



Arkansas Comprehensive Testing, Assessment, and Accountability Program

**RELEASED ITEM**  
**BOOKLET**  
**Geometry**  
**End-of-Course Examinations**  
**2011–2012 Administrations**

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**Arkansas Department of Education**



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## PART I OVERVIEW

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The criterion-referenced tests implemented as part of the **Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP)** are being developed in response to Arkansas Legislative Act 35, which requires the State Board of Education to develop a comprehensive testing program that includes assessment of the challenging academic content standards defined by the Arkansas Curriculum Frameworks.

As part of this program, students in Arkansas public schools in 2012 who had completed or were completing Geometry by the end of first semester participated in the Mid-Year Geometry End-of-Course Examination. Students in Arkansas public schools who had completed or were completing Geometry by the end of the spring semester participated in the Spring Geometry End-of-Course Examination.

This Released Item Booklet for the Geometry End-of-Course Examinations contains test questions or items that were asked of students during the 2011–2012 operational administrations. The test items included in Part II of this booklet are some of the items that contributed to the student performance results for these administrations.

Students were given approximately an hour and a half each day to complete assigned test sessions during the two days of Mid-Year testing. Students were given approximately two hours each day to complete assigned test sessions during the two days of Spring testing. Students were permitted to use a calculator for both multiple-choice and open-response items. Students were also supplied with a reference sheet to be used so that all students would have equal access to this information during testing. (See the reference sheet on page 55 of this booklet.) All of the multiple-choice items within this booklet have the correct response marked with an asterisk (\*).

The development of the Geometry End-of-Course Examinations was based on the *Arkansas Geometry Mathematics Curriculum Framework*. This framework has distinct levels: Strands to be taught in concert, Content Standards within each Strand, and Student Learning Expectations within each Content Standard. An abridged version of the *Arkansas Geometry Mathematics Curriculum Framework* can be found in Part III of this booklet. It is important to note that this abridged version lists only the predominant Strand, Content Standard, and Student Learning Expectation associated with each item. However, since many key concepts within the *Arkansas Geometry Mathematics Curriculum Framework* are interrelated, in many cases there are other item correlations or associations across Strands, Content Standards, and Student Learning Expectations.

Part IV of the Released Item Booklet contains a tabular listing of the Strand, Content Standard, and Student Learning Expectation that each question was designed to assess. The multiple-choice and open-response items found on the Geometry End-of-Course Examinations were developed in close association with the Arkansas education community. Arkansas teachers participated as members of the Geometry Content Advisory Committee, providing routine feedback and recommendations for all items. The number of items associated with specific Strands, Content Standards, and Student Learning Expectations was based on approximate proportions suggested by the Content Advisory Committee, and their recommendations were accommodated to the greatest extent possible given the overall test design. Part IV of the Released Item Booklet provides Arkansas educators with specific information on how Geometry End-of-Course Examination items align or correlate with the *Arkansas Geometry Mathematics Curriculum Framework* to provide models for classroom instruction.

## **PART I SCORING STUDENT RESPONSES TO GEOMETRY OPEN-RESPONSE ITEMS**

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

The Arkansas Geometry Rangefinding Committee assisted in the development of the scoring criteria. The committee is comprised of active Arkansas educators with expertise in mathematics education.

### **Reader Training**

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.

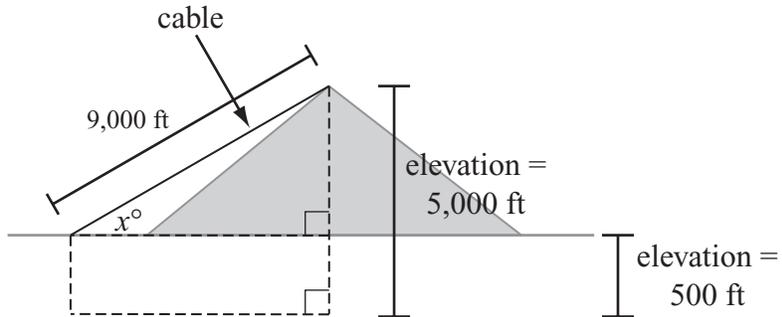
Once scoring of the actual student responses begins, readers are monitored constantly throughout the project to ensure that they are scoring according to the criteria. Daily and cumulative statistics are posted and analyzed, and Scoring Directors or Team Leaders reread selected responses scored by the 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.

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

1. A cable car starts at an elevation of 500 feet above sea level and rises to the top of a peak that is 5,000 feet above sea level. The cable is 9,000 feet long.

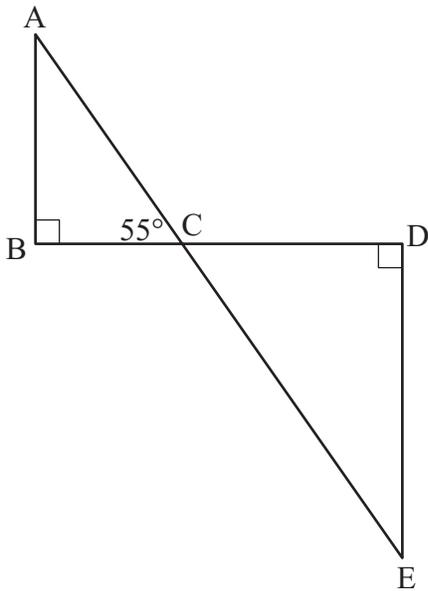


What is  $x$ , the measure of the angle of elevation of the cable?

- A.  $3^\circ$
- B.  $6^\circ$
- \* C.  $30^\circ$
- D.  $33^\circ$

**PART II MID-YEAR RELEASED GEOMETRY ITEMS**

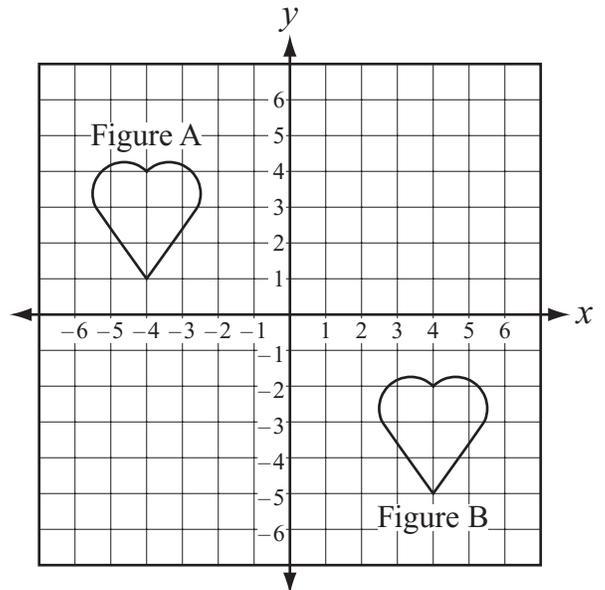
2.  $\overline{AE}$  is intersected by  $\overline{BD}$  at the point C, forming two right triangles,  $\triangle ABC$  and  $\triangle EDC$ .



What is the measure of  $\angle E$ ?

- \* A.  $35^\circ$
- B.  $45^\circ$
- C.  $55^\circ$
- D.  $90^\circ$

3. Look at the graph below.

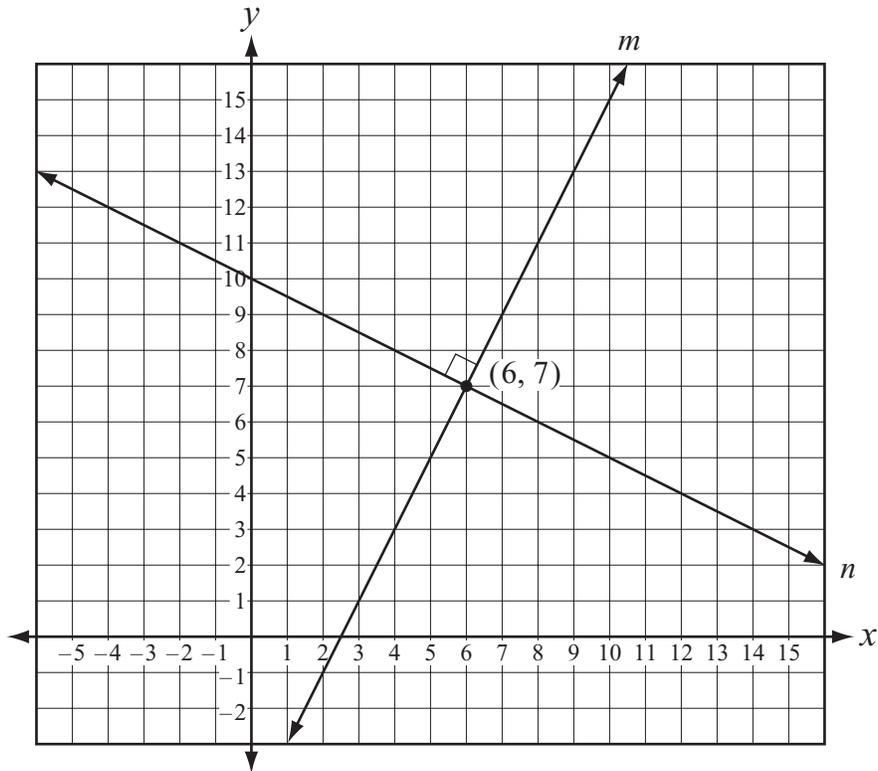


Which best describes the transformation from Figure A to Figure B?

- A. translation 1 unit right and 1 unit down
- \* B. translation 8 units right and 6 units down
- C. translation 8 units right and 3 units down
- D. translation 6 units right and 8 units down

PART II MID-YEAR RELEASED GEOMETRY ITEMS

4. The coordinate grid below shows that line  $m$  and line  $n$  are perpendicular to each other.



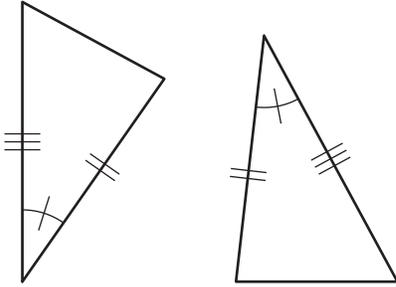
If the equation for line  $n$  is  $y = -\frac{1}{2}x + 10$ , then which is the equation for line  $m$ ?

- A.  $y = 2x - 8$
- \* B.  $y = 2x - 5$
- C.  $y = -2x + 19$
- D.  $y = -2x + 20$

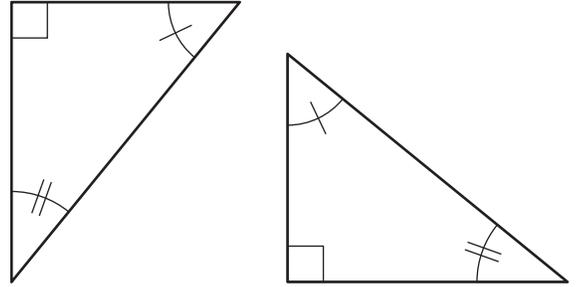
**PART II MID-YEAR RELEASED GEOMETRY ITEMS**

5. Which two triangles are congruent, according to the side-angle-side (SAS) theorem?

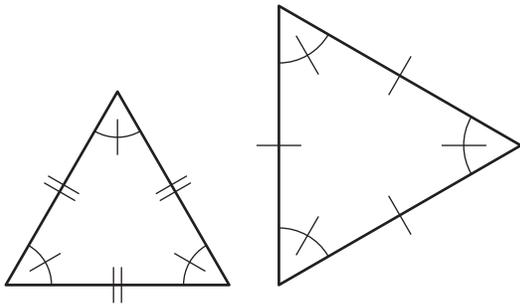
\* A.



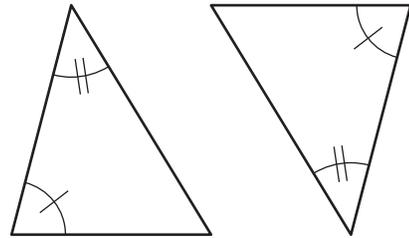
B.



C.



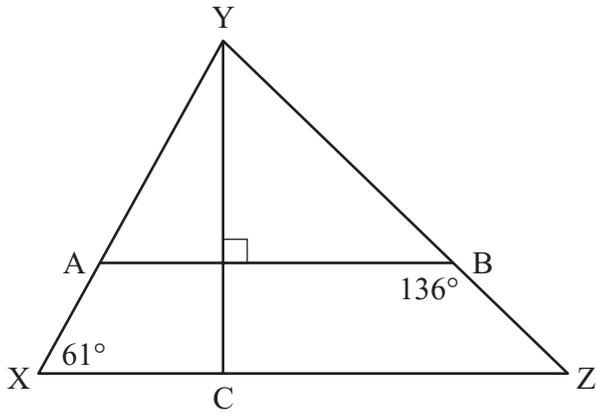
D.



**PART II MID-YEAR RELEASED GEOMETRY ITEMS**

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6. In the figure below,  $\overline{AB}$  and  $\overline{XZ}$  are parallel to each other.



