



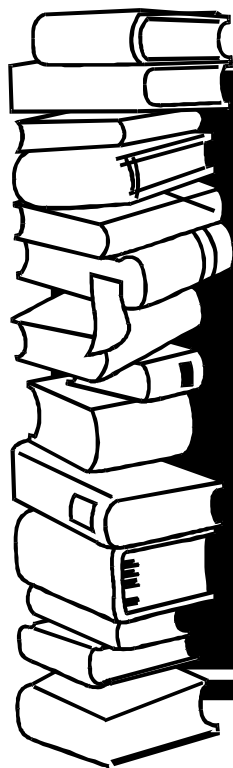
# GEE 21

Graduation Exit Examination  
for the 21<sup>st</sup> Century

## Released Test Items:

Sample Student Work Illustrating GEE 21's  
Achievement Levels

July 2001



# GRADE 10

# Mathematics

reaching for  
results 

LOUISIANA DEPARTMENT OF EDUCATION

Cecil J. Picard, Superintendent



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**Louisiana's Graduation Exit Examination  
for the 21<sup>st</sup> Century (GEE 21)**

**GRADE 10 SAMPLE ITEMS AND STUDENT WORK  
FROM THE 2000–2001 GEE 21**

GEE 21 is an integral part of the Louisiana school and district accountability system passed by the state legislature and signed into law by Governor Mike Foster 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 the school year 2000–2001, students in grade 10 took GEE 21 English Language Arts and Mathematics tests for the first time. 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 meant to promote understanding of the knowledge and skills that students must have and the kinds of work they must produce to be successful on the GEE 21. A list of other documents providing background and further information on the GEE 21 can be found by accessing the Louisiana Department of Education Web site at [www.louisianaschools.net](http://www.louisianaschools.net).

**GEE 21 Reports**

Louisiana's grade 10 students are tested in March of each year. Individual student, school, district, and state test results are reported in June and July. School and district accountability results are reported in September.

For GEE 21, student scores are reported in terms of five achievement levels: *Advanced*, *Proficient*, *Basic*, *Approaching Basic*, and *Unsatisfactory*. The percentages of students scoring at each level are reported for the school, district, and state. The general definitions for the achievement levels are shown on page 2.

The specific definitions of the achievement levels for Mathematics are in Appendix A of this report.

**GEE 21**  
**General Achievement Level Definitions**

<b>Achievement Level</b>	<b>Definition</b>
<b>Advanced</b>	A student at this level has demonstrated superior performance beyond the proficient level of mastery.
<b>Proficient</b>	A student at this level has demonstrated competency over challenging subject matter and is well prepared for the next level of schooling.
<b>Basic</b>	A student at this level has demonstrated only the fundamental knowledge and skills needed for the next level of schooling.
<b>Approaching Basic</b>	A student at this level has only partially demonstrated the fundamental knowledge and skills needed for the next level of schooling.
<b>Unsatisfactory</b>	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 that was completed as part of the GEE 21 assessment. It includes examples of multiple-choice and constructed-response items, which exemplify what students scoring at specified achievement levels should know and be able to do. A discussion of each item highlights the 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 the sample items included in this report represent a small portion of the body of knowledge and skills measured by the GEE 21 tests. Additional items will be released in future years of the GEE 21.

## Mathematics

The grade 10 GEE 21 Mathematics test is composed of 60 multiple-choice and four constructed-response items. A student earns one point for each correct answer to a multiple-choice item and from zero to four points for the answer and work shown for each constructed-response item. The general scoring rubric, or guide, for constructed-response items is shown below.

