digit, 1, is in the tens place and represents the value *1 ten.* The digit 2 is in the ones place and represents the value *2 ones.* The combination of these values, *1 ten* and *2 ones,* can be represented as *12 ones.* Option D is the correct response. This item does not require the use of a calculator.

Strand: Measurement

Benchmark M.1: Applying (measure or solve measurement problem) the concepts of length (inches, feet, yards, miles, millimeters, centimeters, decimeters, meters, kilometers), area, volume, capacity (cups, liquid pints and quarts, gallons, milliliters, liters), weight (ounces, pounds, tons, grams, kilograms), mass, time (seconds, minutes, hours, days, weeks, months, years), money, and temperature (Celsius and Fahrenheit) to real-world experiences

Achievement Level: ***Mastery***

The measurements of the tent floor that Tran and his brother will share are shown below.



What is the area of the floor?

A. 11 sq. ft.

B. 14 sq. ft.

C. 22 sq. ft.

* D. 28 sq. ft.

* correct answer

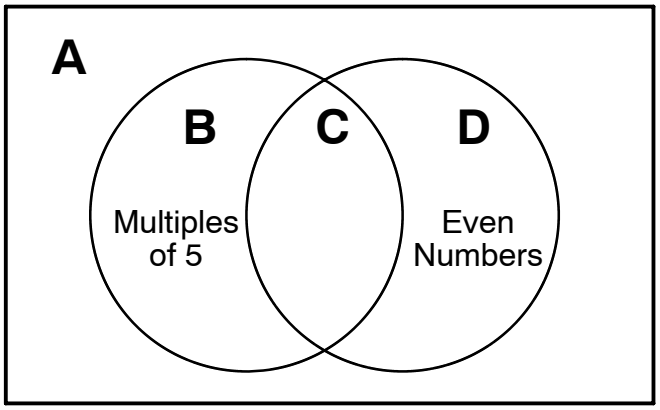
This item would most likely be answered correctly by students who score at the *Mastery* level and above. The item requires students to determine the area of a rectangular floor. Students who respond correctly to this item must know that the area of a rectangle can be found by multiplying length by width (7 feet × 4 feet). Option D, 28 square feet, is the correct response. Other answer options reflect errors typically made by students who do not know the procedure used to determine the area of a rectangle. Options A and C result from adding sides rather than multiplying. Option B is the result of simply doubling the length. The use of a calculator is not allowed on this item.

Strand: Data Analysis, Probability, and Discrete Math

Benchmark D.3: Formulating and solving problems that involve the use of data

Achievement Level: ***Basic***

Use the Venn diagram below to answer the following question.



In which section of the Venn diagram does the number 52 belong?

A. section A
B. section B
C. section C
* D. section D

* correct answer

This item would most likely be answered correctly by students who score at the *Basic* level and above. The item requires students to solve a problem that involves classifying data. The ability to classify data (information) is the basis for many of the skills and techniques used to solve mathematical problems. Young students typically first learn to classify data according to a single characteristic and then progress to the point where they can classify data according to multiple characteristics. For example, very young children may be asked to classify shapes as "circles" or "not circles." By 4th grade, students are expected to classify information based on multiple characteristics. In this problem, students must classify a number according to two characteristics: "Is the number even?" and "Is the number a multiple of five?" If a given number is a multiple of 5 but is not even, section B should be chosen. If a given number is even but is not a multiple of 5, section D should be chosen. If both characteristics are true for a given number, section C should be chosen. If neither characteristic is true, section A should be chosen. Option D is the correct response. This item does not require the use of a calculator.

Strand: Patterns, Relations, and Functions

Benchmark P.2: Representing and describing mathematical relationships using tables, variables, open sentences, and graphs

Achievement Level: ***Approaching Basic***

Freda was playing the "Plants Are Fun" computer counting game. Each time she entered a number of plants, a different number was printed. The table shows the results.

Input Number	Output Number
2	4
6	12
7	14
11	22

What did the computer do to each input number?

A. added 2

B. added 6

* C. multiplied by 2

D. divided by 2

* correct answer

This item would most likely be answered correctly by students who score at the *Approaching Basic* level and above. The item requires students to recognize a rule for determining values in a table. The student has to answer the question "What must I do to the input number to *always* get the output number?" Answer options A and B are incorrect rules since each describes only one input-output pair of numbers in the table. Answer option D is incorrect since it describes the input-output pairs only if the student begins with the output number, not the input number. Answer option C states a rule that will always give the correct pair of numbers. If the input number is multiplied by 2, the result is always the output number. The use of a calculator is not allowed on this item.

Grade 4 Mathematics—Scoring Rubric
Constructed-Response Item

The work presented in this section contains examples of student work at each score point for a mathematics constructed-response item. The content standard for this item is **Algebra.** In problem-solving investigations, students demonstrate an understanding of concepts and processes that allow them to analyze, represent, and describe relationships among variable quantities and to apply algebraic methods to real-world situations.

Hahn, Rashid, and Joe picked up litter at Arliss Park. The table below shows what each student removed.

Litter Removal

	Cans	Papers	Boxes	Total
Hahn	3	11	2	?
Rashid	5	?	?	18
Joe	?	7	5	15

a. How many cans did Joe remove?

_____

b. Write a number sentence using the letter n to represent the number of cans Joe removed.