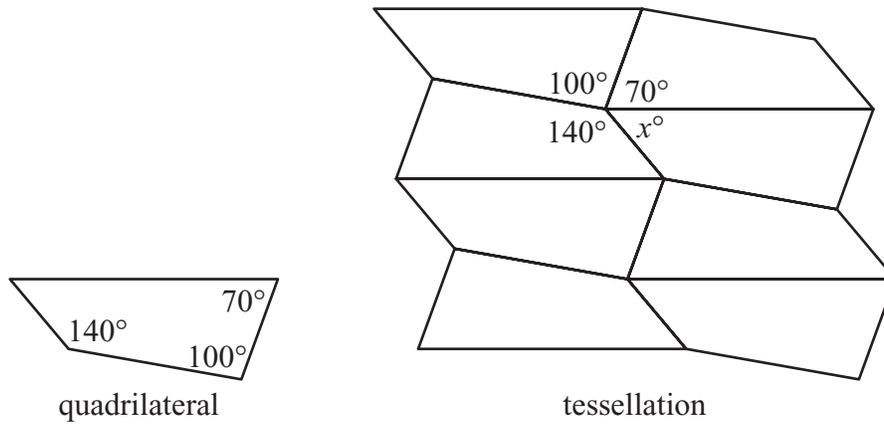
What is the measure of  $\angle XYZ$ ?

- \* A.  $29^\circ$
- B.  $44^\circ$
- C.  $46^\circ$
- D.  $75^\circ$

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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7. The figure below is a tessellation of a quadrilateral.

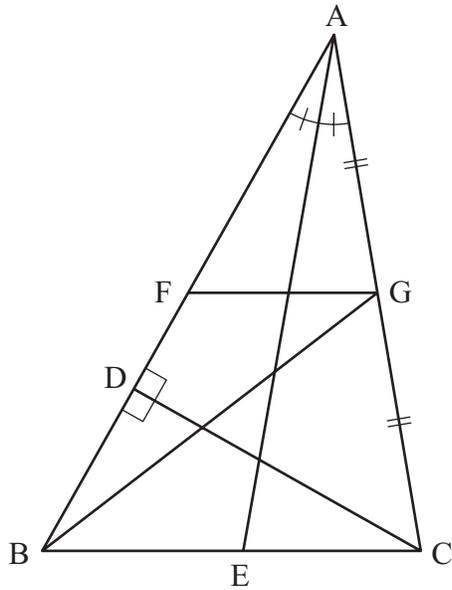


What is the value of  $x$ ?

- A. 20
- B. 40
- \* C. 50
- D. 100

**PART II MID-YEAR RELEASED GEOMETRY ITEMS**

8. Triangle ABC is shown below.



Which segment is an angle bisector?

- \* A.  $\overline{AE}$
- B.  $\overline{BG}$
- C.  $\overline{CD}$
- D.  $\overline{FG}$

9. On a globe, lines of longitude run north-south and lines of latitude run east-west. How many times do the Prime Meridian ( $0^\circ$  longitude) and the Equator ( $0^\circ$  latitude) intersect?

- A. 1
- \* B. 2
- C. 4
- D. 8

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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10. Each figure shown below is a square measuring 1 unit wide by 1 unit long.

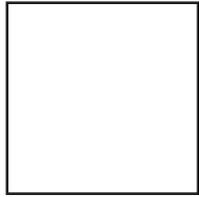


Figure 1

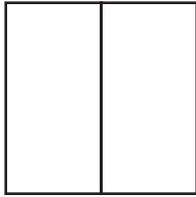


Figure 2

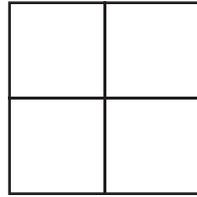


Figure 3

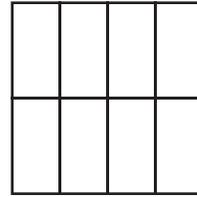


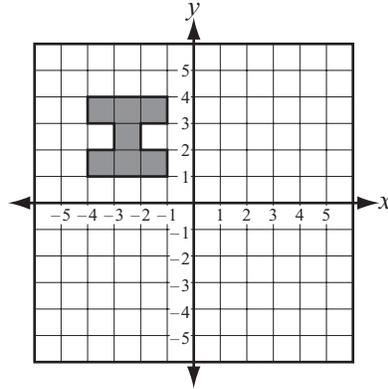
Figure 4

If the pattern continues, how many sections will make up Figure 8?

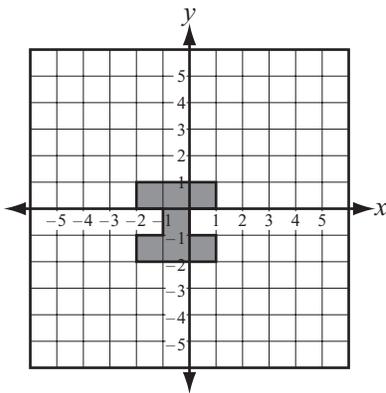
- A. 16 sections
- B. 32 sections
- \* C. 128 sections
- D. 256 sections

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

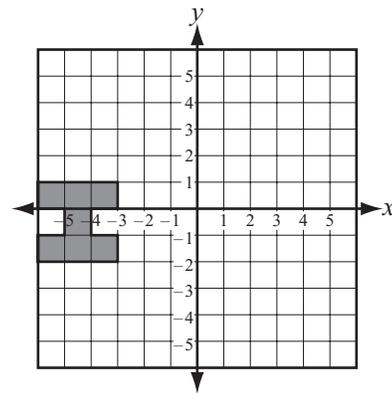
11. Which image will result from the figure below being translated three units down and two units to the right?



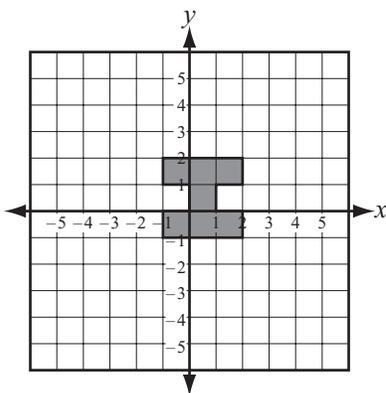
\* A.



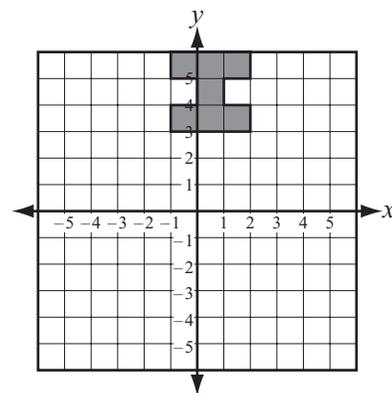
B.



C.



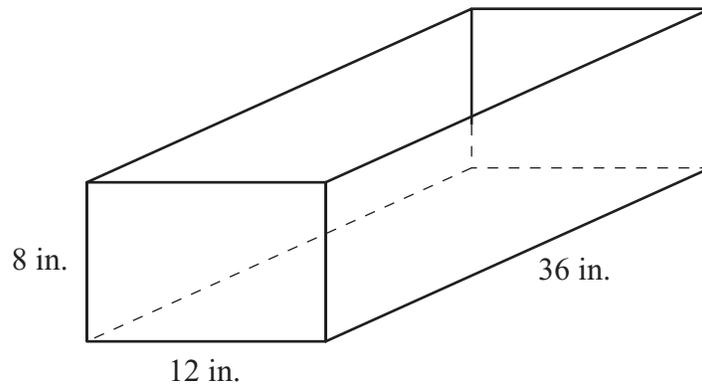
D.



## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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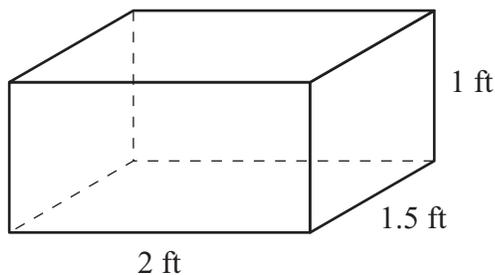
12. Maia makes flower boxes to sell at a farmer's market. One flower box is shown below.



Maia wants to make another flower box that has a length of 24 inches instead of 36 inches. What will be the difference in volumes of the two flower boxes?

- A. 480 in.<sup>3</sup>
  - \* B. 1,152 in.<sup>3</sup>
  - C. 2,304 in.<sup>3</sup>
  - D. 3,456 in.<sup>3</sup>
- 

13. Max wants to wrap a box in the shape of a rectangular prism that is 2 ft long, 1 ft high, and 1.5 ft deep.



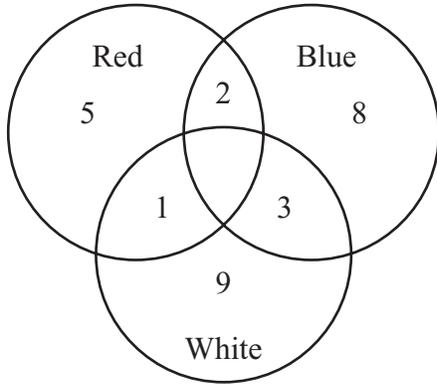
How much wrapping paper is needed to cover the exact surface area of the box?

- A. 3 ft<sup>2</sup>
- B. 4.5 ft<sup>2</sup>
- C. 6.5 ft<sup>2</sup>
- \* D. 13 ft<sup>2</sup>

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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14. The Venn diagram below shows the colors of the cars in a school parking lot.



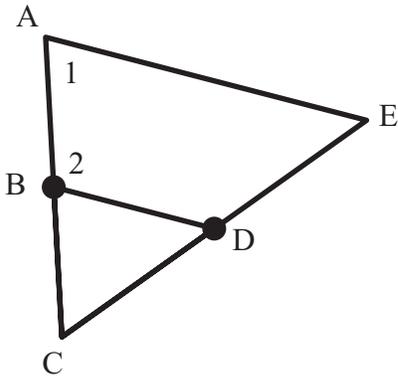
How many cars in the school parking lot are at least partly white?

- A. 9
- B. 10
- C. 12
- \* D. 13

PART II MID-YEAR RELEASED GEOMETRY ITEMS

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15. In the triangle shown below, point B is the midpoint of line  $\overline{AC}$ , and point D is the midpoint of line  $\overline{CE}$ .

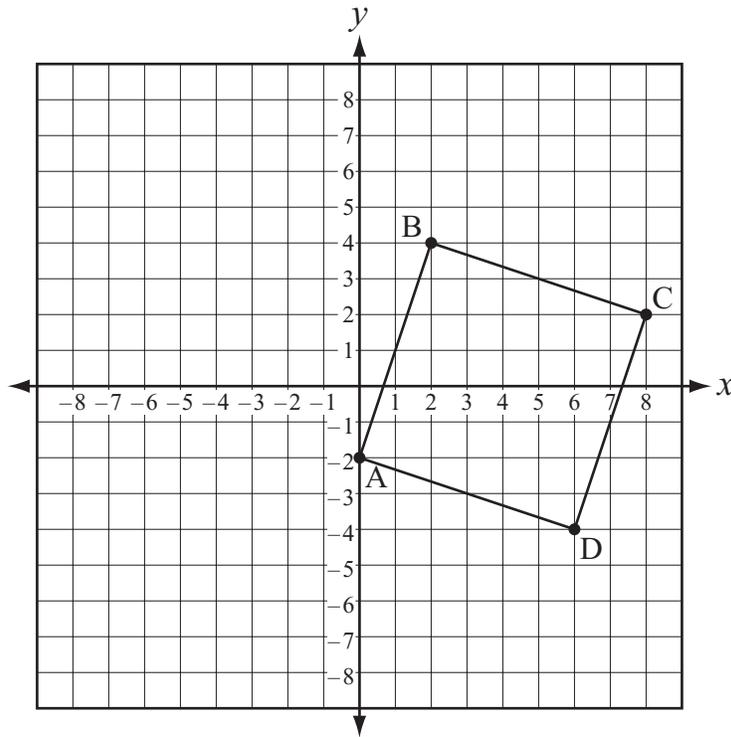


Which conclusion is supported by the information above?

- A.  $\angle 1$  and  $\angle 2$  are straight angles.
- B.  $\angle 1$  and  $\angle 2$  are congruent angles.
- \* C.  $\angle 1$  and  $\angle 2$  are supplementary angles.
- D.  $\angle 1$  and  $\angle 2$  are complementary angles.

PART II MID-YEAR RELEASED GEOMETRY ITEMS

16. The figure below shows a square with vertices A, B, C, and D.

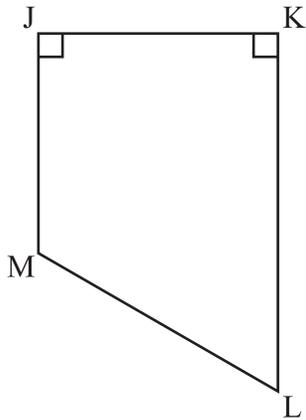


Which statement **must** be true?

- A. The slope of  $\overrightarrow{AB}$  equals the slope of  $\overrightarrow{BC}$ .
- \* B. The slope of  $\overrightarrow{BC}$  equals the slope of  $\overrightarrow{AD}$ .
- C. The slope of  $\overrightarrow{CD}$  is the opposite reciprocal of the slope of  $\overrightarrow{AB}$ .
- D. The slope of  $\overrightarrow{AD}$  is the opposite reciprocal of the slope of  $\overrightarrow{BC}$ .

