



**Arkansas Comprehensive Testing, Assessment, and Accountability Program**

# **TEACHER HANDBOOK**

## **GEOMETRY**

## **END-OF-COURSE EXAMINATIONS**

## **2011–2012 ADMINISTRATIONS**

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**Arkansas Department of Education**



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## INTRODUCTION

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The **Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP)** includes Mid-Year and Spring Geometry End-of-Course Examinations for students completing Geometry or the equivalent for high school graduation credit. The examinations consist of multiple-choice and open-response questions that directly assess student knowledge. The *Arkansas Geometry Mathematics Curriculum Framework* is the basis for the development of the Geometry End-of-Course Examinations.

In January or April 2012, all students who had completed or were completing the required course work for Geometry for high school graduation credit participated in the Mid-Year or Spring Geometry End-of-Course Examination. Results of the Geometry End-of-Course Examinations will be provided to all students, schools, and districts to be used as the basis for instructional change.

This handbook provides information regarding the scoring of student responses to the Geometry open-response items. It describes the scoring procedures and the scoring criteria (rubrics) used to assess student responses. Copies of actual student responses are provided, along with scores given to those responses, to illustrate how the scoring criteria were applied to Geometry open-response items.

Additional information about the Geometry End-of-Course Examination is available through the Arkansas Department of Education. Questions can be addressed to the Office of Student Assessment at 501-682-4558.

## SCORING STUDENT RESPONSES TO OPEN-RESPONSE ITEMS

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The multiple-choice and open-response test items for the Geometry End-of-Course Examination are developed with the assistance and approval of the Geometry Content Advisory Committee. This committee is comprised of active Arkansas educators with expertise in Mathematics education. The Geometry Content Advisory Committee develops and reviews multiple-choice and open-response items to ensure that they reflect the *Arkansas Geometry Mathematics Curriculum Framework*.

While multiple-choice items are scored by machine to determine if the student chose the correct answer from four options, open-response items must be scored by trained “readers” using a pre-established set of scoring criteria.

### READER TRAINING

Readers are trained to score only one content area. Qualified readers for the Arkansas scoring will be those with a four-year college degree in English, language arts, education, mathematics, science, or related fields.

Before readers are allowed to begin assigning scores to any student responses, they go through intensive training. The first step in that training is for the readers to read the Geometry open-response items as they appear in the test booklet and to respond—just as the student test takers are required to do. This step gives the readers some insight into how the students might have responded. The next step is the readers’ introduction to the scoring rubric. All of the specific requirements of the rubric are explained by the Scoring Director who has been specifically trained to lead the scoring group. Then responses (anchor papers) that illustrate the score points of the rubric are presented to the readers and discussed. The goal of this discussion is for the readers to understand why a particular response (or type of response) receives a particular score. After discussion of the rubric and anchor papers, readers practice scoring sets of responses that have been pre-scored and selected for use as training papers. Detailed discussion of the responses and the scores they receive follows.

After three or four of these practice sets, readers are given “qualifying rounds.” These are additional sets of pre-scored papers, and, in order to qualify, each reader must score in exact agreement on at least 80% of the responses and have no more than 5% non-adjacent agreement on the responses. Readers who do not score within the required rate of agreement are not allowed to score the Geometry End-of-Course Examination responses.

Once scoring of the actual student responses begins, readers are monitored constantly throughout the project to ensure that they are scoring according to the criteria. Daily and cumulative statistics are posted and analyzed, and Scoring Directors or Team Leaders reread selected responses scored by the readers. These procedures promote reliable and consistent scoring. Any reader who does not maintain an acceptable level of agreement is dismissed from the project.

### SCORING PROCEDURES

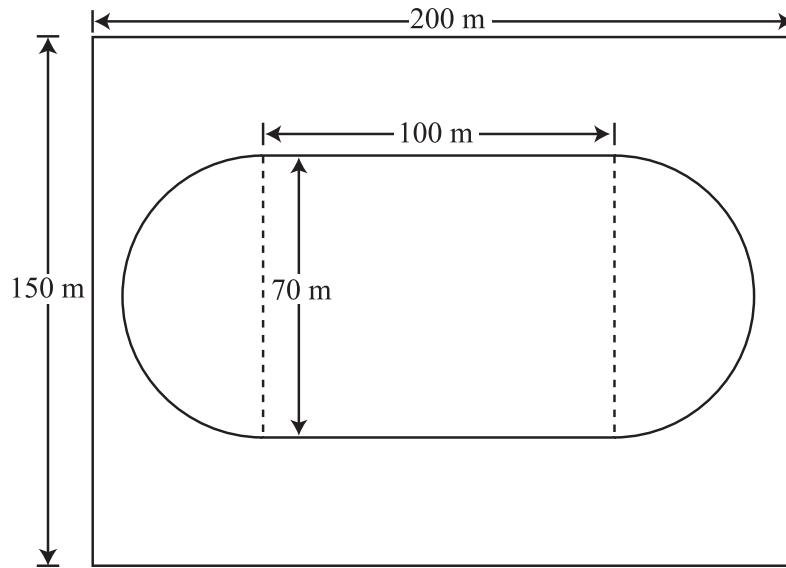
All student responses to the Geometry End-of-Course Examination open-response test items are scored independently by two readers. Those two scores are compared, and responses that receive scores that are non-adjacent (a “1” and a “3,” for example) are scored a third time by a Team Leader or the Scoring Director for resolution.

On the following pages, open-response items are presented as they appeared in the *2012 Mid-Year and Spring Geometry End-of-Course Examinations*. The specific scoring rubric for each item and annotated responses for each score point of the rubric follows. The goal is for classroom teachers and their students to understand how responses are scored. It is hoped that this understanding will help students see what kind of performance is expected of them on the Geometry End-of-Course Examination.

# **GEOMETRY RESPONSES**

## ITEM A—2012 GEOMETRY

- A. A rectangular field measuring 150 meters by 200 meters contains a running track. The area enclosed by the running track is in the shape of a rectangle with semicircles on each end, as illustrated below.



1. Determine the area enclosed by the running track. Round your answer to the nearest square meter. Show your work or explain how you found your answer.
2. A bag of supplies is dropped from a helicopter and lands on the field. Assuming the bag is equally likely to land anywhere in the field, what is the probability that the bag lands **outside** the area enclosed by the running track? Round your answer to the nearest whole percent. Show your work or explain how you found your answer.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.



## ITEM A—2012 GEOMETRY

### Item A Scoring Rubric—2012 Geometry

Score	Description
4	The student earns 4 points. The response contains no incorrect work. Note: Label of “sq. m” is not required in Part 1 Label of “%” is not required in Part 2
3	The student earns 3 – 3½ points.
2	The student earns 2 – 2½ points.
1	The student earns ½ – 1½ points, or some minimal understanding is shown.
0	The student earns 0 points. No understanding is shown.
B	Blank — No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

## SOLUTION AND SCORING

**but use the exact value in the calculator to find their answer.**

Part	Points
1	<p><b>2 points possible:</b></p> <p>2 points:    Correct area:        <b>10,847</b>    (<i>rounded to the nearest sq. m using 3.14</i>)  or  <b>10,848</b>    (<i>rounded to the nearest sq. m using the <math>\pi</math> key</i>)  Correct procedure is shown and/or explained  Give credit for the following or equivalent:</p> <p>Ex:    <math>70 \times 100 + \pi \left( \frac{70}{2} \right)^2 = 7000 + 3848.451001... = 10,848.451... \approx 10,848</math></p> <p>Ex:    <math>7000 + 3.14(35^2) = 7000 + 3846.5 = 10,846.5 \approx 10,847</math></p> <p><b>OR</b></p> <p>1½ point:    Area is correctly rounded to a position other than the nearest square meter,  is truncated to any position, or work contains evidence of early rounding(s)  Correct procedure is shown and/or explained</p> <p>Ex:    <math>7000 + 35 \pi = 10,848.45</math>        (<i>rounded to the nearest 100<sup>th</sup></i>)</p> <p>Ex:    <math>(100)(70) + \pi(35^2) = 7000 + 3848.45</math>  <math>= 7000 + 3848.5 = 10,848.5 = 10,849</math>    (<i>evidence of early rounding</i>)</p> <p><b>OR</b></p> <p>1 point:        •    Correct area:    <b>10,847</b>    or    <b>10848</b>    (<i>rounded to the nearest sq. m</i>)  Procedure is incomplete or missing  or  •    Area is incorrect due to a calculation, copy, or rounding error,  or is incorrect due to early rounding (without evidence in work)  May or may not be rounded to the nearest square meter  Correct procedure is shown and/or explained</p> <p>Ex:    <math>(100)(70) + \pi(35^2) = 7000 + 3848.45 = 10,848.45 = 10,849</math>  (<i>rounding error - no evidence of early rounding in work</i>)</p>

# ITEM A SOLUTION AND SCORING—2012 GEOMETRY

Part	Points
2	<p><b>2 points possible:</b></p> <p>2 points:    Correct probability: <b>64</b>    (<i>rounded to the nearest whole %</i>)  (<i>or correct probability based on an incorrect area in Part 1</i>)  Correct procedure is shown and/or explained  Give credit for the following or equivalent:</p> <p style="padding-left: 40px;">Ex:    <math>\frac{(200 \cdot 150) - (10,848)}{(200 \cdot 150)} = \frac{30,000 - 10,848}{30,000} = \frac{19,152}{30,000} = .6384 = 64\%</math>  (<i>Note: using value kept in calculator: 638384...</i>)</p> <p style="padding-left: 40px;">Ex:    <math>\frac{30,000 - 10,847}{30,000} = 64\%</math>    (<i>shows subtraction and division</i>)</p> <p style="padding-left: 40px;">Ex:    <math>150 \times 200 = 30,000</math>  <math>\frac{19,152}{30,000} = 64\%</math>    (<i>shows calculation of 30,000 and division</i>)</p> <p style="padding-left: 40px;">Ex:    <math>P(\text{inside running track}) = \frac{10,848}{30000} \approx 0.3616 \approx 36\%</math>  <math>P(\text{outside running track}) = 100\% - 36\% = 64\%</math></p> <p><b>OR</b></p> <p>1½ point:    Probability is correctly rounded to a position other than the nearest whole %  or is truncated to any position  (<i>Value using <math>\pi</math> key: 3.84% or 63.8384...% using value kept in calculator</i>  <i>Value using 3.14: 3.843%</i>)  Correct procedure is shown and/or explained</p> <p><b>OR</b></p> <p>1 point:    •    Correct probability: <b>64</b>    (<i>rounded to the nearest whole %</i>)  (<i>or correct probability based on an incorrect area in Part 1</i>)  Procedure is incomplete or missing  or  •    Probability is incorrect due to a calculation, copy, or rounding error  or is not given in percent form or is missing  May or may not be rounded to the nearest whole %  Correct procedure is shown and/or explained</p>

# ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 4

## Part 1

		Points
Correct area:	10848 m <sup>2</sup>	2
Correct procedure:	$100 \times 70 = 7000$ ; $\pi 35^2 = 3848.4$ ; $7000 + 3848.4 = 10848.4$	

## Part 2

		Points
Correct probability:	64%	2
Correct procedure:	$200 \times 150 = 30,000 - 10,848 = 19,152$ ; $\frac{19,152}{30,000} = .6384$	

