



Arkansas Comprehensive Testing, Assessment, and Accountability Program

**RELEASED ITEM**  
**BOOKLET**  
**Geometry**  
**End-of-Course Examinations**  
**2010-2011 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 2011 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 2010-2011 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 57 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, there may be many cases in which 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 comprises 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 food company packages soup in a cylindrical can with radius 4 cm and height 12 cm. What is the surface area of the can? Use 3.14 for  $\pi$ .

A. 251.20 cm<sup>2</sup>  
B. 351.68 cm<sup>2</sup>  
\*C. 401.92 cm<sup>2</sup>  
D. 602.88 cm<sup>2</sup>

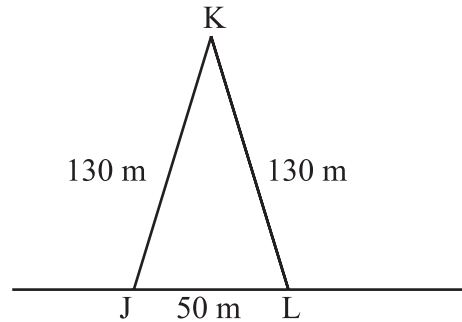
2. What is the distance between the points with coordinates (10, 3) and (2, -1)?

A.  $\sqrt{68}$  grid units  
\*B.  $\sqrt{80}$  grid units  
C.  $\sqrt{82}$  grid units  
D.  $\sqrt{122}$  grid units

3. One angle of a parallelogram measures 50°. What are the measures of the other three angles?

A. 40°, 40°, 50°  
B. 50°, 50°, 50°  
C. 80°, 90°, 90°  
\*D. 50°, 130°, 130°

4. The figure below shows the profile of a proposed tower.

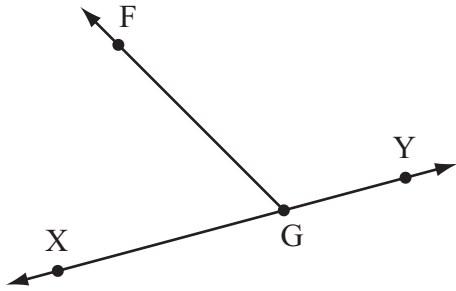


The architectural plans include a midsegment connecting JK and LK. What will be the length of the midsegment?

- \*A. 25 m  
B. 50 m  
C. 65 m  
D. 80 m
5. Helen needs to mail supplies to her daughter. She has two boxes that she can use to pack the supplies. One box has a length of 9.0 inches, a width of 5.5 inches, and a height of 4.0 inches. The second box has the same length, twice the width, and its height is one inch less than the height of the first box. How much more space does she have if she uses the second box instead of the first box?
- \*A. 99.0 cubic inches  
B. 103.0 cubic inches  
C. 198.0 cubic inches  
D. 297.0 cubic inches

PART II MID-YEAR RELEASED GEOMETRY ITEMS

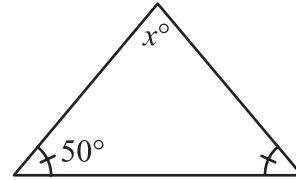
6.  $\overleftrightarrow{XY}$  passes through the endpoint of  $\overline{GF}$ .



How many angles measuring less than  $180^\circ$  are shown?

- A. 1
- \*B. 2
- C. 3
- D. 4

7. In the figure below, what is the value of  $x$ ?

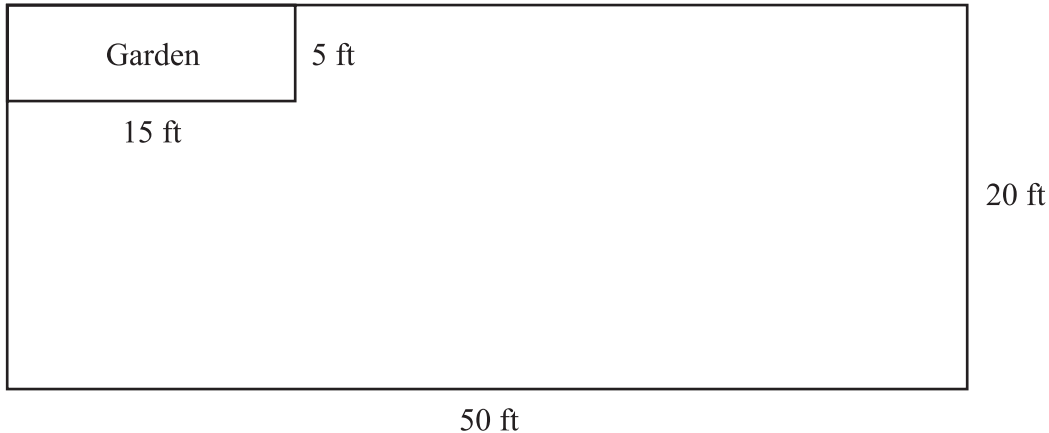


- A. 40
- B. 45
- C. 65
- \*D. 80

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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8. Hank delivers the newspaper to Mrs. Fredericks. She has a rectangular front yard with a rectangular garden, as shown below.



Hank throws the newspaper from his bicycle to Mrs. Fredericks' front yard. Assuming the newspaper is equally likely to land anywhere in Mrs. Fredericks' front yard, what is the probability that it does **not** land in her garden?

- A. 7.5%
- B. 13.3%
- C. 71.4%
- \*D. 92.5%
- 
9. Which equation represents the line that passes through the point  $(0, 0)$  and is perpendicular to the line  $y = -3x$ ?

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

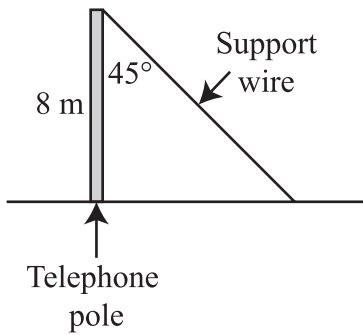


PART II MID-YEAR RELEASED GEOMETRY ITEMS

10. Which Platonic solid has regular pentagons as faces?

- \*A. dodecahedron
- B. icosahedron
- C. tetrahedron
- D. octahedron

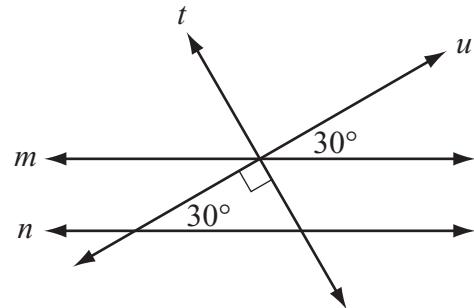
11. A support wire for a telephone pole will be dropped from the top of the pole to the ground at an angle of  $45^\circ$ .



How long must the wire be? Round your answer to the nearest tenth.

- A. 6.9 m
- \*B. 11.3 m
- C. 13.9 m
- D. 16.0 m

12. Which **best** describes the relationship between lines  $m$  and  $n$ ?

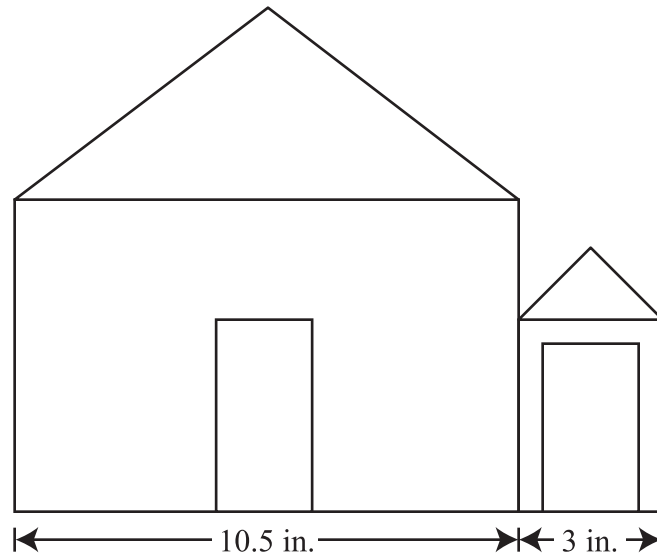


- A. They are skew.
- \*B. They are parallel.
- C. They are transversal.
- D. They are perpendicular.

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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13. Tim is designing his house. His outline of the front of the house and garage is shown below.

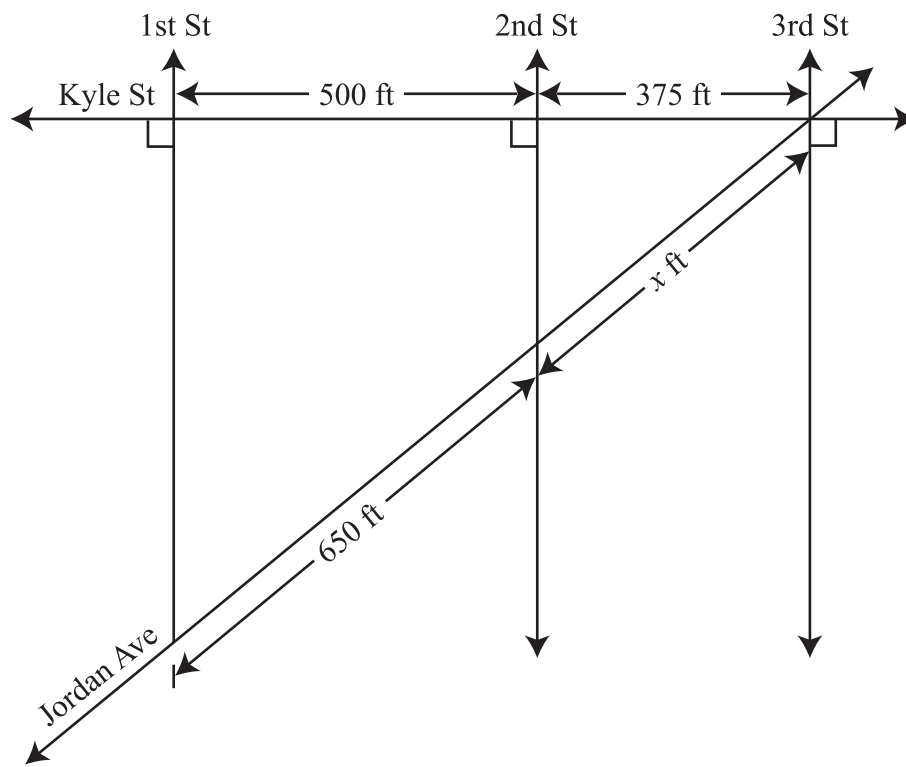


If he uses a scale of 1.5 in. = 14 ft, what would be the actual length of this side of the house and garage?