**PART II MID-YEAR RELEASED GEOMETRY ITEMS**

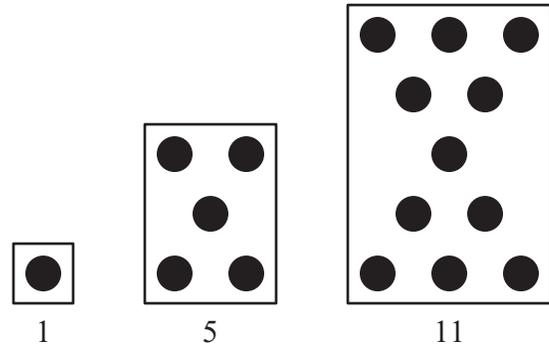
17. For quadrilateral JKLM, shown below,  $m\angle KLM = (2x)^\circ$  and  $m\angle LMJ = (4x)^\circ$ .



What is the value of  $x$ ?

- A. 15
  - \* B. 30
  - C. 60
  - D. 75
18. Which of the following lengths could **not** be the side lengths of a triangle?
- A. 0.2, 0.5, 0.6
  - B. 1.2, 40, 40
  - C. 5, 12, 13
  - \* D. 9, 27, 81

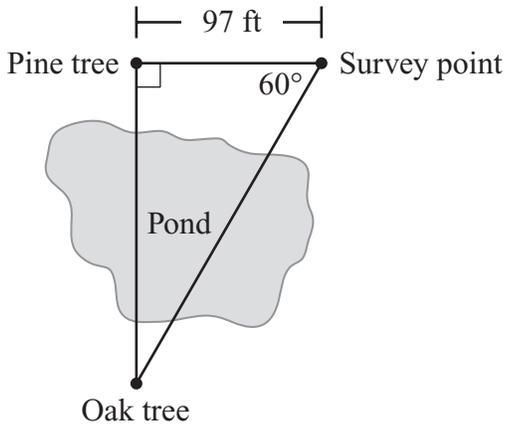
19. If the pattern shown below continues, how many dots will appear in the 7<sup>th</sup> figure?



- A. 31 dots
- B. 35 dots
- \* C. 55 dots
- D. 71 dots

**PART II MID-YEAR RELEASED GEOMETRY ITEMS**

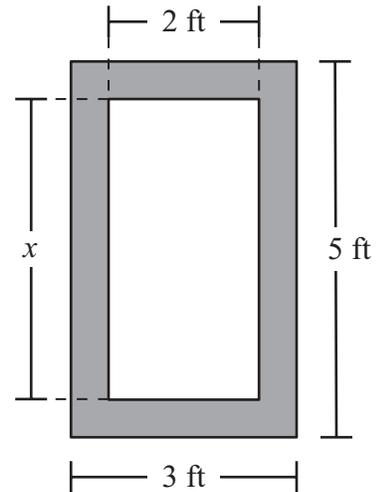
20. As an assignment, two students in a surveying class had to find the distance between two trees separated by a pond. Starting at the pine tree, they walked until they found a point at which the angle formed between the pine tree, the survey point, and the oak tree was  $60^\circ$ . Their sketch is shown below.



To the nearest foot, what is the distance between the pine tree and the oak tree?

- \* A. 168 ft
- B. 194 ft
- C. 291 ft
- D. 336 ft

21. Toby has a rug made of a white rectangle surrounded by a dark border. The white rectangle is geometrically similar in shape to the entire rug.

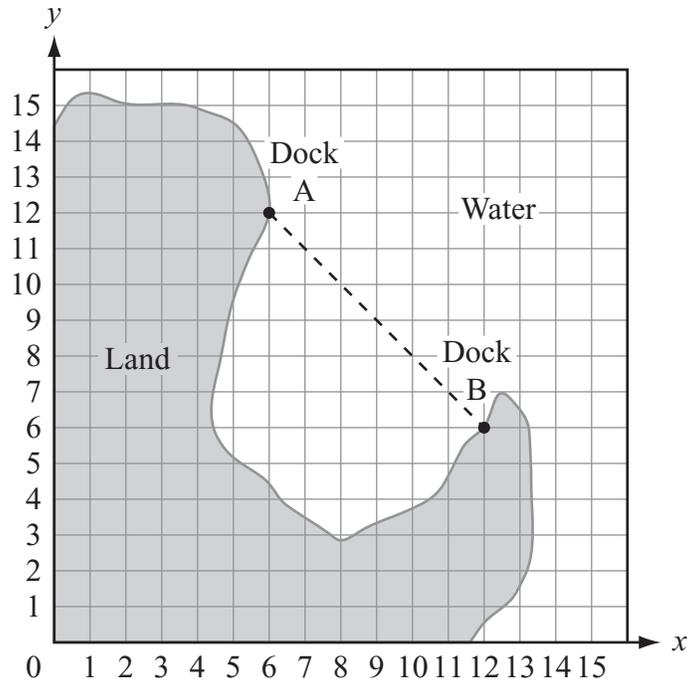


The entire rug is 3 feet wide and 5 feet long, and the white rectangle is 2 feet wide. What is  $x$ , the length of the white rectangle? Round to the nearest tenth of a foot.

- A. 1.2 feet
  - \* B. 3.3 feet
  - C. 6.0 feet
  - D. 7.5 feet
22. Johan draws a triangle that has an angle measuring  $91^\circ$ . What type of triangle could Johan have drawn?
- A. right
  - B. acute
  - \* C. isosceles
  - D. equilateral

**PART II MID-YEAR RELEASED GEOMETRY ITEMS**

23. A crab trap is placed at the midpoint of docks A and B.

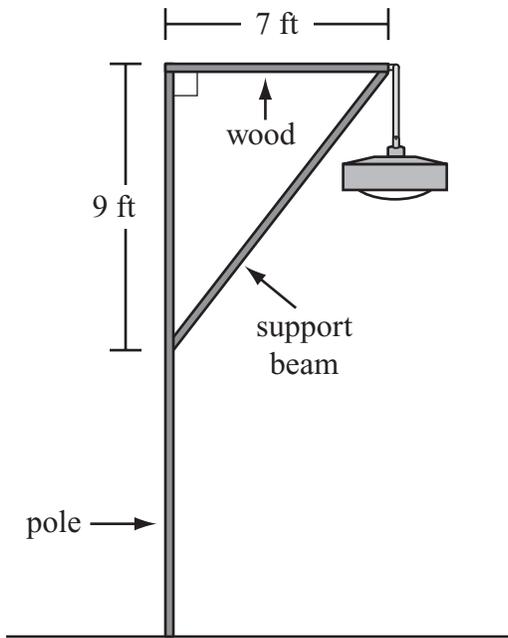


What are the coordinates of the crab trap?

- A. (3, 3)
- B. (8, 10)
- \* C. (9, 9)
- D. (10, 8)

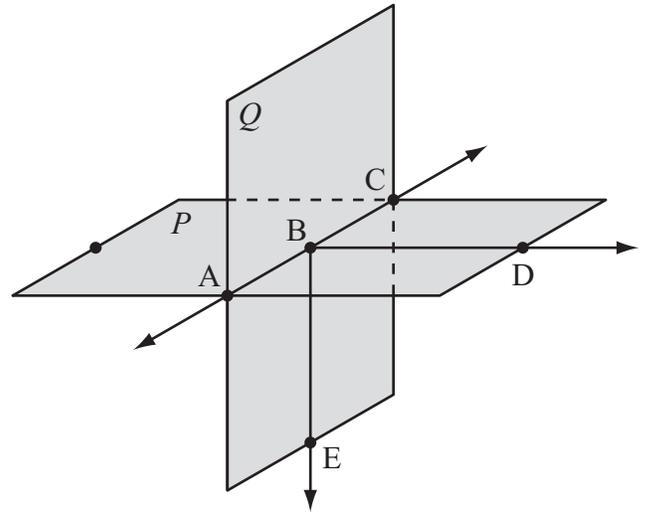
PART II MID-YEAR RELEASED GEOMETRY ITEMS

24. A street lamp hangs from the end of a 7-foot length of wood connected to a pole. A support beam connects the end of the horizontal length of wood to the pole at a point 9 feet from the top of the pole. To the nearest tenth of a foot, how long is the support beam?



- A. 5.7 ft
- B. 8.0 ft
- \* C. 11.4 ft
- D. 16.0 ft

25. Planes  $P$  and  $Q$  are perpendicular to each other.



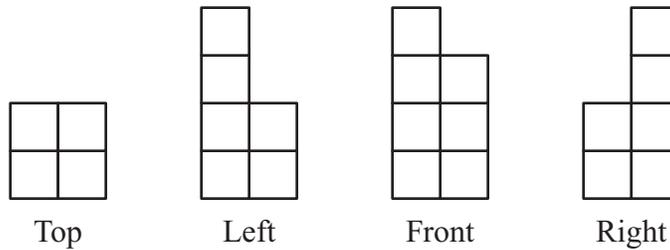
What is the intersection of planes  $P$  and  $Q$ ?

- A.  $\overline{BE}$
- \* B.  $\overleftrightarrow{AC}$
- C. point B
- D.  $\angle DBE$

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

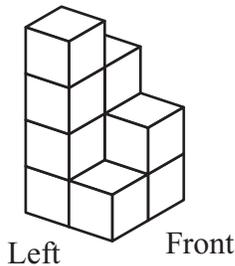
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Use the following views of a solid figure to answer question 26.

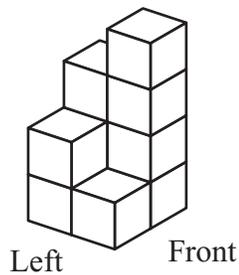


26. Which of the following shows a solid figure with these views?

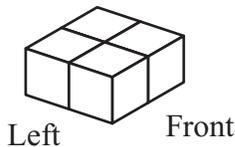
\* A.



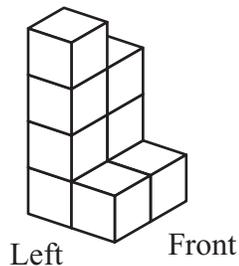
B.



C.



D.



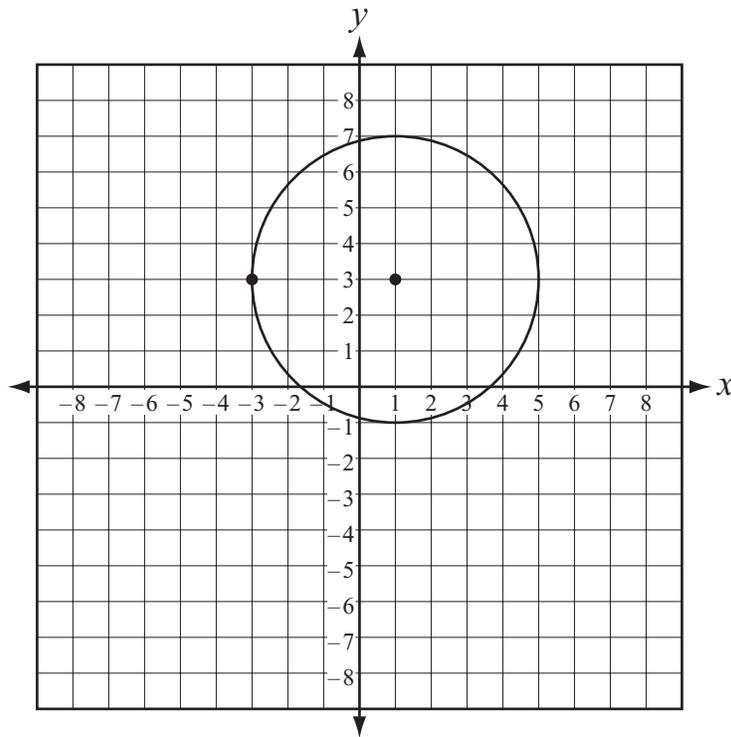
27. The radius of sphere  $A$  is 3 times the radius of sphere  $B$ . Which best describes the relationship between the surface area of sphere  $A$  and the surface area of sphere  $B$ ?

- A. The surface area of  $A$  is  $\frac{1}{9}$ <sup>th</sup> of the surface area of  $B$ .
- B. The surface area of  $A$  is  $\frac{1}{27}$ <sup>th</sup> of the surface area of  $B$ .
- \* C. The surface area of  $A$  is 9 times greater than the surface area of  $B$ .
- D. The surface area of  $A$  is 27 times greater than the surface area of  $B$ .

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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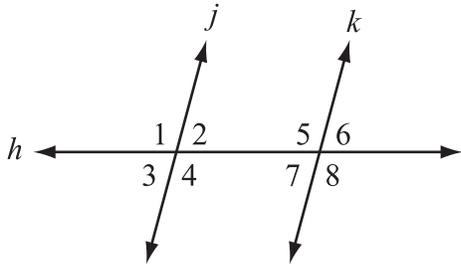
28. A factory uses the pattern shown below to cut circles out of sheet metal to make the bottoms of buckets.



