LEAP
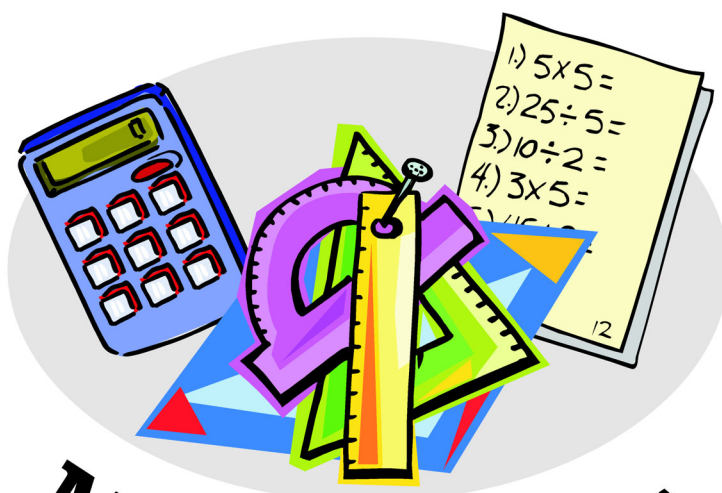## for the 21st Century

Released Test Items:

Sample Student Work Illustrating LEAP 21
Achievement Levels

July 2004

Grade 8
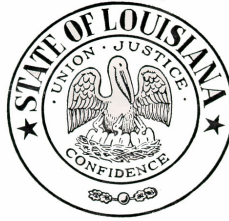
Mathematics

Reaching For Results

Louisiana Department of
EDUCATION

LOUISIANA DEPARTMENT OF EDUCATION

Cecil J. Picard
State Superintendent of Education

Louisiana State Board of Elementary and Secondary Education

**Louisiana Educational Assessment Program
for the 21st Century (LEAP 21)**

GRADE 8 SAMPLE ITEMS AND STUDENT WORK
2003–2004

LEAP 21 is an integral part of the Louisiana school and district accountability system passed by the state legislature and signed into law in 1997. The primary purposes of the accountability system are to raise expectations for achievement for all Louisiana public school students and to improve public education in the state.

In March 2004, students in grade 8 took LEAP 21 English Language Arts, Mathematics, Science, and Social Studies tests. The test scores are combined with other relevant data to create school and district accountability scores, which serve as a means of measuring educational quality and improvement in educational programs over time.

This document is part of a series of materials meant to promote understanding of knowledge and skills students must have and the kinds of work they must produce to be successful on the LEAP 21. A list of other documents providing background and further information on the LEAP 21 tests can be found on the Louisiana Department of Education Web site at www.louisianaschools.net.

LEAP 21 Reports

Louisiana's grade 8 students are tested each year in March. Individual student, school, district, and state test results are released in phases in May and July. School and district accountability results are reported in the fall.

For LEAP 21, student scores are reported at five achievement levels: *Advanced, Mastery, Basic, Approaching Basic,* and *Unsatisfactory*. The percentage of students scoring at each level is reported for individual schools, districts, and the state. General definitions for achievement levels are given on page 2. Specific definitions of achievement levels for the Mathematics test were published in the 1999 Released Items documents. The achievement level definitions for all content areas can be found on the Louisiana Department of Education Web site at www.louisianaschools.net. Click on the "Testing" link below the tabs at the top of the page, then on the "Achievement Levels" link at the left of the page.

LEAP 21
General Achievement Level Definitions

Achievement Level	Definition
Advanced	A student at this level has demonstrated superior performance beyond the level of mastery.
Mastery	A student at this level has demonstrated competency over challenging subject matter and is well prepared for the next level of schooling.
Basic	A student at this level has demonstrated only the fundamental knowledge and skills needed for the next level of schooling.
Approaching Basic	A student at this level has only partially demonstrated the fundamental knowledge and skills needed for the next level of schooling.
Unsatisfactory	A student at this level has not demonstrated the fundamental knowledge and skills needed for the next level of schooling.

Purpose of This Document

This document presents student work in the Mathematics test, which was completed as part of a LEAP 21 assessment. The document includes examples of multiple-choice items and constructed-response items that exemplify what students scoring at specified achievement levels should know and be able to do. A discussion of each item highlights knowledge and skills it is intended to measure, as well as strengths and weaknesses in the student work on the item.