- A. 98 ft
- \*B. 126 ft
- C. 147 ft
- D. 189 ft

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

14. A portion of a city map is shown below.



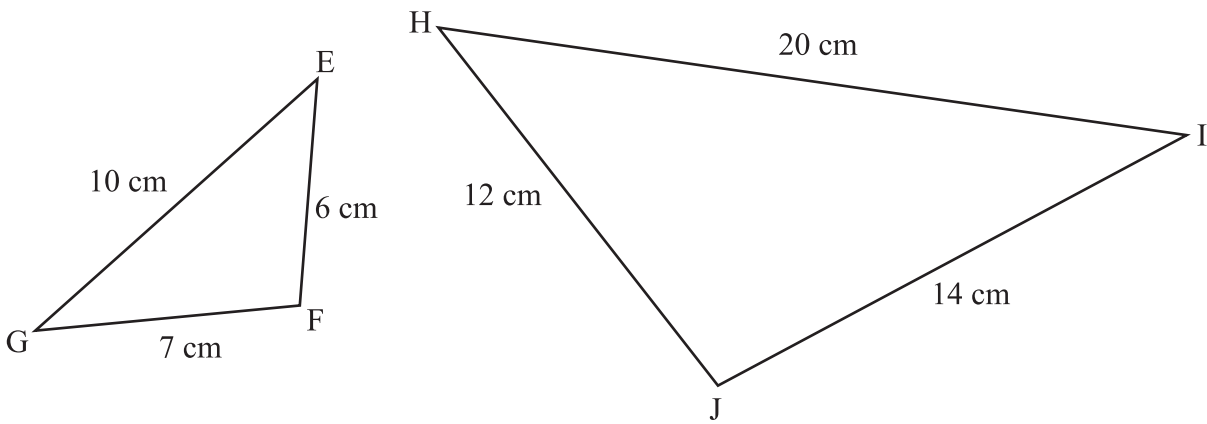
What is the value of  $x$ , rounded to the nearest foot?

- A. 375
- \*B. 488
- C. 525
- D. 867

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

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15. Given the two triangles below, which angle is congruent to  $\angle F$ ?



- A.  $\angle E$
- B.  $\angle H$
- C.  $\angle I$
- \*D.  $\angle J$

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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16. Mr. Smith, Mr. Jones, Ms. Brown, Ms. Rodriguez, and Mr. Patel each own a car. Their cars are each of a different color—red, yellow, green, blue, and white. The following information is known.

- Neither Ms. Rodriguez nor Mr. Patel owns the red car.
- Mr. Jones and Mr. Smith sometimes go on a camping trip with the owner of the yellow car.
- The white car belongs to the person whose name is the name of a color.
- Mr. Smith's car is blue.

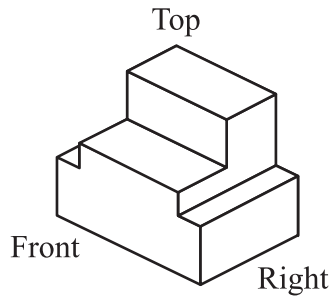
Who owns the red car?

- \*A. Mr. Jones
- B. Mr. Smith
- C. Ms. Brown
- D. Ms. Rodriguez



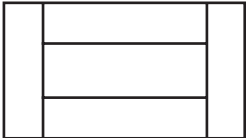
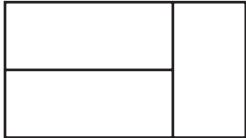
## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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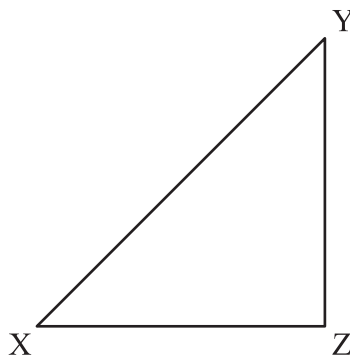
17. A three-dimensional object is shown below.



Which could be the top view of the object?

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

18. Which statement would be sufficient to prove that  $\triangle XYZ$  is a right triangle?

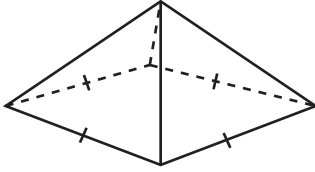


- A.  $XZ = ZY$
- B.  $m\angle X = 45^\circ$
- C.  $XZ + YZ \geq XY$
- \*D.  $m\angle X + m\angle Y = 90^\circ$

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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19. The pyramid shown below is cut by a plane parallel to its base.

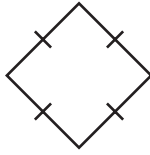


What is the cross section of the cut?

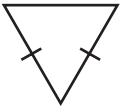
A.



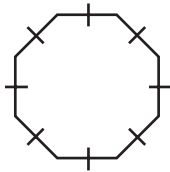
\*B.



C.



D.



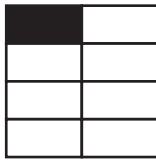
## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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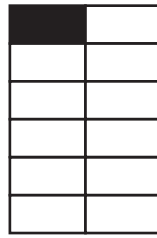
20. If the pattern below continues, what fractional part of the figure will be unshaded in Stage 7?



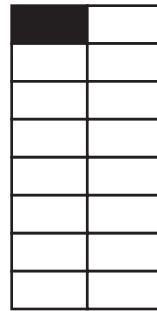
Stage 1



Stage 2



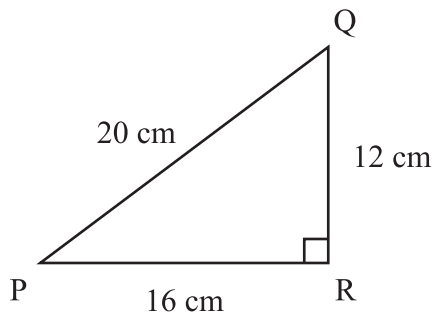
Stage 3



Stage 4

- A.  $\frac{19}{20}$
- B.  $\frac{23}{24}$
- \*C.  $\frac{27}{28}$
- D.  $\frac{31}{32}$

21. The figure below shows  $\triangle PQR$ .



What is the value of  $\sin(P)$ ?

- \*A.  $\frac{3}{5}$
- B.  $\frac{3}{4}$
- C.  $\frac{4}{5}$
- D.  $\frac{4}{3}$

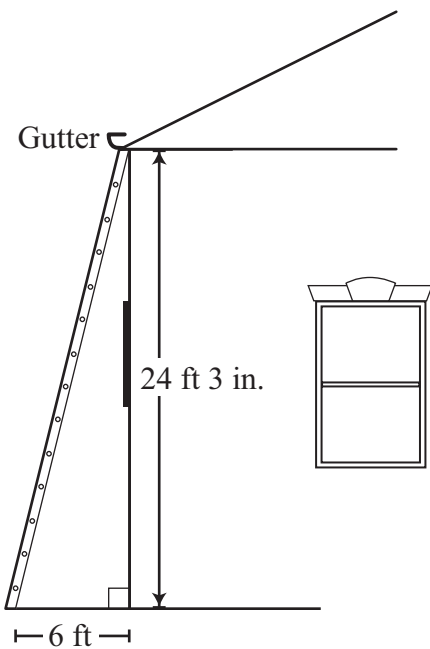


**PART II MID-YEAR RELEASED GEOMETRY ITEMS**

22. What is the equation of the circle with center point (4, 5) and a radius of 3 units?

- A.  $(x - 4)^2 + (y - 5)^2 = 3$
- B.  $(x - 5)^2 + (y - 4)^2 = 3$
- \*C.  $(x - 4)^2 + (y - 5)^2 = 9$
- D.  $(x - 5)^2 + (y - 4)^2 = 9$

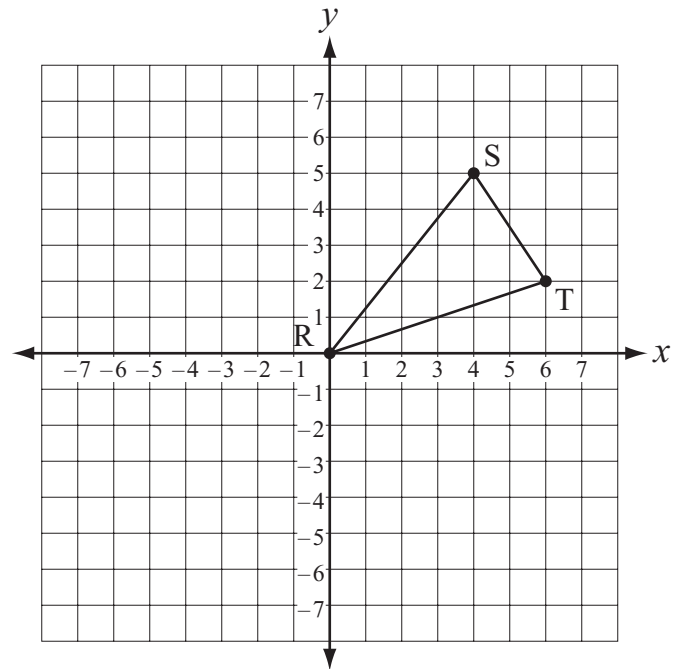
23. Carl is preparing to clean out the gutters on his house. The gutters are 24 feet, 3 inches from the ground. He plans to place the bottom of his ladder 6 feet away from the house and the top of the ladder at the base of the gutter.



What is the length of the ladder that Carl needs? Round your answer to the nearest tenth.

- A. 4.3 feet
- B. 23.4 feet
- \*C. 25.0 feet
- D. 30.4 feet

24.  $\triangle RST$  is shown below.



If  $\triangle RST$  is rotated  $180^\circ$  clockwise about the origin, what will be the coordinates of the image of point T?

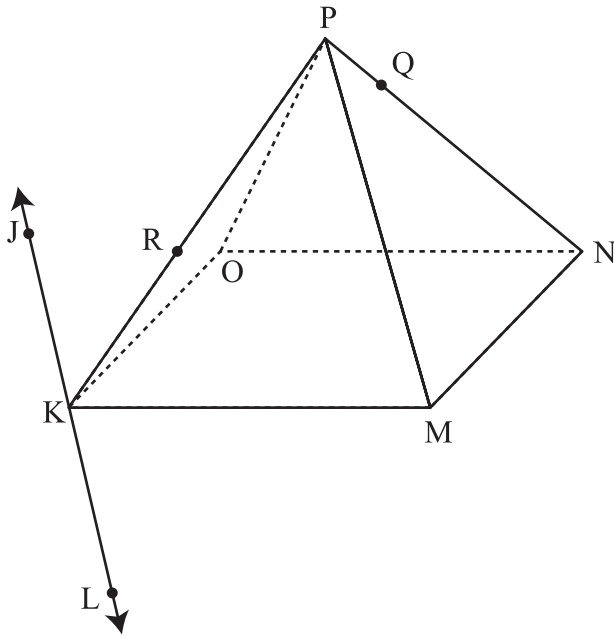
- A. (6, 2)
- B. (-6, 2)
- C. (6, -2)
- \*D. (-6, -2)

25. Which collection of segment lengths could **not** be the lengths of the sides of a triangle?

- \*A. 1 cm, 2 cm, 3 cm
- B. 1 cm, 3 cm, 3 cm
- C. 2 cm, 3 cm, 3 cm
- D. 2 cm, 3 cm, 4 cm

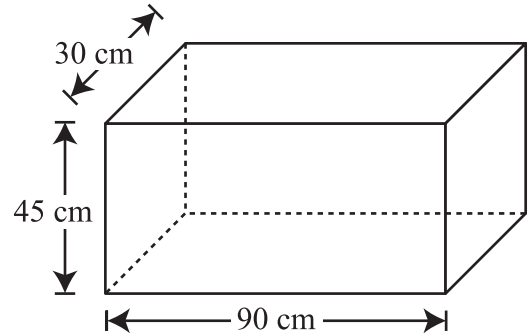
PART II MID-YEAR RELEASED GEOMETRY ITEMS

26. In the figure below, which group of 3 points does **not** form a plane?



- \*A. Points P, Q, and N  
 B. Points K, O, and P  
 C. Points L, K, and R  
 D. Points J, K, and M
27. Which is the correct classification for a figure with vertices P (2, 4), Q (6, 4), R (2, 0), and S (8, 0)?
- A. Parallelogram  
 B. Rectangle  
 C. Square  
 \*D. Trapezoid

28. What is the volume of the rectangular prism shown below?



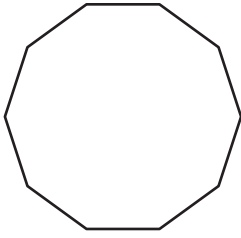
- A. 729000 cm<sup>3</sup>  
 \*B. 121500 cm<sup>3</sup>  
 C. 24300 cm<sup>3</sup>  
 D. 16200 cm<sup>3</sup>
29. A line has the equation  $y = 3x - 2$ . What is the equation of the line parallel to this line and passing through the point (5, 4)?
- \*A.  $y = 3x - 11$   
 B.  $y = -\frac{1}{3}x - \frac{17}{3}$   
 C.  $y = 15x - 8$   
 D.  $y = \frac{6}{5}x - 2$

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

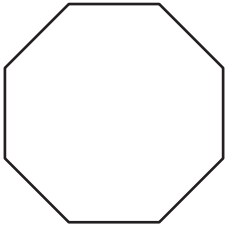
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30. Which shape will tessellate?