Score	Description
<b>4</b>	<ul style="list-style-type: none"><li>• The student's response demonstrates in-depth understanding of the relevant content and/or procedures.</li><li>• The student completes all important components of the task accurately and communicates ideas effectively.</li><li>• Where appropriate, the student offers insightful interpretations and/or extensions.</li><li>• Where appropriate, the student uses more sophisticated reasoning and/or efficient procedures.</li></ul>
<b>3</b>	<ul style="list-style-type: none"><li>• The student completes most important aspects of the task accurately and communicates clearly.</li><li>• The response demonstrates an understanding of major concepts and/or processes, although less important ideas or details may be overlooked or misunderstood.</li><li>• The student's logic and reasoning may contain minor flaws.</li></ul>
<b>2</b>	<ul style="list-style-type: none"><li>• The student completes some parts of the task successfully.</li><li>• The response demonstrates gaps in conceptual understanding.</li></ul>
<b>1</b>	<ul style="list-style-type: none"><li>• The student completes only a small portion of the task and/or shows minimal understanding of the concepts and/or processes.</li></ul>
<b>0</b>	<ul style="list-style-type: none"><li>• Student's response is incorrect, irrelevant, too brief to evaluate, or blank.</li></ul>

**Note:** It is important to recognize that the score points for constructed-response items and the GEE 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* achievement level in the assessment has earned a score of 4 on each of the constructed-response items.

It is possible for a tenth-grade student to earn a total of 76 points in the GEE 21 Mathematics assessment. 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 raw score ranges for each achievement level are listed on page 4.

## Spring 2001 Mathematics Test, Grade 10

<b>Achievement Level</b>	<b>Raw Score Range</b>
Advanced	65–76 points
Proficient	54.5–64.5 points
Basic	38–54 points
Approaching Basic	31.5–37.5 points
Unsatisfactory	0–31 points

This document presents one multiple-choice item for each achievement level, except for the *Unsatisfactory* level. Examples of *Unsatisfactory* work are not included; by definition, work at that achievement level exhibits a narrower range of knowledge and skills than work classified as *Approaching Basic*. In addition, we include one constructed-response item with student work. An example of student work for each score point is provided.

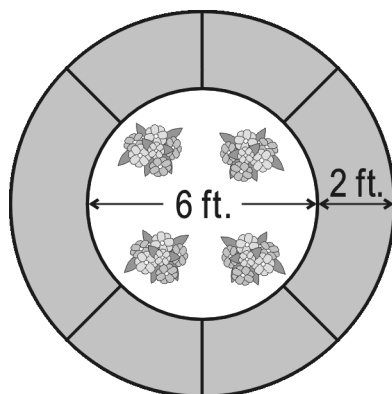
This document presents items that were completed by students as part of the GEE 21 assessment. The information shown for each item includes

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

**Advanced Achievement Level  
Multiple-Choice Item**

This question would most likely be answered correctly by students who score at the *Advanced* achievement level. A student who scores at this level demonstrates superior performance beyond the proficient level of mastery. The content standard for this item is **Measurement**. In solving problems for this content standard, students demonstrate an understanding of concepts, processes, and real-life applications of measurement.

Use the diagram below to answer question XX.



Which is the **best** estimate for the area of the walkway around this circular flower bed?

- A. 40 square feet
- \* B. 50 square feet
- C. 100 square feet
- D. 200 square feet

\* correct answer

This item requires tenth-grade students to understand how to find the area of an object using multiple steps. In order to find the area of the walkway around the circular flower bed, they must first estimate the area of both the flower bed and the walkway together. Once they have found an estimate of the whole area, they can then subtract the area of the flower bed from this to find the area of the walkway. The use of a calculator is allowed for this item.

**Proficient Achievement Level**  
**Multiple-Choice Item**

This question would most likely be answered correctly by students who score at the *Proficient* achievement level and above. A student scoring at this level demonstrates competency over challenging subject matter and is well prepared for the next level of schooling. The content standard for this item is **Algebra**. In solving problems for this content standard, 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.

The following formula can be used to predict the weight of boys between the ages of 1 and 8:

$$w = 5a + 17$$

where  $w$  is the average weight in pounds, and  $a$  is the boy's age in years.

According to this formula, how much weight will a boy gain each year?

- \*A. 5 pounds
- B. 11 pounds
- C. 17 pounds
- D. 22 pounds

\* correct answer

This item requires tenth-grade students to be able to recognize the relationship between operations involving real numbers and operations involving algebraic expressions. The student is told that the letter  $a$  in the algebraic expression is for the boy's age. A student who understands that slope is the rate of change will recognize that in this situation the slope 5 represents the weight gain per year. Another way to answer the question would be to subtract the total weight at age 1 from the total weight at age 2. The difference would be the amount the boy would gain each year. A calculator is not needed for this item.

