

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	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• The student completes some parts of the task successfully.• The student's response demonstrates gaps in conceptual understanding.
1	<ul style="list-style-type: none">• The student completes only a small portion of the task and/or shows minimal understanding of the concepts and/or processes.
0	<ul style="list-style-type: none">• 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 2004 raw score range for each achievement level is listed on the next page.

Spring 2004 Mathematics Test, Grade 4

Achievement Level	Raw Score Range
Advanced	68 – 72 points
Mastery	61 – 67.5 points
Basic	47 – 60.5 points
Approaching Basic	37 – 46.5 points
Unsatisfactory	0 – 36.5 points

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 0–4 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.

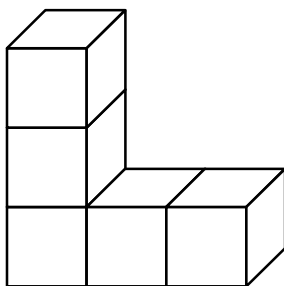
Grade 4—Mathematics
Multiple-Choice Items

Strand: Geometry

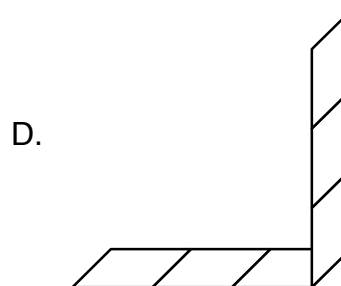
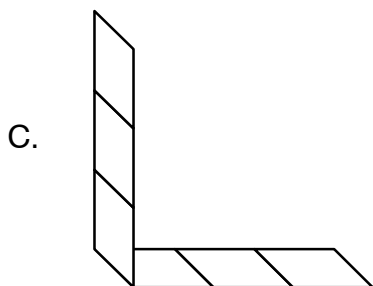
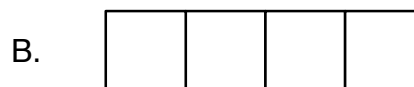
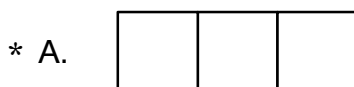
Benchmark G.1: Determining the relationships among shapes

Achievement Level: *Advanced*

Jennifer made this shape using five cubes.



If you look at the shape from above, which might you see?



* correct answer

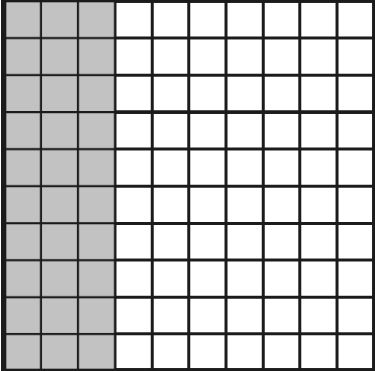
This item would most likely be answered correctly by students who score at the *Advanced* level. The item requires 4th-grade students to identify a two-dimensional view of a three-dimensional shape. The ability to create and recognize different representations or views is considered a very valuable skill. To choose the correct two-dimensional representation, the student must picture what would be seen if the three-dimensional shape was viewed from directly above. When viewed from this perspective, a line of three squares (the tops of three of the blocks) is what would be seen. Therefore, the correct response is A. This item does not require a calculator.

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: *Mastery*

Ms. Carew asked what part of this hundred block is shaded.



Whitney says that $\frac{3}{10}$ is shaded.
Adam says that 0.3 is shaded.
Sally says that 0.30 is shaded.
Colea says that 0.03 is shaded.

Who is **wrong**?

- A. Whitney
- B. Adam
- C. Sally
- * D. Colea

* correct answer

This item would most likely be answered correctly by students who score at the *Mastery* level or above. The item requires 4th-grade students to demonstrate that they can express a number in different forms. They must determine the equivalent value of a number when shown as a graphic (shaded grid), a fraction, and a decimal number. In the grid, the number is represented by the 30 out of 100 blocks that are shaded. This shaded portion can be represented by the fraction $\frac{30}{100}$ or the decimal number 0.30. The students must then recognize that these two numbers can also be written in reduced form as $\frac{3}{10}$ and 0.3. The number Colea has chosen, 0.03, represents only 3 shaded squares. This is not equivalent to the other numbers; therefore, the correct choice is D. The use of a calculator is allowed on this item.