Total Points

4

①  $100 \times 70$  area of rectangle  
 $7,000 \text{ m}^2$

$\pi 35^2$  area of circle  
 $= 3848.4 \text{ m}^2$  (2 semi-circles)

$7000 + 3848.4$   
 $10848.4 \text{ m}^2$   
 $\approx 10848 \text{ m}^2$  area enclosed by track

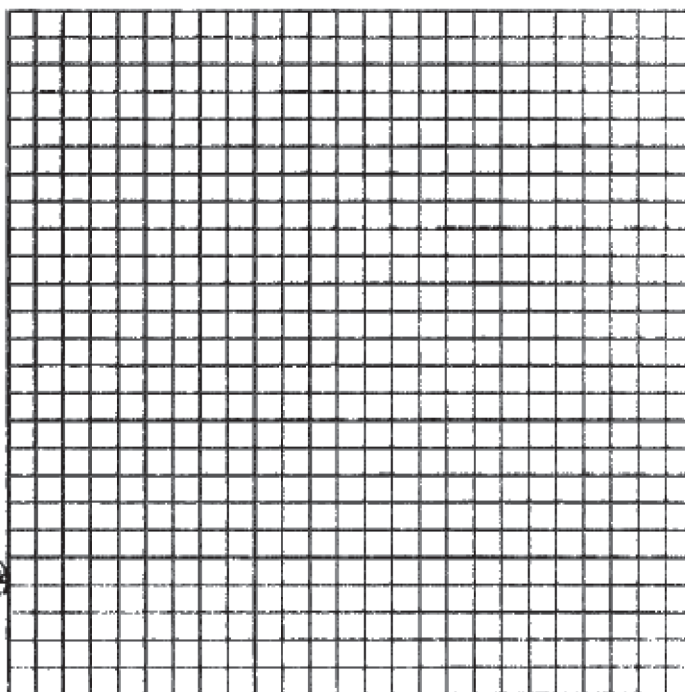
②  $200 \times 150$   
 $30,000 \text{ m}^2$  (area of all)

$- 10,848 \text{ m}^2$  (area of track enclosed)

$19,152 \text{ m}^2$  (area of field)

$\frac{19,152 \text{ field}}{30,000 \text{ all}}$

$= .6384$   
 $\approx 64\%$



# ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 3

<u>Part 1</u>		Points
Rounded area:	10846.5 (using 3.14, rounded to the nearest 10 <sup>th</sup> )	1½
Correct procedure:	$70 \cdot 100 = 7000$ ; $35^2 \cdot \pi = 3846.5$ ; $7000 + 3846.5 = 10846.5$	
<u>Part 2</u>		Points
Truncated probability:	63%	1½
Correct procedure:	$30,000 - 10846.5 = 19153.5$ ; $\frac{100}{30,000} = \frac{x}{19153.5}$ ; $\frac{30,000x}{30,000} = \frac{1915350}{30000}$	
<b>Total Points</b>		<b>3</b>

1.

70 m. 100m = 7000m  
 $35^2 \cdot \pi = 3846.5$

7000  
 $+ 3846.5$   
 10846.5 m  
 of area inside

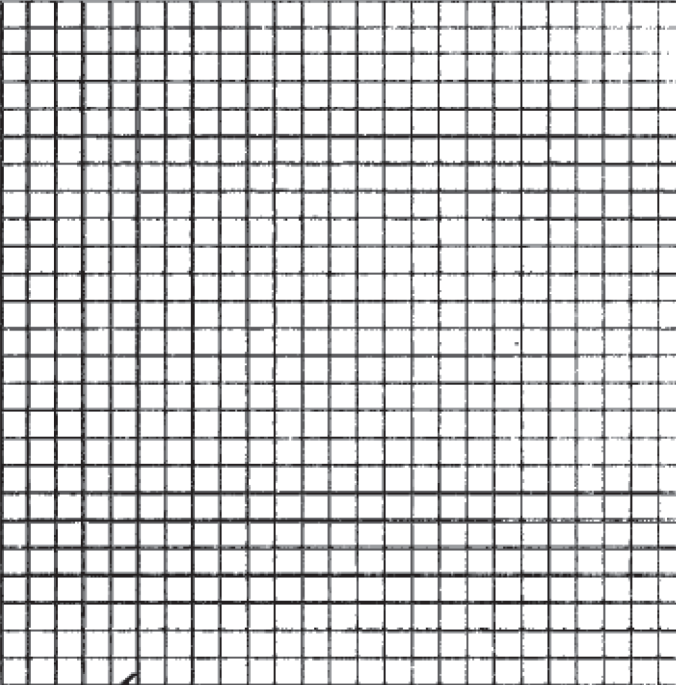
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2.  $30,000 - 10846.5 = 19153.5$  m  
 Area of hole rectangle

$\frac{100\%}{30,000} = \frac{x}{19153.5}$

$\frac{30,000x}{30,000} = \frac{1915350}{30,000}$

$x = 63\%$   
 it will  
 land outside  
 of the beach



# ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 2

## Part 1

		Points
Incorrect area:	7000	0
Incorrect procedure:	$\pi 70^2 = 15394$ ; $70 \cdot 100 = 7000$	

## Part 2

		Points
Correct probability based on Part 1:	77%	2
Correct procedure:	$200 \times 150 = 30000$ ; $\frac{7000}{30000} = 23\%$ ; $100 - 23 = 77$	
Total Points		2

①  $A = lw$   
 $100 \times 70 = 7000 \text{ m}^2$

Running Track is  
 $7000 \text{ m}^2$

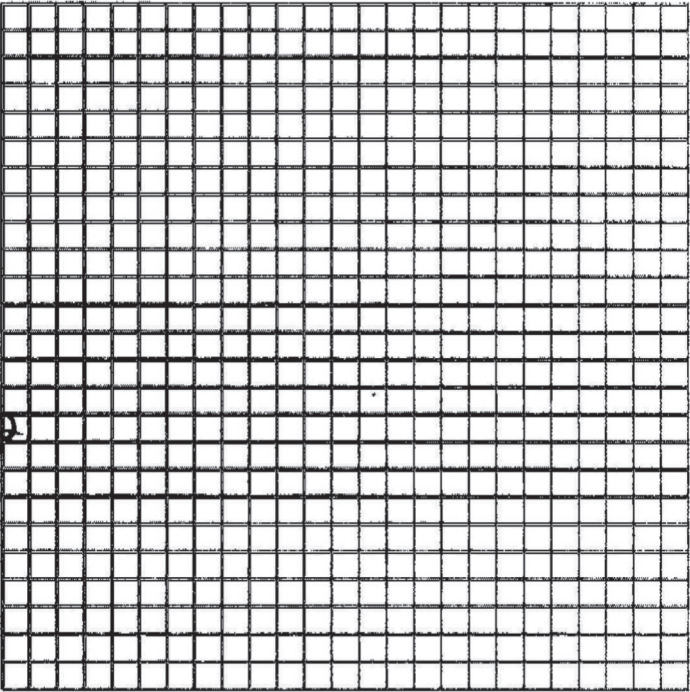
②  $A = lw$   
 $200 \times 150 = 30000 \text{ m}^2$

The total field is  
 $30,000 \text{ m}^2$

$30,000 - 7000 = 23,000 \text{ m}^2$

$23,000 \text{ m}^2$  is left from the running track

$\frac{7,000}{30,000} = 23 \frac{23}{77} \%$   $\frac{100}{23} \left| \begin{array}{l} 77\% \text{ likely} \\ \text{to land outside} \end{array} \right.$



# ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 1

**Part 1**

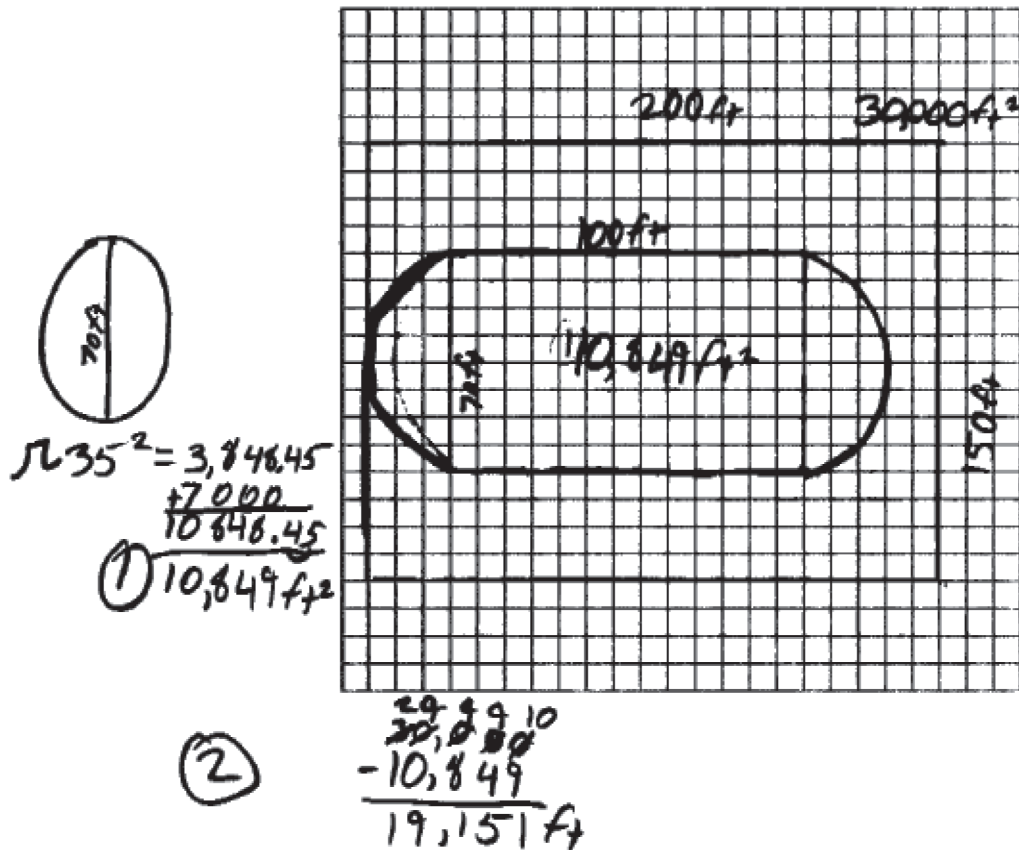
		Points
Incorrect area:	10849 (due to rounding error)	1
Correct procedure:	$\pi 35^2 = 3848.45 + 7000 = 10848.45$	

**Part 2**

		Points
Incorrect probability:	19,151 ft	0
Incorrect procedure:	$30,000 - 10,849 = 19,151$	

Total Points

1



# ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 0

## Part 1

		Points
Incorrect area:	7050	0
Incorrect procedure:	$70 \times 100 = 7000$ ; $7000 + 50 = 7050$	

## Part 2

		Points
Incorrect probability:	42%	0
Incorrect procedure:	$200 \times 150 = 30000$ ; $30000 \div 7050 = 42\%$	

Total Points

0

1)

$$\begin{array}{r} 100 \text{ m} \\ \times 70 \text{ m} \\ \hline 7000 \text{ m.} \\ 7000 \\ + 50 \\ \hline \end{array}$$