As you review the items, it is important to remember that a student's achievement level is based on his or her *total test score* (cumulative score for all questions in the test) in a content area, *not* on one particular item or section, and that sample items included in this report represent a small portion of the body of knowledge and skills measured by the LEAP 21 tests. Additional items will be released in future years of the LEAP 21.

Mathematics

The grade 8 LEAP 21 Mathematics test is composed of sixty multiple-choice and four 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 constructed-response item.

It is possible for an 8th-grade student to earn a total of 76 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 page 4.

Spring 2004 Mathematics Test, Grade 8

Achievement Level	Raw Score Range
Advanced	69.5 – 76 points
Mastery	63.5 – 69 points
Basic	38 – 63 points
Approaching Basic	28.5 – 37.5 points
Unsatisfactory	0 – 28 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 are included. Each student response is annotated to explain how its score was derived and the strengths and weaknesses of the response.

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

Strand: Data Analysis, Probability, and Discrete Math

Benchmark D.5:   Comparing experimental probability results with theoretical probability (e.g., representing probabilities of concrete situations as common fractions, investigating single-event and multiple-event probability, using sample spaces, geometric figures, tables, and/or graphs).

Achievement Level: *Advanced*

Bruce and Calvin are playing the board game shown below.
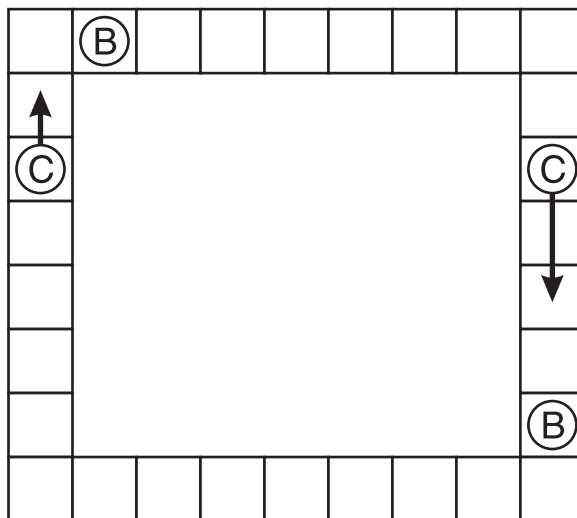
It is Calvin's turn to roll a number cube labeled from 1 to 6. If one of Calvin's tokens (C) lands on a space already occupied by one of Bruce's tokens (B), Bruce's token is knocked off. Calvin has the choice of moving either of his tokens. What is the probability that Calvin will be able to knock off one of Bruce's tokens?

   A. $\dfrac{1}{36}$

   B. $\dfrac{1}{7}$

   C. $\dfrac{2}{12}$

*D. $\dfrac{1}{3}$

* correct answer

This item would most likely be answered correctly by students who score at the *Advanced* level. The item requires 8th-grade students to determine the probability that Calvin's token will land on a space already occupied by one of Bruce's tokens. Students must recognize that this will occur if Calvin rolls either a 3 or a 4. These possibilities (3 or 4) are referred to as successful outcomes. Students then apply this information to the basic definition of probability:

$$\textbf{Probability of Successful Outcomes} = \frac{\textbf{Number of Successful Outcomes}}{\textbf{Number of All Possible Outcomes}}$$

The number cube has 6 **possible outcomes** and there are 2 **successful outcomes**. Therefore, students must correctly conclude that the probability of Calvin's token landing on a space occupied by one of Bruce's tokens is $\frac{2}{6}$.

Since $\frac{2}{6}$ can be written as $\frac{1}{3}$, the correct answer is D. The use of a calculator is allowed on this item.

Strand: Number and Number Relations

Benchmark N.3:   Reading, writing, representing, and using rational
                          numbers in a variety of forms (e.g., integers, mixed
                          numbers, and improper fractions).

Achievement Level: *Mastery*

Danielle is inviting five girls to her
birthday party. For lunch, she and her
five friends will eat nine small pizzas. If
everybody at the party eats the same
amount, how much will each girl eat?