_____

c. Rashid removed the same number of papers as Joe removed cans. How many **boxes** did Rashid remove? Show your work.

_____

d. Use one of the following symbols (=, <, >) to describe the relationship between the total number of items that Hahn and Rashid found.

_____

Scoring Rubric

Score	Description
4	The student earns 4 points.
3	The student earns 3 or $3\frac{1}{2}$ points.
2	The student earns 2 or $2\frac{1}{2}$ points.
1	The student earns $\frac{1}{2}$ to $1\frac{1}{2}$ points **OR** The student demonstrates minimal understanding of variables and mathematical symbols.
0	The student's response is incorrect, irrelevant, too brief to evaluate, or blank.

Points Assigned:

Part A (1 point)

- 1 point for the correct answer of 3

Part B (1 point)

- 1 point for writing a correct number sentence (n + 7 + 5 = 15 or 15 – 5 – 7 = n, or n + 12 = 15)
  OR
- $\frac{1}{2}$ point for correct number sentence with no indication of an unknown (3 + 7 + 5 = 15)

Part C (1 point)

- 1 point for giving the correct answer of 10 boxes (or answers consistent with an incorrect answer to part a) with correct process (18 – 5 – 3 = 10 or 18 – 8 = 10 or 10 + 5 + 3 = 18)
  OR
- $\frac{1}{2}$ point for an incorrect answer using a correct process with arithmetic error(s) **OR** for a correct answer (or answer consistent with an incorrect answer to part a) with no process

Part D (1 point)

- 1 point for correct number sentence (16 < 18 or 18 > 16)
  OR
- $\frac{1}{2}$ point for correctly comparing the wrong people or for 18 ≠ 16

Score 4

Below is the work of a student who received a score of 4 for his or her response. A score of 4 is given when a student completes all important components of the task and communicates ideas effectively. The student demonstrates in-depth understanding of the content area and completes all of the important components of the task.

Hahn, Rashid, and Joe picked up litter at Arliss Park. The table below shows what each student removed.

Litter Removal

	Cans	Papers	Boxes	Total
Hahn	3	11	2	?
Rashid	5	?	?	18
Joe	?	7	5	15

a. How many cans did Joe remove?

3

b. Write a number sentence using the letter *n* to represent the number of cans Joe removed.

n + 7 + 5 = 15

c. Rashid removed the same number of papers as Joe removed cans. How many **boxes** did Rashid remove? Show your work.

10 5 + 3 + 10 = 18

d. Use one of the following symbols (=, <, >) to describe the relationship between the total number of items that Hahn and Rashid found.

16 < 18

This response demonstrates the mathematical skills required to correctly answer all parts of the question. The student provides a correct answer for each part, with work shown supporting how the answer was derived in part c. This response is correct and complete, and the student earns a total of 4 points for a score of 4.

Score 3

Below is the work of a student who received a score of 3 for his or her response. A score of 3 is given when a student completes the most important aspects of the required task and communicates his or her ideas clearly. The response should demonstrate the student's understanding of major concepts and/or processes, although the student may have overlooked or misunderstood less important ideas.

Hahn, Rashid, and Joe picked up litter at Arliss Park. The table below shows what each student removed.

Litter Removal

	Cans	Papers	Boxes	Total
Hahn	3	11	2	?
Rashid	5	?	?	18
Joe	?	7	5	15

a. How many cans did Joe remove?

3 cans

b. Write a number sentence using the letter *n* to represent the number of cans Joe removed.

15 - 12 = n

c. Rashid removed the same number of papers as Joe removed cans. How many **boxes** did Rashid remove? Show your work.

5+3=8 8+10=18

d. Use one of the following symbols (=, <, >) to describe the relationship between the total number of items that Hahn and Rashid found.

Hahn 16 < Rashid 18

This response demonstrates the mathematical skills required to answer most of the question correctly, but it is not complete. The student provides a correct answer to parts a, b, and d. In part c, the work shown demonstrates the correct process for deriving the answer but does not clearly indicate the correct answer of 10 boxes. The student earns a total of $3\frac{1}{2}$ points (1 point each for parts a, b and d, and $\frac{1}{2}$ point for part c), for a score of 3.

Score 2

Below is the work of a student who received a score of 2 for his or her response. A score of 2 is given when a student completes some parts of the task successfully. The student's response demonstrates gaps in conceptual understanding.

Hahn, Rashid, and Joe picked up litter at Arliss Park. The table below shows what each student removed.

Litter Removal

	Cans	Papers	Boxes	Total
Hahn	3	11	2	?
Rashid	5	?	?	18
Joe	?	7	5	15

a. How many cans did Joe remove?

3 cans

b. Write a number sentence using the letter *n* to represent the number of cans Joe removed.

7 − 4 = n

c. Rashid removed the same number of papers as Joe removed cans. How many **boxes** did Rashid remove? Show your work.

5 boxes

10 5
+8 +5
18 10

d. Use one of the following symbols (=, <, >) to describe the relationship between the total number of items that Hahn and Rashid found.

16 < 18

This response demonstrates the mathematical skills required to correctly answer two parts of the question. The student provides correct answers to parts a and d, but the answers given for parts b and c are incorrect. Also, the work shown in part c is not correct (the student uses 5 for the number of papers that Rashid removed, instead of 3). The student earns a total of 2 points (1 point each for part a and part d) for a score of 2.