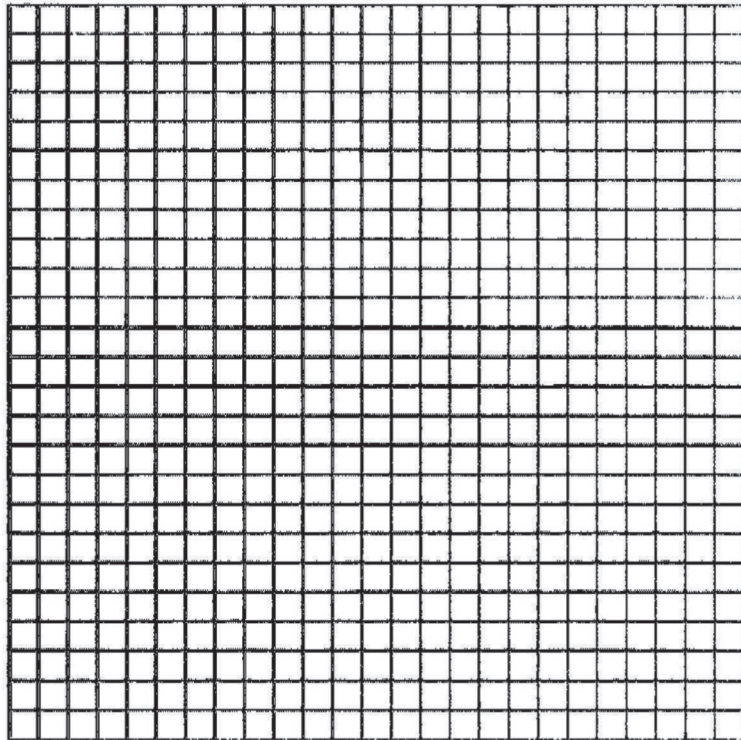
$A = 7050 \text{ m}$

2)

$$\begin{array}{r} 200 \text{ m} \\ \times 150 \\ \hline 30000 \end{array}$$

$$30000 \div 7050$$

$(42\%)$  that the bag will land outside of the track.





## ITEM B—2012 GEOMETRY

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**B.** In  $\triangle ABC$ , A is at  $(-4, 1)$ , B is at  $(2, 4)$ , and C is at  $(-1, 1)$ .

1. In your answer document, graph  $\triangle ABC$ . Make sure you label the vertices.
2. Translate  $\triangle ABC$  from Part 1 six units right and 1 unit up and label the vertices DEF, respectively.
3. Reflect  $\triangle DEF$  in Part 2 over the  $x$ -axis and label the vertices RST, respectively.
4. Rotate  $\triangle RST$  in Part 3 clockwise 90 degrees about the origin and label the vertices MJK, respectively.

BE SURE TO LABEL YOUR RESPONSES 1, 2, 3, AND 4.

## ITEM B—2012 GEOMETRY

### Item B Scoring Rubric—2012 Geometry

Score	Description
4	The student earns 4 points. The response contains no incorrect work.
3	The student earns 3 – 3½ points.
2	The student earns 2 – 2½ points.
1	The student earns ½ – 1½ points, or some minimal understanding is shown. Ex: Unconnected correct points and labels for two to four triangles
0	The student earns 0 points. No understanding is shown.
B	Blank — No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

#### Notes:

In all parts, the expected  $x$ - and  $y$ -coordinates are not required but are as follows:

**Part 1:  $\triangle ABC$  :** A (–4, 1) B (2, 4) C (–1, 1)

**Part 2:  $\triangle DEF$  :** D (2, 2) E (8, 5) F (5, 2)

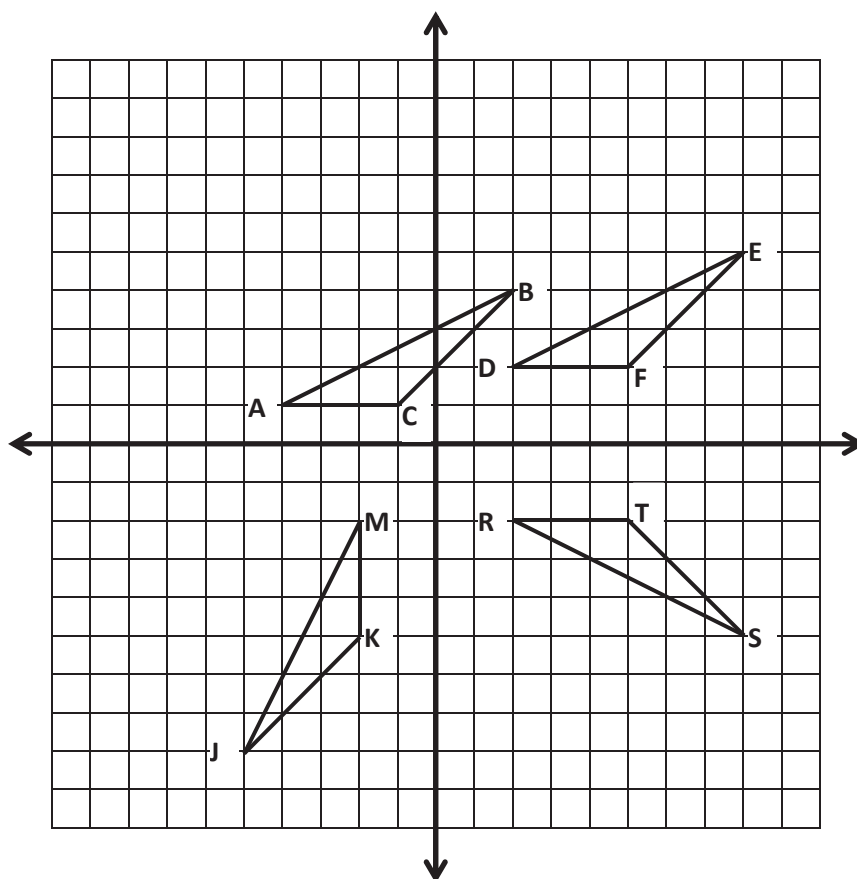
**Part 3:  $\triangle RST$  :** R (2, –2) S (8, –5) T (5, –2)

**Part 4:  $\triangle MJK$  :** M (–2, –2) J (–5, –8) K (–2, –5)

## ITEM B SOLUTION AND SCORING—2012 GEOMETRY

### SOLUTION AND SCORING

- Notes:**
- Intervals on the  $x$  and  $y$  axes do not have to be numbered but must be consistent to receive credit in Part 1. Subsequent credit may be awarded if coordinates are correctly plotted and connected and intervals are consistent based on given triangles.
  - Labeling of the  $x$  and  $y$  axes is not required at any level.
  - To receive full credit in any part, vertices must be correctly plotted and labeled with the corresponding letter, as shown in solution below.  
*Coordinates are not required.*



## ITEM B SOLUTION AND SCORING—2012 GEOMETRY

4 points possible:

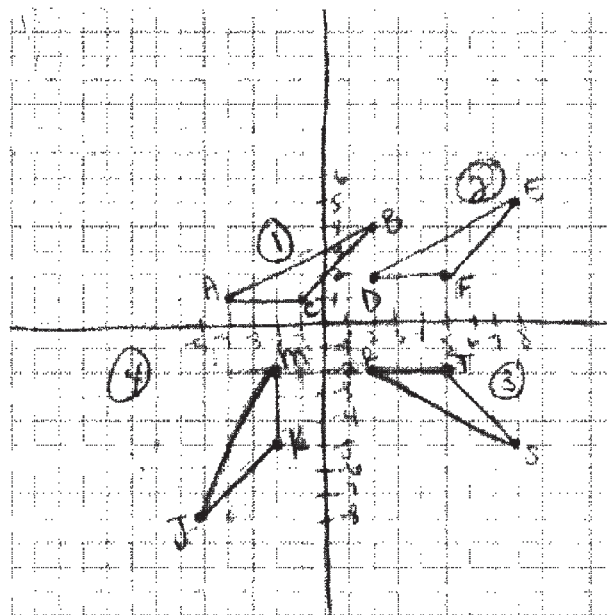
Part	Points
1	<p><b>1 point possible:</b></p> <p>1 point:      Correct and complete graph:</p> <ul style="list-style-type: none"> <li>• Triangle ABC is correctly plotted</li> <li>• Corresponding vertices are labeled A, B and C</li> </ul> <p style="text-align: center;">or</p> <p style="text-align: center;">Corresponding vertices are labeled <math>(-4, 1)</math>, <math>(2, 4)</math>, and <math>(-1, 1)</math></p> <p><b>OR</b></p> <p>½ point:      Triangle ABC is correctly plotted Labels may be incomplete or missing but not incorrect (If labels are missing, triangle must be identified as Part 1)</p>
2	<p><b>1 point possible:</b></p> <p>1 point:      Correct and complete translation:</p> <ul style="list-style-type: none"> <li>• Triangle DEF is correctly plotted <i>(or correct plotting of <math>\triangle DEF</math> based on an incorrect <math>\triangle</math> in Part 1)</i></li> <li>• Corresponding vertices are labeled D, E and F</li> </ul> <p><b>OR</b></p> <p>½ point:      Triangle DEF is correctly plotted <i>(or correct plotting of <math>\triangle DEF</math> based on an incorrect <math>\triangle</math> in Part 1)</i> Labels may be incomplete or missing but not incorrect (If labels are missing, triangle must be identified as Part 2)</p>
3	<p><b>1 point possible:</b></p> <p>1 point:      Correct and complete reflection:</p> <ul style="list-style-type: none"> <li>• Triangle RST is correctly plotted <i>(or correct plotting of <math>\triangle RST</math> based on the <math>\triangle</math> in Part 2)</i></li> <li>• Corresponding vertices are labeled R, S and T</li> </ul> <p style="text-align: center;">Or</p> <p>½ point:      Triangle RST is correctly plotted <i>(or correct plotting of <math>\triangle RST</math> based on the <math>\triangle</math> in Part 2)</i> Labels may be incomplete or missing but not incorrect (If labels are missing, triangle must be identified as Part 3)</p>
4	<p><b>1 point possible:</b></p> <p>1 point:      Correct and complete rotation:</p> <ul style="list-style-type: none"> <li>• Triangle MJK is correctly plotted <i>(or correct plotting of <math>\triangle MJK</math> based on the <math>\triangle</math> in Part 3)</i></li> <li>• Corresponding vertices are labeled M, J and K</li> </ul> <p style="text-align: center;">Or</p> <p>½ point:      Triangle MJK is correctly plotted <i>(or correct plotting of <math>\triangle MJK</math> based on the <math>\triangle</math> in Part 3)</i> Labels may be incomplete or missing but not incorrect (If labels are missing, triangle must be identified as Part 4)</p>

# ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

**SCORE POINT: 4**

<u>Part 1</u>		Points
Correct & complete graph:	$\triangle ABC$ is correctly plotted & labeled	1
<u>Part 2</u>		Points
Correct & complete translation:	$\triangle DEF$ is correctly plotted & labeled	1
<u>Part 3</u>		Points
Correct & complete reflection:	$\triangle RST$ is correctly plotted & labeled	1
<u>Part 4</u>		Points
Correct & complete rotation:	$\triangle MJK$ is correctly plotted & labeled	1
<b>Total Points</b>		<b>4</b>