**Basic Achievement Level**  
**Multiple-Choice Item**

This question would most likely be answered correctly by students at the *Basic* achievement level and above. A student at this level demonstrates only the fundamental knowledge and skills needed for the next level of schooling. The content standard for this item is **Number and Number Relations**. In solving problems for this content standard, students demonstrate an understanding of the real number system and communicate the relationships within that system using a variety of techniques and tools.

Cindy borrowed \$10,000 to purchase a new car. She paid back \$245 per month over a period of four years, which covered the loan amount and the interest. What is the total interest Cindy paid?

- A. \$980
- \* B. \$1,760
- C. \$2,940
- D. \$11,760

\* correct answer

This item requires tenth-grade students to select and use the appropriate operations for the given situation. The student could multiply 48 months by \$245 per month to calculate the total amount that Cindy paid for the car. To find the interest, the student would need to subtract the initial \$10,000 Cindy borrowed. The use of a calculator is allowed for this item.

**Approaching Basic Achievement Level**  
**Multiple-Choice Item**

This question would most likely be answered correctly by students who score at the *Approaching Basic* achievement level and above. A student who scores at this level only partially demonstrates the fundamental knowledge and skills needed for the next level of schooling. The content standard for this item is **Data Analysis, Probability, and Discrete Math**. In solving problems for this content standard, students discover trends, formulate conjectures regarding cause and effect relationships, and demonstrate critical-thinking skills in order to make informed decisions.

Roy compared the price of a tape player at 5 stores. The prices at the different stores were \$80.00, \$95.00, \$60.00, \$90.00, and \$85.00. What was the average (mean) price of the tape players?

- A. \$415.00
- B. \$410.00
- C. \$85.00
- \* D. \$82.00

\* correct answer

This item requires tenth-grade students to know what it means to find the “mean” or “average” for a group of numbers. The student will need to add up the numbers in the question and then divide that answer by however many numbers they add up. This particular item asks the student to find the mean of five numbers; therefore, they add up those five numbers and then divide by five. The use of a calculator is allowed for this item.

**Grade 10 Mathematics – Scoring Rubric  
Constructed-Response Item**

The following pages present a mathematics constructed-response item, a scoring rubric, and examples of student work at each score point. The content standard for this item is **Measurement**.

In solving problems in **Measurement**, students demonstrate an understanding of the concepts, processes, and real-life applications of measurement. The original item is shown below, and the scoring rubric is on page 10.

**Note:** The examples of student work have been reduced in size to fit here. Font size on the GEE 21 assessments is typically 12 point.

A school banner is 6 feet wide by 4 feet high.

- a. If the banner were 5 feet wide, how high would it have to be in order to have the same area as the first banner?
  
- b. Give **three** more examples of rectangular banners that would have areas the same as the first banner but with dimensions different from both the first banner and the banner in part a. Make the width greater than the height in each example.
  
- c. Suppose that the length of a rectangle with an area of 24 square units is unknown. Let  $x$  represent the length. Write an expression for the width in terms of  $x$ . Use this expression to write a formula for the **perimeter**,  $p$ , in terms of the unknown value,  $x$ .

## Scoring Rubric

Score	Description
4	Student earns 5 points.
3	Student earns 4 or 4 1/2 points.
2	Student earns 2 to 3 1/2 points.
1	Student earns 1/2 to 1 1/2 points <b>OR</b> Student shows minimal understanding of area and/or perimeter formulas and/or writing algebraic expressions.
0	Response is incorrect, irrelevant, too brief to evaluate, or blank.

