Alabama Reading and Mathematics Test

Annotated Packet

for

Mathematics

Grade 8

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# ARMT GRADE 8 MATHEMATICS

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INTRODUCTION

This document provides specific information about the open-ended questions on the Alabama Reading and Mathematics Test (ARMT). It is intended to give an overview of how responses to open-ended questions are scored and to provide responses at each score point.

This document includes two open-ended questions from previous administrations of the ARMT. Each open-ended question is followed by the scoring rubric and three responses for each score point. Sample responses will include annotations and explanations on scoring decisions.
Annotations: A brief explanation of why a paper has received the score it has, emphasizing the specific ways it is representative of that score point and sometimes pointing out what is lacking that may have made it a higher score point.

Invalids: Refers to student responses which do not meet criteria for scorability. For example, blank papers; off-task and/or off-topic papers; papers containing only irrelevant marks or images. These papers receive a score of zero.

Item: A question for which a score or set of scores is to be recorded based on the response.

Logic: The correct operation performed on the correct numbers. An error in transcription or omission of numbers from a list leads to a lack of full logic. Incorrect numbers resulting from a computation, transcription, or omission error in an early part of a response are considered part of correct logic when appropriately used in subsequent sections of the response.

Open-ended response: Complex assessment items/tasks that can be approached or solved in more than one way and have more than one accurate response. Students are asked to include reasons for their conclusions.

Rubric: Written descriptions of the performance evidence or behaviors expected at each level or score point on the scale for open-ended items.

Score point: A numerical value representing the level of success a constructed response achieves in relation to the rubric and the descriptors for each score point.
There is a relationship between speed and miles per gallon. The linear relationship indicates at higher speeds a driver gets fewer miles per gallon.

The prediction of miles per gallon will be between 26 and 27 miles per gallon.
## RUBRIC

<table>
<thead>
<tr>
<th>Score Points</th>
<th>RESPONSE ATTRIBUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>All correct.</td>
</tr>
<tr>
<td>2</td>
<td>The logics or explanations are correct.</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>One correct logic, and the answers for at least parts b and c are correct.</td>
</tr>
<tr>
<td>1</td>
<td>Errors in logic and the answers for two problems are correct.</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>Answers are correct for two problems, with no logic.</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>One answer or drawing is correct.</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>One logic is correct.</td>
</tr>
<tr>
<td>0</td>
<td>None correct. (Also, blanks, rewrites problem, foreign language, illegible, refusals, off tasks, etc. scored as invalid.)</td>
</tr>
</tbody>
</table>
A---The unsuccessful attempt at a scatter plot does not receive any credit.
B---Provides an incorrect answer, “no relationship” without any supporting logic.
C---Provides a correct answer, “at 35mph miles per gallon will be 26”. Supporting logic is not provided.

According to the rubric, giving one correct answer is enough to receive a score point of 1.
A---The response is a line graph instead of a scatter plot. Any graph other than a scatter plot does not receive any credit.
B---Provides a correct answer, “There is a relationship...” with correct supporting logic, “The higher the speed, the lower the miles per gallon.”
C---27.5 is considered out of the acceptable range of between 26 and 27.

According to the rubric, this earns a score point of 1 because of the correct answer OR correct logic in part b.
A---The response is a line graph instead of a scatter plot. Any graph other than a scatter plot does not receive any credit.

B---Provides a correct answer, “relation (yes)...” without adequate supporting logic. “they go in a rather straight line” lacks the specificity required for supporting logic. Because of the dichotomous nature of this part, and the lack of specificity provided, no credit is given for this part.

C---Provides a correct answer, 26.5, with some supporting logic, “...the median of 28 & 25 is 26.5”.

According to the rubric, one correct answer receives a score point of 1.
Sample Paper 4
Score Point 2

A---The scatter plot is not correctly drawn. Both axes are labeled and the points are correctly plotted. However, there is not a consistent scale along the horizontal axis; intervals start at 15 and switch to 5.

B---Provides a correct answer, “There is a relationship...”, and correct logic, “The faster speed used, the less miles per gallon...(The line is going down to the left.”

C---Provides a correct answer, “...between 26 and 27...” and correct logic, “...because it’s in the middle of 30 and 40.”

According to the rubric, correct logics receive a score point of 2.
Sample Paper 5
Score Point 2

A---The scatter plot is not correctly drawn. Both axes are labeled. However, there is not a consistent scale along either axis, and one point is not correctly plotted. Additionally, the dependent and independent axes are reversed.

The scatter plot shows a correlation between speed and miles per gallon. Points are plotted as follows:

- Speed: 21, 23, 25, 27 miles per hour
- Miles per Gallon: 70, 60, 50, 40

B---Provides a correct answer and logic with, “The more speed the less miles per gallon”.

C---Provides a correct answer, “26 or 27 mph”, with correct logic, “because it is between 30 and 40 mph”.