   A. $\frac{1}{2}$ pizza

   B. $\frac{2}{3}$ pizza

  *C. $1\frac{1}{2}$ pizzas

   D. $1\frac{2}{3}$ pizzas
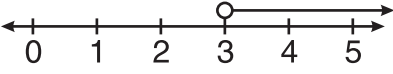
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    * correct answer

This item would most likely be answered correctly by students who score at the
Mastery level or above. The item requires 8th-grade students to solve a problem
in which a solution is represented as a mixed number. The students must
determine the portion of the 9 small pizzas each girl will eat. Since Danielle
invited 5 friends to her party, the portion of 9 pizzas eaten by each person is
found by dividing 9 by 6 (9 ÷ 6). The answer to this division is 1 with a
remainder of 3. Students must express this result as the mixed number, $1\frac{3}{6}$
pizzas, which is equivalent to $1\frac{1}{2}$ pizzas or answer option C. As an alternative
approach, students may recognize that the portion of the 9 pizzas eaten by
each person can be expressed as $\frac{9}{6}$. This fraction can also be written as $1\frac{3}{6}$,
which is equivalent to answer option C. The use of a calculator is not allowed
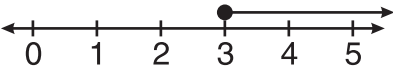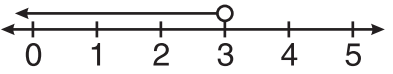on this item.

Strand: Algebra

Benchmark A.2: Modeling and developing methods for solving equations and inequalities (e.g., using charts, graphs, manipulatives, and/or standard algebraic procedures).
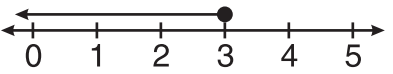
Achievement Level: *Basic*

Which graph represents $x \geq 3$?

A.

* B.

C.

D.

* correct answer

This item would most likely be answered correctly by students who score at the *Basic* level or above. The item requires 8th-grade students to represent an inequality as a graph on a number line. The students must know that the solution to the inequality written in the question, $x \geq 3$, includes the number 3 and all numbers greater than three. This is represented by the graph in answer option B. The solid circle or dot above the three is necessary to show that the number 3 is included in the solution. The use of a calculator is not allowed on this item.

Strand: Patterns, Relations, and Functions

Benchmark P.1:   Describing, extending, analyzing, and creating a wide
                          variety of numerical, geometrical, and statistical patterns
                          (e.g., skip counting of rational numbers, and simple
                          exponential number patterns).

Achievement Level: *Approaching Basic*

Look at this sequence of numbers.

1, 2, 4, 5, 10, 11, 22, 23, 46, . . .

Which of the following could be the next
three numbers?

    A.   47, 48, 49

    B.   47, 48, 96

 * C.   47, 94, 95

    D.   92, 93, 94

---

* correct answer

This item would most likely be answered correctly by students who score at the
Approaching Basic level or above. The item requires 8th-grade students to
analyze and continue a numerical pattern. The students must recognize that
there are two rules used to create this sequence or pattern. Some students may
know this as a two-step sequence or pattern. Beginning with the first term, 1,
succeeding terms are found by adding 1 and then multiplying by 2. Following
these steps, students will determine the next three numbers in the pattern by
first adding 1 to 46 to get 47. That number is then multiplied by 2 (47 • 2) to
get 94. Finally, the third number is found by adding 1 to 94 to get 95. The
correct answer is C. This item does not require the use of a calculator.

The following pages present a mathematics constructed-response item, a scoring rubric, and examples of student work at scores of 0 to 4. The original item is shown below, and the scoring rubric can be found on page 11. The content standard for this item is **Geometry.** In solving problems for this content standard, students demonstrate an understanding of geometric concepts and applications involving one-, two-, and three-dimensional geometry and justify their findings.

Juanita works in a paint store. The store sells paint in 1-gallon and 1-quart cans. The 1-gallon cans have a diameter of $6\frac{1}{2}$ inches, and the 1-quart cans have a diameter of 4 inches.

a. Juanita is placing cans of paint on the shelves in rows and columns. The shelves are 18 inches wide and 50 inches long. How many 1-gallon cans of paint will fit on a shelf? Justify your answer.