### Points assigned:

#### Part a (1 point)

- 1 point for correct height (4.8', approximately 4'10")  
**OR**
- 1/2 point for correct strategy with computation or unit conversion error

#### Part b (2 points)

- 2 points for three different sets of dimensions, all of which result in area of 24 square feet and which have width > height as specified (width and height need not be clearly labeled, as long as dimensions are in same order for each set)  
**OR**
- 1 point for one or two different sets of dimensions which fulfill criteria (area = 24 sq. ft.;  $w > h$ )


Note: if decimal lengths are used (e.g., 7 by 3.4, allow for rounding, as  $24 \div 7$  rounds to 3.4)

#### Part c (2 points)

- 2 points for correct algebraic expression for width and correct formula for perimeter (width =  $\frac{24}{x}$ ;  $p = \frac{48}{x} + 2x$ ; or algebraic equivalent)  
**OR**
- 1 point for correct width but correct perimeter not given OR for formula showing correct perimeter relationship but using an incorrect expression for width OR for correct expressions based on use of perimeter formula of square (i.e., assumes length and width are the same).

**Score Point 4**  
**Constructed-Response Item**

Below is the work of a tenth-grade student who received 4 points for this response. A score point 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.

A school banner is 6 feet wide by 4 feet high. 

a. If the banner were 5 feet wide, how high would it have to be in order to have the same area as the first banner?

$h = 4.8$

b. Give **three** more examples of rectangular banners that would have areas the same as the first banner but with dimensions different from both the first banner and the banner in part a. Make the width greater than the height in each example.

1)  $h = 3$     2)  $h = 2$     3)  $h = 2.5$   
 $w = 8$          $w = 12$          $w = 9.6$

c. Suppose that the length of a rectangle with an area of 24 square units is unknown. Let  $x$  represent the length. Write an expression for the width in terms of  $x$ . Use this expression to write a formula for the **perimeter**,  $p$ , in terms of the unknown value,  $x$ .

$\frac{24}{x} = w$   
 $p = 2x + 2\left(\frac{24}{x}\right)$

This response demonstrates the math skills necessary to answer all parts of the question correctly. The student provides a correct answer to Part a, gives three correct sets of dimensions in Part b, and gives a complete and correct answer to Part c. The response demonstrates an in-depth understanding of area and perimeter formulas, as well as writing algebraic expressions.

**Score Point 3**  
**Constructed-Response Item**

Below is the work of a tenth-grade student who received 3 points for this response. A score point 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.

A school banner is 6 feet wide by 4 feet high. 24

a. If the banner were 5 feet wide, how high would it have to be in order to have the same area as the first banner?

$24 = \frac{5}{5} \times h$        $A = b \times h$

$4.8 = h$

b. Give **three** more examples of rectangular banners that would have areas the same as the first banner but with dimensions different from both the first banner and the banner in part a. Make the width greater than the height in each example.

① 8 feet wide by 3 feet high  
 ② 10 feet wide by 2.4 feet high  
 ③ 12 feet wide by 2 feet high

c. Suppose that the length of a rectangle with an area of 24 square units is unknown. Let  $x$  represent the length. Write an expression for the width in terms of  $x$ . Use this expression to write a formula for the **perimeter**,  $p$ , in terms of the unknown value,  $x$ .

$A = l \times w$        $w = \frac{24}{x} \cdot x$   
 $24 = x \cdot$        $w = \frac{24}{x}$

$p = 2x + \frac{24}{x}$

This response demonstrates that the student has the math skills necessary to answer most of the question correctly. The student provides a correct answer to Part a, and gives three correct sets of dimensions in Part b. The response for Part c provides a correct expression for the width of the rectangle in terms of  $x$ , but the formula for the perimeter is incorrect. The response demonstrates an understanding of the major concepts of the question, but contains an error in one part.

**Score Point 2**  
**Constructed-Response Item**

Below is the work of a tenth-grade student who received 2 points for this response. A score point 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.

A school banner is 6 feet wide by 4 feet high.

- a. If the banner were 5 feet wide, how high would it have to be in order to have the same area as the first banner?

4 ft 8 in. high

- b. Give **three** more examples of rectangular banners that would have areas the same as the first banner but with dimensions different from both the first banner and the banner in part a. Make the width greater than the height in each example.