According to the rubric, correct logics receive a score point of 2.
A---The scatter plot is correctly drawn with both axes labeled, consistent scales along both axes, and correctly plotted points. The lack of a title does not diminish the quality of the drawing.

B---Provides a correct answer ("There is a relationship...") and correct logic ("When your speed increases your miles per gallon decrease.")

C---Provides a correct answer ("26 miles per gallon") without any supporting logic.

According to the rubric, one correct logic and the answers for at least parts b and c correct receives a score point of 2.
Sample Paper 7
Score Point 3

A---The scatter plot is correctly drawn with both axes labeled, consistent scales along both axes, and correctly plotted points. The lack of a title does not diminish the quality of the drawing.

B---Provides a correct answer (“There is a relationship”) and correct logic (“The higher the speed of the car, the less MPG it gets”).

C---Provides a correct answer (“26.5MPG”). The supporting logic is provided by the calculations and the drawing.

According to the rubric, if all is correct, the response receives a score point of 3.
A---The scatter plot is correctly drawn with both axes labeled, consistent scales along both axes, and correctly plotted points.

---

B---Provides a correct answer ("There is a relationship") and correct logic ("As your speed increases, your mi. per gallon decreases").

C---Provides a correct answer, ("about 26") and correct logic ("The mi. per gallon keeps rising as the speed decreases by 2 at first, then 1").

According to the rubric, if all is correct, the response receives a score point of 3.
A---The scatter plot is correctly drawn with both axes labeled, consistent scales along both axes, and correctly plotted points.

B---Provides a correct answer ("there is a relationship...") and correct logic ("...the points are decreasing").

C---Provides a correct answer of "around 26" with correct logic ("...35 mph is in between 28 miles per gallon and 25 miles per gallon").

According to the rubric, if all is correct, the response receives a score point of 3.
QUESTION

This problem requires you to show your work and/or explain your reasoning. You may use drawings, words, and/or numbers in your answer. Your answer should be written so that another person could read it and understand your reasoning. It is important that you show all your work.

Paolo has 2 decorative wooden storage containers that he wants to paint.

- One container is cylindrical in shape, with a radius of 20 cm and a height of 40 cm.
- The other container is box-shaped, and is 15 cm wide, 30 cm long, and 50 cm high. He will paint only the outside of each container, including the lid.

Which container has a greater surface area for Paolo to paint?

Show all your work and/or explain your reasoning in the space provided in the answer document.

Accurate Response(s):

Cylinder has larger surface area.

The surface area of the cylinder may range from 7536 to 7543.2 sq. cm.

\[
(2\pi rh) + (2\pi r^2) \\
(2 \cdot 3.14 \cdot 20 \cdot 40) + (2 \cdot 3.14 \cdot 20^2) = 5024 + 2512 = 7536 \text{ sq. cm.} \\
(2 \cdot 3.143 \cdot 20 \cdot 40) + (2 \cdot 3.143 \cdot 20^2) = 5028.8 + 2514.4 = 7543.2 \text{ sq. cm.}
\]

Surface area of the rectangular prism

\[
(2lh) + (2wh) + (2hv) \\
(2 \cdot 30 \cdot 50) + (2 \cdot 15 \cdot 50) + (2 \cdot 30 \cdot 15) = 3000 + 1500 + 900 = 5400 \text{ sq. cm.}
\]
## RUBRIC

<table>
<thead>
<tr>
<th>SCORE POINTS</th>
<th>RESPONSE ATTRIBUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>All correct.</td>
</tr>
</tbody>
</table>
| 2            | Three logics or explanations are correct.  
              | OR  
              | Two logics or explanations are correct, and all answers are correct. |
| 1            | One or more answers are correct.  
              | OR  
              | One or two logics or explanations are correct. |
| 0            | None correct. (Also, blanks, rewrites problem, foreign language, illegible, refusals, off task, etc. scored as invalid.) |
Sample Paper 10
Score Point 1

The response provides a correct answer (7536 cm) for the surface area of the cylinder and correct logic (correctly uses the surface area formula for a cylinder with the correct values substituted into the formula).

The response provides an incorrect answer (22500 cm) for the surface area of the box and incorrect logic (uses the volume formula instead of the surface area formula for a rectangular prism).

Based on the surface area error of the rectangular prism, the response provides a correct answer (“The square container has a greater surface area…”). The surface areas calculated for the cylinder and prism provide the supporting logic.

According to the rubric, if one or two logics or explanations are correct, the response earns a score point of 1.

Note: At this score point level, units are not a factor in determining the score point.
The answers and logics for the surface areas are omitted.

The response makes a correct comparison of greater surface area through the identification of the cylinder. Supporting logic is not provided.

According to the rubric, if one or more answers are correct, the response earns a score point of 1.
Sample Paper 12
Score Point 1

The response provides a correct answer (5,400) for the surface area of the box and correct logic (correctly uses the surface area formula for a rectangular prism with the correct values used to calculate the surface area).