50 inches

18 inches
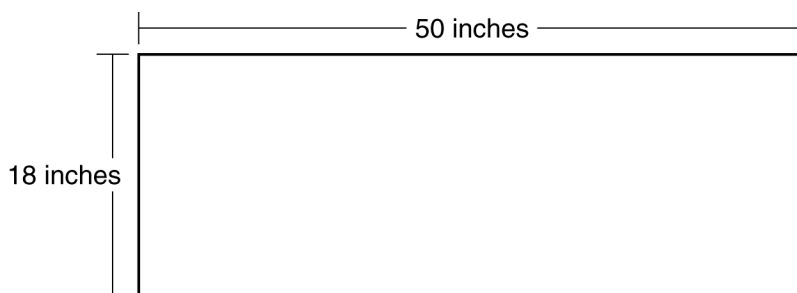
b. How many 1-quart cans of paint will fit on a shelf? Justify your answer.

c. Juanita put as many 1-gallon cans of paint as possible on a shelf. Then she decided to put 1-quart cans in the remaining space. How many 1-quart cans of paint can fit in the remaining space? Justify your answer using words, symbols, or pictures.

Scoring Rubric

Score	Description
4	Student earns 6 points.
3	Student earns 4 or 5 points.
2	Student earns 3 points.
1	Student earns 1 or 2 points. **OR** Student shows minimal understanding.
0	Response is incorrect, irrelevant to the skill or concept being measured, or blank.

Points Assigned:

Part A (2 points)

- 2 points for correct procedure and correct number of cans
  ($18 \div 6\frac{1}{2} \approx 2$, $50 \div 6\frac{1}{2} \approx 7$, $2 \times 7 =$ **14** or **14 cans**)
  OR
- 1 point for correct procedure for calculating number of cans with arithmetic error(s) **OR** for correct answer with incorrect, incomplete, or no procedure, **OR** for correct answer with incorrect units

Part B (2 points)

- 2 points for correct procedure and correct number of cans ($18 \div 4 \approx 4$, $50 \div 4 \approx 12$, $4 \times 12 =$ **48** or **48 cans**)
  OR
- 1 point for correct procedure for calculating number of cans with arithmetic error(s) **OR** for correct answer with incorrect, incomplete, or no procedure, **OR** for correct answer with incorrect units

Part C (2 points)

- 2 points for correct answer based on part a and correct procedure for calculating number of cans. (The following example is based on a correct answer to part a. Two rows of 7 one-gallon cans fit on the shelf, which takes up a space of 45.5 inches by 13 inches; this leaves 5 inches in the front, which is room for 1 row of 12 one-quart cans, and 4.5 inches on a side, which is room for 1 column of one-quart cans; $18 \div 4 \approx 4$, $50 \div 4 \approx 12$; $12 + 4 = 16$ cans, but the can at the corner gets counted twice, so $16 - 1 = 15$ cans)
  OR
- 1 point for correct procedure for calculating number of cans with arithmetic error(s) **OR** for correct answer with incorrect, incomplete, or no procedure

Score 4

Below is the work of an 8th-grade student who received a score of 4 for this response. A score of 4 is given when a student completes all of the important components of the task and communicates his or her ideas effectively. The response should demonstrate in-depth understanding of the content area, and all the important components of the task should be complete.

Juanita works in a paint store. The store sells paint in 1-gallon and 1-quart cans. The 1-gallon cans have a diameter of $6\frac{1}{2}$ inches, and the 1-quart cans have a diameter of 4 inches.

a. Juanita is placing cans of paint on the shelves in rows and columns. The shelves are 18 inches wide and 50 inches long. How many 1-gallon cans of paint will fit on a shelf? Justify your answer.
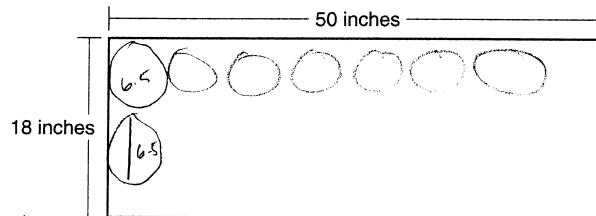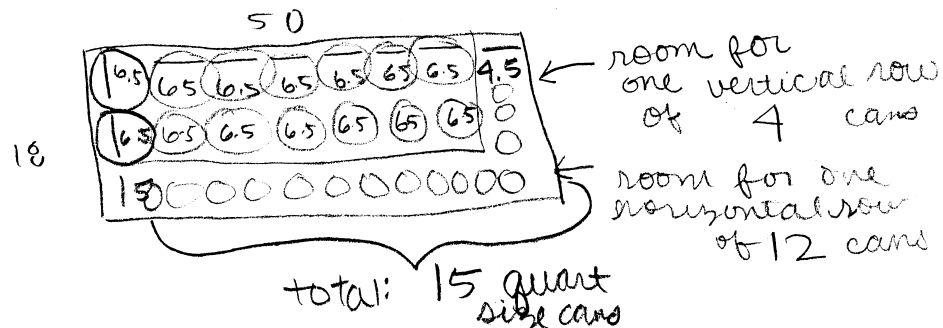
14 gallon cans would fit because only two rows of 6.5 in. cans could fit in 18 inches of space and only 7, 6.5 in. cans could fit in 50 inches. This gives you (7·2 = 14) an answer.

b. How many 1-quart cans of paint will fit on a shelf? Justify your answer.