Strand: Algebra

Benchmark A.2: Modeling and developing strategies for solving equations and inequalities

Achievement Level: *Basic*

Parents and students attended Back-to-School night in the school auditorium. In the front of the auditorium, there are 76 chairs arranged equally in 4 rows. How many chairs are in each row?

$$4 \times \square = 76$$

- A. 12
- B. 15
- C. 18
- * D. 19

* correct answer

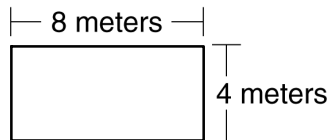
This item would most likely be answered correctly by students who score at the *Basic* level or above. The item allows 4th-grade students to use a choice of strategies to model and solve the problem. From reading the item, they may directly determine the number of chairs in each row by dividing 76 by 4. As a second option, they may use the equation ($4 \times \square = 76$) as an intermediate step in modeling the question. They must recognize that the box represents the number of chairs in each row. Students who use the equation must use the inverse operation (often this is called the “turn around”) to answer the question by dividing, $76 \div 4$. With either strategy, the correct answer is D. The use of a calculator is not allowed on this item.

Strand: Measurement

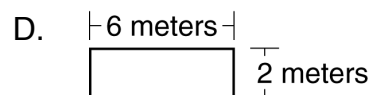
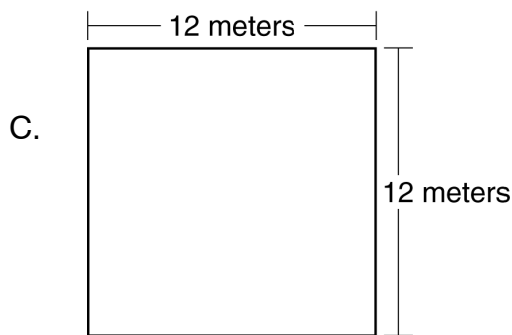
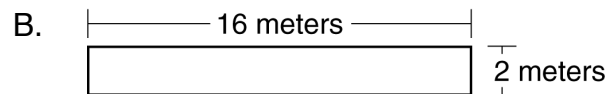
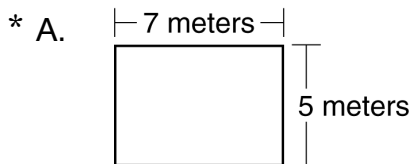
Benchmark M.1: Applying (measure or solve measurement problem) the concepts of length (inches, feet, yards, miles, millimeters, centimeters, decimeters, meters, kilometers), area, volume, capacity (cups, liquid pints and quarts, gallons, milliliters, liters), weight (ounces, pounds, tons, grams, kilograms),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

Achievement Level: *Approaching Basic*

A diagram of Tameka's garden, which is a rectangle, is shown below.



Which of these rectangular figures has a perimeter that is equal to the perimeter of Tameka's garden?



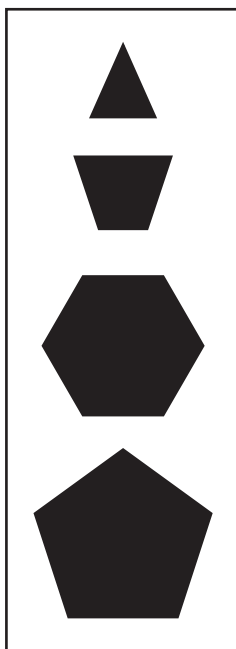
* correct answer

This item would most likely be answered correctly by students who score at the *Approaching Basic* level or above. The item requires 4th-grade students to demonstrate the ability to determine perimeter. The students must first compute the perimeter (distance around) of Tameka's garden. To find this perimeter, it is necessary that they use measurements for the two sides that are not listed, 8 and 4. The perimeter of Tameka's garden is then found by adding $8 + 4 + 8 + 4$. The perimeter of the garden is 24 meters. By using the same procedure, the students will find that the perimeter of the answer option A is also 24 meters. As an alternative method, students may find half of the perimeter of Tameka's garden by adding $8 + 4$. They will then find that half of the perimeter ($7 + 5$) of answer option A is also 12. This item does not require the use of a calculator.