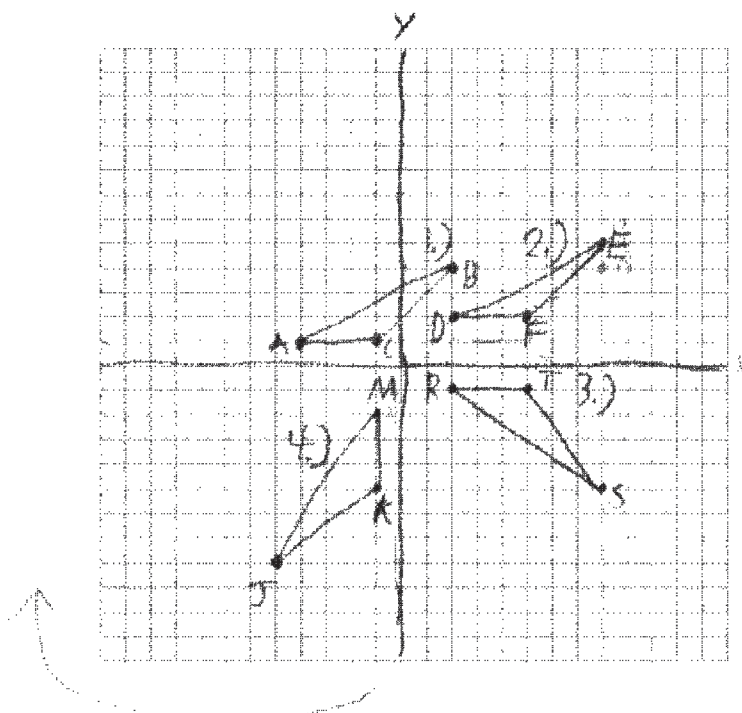
$(x+6, y+1)$   
 2) A  $\rightarrow$  D  
 $(-4, 1) \rightarrow (2, 2)$   
 B  $\rightarrow$  E  
 $(2, 4) \rightarrow (8, 5)$   
 C  $\rightarrow$  F  
 $(-1, 1) \rightarrow (5, 2)$   
 3) D  $\rightarrow$  R  $(x, y)$   
 $(2, 2) \rightarrow (2, -2)$   
 E  $\rightarrow$  S  
 $(8, 5) \rightarrow (8, -5)$   
 F  $\rightarrow$  T  
 $(5, 2) \rightarrow (5, -2)$   
 4) R  $\rightarrow$  M  
 $(2, -2) \rightarrow (-2, -2)$   
 S  $\rightarrow$  J  
 $(8, -5) \rightarrow (-5, -8)$   
 T  $\rightarrow$  K  
 $(5, -2) \rightarrow (-2, -5)$



# ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

## SCORE POINT: 3

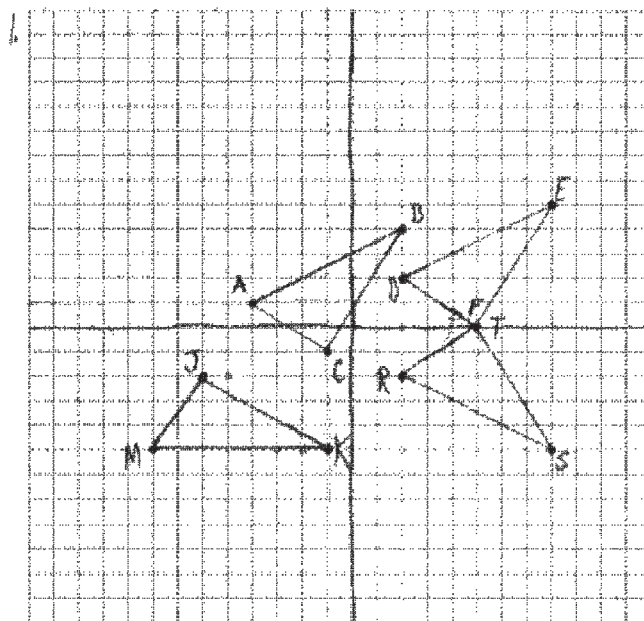
<u>Part 1</u>		Points
Correct & complete graph:	$\triangle ABC$ is correctly plotted & labeled	1
<u>Part 2</u>		Points
Correct & complete translation:	$\triangle DEF$ is correctly plotted & labeled	1
<u>Part 3</u>		Points
Incorrect reflection:	$\triangle RST$ is incorrectly plotted	0
<u>Part 4</u>		Points
Correct & complete rotation of Part 3 triangle:	$\triangle MJK$ is correctly plotted & labeled	1
Total Points		3



# ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 2

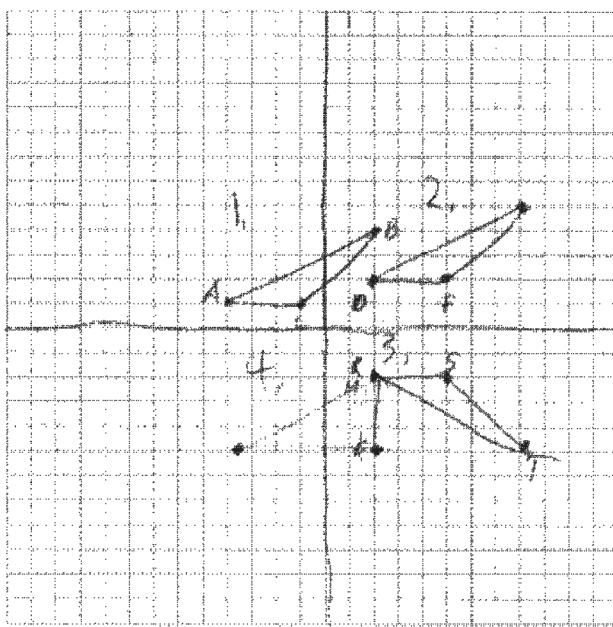
<u>Part 1</u>		Points
Incorrect graph:	C is incorrectly plotted at $(-1, -1)$	0
<u>Part 2</u>		Points
Correct & complete translation of Part 1 triangle:	$\triangle DEF$ is correctly plotted & labeled	1
<u>Part 3</u>		Points
Correct & complete reflection of Part 2 triangle:	$\triangle RST$ is correctly plotted & labeled	1
<u>Part 4</u>		Points
Incorrect rotation:	$\triangle MJK$ is incorrectly plotted	0
Total Points		2



# ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 1

<u>Part 1</u>		Points
Correct & complete graph:	$\triangle ABC$ is correctly plotted & labeled	1
<u>Part 2</u>		Points
Incomplete translation:	$\triangle DEF$ is correctly plotted; labels are incomplete: E is missing	$\frac{1}{2}$
<u>Part 3</u>		Points
Incorrect reflection:	Vertices ST and T are reversed	0
<u>Part 4</u>		Points
Incorrect rotation:	$\triangle MJK$ is incorrectly plotted	0
Total Points		$1\frac{1}{2}$

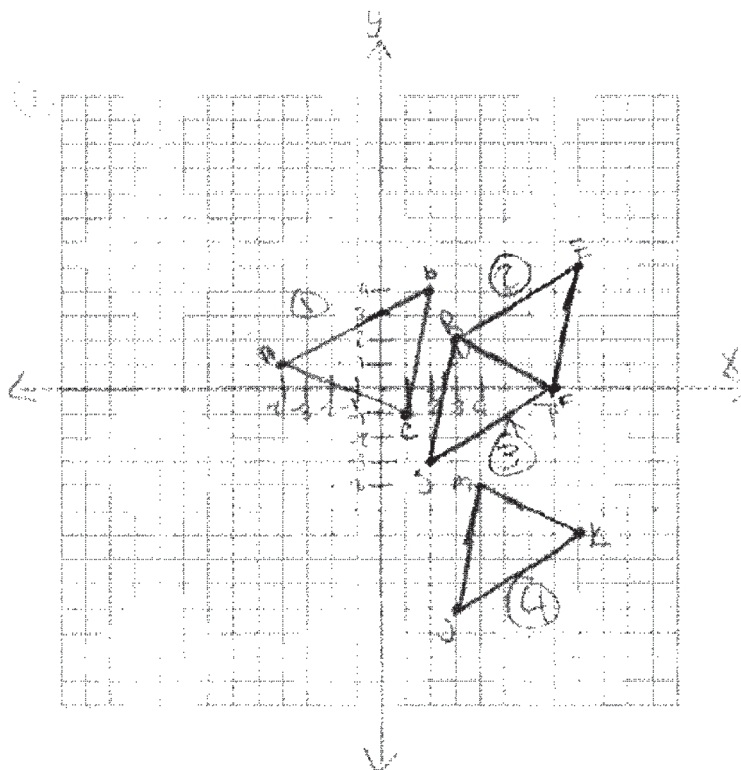




# ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

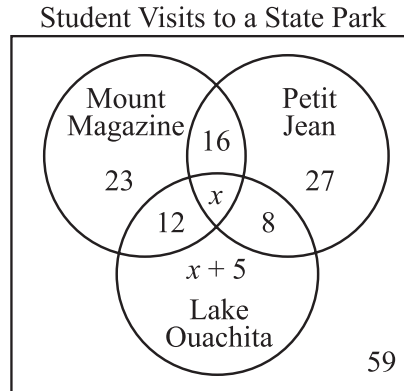
SCORE POINT: 0

<u>Part 1</u>		Points
Incorrect graph:	C is incorrectly plotted at (1,-1)	0
<u>Part 2</u>		Points
Incorrect translation:	Points E and F are correctly plotted; Point D is 7 units to the right	0
<u>Part 3</u>		Points
Incorrect reflection:	$\triangle RST$ is incorrectly plotted	0
<u>Part 4</u>		Points
Incorrect rotation:	$\triangle MJK$ is incorrectly plotted & labeled	0
Total Points		0



## ITEM C—2012 GEOMETRY

- C. The school newspaper conducted a survey of whether students had visited Mount Magazine State Park, Petit Jean State Park, or Lake Ouachita State Park in the past year. The results of the survey are in the Venn diagram below.



1. A total of 115 students in the survey had **not** visited Petit Jean State Park. Determine the value of  $x$ . Show your work or explain how you found your answer.
2. Determine how many students in the survey visited each of the three parks. Show your work or explain how you found your answer.
3. Determine the number of students who were surveyed. Show your work or explain how you found your answer.

BE SURE TO LABEL YOUR RESPONSES 1, 2, AND 3.

## ITEM C—2012 GEOMETRY

### Item C Scoring Rubric—2012 Geometry

Score	Description
4	The student earns 6 points. The response contains no incorrect work.
3	The student earns 4 – 5 points.
2	The student earns 2 – 3 points.
1	The student earns 1 point, or some minimal understanding is shown.
0	The student earns 0 points. No understanding is shown.
B	Blank — No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

# ITEM C SOLUTION AND SCORING—2012 GEOMETRY

## SOLUTION AND SCORING

If an error results in a fraction of a student, “x.5,”

appropriate credit is given if the answer is rounded up or left as a fraction.

No credit is given if the answer is rounded down.