48 quart cans would fit because only 4 rows of 4 in. cans could fit in 18 in of space and only 12, 4 in. cans could fit in 50 inches of space. This gives you (4·12 = 48) an answer

c. Juanita put as many 1-gallon cans of paint as possible on a shelf. Then she decided to put 1-quart cans in the remaining space. How many 1-quart cans of paint can fit in the remaining space? Justify your answer using words, symbols, or pictures.

room for one vertical row of 4 cans

room for one horizontal row of 12 cans

total: 15 quart size cans

This response demonstrates the mathematical skills required to answer all parts of the question correctly with appropriate justification in each part. The student determines the correct number of cans that can fit on a shelf in each part and provides an explanation that demonstrates a correct strategy was used. The response is correct and complete and earns a total of 6 points for a score of 4.

Score 3

Below is the work of an 8th-grade student who received a score of 3 for this 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 one part of the problem.

Juanita works in a paint store. The store sells paint in 1-gallon and 1-quart cans. The 1-gallon cans have a diameter of $6\frac{1}{2}$ inches, and the 1-quart cans have a diameter of 4 inches.

a. Juanita is placing cans of paint on the shelves in rows and columns. The shelves are 18 inches wide and 50 inches long. How many 1-gallon cans of paint will fit on a shelf? Justify your answer.

|← 50 inches →|

18 inches
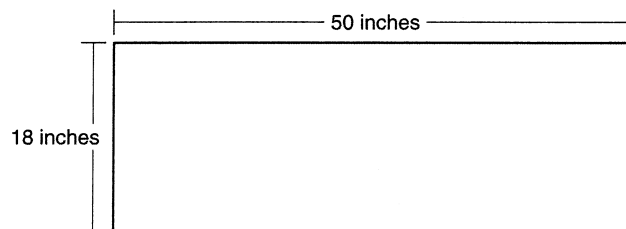
You could fit 19. I get this because you can only fit 7 cans long ways and only 2 can to the width. Just multiply the two.

b. How many 1-quart cans of paint will fit on a shelf? Justify your answer.

48 would fit. only 4 would fit wide, and only 12 would fit longways multiply the two.

c. Juanita put as many 1-gallon cans of paint as possible on a shelf. Then she decided to put 1-quart cans in the remaining space. How many 1-quart cans of paint can fit in the remaining space? Justify your answer using words, symbols, or pictures.

*She could put 16 quarts of paint*

18

50
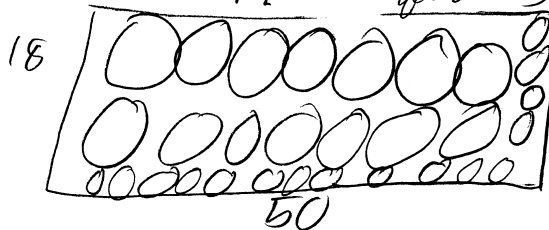
This response demonstrates the mathematical skills required to answer most of the question correctly but contains an error in part c. The student determines the correct number of cans that can fit on a shelf in parts a and b, and provides an explanation that demonstrates that a correct strategy was used in both parts. In part c, the student's work shown demonstrates an understanding of an appropriate strategy but arrives at an incorrect number of cans because of counting the corner can twice. The response therefore earns a total of 5 points (2 in part a, 2 in part b, and 1 in part c) for a score of 3.

Score 2

Below is the work of an 8th-grade student who received a score of 2 for this response. A score of 2 is given when a student completes some parts of the task successfully. The student's response demonstrates gaps in his or her conceptual understanding.