A comparison of the surface areas is not attempted.

According to the rubric, if one or two logics or explanations are correct, the response earns a score point of 1.
The incorrect answers for the surface areas are due to calculation errors.

The response has a correct comparison answer (“The basket has a greater surface area”). The surface areas calculated for the cylinder and prism provide the supporting logic.

According to the rubric, if three logics or explanations are correct, the response earns a score point of 2.
The response provides a correct answer (7536) for the surface area of the cylinder and correct logic (correctly uses the surface area formula for a cylinder with the correct intermediate products displayed beneath the formula).

The response provides a correct answer (5400) for the surface area of the box and correct logic (correctly uses the surface area formula for a rectangular prism with the correct values used to calculate the surface area).

The response has a correct comparison answer (“Bigger” written above the cylinder). The vague reference to bigger lacks the specificity needed to earn full credit for the logic.

Note: The absence of units does not detract from the quality of the response.

According to the rubric, if two logics or explanations are correct, and all answers are correct, the response earns a score point of 2.
**Sample Paper 15**

**Score Point 2**

<table>
<thead>
<tr>
<th>Cylinder</th>
<th>( SA = 2\pi rh + 2\pi r^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( SA = 2(3.14)(20)(40) + 2(3.14)(20^2) )</td>
</tr>
<tr>
<td></td>
<td>( SA = 2(3.14)(800) + 2(3.14)(400) )</td>
</tr>
<tr>
<td></td>
<td>( SA = 5024 + 2512 )</td>
</tr>
<tr>
<td></td>
<td>( SA = 7,536 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rectangular Prism</th>
<th>( SA = 2lw + 2lh + 2wh )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( SA = 2((15)(50) + (30)(50) + (30)(15)) )</td>
</tr>
<tr>
<td></td>
<td>( SA = (750 + 1500 + 450) )</td>
</tr>
<tr>
<td></td>
<td>( SA = 2700 )</td>
</tr>
</tbody>
</table>

The response provides a correct answer (7,536) for the surface area of the cylinder and correct logic (correctly uses the surface area formula for a cylinder with the correct values substituted into the formula).

The response provides an incorrect answer (2700) for the surface area of the box but correct logic (chooses the correct surface area formula and substitutes the correct values into the formula; however, the failure to multiply by 2 produces an incorrect answer).

The response has a correct comparison answer ("The cylinder has a greater surface area... "). The surface areas calculated for the cylinder and prism provide the supporting logic.

Note: The absence of units does not detract from the quality of the response.

According to the rubric, if three logics or explanations are correct, the response earns a score point of 2.
<table>
<thead>
<tr>
<th>Surface Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cylinder:</strong> ( \pi r^2 h + 2\pi rh )</td>
</tr>
<tr>
<td>( 5,024 + 2,512 = 7,536 )</td>
</tr>
<tr>
<td><strong>Box:</strong> ( 2(lw + lh + wh) )</td>
</tr>
<tr>
<td>( 2(15 \times 30 + 15 \times 50 + 50 \times 30) )</td>
</tr>
<tr>
<td>71,500</td>
</tr>
</tbody>
</table>

The response provides a correct answer (7,536) for the surface area of the cylinder and correct logic (correctly uses the surface area formula for a cylinder with the correct intermediate products displayed beneath the formula).

The response provides a correct answer (5,400) for the surface area of the box and correct logic (correctly uses the surface area formula for a rectangular prism with the correct values substituted into the formula).

The response has a correct comparison answer ("The Cylinder has a greater Surface Area..."). The surface areas calculated for the cylinder and prism provide the supporting logic.

Note: The absence of units does not detract from the quality of the response.

According to the rubric, if all answers and logics are valid, the response earns a score point of 3.
### Sample Paper 17

**Score Point 3**

The response provides a correct answer (7,536) for the surface area of the cylinder and correct logic (correctly uses the surface area formula for a cylinder with the correct values substituted into the formula).

The response provides a correct answer (5400) for the surface area of the box and correct logic (correctly uses the surface area formula for a rectangular prism with the correct values substituted into the formula).

The response has a correct comparison answer (“The cylinder has more surface area…”). The surface areas calculated for the cylinder and prism provide the supporting logic.

Note: The absence of units does not detract from the quality of the response.

According to the rubric, if all answers and logics are valid, the response earns a score point of 3.
The response provides a correct answer (7536 cm$^2$) for the surface area of the cylinder and correct logic (correctly uses the surface area formula for a cylinder with the correct values substituted into the formula).

The response provides a correct answer (5400 cm$^2$) for the surface area of the box and correct logic (correctly uses the surface area formula for a rectangular prism with the correct values substituted into the formula).

According to the rubric, if all answers and logics are valid, the response earns a score point of 3.