7 ft wide      3 feet high  
12 ft wide      2 feet high  
10 ft wide      2 ft 4 in high

- c. Suppose that the length of a rectangle with an area of 24 square units is unknown. Let  $x$  represent the length. Write an expression for the width in terms of  $x$ . Use this expression to write a formula for the **perimeter**,  $p$ , in terms of the unknown value,  $x$ .



$$w = \frac{24}{x}$$

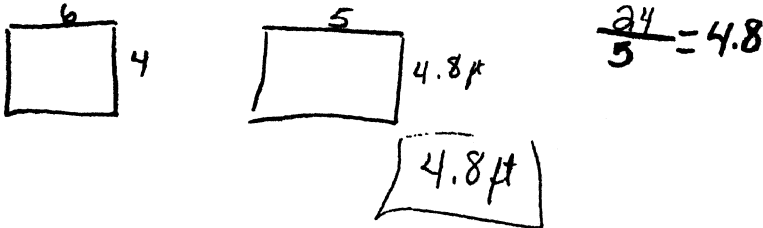
This response demonstrates the math skills required to complete some parts of the question correctly. The student provides an incorrect answer to Part a and only a partially correct answer to Part b. In Part c, the student provides a correct expression for the width of the rectangle in terms of  $x$  but does not write a formula for the perimeter. The response demonstrates gaps in the student's conceptual understanding of some of the components of the question.

**Score Point 1**  
**Constructed-Response Item**

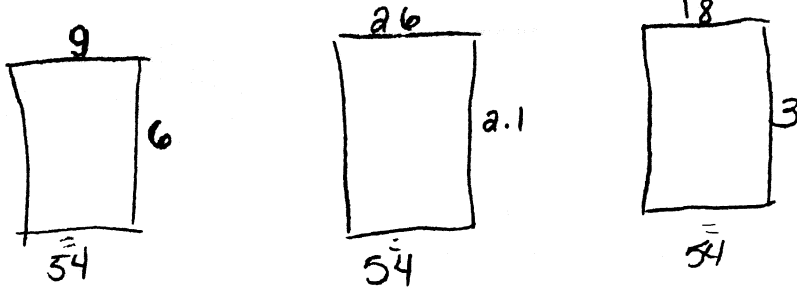
Below is the work of a tenth-grade student who received 1 point for this response. A score point of 1 is given when a student completes only one part of the task, or when the student's response demonstrates minimal understanding of the concepts and/or processes.

A school banner is 6 feet wide by 4 feet high.

a. If the banner were 5 feet wide, how high would it have to be in order to have the same area as the first banner?



b. Give **three** more examples of rectangular banners that would have areas the same as the first banner but with dimensions different from both the first banner and the banner in part a. Make the width greater than the height in each example.



c. Suppose that the length of a rectangle with an area of 24 square units is unknown. Let  $x$  represent the length. Write an expression for the width in terms of  $x$ . Use this expression to write a formula for the **perimeter**,  $p$ , in terms of the unknown value,  $x$ .

$$x \cdot w = 24$$

$$x \cdot 2 = p$$

This response demonstrates the math skills required to complete only one part of the question correctly. The student provides a correct answer to Part a, but the answers to the other parts are incorrect.

**Score Point 0**  
**Constructed-Response Item**

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

A school banner is 6 feet wide by 4 feet high.

a. If the banner were 5 feet wide, how high would it have to be in order to have the same area as the first banner?

5 feet wide + 3 feet high

b. Give **three** more examples of rectangular banners that would have areas the same as the first banner but with dimensions different from both the first banner and the banner in part a. Make the width greater than the height in each example.

10 feet wide + 6 feet high

12 feet wide + 10 feet high

24 feet wide + 19 feet high

c. Suppose that the length of a rectangle with an area of 24 square units is unknown. Let  $x$  represent the length. Write an expression for the width in terms of  $x$ . Use this expression to write a formula for the **perimeter**,  $p$ , in terms of the unknown value,  $x$ .

$$\frac{x+x}{p}$$

This response demonstrates no understanding of the math skills required to solve any part of the question correctly. The student gives incorrect answers to all parts of the question. The response does not demonstrate an understanding of area and/or perimeter formulas.