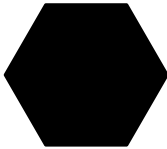
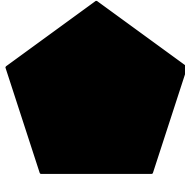
**Grade 4 Mathematics—Scoring Rubric
Constructed-Response Item**

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 **Data Analysis, Probability, and Discrete Math**. In problem-solving investigations, students discover trends, formulate conjectures regarding cause-and-effect relationships, and demonstrate critical thinking skills in order to make informed decisions.

Jacob tossed **six** beanbags onto the board below.



- A.** Use these clues to find how many beanbags landed on each shape.
Write your answer on the chart on page X.
- The beanbags all landed on two of the shapes.
 - The two shapes were not next to each other.
 - The same number of beanbags landed on each of the two shapes.
 - No beanbags landed on the pentagon.

Points & Shapes	Bean Bags
	
	
	
	

Each time a beanbag lands on a shape, Jacob earns points.

- A triangle is worth 12 points.
- A trapezoid is worth 8 points.
- A hexagon is worth 4 points.
- A pentagon is worth 2 points.

B. How many points did Jacob earn? _____ points
 Show or explain how you found your answer.

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 $1\frac{1}{2}$ to $2\frac{1}{2}$ points.
1	The student earns $\frac{1}{2}$ or 1 point
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured, or blank.

Points Assigned

Part A: (maximum 2 points)





- $\frac{1}{2}$ point for each clue correctly followed (student must clearly indicate how many landed on each shape; 0 or blank is acceptable for trapezoid and pentagon)

Part B (2 points)

- 1 point for correct answer based on part A (if A is correct, answer is 48)
AND
- 1 point for correct strategy or explanation
[$36 + 12 = 48$ or $(3 \times 12) + (3 \times 4) = 48$ or $12 + 12 + 12 + 4 + 4 + 4 = 48$]



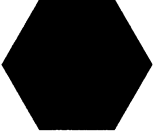
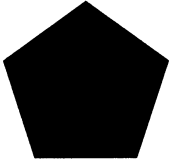
Note: If total number of bean bags tossed does not equal 6, do not award a score of 4, otherwise do not penalize.

Sample response, part A:

Shapes	Number of Beanbags
	3
	0
	3
	0

Score 4

Below is the work of a 4th-grade 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.

Shapes	Number of Beanbags
	3 beanbags
	
	3 beanbags
	

Each time a beanbag lands on a shape, Jacob earns points.

- A triangle is worth 12 points.
- A trapezoid is worth 8 points.
- A hexagon is worth 4 points.
- A pentagon is worth 2 points.




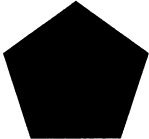
B. How many points did Jacob earn? 48 points
Show or explain how you found your answer.

$$\begin{array}{r} 4 \\ 4 \\ +4 \\ \hline 12 \\ +36 \\ \hline 48 \text{ points} \end{array} + \begin{array}{r} 12 \\ 12 \\ +12 \\ \hline 36 \\ =48 \text{ points} \end{array}$$

This response demonstrates the mathematical skills required to answer all parts of the question correctly, with work shown in part B. In part A, the student uses all of the clues to find the correct number of bean bags that landed on each shape. In part B, the student finds the correct amount of points earned, with work shown demonstrating a correct strategy. The response is complete and correct and earns a total of 4 points for a score of 4.

Score 3

Below is the work of a 4th-grade 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.

Shapes	Number of Beanbags
	2
	0
	2
	0

Each time a beanbag lands on a shape, Jacob earns points.

- A triangle is worth 12 points.
- A trapezoid is worth 8 points.
- A hexagon is worth 4 points.
- A pentagon is worth 2 points.