Juanita works in a paint store. The store sells paint in 1-gallon and 1-quart cans. The 1-gallon cans have a diameter of $6\frac{1}{2}$ inches, and the 1-quart cans have a diameter of 4 inches.

a. Juanita is placing cans of paint on the shelves in rows and columns. The shelves are 18 inches wide and 50 inches long. How many 1-gallon cans of paint will fit on a shelf? Justify your answer.
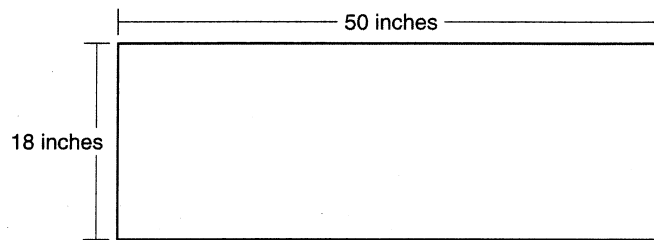
50 inches

18 inches

7
2

7 going with 50 inches in 2 rows So the anwer would be 14 cans.

b. How many 1-quart cans of paint will fit on a shelf? Justify your answer.

12
4

12 going with 50 inches in 4 rows, So the answer would be 36 cans.

c. Juanita put as many 1-gallon cans of paint as possible on a shelf. Then she decided to put 1-quart cans in the remaining space. How many 1-quart cans of paint can fit in the remaining space? Justify your answer using words, symbols, or pictures.

2 because the is only enough Space for 2
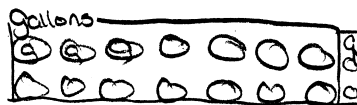
This response demonstrates an understanding of the relevant concepts in two parts, but the third part is incorrect and does not contain work or an explanation that demonstrates an understanding of an appropriate strategy. The student determines the correct number of cans that can fit on the shelf in part a with appropriate justification. In part b, the explanation provided demonstrates an understanding of an appropriate strategy for finding the correct number of cans, but the answer is incorrect due to a calculation error (12 times 4 does not equal 36). The answer to part c is incorrect, and the explanation provided for this part does not demonstrate an appropriate strategy for finding the correct number of cans. The response earns a total of 3 points (2 in part a and 1 in part b) for a score of 2.

Score 1

Below is the work of an 8th-grade student who received a score of 1 for this response. A score of 1 is given when a student completes only one part of the task, or when the student's response demonstrates minimal understanding of the concepts and/or processes.

Juanita works in a paint store. The store sells paint in 1-gallon and 1-quart cans. The 1-gallon cans have a diameter of $6\frac{1}{2}$ inches, and the 1-quart cans have a diameter of 4 inches.

a. Juanita is placing cans of paint on the shelves in rows and columns. The shelves are 18 inches wide and 50 inches long. How many 1-gallon cans of paint will fit on a shelf? Justify your answer. 14

(diagram of shelf 50 inches long and 18 inches wide with two rows of cans) 68 q)
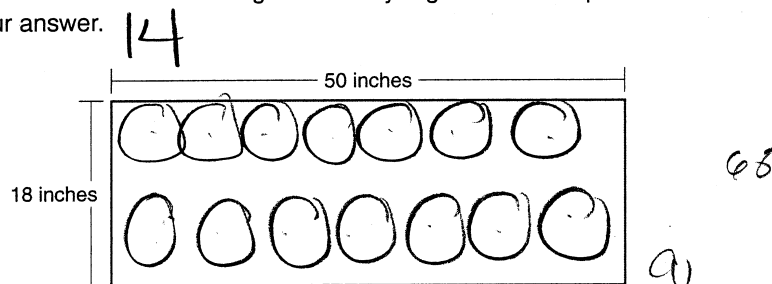
b. How many 1-quart cans of paint will fit on a shelf? Justify your answer. 17. I divided 18 ÷ 4 = 4.5 and 50 ÷ 4 = 12.5 I added them together and got 17.

c. Juanita put as many 1-gallon cans of paint as possible on a shelf. Then she decided to put 1-quart cans in the remaining space. How many 1-quart cans of paint can fit in the remaining space? Justify your answer using words, symbols, or pictures.