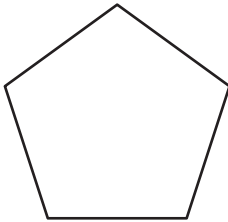
A.



B.



C.

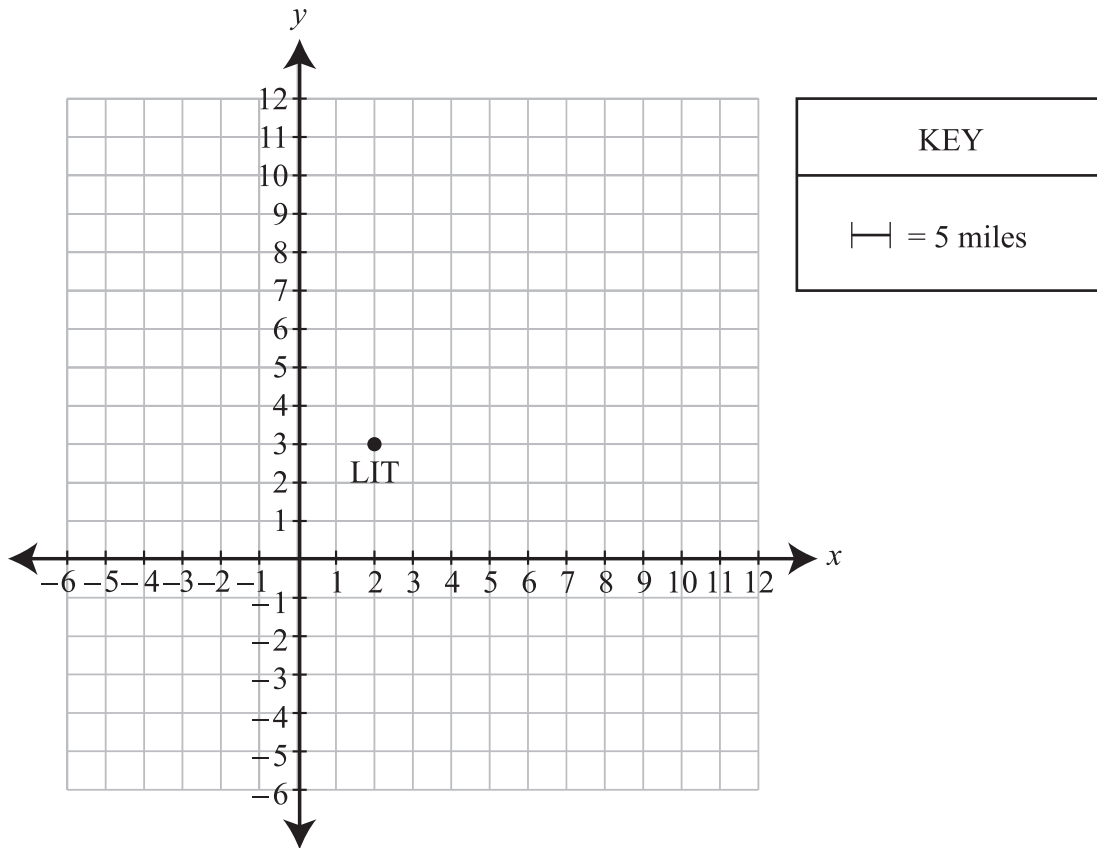


\*D.



## PART II MID-YEAR RELEASED GEOMETRY ITEMS

- A. An air traffic control system at Little Rock National (LIT) airport, located at  $(2, 3)$  on the grid below, uses a radar system that sends out signals to determine the locations of airplanes. This system can detect planes within a circular region having a radius of 35 miles from LIT. Each grid unit represents 5 miles.



An airplane is heading directly toward LIT from the location represented by coordinates  $(-4, 7)$  on the grid.

1. Can the plane be detected by the radar? Support your answer with mathematical evidence.
2. The air traffic controller instructs the pilot to begin circling the airport halfway between the airport and her current location. What will be the coordinates of the plane's location when the pilot begins to circle the airport? Show your work or explain your answer.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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### Item A Scoring Rubric—2011 Geometry

Score	Description
4	The student earns 4 points. The response contains no incorrect work. Parentheses are included if coordinates are listed as an ordered pair in Part 2.
3	The student earns 3 points.
2	The student earns 2 points.
1	The student earns 1 point or some minimal understanding is shown.  Ex: Each coordinate is incorrect due to a calculation or copy error in Part 2 The correct procedure is shown for both.
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” assigned for the item.)

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

### SOLUTION AND SCORING

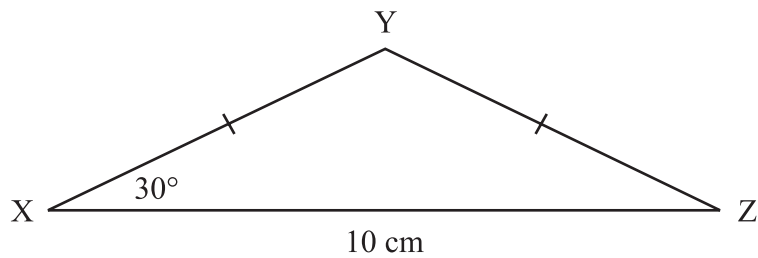
Part	Points
<b>1</b>	<p><b>2 points possible</b></p> <p>2 points: Correct answer of “No” (or equivalent) Correct procedures are shown and/or explained Give credit for the following or equivalent: <i>Note: Distance may be rounded to 10ths place or smaller at any level.</i></p> <ul style="list-style-type: none"> <li>• Uses Distance Formula:           <p style="margin-left: 40px;">Ex: “No, the plane cannot be detected. The plane’s distance from the airport is:</p> <math display="block">\sqrt{(2 - (-4))^2 + (3 - (7))^2} = \sqrt{36 + 16} = \sqrt{52} \approx 7.2 \text{ units}</math> <p style="margin-left: 40px;">7.2 units is 36 miles away, so the plane is too far.”</p> <p style="margin-left: 40px;">Ex: “No because <math>\sqrt{20^2 + 30^2} = 36.05</math>.”</p> </li> <li>• Uses Pythagorean Theorem:           <p style="margin-left: 40px;">Ex: <math>4^2 + 6^2 = c^2</math></p> <math display="block">52 = c^2</math> <math display="block">x = 7.21</math> <p style="margin-left: 40px;">“7.21 <math>\geq</math> 7, so plane can’t be detected.” (35 miles = 7 units not required)</p> </li> </ul> <p><b>OR</b></p> <p>1 point: Give credit for the following: <i>Note: Labels of “miles” and/or “units” may be incorrect or missing.</i></p> <ul style="list-style-type: none"> <li>• Answer of “No” is incorrect or missing Work is correct and complete</li> <p style="text-align: center;">or</p> <li>• Work contains a calculation, copy, counting or rounding error <i>Note: Writing down given coordinate(s) incorrectly will be considered a copy error.</i> Correct procedures are shown and/or explained Correct answer based on error is given</li> <p style="text-align: center;">or</p> <li>• Correct answer of “No” or equivalent Work is incomplete, but some correct procedure is shown Ex: “No because it’s about 7.21 units away which is too far.” (work to find 7.21 is missing)</li> </ul>

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

Part	Points
<b>2</b>	<p><b>2 points possible</b></p> <p>2 points:      Correct coordinates:            (-1, 5) (Parentheses are required for a “4”)            or <math>x = -1</math> and <math>y = 5</math>            (or correct coordinates based on a copy error from Part 1)            Correct procedure shown and/or explained            Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> <li>• Uses Midpoint Formula:               Ex: <math>\left(\frac{2 + (-4)}{2}, \frac{3 + 7}{2}\right) = (-1, 5)</math></li> <li>• Uses Slope and horizontal and vertical distances:               Ex: (-1, 5) “The slope is <math>-\frac{2}{3}</math> so if I go up 2 and left 3 from LIT,              I will reach the midpoint. To get from the midpoint to the plane,              I go up 2 and left 3.”</li> </ul> <p><b>OR</b></p> <p>1 point:      Give credit for the following:</p> <ul style="list-style-type: none"> <li>• Correct coordinates              Work is incomplete or missing               or</li> <li>• Coordinate(s) incorrect due to a calculation, counting or visible copy error(s)              Correct procedure is shown and/or explained</li> </ul>

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

B.  $\triangle XYZ$  is shown below.



1. Determine  $m\angle Y$ . Show your work or explain how you found your answer.
2. An altitude is drawn from point Y to  $\overline{XZ}$ , and the point where the altitude intersects  $\overline{XZ}$  is labeled W. What is YW? Give your answer in simplest radical form or round your answer to the nearest hundredth. Show your work or explain how you found your answer.
3. Determine the area of  $\triangle XYZ$ . Give your answer in simplest radical form or round your answer to the nearest hundredth. Show your work or explain how you found your answer.

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

<b>Item B Scoring Rubric—2011 Geometry</b>
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Score	Description
<b>4</b>	The student earns 4 points. The response contains no incorrect work. The response contains: Correct label of “degrees” or “°” in Part 1 Correct label of “cm” in Part 2 Correct label of “sq. cm” in Part 3
<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” assigned for the item.)