6 points possible:

Part	Points
1	<p><b>2 points possible:</b></p> <p>2 points:     Correct value:     <b>16</b>  Correct procedure is shown and/or explained:  Give credit for the following or equivalent:  Ex:     <math>23 + 12 + (x + 5) + 59 = 115</math>  <math>x + 99 = 115</math>  <math>x = 16</math></p> <p>Ex:     <math>23 + 12 = 35</math>     <math>115 - 35 = 80</math>     <math>80 - 59 = 21</math>  <math>16 + 5 = 21</math>     So <math>x = 16</math>.</p> <p><b>OR</b></p> <p>1 point:     •     Correct value: 16  Work is incomplete or missing  or  •     Value is incorrect due to a calculation or <i>obvious</i> copy error  Correct procedure is shown and/or explained  or  •     Value of 75 (# not visiting any park, 59, is disregarded)  Corresponding correct procedure is shown and/or explained</p>
2	<p><b>2 points possible:</b></p> <p>2 points:     •     3 Correct Answers:     <b>Mount Magazine:     67</b>  <b>Petit Jean:     67</b>  <b>Lake Ouachita:     57</b>  <i>(or 3 correct answers, shown below, based on an incorrect <math>x</math> in Part 1):</i>  Mount Magazine:     <math>x + 51</math>  Petit Jean:     <math>x + 51</math>  Lake Ouachita:     <math>2x + 25</math></p> <p>Correct &amp; complete procedure is shown and/or explained for at least 2 parks.  Give credit for the following or equivalent:  Mount Magazine:     <math>23 + 16 + 16 + 12 = 67</math>  Petit Jean:     <math>16 + 27 + 8 + 16 = 67</math>  Lake Ouachita:     <math>12 + 16 + 8 + (16 + 5) = 57</math>  or  •     Answer of <math>x</math> from Part 1 with explanation  Explanation includes explicit evidence  that “<b>each</b>” is interpreted as meaning “<b>all</b>”</p> <p><b>OR</b></p> <p>1 point:     •     3 Correct Answers:     MM: 67,     PJ: 67,     LO: 57  <i>(or 3 correct answers based on an incorrect value for <math>x</math> in Part 1)</i>  Work is incomplete or missing  or</p>

# ITEM C SOLUTION AND SCORING—2012 GEOMETRY

Part	Points
	<ul style="list-style-type: none"> <li>2 Correct Answers (or 2 correct answers based on an incorrect value for <math>x</math> in Part 1) Correct &amp; complete procedure is shown and/or explained for at least 1 park 3<sup>rd</sup> answer may be incorrect or missing or</li> <li>Answer of <math>x</math> from Part 1 Explanation is missing or does not include explicit evidence that “each” is interpreted as meaning “all”</li> </ul>
3	<p><b>2 points possible:</b></p> <p>2 points:    Correct Answer:    <b>182</b> (or correct answer, <b><math>2x + 150</math></b>, based on an incorrect value for <math>x</math> in Part 1) Correct procedure shown and/or explained: Give credit for the following or equivalent: Ex:    Total: <math>23 + 16 + 16 + 12 + 27 + 8 + (16 + 5) + 59 = 182</math> Ex:    115 had <b>not</b> visited Petit Jean State park, and 67 did, so <math>115 + 67 = 182</math> Ex:    Total that visited each park, minus the overlaps, plus the number that did not visit any park: <math>67 + 67 + 57 - 16 - 12 - 8 - 2(16) + 59 = 182</math></p> <p><b>OR</b></p> <p>1 point:    <ul style="list-style-type: none"> <li>Answer is correct:    182 (or correct answer based on an incorrect value for <math>x</math> in Part 1: <b><math>2x + 150</math></b>) Work is incomplete or missing or</li> <li>Answer is incorrect due to a calculation or <i>obvious</i> copy error Correct procedure is shown and/or explained or</li> <li>Answer of 123 (# not visiting any park, 59, is disregarded) (or correct answer based on an incorrect value for <math>x</math> in Part 1: <b><math>2x + 91</math></b>) Corresponding correct procedure is shown and/or explained</li> </ul></p>

# ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

## SCORE POINT: 4

### Part 1

		Points
Correct $x$ :	16	2
Correct procedure:	$115 - 23 - 12 - 59 = 21$ ; $21 = x + 5$ ; $16 = x$	

### Part 2

		Points
3 Correct answers:	Mt. Magazine: 67; Petit Jean: 67; Lake Ouachita: 57	2
Correct procedure:	$23 + 12 + 16 + 16 = 67$ ; $27 + 16 + 16 + 8 = 67$ ; $16 + 5 + 16 + 12 + 8 = 57$	

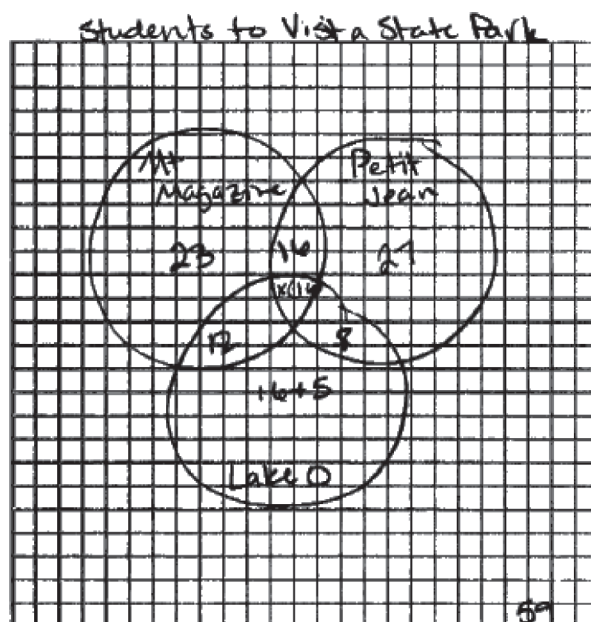
### Part 3

		Points
Correct answer:	182	2
Correct procedure:	$59 + 16 + 5 + 8 + 27 + 16 + 16 + 12 + 23 = 182$	

Total Points

6

- ①  $115 - 23 - 12 - 59 = 21$   
 $21 = x + 5$   
 $16 = x$
- ② Mount Magazine  
 $23 + 12 + 16 + 16 = 67$   
 67 students visited Mt. Magazine.
- Petit Jean  
 $27 + 16 + 16 + 8 = 67$   
 67 students visited Petit Jean
- Lake Ouachita  
 $16 + 5 + 16 + 12 + 8 = 57$   
 57 students visited Lake Ouachita



- ③  $59 + 16 + 5 + 8 + 27 + 16 + 16 + 12 + 23 = 182$   
 182 students total were surveyed.

# ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

## SCORE POINT: 3

<u>Part 1</u>		Points
Answer based on omission of 59:	75 (# not visiting any park, 59, is disregarded)	1
Correct procedure:	$23 + 12 + x + 5 = 115$ ; $35 + x + 5 = 115$ ; $40 + x = 115$ ; $-40$ ; $x = 75$	
<u>Part 2</u>		Points
3 Correct answers based on Part 1:	Lake Ouachita: 175; Mt. Magazine: 126; Petit Jean: 126	2
Correct procedure:	$75 + 5 + 12 + 8 + 75 = 175$ ; $16 + 75 + 12 + 23 = 126$ ; $16 + 75 + 8 + 27 = 126$	
<u>Part 3</u>		Points
Correct answer based on Part 1:	300	2
Correct procedure:	$16 + 23 + 12 + 75 + 8 + 27 + 80 + 59 = 300$	
<b>Total Points</b>		<b>5</b>

1)  $23 + 12 + x + 5 = 115$   
 $35 + x + 5 = 115$   
 $40 + x = 115$   
 $-40$   
 $x = 75$

2) Lake Ouachita  
 $x = 75 \rightarrow 75 + 5 + 12 + 8 + 75 = 175$   
175 students

Mt. Magazine  
 $16 + 75 + 12 + 23 = 126$   
126 students

Petit Jean  
 $16 + 75 + 8 + 27 = 126$   
126 students

3)  $16 + 23 + 12 + 75 + 8 + 27 + 80 + 59 = 300$   
300 students total were surveyed

# ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

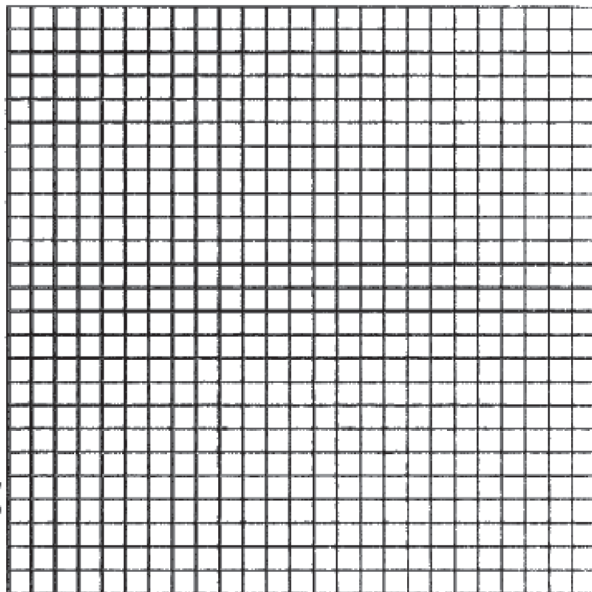
## SCORE POINT: 2

<u>Part 1</u>		Points
Correct $x$ :	16	2
Correct procedure:	$23 + 12 = 35$ ; $115 - 35 = 80$ ; $80 - 59 = 21$ ; $21 - 5 = 16$	
<u>Part 2</u>		Points
3 Correct answers:	Mt. Magazine: 67; Lake Ouachita: 57; Petit Jean: 67	1
Missing procedure:		
<u>Part 3</u>		Points
Incorrect answer:	250	0
Incorrect procedure:	Adds visitors to each park (Part 2) to 59: $57 + 67 + 67 + 59 = 250$	
Total Points		3

1.  $23 + 12 = 35$   
 $115 - 35 = 80$   
 $80 - 59 = 21$   
 $21 - 5 = 16$   
 $x = 16$

2. Mount Magazine  
67 students  
Lake Ouachita  
57 students  
Petit Jean  
67 students

3.  $57 + 67 + 67 + 59 = 250$  students were surveyed.