If the center of the circle is  $(1, 3)$ , what is the equation of the edge of the circular pattern?

- \* A.  $(x-1)^2 + (y-3)^2 = 16$
- B.  $(x-1)^2 + (y-3)^2 = 25$
- C.  $(x-3)^2 + (y-1)^2 = 16$
- D.  $(x-3)^2 + (y-1)^2 = 25$

Use the diagram below to answer question 29.



29. Which statement would make lines  $j$  and  $k$  parallel?

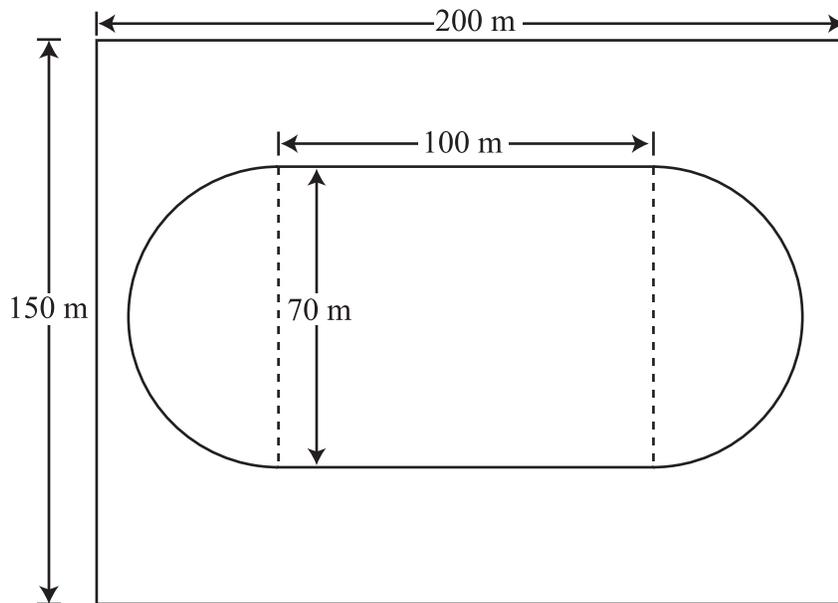
- A.  $\angle 1 \cong \angle 4$
- \* B.  $\angle 1 \cong \angle 5$
- C.  $\angle 3 \cong \angle 2$
- D.  $\angle 3 \cong \angle 8$

30. Line  $m$  intersects line  $n$  to form a  $90^\circ$  angle. The equation of line  $m$  is  $y = 7x - 4$ . If line  $n$  passes through  $(-7, -2)$ , what is the equation of line  $n$ ?

- A.  $y = 7x + 7$
- B.  $y = 7x + 47$
- \* C.  $y = -\frac{1}{7}x - 3$
- D.  $y = -\frac{1}{7}x - \frac{51}{7}$

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

- 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.

<b>Item A Scoring Rubric—2012 Geometry</b>
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Score	Description
<b>4</b>	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
<b>3</b>	The student earns 3 – 3½ points.
<b>2</b>	The student earns 2 – 2½ points.
<b>1</b>	The student earns ½ – 1½ points, or some minimal understanding is shown.
<b>0</b>	The student earns 0 points. No understanding is shown.
<b>B</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.)



## PART II MID-YEAR RELEASED GEOMETRY ITEMS

Part	Points
<b>2</b>	<p><b>2 points possible:</b></p> <p>2 points: Correct probability: <b>64</b> (rounded to the nearest whole %) (or correct probability based on an incorrect area in Part 1) Correct procedure is shown and/or explained Give credit for the following or equivalent:</p> <p style="text-align: center;">Ex: <math display="block">\frac{(200 \cdot 150) - (10,848)}{(200 \cdot 150)} = \frac{30,000 - 10,848}{30,000} = \frac{19,152}{30,000} = .6384 = 64\%</math> (Note: using value kept in calculator: 638384...)</p> <p style="text-align: center;">Ex: <math display="block">\frac{30,000 - 10,847}{30,000} = 64\% \quad (\text{shows subtraction and division})</math></p> <p style="text-align: center;">Ex: <math display="block">150 \times 200 = 30,000</math> <math display="block">\frac{19,152}{30,000} = 64\% \quad (\text{shows calculation of 30,000 and division})</math></p> <p style="text-align: center;">Ex: <math display="block">P(\text{inside running track}) = \frac{10,848}{30000} \approx 0.3616 \approx 36\%</math> <math display="block">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 (Value using <math>\pi</math> key: 3.84% or 63.8384...% using value kept in calculator Value using 3.14: 3.843%) Correct procedure is shown and/or explained</p> <p><b>OR</b></p> <p>1 point:</p> <ul style="list-style-type: none"> <li>• Correct probability: <b>64</b> (rounded to the nearest whole %) (or correct probability based on an incorrect area in Part 1) Procedure is incomplete or missing or</li> <li>• 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</li> </ul>

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

**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.

<b>Item B Scoring Rubric—2012 Geometry</b>
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Score	Description
<b>4</b>	The student earns 4 points. The response contains no incorrect work.
<b>3</b>	The student earns 3 – 3½ points.
<b>2</b>	The student earns 2 – 2½ points.
<b>1</b>	The student earns ½ – 1½ points, or some minimal understanding is shown. Ex: Unconnected correct points and labels for two to four triangles
<b>0</b>	The student earns 0 points. No understanding is shown.
<b>B</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  $(5, 2)$

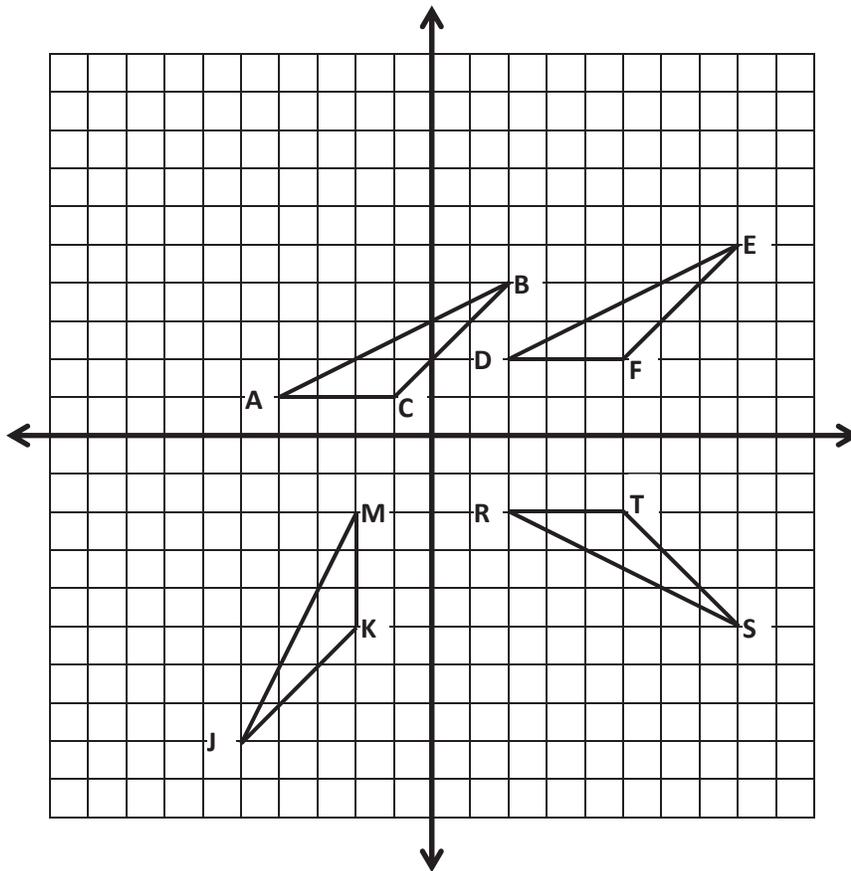
**Part 3:**  $\triangle RST$  : R  $(2, -2)$  S  $(8, -5)$  T  $(5, -2)$

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

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

### 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.*



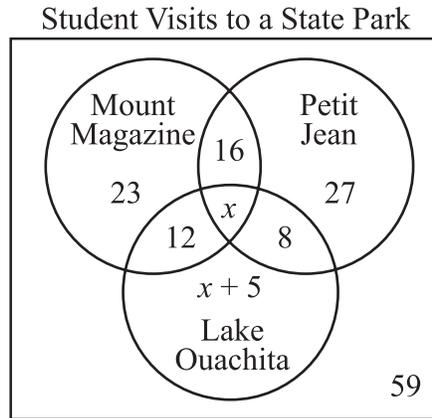
## PART II MID-YEAR RELEASED GEOMETRY ITEMS

4 points possible:

Part	Points
<b>1</b>	<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 (−4, 1), (2, 4), and (−1, 1)</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>
<b>2</b>	<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>\Delta DEF</math> based on an incorrect <math>\Delta</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>\Delta DEF</math> based on an incorrect <math>\Delta</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>
<b>3</b>	<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>\Delta RST</math> based on the <math>\Delta</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>\Delta RST</math> based on the <math>\Delta</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>
<b>4</b>	<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>\Delta MJK</math> based on the <math>\Delta</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>\Delta MJK</math> based on the <math>\Delta</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>

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

- 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 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>B</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.)

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

### 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:           <ul style="list-style-type: none"> <li>• Correct value: 16 Work is incomplete or missing or</li> <li>• Value is incorrect due to a calculation or <i>obvious</i> copy error Correct procedure is shown and/or explained or</li> <li>• Value of 75 (# not visiting any park, 59, is disregarded) Corresponding correct procedure is shown and/or explained</li> </ul> </p>
2	<p><b>2 points possible:</b></p> <p>2 points:           <ul style="list-style-type: none"> <li>• 3 Correct Answers: <b>Mount Magazine: 67</b> <b>Petit Jean: 67</b> <b>Lake Ouachita: 57</b></li> </ul> <p style="text-align: center;"><i>(or 3 correct answers, shown below, based on an incorrect x in Part 1):</i>            Mount Magazine: <b><math>x + 51</math></b>            Petit Jean: <b><math>x + 51</math></b>            Lake Ouachita: <b><math>2x + 25</math></b></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></p> <p style="text-align: center;">or</p> <ul style="list-style-type: none"> <li>• Answer of <math>x</math> from Part 1 with explanation Explanation includes explicit evidence that “each” is interpreted as meaning “all”</li> </ul> <p><b>OR</b></p> <p>1 point:           <ul style="list-style-type: none"> <li>• 3 Correct Answers: MM: 67, PJ: 67, LO: 57 <i>(or 3 correct answers based on an incorrect value for x in Part 1)</i> Work is incomplete or missing or</li> </ul> </p> </p>

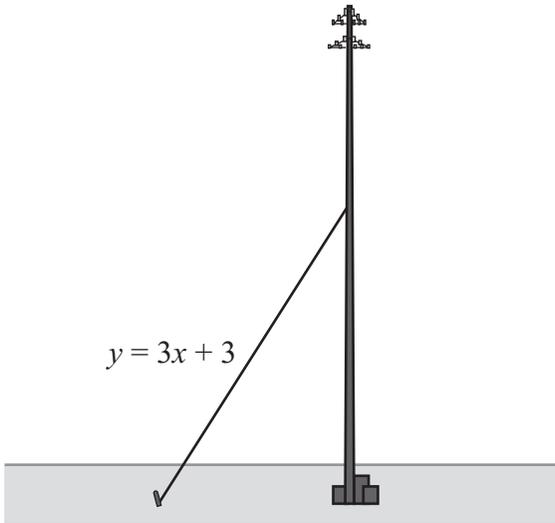
## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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, <math>2x + 150</math>, 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: <math>2x + 150</math>) 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: <math>2x + 91</math>) Corresponding correct procedure is shown and/or explained</li> </ul> </p>

## PART II SPRING RELEASED GEOMETRY ITEMS

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1. The line in the diagram below represents a cable used to support a cell-phone transmission tower.

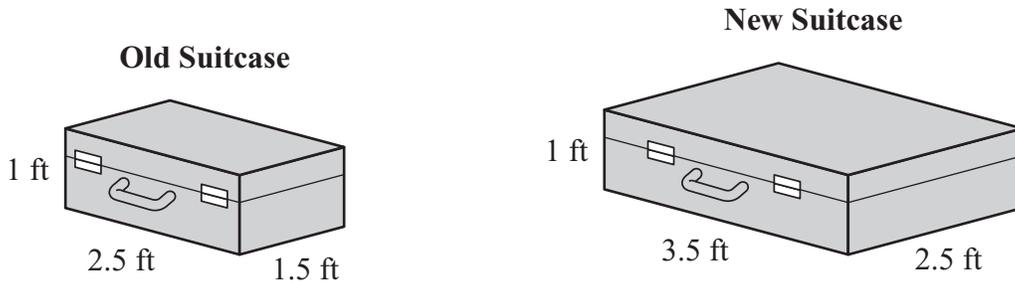


A second, longer cable will be attached to the tower above the first one. The two cables will be parallel to each other. Which could be the equation of the second cable?