## PART II MID-YEAR RELEASED GEOMETRY ITEMS

### SOLUTION AND SCORING

Part	Points
<b>1</b>	<p><b>1 point possible</b></p> <p>1 point: Correct measure: 120 (degrees)            Correct procedure is shown and/or explained            Give credit for the following or equivalent:</p> <p>Ex: Since <math>XY = YZ</math>, <math>m\angle Z = m\angle X = 30^\circ</math>.            so <math>m\angle Y = 180 - 30 - 30 = 120</math></p> <p>Ex: <math>180 - (2 \times 30) = 120</math></p> <p>Ex: The triangle is isosceles, so if the altitude is drawn from Y to <math>\overline{XZ}</math>            it will be perpendicular and form <math>90^\circ</math> angles. Therefore, each            will be a <math>30 - 60 - 90</math> triangle, and <math>m\angle Y = 2(60) = 120</math> degrees.</p> <p><b>OR</b></p> <p><math>\frac{1}{2}</math> point Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> <li>• Correct answer              Procedure is incomplete or missing              or</li> <li>• Answer is incorrect due to calculation or copy error              Correct procedure is shown and/or explained</li> </ul>
<b>2</b>	<p><b>2 points possible</b></p> <p>2 points: Correct length: <math>\frac{5\sqrt{3}}{3}</math> or 2.89 (cm)</p> <p>Correct procedure is shown and/or explained            Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> <li>• Uses properties of Special Right Triangles:</li> </ul> <p>Ex: <math>\triangle YWZ</math> is a 30-60-90 triangle</p> $5 = a\sqrt{3} \quad a = \frac{5}{\sqrt{3}} = \frac{5\sqrt{3}}{3}$ <p>Ex: <math>a\sqrt{3} = 5 \quad a = \frac{5}{1.732} = 2.89</math></p> <p>Ex: <math>\frac{1}{x} = \frac{\sqrt{3}}{5} \quad x\sqrt{3} = 5 \quad x = 2.89</math></p>

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

Part	Points
2	<p><b>2 points possible (continued)</b></p> <ul style="list-style-type: none"> <li>• Uses Trig. Functions:             <math display="block">\text{Ex: } \tan 30^\circ = \frac{YW}{5} \quad YW = 5 \tan 30^\circ = 2.886 = 2.89</math>   <math display="block">\text{Ex: } \tan 30^\circ = \frac{x}{5} \quad x = \frac{5\sqrt{3}}{3}</math> </li> <li>• Uses Law of Sines:             <math display="block">\text{Ex: } \frac{\sin 30^\circ}{y} = \frac{\sin 60^\circ}{5} \quad \text{etc.}</math> </li> </ul> <p><b>OR</b></p> <p>1½ points: Answer is correctly rounded or truncated to a place other than the 100ths place or is not left in simplest radical form Correct procedure is shown and/or explained</p> <p><b>OR</b></p> <p>1 point:           <ul style="list-style-type: none"> <li>• Correct answer of <math>\frac{5\sqrt{3}}{3}</math> or 2.89                               Procedure is incomplete or missing or contains incorrect trig. notation                               or                 <li>• Answer is incorrect due to calculation, copy or rounding error                               Correct procedure is shown and/or explained</li> </li></ul> </p> <p><b>OR</b></p> <p>½ point: Answer is rounded, truncated etc. Some support is given</p>

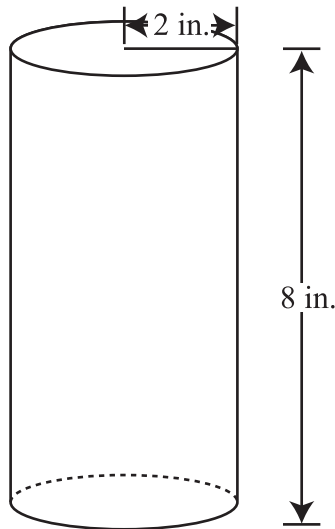
## PART II MID-YEAR RELEASED GEOMETRY ITEMS

Part	Points
<b>3</b>	<p><b>1 point possible</b></p> <p>1 point      Correct answer (based upon input):    14.43    or    14.45    (sq. cm)            (or 14.46 with correct procedure of finding area of 2 triangles)            (or correct answer rounded to 100ths place based on an incorrect answer in Pt. 2)            Correct procedure is shown and/or explained            Give credit for the following or equivalent:</p> $\text{Ex: } A = \frac{10(2.89)}{2} = 14.45$ $\text{Ex: } A = \frac{1}{2}(10)\left(\frac{5\sqrt{3}}{3}\right) = 14.43 \quad \left(\text{or } \frac{25\sqrt{3}}{3}\right)$  <p><b>OR</b></p> <p>½ point:      Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> <li>• Correct answer                Procedure is incomplete or missing</li>   <li style="text-align: center;">or</li>   <li>• Answer is incorrect due to calculation, copy or rounding error                and/or answer is not rounded to the nearest 100ths place                Correct procedure is shown and/or explained</li> </ul>

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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- C. Double Gold Food Company currently packages its oatmeal in cardboard cylinders with the dimensions shown below.



Double Gold Food plans to increase the volume of the containers 25%.

1. If Double Gold Food decides to change the height of the current container but keep the radius the same, what will be the height of the new container? Show your work or explain how you found your answer.
2. If Double Gold Food decides to change the radius of the current container but keep the height the same, what will be the radius of the new container? Round your answer to the nearest hundredth of an inch. Show your work or explain how you found your answer.
3. The amount of materials needed to create the container depends on its surface area. Determine which option, increasing the height only or increasing the radius only, results in a cylindrical container with the **least** surface area? Show your work or explain how you found your answer.

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

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

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### Item C Scoring Rubric—2011 Geometry

Score	Description
4	The student earns 5 points. The response contains no incorrect work. The Label of “inches” is used in Part 1.
3	The student earns $3\frac{1}{2}$ – $4\frac{1}{2}$ points.
2	The student earns 2–3 points.
1	The student earns $\frac{1}{2}$ – $1\frac{1}{2}$ 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” assigned for the item.)

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

### SOLUTION AND SCORING

**Note: Do not deduct for internal work that contains early-rounded or truncated values. Many students write these values for the sake of brevity, but use the exact value in the calculator to find their final answer.**

**Note: Steps may be combined, resulting in incorrect internal work, except at the “4” level.**

**5 points possible:**

Part	Points
1	<p><b>1½ points possible</b></p> <p><b>Note: Work may include values that have been truncated or rounded early (except using Guess &amp; Check), resulting in answers that are not exact.</b></p> <p>1½ points: Correct height: 10 (Accept <math>9.9 - 9.\bar{9}</math>) (in)            Correct procedure shown and/or explained            Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> <li>• <math>V = (3.14)(2^2)(8) = 100.48</math>  <math>(.25)(100.48) = \underline{25.12}</math>              New <math>V = \underline{125.6}</math>  <math>125.6 = (3.14)2^2h \rightarrow 40 = 4h \rightarrow 10 = h</math></li> <li>• <math>V</math> (new container): <math>(1.25)\pi(2^2)8 = 40\pi = \pi(2^2)h \rightarrow 10 = h</math></li> <li>• <math>V</math> (current container): <math>V = \pi r^2 h = \pi(2)^2(8) = 32\pi = 100.530\dots</math>  <math>V</math> (new container): <math>1.25 \times 100.530\dots = 125.663\dots</math>  <math>\pi(2^2)h = 125.663\dots</math>  <math>h = 9.99</math></li> <li>• Guess and Check: (answer and work must be exact)              Ex: <math>V = (1.25)(3.14)(2^2)(8) = 125.6</math>  <math>(3.14)(2^2)(10) = 125.6 \rightarrow h = 10</math></li> <li>• <math>h = 8 + .25(8) = 10</math> (<i>volumes are not required with this method</i>)</li> </ul> <p><b>OR</b></p> <p>1 point:</p> <ul style="list-style-type: none"> <li>• Height is correct              Work is incomplete              or</li> <li>• Height is incorrect              Work contains a calculation, copy or an obvious rounding error              Correct procedure is shown and/or explained</li> </ul> <p><b>OR</b></p> <p>½ point:</p> <ul style="list-style-type: none"> <li>• Height is correct              Work is missing</li> </ul>

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

Part	Points
2	<p><b>1½ points possible</b>  <b>Note: Work may include values that have been truncated or rounded early (except using Guess &amp; Check), resulting in answers that are not exact.</b></p> <p>1½ points:    Correct radius:    2.24    (in)  <i>(or correct r rounded to the nearest 100th based on V and/or work in Pt. 1)</i>            Correct procedure shown and/or explained            Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> <li>• V (new container): <math>\pi r^2 8 = 125.663\dots</math>  <math>5 = r^2</math>  <math>\sqrt{5} = r = 2.23606\dots \rightarrow 2.24</math></li> </ul> <p><b>OR</b></p> <p>1 point:    • Radius is correct  <i>(or correct r rounded to the nearest 100th based on V and/or work in Pt. 1)</i>            Work is incomplete                              or            • Radius is incorrect  <i>Work contains a calculation, copy or an obvious rounding error and/or is not rounded to the nearest 100th</i>            Correct procedure is shown and/or explained</p> <p><b>OR</b></p> <p>½ point:    • Radius is correct  <i>(or correct r rounded to the nearest 100th based on V and/or work in Pt. 1)</i>            Work is missing</p>
3	<p><b>2 points possible</b>  <b>Note: No deduction is made for the rounding or truncating of SA's to any position in Part 3</b></p> <p>2 points:    Correct answer: Increasing the radius  <i>(or correct answer based on incorrect answer(s) and Parts 1 and/or 2)</i>            Correct procedure is shown and/or explained            Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> <li>• SA of the cylinder with the increased height: <b>(Accept 150-151)</b>              Ex: <math>SA = 2\pi rh + 2\pi r^2 = 2\pi(2)(10) + 2\pi(2)^2 \approx 150.8</math>               SA of the cylinder with the increased radius: <b>(Accept 143-144.13)</b>              Ex: <math>SA = 2\pi rh + 2\pi r^2 = 112.59 + 31.52 \approx 144.11</math>              So the surface area would be less if you increase the radius.</li> <li>• <math>SA = 2\pi r^2 + 2\pi rh = 2\pi r(r + h)</math>              Increase height: <math>SA = 2\pi \cdot 2(2 + 10) = 4\pi \cdot 12 = 48\pi</math>              Increase radius: <math>SA = 2\pi(2.24)(2.24 + 8) = 45.8752\pi</math>              Therefore the SA is smaller if you increase <math>r</math>.</li> </ul>

## PART II MID-YEAR RELEASED GEOMETRY ITEMS

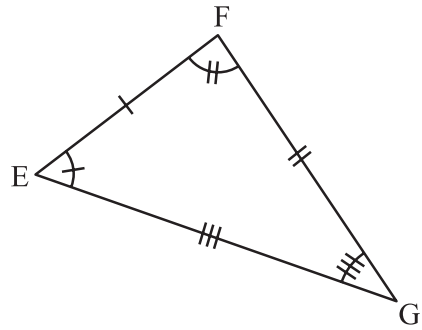
Part	Points
3	<p><b>2 points possible (continued)</b></p> <p><b>OR</b>            1½ points:           <ul style="list-style-type: none"> <li>• Both Surface Areas are correctly found with work shown and/or explained                Answer is missing</li> </ul> </p> <p><b>OR</b>            1 point:           <ul style="list-style-type: none"> <li>• Both Surface Areas are correct with no work shown or explained                Answer is correct                or</li> <li>• Both Surface Areas are correct with work shown and/or explained                Answer is incorrect                or</li> <li>• 1 Surface Area is correct                1 Surface Area is incorrect due to a calculation, copy or rounding error                Correct procedure is shown and/or explained                Answer is correct based on error</li> </ul> </p> <p><b>OR</b>            ½ point:           <ul style="list-style-type: none"> <li>• Both Lateral Surface Areas are correct (top and bottom are omitted)                Work is shown and/or explained                Answer is correct                Ex: <math>SA = 2\pi rh = 2(3.14)(2)(10) = 125.6</math>  <math>SA = 2\pi rh = 2(3.14)(2.24)(8) = 112.5376</math>                Increasing the radius results in a smaller SA                or</li> <li>• Correct answer based on 2 incorrect total surface areas due to                calculation error(s)                Correct procedure is shown and/or explained</li> </ul> </p>



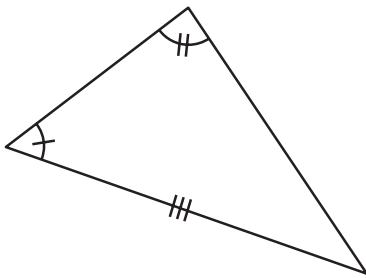
## PART II SPRING RELEASED GEOMETRY ITEMS

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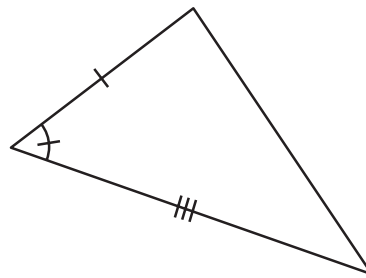
1. Which choice shows a triangle that is congruent to  $\triangle EFG$  by applying the AAS Congruence Theorem only?