(diagram of shelf 50 inches long and 18 inches wide with cans labeled q and g) q=quart g=gallon
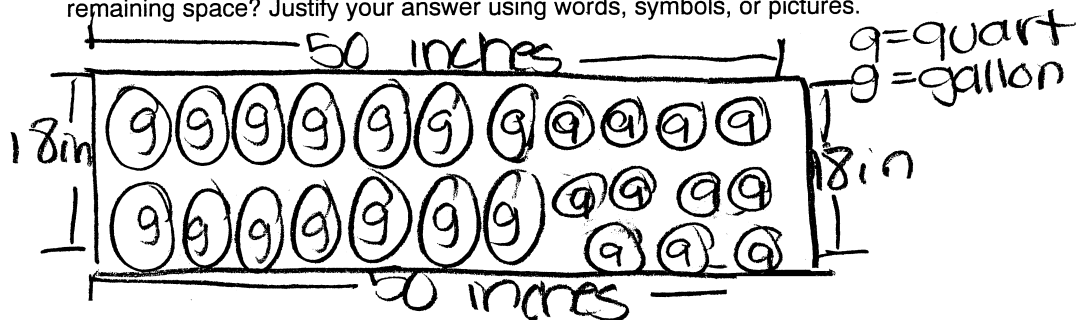
The response demonstrates a minimal understanding of the relevant concepts in at least one part of the question. The student provides a correct answer to part a with work shown demonstrating an appropriate strategy. The answers provided for parts b and c are incorrect and the work shown or explanation provided does not demonstrate a correct strategy for finding the number of cans for either part. The response earns a total of 2 points (in part a) for a score of 1.

Score 0

Below is the work of an 8th-grade student who received a score of 0 for this response. A score of 0 is given when a student's response is incorrect, irrelevant, too brief to evaluate, or blank.

Juanita works in a paint store. The store sells paint in 1-gallon and 1-quart cans. The 1-gallon cans have a diameter of $6\frac{1}{2}$ inches, and the 1-quart cans have a diameter of 4 inches.

a. Juanita is placing cans of paint on the shelves in rows and columns. The shelves are 18 inches wide and 50 inches long. How many 1-gallon cans of paint will fit on a shelf? Justify your answer.

|← 50 inches →|

18 inches

138 gallons of paint will fit on this shelf because 50 x 18 = 900. 900 ÷ 6½ = 138 ⅔.
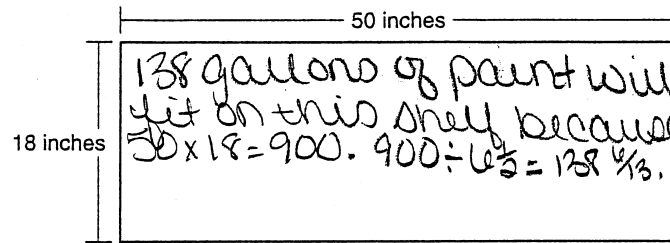
b. How many 1-quart cans of paint will fit on a shelf? Justify your answer.

228 quarts of paint will fit on the shelf b/c 900 ÷ 4 = 225.

c. Juanita put as many 1-gallon cans of paint as possible on a shelf. Then she decided to put 1-quart cans in the remaining space. How many 1-quart cans of paint can fit in the remaining space? Justify your answer using words, symbols, or pictures.

She could fit 34 quarts in the remaining space b/c 138 ⅔ ÷ 4 = 34 ⅔
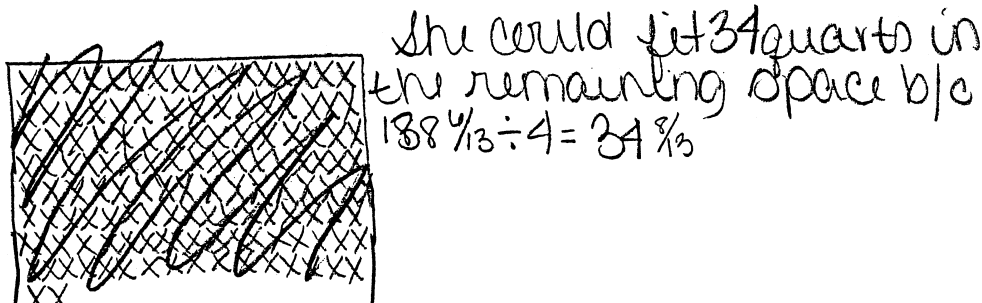
The response is incorrect and does not demonstrate a minimal understanding of the relevant concepts in any part of the question. The answers to all parts are incorrect, and the work shown does not demonstrate an understanding of an appropriate strategy in any part.

LEAP

for the 21st Century

Spring 2004

Louisiana Department of Education
Office of Student and School Performance
Division of Student Standards and Assessments