- A.  $y = -\frac{1}{3}x + 6$
- B.  $y = -\frac{1}{3}x + 3$
- \* C.  $y = 3x + 6$
- D.  $y = 3x + 3$

## PART II SPRING RELEASED GEOMETRY ITEMS

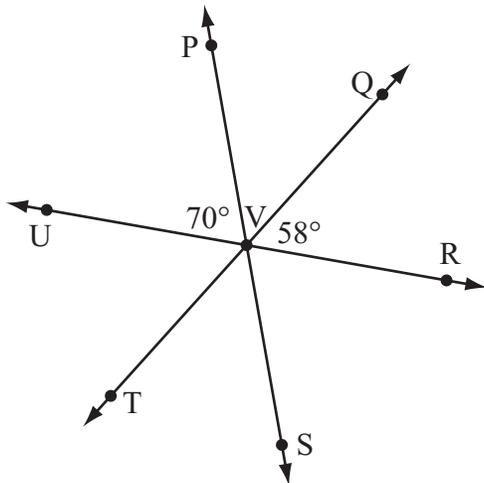
2. Hannah's old suitcase has a length of 2.5 feet, a width of 1.5 feet, and a height of 1 foot. Her new suitcase has a length of 3.5 feet, a width of 2.5 feet, and a height of 1 foot.



How many more cubic feet of volume does Hannah's new suitcase have than her old suitcase has?

- A.  $2 \text{ ft}^3$
- \* B.  $5 \text{ ft}^3$
- C.  $8.75 \text{ ft}^3$
- D.  $14 \text{ ft}^3$

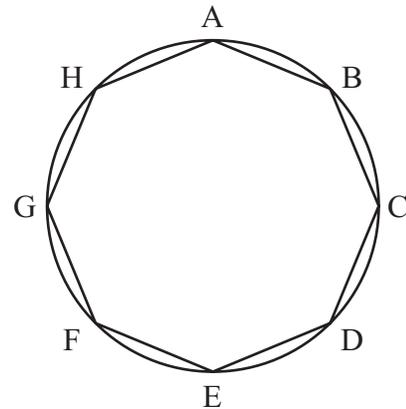
3.  $\overleftrightarrow{PS}$ ,  $\overleftrightarrow{QT}$ , and  $\overleftrightarrow{UR}$  intersect at point V.



What is  $m\angle UVS$ ?

- A.  $20^\circ$
- B.  $58^\circ$
- \* C.  $110^\circ$
- D.  $128^\circ$

4. The figure below shows an octagon inscribed within a circle.

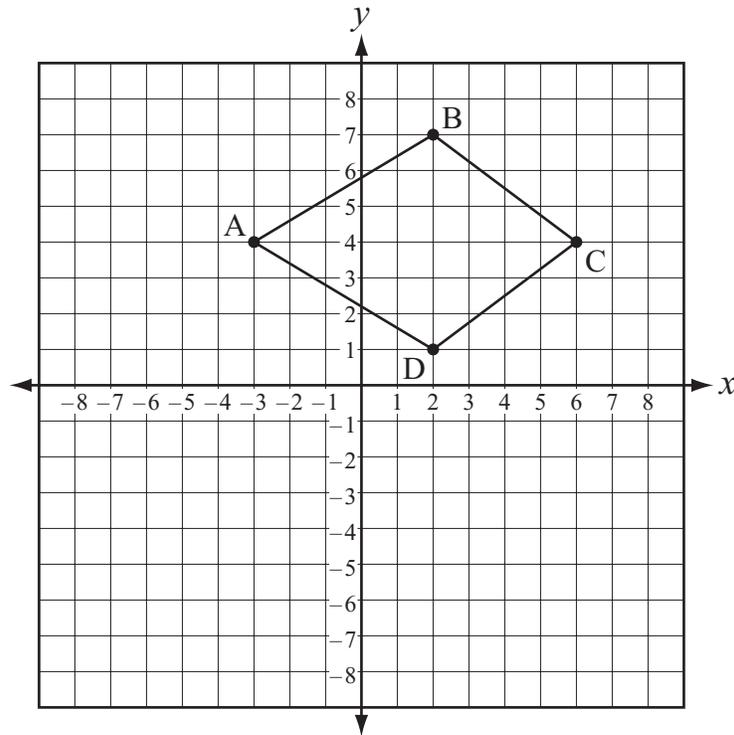


What is the  $m\widehat{AD}$ ?

- A.  $45^\circ$
- B.  $90^\circ$
- C.  $105^\circ$
- \* D.  $135^\circ$

## PART II SPRING RELEASED GEOMETRY ITEMS

5. The vertices of quadrilateral ABCD are plotted on the coordinate plane below.

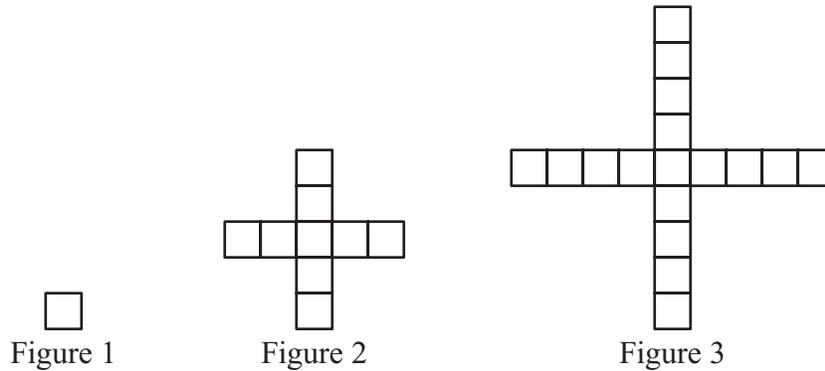


What is the **most** specific name of quadrilateral ABCD?

- \* A. kite
- B. square
- C. rhombus
- D. parallelogram

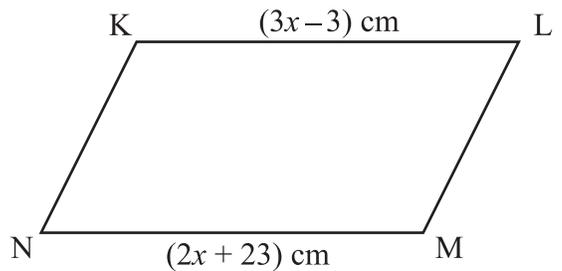
**PART II SPRING RELEASED GEOMETRY ITEMS**

6. If the pattern below continues, how many squares would appear in the 9<sup>th</sup> figure?



- A. 64 squares  
 \* B. 65 squares  
 C. 72 squares  
 D. 73 squares
- 
7. What is the midpoint of the line segment from  $(-10, -4)$  to  $(12, 2)$ ?
- \* A.  $(1, -1)$   
 B.  $(2, -2)$   
 C.  $(-4, 4)$   
 D.  $(-7, 7)$
8. Which of the following segment lengths can be used to form a triangle?
- A. 2 cm, 3 cm, 5 cm  
 B. 2 cm, 3 cm, 13 cm  
 C. 2 cm, 4 cm, 7 cm  
 \* D. 2 cm, 5 cm, 6 cm

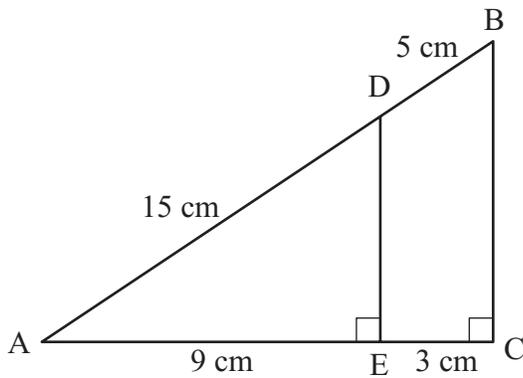
9. In parallelogram KLMN, what is the value of  $x$ ?



- A. 14  
 B. 20  
 \* C. 26  
 D. 32

PART II SPRING RELEASED GEOMETRY ITEMS

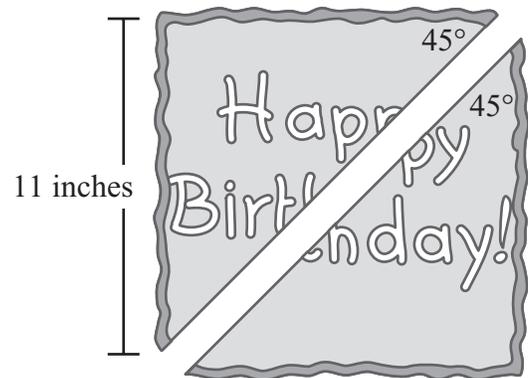
10. Look at the figure below.



What is  $\cos A$ ?

- A.  $\frac{1}{3}$
- B.  $\frac{2}{5}$
- \* C.  $\frac{3}{5}$
- D.  $\frac{3}{4}$
11. Which could be the measures of the angles of  $\triangle JKL$ ?
- A.  $m\angle J = 33^\circ, m\angle K = 56^\circ, m\angle L = 65^\circ$
- \* B.  $m\angle J = 35^\circ, m\angle K = 45^\circ, m\angle L = 100^\circ$
- C.  $m\angle J = 130^\circ, m\angle K = 144^\circ, m\angle L = 194^\circ$
- D.  $m\angle J = 180^\circ, m\angle K = 180^\circ, m\angle L = 180^\circ$

12. Sonalee cut her square birthday cake diagonally, making two triangular sections with 45 degree angles.

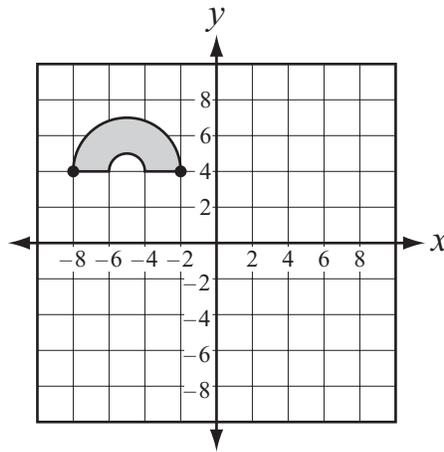


If the side of the cake is 11 inches, how long is the diagonal of the cake?

- A. 5.5
- B.  $\frac{11}{\sqrt{2}}$
- C. 11
- \* D.  $11\sqrt{2}$

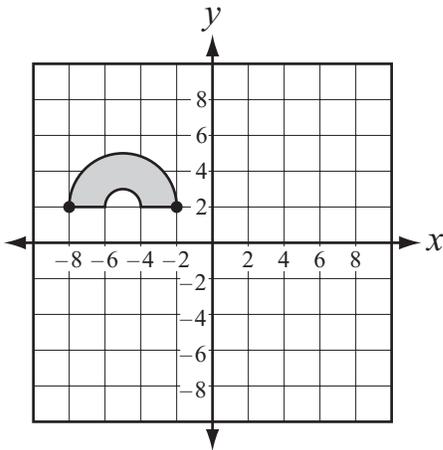
## PART II SPRING RELEASED GEOMETRY ITEMS

13. Look at the graph below.

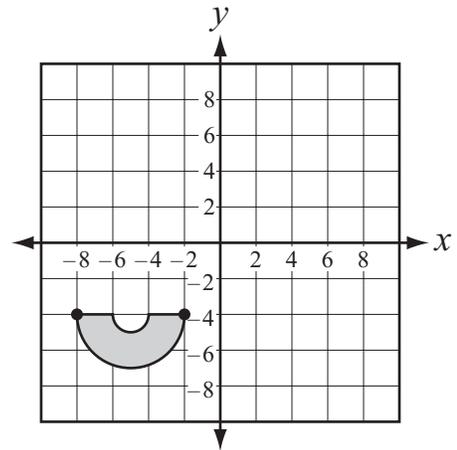


Which shows the figure below after being translated 2 units down and reflected over the  $x$ -axis?

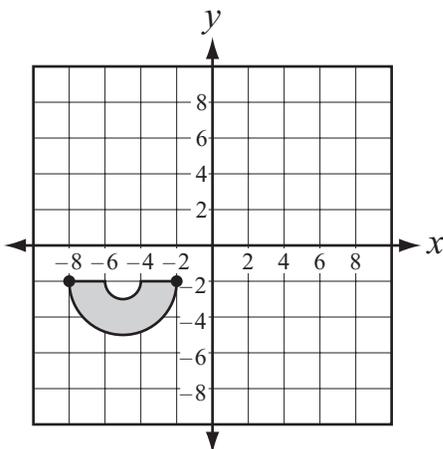
A.



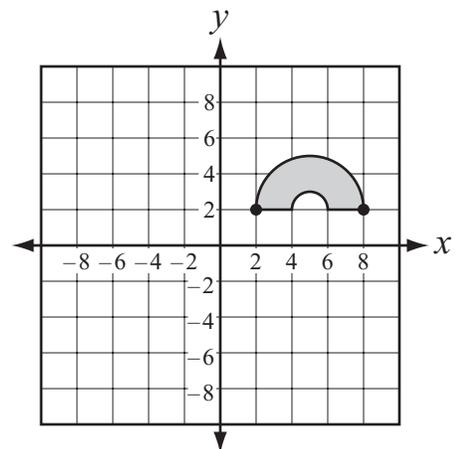
B.



\* C.



D.