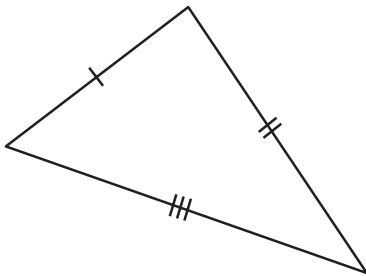
\*A.



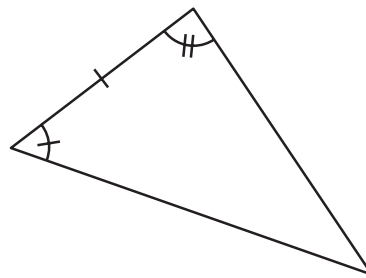
B.



C.

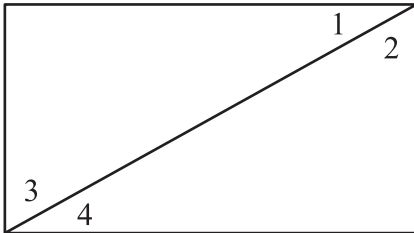


D.



## PART II SPRING RELEASED GEOMETRY ITEMS

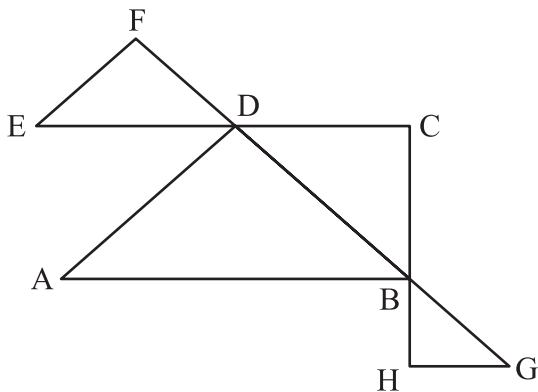
2. The rectangle below is divided by one of the rectangle's diagonals, forming the angles shown.



Which of the following statements is true based on this information?

- A.  $m\angle 1 = m\angle 2$
- B.  $m\angle 1 = m\angle 3$
- \*C.  $m\angle 2 = m\angle 3$
- D.  $m\angle 2 = m\angle 4$

Use the following diagram to answer question 3.



3. Which of the following is a quadrilateral?

- \*A. ADCB
- B. ADBC
- C. BFED
- D. CBGH

4. Circle O has its center at  $(9, 3)$ , and point  $(3, -2)$  lies on circle O. What is the diameter of circle O? Round your answer to the nearest tenth of a unit.

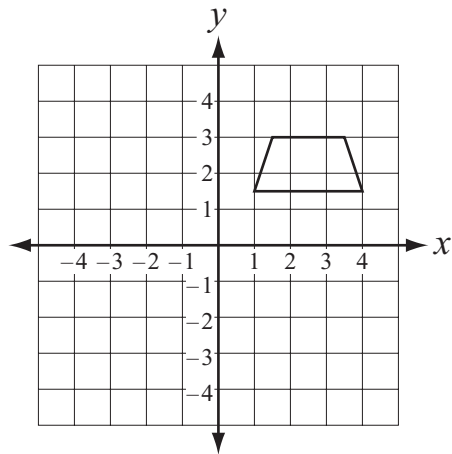
- A. 6.6 units
- B. 11.8 units
- \*C. 15.6 units
- D. 24.1 units

5. A catalog shows a picture of a photo album. In the picture, the photo album measures 2.5 inches by 3.5 inches. The picture is at a scale of 1 inch = 3.2 inches. What are the dimensions of the actual photo album? Round your answers to the nearest tenth of an inch.

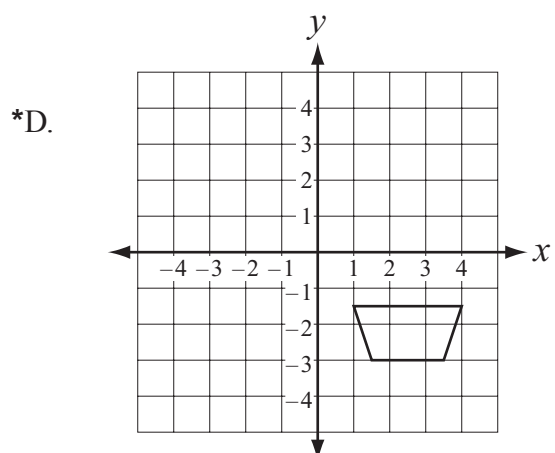
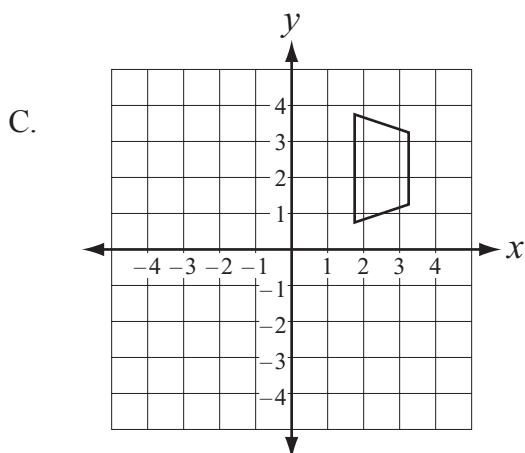
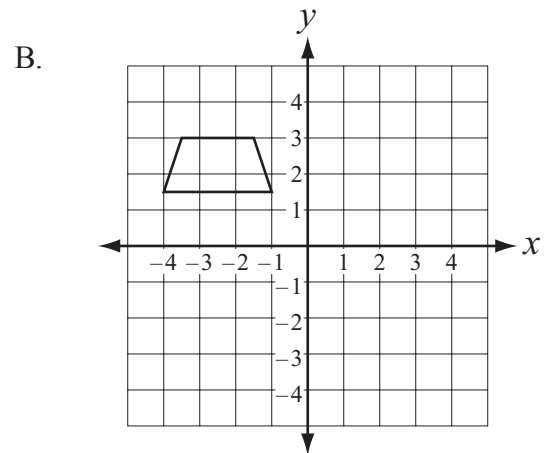
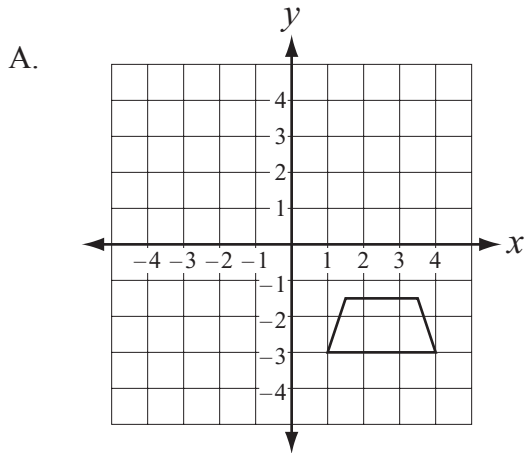
- A. 0.8 inches by 1.1 inches
- B. 1.3 inches by 1.1 inches
- \*C. 8.0 inches by 11.2 inches
- D. 8.8 inches by 11.2 inches

## PART II SPRING RELEASED GEOMETRY ITEMS

Use the graph below to answer question 6.

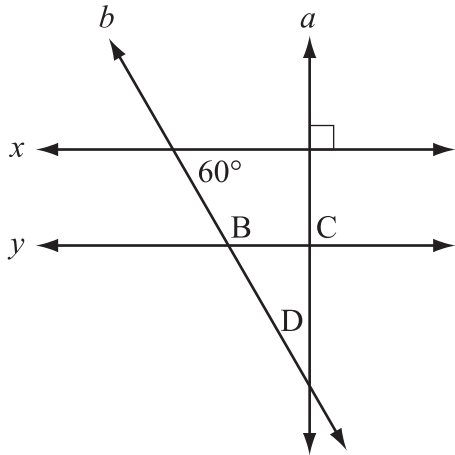


6. Which graph shows a reflection across the  $x$ -axis of the image above?



**PART II SPRING RELEASED GEOMETRY ITEMS**

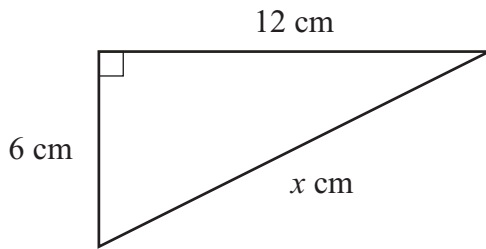
7. Lines  $x$  and  $y$  are parallel,  $a$  is a transversal that is perpendicular to  $x$ , and  $b$  is another transversal.



What is the measure of  $\angle D$ ?

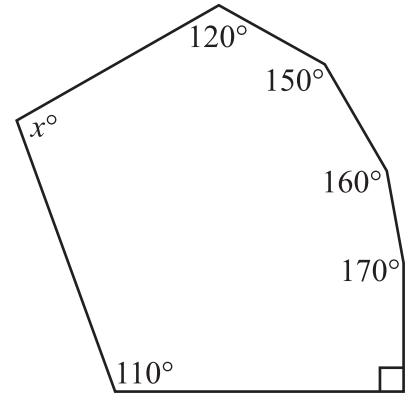
- \*A.  $30^\circ$
- B.  $60^\circ$
- C.  $90^\circ$
- D.  $120^\circ$

Use the diagram below to answer question 8.



8. What is the value of  $x$  to the nearest tenth?
- A. 4.2
  - B. 10.4
  - C. 13.0
  - \*D. 13.4

9. The cross section of a building is shown below.



What is the value of  $x$ ?