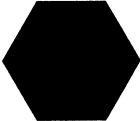
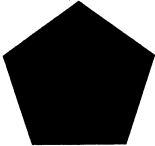
B. How many points did Jacob earn? 32 points
Show or explain how you found your answer.

$$\begin{array}{r} 12 \\ +12 \\ \hline 24 \end{array}$$
$$\begin{array}{r} 4 \\ +4 \\ \hline 8 \end{array}$$
$$\begin{array}{r} 1 \\ 24 \\ +8 \\ \hline 32 \end{array}$$

This response demonstrates the mathematical skills required to answer most of the question correctly, but does contain an error in part A. The student uses the clues to find the number of bean bags that landed on each shape, but the student only accounts for 4 of the 6 bean bags tossed. The answer to part B is correct based on the answer to part A, with work shown demonstrating a correct strategy. The response demonstrates an understanding of the mathematical concepts in both parts, and receives a score of 3 due to the error in part A.

Score 2

Below is the work of a 4th-grade 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.

Shapes	Number of Beanbags
	3 beanbags
	
	3 beanbags
	

Each time a beanbag lands on a shape, Jacob earns points.

- A triangle is worth 12 points.
- A trapezoid is worth 8 points.
- A hexagon is worth 4 points.
- A pentagon is worth 2 points.



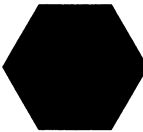
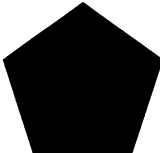
B. How many points did Jacob earn? 26 points
Show or explain how you found your answer.

I add the 12, 8, 4, 2 on the chart and got 26 points.

This response demonstrates the mathematical skills required to answer only one part of the question correctly. In part A, the student uses all of the clues to find the correct number of bean bags that landed on each shape. The answer to part B is incorrect, with work that does not demonstrate a correct strategy for finding the number of points earned. The response earns a total of 2 points (in part A) for a score of 2.

Score 1

Below is the work of a 4th-grade student who received a score of 1 for his or her response. A score of 1 is given when a student completes only a small portion of the task.

Shapes	Number of Beanbags
	1
	1
	12
	None

Each time a beanbag lands on a shape, Jacob earns points.

- A triangle is worth 12 points.
- A trapezoid is worth 8 points.
- A hexagon is worth 4 points.
- A pentagon is worth 2 points.



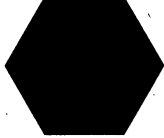
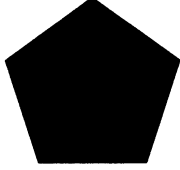
B. How many points did Jacob earn? 24 points
Show or explain how you found your answer.

$$\begin{array}{r} 12 \\ + 8 \\ + 4 \\ \hline 24 \end{array}$$

The response demonstrates a minimal understanding of the relevant concepts in at least one part of the question. The student uses only one clue correctly (no bean bags landed on the pentagon) in an attempt to find how many bean bags landed on each shape. The answer to part B is incorrect and the work shown does not demonstrate a correct strategy for finding the number of points earned. The response earns a total of $\frac{1}{2}$ point (in part A) for a score of 1.

Score 0

Below is the work of a 4th-grade student who received a score of 0 for his or her response. A score of 0 is given when a student's response is incorrect, irrelevant, too brief to evaluate, or blank.

Shapes	Number of Beanbags
	3
	4
	6
	5

Each time a beanbag lands on a shape, Jacob earns points.

- A triangle is worth 12 points.
- A trapezoid is worth 8 points.
- A hexagon is worth 4 points.
- A pentagon is worth 2 points.

B. How many points did Jacob earn? 18 points
Show or explain how you found your answer.

$$\begin{array}{r} 6 \\ + 4 \\ + 7 \\ \hline 18 \end{array}$$

The response is incorrect and does not demonstrate a minimal understanding of the relevant concepts in any part of the question. The student does not use any of the clues correctly in the attempt to find how many bean bags landed on each shape, and the answer to part B is incorrect with work shown that does not demonstrate a correct strategy for finding the number of points earned.