## PART II SPRING RELEASED GEOMETRY ITEMS

14. What is the equation of a circle with center at  $(10, 8)$  and a radius of 12?

A.  $(x - 10)^2 - (y - 8)^2 = 144$

\* B.  $(x - 10)^2 + (y - 8)^2 = 144$

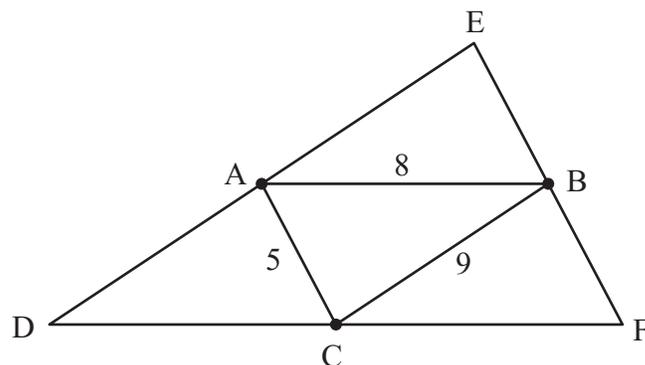
C.  $(x + 10)^2 - (y + 8)^2 = 144$

D.  $(x + 10)^2 + (y + 8)^2 = 144$

15. Brian, Paul, and Luke are brothers. Brian is 2 inches shorter than Paul. Paul is 5 inches taller than Luke. What can you conclude using deductive reasoning?

- \* A. Brian is 3 inches taller than Luke.
- B. Luke is 7 inches shorter than Brian.
- C. Brian is 1 inch taller than Luke.
- D. Paul is 3 inches taller than Brian.

16. In the figure below, point A is the midpoint of  $\overline{DE}$ , point B is the midpoint of  $\overline{EF}$ , and point C is the midpoint of  $\overline{DF}$ .



What is the perimeter of  $\triangle DEF$ ?

- A. 11 units
- B. 22 units
- \* C. 44 units
- D. 66 units

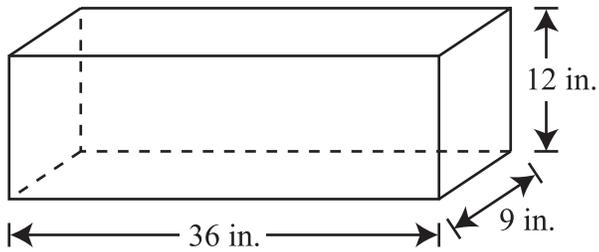
17. Which would be the equation of a line that passes through the point  $(3, 10)$  and is perpendicular to the line with equation

$$y = \frac{3}{4}x + 7?$$

- A.  $y = -\frac{4}{3}x + \frac{49}{3}$
- \* B.  $y = -\frac{4}{3}x + 14$
- C.  $y = \frac{3}{4}x + \frac{31}{4}$
- D.  $y = \frac{4}{3}x + 6$

PART II SPRING RELEASED GEOMETRY ITEMS

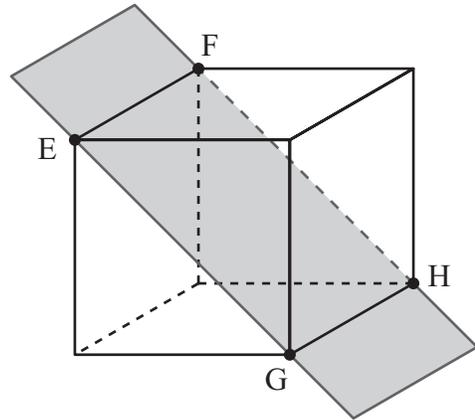
18. An aquarium in the shape of a rectangular prism, as shown below, is to be filled with water up to 2 inches from the top.



How many cubic inches of water will the aquarium contain?

- A. 648 in.<sup>3</sup>
- B. 1,548 in.<sup>3</sup>
- C. 2,380 in.<sup>3</sup>
- \* D. 3,240 in.<sup>3</sup>

19. A cube is cut by a plane that intersects corners E, F, G, and H as shown below.

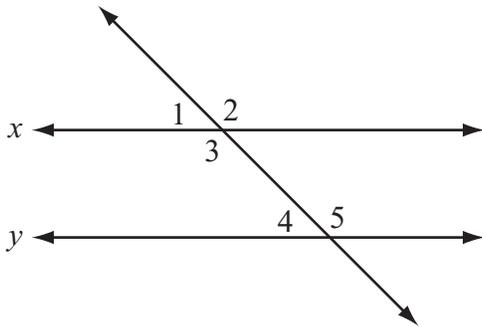


What shape represents the cross-section of this intersection?

- \* A. rectangle
- B. rhombus
- C. trapezoid
- D. square

PART II SPRING RELEASED GEOMETRY ITEMS

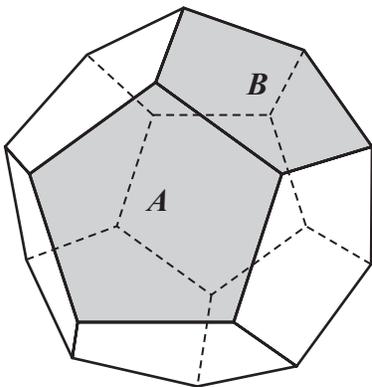
20. Look at the figure below.



Which would prove that line  $x$  is parallel to line  $y$ ?

- A.  $m\angle 1 + m\angle 2 = 180^\circ$
- B.  $m\angle 2 + m\angle 3 = 180^\circ$
- \* C.  $m\angle 3 + m\angle 4 = 180^\circ$
- D.  $m\angle 4 + m\angle 5 = 180^\circ$

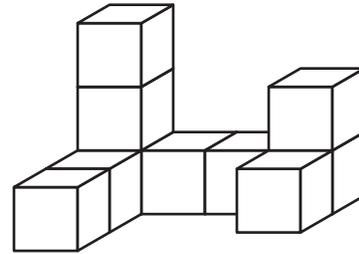
21. The figure below is a dodecahedron, one of the Platonic Solids. The area of face  $A$  is  $6 \text{ cm}^2$ .



What is the area of face  $B$ ?

- A.  $3 \text{ cm}^2$
- \* B.  $6 \text{ cm}^2$
- C.  $36 \text{ cm}^2$
- D.  $72 \text{ cm}^2$

22. Parker built the figure below with cubes.



Which of the following is the right view?

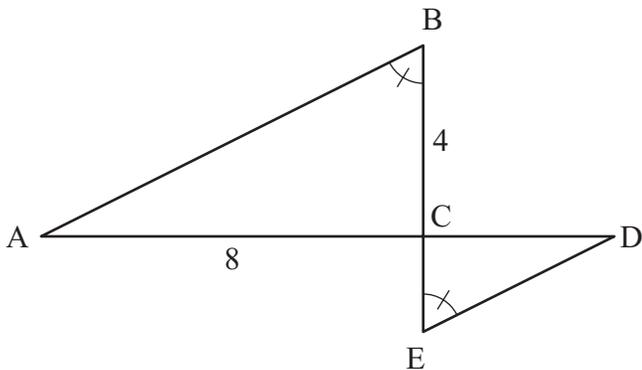
- A.
- B.
- \* C.
- D.

**PART II SPRING RELEASED GEOMETRY ITEMS**

23. An ocean aquarium is making an exhibit for its jellyfish. It will have two tanks in the shape of cylinders. Both cylinders will have the same radius, but one tank will be three times as tall as the other tank. What is the ratio of the volume of the short tank to the volume of the tall tank?

- \* A. 1:3
- B. 1:6
- C. 1:9
- D. 1:18

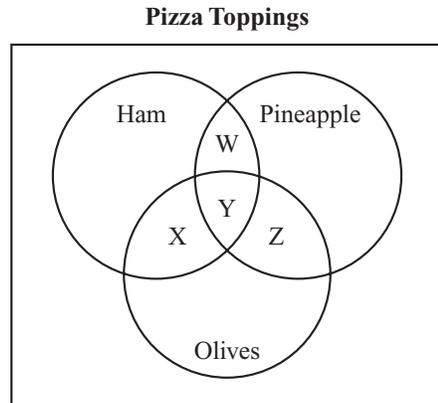
24. Look at the figure below.



If  $\overline{AD}$  is 12 inches, how many inches is  $\overline{CE}$ ?

- A. 1
- \* B. 2
- C. 6
- D. 8

25. Darius likes his pizza to have pineapple and olives but not ham.

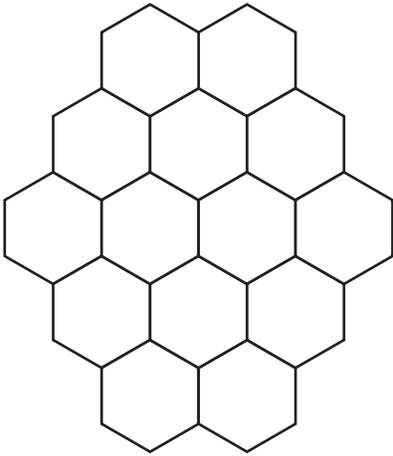


In the Venn diagram above, which section represents what Darius likes on his pizza?

- A. W
- B. X
- C. Y
- \* D. Z

## PART II SPRING RELEASED GEOMETRY ITEMS

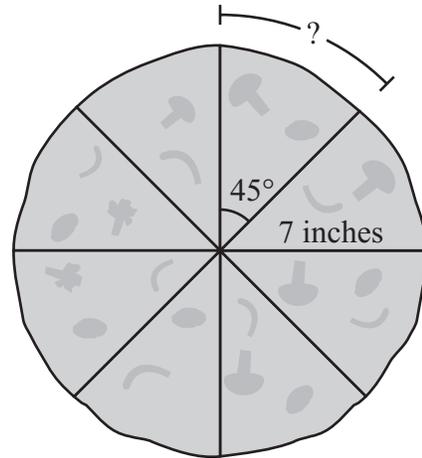
26. Lori makes a tessellation using only exact copies of a single shape. The tessellation is shown below.



Why is this figure considered a tessellation?

- \* A. because the figure has no gaps or overlaps
- B. because only a hexagon can make a tessellation
- C. because all polygons can be used to make tessellations
- D. because tessellations can only be made of a single, repeated shape

27. Tong ordered a pizza with a radius of 7 inches. Each slice of pizza has an angle of  $45^\circ$ , as shown below.

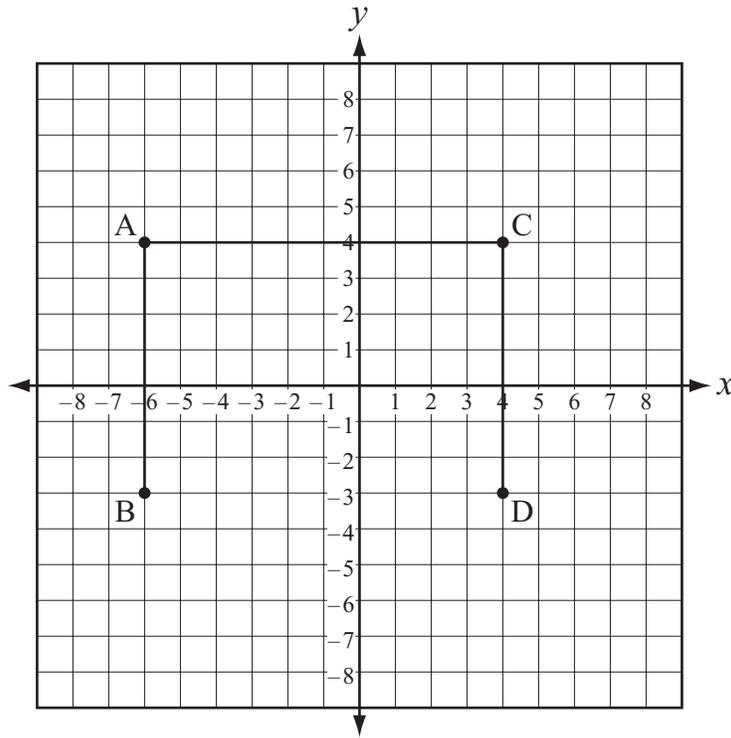


What is the arc length of one slice of pizza?  
Use  $\pi = 3.14$  and round to the nearest hundredth.

- A. 2.75 inches
- B. 3.86 inches
- \* C. 5.50 inches
- D. 19.23 inches

## PART II SPRING RELEASED GEOMETRY ITEMS

28. Platform  $\overline{AC}$  is supported by beams  $\overline{AB}$  and  $\overline{CD}$ . Jay wants to add a third beam to help support the platform. This beam will meet  $\overline{AC}$  at its midpoint, forming a right angle.