- A. 90
- \*B. 100
- C. 110
- D. 120

10. How many non-overlapping rectangles make up the 7th figure in the series below?

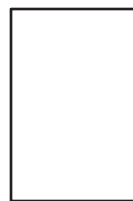


Figure 1



Figure 2

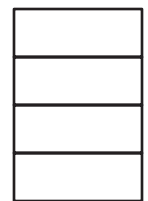


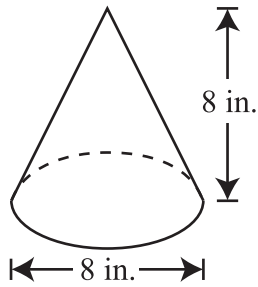
Figure 3

- A. 14
- B. 32
- C. 49
- \*D. 64

PART II SPRING RELEASED GEOMETRY ITEMS

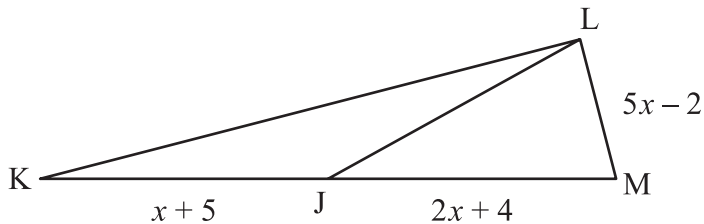
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11. If the height of the cone below were increased to 16 inches and the diameter stayed the same, by **approximately** how much would its volume increase?



- \*A.  $134 \text{ in.}^3$
  - B.  $268 \text{ in.}^3$
  - C.  $402 \text{ in.}^3$
  - D.  $938 \text{ in.}^3$
- 

12.  $\overline{LJ}$  is a median of  $\triangle KLM$ .



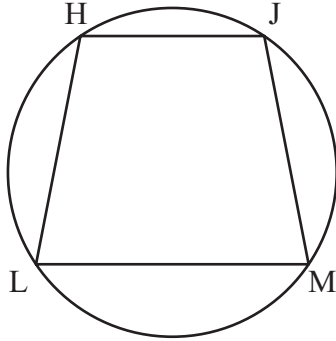
What is LM?

- A. 1
- \*B. 3
- C. 6
- D. 7

**PART II SPRING RELEASED GEOMETRY ITEMS**

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13. Quadrilateral HJML is inscribed in the circle below. Arc JML measures  $230^\circ$ .



What is the measure of  $\widehat{LHJ}$ ?

- A.  $50^\circ$
- B.  $90^\circ$
- C.  $100^\circ$
- \*D.  $130^\circ$

14. A pattern of shapes is shown below. Each shape is made using cubes with an edge length of 1 cm.

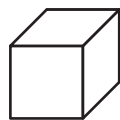


Figure 1  
SA =  $6 \text{ cm}^2$

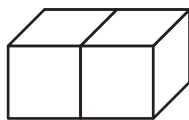


Figure 2  
SA =  $10 \text{ cm}^2$

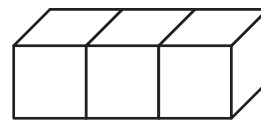


Figure 3  
SA =  $14 \text{ cm}^2$

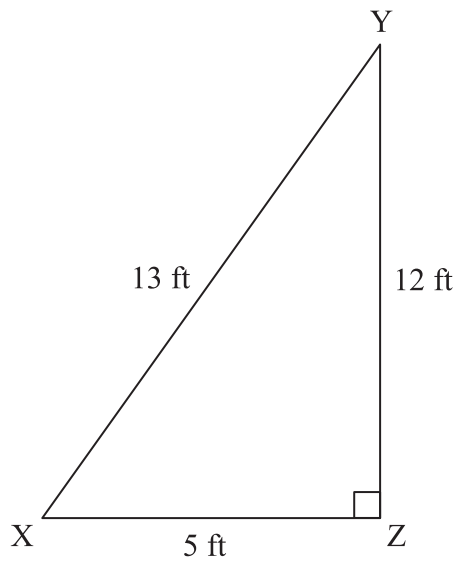
If the pattern continues, what will be the surface area of Figure 5?

- A.  $18 \text{ cm}^2$
- \*B.  $22 \text{ cm}^2$
- C.  $24 \text{ cm}^2$
- D.  $26 \text{ cm}^2$

**PART II SPRING RELEASED GEOMETRY ITEMS**

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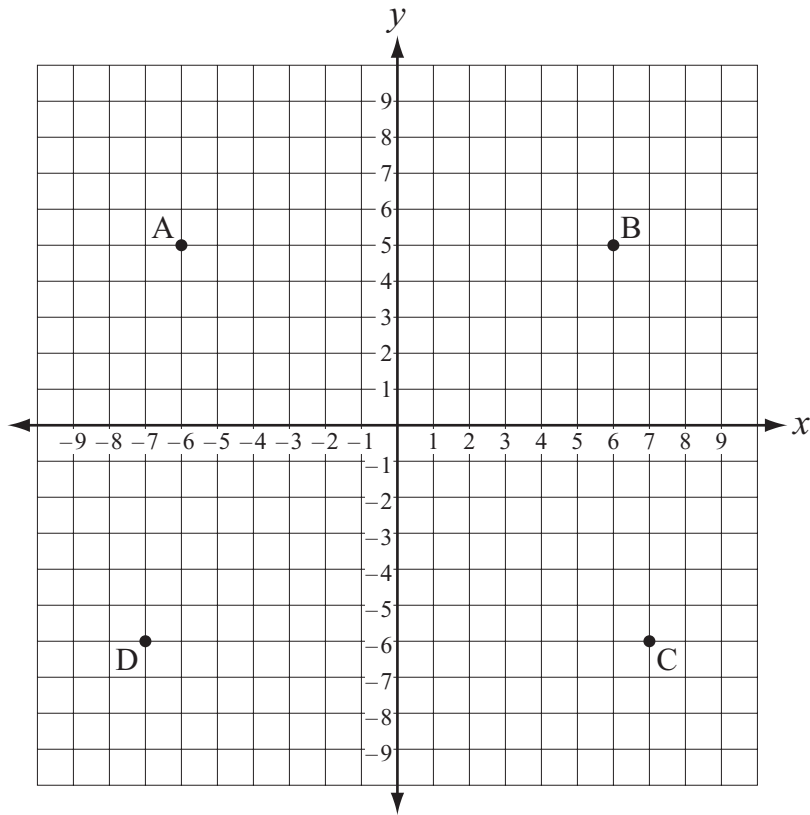
15. In  $\triangle XYZ$ , what is  $\sin X$ ?



- A.  $\frac{5}{13}$
- B.  $\frac{5}{12}$
- \*C.  $\frac{12}{13}$
- D.  $\frac{12}{5}$

PART II SPRING RELEASED GEOMETRY ITEMS

16. Four points, A, B, C, and D are plotted on the coordinate plane below to form a quadrilateral.



What type of quadrilateral is formed by connecting points A, B, C, and D?

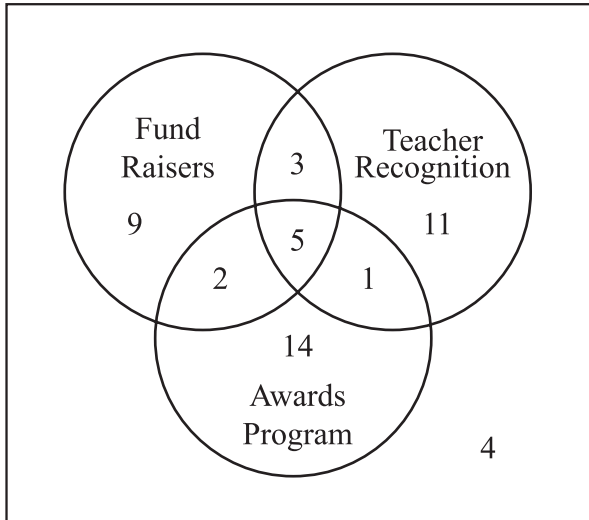
- A. Parallelogram
- B. Rectangle
- C. Rhombus
- \*D. Trapezoid



## PART II SPRING RELEASED GEOMETRY ITEMS

17. Thomas created a Venn diagram to help him organize committees for the student council.

**Student Council Committees**



How many of the students are on two or more committees?

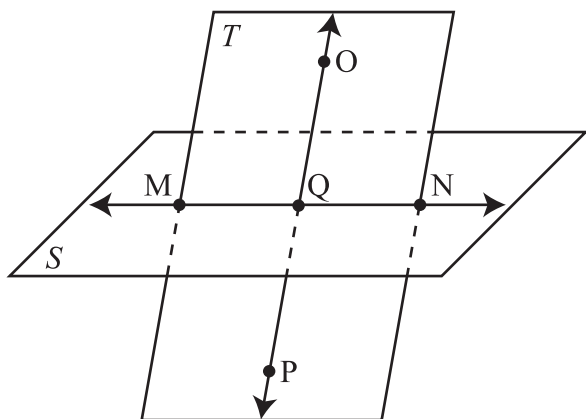
- A. 6
- B. 8
- \*C. 11
- D. 17

18. Jimmy is remodeling his kitchen. He drew a scale drawing that shows the new locations for his appliances. The opening where the oven will be placed has a length of 4 inches on his drawing. He used a scale of 1.5 inches = 12 inches. What will be the length of the actual oven in his kitchen?

- A. 18 inches
- B. 20 inches
- \*C. 32 inches
- D. 48 inches

PART II SPRING RELEASED GEOMETRY ITEMS

19. In the diagram below, line  $OP$  lies on plane  $T$  and line  $MN$  lies on plane  $S$ .



What is the intersection of planes  $S$  and  $T$ ?

- \*A. line  $MN$   
 B. point  $Q$   
 C. line  $OP$   
 D. point  $M$
20. The slope of  $\overline{RS}$  is  $\frac{5}{4}$  and its midpoint has coordinates  $(-20, -5)$ . What is the equation of the perpendicular bisector of  $\overline{RS}$ ?

- A.  $y = -\frac{5}{4}x - 30$   
 \*B.  $y = -\frac{4}{5}x - 21$   
 C.  $y = \frac{4}{5}x + 11$   
 D.  $y = \frac{5}{4}x + 20$

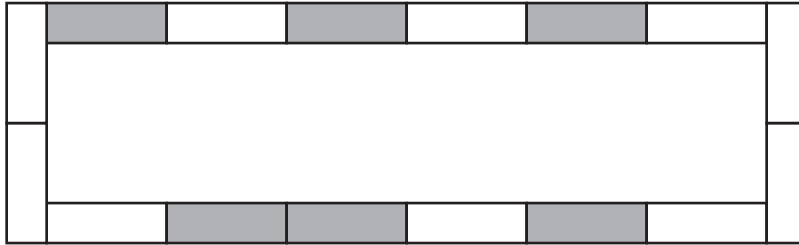
21. How many faces does an octahedron have?

- A. 4  
 B. 6  
 \*C. 8  
 D. 12

## PART II SPRING RELEASED GEOMETRY ITEMS

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22. In a game called “Prize Walk,” a player walks along a rectangular path while music plays. If a player is standing in a shaded section when the music stops, the player wins a prize.



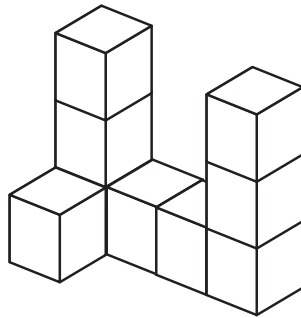
Each rectangular section of the path is the same size. If a player is equally likely to be on any section of the path, what is the probability of winning a prize?