**ACHIEVEMENT LEVEL  
DEFINITIONS FOR  
MATHEMATICS – GRADE 10**

**LOUISIANA'S GRADUATION EXIT EXAMINATION FOR THE 21<sup>ST</sup> CENTURY (GEE 21)  
MATHEMATICS ACHIEVEMENT LEVELS AND DEFINITIONS  
GRADE 10**

<b>ACHIEVEMENT LEVEL</b>	<b>DEFINITION</b>
<b>ADVANCED</b>	<p>Tenth-grade students performing at the Advanced level consistently demonstrate the integration of procedural and conceptual knowledge and the synthesis of ideas in the six Louisiana mathematics content strands.<sup>1</sup></p> <p>Tenth-grade students performing at this level</p> <ul style="list-style-type: none"> <li>• <i>understand the function concept and are able to communicate and apply the numeric, algebraic, and graphical properties of functions;</i></li> <li>• <i>apply their knowledge of algebra, geometry, and statistics to solve problems in more advanced areas of continuous and discrete mathematics;</i></li> <li>• <i>formulate generalizations and create models through probing examples and counter examples; and</i></li> <li>• <i>communicate their mathematical reasoning through the clear, concise, and correct use of mathematical symbolism and logical thinking.</i></li> </ul>
<b>PROFICIENT</b>	<p>Tenth-grade students performing at the Proficient level consistently apply mathematical concepts and procedures to the solutions of complex problems in the six Louisiana mathematics content strands.</p> <p>Tenth-grade students performing at this level</p> <ul style="list-style-type: none"> <li>• <i>demonstrate an understanding of algebraic, statistical, and geometric and spatial reasoning;</i></li> <li>• <i>simplify algebraic expressions; justify geometric relationships; and judge and defend the reasonableness of answers as applied to real-world situations;</i></li> <li>• <i>analyze and interpret data in various forms;</i></li> <li>• <i>understand and use elements of the linear function concept in symbolic, graphical, and tabular form; and</i></li> <li>• <i>make conjectures, defend ideas, and give supporting examples.</i></li> </ul>
<b>BASIC</b>	<p>Tenth-grade students performing at the Basic level demonstrate procedural and conceptual knowledge in solving problems in the six Louisiana mathematics content strands.</p> <p>Tenth-grade students performing at this level</p> <ul style="list-style-type: none"> <li>• <i>use estimation to verify solutions and determine the reasonableness of results as applied to routine real-world problems;</i></li> <li>• <i>use algebraic and geometric reasoning strategies to solve problems;</i></li> <li>• <i>recognize relationships presented in verbal, algebraic, tabular, and graphical forms; and demonstrate knowledge of geometric relationships and corresponding measurement skills;</i></li> <li>• <i>apply statistical reasoning in the organization and display of data and in reading tables and graphs;</i></li> <li>• <i>generalize from patterns and examples in the areas of algebra, geometry, and statistics;</i></li> <li>• <i>use correct mathematical language and symbols to communicate mathematical relationships and reasoning processes; and</i></li> <li>• <i>use calculators appropriately to solve problems.</i></li> </ul>

<sup>1</sup> The six Louisiana mathematics content strands are: number and number relations; algebra; measurement; geometry; data analysis, probability, and discrete math; and patterns, relations, and functions.

<p><b>APPROACHING BASIC</b></p>	<p>Tenth-grade students performing at the Approaching Basic level partially demonstrate fundamental knowledge and skills in solving problems in the six Louisiana mathematics content strands.</p> <p>Tenth-grade students performing at this level</p> <ul style="list-style-type: none"> <li>• <i>use estimation and measurement to verify solutions and determine the reasonableness of results as applied to routine real-world problems;</i></li> <li>• <i>show limited use of fundamental algebraic, geometric, and statistical reasoning in problem solving;</i></li> <li>• <i>interpret data presented in various forms;</i></li> <li>• <i>show limited skills in communicating mathematically; and</i></li> <li>• <i>are inconsistent in the application of conceptual knowledge.</i></li> </ul>
<p><b>UNSATISFACTORY</b></p>	<p><u>Louisiana Policy Definition</u></p> <p><b>A student at this level has not demonstrated the fundamental knowledge and skills needed for the next level of schooling.</b></p>