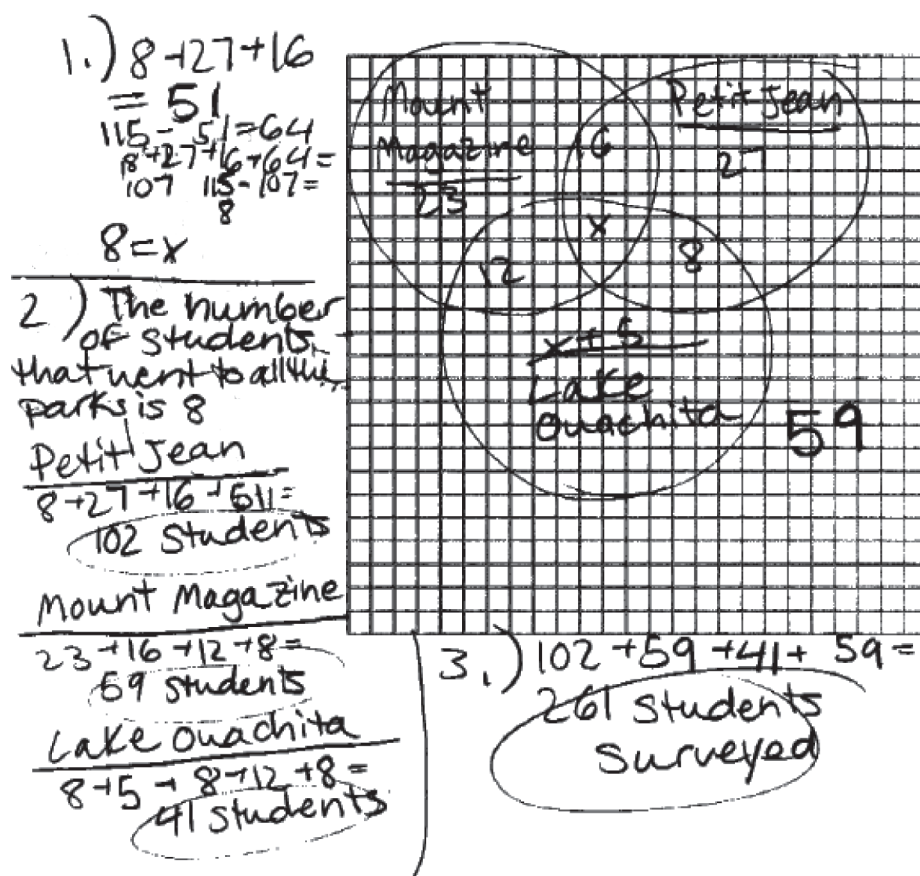




# ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

## SCORE POINT: 1

<u>Part 1</u>		Points
Incorrect $x$ :	8	0
Incorrect procedure:	$8 + 27 + 16 = 51$ ( <i>partial # that visited Petit Jean</i> ); $115 - 51 = 64$ ; $18 + 27 + 16 + 64 = 107$ ; $115 - 107 = 8$	
<u>Part 2</u>		Points
2 Correct answers based on Part 1:	Mt. Magazine: 59; Lake Ouachita: 41; Petit Jean: 102 ( <i>should be 59</i> )	1
2 Correct procedures:	$23 + 16 + 12 + 8 = 59$ ; $8 + 5 + 8 + 12 + 8 = 41$ ; $8 + 27 + 16 + 51 = 102$ ( <i>51 should be 8</i> )	
<u>Part 3</u>		Points
Incorrect answer:	261	0
Incorrect procedure:	Adds Part 2 answers to 59: $102 + 59 + 41 + 59 = 261$	
<b>Total Points</b>		<b>1</b>



# ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 0

<u>Part 1</u>		Points
Incorrect $x$ :	51	0
Incorrect procedure:	$115 - 23 - 12 - 16 - 8 - 5$ (added $23 + 12 + 16 + 8 + 5 = 64$ ); $115 - 64 = 51$	
<u>Part 2</u>		Points
Incorrect answer:	71	0
Incorrect procedure:	$12 + 51 + 8 = 71$	
<u>Part 3</u>		Points
Incorrect answer:	177	0
Incorrect procedure:	$23 + 27 + 56 + 12 + 51 + 8 = 177$ (omits 16 and 59)	
Total Points		0

① 115 had not visited  
 Petit Jean  
 $115 - 23 - 12 - 16 - 8 - 5$   
 $= 64$   $115 - 64 = 51$   
 $51 = x$

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②  $12 + x + 8 = 71$   
 71 Students  
 visited the 3 Parks

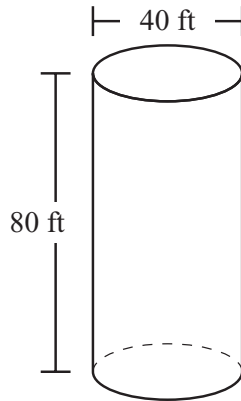
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③  
 Mt. Mg. 23  
 Petit J. 27  
 Lake O.  $x + 56$   
 All three 12, 51, 8  
 $23 + 27 + 56 + 12 + 51 + 8 = 177$  students surveyed

## ITEM D—2012 GEOMETRY

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- D.** A manufacturing company uses cylindrical storage tanks with a diameter of 40 ft and a height of 80 ft, as shown below.



1. What is the volume of each of the storage tanks? Round your answer to the nearest cubic foot. Show or explain all work.
2. If the manufacturing company changes the diameter of the storage tanks to be 80 ft and keeps the height the same, what is the new volume of each tank? Round your answer to the nearest cubic foot. Show or explain all work.
3. What should the diameter of the storage tank be if the manufacturing company wants the volume of the storage tank to be 16 times as great as the original volume and the height remains the same? Show or explain all work.

BE SURE TO LABEL YOUR RESPONSES 1, 2, AND 3.

## ITEM D—2012 GEOMETRY

### Item D Scoring Rubric—2012 Geometry

Score	Description
4	The student earns 4 points. The response contains no incorrect work. Correct label of “feet” in Part 3
3	The student earns 3 – 3½ points.
2	The student earns 2 – 2½ points.
1	The student earns ½ – 1½ points, or some minimal understanding is shown.
0	The student earns 0 points. No understanding is shown.
B	Blank — No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

## SOLUTION AND SCORING

**4 points possible:**

33

# ITEM D SOLUTION AND SCORING—2012 GEOMETRY

Part	Points
3	<p><b>2 points possible:</b></p> <p>2 points:    Correct diameter:    <b>160</b>    (<i>feet [required for a 4]</i>)  (or correct diameter based on an incorrect volume in Part 1)  Correct procedure shown and/or explained  Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> <li>• “Since the radius is squared to find the volume,  we would need to multiply the original volume by 4 squared  to end up with a volume that is 16 times as great as the original.  The new diameter would be <math>40 \times 4 = 160</math>”</li> <li>• <math>\sqrt{16} = 4</math>                      “So the diameter needs to be 4 times the original diameter of 40,  or 160.”</li> <li>• <math>(3.14)r^2 80 = 16(100,480)</math>  <math display="block">r^2 = \frac{16(100,480)}{(3.14)(80)} = \frac{1,607,680}{251.2} = 6400</math>  <math>r = \sqrt{6400} = 80</math>  <math>d = 2 \cdot 80 = 160</math></li> <li>• <math>\pi r^2 80 = 16(100,531)</math>  <math display="block">r^2 = \frac{16 \cdot 100,531}{\pi 80} = \frac{1,608,496}{251.32741\dots} = 6400.00223\dots \approx 6400</math>  <math>r = \sqrt{6400} = 80</math>  <math>d = 2 \cdot 80 = 160</math></li> </ul> <p><b>OR</b></p> <p>1 point:   </p> <ul style="list-style-type: none"> <li>• Correct diameter:                      <b>160</b>    (<i>ft.</i>)  Work is incomplete, including a one-trial “<b>guess and check</b>,” or missing or</li> <li>• Diameter is incorrect due to a calculation, copy,  label exponent attached to numerical value, or rounding error  Correct procedure is shown and/or explained  or</li> <li>• Correctly identifies <b>radius: 80</b>    (<i>ft.</i>)  Correct procedure shown and/or explained</li> </ul>

# ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 4

<u>Part 1</u>		Points
Correct volume:	100531 ft <sup>3</sup> (using $\pi$ key)	1
Correct procedure:	$\pi 20^2 80$ ; $32000\pi$	
<u>Part 2</u>		Points
Correct volume:	402124 ft <sup>3</sup> (using $\pi$ key)	1
Correct procedure:	$\pi 40^2 80$ ; $128000\pi$	
<u>Part 3</u>		Points
Correct diameter:	160.00 ft (prompt does not specify rounding to the nearest foot $\Rightarrow$ "160.00" is acceptable)	2
Correct procedure:	$\frac{1608496}{80} = \pi r^2 \frac{80}{80}$ ; $\frac{20106.2}{\pi} = \frac{\pi}{\pi} r^2$ ; $\sqrt{6400.002} = \sqrt{r^2}$ ; $80.00 = r$ ; $80.00 \times 2 = 160.00$	
Total Points		4

1)  $V = \pi 20^2 80$   
 $V = 100531.43$   
 $V = 32000\pi$   
 $V = 100531.43$   
The volume of each of the storage tanks is 100531.43

2)  $V = \pi 40^2 80$   
 $V = 128000\pi$   
 $V = 402124.13$   
The new volume of each tank is 402124.13

3)  $\frac{1608496}{80} = \pi r^2 \frac{80}{80}$   
 $20106.2 = \pi r^2$   
 $\frac{20106.2}{\pi} = r^2$   
 $\sqrt{\frac{20106.2}{\pi}} = r$   
 $80.00 = r$   
 $80.00 \times 2 = 160.00$   
The diameter of the storage tank should be 160.00 ft

# ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

## SCORE POINT: 3

<u>Part 1</u>		Points
Correct volume:	100531 ft <sup>3</sup>	1
Correct procedure:	$\pi(20)^2(80)$	
<u>Part 2</u>		Points
Correct volume:	402124 ft <sup>3</sup>	1
Correct procedure:	$\pi(40)^2(80)$	
<u>Part 3</u>		Points
Incorrect diameter:	502.655 ft (due to calculation error)	1
Correct procedure:	$100531 \cdot 16 = 1608496$ ; $\frac{1608496}{80\pi} = \frac{\pi r^2(80)}{80\pi}$ ; $\sqrt{63165.5} = \sqrt{r^2}$ (should be $\sqrt{6400} = \sqrt{r^2}$ ); $251.327 = r$ ; $251.327 \cdot 2 = 502.655$	
Total Points		3

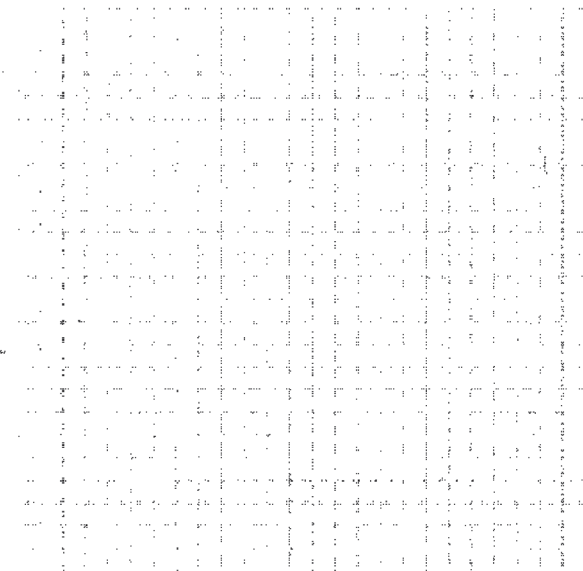
①  $V = \pi r^2 h$   
 $V = \pi(20)^2(80)$   
 $V = 100531 \text{ ft}^3$

②  $V = \pi(40)^2(80)$   
 $V = 402124 \text{ ft}^3$

③  
 $100531 \cdot 16 = 1608496$   
 $V = \pi r^2 h$

$1608496 = \pi r^2(80)$   
 $80\pi$

$63165.5 = r^2$   
 $251.327 = r$   
 $251.327 \cdot 2 = 502.655$



multiply  $r$  by two to get the diameter since radius is half the diameter.  
 $251.327 = r$   
 $251.327 \cdot 2 = 502.655$   
 New diameter = 502.655 ft



# ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 2

<u>Part 1</u>		Points
Correct volume:	100531 ft <sup>3</sup>	1
Correct procedure:	$\pi 20^2 (80)$	
<u>Part 2</u>		Points
Correct volume:	402124 ft <sup>3</sup>	1
Correct procedure:	$\pi (40)^2 80$	
<u>Part 3</u>		Points
Incorrect diameter:	158 (due to <b>two</b> calculation errors)	0
Correct procedure:	$100531 \cdot 16 = 160848$ (should be <b>1,608,496</b> ); $\frac{160848}{80\pi} = \frac{\pi r^2 (80)}{80\pi}$ ; $\sqrt{r^2} = \sqrt{6316}$ (SB $\sqrt{639.99}$ ); $r \approx 79$ ; $d = 2r$ ; $d \approx 158$ (no credit for having more than one error)	
Total Points		2