- \*A. 37.5%  
B. 50%  
C. 60%  
D. 62.5%
- 
23. Which of the following is the equation for a circle with a radius of 5 and a center at  $(-2, 4)$ ?
- A.  $(x - 2)^2 + (y + 4)^2 = 25$   
B.  $(x - 4)^2 + (y + 2)^2 = 25$   
\*C.  $(x + 2)^2 + (y - 4)^2 = 25$   
D.  $(x + 4)^2 + (y - 2)^2 = 25$

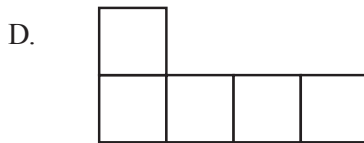
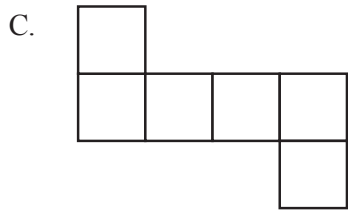
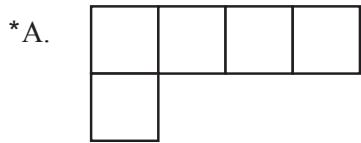
## PART II SPRING RELEASED GEOMETRY ITEMS

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24. Robbie made a model of a building using cubes, as shown below.

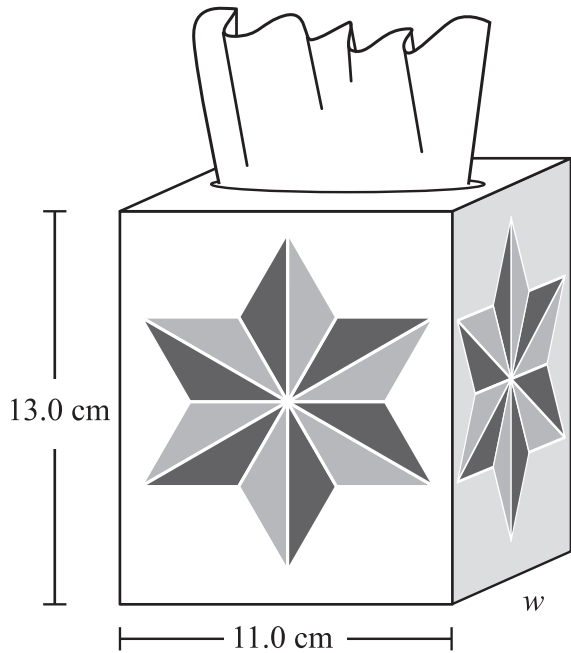


What would be the top view of Robbie's model?



**PART II SPRING RELEASED GEOMETRY ITEMS**

25. A box of tissues is 13.0 cm in height and 11.0 cm in length. Its volume is 1501.5 cubic cm.



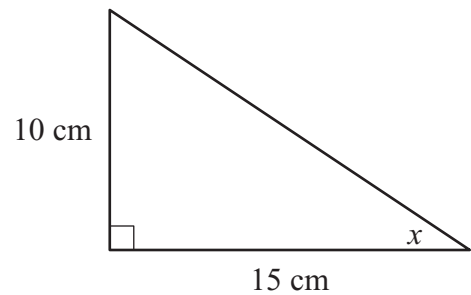
What is the width,  $w$ , of the box of tissues?

- \*A. 10.5 cm
- B. 11.5 cm
- C. 25.3 cm
- D. 31.2 cm

26. What is the equation of the line perpendicular to the line with equation  $y = \frac{5}{4}x + 8$  that passes through point  $(-4, 3)$ ?

- A.  $y = -\frac{5}{4}x - 2$
- B.  $y = \frac{4}{5}x + \frac{31}{5}$
- C.  $y = \frac{4}{5}x + \frac{1}{5}$
- \*D.  $y = -\frac{4}{5}x - \frac{1}{5}$

Use the diagram below to answer question 27.

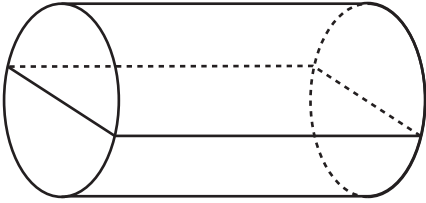


27. What is the measurement of angle  $x$ , rounded to the nearest tenth?

- \*A.  $33.7^\circ$
- B.  $41.8^\circ$
- C.  $48.2^\circ$
- D.  $56.3^\circ$

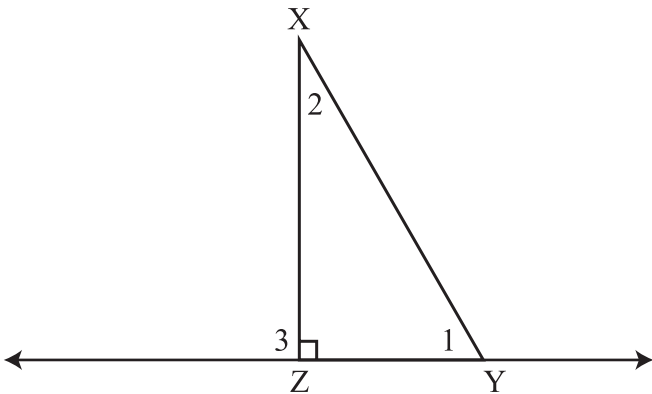
PART II SPRING RELEASED GEOMETRY ITEMS

28. The cylinder shown below will be cut by a plane along a diameter of both circular bases.



What shape **most** specifically describes the cross-section?

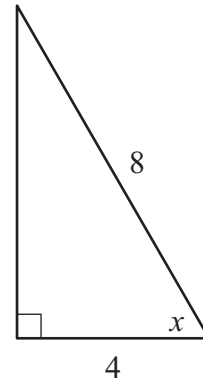
- A. oval
  - B. circle
  - \*C. rectangle
  - D. parallelogram
29. In the figure below,  $\overline{XZ} \perp \overline{ZY}$ .



Which is true?

- A.  $\angle 3$  and  $\angle 1$  are complementary.
- B.  $\angle 1$  and  $\angle 2$  are supplementary.
- C.  $m\angle 3 > m\angle 2 + m\angle 1$
- \*D.  $m\angle 3 = m\angle 1 + m\angle 2$

Use the diagram below to answer question 30.

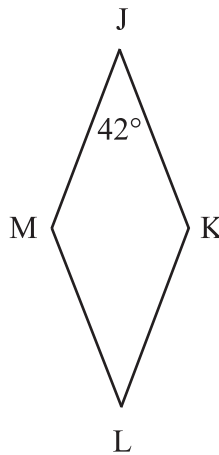


30. What is the value of  $x$ ?

- A.  $26.6^\circ$
- B.  $30^\circ$
- C.  $45^\circ$
- \*D.  $60^\circ$

## PART II SPRING RELEASED GEOMETRY ITEMS

- A. Quadrilateral JKLM has four congruent sides.



1. What is the **most** specific name for quadrilateral JKLM? Explain your reasoning.
2. Determine  $m\angle K$ . Show your work or explain how you found your answer.
3.  $MK = 7.6$  cm and  $JL = 19.8$  cm. What is the perimeter of JKLM? Round your answer to the nearest tenth of a centimeter. Show your work or explain how you found your answer.

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

<b>Item A Scoring Rubric—2011 Geometry</b>
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Score	Description
<b>4</b>	The student earns 4 points. The response contains no incorrect work. The correct label of “degrees” is included in Part 2.
<b>3</b>	The student earns $2\frac{1}{2}$ – $3\frac{1}{2}$ points and credit is earned in all 3 parts.
<b>2</b>	The student earns $2$ – $2\frac{1}{2}$ points and credit is earned in only 2 parts.
<b>1</b>	The student earns $\frac{1}{2}$ – $1\frac{1}{2}$ points or some minimal understanding is shown. Ex: Name in Part 1 is incorrect – Correct explanation to prove that the quadrilateral is a rhombus is included (with no other credit)
<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” assigned for the item.)

## PART II SPRING RELEASED GEOMETRY ITEMS

### SOLUTION AND SCORING

**Note: Do not deduct for internal work that contains early-rounded or truncated values. Many students write these values for the sake of brevity, but use the exact value in the calculator to find their final answer.**

**4 points possible:**

Part	Points
<b>1</b>	<p><b>1 point possible</b></p> <p>1 point:      Correct name: <b>Rhombus</b>                      Correct explanation                      Give credit for the following or equivalent:</p> <p style="margin-left: 40px;">Ex: “All four sides are congruent and the angles don’t measure 90°, so it’s a rhombus.”</p> <p style="margin-left: 40px;">Ex: “Rhombus - 4 sides are congruent but the angles aren’t all congruent.”</p> <p style="margin-left: 40px;">Ex: “4 sides are the same length and we can tell from the measures of the angles that it’s not a square, so it’s a rhombus.”</p> <p style="margin-left: 40px;">Ex: “Rhombus because it has 2 sets (<i>or pairs</i>) of congruent angles.”  <i>(The fact that 4 sides are ≅ is given in the prompt, and the fact that the angles are not right angles is implied)</i></p> <p><b>OR</b></p> <p>½ point:      • Correct name: <b>Rhombus</b>                      Work is incomplete, missing or incorrect</p>
<b>2</b>	<p><b>1 point possible</b></p> <p>1 point:      Correct <math>m\angle K</math>:    <b>138</b>    (degrees)                      Correct procedure is shown and/or explained                      Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> <li>• (<i>Since JKLM is a rhombus, opposite angles are congruent and the sum of the measure of the angles is 360°.</i>)                          Ex: <math>2(42) + 2(m\angle K) = 360</math>  <math>2(m\angle K) = 276 \rightarrow m\angle K = 138</math></li> <li>• (<i>Since JKLM is a rhombus, adjacent angles are supplementary.</i>)                          Ex: <math>42 + m\angle K = 180</math>  <math>m\angle K = 138</math></li> </ul> <p><b>OR</b></p> <p>½ point:      • Measure is correct:    <b>138</b>                      Work is incomplete or missing                      or                      • Measure is incorrect due to a calculation or copy error                      Correct procedure is shown and/or explained</p>



## PART II SPRING RELEASED GEOMETRY ITEMS

Part	Points
<b>3</b>	<p><b>2 points possible</b></p> <p>2 points: Correct Perimeter: 42.4 (cm)            Correct procedure is shown and/or explained            Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> <li>• Using the Pythagorean Theorem               <p>Ex: <i>(The diagonals of a rhombus are perpendicular bisectors. Therefore, the 4 triangles formed by the diagonals and the sides of the rhombus are congruent right triangles.)</i></p> <p>Lengths of the legs of the triangles are:</p> <math display="block">\frac{7.6}{2} = 3.8 \quad \frac{19.8}{2} = 9.9 \quad (\text{not required})</math> <math display="block">(3.8)^2 + (9.9)^2 = 14.44 + 98.01 = 112.45</math> <math display="block">\sqrt{112.45} = 10.604244... \rightarrow 10.6</math> <math display="block">4(10.6...) = 42.416977... \rightarrow 42.4</math> <p>Ex: <math>\sqrt{9.9^2 + 3.8^2} = 10.6</math>  <math>4(10.6) = 42.4</math></p> </li> <li>• Using Trig. Functions               <p>Ex: <math>\sin 21^\circ = \frac{3.8}{x}</math> <math>x = 10.6036...</math> (or <math>\cos 69^\circ = \frac{3.8}{x}</math> etc.)</p> <math display="block">4(10.6) = 42.4</math> <p>Ex: <math>\sin 69^\circ = \frac{9.9}{x}</math> <math>x = 10.6043...</math> (or <math>\cos 21^\circ = \frac{9.9}{x}</math> etc.)</p> <math display="block">4(10.6) = 42.4</math> </li> </ul> <p><b>OR</b></p> <p>1½ points: • Perimeter is correctly rounded or truncated to a place other than the nearest 10th            Correct procedure is shown and/or explained</p>