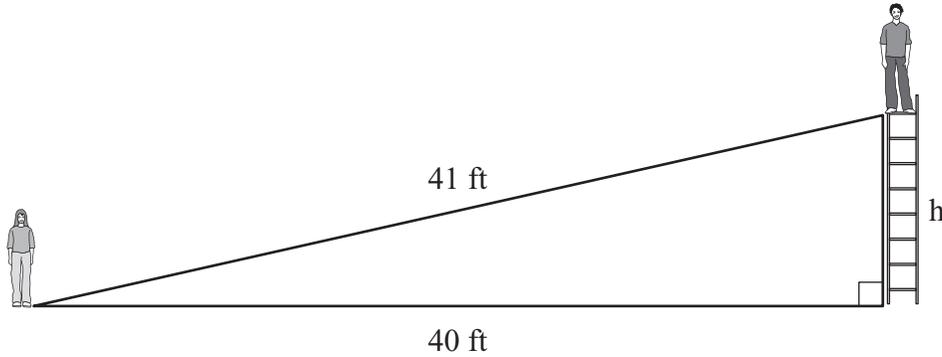
Which of the following is the equation of the line that contains the third beam?

- A.  $x = -6$
- \* B.  $x = -1$
- C.  $x = 0$
- D.  $x = 4$

## PART II SPRING RELEASED GEOMETRY ITEMS

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29. Rodrigo climbs a ladder to hang a banner over a doorway. Gabriela stands on the ground 41 feet from him, giving him directions. She is standing 40 feet from the foot of the ladder.



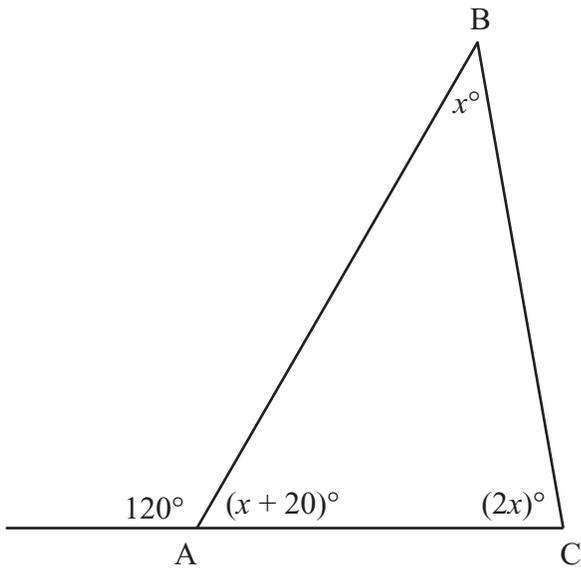
What is the height of the ladder?

- \* A. 9 ft
- B. 40.5 ft
- C. 57 ft
- D. 81 ft

PART II SPRING RELEASED GEOMETRY ITEMS

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30. In  $\triangle ABC$  below, the  $m\angle A = (x + 20)^\circ$ , the  $m\angle B = x^\circ$ , and the  $m\angle C = (2x)^\circ$ . The exterior angle at A measures  $120^\circ$ .

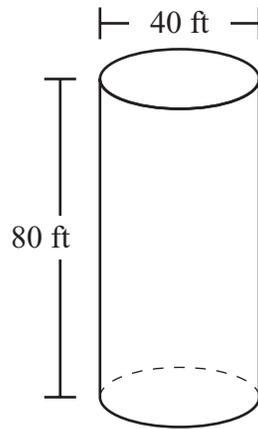


What is the value of  $x$ ?

- A. 20
- \* B. 40
- C. 60
- D. 80

## PART II SPRING RELEASED GEOMETRY ITEMS

- A. 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 A 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.)

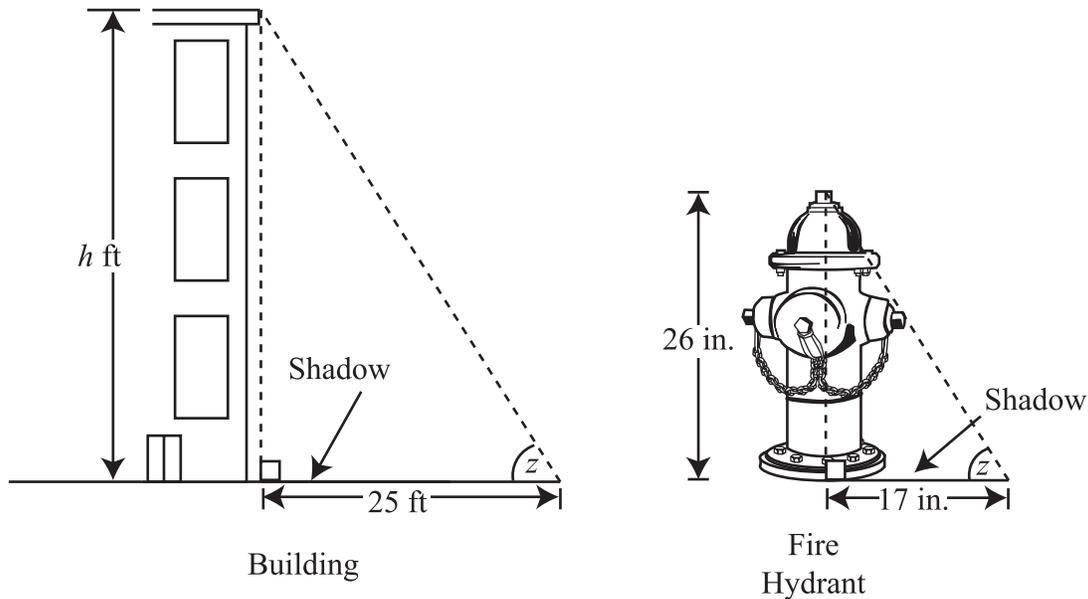


## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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 display="block">r = \sqrt{6400} = 80</math> <math display="block">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 display="block">r = \sqrt{6400} = 80</math> <math display="block">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>

## PART II SPRING RELEASED GEOMETRY ITEMS

- B.** 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 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.
0	The student earns 0 points. No understanding is shown.
<b>B</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.)

## PART II SPRING RELEASED GEOMETRY ITEMS

### 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:

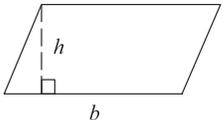
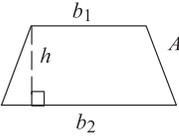
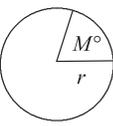
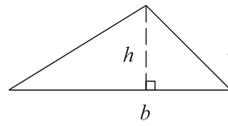
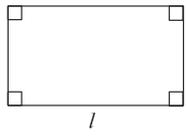
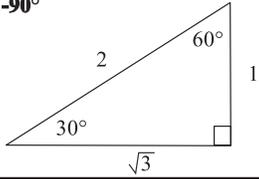
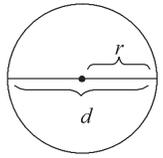
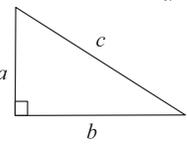
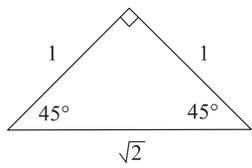
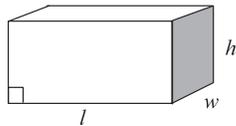
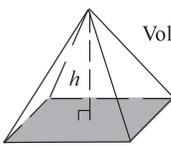
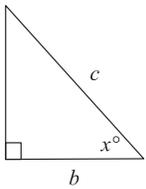
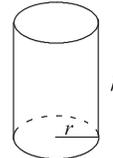
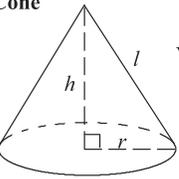
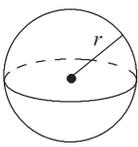
Part	Points
<b>1</b>	<p><b>2 points possible:</b></p> <p>2 points: Correct answer of 38 (feet)            Correct procedure shown and/or explained            Give credit for the following or equivalent:</p> <p>Ex: <math>\frac{26}{17} = 1.52941\dots \approx 1.53</math></p> $\frac{h}{25} = 1.53 \Rightarrow h = 25 \times 1.53 = 38.25 \approx 38\text{ft}$ <p>Ex: <math>\frac{h}{26} = \frac{25}{17}</math>      <math>25 \times 26 = 650</math>      <math>\frac{650}{17} = 38.23529\dots \approx 38'</math></p> <p>Ex: (student converts to inches and converts back to feet)  <math>25' \times 12" = 300"</math></p> $\frac{300}{h} = \frac{17}{26} \quad 17h = 26 \times 300 = 7800 \quad h = \frac{7800}{17} = 458.82352\dots$ $\frac{458.82352\dots}{12} = 38.23529\dots \approx 38'$ <p>Ex: (student converts to feet)</p> $\frac{17''}{12''} = 1.41\bar{6}' \quad \frac{26''}{12''} = 2.1\bar{6}' \quad (\text{not required})$ $\frac{1.41\bar{6}}{2.1\bar{6}} = \frac{25}{x} \quad x = \frac{2.1\bar{6} \times 25}{1.41\bar{6}} = \frac{54.1\bar{6}}{1.41\bar{6}} = 38.23529\dots \approx 38'$ <p>Ex: <math>z_{\text{hydant}} = \tan^{-1} \frac{26}{17} = 56.82148\dots</math>      <math>\tan 56.82\dots = \frac{h}{25}</math></p> $h = 25 \times \tan 56.82\dots = 38.23529\dots \approx 38'$ <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>

## PART II SPRING RELEASED GEOMETRY ITEMS

Part	Points
<b>2</b>	<p><b>2 points possible:</b></p> <p>2 points: Correct answer of 57 (degrees)  <i>(or correct angle based on an incorrect height in Part 1)</i>            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 \quad (\text{use } 38.23\dots \text{ value in calculator})</math></p> <p>Ex: <math>z = \tan^{-1}\left(\frac{38}{25}\right) = 56.65929\dots \approx 57^\circ \quad (\text{use } 38)</math></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>

# PART II END-OF-COURSE MATHEMATICS REFERENCE SHEET

## End-of-Course Mathematics Reference Sheet

<p><b>Parallelogram</b></p>  <p><math>P =</math> sum of all sides <math>A = bh</math></p>	<p><b>Trapezoid</b></p>  <p><math>A = \frac{h(b_1 + b_2)}{2}</math></p>	<p><b>Arc and Sector</b></p>  <p>Arc Length = <math>\left(\frac{M}{360}\right) \times 2\pi r</math> Sector area = <math>\left(\frac{M}{360}\right) \times \pi r^2</math></p>
<p><b>Triangle</b></p>  <p><math>P =</math> sum of all sides <math>A = \frac{bh}{2}</math></p>	<p><b>Rectangle</b></p>  <p><math>P = 2l + 2w</math> <math>A = lw</math></p>	<p><b>30° -60° -90°</b></p> 
<p><b>Circle</b></p>  <p><math>C = 2\pi r</math> <math>C = \pi d</math> <math>A = \pi r^2</math> <math>\pi \approx 3.14</math></p>	<p><b>Pythagorean Theorem</b></p>  <p><math>a^2 + b^2 = c^2</math></p>	<p><b>45° -45° -90°</b></p> 
<p><b>Rectangular Solid</b></p>  <p>Volume = <math>lwh</math> Surface area = <math>2lw + 2lh + 2wh</math></p>	<p><b>Pyramid</b></p>  <p><math>B =</math> area of base (shaded) Volume = <math>\frac{Bh}{3}</math></p>	<p><b>Trigonometric Ratios</b></p>  <p><math>\sin x^\circ = \frac{a}{c}</math> <math>\cos x^\circ = \frac{b}{c}</math> <math>\tan x^\circ = \frac{a}{b}</math></p>
<p><b>Cylinder</b></p>  <p>Volume = <math>\pi r^2 h</math> Surface area = <math>2\pi rh + 2\pi r^2</math></p>	<p><b>Cone</b></p>  <p><math>l =</math> slant height Volume = <math>\frac{\pi r^2 h}{3}</math> Surface area = <math>\pi rl + \pi r^2</math></p>	<p><b>Sphere</b></p>  <p>Volume = <math>\frac{4\pi r^3}{3}</math> Surface area = <math>4\pi r^2</math></p>

Miscellaneous Formulas	Area of an equilateral triangle	$A = \frac{s^2\sqrt{3}}{4}$ $s =$ length of a side
	Distance	rate $\times$ time
	Interest	principal $\times$ rate $\times$ time in years
	Sum of the angles of a polygon having $n$ sides	$(n - 2)180^\circ$
	Distance between points on a coordinate plane	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
	Midpoint	$\left(\frac{x_2 + x_1}{2}, \frac{y_2 + y_1}{2}\right)$
	Slope of a nonvertical line (where $x_2 \neq x_1$ )	$m = \frac{y_2 - y_1}{x_2 - x_1}$
	Slope intercept (where $m =$ slope, $b =$ intercept)	$y = mx + b$
	Last term of an arithmetic series	$a_n = a + (n - 1)d$
	Last term of a geometric series (where $n \geq 1$ )	$a_n = ar^{n-1}$
	Quadratic formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
	Area of a square	$A = s^2$
Volume of a cube	$V = s^3$	
Area of a regular polygon	$A = \frac{1}{2}ap$ $a =$ apothem, $p =$ perimeter	