①

$$V = \pi r^2 h$$

$$V = \pi 20^2 (80)$$

$$V = 100531 \text{ ft}^3$$

②

$$V = \pi r^2 h$$

$$V = \pi (40)^2 80$$

$$V = 402124 \text{ ft}^3$$

③

$$100531 \cdot 16$$

$$V = 160848 \text{ ft}^3$$

$$\sqrt{r^2} = \sqrt{6316}$$

$$r \approx 79$$

$$\frac{160848}{80\pi} = \frac{\pi r^2 (80)}{80\pi} \quad d = 2r$$

$$d \approx 158$$

# ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 1

## Part 1

		Points
Incorrect volume:	$32,000\pi$ (not rounded to the nearest cubic foot)	$\frac{1}{2}$
Correct procedure:	$\pi(20)^2 80$	

## Part 2

		Points
Incorrect volume:	$128,000\pi$ (not rounded to the nearest cubic foot)	$\frac{1}{2}$
Correct procedure:	$\pi(40)^2 (80)$	

## Part 3

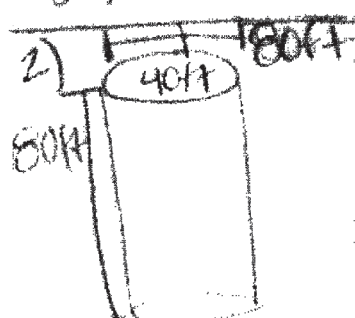
		Points
Incorrect diameter:	80	0
Incorrect procedure:	$32000 \times 16 = 512,000$ ; $\pi(80)^2 (80) = 512,000\pi$	

Total Points

1

Handwritten student work on grid paper:

1)  $\pi r^2 h$   
 $\pi(20)^2 80$   
 $32,000\pi \text{ ft}^3$

2)   $80\text{ft}$

$\pi r^2 h$   
 $\pi(40)^2 (80)$   
 $128,000\pi \text{ ft}^3$

3)  $\pi(80)^2 (80) = 512,000\pi \text{ ft}^3$   
 The diameter should be 80ft.

$32000 \times 16 = 512,000 \text{ ft}^3$

# ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

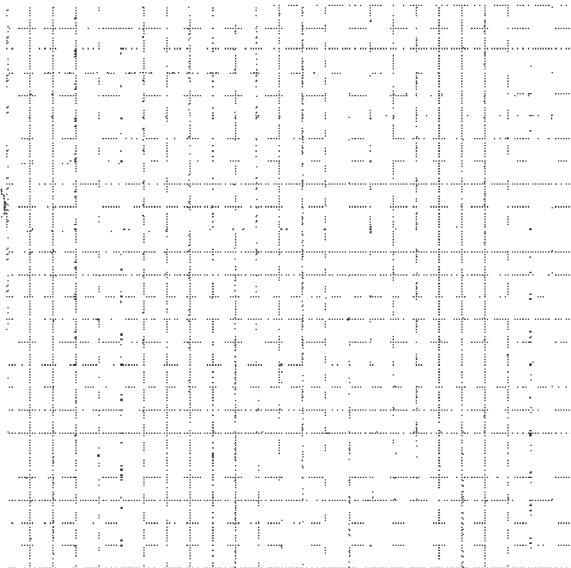
SCORE POINT: 0

<u>Part 1</u>		Points
Incorrect volume:	8373.3	0
Incorrect procedure:	$3.14 \cdot 20^2 \cdot 80 = \frac{100480}{12} = 8373.3$	
<u>Part 2</u>		Points
Incorrect volume:	33493.3	0
Incorrect procedure:	$3.14 \cdot 40^2 \cdot 80 = \frac{401920}{12} = 33493.3$	
<u>Part 3</u>		Points
Incorrect diameter:	56	0
Incorrect procedure:	$40 + 16 = 56$	
Total Points		0

$$\begin{aligned}
 1) V &= \pi r^2 h \\
 &= 3.14 \cdot 20^2 \cdot 80 \\
 &= \frac{100480}{12} \\
 &= 8373.3 \text{ ft}
 \end{aligned}$$

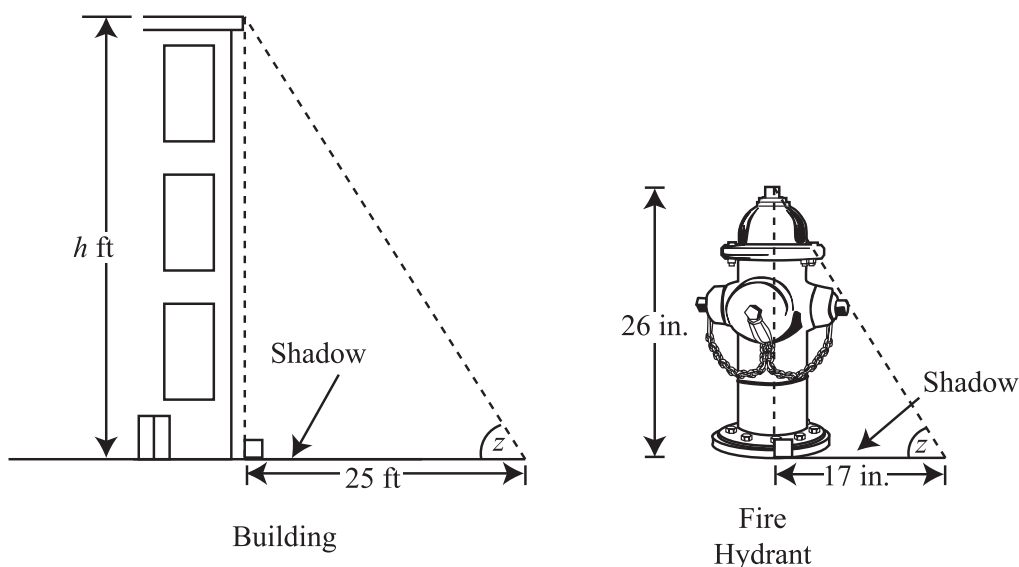
$$\begin{aligned}
 2) V &= \pi r^2 h \\
 &= 3.14 \cdot 40^2 \cdot 80 \\
 &= \frac{401920}{12} \\
 &= 33493.3 \text{ ft}
 \end{aligned}$$

$$\begin{aligned}
 3. & \begin{array}{r} 40 \\ + 16 \\ \hline 56 \end{array} \\
 & 56 \text{ ft}
 \end{aligned}$$



## ITEM E—2012 GEOMETRY

- E. Jeffrey is determining the height of a building. He takes advantage of a nearby fire hydrant and the shadows that are cast on the ground.



The fire hydrant is 26 inches tall, and the shadow cast by it is 17 inches long. The shadow cast by the building is 25 feet long, as shown above.

1. Determine the height of the building,  $h$ . Round your answer to the nearest foot. Show your work or explain how you found your answer.
2. What is the value of  $z$ , the measure of the angle of elevation to the Sun? Round your answer to the nearest degree. Show your work or explain your answer.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.

## ITEM E—2012 GEOMETRY

### Item E Scoring Rubric—2012 Geometry

Score	Description
4	The student earns 4 points. The response contains no incorrect work.
3	The student earns 3 – 3½ points.
2	The student earns 2 – 2½ points.
1	The student earns ½ – 1½ points, or some minimal understanding is shown.
0	The student earns 0 points. No understanding is shown.
B	Blank — No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

# ITEM E SOLUTION AND SCORING—2012 GEOMETRY

## SOLUTION AND SCORING

Do not deduct for early rounding or truncating in internal work that results in the correct answer.  
Students may write these values for brevity, using the exact calculator value to find their answer.

4 points possible:

Part	Points
1	<p><b>2 points possible:</b></p> <p>2 points: Correct answer of 38 (feet) Correct procedure shown and/or explained Give credit for the following or equivalent:</p> <p>Ex: <math>\frac{26}{17} = 1.52941... \approx 1.53</math>  <math>\frac{h}{25} = 1.53 \Rightarrow h = 25 \times 1.53 = 38.25 \approx 38\text{ft}</math></p> <p>Ex: <math>\frac{h}{26} = \frac{25}{17}</math>      <math>25 \times 26 = 650</math>      <math>\frac{650}{17} = 38.23529... \approx 38'</math></p> <p>Ex: (student converts to inches and converts back to feet)  <math>25' \times 12" = 300"</math>  <math>\frac{300}{h} = \frac{17}{26}</math>      <math>17h = 26 \times 300 = 7800</math>      <math>h = \frac{7800}{17} = 458.82352...</math>  <math>\frac{458.82352...}{12} = 38.23529... \approx 38'</math></p> <p>Ex: (student converts to feet)  <math>\frac{17''}{12''} = 1.41\bar{6}'</math>      <math>\frac{26''}{12''} = 2.1\bar{6}'</math>      (<i>not required</i>)  <math>\frac{1.41\bar{6}}{2.1\bar{6}} = \frac{25}{x}</math>      <math>x = \frac{2.1\bar{6} \times 25}{1.41\bar{6}} = \frac{54.1\bar{6}}{1.41\bar{6}} = 38.23529... \approx 38'</math></p> <p>Ex: <math>z_{\text{hydrant}} = \tan^{-1} \frac{26}{17} = 56.82148...</math>      <math>\tan 56.82... = \frac{h}{25}</math>  <math>h = 25 \times \tan 56.82... = 38.23529... \approx 38'</math></p> <p><b>OR</b></p> <p>1½ points: Answer is correct but is not rounded to the nearest foot, or work contains evidence of early rounding(s) that results in an incorrect answer Correct procedure is shown and/or explained</p> <p>Ex: <math>\frac{h}{25} = \frac{26}{17}</math>      <math>h = 38.24</math></p> <p><b>OR</b></p> <p>1 point: Give credit for the following:</p> <ul style="list-style-type: none"> <li>• Correct answer of 38 Work is missing or contains incorrect trig notation or</li> <li>• Answer is incorrect due to a calculation, copy or rounding error Correct procedure is shown or explained</li> </ul>