## PART II SPRING RELEASED GEOMETRY ITEMS

Part	Points
3	<p><b>2 points possible (continued)</b></p> <p><b>OR</b></p> <p>1 point:</p> <ul style="list-style-type: none"><li>• Perimeter is correct: 42.4 Work is incomplete or missing or</li><li>• Perimeter is incorrect due to a calculation, copy or rounding error May or may not be rounded to the nearest 10th Correct procedure is shown and/or explained or</li><li>• Perimeter is correctly rounded or truncated to a place other than the nearest 10th Work is incomplete (Ex: <math>10.6 \times 6 = 42.417</math>) or</li><li>• The correct length of 1 side of the rhombus is found (10.6) Correct procedure is shown and/or explained Does not proceed to find Perimeter</li></ul> <p><b>OR</b></p> <p>1 point:</p> <ul style="list-style-type: none"><li>• Perimeter is incorrect due to 2 calculation, copy or rounding errors May or may not be rounded to the nearest 10th Correct procedure is shown and/or explained</li></ul>

## PART II SPRING RELEASED GEOMETRY ITEMS

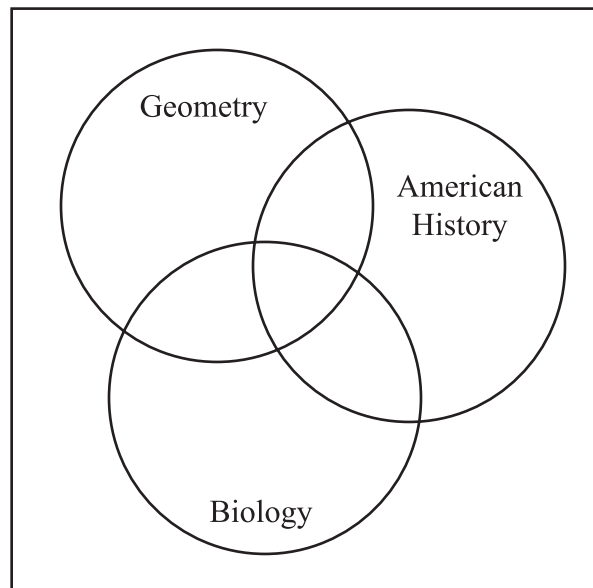
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B. A middle school has the following information on its 75 seventh-grade students:

- 33 students are taking Biology
- 39 students are taking American History
- 43 students are taking Geometry
- 12 students take Biology and American History
- 21 students take Geometry and Biology
- 17 students take Geometry and American History
- 7 students are taking Biology, Geometry, and American History

Copy the Venn diagram below into your Student Answer Document.

Seventh Grade Students



1. Complete the Venn diagram based on the information given. Be sure to include those students who take none of these classes.
2. How many students are taking **fewer than 2** of these courses? Show your work or explain how you found your answer.
3. How many students are taking **exactly 2** of these courses? Show your work or explain how you found your answer.

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

## PART II SPRING RELEASED GEOMETRY ITEMS

### Item B Scoring Rubric—2011 Geometry

Score	Description
4	The student earns <b>5</b> points. Labels of “Geometry” or “G”, “American History”, “AH”, or “H”, and “Biology” or “B” (or equivalent) are included in Venn Diagram No incorrect work is included.
3	The student earns <b>3½–4½</b> points.
2	The student earns <b>3</b> points.
1	The student earns <b>½–1½</b> points or some minimal understanding is shown. Ex: Sum of #'s given in Venn Diagram is 75 (with no other credit)
0	The student earns <b>0</b> 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” assigned for the item.)

## PART II SPRING RELEASED GEOMETRY ITEMS

### SOLUTION AND SCORING

5 points possible:

Part	Points
<b>1</b>	<p><b>3 points possible</b></p> <p style="text-align: center;">Ex:            <b>Seventh Grade Students</b></p> <div style="text-align: center; border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <p>The diagram shows three overlapping circles within a rectangular frame. The top-left circle is labeled 'Geometry' and contains the number 12 in its non-overlapping region. The top-right circle is labeled 'American History' and contains the number 17 in its non-overlapping region. The bottom circle is labeled 'Biology' and contains the number 7 in its non-overlapping region. The intersections contain the following numbers: 10 in the intersection of Geometry and American History; 14 in the intersection of Geometry and Biology; 5 in the intersection of American History and Biology; and 7 in the central intersection of all three circles. The number 3 is located in the bottom-left corner of the frame, outside the circles.</p> </div> <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>• <b>To receive credit, 3 intersecting circles must be drawn and positioned as in prompt. Labels of “Geometry” or “G”, “American History”, “AH”, or “H”, and “Biology” or “B” (or equivalent are required at the “4” level.</b></li> <li>• <b>Work is not required</b></li> <li>• <b>Credit is given, as indicated below, when correct values and no others are listed.</b></li> </ul> <p>3 points:    <b>All 8 values</b> are correct and are placed in the appropriate positions, as shown in the diagram above.</p> <p><b>OR</b></p> <p>2½ points:    <b>7 values within all 3 circles</b> are correct and are placed in the appropriate positions. “3” (# taking no courses) is incorrect or missing.</p> <p><b>OR</b></p> <p>2 point:    <b>All values within 1 or 2 circles</b> are correct and are placed in the appropriate positions. Other value(s) are incorrect or missing.</p> <p style="margin-left: 40px;">Ex: Geometry: 12, 10, 14 and 7 are correctly placed                Biology: 7, 14, 5 and 7 are correctly placed                Remaining #(s) are incorrect or missing</p>

## PART II SPRING RELEASED GEOMETRY ITEMS

Part	Points
1	<p><b>3 points possible (continued)</b></p> <p style="text-align: center;">Ex: A. History: 17, 5, 10 and 7 are correctly placed Remaining #(s) are incorrect or missing</p> <p><b>OR</b></p> <p>1½ point:</p> <ul style="list-style-type: none"> <li>• All 4 values in the <b>intersections (2 or 3 courses)</b> of the 3 circles, <b>14, 10, 5 and 7</b> are correct and are placed in the appropriate positions. Values or representing 0 or 1 subject (3, 12, 17 and 7) are incorrect or missing. or</li> <li>• Values representing “<b>1 course only</b>” (12, 17, 7) and “<b>All 3 courses</b>” (7) are correct and are placed in the appropriate positions. Values representing “2 subjects only” (14, 7, 5) are incorrect or missing.</li> </ul> <p><b>OR</b></p> <p>1 point:      <b>Any 3 or 4 random values</b> are correct</p>
2	<p><b>1 point possible</b></p> <p><b>Note: If no entry is made for # of students taking no courses, assume it is 0.</b></p> <p>1 point:</p> <p>Correct answer:    <b>39</b>    (<b># taking fewer than 2 courses</b>) <i>(or correct # based on incorrect value(s) in Part 1)</i> Correct procedure is shown and/or explained Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> <li>• <math>12 + 17 + 7 + 3 = 39</math></li> <li>• <math>75 - (14 + 7 + 10 + 5) = 75 - 36 = 39</math></li> </ul> <p><b>OR</b></p> <p>½ point:</p> <ul style="list-style-type: none"> <li>• Answer is correct:    39 <i>(or correct # based on incorrect value(s) in Part 1)</i> Work is incomplete or missing or</li> <li>• Answer is incorrect due to a calculation or copy error Correct procedure is shown and/or explained or</li> <li>• Correct answer based on #'s taking exactly 1 course Number (<math>\neq 0</math>) taking no courses is ignored Correct procedure is shown and/or explained</li> </ul>

## PART II SPRING RELEASED GEOMETRY ITEMS

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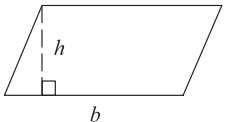
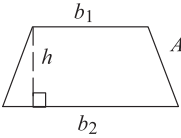
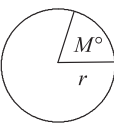
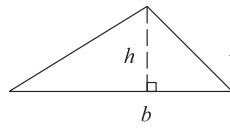
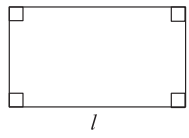
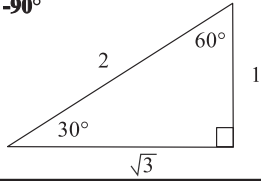
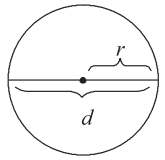
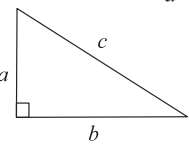
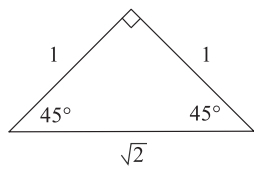
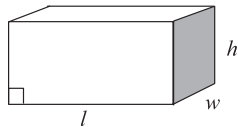
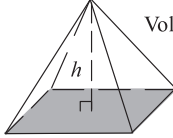
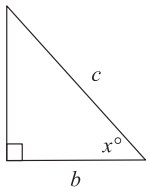
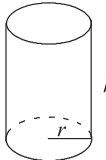
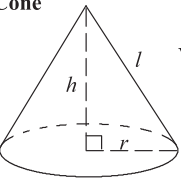
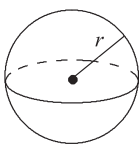
Part	Points
3	<p><b>1 point possible</b></p> <p>1 point:</p> <ul style="list-style-type: none"><li>• Correct answer: <b>29</b> (<b>#taking exactly 2 courses</b>) (or correct # based on incorrect value(s) in Part 1) Correct procedure is shown and/or explained Give credit for the following or equivalent:<ul style="list-style-type: none"><li>• <math>10 + 14 + 5 = 29</math></li><li>• <math>75 - 39 - 7 = 29</math></li></ul></li></ul> <p><b>OR</b></p> <p>½ point:</p> <ul style="list-style-type: none"><li>• Answer is correct: 29 (or correct # based on incorrect value(s) in Part 1) Work is incomplete or missing or</li><li>• Answer is incorrect due to a calculation or copy error Correct procedure is shown and/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 *2011 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 2011 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	M	3	2
2	CGT	5	1
3	R	4	1
4	T	2	3
5	M	3	3
6	LG	1	2
7	R	4	2
8	M	3	1
9	CGT	5	3
10	R	4	4
11	T	2	5
12	LG	1	5
13	M	3	4
14	M	3	5
15	T	2	1
16	LG	1	1
17	R	4	7
18	LG	1	6
19	R	4	8
20	LG	1	3
21	T	2	7
22	CGT	5	6
23	T	2	4
24	CGT	5	7
25	T	2	2
26	LG	1	2
27	CGT	5	5
28	M	3	2
29	CGT	5	2
30	R	4	3
A	CGT	5	6
B	T	2	5
C	M	3	3

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

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

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











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