## PART III CURRICULUM FRAMEWORK

### The Arkansas Geometry Mathematics Curriculum Framework\*

Strands	Content Standards	Student Learning Expectations
1. LANGUAGE OF GEOMETRY (LG)	1. Students will develop the language of geometry including specialized vocabulary, reasoning, and application of theorems, properties, and postulates.	<ol style="list-style-type: none"> <li>1. Define, compare, and contrast inductive reasoning and deductive reasoning for making predictions based on real-world situations.               <ul style="list-style-type: none"> <li>• Venn diagrams</li> <li>• matrix logic</li> <li>• conditional statements (statement, inverse, converse, and contrapositive)</li> <li>• figural patterns</li> </ul> </li> <li>2. Represent points, lines, and planes pictorially with proper identification, as well as basic concepts derived from these undefined terms, such as segments, rays, and angles.</li> <li>3. Describe relationships derived from geometric figures or figural patterns.</li> <li>4. Apply, with and without appropriate technology, definitions, theorems, properties, and postulates related to such topics as complementary, supplementary, vertical angles, linear pairs, and angles formed by perpendicular lines.</li> <li>5. Explore, with and without proper technology, the relationship between angles formed by two lines cut by a transversal to justify when lines are parallel.</li> <li>6. Give justification for conclusions reached by deductive reasoning. State and prove key basic theorems in geometry (i.e., the Pythagorean theorem, the sum of the measures of the angles of a triangle is <math>180^\circ</math>, and the line joining the midpoints of two sides of a triangle is parallel to the third side and half its length).</li> </ol>
2. TRIANGLES (T)	2. Students will identify and describe types of triangles and their special segments. They will use logic to apply the properties of congruence, similarity, and inequalities. The students will apply the Pythagorean Theorem and trigonometric ratios to solve problems in real-world situations.	<ol style="list-style-type: none"> <li>1. Apply congruence (SSS ...) and similarity (AA ...) correspondences and properties of figures to find missing parts of geometric figures, and provide logical justification.</li> <li>2. Investigate the measures of segments to determine the existence of triangles (triangle inequality theorem).</li> <li>3. Identify and use the special segments of triangles (altitude, median, angle bisector, perpendicular bisector, and midsegment) to solve problems.</li> <li>4. Apply the Pythagorean Theorem and its converse in solving practical problems.</li> <li>5. Use the special right triangle relationships (<math>30^\circ</math>-<math>60^\circ</math>-<math>90^\circ</math> and <math>45^\circ</math>-<math>45^\circ</math>-<math>90^\circ</math>) to solve problems.</li> <li>6. Use trigonometric ratios (sine, cosine, tangent) to determine lengths of sides and measures of angles in right triangles, including angles of elevation and angles of depression.</li> <li>7. Use similarity of right triangles to express the sine, cosine, and tangent of an angle, in a right triangle, as a ratio of given lengths of sides.</li> </ol>

\*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the 2012 Mid-Year and Spring End-of-Course Geometry Examinations.

## PART III CURRICULUM FRAMEWORK

### The Arkansas Geometry Mathematics Curriculum Framework\*

Strands	Content Standards	Student Learning Expectations
3. MEASUREMENT (M)	3. Students will measure and compare, while using appropriate formulas, tools, and technology, to solve problems dealing with length, perimeter, area, and volume.	<ol style="list-style-type: none"> <li>1. Calculate probabilities arising in geometric contexts. (Ex. Find the probability of hitting a particular ring on a dartboard.)</li> <li>2. Apply, using appropriate units, appropriate formulas (area, perimeter, surface area, volume) to solve application problems involving polygons, prisms, pyramids, cones, cylinders, and spheres, as well as composite figures, expressing solutions in both exact and approximate forms.</li> <li>3. Relate changes in the measurement of one attribute of an object to changes in other attributes. (Ex. How does changing the radius or height of a cylinder affect its surface area or volume?)</li> <li>4. Use (given similar geometric objects) proportional reasoning to solve practical problems (including scale drawings).</li> <li>5. Identify and apply properties of, and theorems about, parallel and perpendicular lines to prove other theorems and perform basic Euclidean constructions.</li> </ol>
4. RELATIONSHIPS BETWEEN TWO- AND THREE-DIMENSIONS (R)	4. Students will analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	<ol style="list-style-type: none"> <li>1. Explore and verify the properties of quadrilaterals.</li> <li>2. Solve problems using properties of polygons.               <ul style="list-style-type: none"> <li>• sum of the measures of the interior angles of a polygon</li> <li>• interior and exterior angle measure of a regular polygon or irregular polygon</li> <li>• number of sides or angles of a polygon</li> </ul> </li> <li>3. Identify and explain why figures tessellate.</li> <li>4. Identify the attributes of the five Platonic Solids.</li> <li>5. Investigate and use the properties of angles (central and inscribed), arcs, chords, tangents, and secants to solve problems involving circles.</li> <li>6. Solve problems using inscribed and circumscribed figures.</li> <li>7. Use orthographic drawings (top, front, side) and isometric drawings (corner) to represent three-dimensional objects.</li> <li>8. Draw, examine, and classify cross-sections of three-dimensional objects.</li> <li>9. Explore non-Euclidean geometries, such as spherical geometry, and identify its unique properties which result from a change in the parallel postulate.</li> </ol>
5. COORDINATE GEOMETRY AND TRANSFORMATIONS (CGT)	5. Students will specify locations, apply transformations, and describe relationships using coordinate geometry.	<ol style="list-style-type: none"> <li>1. Use coordinate geometry to find the distance between two points, the midpoint of a segment, and the slopes of parallel, perpendicular, horizontal, and vertical lines.</li> <li>2. Write the equation of a line parallel to a line through a given point not on the line.</li> <li>3. Write the equation of a line perpendicular to a line through a given point.</li> <li>4. Write the equation of the perpendicular bisector of a line segment.</li> <li>5. Determine, given a set of points, the type of figure based on its properties (parallelogram, isosceles triangle, trapezoid).</li> <li>6. Write, in standard form, the equation of a circle, given a graph on a coordinate plane or the center and radius of a circle.</li> <li>7. Draw and interpret the results of transformations and successive transformations on figures in the coordinate plane.               <ul style="list-style-type: none"> <li>• translations</li> <li>• reflections</li> <li>• rotations (90°, 180°, clockwise and counterclockwise about the origin)</li> <li>• dilations (scale factor)</li> </ul> </li> </ol>

\*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the 2012 Mid-Year and Spring End-of-Course Geometry Examinations.

## PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

### Mid-Year Released Geometry Items\*

Strands	Content Standards
1— LANGUAGE OF GEOMETRY (LG)	1. Students will develop the language of geometry including specialized vocabulary, reasoning, and application of theorems, properties, and postulates.
2— TRIANGLES (T)	2. Students will identify and describe types of triangles and their special segments. They will use logic to apply the properties of congruence, similarity, and inequalities. The students will apply the Pythagorean Theorem and trigonometric ratios to solve problems in real-world situations.
3— MEASUREMENT (M)	3. Students will measure and compare, while using appropriate formulas, tools, and technology, to solve problems dealing with length, perimeter, area, and volume.
4— RELATIONSHIPS BETWEEN TWO- AND THREE-DIMENSIONS (R)	4. Students will analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
5— COORDINATE GEOMETRY AND TRANSFORMATIONS (CGT)	5. Students will specify locations, apply transformations, and describe relationships using coordinate geometry.

Item	Strand	Content Standard	Student Learning Expectation
1	T	2	6
2	LG	1	4
3	CGT	5	7
4	CGT	5	3
5	T	2	1
6	LG	1	4
7	R	4	3
8	T	2	3
9	R	4	9
10	LG	1	3
11	CGT	5	7
12	M	3	3
13	M	3	2
14	LG	1	1
15	LG	1	6
16	CGT	5	5
17	R	4	1
18	T	2	2
19	LG	1	3
20	T	2	5
21	M	3	4
22	R	4	2
23	CGT	5	1
24	T	2	4
25	LG	1	2
26	R	4	7
27	M	3	3
28	CGT	5	6
29	LG	1	5
30	CGT	5	3
A	M	3	1
B	CGT	5	7
C	LG	1	1

\*Only the predominant Strand, Content Standard, and Student Learning Expectation are listed for the Geometry items.

## PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

### Spring Released Geometry Items\*

Strands	Content Standards
1— LANGUAGE OF GEOMETRY (LG)	1. Students will develop the language of geometry including specialized vocabulary, reasoning, and application of theorems, properties, and postulates.
2— TRIANGLES (T)	2. Students will identify and describe types of triangles and their special segments. They will use logic to apply the properties of congruence, similarity, and inequalities. The students will apply the Pythagorean Theorem and trigonometric ratios to solve problems in real-world situations.
3— MEASUREMENT (M)	3. Students will measure and compare, while using appropriate formulas, tools, and technology, to solve problems dealing with length, perimeter, area, and volume.
4— RELATIONSHIPS BETWEEN TWO- AND THREE-DIMENSIONS (R)	4. Students will analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
5— COORDINATE GEOMETRY AND TRANSFORMATIONS (CGT)	5. Students will specify locations, apply transformations, and describe relationships using coordinate geometry.

Item	Strand	Content Standard	Student Learning Expectation
1	CGT	5	2
2	M	3	3
3	LG	1	4
4	R	4	6
5	CGT	5	5
6	LG	1	3
7	CGT	5	1
8	T	2	2
9	R	4	1
10	T	2	7
11	LG	1	6
12	T	2	5
13	CGT	5	7
14	CGT	5	6
15	LG	1	6
16	T	2	3
17	CGT	5	3
18	M	3	2
19	R	4	8
20	LG	1	5
21	R	4	4
22	R	4	7
23	M	3	3
24	T	2	1
25	LG	1	1
26	R	4	3
27	R	4	5
28	CGT	5	4
29	T	2	4
30	R	4	2
A	M	3	3
B	T	2	6

\*Only the predominant Strand, Content Standard, and Student Learning Expectation are listed for the Geometry items.

## PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

### Mid-Year Non-Released Geometry Items\*

Strands	Content Standards
1— LANGUAGE OF GEOMETRY (LG)	1. Students will develop the language of geometry including specialized vocabulary, reasoning, and application of theorems, properties, and postulates.
2— TRIANGLES (T)	2. Students will identify and describe types of triangles and their special segments. They will use logic to apply the properties of congruence, similarity, and inequalities. The students will apply the Pythagorean Theorem and trigonometric ratios to solve problems in real-world situations.
3— MEASUREMENT (M)	3. Students will measure and compare, while using appropriate formulas, tools, and technology, to solve problems dealing with length, perimeter, area, and volume.
4— RELATIONSHIPS BETWEEN TWO- AND THREE-DIMENSIONS (R)	4. Students will analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
5— COORDINATE GEOMETRY AND TRANSFORMATIONS (CGT)	5. Students will specify locations, apply transformations, and describe relationships using coordinate geometry.

Item	Strand	Content Standard	Student Learning Expectation
1	R	4	7
2	M	3	4
3	M	3	3
4	R	4	5
5	CGT	5	1
6	T	2	5
7	CGT	5	6
8	M	3	5
9	T	2	4
10	R	4	8
11	CGT	5	2
12	T	2	6
13	M	3	1
14	R	4	3
15	M	3	2
16	R	4	2
17	M	3	1
18	LG	1	6
19	R	4	6
20	CGT	5	4
21	LG	1	5
22	T	2	7
23	LG	1	2
24	R	4	4
25	CGT	5	5
26	M	3	5
27	T	2	1
28	M	3	4
29	LG	1	1
30	T	2	3
A	R	4	7
B	T	2	4

\*Only the predominant Strand, Content Standard, and Student Learning Expectation are listed for the Geometry items.

## PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

### Spring Non-Released Geometry Items\*

Strands	Content Standards
1— LANGUAGE OF GEOMETRY (LG)	1. Students will develop the language of geometry including specialized vocabulary, reasoning, and application of theorems, properties, and postulates.
2— TRIANGLES (T)	2. Students will identify and describe types of triangles and their special segments. They will use logic to apply the properties of congruence, similarity, and inequalities. The students will apply the Pythagorean Theorem and trigonometric ratios to solve problems in real-world situations.
3— MEASUREMENT (M)	3. Students will measure and compare, while using appropriate formulas, tools, and technology, to solve problems dealing with length, perimeter, area, and volume.
4— RELATIONSHIPS BETWEEN TWO- AND THREE-DIMENSIONS (R)	4. Students will analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
5— COORDINATE GEOMETRY AND TRANSFORMATIONS (CGT)	5. Students will specify locations, apply transformations, and describe relationships using coordinate geometry.

Item	Strand	Content Standard	Student Learning Expectation
1	M	3	1
2	CGT	5	2
3	R	4	9
4	CGT	5	1
5	T	2	3
6	R	4	1
7	M	3	4
8	LG	1	4
9	T	2	2
10	LG	1	2
11	M	3	4
12	LG	1	3
13	M	3	4
14	T	2	5
15	LG	1	2
16	CGT	5	5
17	CGT	5	7
18	R	4	2
19	T	2	1
20	CGT	5	6
21	R	4	4
22	M	3	5
23	M	3	2
24	T	2	4
25	M	3	2
26	M	3	3
27	T	2	6
28	LG	1	5
29	M	3	5
30	LG	1	1
A	LG	1	1
B	R	4	4
C	CGT	5	7

\*Only the predominant Strand, Content Standard, and Student Learning Expectation are listed for the Geometry items.





# ACTAAP

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