# ITEM E SOLUTION AND SCORING—2012 GEOMETRY

Part	Points
2	<p><b>2 points possible:</b></p> <p>2 points:    Correct answer of 57    (degrees)          (or correct angle based on an incorrect height in Part 1)          Correct procedure shown and/or explained          Give credit for the following or equivalent:</p> <p>Ex:    <math>\tan z = \frac{26}{17} = 1.52941\dots; \quad z = \tan^{-1}\left(\frac{26}{17}\right) = 56.82148\dots \approx 57^\circ</math></p> <p>Ex:    <math>z = \tan^{-1}\left(\frac{38}{25}\right) = 56.82148\dots \approx 57^\circ</math>    (use <b>38.23...</b> value in calculator)</p> <p>Ex:    <math>z = \tan^{-1}\left(\frac{38}{25}\right) = 56.65929\dots \approx 57^\circ</math>    (use <b>38</b>)</p> <p>Ex:    <math>\tan z = \frac{26}{17}</math> <b>or</b> <math>\tan z = \frac{38}{25}</math>    with correct answer of <math>z = 57</math></p> <p>Ex:    hypotenuse <math>= \sqrt{26^2 + 17^2} = \sqrt{676 + 289} = \sqrt{965} = 31.06444\dots \approx 31</math>  <math>\sin^{-1}\left(\frac{26}{31}\right) = 57.00411\dots \approx 57^\circ</math> <b>or</b> <math>\cos^{-1}\left(\frac{17}{31}\right) = 56.74356\dots \approx 57^\circ</math></p> <p>Ex:    hypotenuse <math>= \sqrt{25^2 + 38^2} = \sqrt{625 + 1444} = \sqrt{2069} = 45.48626\dots</math>  <math>\sin^{-1}\left(\frac{38}{45.5}\right) = 56.63300\dots \approx 57^\circ</math> <b>or</b> <math>\cos^{-1}\left(\frac{25}{45.5}\right) = 56.67067\dots \approx 57^\circ</math></p> <p><b>OR</b></p> <p>1½ points:    Answer is correct but is not rounded to the nearest degree,          or work contains evidence of early rounding(s) that results in an incorrect answer          Correct procedure is shown and/or explained</p> <p>Ex:    <math>\tan z = \frac{26}{17} \quad z = 56.8</math></p> <p><b>OR</b></p> <p>1 point:    Give credit for the following:</p> <ul style="list-style-type: none"> <li>• Correct answer of 57              Work is missing or contains incorrect trig notation              or</li> <li>• Answer is incorrect due to a calculation, copy or rounding error              Correct procedure is shown or explained</li> </ul>

# ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 4

**Part 1**

		Points
Correct height:	38 feet	2
Correct procedure:	$\frac{h}{26} = \frac{25}{17}; \frac{17h}{17} = \frac{650}{17}$	

**Part 2**

		Points
Correct angle:	57°	2
Correct procedure:	$\tan z = \frac{26}{17}; z = 57^\circ$	
Total Points		4

$$\begin{aligned}
 1) \quad \frac{h}{26} &= \frac{25}{17} \\
 \frac{17h}{17} &= \frac{650}{17} \\
 h &= 38 \text{ feet}
 \end{aligned}$$

$$2) \quad \text{Tangent } x = \frac{\text{opposite}}{\text{adjacent}}$$

$$\tan z = \frac{26}{17}$$

$$z = 57^\circ$$



# ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

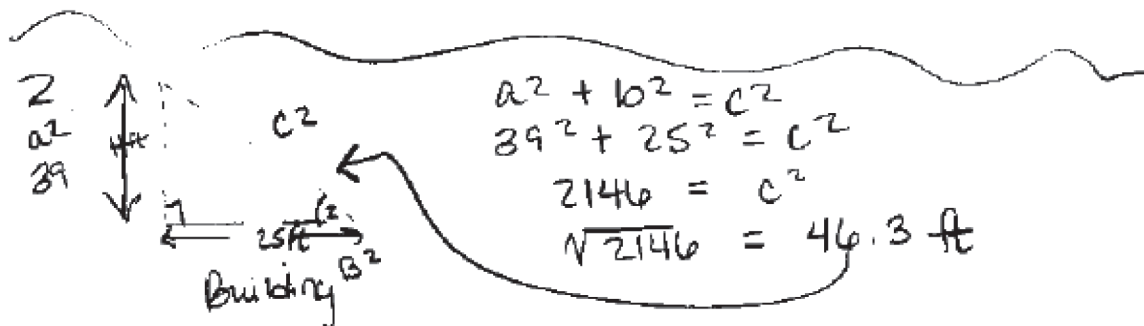
SCORE POINT: 3

<u>Part 1</u>		Points
Incorrect height:	39 ft (due to early internal rounding)	1½
Correct procedure:	26in = 2.2ft (early rounding: should be $26 = 2.1\bar{6}$ ); 17in = 1.4ft (early rounding: SB $17 = 1.41\bar{6}$ ); $\frac{h}{25} = \frac{2.2}{1.4}$ ; $h = 39.3$	
<u>Part 2</u>		Points
Correct angle:	57 degrees (correct angle for incorrect height found in Part 1)	2
Correct explanation for incorrect height in Part 1:	"... do the tangent of z. That would be 39/25. And z would equal 57 degrees."	
Total Points		3½

1 Fire Hydrant Building  
 26 in = 2.2 ft h ft  
 17 in = 1.4 ft 25 ft

$$\frac{h}{25} = \frac{2.2}{1.4} \quad H = 39.3 \text{ ft}$$

The height of the building is 39 ft



To find the measure of  $z$  you would then have to do the tangent of  $z$ . That would be  $39/25$ . And  $z$  would equal 57 degrees.

# ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 2

Part 1		Points
Incorrect height:	37 ft	0
Correct procedure with <b>two</b> errors:	$\frac{1.5}{25}$ (1.5: rounding error: $\frac{17}{12} = 1.4\overline{16}$ ; rounds to 1.4); $\frac{2.2}{h}$ (2.2: early rounding: $\frac{26}{12} = 2.1\overline{6}$ ); $\frac{55}{1.5} = \frac{1.5h}{1.5}$ ; $h = 37$	
Part 2		Points
Correct angle:	$56^\circ$ (correct angle for incorrect height found in Part 1)	2
Correct procedure:	$\tan^{-1}(37/25) = 56^\circ$	
Total Points		2

①

$$\frac{1.5}{25} \quad \frac{2.2}{h}$$

$$\frac{55 = 1.5h}{1.5 \quad 1.5}$$

$$h = 37 \text{ ft.}$$

The height of the building is 37 ft. The way I found it was to convert the inches in to feet then I use the cross multiply formula

②

$$\tan^{-1}(37/25)$$

$$56^\circ$$

The m<2 is  $56^\circ$  I took  $\tan^{-1}$  in to (26/17) and put in to (37/25) and they were both equal

# ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

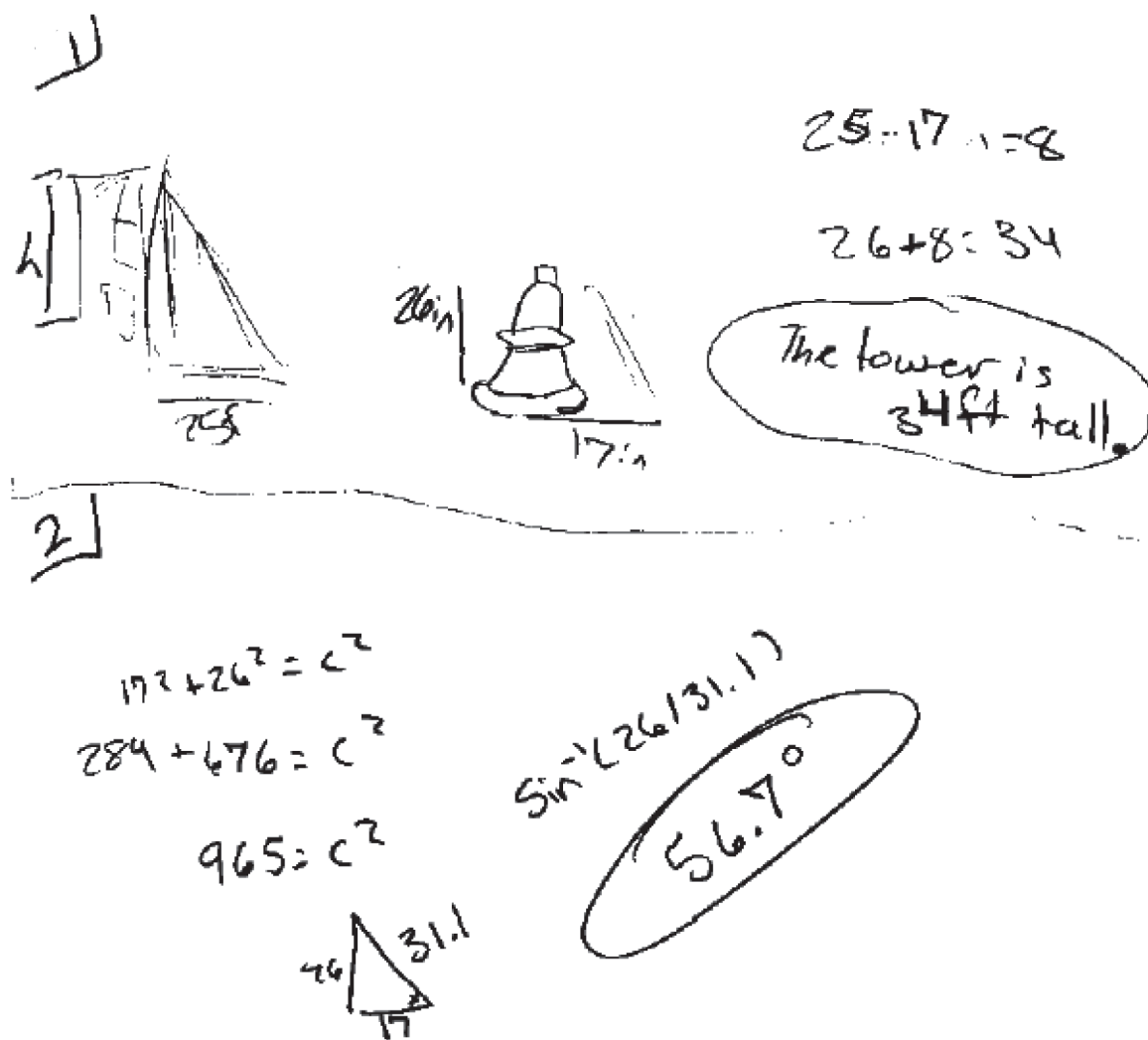
SCORE POINT: 1

## Part 1

		Points
Incorrect height:	34 ft	0
Incorrect procedure:	$25 - 17 = 8$ ; $26 + 8 = 34$	

## Part 2

		Points
Correct angle:	$56.7^\circ$ (not rounded to the nearest degree)	$1\frac{1}{2}$
Correct procedure:	$17^2 + 26^2 = c^2$ ; $289 + 676 = c^2$ ; $965 = c^2$ ; $31.1$ ; $\sin^{-1}(26/31.1)$	
Total Points		$1\frac{1}{2}$



# ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2012 GEOMETRY

SCORE POINT: 0

## Part 1

Incorrect height:	26 ft	0
Incorrect procedure:	$26 \div 12 = 2.2$ ; $17 \div 12 = 1.4$ ; $2.2 - 1.4 = .8$ ; $25 + .8 = 25.8 = 26$	

## Part 2

Incorrect angle:	$14^\circ$	0
Incorrect procedure:	$z = \tan \frac{26}{17}$ ; $26 \div 17 = 1.5$ ; $z = \tan 1.5$ ; $z = 14.1$ (does not calculate $\tan^{-1} 1.5$ )	
Total Points		0

①  $26 \div 12 = 2.2 \text{ ft}$   
 $17 \div 12 = 1.4 \text{ ft}$

$$\begin{array}{r} 2.2 \\ - 1.4 \\ \hline .8 \text{ ft} \end{array}$$

$25 \text{ ft} + .8 \text{ ft} = 25.8 \text{ ft}$

The height of the building is 26 ft.

$25.8 \text{ ft} = \boxed{26 \text{ ft}}$

②  $z = \tan \frac{26}{17}$        $26 \div 17 = 1.5$

$z = \tan 1.5$   
 $z = 14.1$

$\boxed{z = 14^\circ}$







# ACTAAP

**Arkansas Comprehensive Testing, Assessment, and Accountability Program**

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